Finance Research Letters 33 (2020) 101207

Contents lists available at ScienceDirect

Finance Research Letters

journal homepage: www.elsevier.com/locate/frl

Optimal ownership structure and monitoring in entrepreneurial firms

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ARTICLE INFO

Keywords:
Corporate governance
Multiple large shareholders structure
Agency problem
Monitoring

JEL classification:
G24
G32
G34
G38
L26

ABSTRACT

We model the agency problem existing in an entrepreneurial firm between its founder and an outside investor and characterize the optimal corporate governance design. The analysis describes the relationship between two mechanisms: the level of monitoring exerted by the outside investor (short-run) and the ownership structure designed by the founder (long-run). Our results suggest that the optimal corporate governance design resembles a multiple large shareholders (MLS) structure in which a large investor counterbalances the power of the controlling owner. We derive testable implications regarding the separation between control and cash-flow rights and other firm-specific elements influencing the optimal governance structure.

1. Introduction

This article presents a simple agency model of the corporate governance of entrepreneurial firms that provides a rationale for their ownership structure as an optimal decision. The proposed framework identifies the conditions under which this structure will be either concentrated in favor of a controlling investor —the company founder— or balanced as between him and a minority outside investor.

Our analysis suggests that the ownership structure is ultimately the result of efforts by the founder to address a horizontal agency problem, that is, a potential wealth transfer to himself from the outside investor. Thus, the size of the latter's ownership interest, denoted α, constitutes the key long-run corporate governance choice made by the founder to align the interests of the outside investor with his own. We will show that this mechanism works by means of two counteracting channels: (i) a direct *dividend-alignment* channel and (ii) an indirect *monitoring-alignment* channel.

We will also demonstrate that the optimal combination of these two channels depends on the benefits and costs associated with each one and shapes the ownership and corporate governance structure. This analytical framework allows us to identify two alternative solution candidates as the optimal corporate governance design. On the one hand, solution I represents an ownership and governance structure in which the controlling owner coexists with a passive small investor (or a mass of dispersed minority shareholders), and thus, his decisions are not subject to monitoring at all. On the other hand, solution II represents a corporate governance structure in which the controlling owner coexists with an active large investor (blockholder) who monitors his decisions,

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https://doi.org/10.1016/j.frl.2019.06.005
Received 10 April 2018; Received in revised form 20 May 2019; Accepted 17 June 2019
Available online 18 June 2019
1544-6123/

and thus, it resembles a multiple large shareholder (MLS) structure.

We show that, between these two solution candidates, the founder prefers finally the MLS-type structure. This theoretical result is consistent with recent empirical research suggesting favorable effects of the presence of at least one large non-controlling investor on corporate decisions, especially in the case of family-controlled companies. In general, this literature associates the presence of large investors with sufficiently high voting rights to a governance structure in which the decisions taken by the controlling shareholder are subject to high contestability and strong monitoring. The available empirical evidence suggests that this power interplay generates positive effects on decisions like debt source (Boubaker et al., 2017), debt maturity (Ben-Nasr et al., 2015), risk-taking strategies (Boubaker et al., 2016), and directly on the firm value (Attig et al., 2009; Maury and Pajuste, 2005), especially in countries outside the US and UK in which both MLS and family-controlled ownership structures are very typical.

Our analysis highlights two features of an optimal MLS ownership and governance structure. First, we find that it is optimal for the founder to adopt some level of separation between his control rights and cash-flow rights, which provides an economic rationale for the use of real-world schemes like pyramid structures and dual-class stock. Second, we identify four elements that shape how ownership and control are shared between the founder and the outside investor, which allows us to point out several testable predictions. These elements are: (i) the monitoring costs, (ii) the founder's rate of impatience, (iii) the severity of a potential agency problem, and (iv) the level of legal protection for outside investors.

The previous theoretical literature on optimal corporate ownership structures has focused on the explanatory power of elements such as: (i) the agency problem between shareholders and management (Burkart and Panunzi, 2006; Acharya and Volpin, 2010; Bolton and Von Thadden, 1998; Burkart et al., 1997), (ii) the initial owner's incentives to either keep the firm private or go public (Pagano and Röel, 1998; Zingales, 1995), (iii) the revenue-maximizing procedure the owner should use to sell the firm to outside investors (Mello and Parsons, 1998; Stoughton and Zechner, 1998), (iv) the degree of investors' legal protection (Burkart et al., 2014; Burkart and Panunzi, 2006; Shleifer and Wolfenzon, 2002; Almeida and Wolfenzon, 2006; Maury and Pajuste, 2005; La Porta et al., 2002), and (v) the structure of voting rights and takeovers (Grossman and Hart, 1988; Bennedsen and Wolfenzon, 2000; Bebchuck, 1999; Burkart et al., 1998).

This literature has not, however, studied the influence of monitoring on the optimal corporate ownership structure in the context of a horizontal agency problem. Thus, the monitoring-alignment channel identified in the present paper has yet to be characterized. The analyses that perhaps come closest to ours are Pagano and Röel (1998) and Burkart and Panunzi (2006), both of which consider monitoring, but do so in a framework more suitable to a study of the formation of dispersed shareholding structures typically found in Anglo-Saxon countries. The present article, by contrast, provides an economic rationale for the optimality of an ownership structure formed by a strong controlling shareholder/founder and a single large and active outside investor. Our model thus accounts more satisfactorily for the creation of highly concentrated ownership structures found in either family-owned or closely-held companies, especially in developed countries outside the US and UK and in emerging markets.

The rest of this paper proceeds as follows. Section 2 presents an agency model in the context of an entrepreneurial firm, Section 3 characterizes the optimal corporate governance design, Section 4 analyzes the main properties of this design and its predictions for real-world corporate ownership structures, and Section 5 discusses possible avenues for future research. The necessary proofs are all given in an appendix.

2. The model

Consider the following agency relationship between the founder (*he*) and the outside investor (*she*) of an entrepreneurial firm, which is played out in a game of two periods.[1]

In period 1, the founder chooses the ownership stake $\alpha \in \left[0, \frac{1}{2}\right)$ he wants to sell to the outside investor. If α is strictly positive, the founder and the outside investor are the controlling investor and the minority investor, respectively.[2]

Period 2 consists of four stages. In stage 1, the outside investor chooses a level of monitoring denoted $g \in [0, 1]$, to be exerted through the board of directors. The variable g is the probability that the outside investor detects, at a monitoring cost $kg^2/2$, the investment decision the founder will take in the next stage. In stage 2, the founder selects an investment project $a \in \{m, s\}$, which can be detectable through monitoring but is not directly verifiable by the outside investor. Project m brings the founder private benefits of control $B > 0$ but zero cash flow while project s generates a cash flow $y > 0$ with probability $p > 0$ (and therefore no cash flow with the remaining probability) but zero private benefits. In stage 3, the outside investor's monitoring process correctly detects with probability g which of the two projects the founder has chosen. If the process reveals that the project chosen was s, the game moves directly to the next stage. But if m was selected, the founder loses all private benefits, though these are not recovered by his counterpart. The outside investor sues the founder, who must then pay a fine with an expected value of $\phi > 0$ to the financial regulator.[3] Finally, in stage 4 cash flow and benefits are produced, the former being verified and distributed as dividends between the two owners.

[1] The outside investor can be interpreted as a group of small dispersed shareholders in one of the two optimal solution candidates characterized later on.

[2] We assume implicitly that the investor holding an ownership stake greater than or equal to 1/2 is the controlling investor. Thus, assuming that $\alpha < 1/2$ implies that the founder is not willing to transfer the control of the company, and thus, neither the investment decision taken in the next period.

[3] Thus, ϕ is the product of the fine itself and a positive probability of the founder being declared guilty.

We assume that the founder is impatient, which induces him to apply a discount factor to the cash flows he will receive in period 2 and liquidate part of his interest α to the minority investor in period 1. This factor is given by $\frac{1}{1+\rho}$ where $\rho \in (0, 1)$ is the founder's impatience rate. We also adopt the following assumptions: (A1) there is universal risk-neutrality, (A2) all the investors have limited liability, (A3) outside options are normalized to zero, (A4) $B < py$, (A5) $k > \frac{2\rho(B+\phi)^2}{(1+\rho)(2B-py)}$ and (A6) all bargaining power in relation to the sale of α is in the hands of the founder.

3. The results

To characterize the optimal corporate governance design (g^*, α^*), we apply the backward induction principle. Accordingly, we begin by characterizing the equilibrium of period 2, i.e., assuming that α is exogenous.

3.1. Exogenous ownership

Since in the short-run ownership structure is given, the outside investor's best response will be the optimal monitoring $g(\alpha)$ that induces the founder to choose $a = s$.[4] To find this function, she solves the following program:

$$\max_{g} \ \alpha py - \frac{kg^2}{2} \tag{1}$$

subject to

$$(1-\alpha)py \geq (1-g)B - g\phi \tag{2}$$

$$0 \leq g \leq 1, \tag{3}$$

where (2) is the incentive-compatibility constraint and (3) is a feasibility constraint. Note that condition (2) imposes that it is in the founder's best interest to choose action s, which is guaranteed when his expected utility for this choice is equal to or greater than that of choosing project m. Also note that the right-hand side of the incentive-compatibility constraint implies that in choosing m, the founder enjoys a private benefit of control as long as monitoring fails, which occurs with probability $1 - g$. Otherwise, he must pay the fine ϕ.

Let us now define

$$h(\alpha) \equiv \frac{B-(1-\alpha)py}{B+\phi} \tag{4}$$

and

$$\underline{\alpha} \equiv \frac{py-B}{py}. \tag{5}$$

Proposition 1. *For a given ownership structure, the optimal monitoring level is*

$$g(\alpha) = \begin{cases} 0 & \text{if } \alpha \leq \underline{\alpha} \\ h(\alpha) & \text{if } \alpha > \underline{\alpha} \end{cases}. \tag{6}$$

Thus, the minority investor's best-response function implies that the relationship between g and α is *non-linear*. If her stake is too low, she will not monitor the controlling investor at all. This is so because, as the incentive-compatibility constraint indicates, when the dividend share $1 - \alpha$ held by the controlling investor is large enough, this corporate governance device is sufficiently powerful to align him with the minority investor's interests and monitoring is therefore unnecessary.

If, on the other hand, the minority stake is sufficiently high, monitoring will be non-zero given that $h(\alpha) > 0$ when $\alpha > \underline{\alpha}$. Also, there is a positive relationship between the optimal monitoring level and stake α because $\frac{\partial h(\alpha)}{\partial \alpha} > 0$. This is the case given that as the minority investor's stake increases, the left-hand side of (2) decreases and thus the incentive-compatibility constraint is less likely to be satisfied. To counterbalance this, the right-hand-side of constraint (2) must decrease, which can only be achieved by increasing the monitoring level g.

3.2. Endogenous ownership

To find the optimal long-run corporate governance design, we solve the complete game taking into account the best-response function described above. The founder chooses α by solving the program

[4] It can be shown that assumption (A4) ensures that s is indeed the best project from the outside investor's standpoint.

$$\max_{\alpha} \frac{(1-\alpha)py}{1+\rho} + \left(\alpha py - \frac{kg^2}{2}\right) \tag{7}$$

subject to

$$g(\alpha) = \max\{0, h(\alpha)\} \tag{8}$$

$$0 \leq \alpha < \frac{1}{2}. \tag{9}$$

The first term in the objective function (7) is the present value of the expected dividends the founder will receive in period 2 on his stake $1-\alpha$. The second term is the revenues he collects from selling the remainder α in period 1. Since the founder has all the bargaining power, these revenues are consistent with a take-it-or-leave-it offer and have two components: (i) a selling price proportional to the share α of the company's expected cash flows, and (ii) a discount on the selling price due to the monitoring costs the outside investor will incur in the future.[5]

Condition (8) is the outside investor's best response in terms of monitoring while condition (9) is a feasibility constraint that bounds the minority stake.

Let us now define[6]

$$\overline{\alpha} \equiv \underline{\alpha} + \frac{\rho}{1+\rho}\frac{(B+\phi)^2}{kpy}, \tag{10}$$

and the founder's expected payoff evaluated in corporate governance designs $(0, \underline{\alpha})$ and $(h(\overline{\alpha}), \overline{\alpha})$, respectively, as

$$V(0, \underline{\alpha}) \equiv \frac{py(1+\rho\underline{\alpha})}{1+\rho}, \tag{11}$$

and

$$V(h(\overline{\alpha}), \overline{\alpha}) \equiv \frac{py(1+\rho\overline{\alpha})}{1+\rho} - \frac{k(h(\overline{\alpha}))^2}{2}. \tag{12}$$

Lemma 1. *When the ownership structure is endogenous, there are two solution candidates for the optimal corporate governance: (i) Solution I: If* $V(0, \underline{\alpha}) > V(h(\overline{\alpha}), \overline{\alpha})$, *the optimal monitoring level is* $g^* = 0$ *and the optimal minority investor's stake is* $\alpha^* = \underline{\alpha}$. *(ii) Solution II: If* $V(0, \underline{\alpha}) \leq V(h(\overline{\alpha}), \overline{\alpha})$, *the optimal monitoring level is* $g^* = h(\overline{\alpha})$ *and the optimal minority investor's stake is* $\alpha^* = \overline{\alpha}$.

On the one side, solution I represents a corporate governance structure in which the controlling shareholder coexists with a small minority shareholder that does not monitor the former's decisions at all. The size of the ownership stake and the passivity of this second owner allows us to interpret her also as a mass of dispersed minority shareholders without the appropriate incentives to monitor because they are subject to a collective action problem.

On the other side, solution II represents a corporate governance structure in which the controlling shareholder coexists with a large shareholder (or blockholder) that monitors the former's decisions. This governance structure can be associated to what is known in the literature as a multiple large shareholder (MLS) structure since the control of the company is, at some extent, shared among at least two owners. Whereas in practice this power interplay takes place through the distribution of voting rights among the large shareholders, in our theoretical framework this counterbalance is modeled through the effort exerted by the outside investor to monitor the investment project decision taken by the controlling investor.

Proposition 2. *In the long-run the optimal corporate governance design is characterized by* $(g^*, \alpha^*) = (h(\overline{\alpha}), \overline{\alpha})$ *since*

$$V(h(\overline{\alpha}), \overline{\alpha}) > V(0, \underline{\alpha}).$$

This proposition implies that since the founder's payoff is larger with solution II than with solution I, the optimal corporate governance arrangement resembles a MLS structure. Thus, in our discussion of the main properties of the optimal corporate governance design we will confine ourselves to solution II.

According to the available evidence, the MLS structures are typically characterized by a wedge between the control and ownership rights of the controlling shareholder. In order to get an insight into this phenomenon of excess control, let us define Δ, the *control-to-ownership ratio*, as follows

$$\Delta \equiv \frac{1-g^*}{1-\alpha^*},$$

which represents, in the context of our setup, the degree of separation between the founder's control rights and his cash-flow rights.[7]

Corollary 1. *The control-to-ownerhip ratio* Δ *is larger than 1.*

[5] Recall that by assumption (A3), outside options are normalized to zero.

[6] Note that assumption (A5) guarantees that $\overline{\alpha}$ and $\underline{\alpha}$ are less than 1/2.

[7] Recent empirical literature adopts a similar ratio of voting rights to cash-flow rights to proxy for the control-ownership wedge of a controlling owner (Boubaker et al., 2017; Ben-Nasr et al., 2015).

4. Properties of the optimal corporate governance design

Proposition 2 suggests that the optimal governance design of entrepreneurial firms resembles a MLS structure in which the control of the company is shared between the controlling investor and other large investor. In our model, this power interplay is carried out through the effort exerted by the second-largest investor to monitor the investment decision taken by the controlling owner. In addition, Corollary 1 suggests that it is optimal for the founder to adopt some level of separation between control and ownership rights.

Interestingly, all these results are in general supported by the available empirical evidence. First, our findings give an economic rationale to the main features exhibited by the corporate ownership structures in regions in which family firms are prevalent and the major corporate governance issue is concerned with the agency problems between owners, such as Western Europe, East Asia, and other emerging markets (La Porta et al., 1999; Claessens et al., 2000; Faccio and Lang, 2002; Thomsen et al., 2006).[8] In fact, the corporate landscape of those regions is characterized by a significant number of companies controlled through MLS structures and a frequent adoption of mechanisms oriented to separate voting and cash-flow rights like pyramidal schemes and dual-class equity.

Second, our findings are also consistent with the evidence highlighting the positive effects that monitoring effort, exerted by at least one large non-controlling shareholder, generates on companies directly over their corporate value (Cheng et al., 2017; Attig et al., 2009; Maury and Pajuste, 2005; Laeven and Levine, 2008; Jara-Bertin et al., 2008) and indirectly through several channels like higher-risk-taking strategies (Boubaker et al., 2016), preference for financing sources involving more outside monitoring (Boubaker et al., 2017; Ben-Nasr et al., 2015), more efficient investment decisions (Jiang et al., 2018), and a lower cost of equity financing (Attig et al., 2008).

We now explore the comparative statics properties of the optimal corporate governance solution.

Corollary 2. *The optimal corporate governance design is such that* ***1.*** *The optimal monitoring level is: (i) increasing with* B , ρ *and* ϕ*, and (ii) decreasing with* k . ***2.*** *The optimal outside investor's stake is: (i) decreasing (increasing) with* B *if* B *is sufficiently low (high), (ii) increasing with* ρ *and* ϕ*, and (iii) decreasing with* k*.*

Thus, the optimal MLS ownership structure will be more or less balanced between the founder and the outside investor as the horizontal agency problem becomes more severe, depending on the level of private benefits. We interpret this non-linear relationship between α^* and B in light of the trade-off the founder faces when designing the optimal long-run ownership structure of an entrepreneurial firm. When the agency problem worsens because B increases, project m is more appealing and hence, it is more difficult for the incentive-compatibility constraint (2) to be satisfied. Thus, to respond to this phenomenon and restore the correct incentives, corporate governance design has two mechanisms that work on α^* in opposite directions.

On the one hand, there is the *dividend-alignment* channel, which operates directly on α^* through the left-hand side of (2). Under this effect alone, it is optimal for the founder to *decrease* α^* in order to increase his share $1-\alpha^*$ of future dividends, which makes (2) more likely to be satisfied.[9] On the other hand, there is the alternative *monitoring-alignment* channel, which operates *indirectly* on α^* through the right-hand side of (2). Considering only this channel, it is optimal for the outside investor to increase her monitoring level g^* (see part 1-(i) of Corollary 2), which in this case requires by equation (4) that the founder *increase* α^* given that h is an increasing function of α.

Corollary 2 then indicates that when the moral hazard problem is sufficiently severe (i.e., $B > \frac{(1+\rho)k}{2\rho} - \phi$), the optimal corporate governance design should marginally prefer the monitoring channel to the dividend channel for aligning the objectives of the two owners. Consequently, since controlling owners in family firms seems to be more prone to extract wealth from minority shareholders (because they are frequently represented in the top management and the board), our analysis predicts that such firms should have a MLS structure more balanced in terms of both ownership stakes and control rights (i.e., higher α and g). In fact, several of the empirical studies above cited support that prediction, as they show that the positive effects of blockholders' monitoring on firm value and their financial decisions are either stronger in companies more susceptible to a potential expropriation of the minority shareholders like family-controlled firms in Western Europe (Maury and Pajuste, 2005; Boubaker et al., 2016; 2017) or weaker in companies less susceptible to this agency problem like the state-owned enterprises (SOEs) in China (Jian et al., 2018). In the same vein, Attig et al. (2008) provide evidence suggesting that the governance and monitoring role of large investors is more valuable in East Asia than Western Europe, as a horizontal agency problem seems to be more severe in the first of these regions.

Point (i) in Corollary 2 also predicts that in industries with large private benefits, such as those with more intangible assets and large free cash flows (Dyck and Zingales, 2004), one should observe, *ceteris paribus*, a negative correlation between private benefits and the level of ownership concentration in the hands of the founder.

Corollary 2 also establishes that in a MLS structure monitoring will be weaker (lower g^*) and the ownership structure less balanced (lower α^*) the more costly is the monitoring for the outside investor (larger k). This result suggests that if the degree of independence of the auditing process from the controlling investor is low or a board of directors' audit committee is not mandatory, we should observe, *ceteris paribus*, that the minority investor has a smaller ownership stake and will therefore display less activism. This result also predicts that, in more opaque firms monitoring by non-controlling large shareholders should be less effective as higher levels of asymmetric information can be associated to a more costly monitoring, which in fact is consistent with the evidence of Cheng et al. (2017) for a sample of Chinese listed companies. This negative relationship between k and optimal solutions g^* and α^*

[8] Basu et al. (2016) reports the frequent use of MLS structures even in the US.

[9] Evidence of this incentive effect through dividends has been reported by Claessens et al. (2002) and La Porta et al. (2002).

also implies that, if because its nature, an outside investor faces lower monitoring costs (e.g. an institutional investor), the resulting MLS structure should give more ownership stake and control rights to such an investor. Interestingly, Maury and Pajuste (2005) show evidence consistent with the last prediction, since a higher voting stake held by a financial institution is positively related to firm value in family-controlled companies.

Furthermore, our results indicate that the monitoring level will be higher and the ownership structure less concentrated if the founder is more impatient (larger ρ). If we conjecture that there exists an inverse relationship between the degree of impatience and personal wealth, the latter finding implies that we should observe, other things being equal, a positive correlation between the ownership concentration of entrepreneurial firms and the wealth of their founders.[10] In the same vein, if the controlling shareholder has few alternative sources to finance his personal consumption different from the corporate dividends, this large preference for liquidity should manifest, *ceteris paribus*, in a more balanced MLS structure. This situation may be more frequent when the controlling owner is a family rather than other company or a financial institution.

As regards the legal protection of investors, part 1 of Corollary 2 indicates that monitoring will increase if the expected fine ϕ increases, which suggests that the two corporate governance instruments are *complements*. As a consequence, part 2 of the corollary establishes that the outside investor's stake will be larger if investor rights are better protected. This implies that other things being equal, economies with strong legal protection of investors will exhibit MLS structures that are less concentrated in the hands of controlling shareholders, which is consistent with evidence from around the world (La Porta et al., 1999; Claessens et al., 2000; European Corporate Governance Network ECGN, 1997).

In sum, our theoretical findings provide an economic rationale for the typical corporate ownership and governance structure observed in most of non-Anglo-Saxon countries around the world, which includes an extensive use of MLS structures, a high presence of families as the largest controlling shareholder, some disparity between control and ownership rights, and a beneficial role played by the large investors' monitoring in firm decisions and value.

5. Possible extensions

We conclude with an observation regarding the applicability of our analysis and some of their possible extensions. In its current version, our model considers only the agency relationship between the founder and an outside investor, which although useful for examining the ownership structure of firms operating in early stages, prevents us to study the dynamics of more realistic ownership structures over time. For example, in real-world MLS structures the controlling shareholder coexists at the same time with *both* large investors and dispersed minority shareholders. For studying that situation, the proposed model will have to be extended in order to show conditions under which it would be optimal a governance structure with an active outside investor and a large number of passive investors who may free-ride on the former.

Furthermore, in reality we observe MLS structures in which the controlling shareholder's power is contested by *several* large investors, not only by a single investor as in the current version of the model. This situation offers an interesting extension of our framework since most of the empirical research above cited shows that not only the *presence* of at least one large non-controlling investor has positive effects on firms, but also the *number* and *identity* of these blockholders. To that end, we should incorporate into our analysis some possible negative effects associated with the coexistence of several large investors like the possible collusion among them to sharing private benefits of control and the free-riding behavior that may arise regarding individual monitoring efforts.

Lastly, family firms typically adopt sophisticated mechanisms to separate control from ownership rights especially through pyramidal ownership structures and dual-class shares. Related to this point, in the present paper we have derived a preliminary insight into the optimality of some degree of separation of those rights in the context of a MLS structure (see Corollary 1). Nevertheless, an appropriate modelling extension in that direction requires a richer setup that allows us to model voting and ownership rights in more detail and also to predict when one of these specific mechanisms emerge as the optimal corporate governance arrangement.

All these issues will be the subject of the authors' research efforts in the future.

Appendix A

Proof of Proposition 1. The program described by equations (1)–(3) is equivalent to

$$\min_{g} \frac{kg^2}{2}$$
$$\text{subject to}$$
$$\max\left\{0, \frac{B-(1-\alpha)py}{B+\phi}\right\} \leq g \leq 1,$$

whose solution is

[10] Wealth diversification arguments do not apply in the model as we have assumed universal risk-neutrality.

$$g(\alpha) = \max\left\{0, \frac{B - (1-\alpha)py}{B + \phi}\right\}.$$

Using the definitions of $h(\alpha)$ and $\underline{\alpha}$, it is easily shown that the above expression can be rewritten as (6). □

Proof of Lemma 1. The program described by Eqs. (7)–(9) is equivalent to

$$\max_{\alpha} \frac{\rho}{1+\rho}\alpha py - \frac{kg^2}{2} \tag{13}$$

$$\text{subject to}$$

$$g(\alpha) = \max\{0, h(\alpha)\} \tag{14}$$

$$0 \leq \alpha < \frac{1}{2}. \tag{15}$$

In accordance with (6), we analyze two cases.

Case 1: $\alpha \leq \underline{\alpha}$. Since $g(\alpha) = 0$, program (13)–(15) becomes

$$\max_{\alpha} \frac{\rho}{1+\rho}\alpha py$$
$$\text{subject to}$$
$$0 \leq \alpha \leq \underline{\alpha},$$

whose trivial solution is $\alpha^* = \underline{\alpha}$.

Case 2: $\alpha > \underline{\alpha}$. Program (13)–(15) becomes

$$\max_{\alpha} \frac{\rho}{1+\rho}\alpha py - \frac{kg^2}{2}$$
$$\text{subject to}$$
$$g(\alpha) = h(\alpha)$$
$$\underline{\alpha} < \alpha < \frac{1}{2}.$$

Upon substituting $g(\alpha)$ into the objective function and taking the first- and second-order conditions, we get as a solution

$$\begin{aligned}\alpha^* &= \underline{\alpha} + \frac{\rho}{1+\rho}\frac{(B+\phi)^2}{kpy} \\ &\equiv \overline{\alpha}.\end{aligned}$$

Thus, optimal monitoring is

$$g^* = h(\overline{\alpha}).$$

To obtain the definitive characterization of the optimal corporate governance design, we must compare these two possible solutions in terms of the founder's expected payoff from the complete game. That is, after evaluating expression (7) for solutions $(0, \underline{\alpha})$ and $(h(\overline{\alpha}), \overline{\alpha})$, we choose the solution yielding a larger expected payoff. □

Proof of Proposition 2. Using (4), (5), and (10) we rewrite the optimal outside investor's stake as

$$\overline{\alpha} = \frac{py - B}{py} + \frac{\rho}{1+\rho}\frac{(B+\phi)^2}{kpy}, \tag{16}$$

and optimal monitoring as

$$h(\overline{\alpha}) = \frac{B - \left(1 - \left(\frac{py-B}{py} + \frac{\rho(B+\phi)^2}{(1+\rho)kpy}\right)\right)py}{B+\phi}. \tag{17}$$

After substituting (5) into (11), and (16) and (17) into (12), it is possible to show that

$$V(h(\overline{\alpha}), \overline{\alpha}) = V(0, \underline{\alpha}) + \frac{1}{2}\frac{\rho^2}{(1+\rho)^2}\frac{(B+\phi)^2}{k},$$

which implies that $V(h(\overline{\alpha}), \overline{\alpha}) > V(0, \underline{\alpha})$ since parameters k, ρ, B and ϕ are all strictly greater than zero. □

Proof of Corollary 1. The control-to-ownership ratio evaluated at the optimal corporate governance solution is given by

$$\Delta = \frac{1 - h(\overline{\alpha})}{1 - \overline{\alpha}},$$

which is larger than 1 if and only if $\overline{\alpha} > h(\overline{\alpha})$. After replacing the value for $h(\overline{\alpha})$ according to (4), the last inequality becomes

$$\overline{\alpha} > \frac{B - (1 - \overline{\alpha})py}{B + \phi},$$

which is equivalent to

$$\overline{\alpha} < \frac{py - B}{py - B - \phi},$$

which is always true because the right-hand-side of this inequality is greater than 1 as $\phi > 0$, and assumption (A5) implies that $\overline{\alpha}$ is smaller than 1/2. □

Proof of Corollary 2. From expression (17) we can verify that

$$\frac{\partial h(\overline{\alpha})}{\partial B} = \frac{\rho}{(1+\rho)k} > 0,$$

$$\frac{\partial h(\overline{\alpha})}{\partial \rho} = \frac{1}{(1+\rho)^2}\frac{B+\phi}{k} > 0,$$

$$\frac{\partial h(\overline{\alpha})}{\partial \phi} = \frac{\rho}{(1+\rho)k} > 0,$$

and

$$\frac{\partial h(\overline{\alpha})}{\partial k} = -\frac{\rho}{1+\rho}\frac{B+\phi}{k^2} < 0,$$

which completes the first part of the corollary. For the second part, from expression (16) it follows that

$$\frac{\partial \overline{\alpha}}{\partial B} = -\frac{1}{py} + \frac{2\rho(B+\phi)}{(1+\rho)kpy}.$$

Since the first term of this expression is negative and the second one is positive, the final sign of this derivative is indeterminate. It is easily verified that if $B < \frac{(1+\rho)k}{2\rho} - \phi$, $\frac{\partial \overline{\alpha}}{\partial B}$ is negative, otherwise it is positive.

From (16) it can also be verified that

$$\frac{\partial \overline{\alpha}}{\partial \rho} = \frac{(B+\phi)^2}{kpy(1+\rho)^2} > 0.$$

Finally, direct inspection of (16) indicates that $\frac{\partial \overline{\alpha}}{\partial \phi} > 0$ and $\frac{\partial \overline{\alpha}}{\partial k} < 0$. □

Supplementary material

Supplementary material associated with this article can be found, in the online version, at 10.1016/j.frl.2019.06.005

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