

## The Entrepreneur's Choice between Private and Public Ownership

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### ABSTRACT

We analyze an entrepreneur/manager's choice between private and public ownership. The manager needs decision-making autonomy to optimally manage the firm and thus trades off an endogenized control preference against the higher cost of capital accompanying greater managerial autonomy. Investors need liquid ownership stakes. Public capital markets provide liquidity, but stipulate corporate governance that imposes generic exogenous controls, so the manager may not attain the desired trade-off between autonomy and the cost of capital. In contrast, private ownership provides the desired trade-off through precisely calibrated contracting, but creates illiquid ownership. Exploring this tension generates new predictions.

The battle for Safeway raises an old but important question: is it better to be a private company than to be a public one?

*The Economist*, January 25<sup>th</sup> 2003, p. 57

Should a firm be publicly or privately owned? Public ownership involves publicly traded shares and public corporate governance, with diffused ownership and control. Private ownership operates without a market listing and involves private contracting, typically with concentrated ownership and control. That is, private and public ownership differ along two dimensions namely, investor liquidity and the allocation of control between managers and investors, which is determined through corporate governance. While it is well known that liquidity considerations affect the type of ownership chosen, there is also evidence that managers/entrepreneurs give control issues considerable weight. For example, Brau and Fawcett (2005), in their survey of CFOs, report that "CFOs identify the desire to maintain decision-making control as the primary reason

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for staying private.” This motivates the following question: How do control and liquidity considerations impact a firm’s choice of ownership mode?

In addressing this question, we focus on differences in corporate governance across private and public ownership because it is through governance design that investors exercise control on management. These controls appear in various ways, including restrictions on board composition, certification of information veracity, requirements to have decisions approved by the board, shareholder voting rights, etc. Consequently, corporate governance controls may sometimes prevent management from doing what it wants. In some instances, these controls resolve agency problems and minimize self-serving behavior by management. However, even in the absence of agency and information problems, disagreement between management and investors over optimal decisions can arise when there are nonuniform prior beliefs over outcomes that lead to differences of opinion about what actions maximize firm value. It is this form of disagreement that we analyze. That is, we study the incorporation problem of an entrepreneur who is motivated to maximize firm value in his role as manager and who is concerned about potential disagreement with investors over the best way to do this. The nature of corporate governance and the associated investor controls determine how much elbow room or autonomy the manager has when such disagreement arises.

The term “autonomy” refers to the manager’s ability to make decisions with which investors disagree. The manager values autonomy because it facilitates decisions that he believes are value maximizing. Autonomy is costly, however, because rational investors demand a higher cost of capital *ex ante* to compensate for the manager’s ability to make decisions with which they disagree. Thus, the manager faces a natural trade-off in optimally choosing autonomy: An increase in autonomy elevates the manager’s perceived firm value *ceteris paribus* by giving him greater latitude to invest *ex post* in a value-enhancing project disliked by investors, but it also increases the cost of capital *ex ante* by increasing the ownership that must be sold to investors to satisfy their participation constraint. The benefit of private ownership is that it enables the manager to achieve the precise trade-off he desires through private contracting with a few large investors.<sup>1</sup> In contrast, much of the governance structure in public firms is exogenously imposed by regulators and investors, and it is usually designed for the median firm in the economy, so that the combination of management autonomy and cost of capital may not achieve the precise trade-off the manager desires.<sup>2</sup> Balanced against this disadvantage of public ownership is the benefit to investors of trading in a liquid market, which lowers the firm’s cost of capital.<sup>3</sup> For the entrepreneur/manager, on the one hand public ownership

<sup>1</sup> Pagano (1993) also emphasizes the contractibility of corporate governance arrangements with private ownership.

<sup>2</sup> A good example of this is the quote from Goff (2004) in connection with public ownership: “The problem is they’re formula voting,” argues Roger Plank, CFO of Houston-based Apache Corp. “I don’t think they make an effort to look at us as an individual company.”

<sup>3</sup> Numerous papers emphasize the diversification and liquidity benefits of public capital markets, for example, Pagano (1993) and Admati, Pfleiderer, and Zechner (1994).

has a more rigid governance and autonomy structure, while on the other hand it brings a lower cost of capital than private ownership.<sup>4</sup>

This kind of disagreement in creating the trade-off that endogenously determines optimal managerial autonomy is natural in the context of entrepreneurship. The essence of entrepreneurship is the uniqueness of the entrepreneur's idea, often something that is so radically new that there are no historical data against which to evaluate its merits. How the idea is assessed then becomes a matter of each individual's intuition, rather than hard facts. Consequently, irreconcilable differences of opinion between the entrepreneur and financier may emerge.<sup>5</sup>

Disagreement arises in our model due to heterogeneous prior beliefs between the manager and investors about the precision of a commonly observed signal about a project. While rational agents must use Bayes's rule to update their prior beliefs, economic theory does not address how priors themselves arise; these are taken as primitives, along with preferences and endowments. Agents with different priors will not update their beliefs merely because they encounter others with different beliefs, unless there is asymmetric information. In this sense, we follow Kreps (1990, p. 370) who argues that the assumption of homogeneous priors has "little basis in philosophy or logic."<sup>6</sup> Our approach is also consistent with Kurz's (1994a,b) theory of "rational beliefs" in which individuals are allowed to have different beliefs as long as these beliefs are not precluded by historical data. In other words, there is nothing radical about heterogeneous prior beliefs. Morris (1995) shows that such a specification is consistent with Bayesian rationality, and many models, such as Allen and Gale (1999), Coval and Thakor (2005), Harrison and Kreps (1978), and Van den Steen (2004), permit heterogeneous priors.<sup>7</sup>

Our disagreement-based autonomy approach is a break from the tradition of agency and asymmetric information models. While agency and information frictions are important, we also believe that sometimes other forces, such as the anticipation of future disagreement with investors, can drive the entrepreneur's

<sup>4</sup> Maksimovic and Pichler (2001) focus on the lower flexibility of public ownership, but specifically within the context of increased disclosure requirements. Zingales (1995) focuses on a different type of commitment in which the ownership structure affects the bargaining power of the (selling) initial owner.

<sup>5</sup> Having said this, we believe that the potential for disagreement generalizes to non-entrepreneurial firms as well. Managerial decisions often involve unprecedented situations, and intuition fills in the gaps in knowledge left by a lack of hard data (e.g., Clarke and Mackaness (2001)); differences in intuition can lead to disagreement about the optimal decision.

<sup>6</sup> The assumption of common priors is typically associated with the *Harsanyi Doctrine* (see Samuelson (2004)).

<sup>7</sup> A somewhat separate issue is the convergence of these initially different beliefs after the long-run performance of the project is observed. We know from the rational learning literature (e.g., Aumann (1976), Blackwell and Dubins (1962)) that, with heterogeneous priors, learning leads to convergence if we replicate decisions that generate signals based on which the two sides can update their beliefs, and priors are absolutely continuous with respect to each other (see Miller and Sanchirico (1997)). However, in our model, even post-learning convergence may be difficult since we are talking about a new project, one that represents a nonreplicable decision, and the heterogeneous prior beliefs are not necessarily absolutely continuous with respect to each other.

choice of ownership mode. In many IPOs (e.g., Microsoft, eBay, and Google), the ownership stakes retained by the founding entrepreneurs were large enough to align these entrepreneurs' objectives with those of the other shareholders.<sup>8</sup> But our approach asserts that a congruence of objectives does not eliminate potential disagreement and control issues. As an example, consider Richard Branson's decision to take Virgin private in 1989, shortly after it had gone public. Branson reasoned that public markets did not "understand entrepreneurialism." We quote from Brown (1998):

To Branson, it was a question of his personal judgement, and the lengths to which his City investors were prepared to back it. In the wake of the Stock Market crash, and the City's sanguine view of any business regarded as "unpredictable," this was not as far as Branson would have liked.

There are other similar accounts of companies choosing private ownership because of the ability to choose shareholders whose views about optimal decisions are aligned with those of management and therefore, corporate governance can be better tailored to the needs of the firm.<sup>9</sup>

Our model attempts to capture such situations and yields numerous predictions. We find that the choice of ownership mode depends on the stringency of public corporate governance. When public governance is extremely lax and permits considerable managerial autonomy, investors demand an excessively high return and firms prefer private ownership. When corporate governance is extremely stringent and leaves the manager little autonomy, firms once again prefer private ownership because the manager considers public market governance to be too intrusive. For intermediate values of public governance stringency, firms choose public ownership. The measure of this set of values of stringency is affected by the cost of illiquidity for private market investors and the likelihood of agreement between management and investors. A greater likelihood of agreement leads to the optimality of less stringent corporate governance. Moreover, there is a life-cycle effect in the choice of ownership mode: Young firms are more likely to be private, and old firms are more likely to be public.

The rest of this paper is organized as follows. Section I reviews the related literature and discusses the differences between the literature and our approach. Section II presents the model, Section III the analysis, and Section IV the empirical predictions. Section V concludes. All proofs are given in the Appendix.

## **I. Disagreement, Autonomy, and the Related Literature**

Given the extensive literature on the choice between private and public ownership, it is natural to ask why we need a disagreement-cum-autonomy-based

<sup>8</sup> For example, the Google IPO resulted in only 6–8% of the ownership being sold to the public.

<sup>9</sup> Thorton (2004) quotes Arthur F. Anton, CEO of Swagelok Co., "Our whole philosophy is built around doing things for the long term. It just becomes a lot harder to manage [if you are public]. You can't pick your shareholders."

approach. We believe there are four reasons. First, the evidence suggests that control issues are important in the private-versus-public ownership choice in the real world, and the way we characterize the allocation of control is closer to practice than existing models of private benefits of control or property rights. Second, neither agency nor asymmetric information models of ownership structure choice yield the control implications that our analysis provides. Third, fundamental disagreement, as a driver of the allocation of control and the concomitant choice of ownership structure, seems to be a more important consideration than agency or asymmetric information in many instances involving entrepreneurial choice. Fourth, many of the empirical predictions our analysis generates are unique to our autonomy setup, unavailable with agency, or asymmetric information models. We discuss each of these motivations below.

First, there is evidence that control considerations are important in real-world motivations for staying private or going public, particularly in situations in which public market corporate governance is considered excessively intrusive (Brau and Fawcett (2005)). Our model of endogenous control preference seems especially well suited to accommodate such motivations. In particular, our analysis shows the optimality of joint control, wherein the manager has authority to choose with some probability and investors choose with the complement of that probability. That is, joint control refers to a situation in which multiple parties share control over corporate decisions, according to a pre-defined rule for determining how a decision will be made when the parties disagree over the optimal course of action. Such joint control resembles what is often encountered in practice. With start-up firms, the authority over corporate decisions rests with the board (e.g., Lerner (1995) and Kaplan and Stromberg (2003)); in the majority of firms financed by venture capitalists, neither the venture capitalist nor the entrepreneur controls a majority of the board seats (Kaplan and Stromberg (2003)). Therefore, neither party has exclusive control.<sup>10</sup> This stylized fact flies in the face of existing theories that predict the suboptimality of joint control.<sup>11</sup> For example, in Aghion and Bolton's (1992) model of private control benefits, control optimally rests invariably with one party (typically the manager). Because the manager and investors agree ex post on the first-best action choice, any initial allocation of control satisfying the investors' ex ante participation constraint ends up being renegotiated ex post, concentrating all control in one party and yielding the first best. In contrast, since disagreement arises in our model due to fundamental differences in beliefs, the manager and investors may not agree on the optimal action choice even ex post. Consequently,

<sup>10</sup> There are other features, such as entrepreneurial veto powers and redemption rights for the venture capitalist, that also have features of joint control.

<sup>11</sup> Exceptions are recent papers by Yerramilli (2004) and Gomes and Novaes (2001). Yerramilli (2004) seeks to explain the optimality of joint control and redemption rights in venture capital contracts, and finds that joint control is optimal when the firm has low financial slack and sufficient collateral value and the venture capitalist faces high monitoring costs and liquidity constraints. Gomes and Novaes (2001) find that joint control exercised by multiple controlling shareholders protects minority shareholders. However, neither paper is concerned with the choice between private and public ownership.

the ex ante efficient allocation of control in our model is renegotiation-proof in circumstances in which the control allocation in models of private control benefits ends up being renegotiated ex post.<sup>12</sup> Joint control is also inefficient in the property rights literature because it is deleterious to the incentives of both parties to make firm-specific investments (e.g., Hart (1995)).

Turning to our second motivation, the control implications of our analysis are also distinct from those of agency and asymmetric information models. Consider agency models first. Pagano and Roell (1998) focus on a priori inefficient private control benefits and show that the entrepreneur would benefit from a credible precommitment not to extract these at the expense of security benefits. However, costly investor monitoring is required to prevent such extraction abuse.<sup>13</sup> Similarly, Jensen (1986) focuses on the inefficient private benefits enjoyed by the managers and the consequent free cash flow problems in public corporations, suggesting the need for tighter investor control, possibly through private ownership (see also Black and Gilson (1998) and Kaplan and Stromberg (2003)). In these papers, the first-best solution gives investors complete control, although there may be impediments to doing so. This contrasts with joint control that is optimal with autonomy. Closer to our framework are principal-agent models in which the principal can discipline the agent in an interim period and limit his rent extraction, but this reduces the agent's unobserved firm-specific investment (e.g., Aghion and Tirole (1997), Burkart, Gromb, and Panunzi (1997), and von Thadden (1995)). The principal may therefore choose to leave the agent with "real authority" in some future states. However, in these models the ex post allocation of control is not joint; rather, it always rests with one party or the other. For example, in Burkart et al. (1997), investors are in control ex post if they are at least as informed as the manager, and the manager is in control if he is better informed than investors. In von Thadden (1995), joint control is not part of an ex ante efficient renegotiation-proof contract. Thus, a key distinguishing feature of our analysis is that autonomy generates (renegotiation-proof) joint control even ex post.<sup>14</sup>

Asymmetric information models also open up a wedge between the objectives of managers and investors (Stein (1989)). However, if control issues are germane in these models, it is typically efficient to vest the better-informed party with control, as opposed to having joint control. An example is the Burkart

<sup>12</sup> Aghion and Bolton (1992) also predict that the manager should be in control if the firm is not financially constrained and investors should be in control otherwise. In particular, whenever control can be made contingent on future measures of performance, state-contingent control that transfers control from the manager to investors following poor performance is optimal. A similar control allocation appears in Chan, Siegel, and Thakor (1990), wherein performance reveals information about entrepreneurial ability and results in transfer of control to the venture capitalist when performance falls below a threshold.

<sup>13</sup> Pagano and Roell (1998) show that private companies owned by multiple shareholders may experience excessive monitoring and this may induce the firm to go public. In contrast, Chemmanur and Fulghieri (1999) argue that public capital markets involve duplicated monitoring costs.

<sup>14</sup> Autonomy is more than just writing a long-term contract specifying authority allocation in order to preserve ex ante incentives. In our model, autonomy has no ex ante incentives, and we permit the initial allocation of control to be renegotiated at an interim date, as opposed to assuming a precommitment to it via a long-term contract.

et al. (1997) paper discussed earlier. Moreover, if the entrepreneur has better information than investors, the Revelation Principle suggests that truthful information elicitation mechanisms could be designed that result in the bridging of information gaps and a consequent agreement over value-maximizing decisions. The control allocation issue would thus be rendered moot.<sup>15</sup>

We now turn to our third motivation. We point out in the Introduction that there is anecdotal evidence of cases in which the value entrepreneurs attach to control comes not from the desire to expropriate rents from investors or from different objective functions, but from the anticipation of future disagreement with investors despite congruent objectives. In our analysis this disagreement arises due to heterogeneous prior beliefs about the precision of a commonly observed signal. We are agnostic about the source of this difference in beliefs. While such differences may simply represent the heterogeneous initial assessments of rational agents (Kurz (1994a,b)), we do not rule out overconfidence (Bernardo and Welch (2001)), optimism (Manove and Padila (1999)), or other behavioral biases as the source.

It is also possible that entrepreneurs choose private ownership because the stock market inefficiently undervalues some firms.<sup>16</sup> However, if this undervaluation is due to the manager possessing private information (i.e., information to which investors do not have access), then going private is a rather drastic way to deal with a possibly ephemeral situation, particularly given the potential availability of less costly signals such as tender offer repurchases. Our analysis suggests an alternative explanation for firms going private due to low stock prices that does not depend on market inefficiency or asymmetric information. If the potential for disagreement between the manager and public market investors is high, then our model implies that the firm's stock price will be low. The manager may then seek a private investor whose views are more closely aligned with his own so that the potential for disagreement is lower; he may find it worthwhile to compensate such an investor for the lower liquidity of private ownership.<sup>17</sup>

<sup>15</sup> An example of an asymmetric information model of the choice between private and public ownership is Shah and Thakor (1988), which explores the trade-off between the risk sharing benefit afforded by public ownership relative to private ownership and the additional listing costs of public ownership. An optimal mechanism is designed using the Revelation Principle and control issues are irrelevant.

<sup>16</sup> There is anecdotal evidence about this. For example Jeff Atkins, CFO of Spring Industries, one of the dominant players in the U.S. textiles market that went private in April 2001, stated: "We watched the company actually make significant progress over the past 18 months in terms of improving margins and improving competitive position. The markets, however, were just not responding in terms of share price", p. 28 from "Making the Move from Public to Private," *Corporate Finance*, June 2001.

<sup>17</sup> There is also a substantial literature on the relationship between control, liquidity, and ownership concentration for public firms (e.g., Bhide (1993), Coffee (1991)). The main message is that complete investor control is always desirable but it is privately optimal for an investor to exercise this control via monitoring only if his ownership is large enough. However, this may sacrifice liquidity. Bolton and von Thadden (1998) argue that a limited degree of public ownership concentration would combine the benefits of liquidity and control. Maug (1998) claims that a more liquid stock market improves corporate governance.

A final motivation is that our analysis generates predictions that distinguish it from other approaches. For example, our analysis predicts that an increase in the restrictiveness of public market corporate governance increases the attractiveness of public ownership for low-valuation firms and decreases it for high-valuation firms. This prediction cannot be extracted from either an agency or an asymmetric information model.

## II. Model Outline

In this section we describe our model, that is, the agents and project possibilities, the liquidity cost, and the managerial autonomy parameter. We conclude this section with the model's sequence of events.

### A. Agents and Project Possibilities

The economy has one firm and several investors. The firm is managed by an entrepreneur or owner-manager (manager henceforth) who owns 100% of the equity, but is otherwise penniless. All agents are risk neutral and the risk-free interest rate is zero. There are four dates, 0, 1, 2, and 3, defining three time periods. The firm has existing assets (with value normalized to zero) and gets a project at date 0 that requires a \$1 investment. The firm has no internal funds and hence requires external financing for the project. This financing is raised from investors in the form of equity at date 0. Let  $1 - \alpha$  be the share of ownership in the firm sold to external financiers;  $\alpha$  is the ownership share that the manager retains. The manager and investors seek to maximize terminal ( $t = 3$ ) firm value.

Investment in the project occurs at date 2; cash flows are realized at date 3. The firm's project can be one of two types: Good ( $G$ ) or Bad ( $B$ ). The commonly known prior probability is  $p \in (0, 1)$  that a project is  $G$  and  $1 - p$  that it is  $B$ . At date 3 project  $G$  realizes a cash flow of  $A_G + 1$  for sure, where  $A_G > 0$  is the net present value (NPV) of the project, while project  $B$ , with an NPV of  $A_B < 0$ , realizes a cash flow of  $A_B + 1$  for sure. We assume that  $pA_G + [1 - p]A_B \equiv D < 0$ .

The manager and the investors observe the same public signal  $S$  at date 1. The signal value can be  $G$  or  $B$ , indicating project type. The manager and the investors have common prior beliefs about the values of  $S$ , given by  $\Pr(S = G) = p$  and  $\Pr(S = B) = 1 - p$ . Although the manager and investors observe the same signal, they may have different priors about its informativeness. The prior beliefs,  $q$ , about the informativeness of  $S$  are drawn randomly at date 1 from the set  $\{I, U\}$ , where  $q = I$  represents an "informative" signal and  $q = U$  represents an "uninformative" signal. The probability of the manager drawing  $I$  is  $\theta \in (0, 1)$  and drawing  $U$  is  $1 - \theta$ . When the prior belief is that the signal is informative, the agent believes  $\Pr(\text{Project} = G | S = G, q = I) = 1$ ; when the prior belief is that the signal is uninformative, the agent's prior belief about the type of the project does not change, that is,  $\Pr(\text{Project} = G | S = G, q = U) = p$ . With this structure, a signal  $S = B$  always leads to a decision to reject the project since a prior belief  $q = I$  would imply an NPV of  $A_B < 0$ , and a prior belief

$q = U$  would imply an NPV of  $D < 0$ . However, a signal  $S = G$  would lead to different decisions based on the prior beliefs: A prior belief  $q = I$  implies an NPV of  $A_G > 0$ , and a decision to accept the project, whereas a prior belief  $q = U$  implies an NPV of  $D < 0$ , and a decision to reject the project.

The differences in the prior beliefs of the manager and investors come about as follows. The manager and investors (as a group) randomly draw prior beliefs  $q_m$  and  $q_i$ , respectively, from  $\{I, U\}$ , and these beliefs may be correlated. That is, we assume  $\Pr(q_i = j | q_m = j) = \rho$  and  $\Pr(q_i = j | q_m = k) = 1 - \rho$ , where  $j \neq k$  and  $j, k \in \{I, U\}$ . The agreement parameter  $\rho$  becomes common knowledge at  $t = 0$ ,<sup>18</sup> and it can be thought of as being affected by the attributes of the project or more generally the nature of the firm's business. If the project is one that the manager and investors are familiar with based on past projects,  $\rho$  will tend to be high. For unfamiliar projects,  $\rho$  may be low.

To summarize, the commonly observed signal  $S = B$  always leads to agreement between the manager and investors that the project should be rejected, regardless of their prior beliefs. If  $S = G$  and investors and the manager both have prior beliefs  $q = U$ , they also agree that the project should be rejected. If  $S = G$  and investors' prior belief is  $q_i = I$  whereas the manager's prior belief is  $q_m = U$ , then the manager (investors) will not (will) wish to invest. In this case we assume that the project will not be undertaken. The idea is that the manager is essential for the project, and without him no cash flows can be realized. This precludes a situation in which investors simply buy out the manager and run the firm without him,<sup>19</sup> although we show later that our key results hold even if they could. The more complicated case is that of  $S = G$ , the manager's prior belief is  $q_m = I$ , and the investors' prior is  $q_i = U$ . The manager now wishes to invest but the investors do not. This disagreement is the focus of our analysis. It cannot be easily overcome because the wealth-constrained manager cannot readily buy out the investors. We now discuss two key features of the model, the liquidity costs faced by investors and the corporate governance (or managerial autonomy) parameter  $\eta$ .

### *B. Investors' Liquidity Cost*

After the investment has been made at date 2 but prior to date 3, investors suffer a liquidity shock with probability  $\lambda$ ; with probability  $1 - \lambda$  they do not.

<sup>18</sup> Thus, we abstract from asymmetric information issues, such as those in Dessein (2004), whereby the entrepreneur knows more about the alignment of his interests with investors than investors do.

<sup>19</sup> What we have in mind is a situation in which the manager has inalienable human capital tied to the project. Hence, the right to manage the project cannot be traded, only financial claims on its cash flows can be. Moreover, the option of buying out the manager but retaining him to run the project will not work when a good project cash flow ( $A_G + 1$ ) is predicated on the manager actually devoting personal attention to the project. He has no incentive to devote personal attention if doing so entails an unobservable private cost, he receives a flat payment ( $\alpha$ ) because he has been bought out, and he believes the marginal impact of his effort on the payoff ( $D + 1$ ) will be relatively low. All this can be explicitly modeled, but it does not change the results.

A liquidity shock forces investors to try to sell their assets to raise cash. We assume that with public ownership, the trading mechanism allows any investor to costlessly find a buyer who has the same  $\rho$  at the posted price. With private ownership, the investor incurs a search cost,  $l$ , to find a buyer. That is, for example, in a spatial context, one could imagine a limited number of investors with a particular  $\rho$  being arranged at a distance  $d > 0$  from each other along the circumference of a circle, and it costs  $l > 0$  to travel  $d$ . With public ownership,  $d \rightarrow 0$  and therefore  $l \rightarrow 0$ . The expected liquidity cost with private ownership is  $\lambda l \equiv L$ .

### C. Managerial Autonomy Parameter

Whenever the shareholders and the manager disagree over project choice, there has to be a rule with which to resolve the disagreement. We model this using the concept of “autonomy” for the manager. Managerial autonomy is the degree of control given to the manager; it is represented by the probability  $\eta$  that the manager will be able to implement his decision in the face of disagreement with the shareholders. A higher  $\eta$  means higher managerial autonomy. Thus,  $1 - \eta$  is the probability with which shareholders can successfully stop the manager from investing in the project. *Ceteris paribus* the manager prefers more autonomy to less, even though he derives no direct utility from autonomy, that is, there is no exogenous private control benefit in this model. The key is that in public markets  $\eta$  is determined by the corporate governance regime and thus is exogenous for the individual firm, while in the private market it is a choice variable for the manager and is endogenously determined at date 0.<sup>20</sup>

### D. Renegotiation at the Time of the Project Choice

Note that disagreement occurs when the signal  $S = G$  is observed, and the manager wants to invest in the project (he believes  $q = I$ ) but investors do not (they believe  $q = U$ ). In this case, would the manager or the investors want to renegotiate? Given that with probability  $1 - \eta$  the manager loses the opportunity to invest in a value-enhancing project, he would want to buy back control from investors. But since the manager’s wealth consists solely of his share of

<sup>20</sup> The assumption that corporate governance with public ownership is exogenously fixed should be viewed as an approximation rather than being taken literally. In reality, public governance does allow some choice of governance stringency. For example, in the United States, the firm may choose to incorporate in Delaware rather than the location of its physical headquarters. While this may give rise to a range of  $\eta$ ’s with public ownership, legal scholars view public regulation as providing the firm with little flexibility in its choice of governance structure, particularly because federal regulation supersedes state law (see Roe (2003)), and exchange-listing requirements impose further constraints and uniformity. This corresponds well with the idea we want to capture, namely, that there is a greater ability to calibrate the governance structure to the needs of the firm (as perceived by management) in the case of private ownership due to the absence of an exogenous set of governance requirements imposed, for example, by the securities exchange in the case of public firms. Our results will go through even if  $\eta$  is partially endogenized with public ownership as long as it is more “rigid” than with private ownership.

the project cash flows, the only payment he can make to acquire additional control is to increase the investors' share of the future cash flows. Similarly, investors can offer to acquire full control by increasing the manager's ownership. Later we show that the ex ante efficient control allocation we derive is renegotiation-proof.

*E. Sequence of Events*

The sequence of events, summarized in Figure 1, is as follows. At date 0, the manager observes the agreement parameter  $\rho$  and the autonomy parameter  $\eta_{\text{pub}}$  with public ownership, and determines the optimal autonomy parameter  $\eta_{\text{pr}}^*$  with private ownership. He then computes the ownership fractions  $1 - \alpha$  that must be sold to investors with private and public ownership and decides whether the firm should be privately or publicly owned. After this, he raises the needed financing in the form of outside equity. At date 1, the investors and the manager receive a common signal  $S$  about project quality and draw their private priors  $q_i$  and  $q_m$  about the precision of this signal. Renegotiation between the manager and investors, if any, occurs between dates 1 and 2. At date 2, the project investment decision is made, contingent on the signal  $S$ , precision  $q$ , and the autonomy parameter  $\eta$ . Between dates 2 and 3, investors suffer a liquidity shock with probability  $\lambda$ . If the firm is publicly traded, investors sell their shares in the market at the market-clearing price. If the firm is privately held, investors incur a liquidity cost  $l$ . Terminal cash flows are realized at date 3.

**III. Analysis**

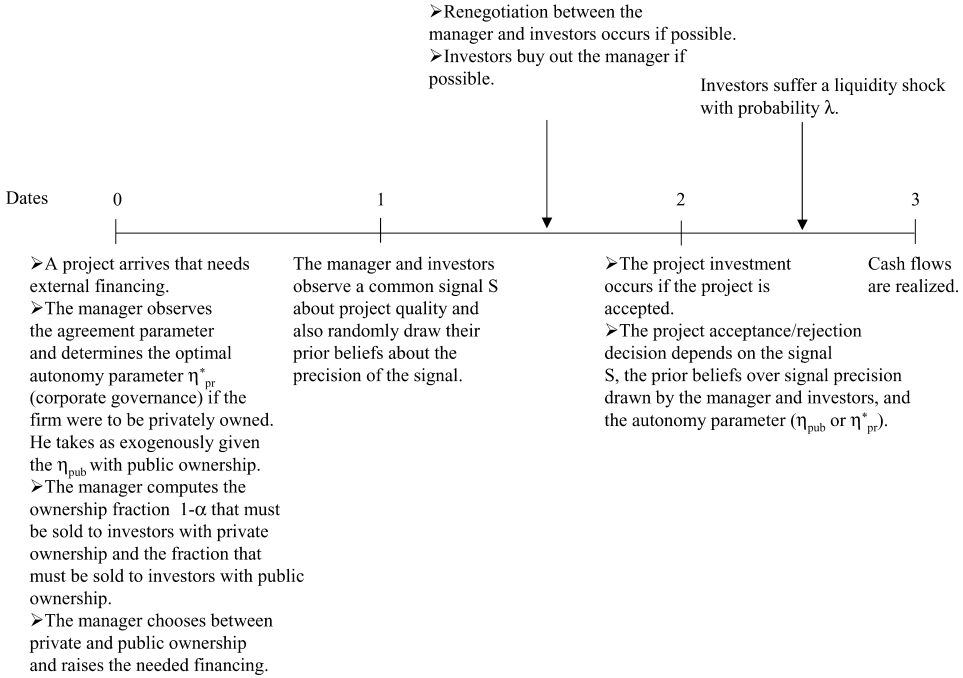
At date 0 the manager chooses the ownership mode, public or private, to maximize his expected wealth at date 3. This fixes the financing source (private versus public equity). The manager's payoffs under alternative ownership structures are analyzed in this section.

*A. Public Ownership: Initial Public Offering (IPO)*

When the manager raises the \$1 investment for the project through an IPO at date 0, he offers the investors a fractional ownership of  $1 - \alpha_{\text{pub}}$  of the date 3 cash flows in return for the \$1. We can now express the expected value of the investors'  $1 - \alpha_{\text{pub}}$  share, evaluated at date 0 by investors, as

$$\begin{aligned} V_{\text{pub}}^I(\alpha_{\text{pub}}) &= [1 - \alpha_{\text{pub}}]\{p\theta\rho A_G + p\theta[1 - \rho]\eta_{\text{pub}}D + 1\} \\ &= [1 - \alpha_{\text{pub}}]W_{\text{pub}}^I, \end{aligned} \tag{1}$$

where  $W_{\text{pub}}^I \equiv p\theta\rho A_G + p\theta[1 - \rho]\eta_{\text{pub}}D + 1$  is the investors' assessment of firm value. The first term in  $W_{\text{pub}}^I$  applies to the case in which  $S = G$ , and both the manager and the investors draw informative priors about the signal precision



**Figure 1. Sequence of events.**

and hence agree that the NPV is  $A_G$ . The second term contains the expected value  $p\theta[1 - \rho]\eta_{pub}D$  and applies when  $S = G$ , the manager draws an informative prior about the signal precision, and investors draw an uninformative prior. In this disagreement state, the manager decides with probability  $\eta_{pub}$ ; and his decision is to invest, which leads investors to assess the NPV as  $D$ . With probability  $1 - \eta_{pub}$ , investors get to decide, in which case there is no investment and the NPV is zero. When  $S = G$  and the manager draws an uninformative prior about the signal precision, no investment occurs and the NPV is zero. The NPV is also zero when  $S = B$  and no investment occurs. The third term in  $W_{pub}^I$  is merely the initial investment, which when added to the NPV, yields firm value.

The equilibrium ownership retained by the manager,  $\alpha_{pub}^*$ , is obtained by solving for the minimum fraction required to be sold to investors,  $1 - \alpha_{pub}^*$ , to raise \$1. This is given by the individual rationality (IR) constraint of the investors as  $V_{pub}^I(\alpha_{pub}^*) = 1$ , which implies

$$\alpha_{pub}^* = 1 - \frac{1}{W_{pub}^I}. \tag{2}$$

The fraction  $1 - \alpha_{pub}^*$  that satisfies (2) can be interpreted as the equilibrium cost of capital with public ownership. We now have

LEMMA 1: When the manager finances in the public market, the cost of capital  $1 - \alpha_{\text{pub}}^*$  is decreasing in the agreement parameter  $\rho$  and increasing in the autonomy parameter  $\eta_{\text{pub}}$ .

Lemma 1 shows the trade-off between managerial autonomy and the cost of capital. The manager desires autonomy, but autonomy is costly because at any nonzero level of managerial autonomy ( $\eta_{\text{pub}} > 0$ ), the manager sometimes succeeds in undertaking a project that the investors do not like and thus the higher is the autonomy offered to the manager, the higher is the return demanded by the investors. Moreover, this cost is a decreasing function of the level of agreement between the manager and investors because the higher is  $\rho$ , the lower is the likelihood of being in the state in which the manager wishes to invest and investors do not.

The manager takes  $1 - \alpha_{\text{pub}}$  as given from (2). The manager's perception of the value of his  $\alpha_{\text{pub}}$  share of the firm with public ownership is given by

$$\begin{aligned} V_{\text{pub}}^M(\alpha_{\text{pub}}) &= \alpha_{\text{pub}}\{p\theta\rho A_G + p\theta[1 - \rho]\eta_{\text{pub}}A_G + 1\} \\ &= \alpha_{\text{pub}}W_{\text{pub}}^M, \end{aligned} \tag{3}$$

where  $W_{\text{pub}}^M \equiv p\theta\rho A_G + p\theta[1 - \rho]\eta_{\text{pub}}A_G + 1$  is the manager's assessment of the value of the firm. Substituting for  $\alpha_{\text{pub}}^*$  from (2) we have

$$V_{\text{pub}}^M = \left[ 1 - \frac{1}{W_{\text{pub}}^I} \right] W_{\text{pub}}^M. \tag{4}$$

Apart from the fact that the investors and the manager have different ownership fractions ( $1 - \alpha_{\text{pub}}^*$  and  $\alpha_{\text{pub}}^*$ , respectively), the manager's valuation  $V_{\text{pub}}^M(\alpha_{\text{pub}})$  and the investors' valuation  $V_{\text{pub}}^I(\alpha_{\text{pub}})$  are different because of differences in beliefs as reflected in the state in which  $S = G$  is observed: The manager's prior belief is that the signal is informative ( $q_m = I$ ) and the investors' prior belief is that it is uninformative ( $q_i = U$ ). In this state, if investment occurs, the manager values the NPV at  $A_G$  and investors value it at  $D$ , causing  $W_{\text{pub}}^I$  and  $W_{\text{pub}}^M$  to diverge; this causes  $V_{\text{pub}}^I$  and  $V_{\text{pub}}^M$  to diverge also.

### B. Private Ownership: Private Placement

When the manager raises private equity, we assume that he raises money from a single investor, who can be thought of as a venture capitalist (VC) or an institutional investor. The principal advantage of private ownership is that the manager and investor can contractually choose the optimal level of managerial autonomy, and hence the division of control between them. The cost of private ownership is the liquidity cost imposed on the investor. We now solve for the optimal degree of managerial autonomy and the associated cost of capital with private ownership.

The initial analysis parallels the earlier analysis of public ownership. The value of the fractional ownership  $1 - \alpha_{pr}$  of the private investor at date 0, as assessed by the private investor, is given by

$$\begin{aligned} V_{pr}^I(\alpha_{pr}) &= [1 - \alpha_{pr}]\{p\theta\rho A_G + p\theta[1 - \rho]\eta_{pr}D + 1\} - L \\ &= [1 - \alpha_{pr}]W_{pr}^I - L, \end{aligned} \quad (5)$$

where  $W_{pr}^I \equiv p\theta\rho A_G + p\theta[1 - \rho]\eta_{pr}D + 1$  is the investor's valuation of the firm. This is similar to equation (1) with public ownership except for the expected liquidity cost  $L$ . Observe from (5) that the investor's valuation is strictly decreasing in  $\eta_{pr}$  (recall  $D < 0$ ) and in  $\alpha_{pr}$ . The investor's participation constraint is  $V_{pr}^I(\alpha_{pr}) \geq 1$ . In equilibrium, this constraint binds. After raising external financing, the manager will own a fraction  $\alpha_{pr}$  of the firm. His assessment of the value of his holding is

$$\begin{aligned} V_{pr}^M(\alpha_{pr}) &= \alpha_{pr}\{p\theta\rho A_G + p\theta[1 - \rho]\eta_{pr}A_G + 1\} \\ &= \alpha_{pr}W_{pr}^M, \end{aligned} \quad (6)$$

where  $W_{pr}^M \equiv p\theta\rho A_G + p\theta[1 - \rho]\eta_{pr}A_G + 1$  is the manager's valuation of the firm. This expression is similar to the public market valuation of the manager,  $V_{pub}^M(\alpha_{pub})$ . It is clear that taking  $\alpha_{pr}$  and  $\eta_{pr}$  as given,  $V_{pr}^M(\alpha_{pr})$  is increasing in  $\eta_{pr}$  and  $\alpha_{pr}$ . Thus,  $V_{pr}^M(\alpha_{pr})$  and  $V_{pr}^I(\alpha_{pr})$  move in opposite directions with changes in  $\alpha_{pr}$  and  $\eta_{pr}$ . This is what generates the trade-off between autonomy  $\eta_{pr}$  and the cost of capital  $1 - \alpha_{pr}$ .

The manager's problem in the case of private ownership can be formulated as

$$\max_{\alpha_{pr}, \eta_{pr}} V_{pr}^M(\alpha_{pr}) \quad (7)$$

$$\text{s.t. } V_{pr}^I(\alpha_{pr}) = 1 \quad (8)$$

$$\text{and } 0 \leq \alpha_{pr} \leq 1, \quad 0 \leq \eta_{pr} \leq 1. \quad (9)$$

We designate  $\eta_{pr}^*$  as the equilibrium value of  $\eta_{pr}$ , and  $\alpha_{pr}^*$  as the equilibrium value of  $\alpha_{pr}$ . We now state an assumption that is sufficient to ensure that  $\eta_{pr}^*$  does not take extreme values.

ASSUMPTION 1:

$$K \in \left(1, 1 - \frac{p\theta[1 - \rho]DA_G}{t}\right), \quad (10)$$

where

$$K \equiv \sqrt{\frac{A_G[1 + A_G p\theta\rho]}{[A_G - D][1 + L]}} \quad \text{and} \quad t \equiv \sqrt{A_G[1 + L][A_G - D][1 + A_G p\theta\rho]}.$$

Note that  $K$  is a measure of the attractiveness of the project to investors; it is increasing in  $A_G$ , the NPV in the agreement state. If the project is sufficiently unattractive to investors, so much of the ownership will have to be sold to investors to raise the necessary financing that they will have claim to most of the project cash flows. It would then not be optimal to give control over the cash flows to the manager, and thus  $\eta_{pr}^* = 0$ . Similarly, if the project is sufficiently attractive, the manager should retain all control, with  $\eta_{pr}^* = 1$ . Assumption 1 rules out these extremes. We assume henceforth that (10) holds.

PROPOSITION 1: *The unique globally optimal value of managerial autonomy with private ownership,  $\eta_{pr}^*$ , is*

$$\eta_{pr}^* = \frac{-A_G[1 + p\theta\rho A_G] + t}{p\theta[1 - \rho]DA_G}. \tag{11}$$

The corresponding value of the ownership retained by the manager,  $\alpha_{pr}^*$ , is given by

$$\alpha_{pr}^* = \frac{t - A_G[1 + L]}{t}. \tag{12}$$

Although the manager's objective function,  $V_{pr}^M(\alpha_{pr})$ , is increasing in  $\eta_{pr}$ , if we take  $\alpha_{pr}$  as given, the manager recognizes in equilibrium that an increase in  $\eta_{pr}$  causes  $\alpha_{pr}$  to fall in order to satisfy (8), and this makes  $V_{pr}^M(\alpha_{pr})$  globally concave in  $\eta_{pr}$ . That is, the concavity of  $V_{pr}^M(\alpha_{pr})$  in  $\eta_{pr}$  comes from the fact that an increase in autonomy pulls the manager's objective function in opposite directions, directly causing it to increase for a fixed  $\alpha_{pr}$  due to the manager's endogenous desire for autonomy, and indirectly causing it to decrease by increasing the cost of capital  $[1 - \alpha_{pr}]$ . We now examine the comparative statics properties of the private equity market equilibrium.

LEMMA 2: *When the manager raises equity from the private investor, the cost of capital  $1 - \alpha_{pr}^*$  is decreasing in the agreement parameter  $\rho$  and increasing in the expected liquidity cost  $L$ .*

Thus, as in the case of public ownership (Lemma 1), the cost of capital decreases in the level of agreement  $\rho$  between the investor and the manager. This happens because investors assign a higher value to the firm when  $\rho$  is higher. Moreover, it is intuitive that the greater the private investor's expected liquidity cost  $L$ , the greater the compensation for illiquidity demanded by the investor and the higher the cost of capital with private ownership. Our next result concerns how the optimal autonomy parameter  $\eta_{pr}^*$  varies with the agreement parameter  $\rho$ .

LEMMA 3: *The optimal autonomy parameter  $\eta_{pr}^*$  is increasing in the agreement parameter  $\rho \forall L \in [0, \infty)$  and decreasing in the expected liquidity cost  $L \forall \rho \in [0, 1)$ .*

Lemma 3 says that investors give greater autonomy to managers with whom they agree more. We know from Lemma 2 that with private ownership the cost of capital is decreasing in  $\rho$  because firm value is increasing in  $\rho$ . The combined implication of Lemmas 2 and 3 is that managers in higher-valued firms have greater autonomy.<sup>21</sup> This differs from what one would expect given the basic structure of our model, since *ceteris paribus* greater managerial autonomy results in lower valuation by investors. But this lemma addresses the endogenously determined equilibrium level of autonomy. Investors who assign a higher valuation to a firm's shares have a higher propensity to agree with the manager. The manager optimally chooses greater autonomy with such investors because the marginal cost of autonomy is lower. Moreover,  $\eta_{pr}^*$  is decreasing in the expected liquidity cost  $L$ , because a higher  $L$  leads to a higher marginal cost of autonomy for the manager.

### *C. Renegotiation-Proofness*

The optimal autonomy parameter  $\eta_{pr}^*$  is the *ex ante* efficient allocation of control between the manager and the investor. Will it survive possible *ex post* renegotiation between the manager and the investor? To examine this question, recall that disagreement arises only when  $S = G$  is observed, the manager believes  $q_m = I$ , and investors believe  $q_i = U$ . In that case, the manager wants to invest but the investors are opposed. If there is no renegotiation, the manager will be able to invest with probability  $\eta_{pr}^*$  and the investor will get to block the investment with probability  $1 - \eta_{pr}^*$ .

With renegotiation, the investor could increase the manager's ownership in exchange for complete control over project choice that would guarantee rejection of the project.<sup>22</sup> Alternatively, the manager could increase the investor's ownership in exchange for investing in the project with probability one. Renegotiation-proofness means that such renegotiations will not occur. We now have

**PROPOSITION 2:** *The ex ante optimal contract in Proposition 1 is renegotiation proof.*

Proposition 2 shows that our *ex ante* efficient control allocation will survive *ex post* renegotiation. The intuition is as follows. Consider first the state in which the manager tries to gain full control by offering to increase the investor's stake in the project. Since the investor's valuation of the project is very low in the disagreement state (it is  $D + 1 < 1$ ), the ownership stake he will need to be given to relinquish control to the manager will be so large that the manager, who values the project at  $A_G + 1 > 1$ , will find it suboptimal to do so. Similarly,

<sup>21</sup> It may well be the case that disagreement is higher on average in higher growth firms that are valued more highly. *Ceteris paribus*, however, greater agreement (higher  $\rho$ ) leads to higher firm value and higher (endogenously determined) managerial autonomy. We return to this in Section IV.

<sup>22</sup> The manager would still run the firm in this case, but the investor would get to decide whether the project is taken.

in the case in which the investor attempts to acquire full control from the manager, the high valuation of the project by the manager ( $A_G + 1$ ) makes it too costly for the investor to do so. Thus, neither the manager nor the investor finds renegotiation profitable.<sup>23</sup> This is an important result because without renegotiation-proofness, the whole notion of an ex ante efficient  $\eta_{pr}^*$  becomes a somewhat moot point since the manager and the investors may renegotiate away from  $\eta_{pr}^*$  to a different autonomy parameter ex post; many of our key results would then be lost.

#### D. Choice between Private and Public Ownership

We now compare the private and public ownership scenarios and characterize the manager's choice between the two.

**PROPOSITION 3:** *For any value of the agreement parameter  $\rho$ , there exists an interval  $[\eta_1, \eta_2]$  such that the manager prefers public ownership for all public market autonomy parameter values  $\eta_{pub} \in [\eta_1, \eta_2]$ . For  $\eta_{pub} \notin [\eta_1, \eta_2]$ , the manager prefers private ownership. Moreover, a sufficient condition for  $[\eta_1, \eta_2] \subset (0, 1)$  is that the expected liquidity cost  $L$  is below some upper bound.*

The intuition is as follows. Since the autonomy parameter with private ownership,  $\eta_{pr}^*$ , is endogenously chosen to be optimal, the manager's objective function is uniquely maximized at  $\eta = \eta_{pr}^*(\rho, L)$  for any given  $\rho$  and  $L$ . In the public market, the manager's optimum is given by  $\eta_{pub}^*(\rho) = \eta_{pr}^*(\rho, 0)$  since the private and public market optima coincide at  $L = 0$ . The manager's valuation  $V_{pub}^M$  monotonically decreases as the exogenously imposed  $\eta_{pub}$  moves away from  $\eta_{pub}^*(\rho)$ . The manager is willing to accept the suboptimal public market  $\eta_{pub}$  as long as the loss due to this is less than the illiquidity cost of private ownership. While the illiquidity cost is independent of  $\eta_{pub}$ , the loss due to a suboptimal  $\eta_{pub}$  increases in the distance between  $\eta_{pub}^*(\rho)$  and  $\eta_{pub}$ . Thus, for  $\eta_{pub}$  sufficiently close to  $\eta_{pub}^*(\rho)$ , the illiquidity cost dominates and public ownership is chosen, while for  $\eta_{pub}$  sufficiently far away from  $\eta_{pub}^*(\rho)$ , the effect of the suboptimality of  $\eta_{pub}$  dominates and private ownership is chosen. For every  $\rho$ , this gives rise to an interval  $[\eta_1, \eta_2]$  of autonomy parameter values around  $\eta_{pub}^*(\rho)$  for which public ownership is preferred. We show in the proof of this proposition that the optimal private ownership autonomy parameter for that  $\rho$ ,  $\eta_{pr}^*(\rho, L)$ , also lies

<sup>23</sup> As we indicate earlier, the optimal solution in models of private benefits of control, such as Aghion and Bolton (1992), is not renegotiation proof and the first best can be achieved via renegotiation of any allocation satisfying the investors' ex ante participation constraint. The reason is that in private-control-benefits models, the only benefits being renegotiated are the security benefits, and not the private benefits, and everybody agrees ex post on the size of the security benefits. For sufficiently high private benefits, the manager may thus be willing to renegotiate away all his security benefits to achieve first best. In contrast, the only benefit in our model is the security benefit, so any renegotiation affecting the manager's ownership of security benefits affects his share of all benefits, and does so in a disagreement state in which differential valuations impede renegotiation. This makes renegotiation inherently more difficult in our setup than in the private benefits model.

within  $[\eta_1, \eta_2]$ . The restriction that  $L$  not be too large is sufficient to guarantee that private ownership is not always eschewed.

Proposition 3 illustrates the trade-off in the choice of ownership mode. Public governance cannot be tailored to an individual firm's needs. Thus, a large disparity between public market governance and the individual firm's needs causes the firm to forgo market liquidity and opt for private ownership. Whenever the disparity is small, the firm chooses public ownership. In the case of high  $\rho$  and low  $\eta_{\text{pub}}$ , the situation is that the public market imposes governance that the manager finds too restrictive. That is, in this case the manager chooses private ownership even though the firm could go public at a high stock price, and avail itself of a relatively low cost of capital. The case of low  $\rho$  and high  $\eta_{\text{pub}}$  is a situation in which public market governance is not particularly restrictive, but the manager prefers private ownership because the cost of capital in the public market is prohibitively high.

Our analysis also suggests that changes in public corporate governance may have a dynamic effect on the composition of firms going public. Increasing governance stringency (lower  $\eta_{\text{pub}}$ ) will induce high- $\rho$  firms—those with high valuations, operating in relatively mature industries with familiar projects — to exit the public market since the privately optimal autonomy  $\eta_{\text{pr}}^*$  for these firms is relatively high. The effect on low- $\rho$  firms will be the exact opposite. Increasing governance stringency enhances the attractiveness of public ownership for these firms. Initiatives like the Sarbanes-Oxley Act that increase corporate governance stringency for public firms are predicted to tilt the composition of public firms more toward lower-valued firms.<sup>24</sup> We now present some comparative statics results.

**PROPOSITION 4:** *The measure of the autonomy interval  $[\eta_1, \eta_2]$  within which  $\eta_{\text{pub}}$  must lie for public ownership to be preferred is increasing in the expected liquidity cost  $L$  and the agreement parameter  $\rho$ .*

This result is quite intuitive. An increase in the expected liquidity cost  $L$  clearly makes private ownership relatively less attractive and hence increases the set of values  $\eta_{\text{pub}}$  can take for which public ownership is preferred. The effect of  $\rho$  is more subtle. A higher value of  $\rho$  makes any market-determined corporate governance regime less unattractive to the manager since the likelihood of disagreement with investors declines as  $\rho$  increases and this dampens the adverse impact of a suboptimal  $\eta_{\text{pub}}$ . Thus, the measure of  $[\eta_1, \eta_2]$  increases

<sup>24</sup> The notion that the trade-off between the rigidity of governance requirements in the public market and the liquidity of public equity markets is an important determinant of the choice between private and public ownership is illustrated by the empirical evidence provided by Bushee and Lenz (2005). They examine the impact of the recent regulatory change mandating firms on the OTC Bulletin Board (OTCBB) to comply with the reporting requirements under the Securities Exchange Act of 1934. They find that this change resulted in a number of firms opting to not comply with these requirements and thus accepting removal from the OTCBB; the consequence is that these firms went private or traded in the Pink Sheets, where SEC filing is not required. Only a small number of firms found it optimal to continue trading on the OTCBB. These firms experienced a permanent increase in market liquidity.

with  $\rho$ . Moreover, Lemma 3 tells us that  $\eta_{pr}^*$ , the optimal private ownership autonomy parameter, increases with  $\rho$ . Because the interval  $[\eta_1, \eta_2]$  surrounds  $\eta_{pr}^*$ , the combined implication of Lemma 3 and Proposition 4 is that as  $\rho$  increases, the interval  $[\eta_1, \eta_2]$  not only increases in measure but also shifts to the right. We now state our next result.

PROPOSITION 5: *The set of exogenous parameter values for which both private and public ownership choices will be observed is nonempty.*

We establish this through a numerical example that shows a wide range of exogenous parameter values for which optimal solutions can be found with private and public ownership.

### E. An Alternative Formulation

The state in which the investor wants to invest in the project and the manager does not is the one in which  $S = G$  is observed, the manager's prior belief is that the signal is uninformative ( $q = U$ ), and the investor's prior belief is that the signal is informative ( $q = I$ ). We have assumed that in this state no project investment will occur because the manager is essential to the project. An alternative specification is one in which the manager is not essential in the sense that the investor can possibly buy him out and proceed with the project. We show below that our results continue to hold in this setting. We examine the case of private ownership since the treatment of the public ownership case is much simpler.<sup>25</sup>

If the manager does not invest, he values the firm at one and his stake at  $\alpha_{pr}^*$ . To leave the manager indifferent between staying with the firm and not investing on the one hand and selling out on the other, the investor must offer him  $\alpha_{pr}^*$ . Thus, to buy out the manager, the investor needs to offer him at least  $\alpha_{pr}^*$ . Note that when there is investment, the investor values the firm at  $A_G + 1$  and the manager's stake at  $\alpha_{pr}^*[A_G + 1] > \alpha_{pr}^*$ . The investor is thus willing to pay the manager  $\alpha_{pr}^*$  to buy him out and invest in the project.<sup>26</sup> We now have the following result.

<sup>25</sup> With public ownership there can't be any changes in  $\eta_{pub}$ , so all that adding the managerial buyout option would do is to increase  $\alpha_{pub}$ .

<sup>26</sup> The manager is paid just enough to make him indifferent between not investing in the project and being bought out. An alternative is to assume that the manager is only paid what he would receive in expectation if investors insisted on implementing the control allocation embedded in the governance regime in this state, which would be  $\alpha_{pr}^*(\eta_{pr}^* * 1 + [1 - \eta_{pr}^*][D + 1])$ . Our analysis is qualitatively unaffected by which specification we choose, so we choose the simpler one. In addition, we have two other reasons for this choice. First, issues of allocating control are only relevant when the party that wants to buy the other out is wealth constrained, as is the case in our renegotiation-proofness analysis. So it seems reasonable to not let the initial control allocation affect the terms of the buyout when investors are not wealth constrained. Second, our approach makes the analysis robust to a specification in which project choice availability is stochastic and the manager can hide a project from investors that he does not like simply by saying no project arrived. In this case, investors will have to offer him enough to make him at least indifferent between hiding the project and revealing it when he does not like it, which would call for a minimum payment of  $\alpha_{pr}^*$ .

PROPOSITION 6: *Suppose the manager is not essential for the project and the investor can buy the manager out when he wishes. Then, there exist the following global optima for the private ownership autonomy parameter and managerial ownership fractions:*

$$\eta_{pr}^{**} = \frac{-A_G[1 + p\theta\rho A_G] + \hat{t}}{p\theta[1 - \rho]DA_G} \quad (13)$$

and

$$\alpha_{pr}^{**} = \frac{\hat{t} - A_G[1 + L - p[1 - \theta][1 - \rho]A_G]}{\hat{t}}, \quad (14)$$

where

$$\hat{t} \equiv \sqrt{A_G\{1 + L - p[1 - \theta][1 - \rho]A_G\}[A_G - D][1 + A_G p\theta\rho]}.$$

Moreover, assuming  $\theta > \hat{\theta}$ , where  $\hat{\theta} \in (0, 1)$ ,  $\eta_{pr}^{**}$  is increasing in  $\rho$ .

Proposition 6, which extends Proposition 1 and Lemma 3 to accommodate a possible buyout of the manager, shows that all our results, including the optimality of joint control, continue to hold even when the manager is not essential. However, an additional restriction on  $\theta$ , the probability that the manager will draw an informative prior, is needed to guarantee that the private ownership autonomy parameter will increase with the agreement parameter. The restriction is that  $\theta$  needs to be sufficiently high. The reason for this is as follows. When the investor can buy the manager out in the state in which the manager does not wish to invest but the investor does, the investor's perceived payoff is actually higher if only he draws an informative prior when  $S = G$  than if both he and the manager do so; in the previous case, the investor's net payoff is  $A_G + 1 - \alpha_{pr}^*$ , whereas in the latter case it is  $[A_G + 1][1 - \alpha_{pr}^*]$ . In this state then, the investor would actually prefer disagreement with the manager. For disagreement to be undesirable for the investors, we would like the effect of this state not to dominate, and this happens when its probability (which is decreasing in  $\theta$ ) is not too high.

#### IV. Empirical Predictions

The main empirical predictions of our model are summarized here. Testing these predictions may require developing empirical proxies for the agreement parameter  $\rho$  and for the managerial autonomy parameter  $\eta$ , neither of which is directly observable in the data. One possible proxy for  $\rho$  is the difference between the prices at which voting and nonvoting common stocks trade in companies that have dual-class stock, assuming that voting stock is held by insiders. A higher  $\rho$  would then mean investors assign a lower value to control and hence a smaller difference between the prices of voting and nonvoting stock should be observed. Another proxy for  $\rho$  might be the number of proxy fights, with fewer proxy fights indicating higher  $\rho$ . One may also infer  $\rho$  from the stock price reaction to an acquisition announcement. A higher  $\rho$  should lead to a higher price

reaction for the acquirer.<sup>27</sup> Empirical proxies for  $\eta$  would be related to the restrictiveness of corporate governance. The Gompers, Ishi, and Mertrick (2003) governance index identifies many variables that may be useful for this. Of particular interest would be to use as controls six of the variables identified by Bebchuk, Cohen, and Ferrell (2004) as representing managerial entrenchment, since they appear to explain most of the governance-driven cross-sectional variation in performance. Charter provisions in IPOs could provide another proxy for  $\eta$  (see Coates (2001)). Our main empirical predictions are:

- (i) When the firm privately places equity, corporate governance is less restrictive for the manager if the firm is more highly valued. This follows jointly from Lemma 2, which implies that the firm's valuation is higher when the agreement parameter  $\rho$  is higher, and Lemma 3, which asserts that  $\eta_{pr}^*$  is higher when  $\rho$  is higher. An empirical measurement of "high value" will need to take into account and control for factors that affect firm value but are unrelated to  $\rho$ , such as future growth prospects, temporary industry overvaluation or undervaluation, and so on.<sup>28</sup>
- (ii) From Proposition 3, we know that when the agreement parameter  $\rho$  between the manager and investors is low and corporate governance in the public capital market is not particularly restrictive (high  $\eta_{pub}$ ), the manager prefers private ownership. This implies that in countries in which corporate governance is relatively lax and the firm is venturing into an unfamiliar project with a high potential for disagreement, private ownership will dominate.
- (iii) From Proposition 3, we know that firms prefer public ownership when the public market autonomy parameter  $\eta_{pub} \in [\eta_1, \eta_2]$ , where the range  $[\eta_1, \eta_2]$  contains  $\eta_{pub}^*(\rho)$ , the optimal public ownership autonomy parameter. This implies that managers prefer public ownership when  $\eta_{pub}$  is close to  $\eta_{pub}^*$ . We know from Lemma 2 that firm valuation is increasing in  $\rho$  and from Lemma 3 that  $\eta_{pub}^*(\rho) = \eta_{pr}^*(\rho, 0)$  is increasing in  $\rho$ , implying that the managers of higher-valued firms optimally have greater autonomy. When joined with Proposition 3, this generates the prediction that a combination of high firm valuation and lax public corporate governance (high  $\eta_{pub}$ ) will cause public ownership to be preferred since the high  $\eta_{pub}$  and the high  $\eta_{pub}^*$  will be relatively close. In contrast, when public market corporate governance is restrictive (low  $\eta_{pub}$ ), a firm with a sufficiently high  $\rho$  will choose to remain private because  $\eta_{pub}^*$  will be relatively far from  $\eta_{pub}$ . This means that a combination of stringent corporate governance and a high firm valuation will lead to a preference for private ownership. Alternatively, if these high-valued firms were to

<sup>27</sup> Dispersion in analysts' earnings forecasts may be another proxy for  $\rho$ , with greater dispersion indicating lower  $\rho$ . But one has to be careful in the interpretation of this variable since it represents disagreement among analysts/investors rather than between management and investors.

<sup>28</sup> Growth firms typically have higher valuations, and this has little to do with  $\rho$ . In fact, growth firms may have a lower average  $\rho$ . Hence, developing an appropriate proxy for  $\rho$  and controlling for growth prospects are important empirical caveats.

be somehow induced to remain public, they would have a preference for relatively lax corporate governance. Note that this prediction is different from that of a standard asymmetric information model in which the most valuable firms prefer greater stringency in corporate governance because it leads to less pooling with lower-quality firms. The prediction also differs from the implications of a standard agency model in which managers who are less likely to act against the investors' interests (take actions that decrease security benefits) will opt for more stringent corporate governance.

- (iv) An increase in the stringency of public market corporate governance increases the attractiveness of public ownership for low valuation firms and decreases it for high valuation firms (see the discussion following Proposition 3). This is in contrast to the prediction that would result from an agency costs model with private benefits of control, wherein firms are either ex ante indifferent to the stringency of governance (with efficient private benefits, where renegotiation leads to the first best) or find public ownership more attractive as the stringency of corporate governance with public ownership increases (with inefficient private benefits, for which  $\eta = 0$  is optimal for shareholders).<sup>29</sup>
- (v) From Proposition 4, we know that an increase in  $\rho$  increases the interval  $[\eta_1, \eta_2]$  of managerial autonomy parameters for which the firm goes public. This implies that as a technology becomes more familiar to investors, and managers and firms establish performance track records (so that disagreement over optimal decisions diminishes), more firms deploying that technology will go public. That is, there is a life-cycle effect in ownership structure choice and the percentage of publicly traded firms will be larger in older, more well established industries.<sup>30</sup>

We believe all of the above predictions are novel in the context of the existing theoretical literature. One of the predictions is consistent with existing stylized facts. If one interprets firms in older industries as also being larger, then Prediction 5 is consistent with the finding of Pagano, Panetta, and Zingales (1998), based on data for Italian firms, that the likelihood of an IPO is increasing in firm size. The rest of our predictions remain to be tested.

Our analysis also suggests implications related to the increasing importance of private equity markets<sup>31</sup> and the more stringent corporate governance of publicly owned firms due to the Sarbanes-Oxley Act (see the discussion following Proposition 3). In particular, our analysis suggests that an important reason for private equity firms to be more prominent now is that they can often provide more efficient corporate governance than is typically encountered

<sup>29</sup> With efficient private benefits, the manager's decisions maximize social surplus (sum of private and security benefits), whereas with inefficient private benefits, social surplus is not maximized.

<sup>30</sup> In other words, familiarity breeds public ownership.

<sup>31</sup> For example, five private equity firms are jointly involved in the planned purchase of Auna, a Spanish telecommunications group. The acquisition of Sears by K-Mart involved Edward Lampert's ESL Investments, a hedge fund that does private equity deals. It is estimated that private equity has grown 3,000% in the past 10 years (see *The Economist* (2004)).

with a public firm.<sup>32</sup> The analysis predicts that high- $\rho$  firms will find private ownership more attractive (see Prediction iii), which should lead to fewer IPOs of relatively highly valued firms, more public firms opting to go private, and further growth in private equity markets.

## V. Conclusion

We examine an entrepreneur's choice of whether to go public or stay private. In either case, after raising external capital the entrepreneur operates as an owner-manager. Hence, the firm's initial choice of ownership mode is driven by the costs and benefits the entrepreneur perceives in his role as manager and part owner. This managerial perspective on the choice of ownership structure leads to the observation that the entrepreneur will care about the autonomy that he will enjoy after raising external financing. This autonomy matters to the entrepreneur not because of any innate preference for independence or private benefits of control. Rather, it matters because it determines his ability to make decisions that he views as maximizing firm value when investors disagree with him. Possible disagreement arises not from a divergence of objectives (caused by asymmetric information or agency problems) between the entrepreneur and the investors, rather from a difference of opinions. This approach produces results that are significantly different from those one would obtain with exogenous private benefits of control, other forms of agency problems, or asymmetric information.

We build on this idea of fundamental disagreement by joining it with two other aspects of ownership structure. One is that corporate governance can be privately contracted upon with private ownership, thereby allowing the entrepreneur to choose the ex ante value-maximizing corporate governance structure, whereas a standardized structure—one dictated by the specific corporate governance requirements for publicly listed firms—must be adopted with public ownership. The second aspect is that those who provide financing have more liquid ownership stakes if the firm is publicly traded than if it is private. Consequently, in making his choice, the entrepreneur trades off the greater ability he has with private ownership to match the stringency of corporate governance to the perceived needs of the firm against the greater investor liquidity and lower cost of capital associated with public ownership.

We find that both excessively stringent and excessively lax corporate governance structures with public ownership encourage firms to stay private. While our analysis depends only on public corporate governance being less flexible than private corporate governance, we choose to model public governance as being completely rigid. In practice, public firms have had some latitude in choosing corporate governance stringency, through the choice of the number

<sup>32</sup> *The Economist* (2004) states: "Today, private equity firms often seem to provide better corporate governance than is generally found at many public firms . . . (Ironically, the recent wave of new corporate governance regulations has made more people in public companies yearn to go private)", p. 9.

of outside versus inside directors, which antitakeover provisions to adopt, and so on. In fact, our analysis provides a rationale for why even public governance would provide some choice of stringency to the firm, even if this choice is more restricted than it is for private firms. As momentum gathers in favor of more restrictive governance for public companies, our analysis provides an argument for caution. The effect of the strengthening of corporate governance on the going-public decision of firms is positive for less established (low- $\rho$ ) firms but possibly negative for firms with good track records (high- $\rho$ ). Future research could be directed at the implications of this for the optimal design of public market corporate governance.

### Appendix

*Proof of Lemma 1:* The equilibrium fraction of ownership,  $1 - \alpha_{\text{pub}}^*$ , demanded by the shareholders is determined by (2). Simplifying, we get

$$1 - \alpha_{\text{pub}}^* = \frac{1}{1 + [p\theta\rho A_G + p\theta\{1 - \rho\}\eta_{\text{pub}}D]} . \quad (\text{A1})$$

Since  $D < 0$ , it is evident that  $1 - \alpha_{\text{pub}}^*$  is increasing in  $\eta_{\text{pub}}$  and decreasing in  $\rho$ . Q.E.D.

*Proof of Proposition 1:* Substituting for  $V_{\text{pr}}^I(\alpha_{\text{pr}})$  from (5) and  $V_{\text{pr}}^M(\alpha_{\text{pr}})$  from (6) in the manager's maximization problem (7)–(9) yields

$$\max_{\alpha_{\text{pr}}, \eta_{\text{pr}}} \alpha_{\text{pr}} W_{\text{pr}}^M \quad (\text{A2})$$

$$\text{s.t.} \quad [1 - \alpha_{\text{pr}}] W_{\text{pr}}^I - L = 1 \quad (\text{A3})$$

$$\text{and } 0 \leq \alpha_{\text{pr}} \leq 1, \quad 0 \leq \eta_{\text{pr}} \leq 1 . \quad (\text{A4})$$

Substituting for  $\alpha_{\text{pr}}$  from (A3) into the manager's objective (A2), we obtain

$$\max_{\eta_{\text{pr}}} \left[ 1 - \frac{1 + L}{W_{\text{pr}}^I} \right] W_{\text{pr}}^M . \quad (\text{A5})$$

We initially ignore the boundary conditions on  $\eta_{\text{pr}}$  given in (A4). The first-order condition with respect to  $\eta_{\text{pr}}$  yields

$$\frac{\partial V_{\text{pr}}^M}{\partial \eta_{\text{pr}}} = \frac{p\theta D[1 - \rho][1 + L]W_{\text{pr}}^M}{[W_{\text{pr}}^I]^2} + p\theta A_G[1 - \rho] \left[ \frac{W_{\text{pr}}^I - 1 - L}{W_{\text{pr}}^I} \right] = 0 . \quad (\text{A6})$$

This implies

$$D[1 + L]W_{\text{pr}}^M + A_G [W_{\text{pr}}^I - 1 - L] W_{\text{pr}}^I = 0 . \quad (\text{A7})$$

Expanding the left-hand side of the above equation, we have a quadratic equation in  $\eta_{pr}$  with two positive real roots. The smaller root corresponding to the maximum is given in (11). The larger root represents a minimum for  $V_{pub}^M$ . At this root however,  $W_{pr}^I < 0$  and hence this is not a feasible solution.<sup>33</sup> The  $\alpha_{pr}^*$  in (12) can be obtained by substituting for  $\eta_{pr}^*$  from (11). Note that Assumption 1 guarantees that the boundary conditions on  $\eta_{pr}^*$  and  $\alpha_{pr}^*$  are satisfied.

We can show that the second-order condition establishing the concavity of  $V_{pr}^M$  in  $\eta_{pr}$  is satisfied by differentiating  $\frac{\partial V_{pr}^M}{\partial \eta_{pr}}$  in (A6) with respect to  $\eta_{pr}$  as

$$\frac{\partial^2 V_{pr}^M}{\partial \eta_{pr}^2} = p\theta D[1 - \rho][1 + L] \left[ \frac{[W_{pr}^I]^2 [p\theta\{1 - \rho\}A_G] - 2W_{pr}^I W_{pr}^M [p\theta\{1 - \rho\}D]}{[W_{pr}^I]^4} \right] + p\theta A_G [1 - \rho] \left[ \frac{W_{pr}^I p\theta D[1 - \rho] - p\theta D[1 - \rho][W_{pr}^I - 1 - L]}{[W_{pr}^I]^2} \right]. \tag{A8}$$

This can be simplified to

$$\frac{\partial^2 V_{pr}^M}{\partial \eta_{pr}^2} = p^2 \theta^2 D [1 - \rho]^2 [1 + L] \left[ \frac{W_{pr}^I A_G - 2D W_{pr}^M}{[W_{pr}^I]^3} \right] + p^2 \theta^2 A_G D [1 - \rho]^2 \left[ \frac{1 + L}{[W_{pr}^I]^2} \right]. \tag{A9}$$

Since  $W_{pr}^I > 1$ ,  $W_{pr}^M > 1$ , and  $D < 0$ , it is obvious that the right-hand side above is negative, and thus we have proved that  $\frac{\partial^2 V_{pr}^M}{\partial \eta_{pr}^2} < 0$ . Q.E.D.

*Proof of Lemma 2:* We know from Proposition 1 that  $1 - \alpha_{pr}^* = \frac{A_G[1+L]}{t}$ , where  $t$  is defined in Assumption 1 and is increasing in  $\rho$ . Thus,  $1 - \alpha_{pr}^*$  is decreasing in  $\rho$ . Further, it is clear that  $1 - \alpha_{pr}^*$  is increasing in  $L$ . Q.E.D.

*Proof of Lemma 3:* Differentiating  $\eta_{pr}^*$  in (11) with respect to  $\rho$ , we have

$$\frac{\partial \eta_{pr}^*}{\partial \rho} = \frac{[1 - \rho] \left[ A_G^2 p\theta - \frac{\partial t}{\partial \rho} \right] + A_G [1 + p\theta \rho A_G] - t}{[1 - \rho]^2 [-p\theta D A_G]}. \tag{A10}$$

We see that because  $D < 0$ , we will have  $\frac{\partial \eta_{pr}^*}{\partial \rho} > 0$  if

$$[1 - \rho] \left[ A_G^2 p\theta - \frac{\partial t}{\partial \rho} \right] + A_G [1 + p\theta \rho A_G] - t > 0. \tag{A11}$$

<sup>33</sup>  $V_{pr}^I$  has a point of discontinuity when  $W_{pr}^I = 0$ . It can be shown that as long as  $D > -1$ , the value of  $\eta_{pr}$  for which  $W_{pr}^I = 0$  is greater than one. It is apparent that  $D > -1$  is equivalent to a limited liability constraint, and is therefore satisfied.

Substituting for  $\frac{\partial t}{\partial \rho}$  by using the definition of  $t$  from Assumption 1, we have

$$[1 - \rho] \left[ A_G^2 p \theta - \frac{p \theta A_G^2 [A_G - D][1 + L]}{2t} \right] + A_G [1 + p \theta \rho A_G] - t > 0. \quad (\text{A12})$$

Simplifying (A12) and ignoring constant terms, we see that (A12) will hold if

$$\begin{aligned} 2t A_G [1 + p \theta A_G] &> 2t^2 + p \theta A_G^2 [1 - \rho] [A_G - D][1 + L] \\ \text{or } 2t A_G [1 + p \theta A_G] &> A_G [A_G - D][1 + L] \{2[1 + p \theta \rho A_G] + p \theta A_G [1 - \rho]\}. \end{aligned} \quad (\text{A13})$$

Since  $\rho < 1$ , for (A13) to hold it is sufficient to show that

$$t > [A_G - D][1 + L]. \quad (\text{A14})$$

Substituting for  $t$  from Assumption 1 we see that (A14) will hold if  $K^2 > 1$ , which we know is true from Assumption 1. Thus we have proved that  $\frac{\partial \eta_{pr}^*}{\partial \rho} > 0$ .

Since  $t$  is increasing in  $L$  and  $D < 0$ , it is also clear that  $\frac{\partial \eta_{pr}^*}{\partial L} < 0$ . Q.E.D.

*Proof of Proposition 2:* We prove Proposition 2 in two steps. First, we derive necessary and sufficient conditions to ensure renegotiation-proofness. In the second part, we will show how Assumption 1 ensures that these conditions are satisfied.

The optimal control allocation divides control between the manager and the investors. Hence, two kinds of renegotiation can occur: The investor can acquire additional control from the manager, or the manager can acquire additional control from the investor, with the acquisition of additional control in each case involving an offer to increase the other party's ownership share; the party acquiring control ends up with total control. We consider each kind of renegotiation. It is convenient to define  $\alpha_1 \equiv \frac{D}{D - A_G}$  and  $\alpha_2 \equiv \frac{D[A_G + 1]}{D - A_G}$ .

#### *Investors Acquiring Control from Manager*

Starting out with  $\eta_{pr}^*$ , the expected loss suffered by investors in the event of disagreement is  $\text{Loss} = \eta_{pr}^* [1 - \alpha_{pr}^*] [-D]$ , and the expected benefit enjoyed by the manager is  $\text{Benefit} = \alpha_{pr}^* \eta_{pr}^* A_G$ . For renegotiation to fail, the loss suffered by the investors should be less than the benefit perceived by the manager. That is,

$$\eta_{pr}^* [1 - \alpha_{pr}^*] [-D] < \alpha_{pr}^* \eta_{pr}^* A_G, \quad (\text{A15})$$

which implies

$$\alpha_{pr}^* > \frac{D}{D - A_G}. \quad (\text{A16})$$

#### *Manager Acquiring Control from Investors*

The manager can acquire total control by agreeing to reduce his ownership stake from  $\alpha_{pr}^*$  to some  $\alpha_0 < \alpha_{pr}^*$ . The manager's expected utility with the original contract is  $\alpha_{pr}^* \{ \eta_{pr}^* [A_G + 1] + [1 - \eta_{pr}^*] 1 \}$ . If he acquires total control, he can

guarantee investment with probability one, and his utility is  $\alpha_0[A_G + 1]$ . So, a necessary condition for the manager to be willing to renegotiate is

$$\alpha_0[A_G + 1] \geq \alpha_{pr}^*[\eta_{pr}^*\{A_G + 1\} + \{1 - \eta_{pr}^*\}1], \quad (A17)$$

which implies

$$\alpha_0 \geq \frac{\alpha_{pr}^*[\eta_{pr}^*\{A_G + 1\} + \{1 - \eta_{pr}^*\}1]}{A_G + 1} \equiv \hat{\alpha}. \quad (A18)$$

The investor's expected utility is  $[1 - \alpha_{pr}^*][\eta_{pr}^*\{D + 1\} + \{1 - \eta_{pr}^*\}1]$  without renegotiation, and it is  $[1 - \alpha_0][D + 1]$  with renegotiation. Thus, for the investor to be willing to renegotiate we need

$$[1 - \alpha_0][D + 1] \geq [1 - \alpha_{pr}^*][\eta_{pr}^*\{D + 1\} + \{1 - \eta_{pr}^*\}1], \quad (A19)$$

which implies

$$\alpha_0 \leq 1 - \frac{[1 - \alpha_{pr}^*][\eta_{pr}^*\{D + 1\} + \{1 - \eta_{pr}^*\}1]}{D + 1} \equiv \hat{\alpha}. \quad (A20)$$

For renegotiation to be feasible, we need  $[\hat{\alpha}, \hat{\alpha}]$  to be a nonempty set, that is,  $\hat{\alpha} > \hat{\alpha}$ . Thus, renegotiation-proofness is guaranteed if

$$\hat{\alpha} < \hat{\alpha}. \quad (A21)$$

Substituting for  $\hat{\alpha}$  and  $\hat{\alpha}$  in (A21) means that the following is sufficient for renegotiation-proofness

$$1 - \frac{[1 - \alpha_{pr}^*][\eta_{pr}^*\{D + 1\} + \{1 - \eta_{pr}^*\}1]}{D + 1} < \frac{\alpha_{pr}^*[\eta_{pr}^*\{A_G + 1\} + \{1 - \eta_{pr}^*\}1]}{A_G + 1},$$

which implies

$$\begin{aligned} \alpha_{pr}^* \left\{ \frac{\eta_{pr}^*\{A_G + 1\} + \{1 - \eta_{pr}^*\}1}{A_G + 1} - \frac{\eta_{pr}^*\{D + 1\} + \{1 - \eta_{pr}^*\}1}{D + 1} \right\} \\ > 1 - \frac{\eta_{pr}^*\{D + 1\} + \{1 - \eta_{pr}^*\}1}{D + 1}. \end{aligned} \quad (A22)$$

The above inequality can be further simplified as

$$\alpha_{pr}^* \frac{\{D - A_G\} \{1 - \eta_{pr}^*\}}{\{A_G + 1\}\{D + 1\}} > \frac{\{1 - \eta_{pr}^*\} D}{D + 1}. \quad (A23)$$

Noting that  $D < 0 < A_G$ , the following suffices for (A23) to hold:

$$\alpha_{pr}^* < \frac{D[A_G + 1]}{D - A_G}. \quad (A24)$$

Combining (A16) and (A24), we see that renegotiation-proofness obtains if

$$\alpha_{pr}^* \in \left( \frac{D}{D - A_G}, \frac{D[A_G + 1]}{D - A_G} \right). \quad (A25)$$

Now we show that Assumption 1 ensures that (A25) holds. Substituting for  $\alpha_{pr}^*$  from (12), we see that  $\alpha_{pr}^* > \frac{D}{D-A_G}$  implies

$$\frac{t - A_G[1 + L]}{t} > \frac{D}{D - A_G}. \tag{A26}$$

Substituting for  $t$  from Assumption 1 and simplifying (A26) yields

$$\sqrt{\frac{[A_G - D][1 + L]}{A_G[1 + A_G p \theta \rho]}} < 1, \tag{A27}$$

which clearly holds given Assumption 1 since the inequality is just  $K > 1$ .

Now we can prove the next part, which is to show that  $\eta_{pr}^* < 1$  implies  $\alpha_{pr}^* < \frac{D[A_G+1]}{D-A_G}$ . Writing out the condition  $\alpha_{pr}^* < \frac{D[A_G+1]}{D-A_G}$  and using (12) we have

$$\frac{t - A_G[1 + L]}{t} < \frac{D[A_G + 1]}{D - A_G}, \tag{A28}$$

which implies

$$\frac{A_G[1 + L]}{t} > \frac{A_G[1 + D]}{A_G - D}. \tag{A29}$$

Substituting in (A29) for  $t$  from Assumption 1 and simplifying we have

$$\sqrt{\frac{[A_G - D][1 + L]}{A_G[1 + A_G p \theta \rho]}} > 1 + D, \tag{A30}$$

implying

$$\frac{1}{K} > 1 + D. \tag{A31}$$

We can show that (A31) holds as long as  $\eta_{pr}^* < 1$ . Using (11), we see that  $\eta_{pr}^* < 1$  implies

$$\frac{-A_G[1 + p \theta \rho A_G] + t}{p \theta [1 - \rho] D A_G} < 1, \tag{A32}$$

which implies

$$-1 + \sqrt{\frac{[1 + L][A_G - D]}{A_G[1 + A_G p \theta \rho]}} > \frac{p \theta [1 - \rho] D}{1 + p \theta \rho A_G}, \tag{A33}$$

$$\text{which holds if } \frac{1}{K} > 1 + \frac{p \theta [1 - \rho] D}{1 + p \theta \rho A_G}. \tag{A34}$$

Since  $\frac{p \theta [1 - \rho]}{[1 + p \theta \rho A_G]} \in (0, 1)$  and  $D < 0$ , we see that satisfaction of (A34) implies that (A31) holds, which means that (A29) holds. Thus, we have shown that  $\eta_{pr}^* < 1$  implies that  $\alpha_{pr}^* < \frac{D[A_G+1]}{D-A_G}$ . Together with the earlier result that  $\alpha_{pr}^* > \frac{D}{D-A_G}$ , this completes our proof that (A25) holds. Q.E.D.

*Proof of Proposition 3:* Choose a specific  $\rho$ . The manager will prefer public ownership iff  $V_{\text{pub}}^M \geq V_{\text{pr}}^M$ . For a given  $\eta_{\text{pub}}$ , using (4) and (6) we see that this translates into

$$\left[ \frac{W_{\text{pr}}^I - 1 - L}{W_{\text{pr}}^I} \right] W_{\text{pr}}^M - \left[ \frac{W_{\text{pub}}^I - 1}{W_{\text{pub}}^I} \right] W_{\text{pub}}^M \leq 0. \tag{A35}$$

To examine when (A35) holds, we need some preliminaries. Considering  $V_{\text{pub}}^M$  and  $V_{\text{pr}}^M$  as functions of  $\eta_{\text{pub}}$  and  $\eta_{\text{pr}}$ , respectively, the main difference between them is the expected liquidity cost  $L$  in  $V_{\text{pr}}^M$ . Note that  $V_{\text{pub}}^M(\eta_{\text{pub}}) = V_{\text{pr}}^M(\eta_{\text{pub}}, L = 0)$ , and that  $V_{\text{pr}}^M$  and  $V_{\text{pub}}^M$  share the same properties as functions of  $\eta$  (compare (3) and (5)). From the proof of Proposition 1, we know  $V_{\text{pr}}^M$  is a continuous and concave function of  $\eta_{\text{pr}}$  with a global maximum at  $\eta_{\text{pr}} = \eta_{\text{pr}}^*$  for  $\eta_{\text{pr}} \in [0, 1]$  and no interior minimum for  $\eta_{\text{pr}} \in [0, 1]$ . Similarly, it can be shown that  $V_{\text{pub}}^M$  is a continuous and concave function of  $\eta_{\text{pub}}$  and has a global maximum at  $\eta_{\text{pub}} = \eta_{\text{pub}}^* = \eta_{\text{pr}}^*(L = 0)$  and no interior minimum for  $\eta_{\text{pub}} \in [0, 1]$ .<sup>34</sup> Further, from Lemma 3 and the fact that  $\eta_{\text{pr}}^*$  is a continuous and decreasing function of  $L$ , it also follows that  $\eta_{\text{pr}}^*(L = 0) = \eta_{\text{pub}}^* > \eta_{\text{pr}}^*$  for any  $L > 0$  and  $\forall \rho \in [0, 1]$ . Without additional restrictions, we cannot ensure that  $\eta_{\text{pub}}^* < 1$ . But it is clear that, given Assumption 1, we have  $\eta_{\text{pub}}^* > 0$ . Given these preliminaries the proof proceeds as follows.

Suppose first that  $\eta_{\text{pub}} = \eta_{\text{pr}}^*$ , in which case  $W_{\text{pr}}^I = W_{\text{pub}}^I$  and  $W_{\text{pr}}^M = W_{\text{pub}}^M$ . Hence, (A35) holds as a strict inequality, and the manager strictly prefers public ownership. Now  $V_{\text{pub}}^M$  achieves its unique maximum at  $\eta_{\text{pub}}^* > \eta_{\text{pr}}^*$ . Thus, as  $\eta_{\text{pub}}$  decreases from  $\eta_{\text{pr}}^*$ ,  $V_{\text{pub}}^M$  continuously decreases while  $V_{\text{pr}}^M$  remains constant. Since the minimum value  $\eta_{\text{pub}}$  can take is zero, we can have two cases: (i) When  $V_{\text{pub}}^M(\eta_{\text{pub}} = 0) \geq V_{\text{pr}}^M$ , by continuity of  $V_{\text{pub}}^M$  in  $\eta_{\text{pub}}$  and the fact that  $V_{\text{pub}}^M$  does not have an interior minimum, we have  $V_{\text{pub}}^M \geq V_{\text{pr}}^M \forall \eta_{\text{pub}} \in [0, \eta_{\text{pr}}^*]$ . Hence, the manager prefers public ownership for all  $\eta_{\text{pub}} \leq \eta_{\text{pr}}^*$  and we have  $\eta_1 = 0$ . (ii) Alternatively, when  $V_{\text{pub}}^M(0) < V_{\text{pr}}^M$ , by continuity of  $V_{\text{pub}}^M$  in  $\eta_{\text{pub}}$  and the absence of an interior minimum for  $V_{\text{pub}}^M$ , there exists a unique value of  $\eta_{\text{pub}} = \eta_1$  such that  $V_{\text{pub}}^M(\eta_1) = V_{\text{pr}}^M$ ,  $V_{\text{pub}}^M \geq V_{\text{pr}}^M \forall \eta_{\text{pub}} \in [\eta_1, \eta_{\text{pr}}^*]$ , and  $V_{\text{pub}}^M < V_{\text{pr}}^M \forall \eta_{\text{pub}} \in [0, \eta_1]$ . In this case, the manager will prefer public ownership for all  $\eta_{\text{pub}} \in [\eta_1, \eta_{\text{pr}}^*]$  and private ownership for all  $\eta_{\text{pub}} \in [0, \eta_1]$ . We assume that when the manager is indifferent between public and private ownership, he chooses public ownership.

When  $\eta_{\text{pub}}$  increases beyond  $\eta_{\text{pr}}^*$ ,  $V_{\text{pub}}^M$  increases until  $\eta_{\text{pub}} = \eta_{\text{pub}}^*$  and then decreases. The analysis when  $\eta_{\text{pub}} > \eta_{\text{pr}}^*$  is similar to the analysis when  $\eta_{\text{pub}} < \eta_{\text{pr}}^*$ . If  $V_{\text{pub}}^M(\eta_{\text{pub}} = 1) \geq V_{\text{pr}}^M$ , the manager prefers public ownership for  $\eta_{\text{pub}} \in [\eta_{\text{pr}}^*, 1]$  and we have  $\eta_2 = 1$ . If  $V_{\text{pub}}^M(\eta_{\text{pub}} = 1) < V_{\text{pr}}^M$ , then for some  $\eta_2 \in (\eta_{\text{pub}}^*, 1)$ , the manager prefers public ownership for  $\eta_{\text{pub}} \in [\eta_{\text{pr}}^*, \eta_2]$  and private ownership for  $\eta_{\text{pub}} \in (\eta_2, 1]$ .

<sup>34</sup> Similar to  $V_{\text{pr}}^I$ ,  $V_{\text{pub}}^I$  has a point of discontinuity for a value of  $\eta_{\text{pub}} > 1$ .

Thus, the four possible cases of  $\eta_1$  and  $\eta_2$  are: (1)  $\eta_1 \in (0, \eta_{pr}^*)$  and  $\eta_2 \in (\eta_{pub}^*, 1)$ , (2)  $\eta_1 \in (0, \eta_{pr}^*)$  and  $\eta_2 = 1$ , (3)  $\eta_1 = 0$  and  $\eta_2 \in (\eta_{pub}^*, 1)$ , and (4)  $\eta_1 = 0$  and  $\eta_2 = 1$ . The necessary and sufficient conditions for only the first case to occur are

$$V_{pr}^M > V_{pub}^M(\eta_{pub} = 0) \quad \text{and} \quad V_{pr}^M > V_{pub}^M(\eta_{pub} = 1) \quad \forall \rho \in [0, 1]. \quad (A36)$$

Note that both of these inequalities obviously hold for  $L = 0$ . Moreover,  $\frac{\partial V_{pr}^M}{\partial L} < 0$  and  $V_{pub}^M$  is independent of  $L$ . Thus, it follows by continuity of  $V_{pr}^M$  and  $V_{pub}^M$  in  $L$ , that (A36) will hold for  $L$  small enough. In terms of exogenous parameters, this condition can be stated as follows. Let  $G(L) \equiv 2t - A_G L - A_G [2 + A_G p \theta \rho] + D$ . It can be shown that given Assumption 1,  $G(L)$  is increasing in  $L$ . A sufficient condition for (A36) to hold is

$$G(L) < \min \left\{ 0, \frac{p\theta[-D][\rho A_G + \{1 - \rho\}D][1 + A_G p \theta \{1 - \rho\}] + A_G D p \theta \rho}{1 + p\theta[\rho A_G + \{1 - \rho\}D]} \right\}, \quad (A37)$$

which means that  $L$  should be small enough. Q.E.D.

*Proof of Proposition 4:* To show that the measure  $[\eta_1, \eta_2]$  increases with  $L$  for the first case mentioned in the proof of Proposition 3, it is sufficient to show that  $\eta_1 \in (0, \eta_{pr}^*)$  is decreasing in  $L$  and  $\eta_2 \in (\eta_{pub}^*, 1)$  is increasing in  $L$ . We show this by rewriting the condition (A35) as the condition for public ownership to be preferred:

$$V_{pr}^M - V_{pub}^M \leq 0. \quad (A38)$$

Since  $\frac{\partial V_{pr}^M}{\partial L} < 0$ , public ownership becomes more attractive as  $L$  increases. When  $V_{pr}^M = V_{pub}^M$ , (A38) can be written as a quadratic in  $\eta_{pub}$ , with  $\eta_1 \in (0, \eta_{pr}^*)$  and  $\eta_2 \in (\eta_{pub}^*, 1)$  being the roots of this quadratic equation. Since  $V_{pub}^M$  achieves a global maximum at  $\eta_{pub}^* \in (\eta_1, \eta_2)$ , we have  $\frac{\partial V_{pub}^M}{\partial \eta} > 0$  at  $\eta_{pub} = \eta_1$  and  $\frac{\partial V_{pub}^M}{\partial \eta} < 0$  at  $\eta_{pub} = \eta_2$ . Hence, when there is an increase in  $L$ ,  $V_{pr}^M$  decreases and this in turn results in an increase in  $\eta_2$  and a decrease in  $\eta_1$  to maintain equality. This leads to the result that the measure of the interval  $[\eta_1, \eta_2]$  is increasing in  $L$ .

For the second part of the proposition (impact of  $\rho$  on  $[\eta_1, \eta_2]$  when  $\eta_1 \in (0, \eta_{pr}^*)$  and  $\eta_2 \in (\eta_{pub}^*, 1)$ ), we can express (A35) as

$$V_{pr}^M - W_{pub}^M \left[ \frac{W_{pub}^I - 1}{W_{pub}^I} \right] \leq 0, \quad (A39)$$

which implies

$$W_{pub}^M [W_{pub}^I - 1] - W_{pub}^I V_{pr}^M \geq 0. \quad (A40)$$

When (A40) holds as an equality, the left-hand side can be written as a quadratic of the form  $a\eta_{pub}^2 + b\eta_{pub} + c = 0$ , where  $a \equiv p^2\theta^2[1 - \rho]^2 A_G D$ ,  $b \equiv p^2\theta^2\rho[1 -$

$\rho][A_G^2 + A_G D] + [1 - V_{pr}^M]p\theta[1 - \rho]D$ , and  $c \equiv p^2\theta^2\rho^2A_G^2 + p\theta\rho A_G[1 - V_{pr}^M] - V_{pr}^M$ . The two solutions to this quadratic equation are  $\eta_1$  and  $\eta_2$ . Hence, to prove  $\eta_2 - \eta_1$  is increasing in  $\rho$ , we need to prove  $\frac{-\sqrt{b^2-4ac}}{a}$  is increasing in  $\rho$  (since  $a < 0$ ). Substituting the relevant expressions, we simplify  $b^2 - 4ac$  as follows:

$$\begin{aligned} b^2 - 4ac &= \{p^2\theta^2\rho[1 - \rho][A_G^2 + A_G D] + [1 - V_{pr}^M]p\theta[1 - \rho]D\}^2 \\ &\quad - 4p^2\theta^2[1 - \rho]^2 A_G D [p\theta\rho A_G [1 - V_{pr}^M] - V_{pr}^M + p^2\theta^2\rho^2 A_G^2] \\ &= p^2\theta^2[1 - \rho]^2 \{ [p\theta\rho[A_G^2 + A_G D] + [1 - V_{pr}^M]D]^2 \\ &\quad - 4A_G D [1 + A_G p\theta\rho][A_G p\theta\rho - V_{pr}^M] \}. \end{aligned} \tag{A41}$$

To show  $\frac{-\sqrt{b^2-4ac}}{a}$  is increasing in  $\rho$ , it is sufficient to show that

$$\text{Diff} \equiv [p\theta\rho[A_G^2 + A_G D] + [1 - V_{pr}^M]D]^2 - 4A_G D [1 + A_G p\theta\rho][A_G p\theta\rho - V_{pr}^M] \tag{A42}$$

is increasing in  $\rho$ . Substituting for  $V_{pr}^M$  and simplifying we have

$$\begin{aligned} \text{Diff} &= 4A_G^2 [1 + A_G p\theta\rho]^2 + 4t^2 + A_G^2 L^2 - 8A_G t [1 + A_G p\theta\rho] \\ &\quad - 4tAL + 4A_G^2 L [1 + A_G p\theta\rho] \\ &\quad - 4A_G [1 + A_G p\theta\rho] \{A_G - D - 2t + A_G^2 p\theta\rho + A_G [1 + L]\}. \end{aligned} \tag{A43}$$

Given Assumption 1, it follows that  $\frac{\partial \text{Diff}}{\partial \rho} > 0$ , which completes the proof that  $\frac{\partial[\eta_1 - \eta_2]}{\partial \rho} > 0$ . Q.E.D.

*Proof of Proposition 5:* Define the set of exogenous parameter values  $\Lambda \equiv \{p, \theta, A_G, A_B, L, \rho, \eta_{pub}\}$ . We prove that  $\Lambda$  is nonempty. We provide a numerical example in which we first vary agreement parameter  $\rho$  and then the expected liquidity cost  $L$ , holding all other exogenous parameters fixed.

A: Exogenous Parameters						
$p$	0.5	0.5	0.5	0.5	0.5	0.5
$\theta$	0.9	0.9	0.9	0.9	0.9	0.9
$A_G + 1$	1.75	1.75	1.75	1.75	1.75	1.75
$A_B + 1$	0	0	0	0	0	0
$\rho$	0.55	0.575	0.60	0.575	0.575	0.575
$L$	0.0001	0.0001	0.0001	0.0001	0.0003	0.0005
B: Endogenous Parameters						
$\eta_1$	0.20	0.38	0.59	0.38	0.24	0.14
$\eta_2$	0.55	0.77	1.00	0.77	0.91	1.0
$\eta_{pr}^*$	0.37	0.57	0.80	0.57	0.57	0.56
$\alpha_{pr}^*$	0.15	0.15	0.16	0.15	0.15	0.15

Panel A gives the values of the exogenous parameters while Panel B gives the corresponding values of the endogenous parameters. In the first three columns we vary the agreement parameter  $\rho$ , while in the last three we vary the expected liquidity cost  $L$ . As can be seen from the above numerical analysis, there is a well-defined  $[\eta_1, \eta_2] \subset (0, 1)$  such that private and public ownership co-exist. When we increase  $\rho$  with all other exogenous parameters held fixed, we see that  $[\eta_1, \eta_2]$  expands, increasing the attractiveness of public ownership. So, if we were to take the case of  $L = 0.0001$  and assume  $\eta_{\text{pub}} = 0.8$ , for example, then private ownership would be preferred for  $\rho = 0.55$  and  $\rho = 0.575$  since  $\eta_{\text{pub}} \notin [\eta_1, \eta_2]$  in those two cases, and public ownership would be preferred for  $\rho = 0.60$  since  $\eta_{\text{pub}} \in [\eta_1, \eta_2]$  in that case. When  $L$  is increased with all other exogenous parameters held fixed,  $[\eta_1, \eta_2]$  expands, increasing the attractiveness of public ownership (Proposition 4). So, if we were to take the case of  $\rho = 0.575$  and assume that  $\eta_{\text{pub}} = 0.8$ , for example, then private ownership would be preferred for  $L = 0.0001$ , and public ownership would be preferred for  $L = 0.0003$  and  $L = 0.0005$ . Note that  $[1 - \alpha_{\text{pr}}^*]$  is decreasing in  $\rho$  (Lemma 2) and  $\eta_{\text{pr}}^*$  is increasing in  $\rho$  (Lemma 3). We have thus shown that  $\Lambda$  is nonempty. Q.E.D.

*Proof of Proposition 6:* If the manager is not essential for the project, the investor can buy out the manager whenever the manager (investor) does not (does) want to invest in the project. This will happen when  $S = G$  is observed, the manager's prior belief is that the signal is uninformative ( $q_m = U$ ), and the investor's prior belief is that it is informative ( $q_i = I$ ). In this state, the manager's valuation of the project remains the same as before, and is shown in (6), while the investor's valuation changes. The investor's valuation of the project when he can buy out the manager becomes

$$\begin{aligned} V_{\text{pr}}^I(\alpha_{\text{pr}}) &= [1 - \alpha_{\text{pr}}]\{1 + p\theta\rho A_G + p\theta[1 - \rho]\eta_{\text{pr}}D\} + p[1 - \theta][1 - \rho]A_G - L \\ &= [1 - \alpha_{\text{pr}}]W_{\text{pr}}^I + p[1 - \theta][1 - \rho]A_G - L. \end{aligned} \quad (\text{A44})$$

Equation (A44) can be compared to the earlier expression (5) in the absence of a buyout. The difference between the investor's valuation when he can buy out the manager (A44) and his valuation when he cannot (5) is the term  $p[1 - \theta][1 - \rho]A_G$ . This is the expected net benefit to the investor from buying out the manager. To see this, note that  $p[1 - \theta][1 - \rho]$  is the probability of the buyout state, and  $A_G$  is the net benefit of the buyout in this state. We can now establish global optimality and derive the expressions (13) and (14). To see that this derivation is analogous to the proof of Proposition 1, define  $L^* \equiv L - \rho[1 - \theta][1 - \rho]A_G$  and replace  $L$  by  $L^*$  in the steps in the proof of Proposition 1. We also need to make an assumption similar to Assumption 1 to ensure that  $\eta_{\text{pr}}^*$  does not take extreme values. We omit these details to conserve space. The result that  $\frac{\partial \eta_{\text{pr}}^*}{\partial \rho} > 0$  can be derived as follows. Using (13) we can show that  $\frac{\partial \eta_{\text{pr}}^*}{\partial \rho} > 0$  is equivalent to

$$\begin{aligned} &\{[1 + L - p[1 - \theta][1 - \rho]A_G][A_G - D]\}\{2 + A_G p\theta[1 + \rho]\} \\ &+ [1 - \rho][A_G - D][1 + A_G p\theta\rho]p[1 - \theta] < 2\hat{\epsilon}[A_G p\theta + 1]. \end{aligned} \quad (\text{A45})$$

Assuming that exogenous parameters satisfy the condition needed for  $\eta_{pr}^{**} \in (0, 1)$ , it can be shown that the above inequality holds if  $\theta = 1$ . Since both sides of the above inequality are continuous in  $\theta$ , the inequality will hold if  $\theta > \hat{\theta}$ , where  $\hat{\theta} \in (0, 1)$  is sufficiently large. Q.E.D.

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