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ABSTRACT

From Elihu Thomson and Herbert Dow in the late nineteenth century to Steve Jobs a hundred years later, many entrepreneurs have been stymied by their investors. In this paper, we use a simple model to explore how outcomes might have been different if entrepreneurs, instead of the investors, had control of their firms. We also explore the importance of legal rules that enable entrepreneurs to lock in control even when, under one-share-one-vote governance, power would rest with their investors. We find that entrepreneurs take advantage of such rules when the cost of capital is low, as in Britain in the early twentieth century or the US in the early twenty-first century. We also find that firms controlled by entrepreneurs can take on more difficult projects, and thus push the technological frontier out more rapidly, than firms controlled by investors. Such firms are also superior in this way to serial startups.

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Do Entrepreneurs Want Control? And Should They Get What They Want?

A Historical and Theoretical Exploration

By 1882 Elihu Thomson had reached the breaking point. Two years earlier a group of investors from Bridgeport, Connecticut had financed a startup, the American Electric Company, to develop an arc-lighting system that he and Edwin Houston had invented. Now it had become clear to Thomson that the Bridgeport capitalists were interested only in quick speculative gains and were unwilling to advance the resources he needed to improve the system and market it effectively. There was little he could do about the situation, however, because he did not control the company. American Electric was a corporation, and Thomson and Houston together owned only a third of its shares. After failing to persuade the controlling shareholders to take a longer view of the enterprise—and failing to raise enough money to buy control—Thomson decided to walk away from the company, abandoning his intellectual property and all the hopes and efforts he had invested in the enterprise (Carlson 1991, Chapter 4).

We know Thomson's story because he ultimately triumphed over adversity. After he left the Connecticut venture, he searched until he found a new set of investors in Lynn, Massachusetts, who bought out the old group and founded the Thomson-Houston Electric Company, the firm around which the General Electric merger was built in 1892. It is not hard to find other similar accounts in the historical record of entrepreneurs succeeding despite the conservatism of their initial backers. Indeed, such stories are the stuff of which business history is made.[1] By contrast, we know comparatively little about entrepreneurs whose aspirations were

[1] So much so that Joseph A. Schumpeter (1934) *defined* an entrepreneur as someone who overcame this kind of conservatism successfully.

blocked by reluctant backers or, conversely, who lost the funds that more accommodating investors provided on bad technological bets. Such failures tend not to be memorialized in the business history literature (Fridenson 2004).

This bias in favor of success is a problem because it encourages scholars to read history backwards—to concentrate on explaining successful entrepreneurs' achievements without seriously considering the contingencies that could have produced different outcomes.[2] The aim of this paper to bring these alternative paths into focus with the help of a simple theoretical model. We are particularly interested in understanding the comparative importance for innovation of startups (that is, enterprises formed to bring a single project to fruition) versus firms (longer-lived enterprises that can take on additional projects if the stakeholders agree). Contrary to conventional expectations, our analysis suggests that firms are likely to be a more important source of technological innovation than startups, and this is especially the case when the firms are controlled by entrepreneurs. After establishing these points, we examine the circumstances under which entrepreneurs were likely to have control or would have wanted to contract for control if the legal rules allowed.

Thomson did not have a choice. When he walked away from the American Electric Company in the early 1880s, most US states mandated that corporations choose their directors by vote of the shareholders under the rule of one-share-one-vote, plurality wins (Guinnane et al. 2007).[3] Because Thomson and his co-inventor did not own or control enough shares, they could not make decisions for the corporation. The only way they could affect decision-making was by expressing their views—that is, by voice—or by exit, to use Albert Hirschman's terms (1970).

[2] On the importance of reading history forward, see Raff (2013) and Lamoreaux, Raff, and Temin (2004).
[3] By the 1880s some states were mandating cumulative voting, which increased the probability that minority shareholders would have representation on the board, though not control (Lamoreaux 2023).

In Europe at the same time, however, it was possible for an entrepreneur to contract for control when founding an enterprise. For example, in Britain organizers of corporations could write articles of association that entrenched a controlling group on the board of directors, allowed members of the board to name themselves managing directors who were exempted from having to stand for reelection, or simply awarded the founders' shares more votes than those of other shareholders (Guinnane et al. 2017). In France, it was similarly possible to write articles of association that separated income from control rights in ways that entrenched a particular group of stockholders regardless of their ownership share (Guinnane et al. 2007). The US rules evolved after Thomson's time, specifically after New Jersey revised its general incorporation law in 1896, and in the US too it became possible to separate income and control rights by means of multiple classes of shares and other devices (Gompers et al. 2010, Rauterberg 2021).[4]

The issue of control in corporate enterprises has spawned a large literature in contract theory, finance, and business and economic history that primarily examines the separation of ownership from control in large, long-established firms where managers' share of equity is small. Most scholars assume that the source of the problem is incomplete and asymmetric information. Shareholders (principals) have difficulty monitoring and directing the managers (agents) who run the firm, and as a result, managers can extract private benefits at shareholders' expense, even though they do not have formal control. The solutions proposed in this literature generally do not involve the reallocation of control, because scholars assume that the formal rules about who has it do not matter. Instead, the literature focuses on the design of the contracts and remuneration mechanisms that align managers' incentives with shareholders' goals.[5]

[4] New Jersey Legislature, "An Act Concerning Corporations," approved 21 April 1896.
[5] This enormous literature traces back to Michael Jensen and William Meckling's famous 1976 paper, "Theory of the Firm." The paper has almost 120,000 citations on Google Scholar.

However, scholars associated with the so-called law and finance school (see, for example, La Porta et al. 1997) have weighed in on the structure of control and have made the case for the superiority of one-share-one-vote corporate governance. In their view, countries with legal regimes that favored this rule did a better job of protecting investors' interests and, consequently, benefited from broader participation in capital markets and higher levels of per capita income. These claims have inspired economic and financial historians to document the governance structures that companies adopted in different times and places. Analyzing the relationship between legal rules and economic outcomes, these historians have sometimes supported the law and finance position, but just as often have found it wanting (see the essays in Morck (2007) on a variety of countries, Mussaccio (2009) on Brazil, Hilt (2014) on the US, and Hannah (2016), Guinnane et al. (2017), and Acheson et al. (2019) on Britain). Nonetheless, for a time the idea that shareholder-friendly corporate governance was superior to alternative structures of control was so persuasive that Henry Hansmann and Reinier Kraakman (2001) proclaimed "The End of History for Corporate Law."

Although we have contributed to this literature (Lamoreaux and Rosenthal 2005, Guinnane et al. 2007), it is not our intention to revisit these controversies here. Instead, our aim in this paper is to explore the effects of different corporate governance regimes on firms' decisions about whether to undertake innovative projects. We are particularly interested in understanding what happens in startup companies when entrepreneurs (like Elihu Thomson in the American Electric Company) want to keep innovating and their backers do not want to let them do it.[6] The articles that are closest in spirit to ours (Aghion and Bolton 1992, Guo 2016, Goshen and Hamdani 2016) recognize that entrepreneurs may seek to commit the firm to

[6] As Pollman (2019) has underscored, neither the principal-agent nor the law and finance literature is well-suited to understanding governance problems in startup companies.

projects that investors would not want to undertake. They approach the problem from the perspective of the principal-agent literature where investors who seek to discipline entrepreneurs face challenges because of asymmetric information or incomplete contracts. Their contribution is to suggest various metrics that investors could use to determine when to reign in entrepreneurs' activities. We take a different tack and ask how entrepreneurs would choose to design the control structure of their firms when they are concerned about their ability to drive the innovation process. Also, unlike most other efforts in this area, we combine a model with a review of some important cases from business history that motivate the salient features of our analysis.

In some ways our model is a simplified version of Aghion and Bolton (1992). As in their model, our entrepreneurs are poor and must elicit the participation of investors in order to undertake projects. In both models, entrepreneurs have private benefits that bias their decisions, and in both models, contracts are incomplete. In Aghion and Bolton, contracts are incomplete because the information parties need to set the control structure of their enterprise is not verifiable. There is, however, the possibility of a verifiable signal on which the parties can base a contingent contract for control. This complex information environment allows Aghion and Bolton to examine the impact of variations in contractual incompleteness on efficiency and explore the extent to which financial contracting can approximate the optimal (complete contract) solution. They conclude that there is "a pecking-order of governance structures" in which the best possibility is entrepreneurial control, followed by continent control based on the interim signal, followed by investor control, if that is the only way to secure financing (Aghion and Bolton 1992, pp. 491-492).

In our model contracts are incomplete, not because information is unverifiable, but because the controlling owner cannot commit to the optimal course of action, even though what that course entails is known to all. The reason is that the decision to invest in a new project is made by whoever is in control and, at the time the decision is made, it is never in the interest of the controlling policy to make the optimal choice. Although theoretically it might be possible to contract in advance to secure the optimal course of action, we do not observe such contracts in the real world. Therefore, we rule them out so we can focus on the real-world problem of how control matters for technological innovation. This approach allows us to investigate both the normative and positive facets of the problem of structuring control. It does not yield a pecking order of solutions, but rather a view of the control decision that is historically contingent. In our model, who has control depends on the experience of the individual firm, circumstances in the macroeconomic environment, and the particular institutions—the legal rules—that are in place.

In our full model, a firm lasts two periods. In the first period, the entrepreneur forms a firm to undertake a project and offers an investor a share of the equity in exchange for capital. In the second, the entrepreneur proposes a new project, but whether the firm undertakes it may depend on who has control. Entrepreneurs and investors share the returns from projects according to their respective equity stakes, but entrepreneurs gain an additional benefit—an externality—from undertaking projects that investors do not share.[7] That benefit means that there is a range of projects that are profitable for the entrepreneur but not the inventor. We assume that projects are differentiated by their degree of difficulty and hence their expected

[7] The externality could involve some kind of learning that either does not benefit the firm or does so only partially, an enhancement of the entrepreneur's reputation, status, and job prospects, or perhaps just a feeling of achievement. We assume for simplicity that the externality is earned whatever the outcome of the project, but if it is earned only if the project is successful, the results do not fundamentally change.

returns. A firm under the control of an entrepreneur will undertake more difficult projects than a firm under the control of an investor and thus do more to push out the technological frontier.

In the first section of the paper we consider a firm that lasts only one period. To implement her project, the entrepreneur must raise funds from an investor and therefore must meet the investor's participation constraint. There are many potential investors, so whether the entrepreneur can secure the investment (and how much equity she will have to give up in exchange for it) depends only on the expected return from the project and the opportunity cost of capital. There is no conflict in this one-period scenario because the externality the entrepreneur gains does not figure into the calculation. Hence it does not matter who has control. However, because the one-period firm is equivalent to a startup by the above definition, the case provides a useful standard of comparison. As we show, on average startups take on less difficult projects than firms that live two periods. Entrepreneurs who form a second startup on the heels of the first do somewhat better, but if the goal is to drive technological change by taking on more difficult projects, firms that live for two periods do better still.

The second section examines the two-period firm's decision to undertake a second project. Because the entrepreneur gains an externality from the project and the investor does not, if the firm is controlled by the entrepreneur it will tackle more difficult projects than when the investor is in control. Under one-share-one-vote governance rules, which party has control depends on the equity stakes set at the start of the first period. Thus, whether the entrepreneur has control is determined by the history of the firm (the degree of difficulty of the first project) and the macroeconomic context (the opportunity cost of capital). The easier the first project and the lower the cost of capital, the greater the likelihood that the entrepreneur will have an equity

stake that gives her control. In periods when the cost of capital is low, ceteris paribus there will be more technological change.

Of course, under more flexible governance rules, it is possible for the entrepreneur to buy control by offering the investor a higher equity stake. But would she want to do it? We answer that question in the third section of the paper with an exercise in backward induction and find that the result depends on the magnitude of the externality and the opportunity cost of capital. Regardless of the size of the externality, in periods when the cost of capital is very low, entrepreneurs will buy control. As the cost of capital increases, they will buy control only if the gain from the externality is very large. Although we cannot observe the size of the externality in the data, the opportunity cost of capital is a matter of historical record. We find broad confirmation of the model in the frequency with which the founders of firms locked in control in late-nineteenth and early-twentieth-century Britain, when the cost of capital fell to historic lows. We see similar patterns in the early twenty-first-century United States, when the cost of capital fell close to zero and founders increasingly used multiple classes of common stock to retain control.

In the final section of the paper we relax some of the assumptions of the model and find that the results do not change. Under one-share-one-vote rules, however, firms that begin with entrepreneurial control are likely, if they live for multiple periods, to shift over time to investor control and hence lose some of their innovative character. By contrast, if the entrepreneur locks in control, she will waste some resources on projects that are too difficult to be socially desirable to undertake. An important implication of our model, therefore, is that neither set of legal rules offers a first-best solution to the problem of when to invest in technologically innovative projects. Whether the rules mandate one-share-one-vote or allow the entrepreneur to contract for

control, the choice of projects will always deviate from the optimal contract. The question then becomes which set of rules are second best, and the answer depends on the history of the firm and the macroeconomic context within which it operates.

The Case of the One-Period Startup

A tinkerer since childhood, Elmer Sperry decided as a young adult that he wanted to become an inventor. While a student at Cortland Normal School in upstate New York, he learned as much as he could about electricity and sought the advice of a professor at nearby Cornell University about technical problems in need of solution. Inspired by the professor's response, he designed a generator capable of supplying a constant current regardless of the load on its circuits. Sperry came from a family of modest means, and he had no money to develop his ideas. Like Thomson and many others in similar positions, he began systematically to scour the local business community for potential investors. He found them at the Cortland Wagon Company, whose executives took Sperry in and provided him with funds to live on, a shop in which to work, and the advice and services of a patent lawyer. The year was 1880, and in this sheltered environment, Sperry not only perfected his dynamo, but over the next two years developed a complete system of arc lighting to go with it. The wagon company had a branch in Chicago, and there in 1883 its officers organized the Sperry Electric Light, Motor, and Car Brake Company, with additional backing from local Chicago investors. Sperry served as electrician, inventor, and superintendent of the enterprise's mechanical department. For his intellectual property, Sperry received $175,000 in stock out of a total capital of $1,000,000 (Hughes,1971).

Sperry was successful in securing financing for his startup, though he had to give up most of the equity in the firm to his investors. It is likely that many other inventors failed to raise

capital at this stage. What determines whether an entrepreneur can raise funds to form a company and how much equity she must give up? In our simple (full information) model, the answer is the difficulty of the project she wishes to undertake and the opportunity cost of capital. If the project is too difficult, it is unlikely to be profitable, and she will not be able to meet the investor's participation constraint—that is, pay him the opportunity cost of his capital. If the project is very easy, it is likely to be profitable, and she will be able both to attract the necessary capital and maintain control. In between, obtaining capital may require the entrepreneur to give up a majority of the equity and, with it, control.

More formally, we assume that the entrepreneur randomly draws a project with probability of success q_1 from the uniform distribution $[\underline{q}, \overline{q}]$. All projects have the same payoffs: *S* if they succeed; *F* if they fail. They differ only in their degree of difficulty *(1-q)*. The entrepreneur owns the project but does not have the capital to undertake it. She is risk neutral and raises one unit of capital from an investor by selling equity. We assume that the entrepreneur's outside opportunities are poor and that she will participate even if her equity stake is zero. (We will return to the issue of debt later.) The investor is also risk neutral and joins the firm if the entrepreneur offers him an equity stake (α_1) large enough so that his expected return is at least equal to the opportunity cost of capital, *r*.

$$\alpha_1[(1-q_1)F + q_1 S] \geq r$$

Because there are lots of potential investors, the entrepreneur only needs to choose an equity share that is just sufficient to meet the investor's participation constraint:

$$\alpha_1 = \frac{r}{(1-q_1)F+q_1 S}$$

Because the entrepreneur cannot offer the investor more than the entire equity, the hardest project that she will be able to undertake ($\underline{q}_1$) is the one where she gives the investor ownership of the entire firm:

If $\alpha_1 = 1,\ \underline{q}_1 = \frac{r-F}{S-F}$.

This very simple model offers three useful lessons. First, as already noted, the investor's equity stake is increasing in the cost of capital and decreasing in the project's probability of success. Thus, in a one-share-one-vote corporation, the lower the cost of capital and the easier the project, the more likely the entrepreneur is to have control. Second, governance is irrelevant for the case of the one-period startup because the only determinant of whether a project will be undertaken is the investor's participation constraint. Third, as the cost of capital falls, firms will be formed to start more difficult projects (that is, projects with a lower probability of success, *q*). Thus, the pace of technological change depends on the cost of capital.

Applied to the case of the Sperry Electric Light, Motor, and Car Brake Company, the model suggests that Sperry's project was easy enough to justify the formation of the firm but hard enough that he had to relinquish control. Easy projects do not always succeed, but harder projects by definition are more likely to fail, and Sperry's seems to have fallen into that category. Despite several infusions of capital, the company limped along until it ceased operations in 1887. Even though it failed, the company realized some return (F in the model) by selling off its property, including Sperry's patents, to a new company, the Sperry Electric Company. That company was not successful either. Sperry worked for it for a while as a consultant, but he did not own any stock. Instead, he used the proceeds from his share of the sale to set himself up as an independent inventor. The failure had been sufficiently traumatic that Sperry resolved never to involve himself in another startup but rather to specialize in invention and profit from selling

or licensing his intellectual property to others (Hughes 1971, Ch. 2). Had he instead decided to put his resources toward a second startup, from the standpoint of our model he would not have had to raise as much capital as he did for the first venture and therefore would have been able to finance more difficult projects. As we will show in the next section, however, serial startups cannot, as a general rule, take on projects as difficult as firms that last two periods, even when the investor is in control.

The Two-Period Firm and the Importance of Control

In 1893, after an explosion at the experimental plant where Herbert Dow was developing a process for producing chlorine bleach, executives of the Midland Chemical Company put a stop to his experiments. Like Elihu Thomson a decade earlier, Dow responded by leaving the startup that he had founded three years earlier, walking away from his intellectual property. Midland Chemical had been formed to exploit Dow's invention of an electrolytic process to extract bromine from brine. This project was a success, and Dow wanted to move on to develop similar processes to extract chlorine, magnesium, and other elements from brine. He did not have control, however, and his backers were not interested in supporting these other projects. For a time, they allowed him to conduct modest experiments at the company's facilities, but after the accident they forbade him to continue. As in the case of Thomson, we know this story because Dow was ultimately successful. He found backers willing to finance an R&D laboratory, the Dow Process Company, which, when his experiments worked, was reorganized as the Dow Chemical Company. Later the new company bought out the Midland investors who had

blocked Dow's chlorine project, taking control of the original company and the patents he had assigned to it.[8]

Dow's experience with Midland illustrates the kinds of conflicts that might arise even in a successful firm over whether to undertake a second project. In our model, such conflicts occur because entrepreneurs earn an externality from taking on new projects that investors do not share. Although entrepreneurs participate with investors in the profits or losses from a second-period project according to their respective equity stakes, entrepreneurs gain an additional benefit from undertaking the project. As a result, firms always face a range of projects in the second period that the entrepreneur wants to undertake but that are too difficult to be profitable for the investor. Projects in this range will only be undertaken if the entrepreneur has control.

In formal terms, at the beginning of the second period the entrepreneur draws a new project, q_2, from the distribution $[\underline{q}, \overline{q}]$. We assume that the first investor has a right of first refusal: If he agrees to the project, the entrepreneur must undertake it within the firm. Also, to keep the exposition simple, we assume that the returns from the first project remain tied up in the firm (which, after all, is still engaged in the first project) until the conclusion of the second period. Hence, if the new project is to be undertaken, the firm must raise another unit of capital from a second investor in exchange for an equity stake (α_2) that meets his participation constraint, *r*. (Again, we leave for later the possibility that the firm can borrow the needed funds.) The entrepreneur will then own $(1-\alpha_1)(1-\alpha_2)$ of the firm, and the first investor $\alpha_1(1-\alpha_2)$.

[8] Margaret Levenstein, *Accounting for Growth: Information Systems and the Creation of the Large Corporation* (Stanford, CA: Stanford University Press, 1998), Ch. 3.

Using the same kind of algebra as for the one-period problem, we can calculate the hardest project that each party would willingly undertake if the first project succeeded (Table 1) and if it failed (Table 2). As the tables indicate, the first investor wants to undertake any project that will earn him a positive expected return and that implies that his threshold for the second project is the same as for the first project (and for a start-up enterprise). The entrepreneur also wants to earn a positive return. However, because she gains an externality, she can profit from some projects that would cause the investor to lose money. Her threshold, therefore, is lower than that of the first investor ($\underline{q}_{2i} > \underline{q}_{2e}$).

If the two existing stakeholders were to maximize their joint return, the hardest project they would undertake would fall in between their two thresholds. That is, $\underline{q}_{2i} > \underline{q}_{2s} > \underline{q}_{2e}$. Given the perfect information setting of our model, it would theoretically be feasible for the stakeholders to contract on the threshold difficulty of the second period project. However, we exclude this possibility from our analysis because we do not observe such contracts in practice. Instead we simply use $\underline{q}_{2s}$ as a benchmark to show how the outcomes of different governance regimes deviate from this optimal result. Thus, if the investor is in control, he will be too conservative and will not agree to any projects between $\underline{q}_{2i}$ and $\underline{q}_{2s}$. If the entrepreneur is in control, she will be too aggressive. Although ex ante she would prefer to commit to $\underline{q}_{2s}$—and would if she owned the entire firm—she cannot. In the second period, when she draws a new project, she will maximize her return by undertaking all projects easier than $\underline{q}_{2e}$.

The stakeholders' different preferences about the second project introduce conflict into the firm of the sort that Dow experienced. In the case of projects between $\underline{q}_{2e}$ and $\underline{q}_{2i}$, the entrepreneur wants to go forward but the investor does not. As we show in the appendix, the

range of projects over which the two stakeholders disagree increases with the size of the externality and the cost of capital. It also increases with the difficulty of the project that the firm undertook in the first period, because the lower the equity stake of the entrepreneur, the smaller the share she bears of any potential losses.

The second investor's threshold is always the project that would give him 100 percent of the firm. Whether the first project succeeded or failed, the value it generated (*S* or *F*) helps the existing stakeholders (the entrepreneur and the first investor) meet the second investor's participation constraint. Because $\underline{q}_{22}$ is always less than $\underline{q}_{2i}$, the second investor is always willing to participate in the second project if the first investor is. Because $\underline{q}_{2i} = \underline{q}_1$, the second investor is always willing to fund more difficult projects than would have been possible in a startup enterprise. Moreover, because both stakeholders contribute to the second project from their returns, the second investor will be able to fund more difficult projects than a serial entrepreneur.

Table 1. The Hardest Project Each Party Would Want to Undertake if the First Project Succeeds

	Condition	Hardest project
Second investor	$\alpha_2 = 1$	$\underline{q}_{22} = \frac{\mathrm{r} - \mathrm{S} - \mathrm{F}}{S - F}$
First investor	$\alpha_1 \left((1 - q_2)F + q_2 S - r\right) > 0$	$\underline{q}_{2i} = \frac{r - F}{S - F}$
Entrepreneur	$(1 - \alpha_1)\left((1 - q_2)F + q_2 S - r\right) + E > 0$	$\underline{q}_{2e} = \frac{r - F - E/(1 - \alpha_1)}{S - F}$
Stakeholders combined (entrepreneur and first investor)	$(1 - q_2)F + q_2 S - r + E > 0$	$\underline{q}_{2s} \geq \frac{r - F - E}{S - F}$

A comparison of Table 2 with Table 1 shows that the only threshold that changes if the first project failed instead of succeeded is the second investor's. If the first project succeeded, the participation constraint of the second investor never affects the firm's decision about a second project. Because S > r > F, if the first project succeeded, the second investor's threshold, $\underline{q}_{22}$, is a negative number and hence can never be binding. If the first project failed, however, the participation constraint of the second investor may bind, depending on the relative magnitudes of F, E, and α_1. Whether that possibility matters depends on who is in control. If the first investor is in control, then the issue is irrelevant because the investor would never agree to projects with a probability of success less than $\underline{q}_{2i}$. However, if the entrepreneur is in control, the second investor's threshold may constrain her choices. In the event that it does, it reduces the range of disagreement between the entrepreneur and the first investor: only projects between $\underline{q}_{22}$ and $\underline{q}_{2i}$ are now possible to finance. But it also raises the expected value of the firm because it rules out projects with higher probabilities of failure. As we show in the next section, this increase raises the value of control to the entrepreneur.

Table 2. The Hardest Project Each Party Would Want to Undertake if the First Project Fails

	Condition	Hardest project
Second investor	$\alpha_2 = 1$	$\underline{q}_{22} = \frac{\mathrm{r} - 2\mathrm{F}}{S - F}$
First investor	$\alpha_1 \left((1 - q_2)F + q_2 S - r\right) > 0$	$\underline{q}_{2i} = \frac{r - F}{S - F}$
Entrepreneur	$(1 - \alpha_1)\left((1 - q_2)F + q_2 S - r\right) + E > 0$	$\underline{q}_{2e} = \frac{r - F - E/(1 - \alpha_1)}{S - F}$
Stakeholders combined (entrepreneur and first investor)	$(1 - q_2)F + q_2 S - r + E > 0$	$\underline{q}_{2s} \geq \frac{r - F - E}{S - F}$

In a one-share-one-vote firm, projects about which the entrepreneur and the investor disagree will be undertaken if the entrepreneur has a majority equity state; if the investor has the majority stake, they will not. Who has control is in turn a function of the level of difficulty of the first project and the opportunity cost of capital. We define the pivotal project to be the level of difficulty of the first-period project that transfers control from the investor to the entrepreneur. We leave the calculation of that value of *q* to the appendix. Here we simply emphasize that control in one-share one-vote firms is entirely driven by the firm's history. If the first project was hard enough, the investor will be in control in second period; if it was easy enough, the entrepreneur will be in control. In other words, in our model the allocation of control in firms with a one-share-one-vote governance rule is not forward looking. Indeed, it cannot be, because the second-period opportunities are independent of those of the first period.

There were (and are) other possible governance rules, however. At the time Dow was forced to stop experimenting at Midland, entrepreneurs in Britain could, and often did, write articles of association that locked in control when they established a firm (Guinnane, Harris, and

Lamoreaux 2017). For example, the articles of Dymock's Patent Twine Company, Limited, named John Dymock, the eponymous inventor, to be the permanent managing director. He did not have to stand for election and would hold the position "as long as he shall live," even though he owned only 15 out of 2000 shares.[9] In France, as in Britain, entrepreneurs could lock in control by naming themselves directors for long periods of time.[10] Moreover, in both countries entrepreneurs could insure their control by creating multiple classes of shares with different voting rights. By the end of the nineteenth century, the rules were beginning to change in the US as well. New Jersey's 1896 general incorporation act gave every corporation the "power to create two or more kinds of stock of such classes, with such designations, preferences and voting powers, or restriction or qualification thereof, as shall be stated … in the certificate of incorporation."[11] New Jersey, in other words, was giving incorporators options similar to those that had long been available in Britain and in countries with French legal systems. Other states gradually adopted similar rules, and in the meantime, entrepreneurs located outside New Jersey always had the option of selecting that state as their corporate home.

Even with these more flexible rules, however, entrepreneurs still had to meet investors' participation constraints to start firms. Because investors knew that entrepreneurs who locked in control would be willing to undertake projects that inflicted losses on them, they would not contribute capital unless they were compensated ex ante for the expected likelihood of that

[9] Article 27, in combination with article 22, specified that Dymock could only be removed if he sold off his shares, missed six months of directors' meetings without permission of the board, or became a bankrupt or a lunatic. Two large shareholders were also entrenched for life as regular directors. Articles of association of the Dymock Patent Twine Co., Ltd. (1912), BT 31, 124849 20980 1920, Board of Trade: Companies Registration Office: Files of Dissolved Companies, National Archives, Kew, United Kingdom.

[10] Lefebvre-Teillard (1985), pp. 168-71 352-70; Lamoreaux and Rosenthal (2005). The law of 1867 was silent on control, but multiple classes of voting shares were issued into the 1920s. See the Citroën example below. *Bulletin annoté des lois et décrets* (1867), pp. 309-386.

[11] New Jersey Legislature, "An Act concerning corporations," approved 21 April 1896.

outcome. How much compensation they required, and whether entrepreneurs would be able to offer it, are the subjects of the next section.

When Will Entrepreneurs Buy Control if the Rules Allow?

Like Herbert Dow, Henry Ford did not have control of the company formed in 1901 to exploit his ideas. Although he served as the Henry Ford Company's chief engineer, he owned only a sixth of its stock, and tensions between Ford and the capitalists who controlled the company developed almost immediately. The capitalists wanted to build expensive cars to sell to rich consumers; Ford wanted to learn how to bring down the price of cars for the mass market. Unable to convince his backers to support his ambitions, he left the company after only six months, determined, as he later put it his autobiography *My Life and Work*, "never again to put myself under orders" (quoted in Gleason 2016, p. 85). This was Ford's second try—an earlier company had failed in its second year of business—so he was really in no position to demand control. He did, however, come to a remarkably accommodating agreement with a Detroit coal dealer named Alexander Young Malcomson, who financed the development of a prototype for the Model A and then organized a corporation to produce it (the Ford Motor Company) in 1903. Ford and Malcomson each owned 25.5 percent of the company's stock, with the rest scattered among a number of smaller shareholders, many of whom Malcomson had lined up. Ford and Malcomson intended to run the enterprise as if it were partnership. Together they would exercise control, but neither would be able to make important decisions on his own (Gleason 2016; Davis 1988).

Unfortunately, the same kinds of tensions over what kind of car to build that had frustrated Ford in his earlier companies soon developed with Malcomson. This time Ford took

matters into his own hands and plotted with enough other shareholders to force Malcomson out. He and his co-conspirators organized a second company, the Ford Manufacturing Company, to supply parts to the Ford Motor Company. With the Motor Company now under the control of the conspirators, the parts company was able to siphon off its earnings by charging high prices. The conspirators in the parts company earned handsome profits, but Malcomson and other minority shareholders were not included in the new company and so did not share in its profits. Under considerable financial pressure at the time, Malcomson decided not to fight the maneuver in court and instead sold out for a fraction of what his shares would soon be worth.[12]

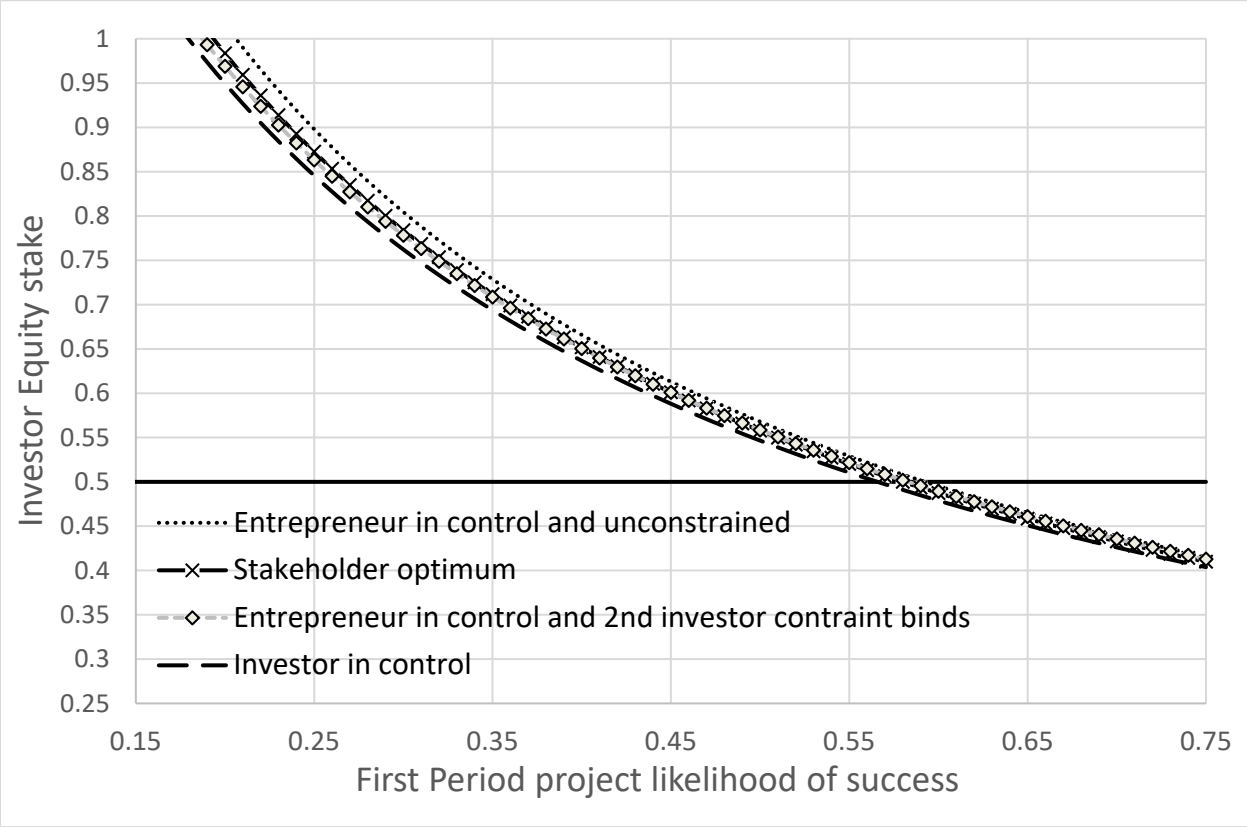
Ford's maneuver was probably actionable. It was certainly unethical. Indeed, one of Ford's allies, Charles H. Bennet, pulled out of the deal, declaring himself "ashamed." "I felt that in my own community, if it was known that I was in with a crowd of follows who had frozen out somebody … I wouldn't stand quite as high as I would like to stand." (quoted in Gleason, 2016, p. 87, 90). Ford undoubtedly thought he had no other choice—that the cost of gaining control legally was prohibitively high, and he was probably correct, especially given his past history.

From the standpoint of our model, the basic problem that entrepreneurs like Ford faced can be seen with the aid of Figure 1. The figure graphs the relationship between the first project's probability of success, q_1 (the horizontal axis), and the equity stake, α_1, that the entrepreneur has to give to the initial investor to meet his participation constraint (the vertical axis). It examines this relationship under several different scenarios. The curve with long dashes represents the case when the investor always has control, and the dotted one the case when the entrepreneur locks in control (and the second investor's participation constraint does not bind). The dotted line is higher throughout than the dashed line to take into account the

[12] The details are from Gleason (2016). But see also Davis (1988) and Nevins (1954).

possibility that the entrepreneur's second draw will come from the part of the *q* distribution where it will be profitable for the entrepreneur to undertake the project but the investor will lose money. The black line represents what the curve would look like if the stakeholders' were able to commit to their joint optimum. It always lies between the dotted and dashed curves. Finally the curve with the gray dashes and diamonds shows what would happen if the entrepreneur locked in control but the parameters were such that the second investor's participation constraint was binding if the first project failed. Whether the stakeholders face the dotted or dashed line depends on the relative values of E and F (see the appendix). The ordering of the other two lines does not change with these parameters.

Figure 1: How the Equity Stakes that Meet the First Investor's Participation Constraint Vary Depending on Who Will Have Control in the Second Period



Note: The figure is drawn from an example, to illustrate the interaction between control and equity stakes. All other figures are drawn from examples as well.

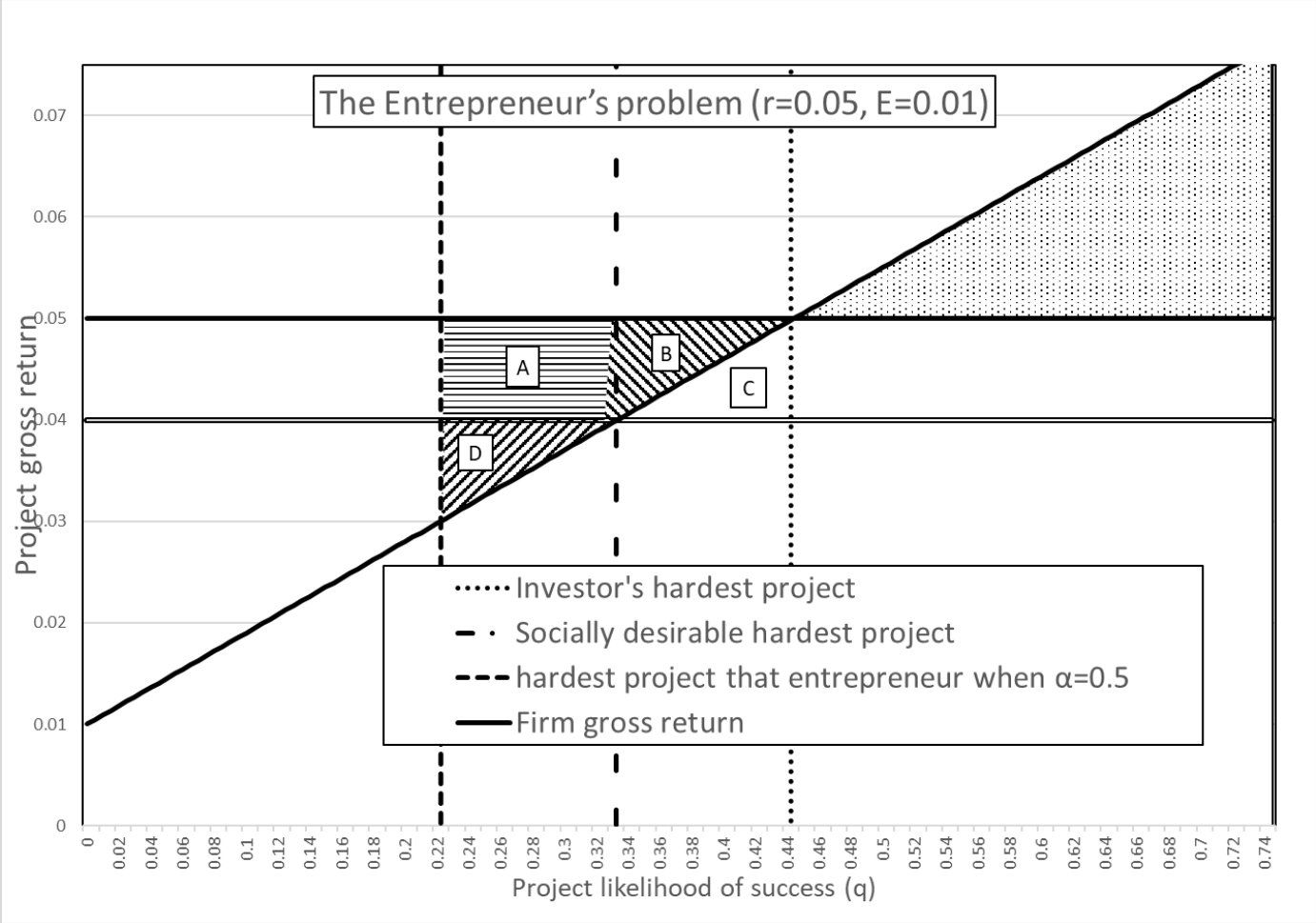
The horizontal line represents the case where the equity stake of the first investor is 0.5. Assuming for the time being that the second investor's participation constraint does not bind, the intersection of that line and the dotted curve mark the pivotal value of q_1 beyond which, under one-share-one-vote legal rules, the entrepreneur would have control. For lower values of q_1, the investor would have control. Under more flexible legal rules the entrepreneur could buy control by giving the investor a greater equity share. In Figure 1, the amount she would have to give up

at each q_1 is indicated by the vertical distance between the dotted and dashed curves. Note that these two lines move closer together as q_1 increases. The reason is that the higher q_1, the higher the entrepreneur's equity stake (1-α_1), and therefore the greater the share of any losses the entrepreneur has to bear. That is, the range of disagreement between the entrepreneur and the investor falls as the entrepreneur's equity stake rises, all other things remaining the same, so the entrepreneur has to compensate the investor less to secure control.

To assess the circumstances under which the entrepreneur will pay in this way for control, it is useful to consider the case when the entrepreneur's equity stake is exactly one-half and the second investor's participation constraint does not bind. It turns out that the analysis of this very specific case provides the essential results we need to show what choices the entrepreneur would make under other values of the parameters. Taking *r* and *E* for the time being as fixed, Figure 2 illustrates the entrepreneur's calculation. The horizontal axis demarcates the difficulty of the second project, q_2, and the vertical axis the gross return from the second project, q_2S + (1-q_2)*F*. The upwardly sloping line shows the gross return as a function of q_1. The slope is *S*-*F* and the intercept *F*. The top horizontal line represents the opportunity cost of capital, *r*. The hardest project the investor wants to undertake, $\underline{q}_{2i}$, is at the intersection of that line and the gross return function. The externality gained by the entrepreneur, *E*, is represented by the vertical distance between the two horizontal lines. At values of q_2 below $\underline{q}_{2i}$, the investor loses more and more money. So, in equal proportion, does the entrepreneur, but the entrepreneur also gains *E*. The stakeholders' optimum is reached where the lower line intersects the gross return function. There the losses of the two stakeholders jointly equal the value of the externality. At this point, the entrepreneur is still ahead, however, because her individual losses are only half the value of the externality she gains. She is therefore willing to continue to support projects with

smaller probabilities of success until at $\underline{q}_{2e}$ her losses equal the value of the externality. (We are assuming here that $\underline{q}_{2e} > \underline{q}$.) In the diagram, the gain from the externality is the area A + B + C, and the loss to the firm is B + A + D. At $\underline{q}_{2e}$ the gains just balance the losses.

Figure 2: The Entrepreneur's Control Calculation under the Assumption that She Has an Equity State of 0.5



The implication of this diagram is that entrepreneurs will be happy with one-share-one-vote governance rules. On the one hand, if the entrepreneur had an equity stake greater than 0.5, she would have control, and she would want it because the hardest project she would undertake would be to the right of $\underline{q}_{2e}$ in the diagram, and the gains from doing this project would outweigh her losses. On the other hand, if the entrepreneur had an equity stake less than 0.5, she would not want to buy control because her stopping point would shift to the left of $\underline{q}_{2e}$, leaving her worse off than accepting investor control.

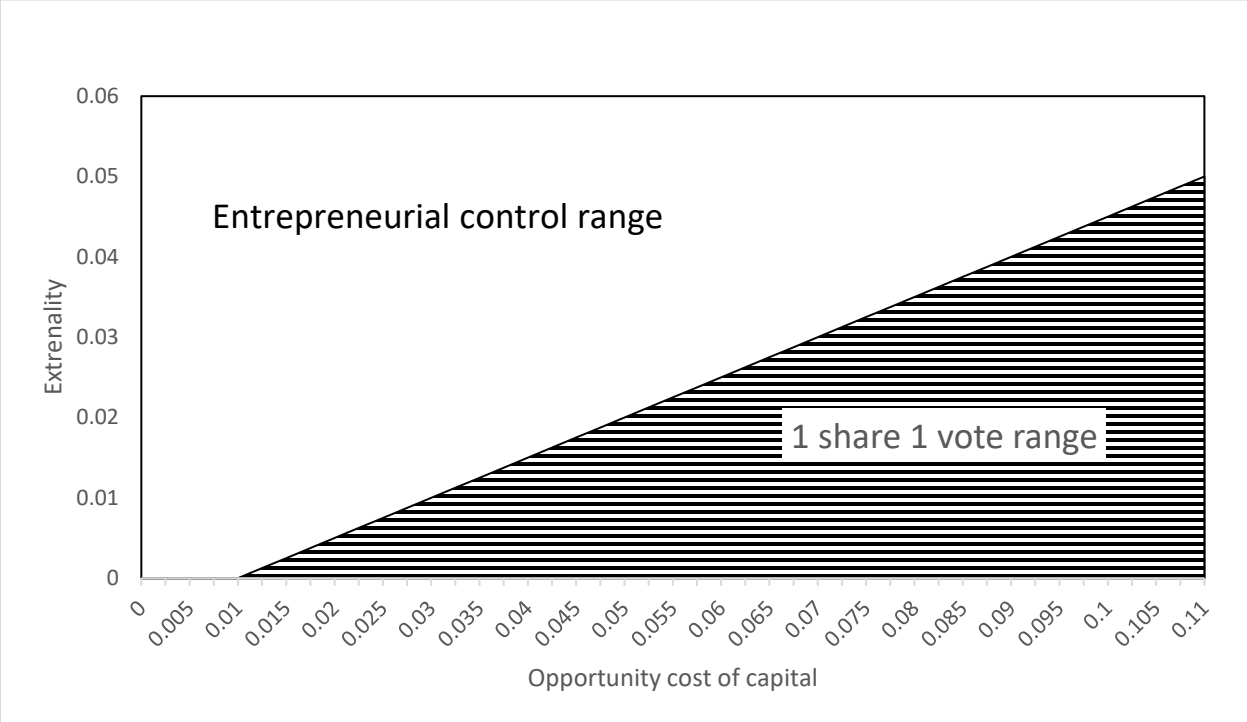
However, this very specific diagram was built by assuming certain fixed values for *r* and *E* that led to a value of $\underline{q}_{2e}$ greater than $\underline{q}$. Suppose instead we allowed *r* to fall by some amount Δ. The fall in *r* does not change the gross return function, the horizontal difference between $\underline{q}_{2i}$, $\underline{q}_{2s}$, and $\underline{q}_{2e}$, or the distance between the two vertical lines. These magnitudes are all dependent on the parameters *S*, *F*, and/or *E*, and are not affected by *r*. What does change are the various $\underline{q}_2$ thresholds, which all shift to the left by $\frac{\Delta}{S-F}$. If *r* falls far enough, $\underline{q}_{2e}$ will drop below $\underline{q}$, and when it does, it will be in the entrepreneur's interest to buy control. Entrepreneurial control will now clearly be second best because the distance between $\underline{q}_{2s}$ and $\underline{q}$ shrinks. At this point, moreover, the distance between $\underline{q}_{2i}$ and $\underline{q}$ also falls. In other words, if *r* falls far enough, the range of disagreement between the entrepreneur and the investor will begin to decline.

Similarly, if we allow *E* to increase, at some point it becomes worthwhile for the entrepreneur to buy control. As *E* rises, some aspects of the diagram remain unchanged, particularly the gross return function and the value of $\underline{q}_{2i}$. But raising the value of *E* lowers the bottom horizontal line and shifts both $\underline{q}_{2e}$ and $\underline{q}_{2s}$ to the left. If *E* is large enough, $\underline{q}_{2e}$ will fall

below $\underline{q}$, making entrepreneurial control both feasible and second best. When *E* increases, however, the range of disagreement between the entrepreneur and the investor increases as well.

Figure 3 summarizes these results by diagramming entrepreneurial control as a function of *r* and *E*. If *r* is very high, the entrepreneur will choose one-share-one-vote governance for all but the very highest values of *E*. As *r* falls, the range of values of E for which the entrepreneur will opt for control will increase until at very low values of *r*, entrepreneurs will always choose control. Similarly as *E* increases, entrepreneurs will buy control for higher and higher values of *r* until at very high values of *E* they always choose control.

Figure 3: The Choice of Control Structure



Note: This picture is drawn on the assumption that the second investor's participation constraint does not bind. If it does bind, then there is a similar dividing line between full entrepreneurial control and control contingent on equity stakes, but it is no longer linear and the shift occurs when the investor's equity stake is strictly larger than a half.

There is one more assumption whose consequence needs to be discussed: that the second investor's participation constraint does not bind. Here we just summarize our analysis and leave the details are in the appendix. Recall that the second investor's participation constraint only binds if the first project fails (and then, as we show in the appendix, only if $F > 2E$). When the constraint binds, the second investor only accepts projects that are strictly easier than the hardest project the entrepreneur wants to do, but he is still willing to undertake projects that the first investor would reject. When the second investor's participation constraint binds, therefore, the

expected return of the first investor goes up and the equity stake needed to meet his participation constraint falls. That in turn raises the likelihood that the entrepreneur will own a majority of the equity. Moreover, as we also show, when the second investor's participation constraint binds, the entrepreneur will want to take control for some values of her equity share less than 0.5 (as before, assuming $\underline{q}_{2e} > \underline{q}$). Below those values, control again depends on equity stakes as in Figure 2, and all the dynamics summarized in Figure 3 hold. That is, if *r* falls (*E* increases) far enough, the entrepreneur will choose to lock in control, and entrepreneurial control will be second best.

Beyond the Model: Debt, Alternative Organizational Forms, and Additional Periods

In the fall of 1934 André Citroën, founder and director of the Citroën automobile works, was a desperate man. Over the previous two years he had borrowed extensively to retool his factory so he could produce hundreds of thousands of the vehicles yearly, and now he needed another loan. A few months earlier his engineers had finished development of a new front-wheel drive automobile, the "Traction Avant," and the bankers refused him the additional credit he needed to put it into production. Although the Traction Avant was an engineering success, the Great Depression meant that sales were much smaller than anticipated, and the bankers were leery of sinking more funds into a project that did not seem likely to pay off anytime soon. Citroën then turned to Michelin, one of his major suppliers, for a lifeline. The tire maker agreed to provide him with the funds he needed but insisted that Citroën put up all his shares in the company as collateral. The loan effectively gave Michelin an option to buy Citroën out at market prices should the firm find itself in further financial straits. On December 20, 1934, Michelin exercised the option at a time when the company's share price was 57 francs, enabling

the tire company to take control of the automobile company for an investment of just 12 million francs (Broustail 2020, p. 161).[13]

Citroën's loss of the automobile company drives home the risks that an entrepreneur bears when she raises capital by borrowing rather than issuing equity, a topic whose consideration we have deferred until now. In our simple two-period model, the risks only matter for the first period. Because the stakeholders cash out at the end of the second period, if the entrepreneur borrows for a second project, the project's outcome affects the distribution of returns and nothing else. The stakeholders pay off the lender and divide the net residual value according to their equity stakes, each of them earning less if the project fails. If, however, the entrepreneur borrows to fund the first project, the risk of failure matters for control. The entrepreneur can borrow if she promises to pay the lender an amount D in period 2 that, given q_1, *S*, and *F*, enables him to earn *r* in expectation. If the project succeeds, the entrepreneur pays off the creditor and is in complete control. Because $S > r$, she can start any project she wishes, and as the sole owner of the firm, she will implement the stakeholders' optimum. If the first project fails, however, the lender takes control, and there is no second period because the lender has no stake in a new project. The entrepreneur is back to square one. The best she can do is to try another startup. The attraction of debt is, thus, the control it affords in the case of success. In the appendix, we show that the entrepreneur only turns to debt when she cannot achieve control with an equity issue. Debt is not a full substitute for investor control because the lender only cares about the return in the period when he makes the loan. In the first period, therefore, the lender invests in a narrower range of projects than the investor in control. When the first project is hard enough that entrepreneur cannot have control with an all-equity firm, she prefers debt to investor

[13] Critics accused Michelin of causing Citroën's financial problems and then taking advantage of the option clause to gain control of the firm unfairly.

control. When the first project is hard enough that the lender is not willing to participate, then the entrepreneur cedes control to the investor. We thus echo this aspect of Aghion and Bolton's "pecking-order theory of governance structures" (1992, p. 491).

If we extend the model beyond two periods, then debt may play a more important role in an entrepreneur's strategy. We return to that possibility below. But first we consider whether the results of the model would be different if the entrepreneur organized her firm using a form other than the corporation. Citroën himself had used other organizational forms earlier in his career. His first company, which made a special type of v-shaped gear, was organized as a limited partnership under the name Citroën, Hinstin, et Cie.[14] The other general partner, Jacques Hinstin, withdrew from the firm after a year. He and his brother Georges, who had been a limited partner in the gear company, were machinery makers, and they continued to operate their own firm as a partnership, Hinstin Frères, at the same address. The gear company remained a limited partnership until 1913, when Citroën reorganized it as a corporation and doubled the firm's capitalization. Although personally he did not own enough shares to control, with family members he had a 54.3 percent stake in the company.[15] During the First World War, Citroën started a munitions company, leasing the works of an automobile company he had previously managed, and, as the sole owner, made a large fortune selling artillery shells to the French government. When the war ended, he used his wealth to start a new automobile company, Usines André Citroën. That company also operated as a single proprietorship until Citroën needed a significant infusion of capital to exploit his innovative ideas. In 1924 he incorporated

[14] Citroen did not invent the gear or the machines that fabricated them. Instead, he functioned as a classic Schumpeterian entrepreneur who saw the economic value of the invention and figured out how to manufacture it successfully (Broustail 2020, p. 61).

[15] The corporation was capitalized at three million francs, half of which went to buying out the limited partnership. Archives de Paris, D3U31 Box 1488 #76 and Box 2405 #1085.

the works as the Société Anonyme André CITROËN with a capital of 50 million francs divided in 100,000 shares (30,000 Class A shares with six votes each and 70,000 Class B shares with one vote). Citroën owned all the Class A shares and 20,000 of the Class B shares, so he had control. In 1925 he increased the company's capital to 100 million francs, and in the next several years to 400 million. He maintained control through 1927 by subscribing for a portion of the additional shares, effectively plowing the entire fortune he had made in World War I into his vision of an integrated and innovative automobile plant.[16]

Entrepreneurs like Citroën found the corporation to be a superior vehicle for raising capital for innovative projects than the ordinary or limited partnership.[17] The problem with an ordinary partnership is that any partner can withdraw at will. In our two-period model, that ability to withdraw would give the investor veto power over a second project. If the entrepreneur sought to undertake a project more difficult than the hardest project the investor would support, the investor could pull out of the firm and force a dissolution. Limited partnerships were only marginally better. Although the limited partners' capital was locked in for the duration of the contract, the entrepreneur could not solicit additional capital without their approval. In firms organized as partnerships, whether ordinary or limited, the investor was always in control of the decision about a second project. On average, therefore, partnerships will undertake less difficult projects than corporations.

Corporations have another advantage as well: They lock in some of the human capital of the entrepreneur. In our model the firm has the right of first refusal on the second idea of the entrepreneur—that is, we assume the entrepreneur cannot leave the firm if the investor supports

[16] *Annuaire Desfossés* 1929, p. 1439 (accessed through Data for Financial History website)
[17] Peugeot was the only one of the top three French auto manufacturers that was organized initially as a corporation. Renault started as the partnership Renault Frères and subsequently reorganized as a corporation. *Annuaire Desfossés* 1912, p. 599. Louis Renault owned more than 90% of the corporation's equity (Fridenson 1972, Ch 5).

the second project. In an ordinary partnership, however, the entrepreneur can depart whenever she wants, and in a limited partnership she can depart at the end of the contract term. Suppose that the second project is one that the investor would want to support. That is, it has a positive expected value after paying the cost of capital to the second investor. If the entrepreneur stays in the firm, she has to share that return with the first investor, but if she leaves she gets to keep it for herself. As a result, in a partnership, the entrepreneur will only present projects to the investor for which the expected value is negative; she is happy to have him to share the losses. The investor understands this calculus and will always leave after the first project. Short of some way to bind the parties to the enterprise, a world of partnerships is a world where one cannot do better than serial start-ups. It is a world with a lower rate of technological change.

This limitation provides another example of how legal rules can matter. Under US law it was difficult to write partnership contracts that bound the parties to the firm. European countries had more flexible rules that enabled firms to impose penalties that at least reduced the incentive of parties to dissolve the enterprise. Moreover, early on they developed variants of the partnership form that enabled entrepreneurs to lock in control. Michelin took advantage of this flexibility and never adopted the corporate form. It was and is a commandite par action (limited partnership with tradeable shares). Its long-term profitability has allowed the Michelin family to maintain complete control, develop new technologies, and periodically turn to the capital markets for funds.

The history of Citroën underscores the limits of our simple two-period model. Innovative firms often go back to the capital markets repeatedly for investment funds, not just once. Citroën was dedicated to innovation. Over the decade before he lost control of the company, he brought four additional generations of automobiles into production (the C, the B, the Rosalie, and the

Traction Avant) (Reynolds 2006). Each was a radical improvement on the design of its predecessor. Each was also associated with a massive retooling that enabled the company to produce at larger scale with a more streamlined assembly-line process. Citroën was the largest automobile producer in France, but creating and abandoning new designs with such rapidity required additional infusions of capital. From 1924 to 1928, the Société Anonyme André Citroën expanded its capitalization by 700,000 shares to fund the series B and Rosalie cars. Citroën himself invested another 63.5 million francs. The evidence on his equity share is somewhat contradictory. If the claims he made to Michelin in 1934 are correct, he retained outright control.[18] If the information in the *Annuaire Desfossé* is correct, he lost outright control after the 1927 equity issue but still cast at least 30 percent of the votes, which given the company's dispersed shareholdings meant that he still had effective control.[19]

Issuing much more equity would have cost Citroën even effective control, so throughout this period the company borrowed as well, both for working capital and for investment. If we extend our model beyond two period, we can see that such borrowing can be a rational strategy under some circumstances. Suppose that the firm operates under one-share-one-vote rules that give the entrepreneur control as long as she maintains a sufficient equity stake. Suppose too that the first project had a q that gave the entrepreneur control at the start of the second period, but only just barely. If the first project succeeds, it will be in the entrepreneur's interest to finance the second project with debt because, even if the project fails, she will be able to pay off the debt and still be in control for the next period's decision.

[18] Broustail 2020, p. 161. Citroen wrote that he had already pledged 100,000 class A shares and was now pledging another 77,000. These totals would have amounted to 1.06 million votes out of a total of 1.8 million.
[19] *Annuaire Desfossés* 1929, p. 1440.

In Citroën's case, each generation of cars was a success, but the speed with which he changed models, combined with his excessively rosy expectations about sales, meant that each model left the firm with mounting liabilities. Ultimately, Citroën came up against the limits of what he could borrow without risking control. He was confident that the Traction Avant would be a technical and commercial success and was willing to stake the firm's future by rebuilding the assembly line. This is when he turned to Michelin and made the bargain that had such dire consequences. He lost his gamble not because of any failure of innovation but because the Great Depression reduced his sales.

Citroën exemplifies the entrepreneur who strongly believes his innovation will succeed and runs roughshod over investors' preferences to see his vision realized. His own heavy investment in the firm indicates that this was not a classic principal-agent story. The firm did not fail because of lack of effort on Citroën's part or because he engaged in excessive risk taking for personal gain. It failed because of its rapid pace of innovation—the number of new models the company brought into mass production in a short space of time. As a coda, it is worth comparing Citroën's behavior with that of Michelin when it took over the auto company. Michelin continued to support the brand's reputation for innovative technologies and brought to market a series of epoch-defining vehicles like the 2CV and the DS. At the same time, Michelin behaved like an investor, slowing the pace of innovation by producing the same models for very long periods of time. The Traction Avant was its main sedan offering for twenty years, the DS for two decades. Clients of limited means could avail themselves of the 2CV in various versions for forty-three years.

History and Theory

The model we have developed in this paper helps us move beyond the simple critique of business history with which we began. The model, by construction, is a-historical. That is, there is nothing about its mechanisms that links it to a particular time or place. And yet, we were driven to construct it in the way we did by accounts of entrepreneurs and their achievements in the business history literature. In this section we come full circle and consider the implications of our model for understanding the theory and practice of corporate governance, both historically and today.

Elihu Thomson and most of the other entrepreneurs whose history informs our model succeeded in their endeavors to build innovative firms, despite their initial conflicts with shareholders. André Citroën had enough wealth to avoid such conflicts early on, but his relentless push to innovate led him into debt, financial collapse, and the loss of his company. Despite these different outcomes, each of these entrepreneurs has entered the pantheon of business history because each was a visionary who transformed an industry. In the case of Thomson (and Dow and Ford), the investors who blocked their ongoing innovations seem with hindsight to have been misguided. If they had only followed their entrepreneur's lead with proper deference, they would have been much more handsomely rewarded. The case of Citroën points in a different direction, however, for the company continued to be an important and innovative automaker after its eponymous entrepreneur was forced out. The more general lesson to be drawn from these cases is that for every entrepreneur like Thomson who has a great second idea that leads his firm to riches, there may be others whose second ideas are more likely to hurt profits than increase them. Investors may be right to be more cautious.

Wary investors should be concerned about control, which is precisely why Michelin organized its interim loans to Citroën so that the tire maker could assume control in the absence of a turnaround. In our model, whether the entrepreneur or the investor has control is partly the result of macroeconomic factors such as the cost of capital, *r*, and partly the result of firm-specific variables such as the size of the externality, *E*, or the difficulty of the first project, q_1. This interaction induces a path dependence that links innovation and control to past success. When times are good and entrepreneurs have relatively easy early projects, they are likely to be in control, and if the early projects succeed, they are likely to remain in control and glide down a path of further innovation. If times are bad and the cost of capital is high or early projects fail, control is likely to be transferred to the investor, who will be more selective going forward. The allocation of control and the choice of projects over time thus depend directly on the history of the firm. This is a far cry from the kind of forward-looking optimal control decisions one finds in most models of corporate governance, starting with Aghion and Bolton (1992) and Hart (1995).

Our model also sheds light on the evolution of economic institutions. In periods when the cost of capital is low, the investor's participation constraint is easier to meet, but more importantly, it is cheaper for the entrepreneur to assume control. As the cost of capital falls, she does so more often. We interpret this implication of the model as consistent with the broad facts of the history of the corporation. For example, in the early nineteenth century, when capital costs were higher, the investor was going to be in control no matter what. In this respect, therefore, early corporations were not much different from partnerships, whether ordinary or limited, and the demand for incorporation was unlikely to be related to conflicts over innovation. Instead, more traditional explanations for the choice of the corporate form, such as the need to

lock in capital and avoid the costs of untimely dissolution, were probably more important (Blair 2003; Lamoreaux and Rosenthal 2005, Guinnane et al. 2007). Only when the cost of capital fell would concerns about who would make investment decisions become an important determinant of the choice of organizational form.

When that happened, the legal rules that governed that choice increasingly mattered. The spread of general incorporation laws that shaped those rules proceeded along two paths that correspond in an intriguing way to relative capital costs. The various US states enacted general incorporation laws in the middle third of the nineteenth century when the cost of capital in the US was quite a bit higher than in Europe, and they mostly enjoined entrepreneurs to follow the straight and narrow path of one-share-one-vote governance. By contrast, in England and France, where capital costs were lower, the first general incorporation statutes gave founders of corporations wide leeway to structure control as they saw fit, using multiple classes of voting shares (as we saw with Citroën) or even by entrenching specific individuals in the articles of incorporation (Guinnane, Harris, and Lamoreaux 2017). Since the enactment of those first statutes, the legal rules have to some extent at least adjusted to the ebb and flow of capital costs. As interest rates fell in the United States at the end of the nineteenth century, New Jersey liberalized its governance rules. When capital costs skyrocketed during the Great Depression, France imposed new constraints that limited variation in voting rights (Hilaire 2010, p. 241).

Academic thinking about corporate governance has experienced a similar ebb and flow. In the 1980s, when interest rates in the US rose, scholars began to question the separation of ownership and control and to insist that corporations should be run in the interest of their investors. The focus in the literature was almost exclusively on the principal-agent problem that arises when manager have little stake in their firm except their salary. Among the solutions

proposed and put into practice were the carrot of stock options and the stick of hostile takeovers and leveraged buyouts. Following the work of Rafael Laporta et al. (1997) touting the benefits of shareholder friendly corporate governance, the World Bank made contestable control central to its policy recommendations (Iskander and Chamlou 2000). It was in this environment that Steve Jobs, who did not have formal control at Apple, was ousted from the company (Issacson 2011).

In the early twentieth-first century, during a long period of extremely low interest rates, Google broke with existing practice by going public in 2004 with multiple classes of shares that kept voting control in the hands of the founders. The move stirred controversy, but the firm was so profitable that this control structure did not materially reduce demand for its stock. Other "tech" companies followed suit in large numbers, and the policy prescriptions of previous decades were cast aside. Indeed, finance economists marvel at the rich contractual environment in which companies now operate (Ewens et al. 2022; Hornuf et al. 2022). It is too early to tell if the spate of inflation that has followed the Covid pandemic will cause a reversal of corporate governance practices—with the prescriptions of the academic literature changing in tandem.

One final lesson of our model is that no simple corporate governance rule is either normatively optimal or positively adopted. Any rule will fail the normative test because there will always be a range of disagreement between the two key stakeholders. One or the other has to have control, and neither will implement the stakeholders' optimum. Any simple rule will also fail positively because what the entrepreneur wants depends on the value of the parameters. There is a broad range of values for which the entrepreneur will want to lock in control, but for other values she will prefer to operate under one-share-one vote. Over those parameter values where she wants to be in control, a flexible legal regime that allows that to occur is the second-best outcome. To be sure, contestable control (and thus one share one vote) may be efficacious

for well-established firms managed by individuals who are anything but residual claimants. For new firms, however, this paper shows that the logic is different. Entrepreneurs will prefer different control arrangements as circumstances vary, and one-share-one-vote governance is just one of the possibilities they will want to deploy.

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Appendix

The model features one entrepreneur and up to two investors.

The game begins when nature draws q_1, the likelihood of success for the first-period project, from a uniform distribution $[\underline{q}, \overline{q}]$. The project's expected return is $(1-q_1)F + q_1 S$, where S is the return if the project succeeds and F if it fails. The entrepreneur makes a take-it-or-leave-it offer to the investor for a share of the equity of the firm, α_1. If capital is provided, the investment is made. The second period proceeds in the same way. Nature draws q_2. Then whoever is in control of the firm decides whether to seek investment from a second investor by offering him a share, α_2, of the equity of the firm. If capital is provided, the investment is made. Payoffs to both investments are realized at the end of period 2, and there is no discounting. The entrepreneur earns the externality E whenever a project is started.

The game is sequential, and we focus on pure strategies and find subgame perfect equilibria.

A.1 A one decision model

The investor and the entrepreneur know the value of all variables. The expected value of the firm is $V_1(q_1) = (1-q_1)F + q_1 S$.

Meeting the investor's participation constraint requires that his equity stake α_1 be such that $\alpha_1\big((1-q_1)F + q_1 S\big) \geq r$. The entrepreneur choses α_1 so that the investor's participation constraint binds: $\alpha = \frac{r}{(1-q_1)F + q_1 S}$.

The hardest project $\underline{q_1}$ that gets started is such that the investor gets all of the firm ($\alpha_1 = 1$):

$$(1-q_1)F + \underline{q_1} S = r \text{ or } \underline{q_1} = \frac{r-F}{S-F}$$

In the one-period model, control does not matter. Nor does the form of investment (debt or equity). There is no conflict between the investor and the entrepreneur, because projects do not get started unless they meet the investor's participation constraint. The only difference between funding a project with debt versus equity is the distribution of payoffs across success or failure. The players are risk neutral, so variance is irrelevant.

A. 2 The two-period model

As is classic with multiperiod models, we solve this problem by backward induction. We start the analysis with the decision whether to go forward with the second project after q_2 has been revealed. We take as given the outcome of the first project—whether it succeeded or not—and the initial investor's equity stake (α_1).

Assume the first project succeeded. (We examine the case where the first project failed in section A4.)

If project 2 does not go forward, the value of the firm is S.

If the firm undertakes project 2, the expected gross value of the firm is $V_2 = S + \big((1-q_2)F + q_2 S\big)$.

For the second project to go forward, the firm must raise capital. For now, let us limit ourselves to equity. Meeting the second investor's participation constraint implies offering him α_2 such that $\alpha_2(\,S + (1-q_2)F + q_2 S) = r$.

$$\text{Or } \alpha_2 = \frac{r}{(\,S+(1-q_2)F+q_2 S)}$$

The hardest project the second investor is willing to participate in ($\underline{q}_{22}$) is such that

$$(\,S + (1-q_2)F + q_2 S) = r \text{ or } \underline{q}_{22} = \frac{\mathrm{r-S-F}}{S-F}$$

Because S>0, $\underline{q}_{22} < \frac{r-F}{S-F} = \underline{q}_1$. That is, the second investor is willing to participate in harder projects than the investor in single-period firms. Moreover, because $S > r$, the second investor is always willing to invest in a successful firm's second project.

The company of the initial stakeholders is the residual claimant to the second project, so $(1-\alpha_2)V_2 = V_2 - r$.

If the project goes forward the entrepreneur and investor split the return at the end of the second period on the basis of the equity stakes they agreed on in the first period.

The first investor gets $\alpha_1(1-\alpha_2)V_2$.

The entrepreneur gets her share of the return plus the externality: $(1-\alpha_1)(1-\alpha_2)V_2 + E$.

A.2.a The externality is zero.

The hardest project $\underline{q}_2$ that the investor and entrepreneur want to undertake is given by $\underline{q}_2 = \frac{r-F}{S-F}$. Recall that the second investor is always willing to participate in projects where q > $\underline{q}_2$. Thus, absent the externality, governance again does not matter. Both stakeholders want to undertake the same range of projects [$\underline{q}_2, \overline{q}$], and there are no capital constraints because the second investor is always willing to participate in those projects.

A.2.b The externality is positive.

The investor does not care about the externality, so his hardest project is still $\underline{q}_{2i} = \frac{r-F}{S-F}$.

The stakeholders together earn:

$$(1-\alpha_2)V_2 + E = (V_2 - r) + E = (S + (1-q_2)F + q_2 S) - r + E.$$

If the second project does not go forward, they earn S, so the stakeholders want $\big((1-q_2)F + q_2 S\big) - r + E \geq 0$. Their hardest project is $\underline{q}_{2s} = \frac{r-F-E}{S-F}$.

The entrepreneur earns $(1-\alpha_1)(1-\alpha_2)V_{2s} + E = (1-\alpha_1)[\,(S + (1-q_2)F + q_2 S) - r] + E$ if the second project goes forward, and $(1-\alpha_1)S$ if it does not.

So, the entrepreneur's decision rule is $(1-\alpha_1)[\,\big((1-q_2)F + q_2 S\big) - r] + E \geq 0$.

That simplifies to a hardest project $\underline{q}_{2e} = \frac{r-F-\frac{E}{(1-\alpha_1)}}{S-F}$.

It is easy to show:

(Ab.1) $\underline{q}_{2i} > \underline{q}_{2s} > \underline{q}_{2e}$. The investor is more selective than the stakeholders combined, and the entrepreneur is less selective.

(Ab.2) $\underline{q}_{2e}$ is decreasing in α_1. When α_1 = 0, then $\underline{q}_{2e} = \underline{q}_{2s}$, and when α_1 = 1, then $\underline{q}_{2e}$ = $\underline{q}$ (the entrepreneur wants to undertake all second-period projects). So, the equity stakes of the first period matter for what the entrepreneur does.

(Ab.3) $\underline{q}_{2i}$ and $\underline{q}_{2s}$ do not dependent on any first period variables.

A.2.c Setting first period equity stakes

Proposition A2: Equilibrium equity stakes for firms where the investor in control and for firms where the entrepreneur in control (α_{1i} and α_{1e}) exist. Further, $\alpha_{1i} < \alpha_{1s} < \alpha_{1e}$, where α_{1s} is the equity stake the investor would have required if the firm followed the stakeholders' optimal plan.

We now set α_1, taking into account the expected value of the second period.
We assume that q is distributed uniformly from $\underline{q}$ to $\overline{q}$ and that the expected value to the investor of doing all projects is positive: $\hat{V}_{2i} = \left(1 - (\frac{\overline{q}+\underline{q}}{2})\right)F + \frac{\overline{q}+\underline{q}}{2}S - r > 0$.

The first assumption keeps the problem neatly linear. The second assumption says that innovation is on average valuable. That means that the equity stake that has to be given to the first investor has to be less than α_{11}, the equity stake the investor would require if there was only one period $\alpha_{11} = \frac{r}{(1-q_1)F+q_1S}$.

We start with the case where the investor makes the second period decision. The expected value of the second period is easy to compute.

The investor undertakes projects easier than $\underline{q}_{2i} = \frac{r-F}{S-F}$. These occur with probability $\frac{\overline{q}-\underline{q}_{2i}}{\overline{q}-\underline{q}}$ and have an expected likelihood of success $\frac{\overline{q}+\underline{q}_{2i}}{2}$. Recall that the expected value of the first period project is:

$$V_1 = (1 - q_1)F + q_1S$$

The expected value of the second-period project when the investor is in control is $\hat{V}_{2i}$:

$$\hat{V}_{2i} = \frac{\overline{q}-\underline{q}_{2i}}{\overline{q}-\underline{q}}\left(\left(1 - \frac{\overline{q}+\underline{q}_{2i}}{2}\right)F + \frac{\overline{q}+\underline{q}_{2i}}{2}S\right) - r$$

The expected value of the firm at the beginning of period 1 when the investor is in control is just:

$$V_{1i}(q_1) = V_1 + \hat{V}_{2i}$$

Meeting the investor's participation constraint implies $\alpha_{1i} = \frac{r}{V_1+\hat{V}_{2i}}$

Now suppose that the firm implements the stakeholders' optimal program. The stakeholders want all projects easier than $\underline{q}_{2s} = \frac{r-F-E}{S-F}$. Those occur with probability $\frac{\overline{q}-\underline{q}_{2s}}{\overline{q}-\underline{q}}$ and have an expected likelihood of success $\frac{\overline{q}+\underline{q}_{2s}}{2}$.

Thus, the investor's return when the stakeholders' optimal threshold is chosen is determined by

$$\hat{V}_{2s} = \frac{\overline{q}-\underline{q}_{2s}}{\overline{q}-\underline{q}}\left(\left(1-\frac{\overline{q}+\underline{q}_{2s}}{2}\right)F + \frac{\overline{q}+\underline{q}_{2s}}{2}S\right) - r$$

$$V_{1s}(q_1) = V_1 + \hat{V}_{2s}$$

Meeting the investor's participation constraint implies $\alpha_{1s} = \frac{r}{V_1+\hat{V}_{2s}}$

Because $\hat{V}_{2s} < \hat{V}_{2i}$, $\alpha_{1i} < \alpha_{1s}$.

Setting both α_{1i} and α_{1s} is easy because the first period equity stake does not enter in the choice of second-period thresholds.

Finally, suppose that the firm implements the entrepreneur's program.

$$\hat{V}_{2e} = \frac{\overline{q}-\underline{q}_{2e}}{\overline{q}-\underline{q}}\left(\left(1-\frac{\overline{q}+\underline{q}_{2e}}{2}\right)F + \frac{\overline{q}+\underline{q}_{2e}}{2}S\right) - r$$

$$\alpha_{1e} = \frac{r}{V_1 + \hat{V}_{2e}}$$

Solving for the equity stake is a bit more complicated because the entrepreneur's second period decision depends on her first period equity stake: $\underline{q}_{2e} = \frac{r-F-\frac{E}{(1-\alpha_1)}}{S-F}$.

The investor's return is strictly increasing in α_{1e}. When the entrepreneur is in control, the investor's expected return is less than it would be if the stakeholders' optimum could be implemented. Given q_1, α_{1s} is set so that the investor's participation constraint binds—that is, the investor's return from participating in a firm that starts with a first project q_1 and follows the stakeholders' optimum is equal to the opportunity cost of capital. It follows that the investor's return from participating in an entrepreneur-led firm with a first project q_1 and an equity stake of α_{1s} is less than the cost of capital. Because the second-period return is positive, the investor is willing to participate if offered the single-period equity stake $\alpha_{11} = \frac{r}{((1-q_1)F+q_1S)}$. By the intermediate value theorem, given a first project q_1, an equilibrium α_{1e} exists such that the investor is willing to participate in an entrepreneur-led firm. If it is not unique, the entrepreneur

will pick the smallest equity stake because that equilibrium is closest to the stakeholders' optimum and thus involves the least rent dissipation.

A.3 Choice of governance form

Proposition A3: If $\alpha_{1e} \leq 0.5$ the entrepreneur always wants to be in control. If $\alpha_{1e} > 0.5$ the entrepreneur wants to be in control only if $\frac{r-F-2E}{S-F} \leq \underline{q}$.

When the entrepreneur is in control, all projects approved by the investor are also approved ($\underline{q}_{2e} < \underline{q}_{2i}$). So we need to compute the expected value of projects between $\underline{q}_{2e} < \underline{q}_{2i}$.

For ease of exposition define $\underline{q}^*_{2e} = \frac{r-F-2E}{S-F}$. This is the threshold project the entrepreneur wants to implement when $\alpha_{1e} = 0.5$. For that specific project, the firm expects to lose 2E.

Projects between $\underline{q}^*_{2e}$ and $\underline{q}_{2i}$ arise with probability $\frac{\underline{q}_{2i}-\underline{q}^*_{2e}}{\overline{q}-\underline{q}} = \frac{2E}{(S-F)(\overline{q}-\underline{q})}$, because $\underline{q}_{2i} - \underline{q}^*_{2e} = \frac{2E}{S-F}$.

Over the range $\underline{q}_{2i}$, $\underline{q}^*_{2e}$, the firm's losses comprise a right triangle of with short sides $\frac{2E}{(S-F)(\overline{q}-\underline{q})}$ and 2E. Expected losses are $\frac{2E^2}{(S-F)(\overline{q}-\underline{q})}$.

The entrepreneur gains a rectangle with sides $\frac{2E}{(S-F)(\overline{q}-\underline{q})}$ and E or $\frac{2E^2}{(S-F)(\overline{q}-\underline{q})}$. The net gain to the entrepreneur exactly cancels out the losses.

As α_{1e} falls from 0.5, $\underline{q}_{2e}$ rises. The losses from doing harder projects than $\underline{q}_{2i}$ fall faster than the loss of the externality, so the entrepreneur wants to be in control. This proves the first part of the proposition.

If $\frac{r-F-2E}{S-F} \leq \underline{q}$, the entrepreneur starts every project when her equity stake is a half and strictly prefers being in control. Moreover, she also prefers to be in control for any α_{1e}>0.5, because the threshold project is not influenced by equity stakes.

If $\frac{r-F-2E}{S-F} > \underline{q}$ and α_{1e}>0.5, the entrepreneur's hardest project is further away from the stakeholders' optimum than the investor's hardest project. Being in control will be entail losses larger than the returns foregone if the investor is in control.

A.4 The second investor's participation constraint

As noted in Section A.2, the second investor's participation constraint can only bind when the entrepreneur is in control and the first project has failed. The hardest project the entrepreneur ever undertakes is $\underline{q}_{2e}^{*} = \frac{r-F-2E}{S-F}$.

If the first project has failed, $\underline{q}_{22} = \frac{\mathrm{r-2F}}{S-F} > \frac{\mathrm{r-S-F}}{S-F}$. A sufficient condition for the second investor's participation to bind is $F < 2E$.

Proposition A4: If the second investor's participation constraint binds, the entrepreneur will want control whenever she would have wanted control if it did not bind. She will also want control for some set of equity stakes α_{1e} >0.5 even if $\frac{r-F-2E}{S-F} > \underline{q}$.

Recall that if the second investor's participation constraint does not bind, the entrepreneur is indifferent about who exercises control when her equity stake is a half (because the hardest project she implements is $\underline{q}_{2e}^{*}$ whether the first project failed or succeeded). When the first project has failed and second investor's participation constraint binds, the hardest project she implements is $\underline{q}_{22}$. Because $\underline{q}_{22}$ is closer to $\underline{q}_{2s}$ than $\underline{q}_{2i}$, she strictly prefers to be in control in this case. As a result, the entrepreneur will keep control for some range of cases where the investor's equity stake is greater than a half.

A.5 The rate of innovation

Proposition A5: Over both periods, the rate of innovation is highest when the entrepreneur is in charge and lowest when the investor is in charge.

The rate of innovation is directly related to the threshold difficulty of projects. In the second period the entrepreneur clearly starts more projects, and, as a consequence, the expected value of the firm is smallest when she is in charge. That effect in turn reduces the difficulty of the projects that can be financed in the first period.

The first-period capital constraints that result from these lower second-period gains are not large enough, however, to offset the extra innovation that the entrepreneur-controlled firm takes on in the second period. In the first period the entrepreneur is the residual claimant and never starts

projects such that the expected value of the project is less than -E. In other words, the entrepreneur only starts the first project if $q_1 = \frac{r-F-E}{S-F}$.

Define $\underline{q}_{1e}$ to be the hardest project a firm undertakes in period 1 when the entrepreneur is control and $\underline{q}_{1i}$ to be the hardest project a firm does in period 1 when the investor is control. We need to deal with two cases depending on whether $\underline{q}^*_{2e}$ is greater or smaller than $\underline{q}$. In each case we compare entrepreneurial with investor control.

Case 1: $\underline{q}^*_{2e} \leq \underline{q}$. The entrepreneur-in-control firm does all possible projects in period 2 ($\underline{q}_{2e} = \underline{q}$). In period 1 she will carry out projects such that $\underline{q}_{1e} = \max\{\frac{r-F-\hat{V}_{2e}}{S-F}, \frac{r-F-E}{S-F}\}$. That is, the entrepreneur would like to start all projects such that $q_1 > \frac{r-F-E}{S-F}$, but she faces a capital constraint of $\hat{V}_{2e}$. If $\hat{V}_{2e} < E$ she can only start firms such that $q_1 > \frac{r-F-\hat{V}_{2e}}{S-F}$.

If the investor has control, the most difficult project the firm starts in the second period is $\underline{q}_{2i} = \frac{r-F}{S-F}$, while in period 1 the hardest project is at most $\underline{q}_{1i} = \frac{r-F-E}{S-F}$.

Notice that $\underline{q}_{2e} < \underline{q}_{1i}$ and $\underline{q}_{1e} < \underline{q}_{2i}$. So, for the case $\underline{q}^*_{2e} \leq \underline{q}$, the firm innovates more if the entrepreneur is in control.

Case 2: $\underline{q}^*_{2e} > \underline{q}$. The entrepreneur cedes control to the investor whenever her equity stake is less than half ($\alpha_{1e} > 0.5$). When $\alpha_{1e} < 0.5$, the entrepreneur assumes control.

Define $\underline{q}^*_{1e}$ as the first-period project such that α_{1e}=0.5.

If $q_1 < \underline{q}^*_{1e}$, the investor will be in control, so in this range of cases the comparison is irrelevant.

If $q_1 \geq \underline{q}^*_{1e}$, the firm can be started with either entrepreneur or investor control, so the comparison is relevant but only concerns the second period. When $q_1 \geq \underline{q}^*_{1e}$, in period 2, if the entrepreneur is control $\underline{q}_{2e} = \frac{r-F-\frac{E}{(1-\alpha_1)}}{S-F}$; If the investor has control, $\underline{q}_{2i} = \frac{r-F}{S-F}$.

Because $\underline{q}_{1e} = \underline{q}_{1i}$ and $\underline{q}_{2e} < \underline{q}_{2i}$, the firm innovates more if the entrepreneur is in control.

Over all the entrepreneurial firm is the most innovative.

A.6 Debt

In Aghion and Bolton and other models of governance, debt/equity ratios play an important role in aligning the incentives of managers with the goals of the owners of the firm. The owners are willing to bear some costs of untimely dissolution or bankruptcy in order to induce managers behave more like owners. In our model, debt matters for a different reason: because it allows the entrepreneur to keep control when the first project succeeds.

Because our model ends with the second period and all players are risk neutral, issuing debt or equity in the second period is of no consequence to the average payoff. Debt does increase the variance of the return to the stakeholders (and reduces the variance of the second-period investor's return).

Debt in the first period matters.

It is easy to show that, if the entrepreneur has control, she prefers debt to equity. If she borrows, she severely limits the set of projects that will be started in period 2 when the first project fails, and she has few gains in the first period when it succeeds because the first investor now no longer cares about the second period.

So, the key issue is whether the entrepreneur prefer debt to investor control. Define $\underline{q}_{1e}{}^{*}$ as the first-period project such that α_{1e}=0.5.

Proposition A6: If α_{1e}<0.5 and $\underline{q}_{2e}^{*} > \underline{q}$, the entrepreneur issues debt iff $\frac{r-F}{S-F} < q_1 < \underline{q}_{1e}{}^{*}$. In all other cases she will secure the needed capital with equity.

Let the entrepreneur issue debt. The first investor is now a lender who lends *r* against a claim of *D* at the beginning of the second period (*D*>*r*). His participation constraint is now:

$r = (1 - q_1)F + q_1 D$ or $D = \frac{r-(1-q_1)F}{q_1}$. The hardest project that can be started with debt is when *D*=*S*. If *D*=*S*, then the lender's expected income is $(1 - q_1)F + q_1 S$ which is the same as when the first investor gets all the equity. The hardest project that can be started with debt, therefore, is the same as that of the one-period firm: $\underline{q}_{1d} = \frac{r-F}{S-F} = \underline{q}_i$.

The first project succeeds with probability q_1, and the entrepreneur in period 2 has wealth of S-D. Because she is the sole owner of the firm, $\underline{q}_{2e} = \underline{q}_{2s} = \frac{r-F-E}{S-F}$. With probability 1-$q_1$, the project fails, and the entrepreneur is back to a one-period firm where $\underline{q}_{i=} \frac{r-F}{S-F}$

If, instead of borrowing, the entrepreneur allows the investor to assume control, the second period threshold is the same: $\underline{q}_{2i}= \frac{r-F}{S-F}$.

Whether the entrepreneur will borrow depends on the value of q_1.

If $\underline{q}_{1e}{}^{*} < q_1$, she can start the firm with debt, let the investor be in control, or assume control herself. She chooses to assume control.

If $\underline{q}_i, < q_1 < \underline{q}_{1e}{}^{*}$, she can start the firm either with debt or investor control. She chooses debt because it allows her to do more in period 2.

If $\underline{q}_{1i} < q_1 < \underline{q}_i$, the entrepreneur cannot start the firm with debt, but she can start a firm controlled by the investor $\underline{q}_{1i} = \frac{r-F-E}{S-F} < \underline{q}_i = \frac{r-F}{S-F}$).

If $q_1 < \underline{q}_{1i}$, the entrepreneur does not start the firm