Managerial Autonomy, Allocation of Control Rights, and Optimal Capital Structure

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We examine the design of control rights of external financiers, and how these interact with the firm's security issuance and capital structure when the firm's initial owners and managers may disagree with new investors over project choice. The first main result is an *ex ante* managerial preference for "soft" financial claims that maximize managerial project-choice autonomy, which is in contrast to agency theory. Second, a dynamic "pecking order" of cash, equity, and debt emerges. Additional results explain equity issuance at high prices, the drifting of leverage ratios with stock returns, cash hoarding, and debt usage without taxes, agency, or signaling. (*JEL* G32, G34, G39)

Introduction

Much has been learned from models in which managers, whose interests diverge from those of financiers, undertake various actions, including designing control rights (e.g., Aghion and Bolton 1992; Masulis and Nahata 2009), choosing securities to raise financing (e.g., Hart and Moore 1995), and determining capital structure (e.g., Grossman and Hart 1982; Jensen and Meckling 1976). Yet, there is much we do not know about security issuance and capital structure, as recent empirical research has uncovered a host of puzzling stylized facts, like the sluggishness of firms in making capital structure adjustments in response to stock price movements. Moreover, the assumption that managers are driven exclusively by narrow self-interest misses the opportunity to examine the corporate finance ramifications of the behavior of managers whose objectives are aligned with those of the shareholders due to sufficiently

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high stock ownership (as in the case of Bill Gates or Warren Buffett), intrinsic motivation (e.g., Van den Steen 2005), or matched "mission preferences" (e.g., Besley and Ghatak 2005). There is, therefore, a need for a fresh perspective.

Of course, if managers always do what all shareholders desire, the problem of separation of ownership and control is rendered sterile. We therefore study a manager who seeks to maximize initial shareholder wealth but who might have a "different model of the world." In particular, we consider a situation in which managers and investors who purchase the firm's securities have different beliefs about the precision of a commonly observed prior signal about a project, which could lead to disagreements over project choice. While our assumption of heterogeneous priors departs from the standard common priors assumption, we note that rationality restricts the revision of prior beliefs to be Bayesian without addressing the origination of these prior beliefs. Priors are taken as part of the primitives, along with preferences and endowments.[1] Our assumption is consistent with Kurz's (1994a,b) theory of "rational beliefs," in which different beliefs are admissible as long as they do not conflict with historical data.[2]

The question we address within this framework is how the initial owners of a firm, whose objectives and beliefs are congruent with those of the manager, design shareholder and bondholder control rights for new investors whose beliefs may differ. We also examine how these control rights interact with the manager's capital structure decisions. The theory we develop to address these issues illuminates many puzzling, stylized facts about capital structure and pivots on the concept of *managerial autonomy*. Simply put, managerial autonomy is a manager's ability to carry out investment decisions that he views as best even when investors disagree. The manager is endogenously shown to value this autonomy because it enhances his ability to maximize shareholder wealth. The analysis focuses on the interaction between endogenously determined investment policy and capital structure.

Our analysis demonstrates that a manager's security issuance is driven by a preference *ex ante* to be free of *ex post* constraints imposed by claimholders. In other words, our focus is on how a manager makes capital structure decisions when he recognizes that these decisions will constrain his *future* real decisions. The manager thus seeks the security with the "softest" control. This is in sharp contrast to the usual agency stories in which the manager prefers *ex ante* to use "hard" claims to commit to constraints imposed by other claimholders;

[1] See Kreps (1990). Morris (1995) discusses why heterogeneous priors are consistent with (Bayesian) rationality. Acemoglu, Chernozhukov, and Yildiz (2006) show conditions under which heterogeneous priors may not converge to a common posterior belief.

[2] Papers with heterogeneous priors include Allen and Gale (1999), Boot, Gopalan, and Thakor (2006, 2008), Garmaise (2001), Harrison and Kreps (1978), Song and Thakor (2007), Thakor and Whited (2011), and Van den Steen (2010a,b). In Abel and Mailath (1994), there are common priors, but it is not common knowledge that projects are poor. Asymmetric information leads investors with a common prior to have different posteriors on project value. In our model, agents have heterogeneous posteriors but not because of asymmetric information.

these constraints limit the manager's *ex post* behavior and hence reduce the *ex ante* agency costs he absorbs.[3] Our analysis implies the immediate reversal of the "role of hard claims in constraining management" results available in the literature (e.g., Hart 1993; Hart and Moore 1995; Polevikov 2004; Stulz 1990).

Our disagreement-based autonomy approach is *not* rooted in managerial agency problems (e.g., Jensen and Meckling 1976; Ross 1973) that incentive contracting can solve, as the manager truly believes he is maximizing firm value. Nor is it an issue of asymmetric or insufficiently aggregated information, as management and investors observe the same signal. That is, all of the usual frictions—taxes, bankruptcy costs, agency costs, and asymmetric information—are absent. The key is that, conditional on a common signal, agents compute different posterior beliefs about project value because of the heterogeneity of priors about signal precision.

Our model works as follows. The manager, acting in the initial owners' interests, designs the corporate governance structure, which determines the shareholders' and bondholders' control rights. He then chooses the firm's capital structure and its project. The manager's project-choice autonomy is affected by the firm's capital and governance structures because capital structure fixes the mix of debt and equity, and because governance structure optimally allocates unequal control rights to debt and equity. As the manager values autonomy, and as his beliefs and objectives are aligned with the initial owners', the initial shareholders may be tempted to let the manager give himself complete autonomy. This is inefficient, however, because managerial autonomy increases the cost of external financing for initial shareholders, as new investors' beliefs may differ from the manager's. Therefore, on the one hand, autonomy strengthens the manager's ability to maximize his assessment of the *initial* shareholders' wealth but, on the other hand, it increases the cost of external financing. This tension produces optimal degrees of managerial autonomy *vis-à-vis* shareholders and bondholders.

The governance structure is affected by the manager's expectations of future events, particularly the *expected* level of manager-investor agreement, and the distribution of the future value of assets in place. When the expected future agreement is higher, the manager perceives a lower detrimental effect of managerial autonomy on the cost of external funding and, thus, sets autonomy higher. When the expected value of the assets in place is sufficiently high, the manager receives greater autonomy with respect to the bondholders because the value of the bondholders' claim becomes less sensitive to the payoff on the

3 The source of the divergence in objectives between the manager and the shareholders does not matter for this result. For example, this result will be obtained even if such a divergence arises from managers having "mission preferences" that differ from those of the firms that employ them, as in Besley and Ghatak (2005). A "mission" is viewed as project attributes that make agents value the project over and above monetary payoffs. Interpreted within our framework, we could have managers who attach personal glory or some other private benefit to the project. However, as long as private benefits are not efficient, the manager will find it optimal *ex ante* to issue hard claims that constrain his *ex post* behavior so as to achieve the *ex ante* efficient project choice (see Aghion and Bolton 1992).

new project, about which there may be disagreement. Furthermore, corporate cash increases the manager's autonomy with respect to both debt and equity.

The manager observes the agreement between himself and the investors prior to security issuance, so security issuance and capital structure are affected by both the observed agreement and the value of assets in place. The agreement parameter is increasing in the stock price because investors value the firm higher when they perceive a lower probability of managerial actions of which they would disapprove. Therefore, the manager finds equity most attractive when the stock price is high and shareholder opposition is least likely. Nevertheless, debt may be preferred if there is a sufficiently high probability that the firm's assets in place will have a high value because bondholders are relatively unconcerned about the firm's project choice under these circumstances and therefore provide the manager with greater autonomy than would be provided by equity. If the firm's assets in place have a low value, then the bondholders' payoff depends on the project cash flow and an asset-substitution moral hazard arises. Bondholders then impose restrictive covenants that provide less managerial autonomy than equity does, and equity is preferred if agreement (and, hence, the stock price) is sufficiently high.[4] When this agreement is low (low stock price), debt may still be preferred. If cash is available, it is the most preferred financing source. The model thus implies a dynamic "pecking order" that depends on the stock price and the value of assets in place.

Our dynamic pecking-order results depend on the firm raising financing for a project. A firm will not issue securities to rebalance its capital structure when no project is available, even though stock price dynamics alter its capital structure, so the firm's capital structure drifts with its stock returns, as documented by Welch (2004). If the firm does issue securities for project financing, the issuance will *reinforce*, rather than counteract, the capital structure effect of stock price movements. For example, an increase in the stock price, which lowers the leverage ratio, will be accompanied by an equity issue, which further decreases leverage. This is because if the stock price and the value of assets in place are within the appropriate ranges, a change in the stock price moves the firm's *optimal* capital structure in the same direction as the price. This generates a striking implication for capital structure—the firm's optimal capital structure is dynamic, as the manager's perception of the optimum varies with the firm's stock price. Our results and this empirical evidence are consistent with the evidence that capital structure is driven by stock returns (e.g., Welch 2004), that investment policy has an important influence on the time path of leverage (DeAngelo and Roll 2011), and that security-issuance decisions that are influenced by stock price levels have *long-lasting* capital structure

[4] This is consistent with the evidence that during financial distress, debt is particularly restrictive (Opler and Titman 1994). We could also distinguish among different types of debt based on autonomy. For example, bank debt is considered to be more flexible than public debt because it is easier to renegotiate (Berlin and Mester 1992).

effects (e.g., Baker and Wurgler 2002). This is in contrast to the two dominant paradigms in capital structure theory. The first of these paradigms is the (static) trade-off theory of optimal capital structure, which consists of Jensen and Meckling's (1976) agency costs theory, and DeAngelo and Masulis's (1980) debt tax shields argument, as well as free cash flow and management discipline considerations (Grossman and Hart 1982).[5] All of these theories predict that an increase in stock prices—which lowers market-value leverage ratios—should lead firms to borrow more to realign their capital structures with their respective optima. The second dominant paradigm is Myers and Majluf's (1984) "pecking order" theory, which predicts that firms will finance first with internal cash or riskless debt, and then with risky debt, and that they will use equity only as a last resort. However, equity issues are actually commonplace and equity issuance patterns are clearly in consistent with the pecking-order theory (e.g., Fama and French 2005). Moreover, the "equity aversion" predicted by pecking-order theory is contrary to the propensity of firms to prefer equity to debt when their stock prices are high.[6]

Zwiebel (1996) develops a related model in which a manager, who can choose between a good and a bad project, fears losing a job-related exogenous control benefit due to a takeover. The manager uses debt as a precommitment against choosing the bad project when the probability of the bad project is high and, hence, the stock price is low. Both Zwiebel's analysis and our analysis imply a negative relationship between leverage and stock prices. The two models are entirely different, however. First, Zwiebel assumes *complete* managerial control, whereas we endogenously derive the degree of managerial control. Second, the manager *ex ante* prefers *hard* claims that constrain him in Zwiebel's model, whereas he seeks *soft* claims in our model. Third, Zwiebel's agency model is driven by the disciplinary role of intermediate levels of debt with bankruptcy costs. We have no bankruptcy costs or agency problems, and the degrees of managerial autonomy with regard to equity and debt depend on the mediating variables—the stock price and the value of assets in place—so that either debt or equity could provide the manager greater autonomy depending on the circumstances. Finally, we examine how cash affects managerial autonomy, and characterize the firm's decision of how to finance

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[5] Both static and dynamic trade-off theories have been criticized for failing to recognize the tax advantage of internal equity (retained earnings) over external equity, as retaining earnings defers the personal taxation of dividends (see Lewellen and Lewellen 2006). These specific tax issues are avoided in alternative theories of capital structure. In Boyd and Smith (1999), the capital structure decision depends on whether returns are observable or state verification is costly. In Brander and Lewis (1986), capital structure affects strategic product-market competition. In Shah and Thakor (1987), capital structure is driven by project financing considerations. Adrian and Shin (2010) emphasize the relationship between liquidity and leverage. Jaggia and Thakor (1994) establish an optimal capital structure based on the trade-off between the tax benefit of debt and its cost in terms of weaker incentives for employees to invest in firm-specific human capital in more highly levered firms (see also Berk, Stanton, and Zechner 2010 for a human-capital-based theory of optimal capital structure).

[6] There are numerous papers that have documented this empirically (e.g., Asquith and Mullins 1986; Jung, Kim, and Stulz 1996). Moreover, CFOs consider stock prices to be an important factor in the security issuance decision (Graham and Harvey 2001).

the project as a choice among cash, equity, and debt. Additional differences—arising from the unique predictions of our model—become evident in the analysis.[7] A common thread running through these predictions is that they are *jointly* conditioned on the firm's stock price, manager-shareholder agreement, and the value of assets in place, which allows for empirical discrimination between our theory and others, such as market timing.

The most closely related paper is Dittmar and Thakor (2007), which develops a disagreement-based model of optimal security issuance and tests its predictions. Like this article, Dittmar and Thakor predict that equity will be issued when agreement is high, and their paper provides direct supporting evidence that such agreement is a significant determinant of equity issuance, even after controlling for the stock price. There are, however, several key differences between that paper and our work. First, we examine the effect of an important mediating variable, the value of assets in place, on the security issuance decision, which Dittmar and Thakor (2007) do not analyze. Therefore, our predictions differ from theirs. For example, while they show that the manager will *always* issue equity when shareholder-manager agreement is high, we show that the manager will issue debt if the value of assets in place is sufficiently high, regardless of the agreement parameter. Moreover, even for lower values of assets in place, the choice between equity and debt depends on the properties of the endogenously determined governance mechanism as well as the value of assets in place. Second, an important goal of our article is to determine the optimal allocation of control rights among security holders (corporate governance), as well as the capital structure and project choice ramifications of that allocation, which Dittmar and Thakor (2007) do not address. Third, this control-rights allocation represents another conditioning variable for capital structure in our model and it thus generates predictions that can be linked back to the exogenous parameters that determine corporate governance. Fourth, unlike Dittmar and Thakor (2007), we examine the impact of cash on managerial autonomy relative to debt and equity, and characterize the firm's choice as a choice among cash, equity, and debt. Finally, we derive numerous unique empirical implications.

The literature on dynamic capital structure choice is also relevant. Dangl and Zechner (2004), who extend the work of Fischer, Heinkel, and Zechner (1989) and Goldstein, Ju, and Leland (2001), examine the effect of dynamic capital structure adjustments on a firm's credit risk. They show that dynamic considerations could rationalize a greater initial reliance on equity.[8] In contrast

7 Another paper that takes a managerial perspective on capital structure is Novaes (2003). He shows that a takeover threat will not reconcile the gap between the free cash flow theory, which says that shareholders use debt to discipline managers, and managerial models in which the manager does not lever up to constrain himself in the absence of a takeover threat. Novaes shows that target managers may *over-lever* with low takeover costs, and that there is a negative correlation between leverage and takeover costs.

8 Dynamic considerations may also lead to capital structure indeterminacy. Hennessy and Whited (2005) show that the firm's leverage ratio displays path dependence and keeps declining over the time if the firm sustains its

to these papers, we focus on how the differential effects of debt, equity, and cash on a manager's project choice autonomy affect the firm's capital structure.

Finally, our article is related to research on how endogenous control considerations drive managerial decisions, e.g., Van den Steen (2010b). Particularly relevant is the research undertaken by Boot, Gopalan, and Thakor (2006, 2008), which addresses the endogenous determination of managerial autonomy when manager-investor disagreement is present. However, the focus of those papers is on the choice between private and public ownership.

This article proceeds as follows. The model is developed in Section 1, while Section 2 contains the analysis. Section 3 discusses the implications of the analysis for security issuance and capital structure, as well as extensions of the analysis. Testable predictions emerging from our results are discussed in Section 4. Section 5 presents our conclusions. All proofs are provided in the Appendix.

1. The Economic Setting: Disagreement, Autonomy, and Security Issuance

This section describes the model and the links between disagreement, autonomy, and security issuance. It begins with an overview of the model.

Overview of key features of the model. Assume that there is an all-equity financed, publicly traded firm in which a manager is making decisions in the best interests of the initial shareholders. The manager's beliefs about what is best may differ from those of new investors, although the beliefs of the manager and initial shareholders coincide.

Three decisions are made: a decision on the corporate governance structure, a decision on the capital structure, and a decision on project choice. The manager designs the corporate governance structure on behalf of the initial shareholders. Subsequently, the manager makes capital structure and project-choice decisions. There is thus an assumed "hierarchy of rigidity" that determines the sequence of these decisions. In particular, we assume that corporate governance in public firms is the most rigid and the least likely to be smoothly responsive to changes in the firm's circumstances (e.g., Boot, Gopalan, and Thakor 2006; Helwege and Packer 2009). Capital structure is the second most rigid. Firms alter their capital structures through various means (e.g., Fama and French 2005), and this happens more frequently than changes in the corporate charter, board composition, or other factors affecting governance stringency. However, security issuance that is driven by the capital structure seems less opportunistic and more rigid than real project choices. Our model accommodates these institutional realities by stipulating that the stringency of corporate

profitability and builds retained earnings. Hennessy and Whited (2005) state that their model generates a data series that is consistent with Baker and Wurgler's (2002) main results.

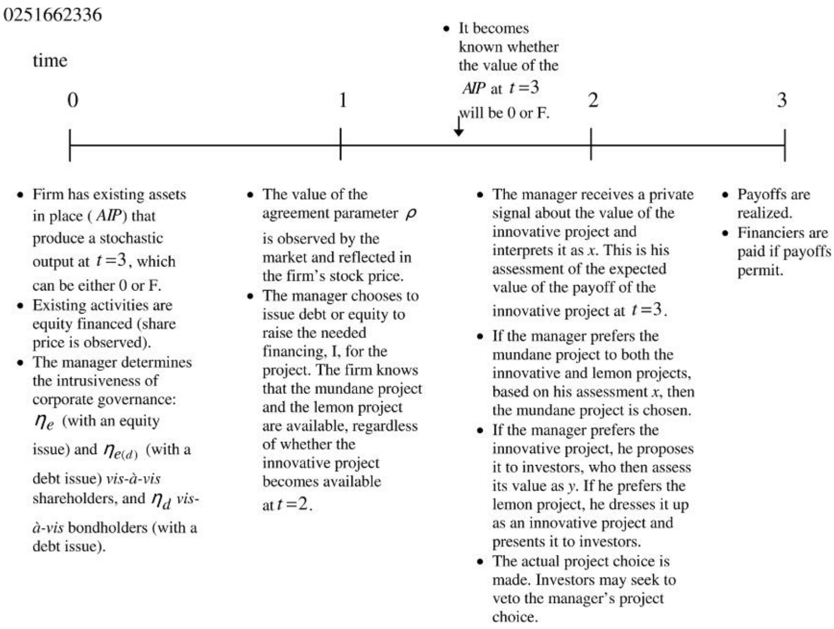

Figure 1
Sequence of events

governance is chosen first[9] (anticipating future capital structure and project choice decisions), that capital structure (which takes governance as a given and anticipates the future project choice) is chosen next, and that the project choice (taking governance and capital structure as givens) is made last. Both debt and equity contracts can be conditioned on verifiable and contractible contingencies.

Preferences, managerial objective, choice of securities, and time line. We assume universal risk neutrality, a zero risk-free interest rate, and no taxes. There are four points in time. A summary of the sequence of events is provided in Figure 1. At $t = 0$, the all-equity-financed firm has existing assets in place (*AIP*) with a value, V_{AIP}, that is stochastic and realized at $t = 3$. The *AIP* cannot be liquidated at a positive price until $t = 3$, i.e., these assets are illiquid. The realized value of V_{AIP} is $\overline{V}_{AIP}$, where $\overline{V}_{AIP}$ is F with probability (w.p.) $\beta \in (0, 1)$ and 0 w.p. $1 - \beta$. The expected value of V_{AIP} is βF.[10] We let

[9] As the manager is optimally setting the *ex ante* governance stringency, with no agency frictions, this situation is isomorphic to one in which a board of directors, faithfully representing the shareholders, determines corporate governance. We have analyzed this case and found that the results are the same.

[10] The assumption that the value of assets in place is stochastic is realistic, as we are referring to economic values rather than accounting values. The values of all of a firm's assets—inventories and receivables, as well as property, plant, and equipment—are constantly subject to reassessments and evolve stochastically in response to market shocks.

$F > I$, where the investment I is defined below. Whether $\overline{V}_{AIP}$ is F or 0 at $t = 3$ becomes known between $t = 1$ and $t = 2$. The firm can also invest in one of three mutually exclusive new projects at $t = 2$: a mundane project, an innovative project, or a lemon project. The mundane project is available at $t = 2$ and produces a riskless payoff at $t = 3$. In addition, an innovative project arrives, along with a lemon project, at $t = 2$. While investors can tell whether the manager invested in the mundane project, they cannot distinguish the innovative project from the lemon, which introduces the standard asset-substitution moral hazard associated with debt.

The manager maximizes the expected terminal ($t = 3$) wealth of those who are shareholders at $t = 0$ and determines the firm's corporate governance (the control given to the investors) at $t = 0$ to do so. At $t = 0$, there is uncertainty about the extent of agreement between the manager and new investors about the value of the innovative project at $t = 2$. The firm's stock price at $t = 0$ will reflect the market's expectation of this agreement and the market's assessment of the innovative project that may arrive at $t = 2$. The market learns of the level of agreement with the manager at $t = 1$. The firm then raises *$I* through debt or equity at $t = 1$. The initial shareholders are wealth constrained, and the manager's only wealth is his compensation at $t = 3$, so new financing involves new investors who face uncertainty about the availability of the innovative project and about the value of the assets in place (*AIP*). The investment of I in the chosen project is made at $t = 2$.[11] Payoffs are realized at $t = 3$.

For simplicity, the investment is either 100% debt financed or 100% equity financed. The debt repayment obligation (at $t = 3$) equals D, with $D = (1 + r)\,I$, where r is the yield on the debt.

Project investments and payoffs. All projects require an investment $\$I$ at $t = 2$. The mundane project pays off R with 100% certainty at $t = 3$ and has a positive NPV, i.e., $R > I$. The lemon pays off a cash flow with a known mean of 0, a variance of $\wedge_{lem}$, and a density function $f(u|0, \wedge_{lem})$. For simplicity, we deal with probability distributions completely described by mean and variance. There is no disagreement between the manager and any investors about the value of either the mundane project or the lemon. The innovative project pays off a random amount u at $t = 3$, but management (insiders) and financiers (outsiders) may disagree at $t = 2$ about the expected value of u.

We interpret the different projects as follows. The mundane project is a routine extension of the firm's existing business. Examples include expanding

[11] The time lag between the raising of financing and the investment in the project is meant to capture the fact that it is not uncommon for investors to acquire *additional* information about the project subsequent to having provided financing. Payoff-germane information arrives almost continuously, so this is unavoidable. From a purely analytical standpoint, disagreement becomes a moot point if the signals on which the manager and investors disagree are received before financing is raised because investors will not provide financing if they disagree. Moreover, in our model, this sequence of events makes it possible to have the financing contracts depend on *future* contingencies, e.g., a realization of a low value (zero) of the AIP could trigger intervention from the bondholders (note that financing is raised prior to the realization of the value of the AIP), so that we can examine how current capital structure decisions constrain *future* real decisions.

capacity to increase the output of an existing product, replacing old equipment with new equipment, and providing a division with investments equal to its annual depreciation in order to continue operations. The innovative project represents a departure from routine operations. It is thus more risky and subject to greater potential disagreement about its value. Examples are a new technology, such as cellular communications; a new business design, such as e-Bay's launching of an online auction business; market entry into a new country; and acquisition of another firm, such as Hewlett-Packard's acquisition of Compaq, which was the subject of considerable disagreement. For our analysis, the mundane project need not be riskless—it must only be less risky than the innovative project. The lemon is simply a negative-NPV project that has the potential to expropriate bondholder wealth and is never desired unless there is an incentive problem between debt and equity.[12]

Disagreement over future payoff of innovative project. At $t = 2$, a signal is observed about the expected value of the payoff of the innovative project at $t = 3$. Everyone observes the same signal about the payoff mean at $t = 2$, but that signal may be interpreted differently by different groups. The initial shareholders and the manager interpret it as x, whereas new investors purchasing the firm's claims interpret it as y. The disagreement over the value of the innovative project is, therefore, between the manager and initial shareholders ("manager," henceforth) on the one hand and the new investors on the other, and this disagreement arises from differences in beliefs, possibly about the precision of the signal being observed. The initial shareholders choose a manager whose beliefs are aligned with theirs, but this alignment is not guaranteed when new investors arrive. For simplicity, we assume all new investors have the same beliefs.

At dates prior to $t = 2$, x and y are random variables for all agents that represent the date-2 interpretations of the expected value of the innovative project, u, made by the manager and new investors, respectively. We assume that x and y are *privately observed non-contractible* valuation assessments. Moreover, the manager observes the value signal first and decides whether to propose the project to investors. The implication of this setup is that, for example, if the manager's valuation is $x \geq R$ with equity, the project is presented to new investors who then interpret its value as y. The manager cannot be forced to propose a project he dislikes. so shareholders never see a project where $x < R$ and are therefore never able to assess its value.[13] Thus, disagreement over project choice is relevant only when $x \geq R$ and $y < R$.

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[12] The manager's ability to secretly switch to the lemon when investors think he is investing in the innovative project can be thought of as a situation in which the lemon is a bad version of the innovative project. That is, a good acquisition may be an innovative project, whereas a bad acquisition may be a lemon project.

[13] In a previous version of the article, we performed our analysis assuming that the availability of the innovative and mundane projects as a pair was stochastic, so that the manager could simply assert that no project arrived when he observes an innovative project that he does not like. The results are qualitatively unchanged in that case. However, because the manager cannot be forced to propose a project he dislikes, it matters little whether the manager sees the signal first or at the same time as investors.

Formally, we can think about x and y being different due to heterogeneity in prior beliefs that are rational in the sense of Kurz (1994a,b).[14] Conditional on x and y, let $f(u|x, \wedge_{\mathrm{I}})$ and $f(u|y, \wedge_{\mathrm{I}})$ be the density functions of u assigned by the manager and the new investors, respectively, where $\wedge_{\mathrm{I}}$ is the variance of u, about which there is no disagreement. Assume $\wedge_{lem} > \wedge_{\mathrm{I}}$, so the lemon has a higher variance than the innovative project.

For simplicity, we assume $x \in \{L, H\}$ and $y \in \{L, H\}$, with $L < I \leq R < H$. Let $\Pr(x = H) = p$, $\Pr(x = L) = 1 - p$, $\Pr(y = i | x = i) = \rho \in [0, 1]\, \forall i \in \{L, H\}$, and $\Pr(y = i | x = j \neq i) = 1 - \rho \;\forall\; i \neq j$. Henceforth, we refer to ρ as the "agreement parameter," where higher values of ρ indicate higher manager-investor agreement. We assume that, *conditional* on ρ, the probability distributions of x and y are common knowledge. However, ρ is unknown at $t = 0$ and becomes known only at $t = 1$. The commonly known distribution function of $\tilde{\rho}$ at $t = 0$ is $\Phi(\tilde{\rho})$; $\tilde{\rho}$ denotes the unknown value of the conditional probability of manager-investor agreement at $t = 0$ and ρ its realization at $t = 1$. Let μ_ρ denote the expected value of $\tilde{\rho}$. We assume that the realization of ρ is commonly observed but is non-verifiable for contracting purposes.[15]

Incompleteness of contracts. Contracts are incomplete in the sense that they can only be based on variables that can be verified in a court of law for contracting purposes. This rules out directly contracting on x, y, or ρ. Moreover, if this assumption is combined with the assumption that the manager has no personal wealth, so that the limited liability constraint operates, we see that some trivial solutions to divergent beliefs are precluded. For example, when $x \geq R$ and $y < R$, the manager cannot put money behind his priors by asking investors to ignore their priors and promising to pay them a large amount if he is proven wrong *ex post*. Such a promise would not be credible. We believe that this is a realistic restriction on contracts, as the strategic bets that firms make in the real world are typically far larger in monetary terms than the personal wealth of their managers.

[14] In other words, we assume that the observables in the economy that agents use to form beliefs that impinge on their valuations of the innovative project have the technical property of "stability" but not stationarity. Kurz (1994a) shows that every stable process is associated with a specific stationary measure and that multiple stable processes can give rise to the same associated stationary measure. While historical data can be used to construct the stationary measure, it cannot generally be used to distinguish among multiple stable processes associated with the same stationary measure. That is, for beliefs to be rational, agents cannot have beliefs that are precluded by historical data. However, multiple rational beliefs can be consistent with the historical data because a stable but non-stationary process is not generally uniquely identified even with countably infinite data points. This permits rational and heterogeneous prior beliefs, not all of which will conform to rational expectations. This heterogeneity of beliefs leads agents in our model to attach different interpretations to the same information. Supporting empirical evidence appears in Kandel and Pearson (1995), where it is shown that trading volume around public information announcements can be best understood within a framework in which agents *interpret* the same information differently.

[15] All of the results that follow were also derived in the more general case in which x and y are bivariate normal with a correlation of ρ.

Managerial autonomy and corporate governance. The manager is indispensable for producing project cash flows. The manager, who has the same beliefs as the initial investors, sets the control each group of investors has *vis-à-vis* the manager. This control allocation maximizes the expected terminal wealth of the initial ($t = 0$) shareholders, conditional on the manager's beliefs. This managerial autonomy determines the manager's "elbow room" to select the project he thinks is best for initial shareholders even when investors disagree. The manager's autonomy with equity is determined at $t = 0$ as part of the corporate governance established at that point. The manager also sets his autonomy *vis-à-vis* bondholders through the debt covenants negotiated at $t = 0$. Conditional on these degrees of autonomy, the manager determines the firm's security issuance (and, hence, its capital structure) at $t = 1$ so as to maximize *his* expectation of the wealth of the initial ($t = 0$) shareholders at $t = 3$. This decision determines management's overall project-choice autonomy at $t = 2$. Simply put, managerial autonomy is the probability that the manager will control project choice when there is manager-shareholder disagreement.

We model managerial autonomy as follows. When the manager assesses the expected value of the innovative project as $x \geq R$ and outside investors assess it as $y < R$, there is disagreement because the outside investors desire the mundane project and the manager prefers the innovative project. For a security issuance of type $j \in \{e, d\}$, where e represents equity and d represents debt, let η_j be the probability that the manager can invest in the innovative project when he wants but the outside investors who purchased security j are opposed to it. $1 - \eta_j$ is then the probability that the security-j investors will block the manager and force an investment in the mundane project.

If the firm issues equity at $t = 1$, then both sides will agree to forsake the lemon, which has a mean payoff of zero and an NPV of $-I$, because the manager has the *same* preferences as shareholders about the objective function being maximized. Moreover, if $x > R$ and $y \geq R$, both will wish to invest in the innovative project. Disagreement arises when $x > R$ and $y < R$, in which case η_e is the probability that the manager can invest in the innovative project. We view η_e as representing the corporate governance mechanism employed by shareholders to influence firm activities. It is determined by many factors, including information disclosure requirements, the number of independent board members, and the extent of shareholder involvement—either through board representation or through activism at shareholder meetings—in managerial decisions.[16]

If the firm issues debt at $t = 1$, there will be two classes of claimants: the initial ($t = 0$) shareholders and the bondholders. With debt, we use $\eta_{e(d)}$ to

[16] Existing shareholders are aligned in their beliefs with the manager, while new shareholders are not. Thus, while existing shareholders may impose some constraints on the manager, new shareholders are likely to impose more stringent and binding constraints. We assume that the amount of external financing being raised is large enough that the voice of the new shareholders matters in corporate governance. As the manager and initial shareholders always agree, η_e essentially determines the influence of the new shareholders.

denote the manager's autonomy with respect to the initial shareholders, with η_d denoting the manager's autonomy with respect to the bondholders. In general, we can write all of the (endogenous) autonomy probabilities, η_e, $\eta_{e(d)}$, and η_d, as functions of the vector of verifiable and contractible state contingencies that may occur in the future. Given the non-verifiability of beliefs and ρ, the only contractible state contingencies in the model are the realization $\overline{V}_{AIP}$ and the type of security issued to raise financing at $t = 1$.[17]

Summary of the sequence of events. To recapitulate, the firm is all-equity financed at $t = 0$, with assets in place that have a stochastic value of V_{AIP}. At $t = 0$, the firm knows that a mundane project, an innovative project, and a lemon project will become available at $t = 2$. The manager knows that, conditional on the innovative project being available, he will receive a signal at $t = 2$ about the expected value of the payoff, u, of the innovative project at $t = 3$. The manager will interpret this signal as x, and outside investors will interpret it as y. Viewed at $t = 2$, u is a random variable with density functions of $f(u|x, \wedge_I)$ for the manager and $f(u|y, \wedge_I)$ for the outside investors, where $\wedge_I$ is the variance of u. Viewed at $t = 1$, x and y are correlated random variables with $\Pr(y = i\,|x = i) = \rho \in [0, 1]$. At $t = 0$, there is uncertainty about the date $t = 1$ value of the agreement parameter, $\tilde{\rho}$, but the probability distributions of x and y, conditional on ρ, are common knowledge. The expected value of $\tilde{\rho}$, μ_ρ, is also common knowledge. Based on these considerations, the board determines η_e and $\eta_{e(d)}$ at $t = 0$, which fixes the intrusiveness of equity-linked corporate governance with equity and debt financing, respectively. Moreover, the debt contract stipulates state-contingent managerial autonomy, η_d, that may depend on $\overline{V}_{AIP}$. Once set, η_e, $\eta_{e(d)}$, and η_d represent unalterable contracts.

At $t = 1$, ρ is realized and reflected in the stock price. The manager observes ρ and then decides whether to issue debt or equity to raise the $\$I$ for investment. Between $t = 1$ and $t = 2$, the realization $\overline{V}_{AIP} \in \{0, F\}$ is observed, which determines the managerial autonomy, η_d. At $t = 2$, the manager and outside investors arrive at their private assessments (x and y, respectively) of the value of the innovative project, and the manager then chooses the innovative project, the lemon, or the mundane project. At $t = 3$, the payoffs are realized and all investors are paid. Figure 1 summarizes the sequence of events.

2. Analysis of Security Issuance

We begin by establishing a preliminary result about the state contingencies that will be embedded in the optimal endogenous autonomy probabilities. Subsequently, in the usual backward induction fashion, we analyze what happens at

[17] In addition to disagreement with the manager, bondholders also care about the inherent risk in positive-NPV projects, with their risk exposure depending partly on the realization $\overline{V}_{AIP} \in \{0, F\}$. Unlike the shareholders, we assume that the bondholders can have a first lien on the AIP. Hence, if $\overline{V}_{AIP}$ is sufficiently large, the value of the (secured) debt claim can be made independent of the project cash flow.

$t = 2$, then analyze events at $t = 1$, and finally examine the optimal design of corporate governance at $t = 0$. The analysis related to $t = 2$ proceeds in two steps. We first focus on the valuation of the firm at $t = 2$ *prior* to the actual project choice but conditional on the firm's capital structure decision. This highlights the market valuation's dependence on the degree of anticipated agreement between management and outside investors. We then analyze the link between the project choice and the market valuation of the firm. This reflects a Nash equilibrium in which the market (correctly) anticipates the firm's project choice and the firm uses the market valuation as an input in its project choice decision. Our main finding is that equity issuance will be preceded by high stock prices, even when the manager is *not* attempting to time the market, and that this decision is affected by mediating variables like the value of assets in place.

2.1 Optimal state contingencies in the endogenous autonomy probabilities

We consider the endogenous autonomy probabilities *vis-à-vis* equity, η_e and $\eta_{e(d)}$, and the autonomy probability *vis-à-vis* debt, η_d. Recall that the autonomy probabilities for each type of security are determined *ex ante* before the security is issued. To determine the optimal values of these intervention probabilities, we fix the security being considered and derive the intervention probability for that security, permitting this probability to depend on (future) *ex post* contractible events. We have the following result:

Theorem 1. The managerial autonomy probability *vis-à-vis* equity that is determined at $t = 0$ will specify a dependence on the type of security issued by the firm at $t = 1$. Specifically, η_e (autonomy probability when equity is issued) will differ from $\eta_{e_{(d)}}$ (autonomy probability when debt is issued). Regardless of $\overline{V}_{AIP}$, the manager sets $\eta_{e_{(d)}} = 1$ and η_e is independent of the realized value of the assets in place, $\overline{V}_{AIP}$. The managerial autonomy probability *vis-à-vis* debt, η_d, specifies a dependence on $\overline{V}_{AIP}$, with $\eta_d = 1$ if $\overline{V}_{AIP} = F$.

This theorem shows that it is *ex ante* efficient for the manager to make the specification of managerial autonomy *vis-à-vis* shareholders dependent on whether the firm issues equity or debt. That is, managerial autonomy is specified *ex ante* as a *function* of variables that will be observable in the future, including the security that is issued. The intuition is as follows. Equity issuance brings in new shareholders, and the share of ownership that must be surrendered to them will generally depend on managerial autonomy, η_e, so the manager is forced to trade off the benefit he perceives from managerial autonomy against the impact of this autonomy on the cost of new equity financing. The manager does not face a similar trade-off with debt, as the cost of debt financing is unaffected by $\eta_{e(d)}$. Moreover, as $\eta_{e(d)}$ refers to the sharing of control between the manager and the initial shareholders—two parties that agree with each other—the manager sets $\eta_{e(d)} = 1$, so η_e and $\eta_{e(d)}$ differ.[18]

The theorem also states that η_e will be divorced from $\overline{V}_{AIP}$. The intuition behind this statement is as follows. The marginal impact of a change in η_e on the expected payoff, as assessed by either initial or new shareholders, is independent of $\overline{V}_{AIP}$, as changes in η_e only affect the perceived profitability of the innovative project. Moreover, the fraction of ownership that must be sold to new shareholders to raise $\$I$ depends on the *expected value* of the AIP rather than on the *actual* realization, $\overline{V}_{AIP}$. Thus, conditioning η_e on $\overline{V}_{AIP}$ serves no purpose.

Finally, this theorem indicates that η_d depends on $\overline{V}_{AIP}$. Note that when $\overline{V}_{AIP} = F$, the bondholders are indifferent to the value of the innovative project because the firm can repay bondholders in full regardless of the value of the innovative project; hence, $\eta_d = 1$. However, if $\overline{V}_{AIP} = 0$, then bondholders care about the value of the innovative project, which will be reflected in the price of debt, so η_d need not be 1. Hence, η_d depends on $\overline{V}_{AIP}$.

2.2 Valuation at *t* = 2

Suppose first that equity was issued at $t = 1$. Let V^t_{old} represent the valuation of the innovative project at date t by the initial shareholders and V^t_n represent the valuation by the new investors. The manager's valuation is the same as that of the initial investors. Let V^t_m represent the valuation of the mundane project (on which everyone agrees) at date t. Then, as the lemon project has a negative NPV, and as the manager and all shareholders have identical preferences, the lemon will always be rejected. If the manager proposes the innovative project, the new shareholders' valuation of the firm at $t = 2$ (just prior to the project choice) will be

$$V^2_n(y, \eta_e) = \begin{cases} \int u f(u|y, \wedge_{\mathrm{I}})\, du + \overline{V}_{AIP} & if\ y \geq R \\ \int \{\eta_e u + [1 - \eta_e]\, R\}\, f(u|y, \wedge_{\mathrm{I}}) du + \overline{V}_{AIP} & if y < R \end{cases}. \quad (1)$$

If the manager proposes the mundane project, shareholders will value the firm at

$$V^2_m = R + \overline{V}_{AIP}. \quad (2)$$

Second, suppose debt was issued at $t = 1$. The control that bondholders exercise depends on the realization $\overline{V}_{AIP} \in \{0, F\}$. If $\overline{V}_{AIP} = F$, then the manager has all the control with respect to bondholders (Theorem 1). Furthermore, we

[18] If the maximum value of $\overline{V}_{AIP}$ were such that debt were not risk-free even with that value, then the value of the innovative project will affect the value of debt. However, $\eta_{e(d)}$ will still be set at 1, as the manager and initial shareholders agree on project choice, so the allocation of control between them does not affect the bondholders' payoff. However, if the maximum $\overline{V}_{AIP}$ is too low, deviating to the lemon project might become attractive to the manager, and the bondholders would set $\eta_d = 0$ in response.

conjecture that $\eta_d = 0$ when $\overline{V}_{AIP} = 0$, and we verify this conjecture in Section 2.4. With $\eta_d = 0$, the bondholders exercise control and it is optimal for them to enforce the choice of the mundane project.[19] Note that being in control does *not* change the nature of the bondholders' claim—it is still a debt claim on total cash flow—because they are only able to dictate project choice rather than require that complete ownership of the firm be transferred to them. Therefore, the control-transfer phenomenon here occurs within the context of a covenant trigger that elevates the decision-intervention authority of bondholders, rather than in the context of an event such as bankruptcy. Hence, upon gaining control, bondholders will seek to maximize the value of debt rather than behave like shareholders.

2.3 Valuation at *t* = 1, conditional on the firm issuing equity at *t* = 1

We first focus on the valuation of equity conditional on equity being issued at $t = 1$. Recall that neither the manager nor shareholders prefer the lemon, so the only choice is between the innovative and mundane projects. Moreover, η_e was determined at $t = 0$ and ρ was realized at $t = 1$. The manager takes η_e as a given at $t = 1$ and recognizes that $1 - \eta_e$ is the probability that outside shareholders will block the firm's choice of the innovative project in case of disagreement, i.e., when $x \geq R$ and $y < R$, and the mundane project will be chosen. Now, the outside shareholders' valuation at $t = 1$ with the innovative project is $V_n^1(\rho, \eta_e)$, while with the mundane project it is V_m^1:

$$V_n^1(\rho, \eta_e) = pH\rho + \eta_e pL[1-\rho] + [1-\eta_e]\, pR[1-\rho] + [1-p] \times R + \beta F, \text{ and} \tag{3}$$

$$V_m^1 = V_m^2 = R + \beta F. \tag{4}$$

Let $g \equiv pH$ represent the (conditional) prior expected value of the innovative project when the project is chosen.We refer to g as the "value of future growth opportunities."

The first term in (3) is the expected project payoff when there is agreement that the innovative project is best. The second term is the payoff perceived by outside shareholders when they believe the mundane project is better but the manager invests in the innovative project. The third term is the payoff perceived by outside shareholders when they believe the mundane project is better but the manager believes the innovative project is better, and shareholders

[19] To see this, note that for any D, the value of debt at $t = 2$ is $\int_{-\infty}^{D} uf(u|y, \wedge_1)\,du + \int_{D}^{\infty} Df(u|y, \wedge_1)\,du < D$ with the innovative project and D with the mundane project. It may be tempting to conclude that our results would be unaffected by dispensing with the lemon project, as the bondholders will always prefer *ex post* to choose the mundane project even in the absence of the lemon. This is not so, however, because in that case the firm will prefer *ex ante* to *not* give bondholders control in any state, so their *ex post* project preference becomes irrelevant. The cost of debt financing will rise, but debt financing will still be available because the expected value of the firm with the innovative project exceeds I.

prevail. The fourth term is the payoff when the manager and outside shareholders agree that the mundane project dominates, while the last term is the expected value of the assets in place. Suppose a fraction $\alpha \in (0, 1)$ of the firm is sold to raise *$I* in equity for the investment. Then, in a competitive capital market,

$$\alpha V_n^1(\rho, \eta_e) = \text{I}. \tag{5}$$

We can now examine the relationship between the firm's stock price and the agreement parameter, ρ.

Lemma 1. Conditional on the firm issuing equity at $t = 1$ to raise $\$I$, the firm's market value is strictly increasing in the agreement parameter, ρ, for any value of the autonomy probability η_e. Moreover, $\partial\alpha/\partial\rho < 0$.

This lemma is intuitive. Higher manager-investor agreement makes it more likely that project choice will match outside investors' wishes, so the investors value the firm more highly and the cost of capital (α) declines.

Lemma 2. $\partial\alpha/\partial\eta_e > 0$ and $\partial^2\alpha/\partial\eta_e^2 > 0$.

Lemma 2 indicates that the cost of new equity financing is increasing and convex in the managerial autonomy probability. This highlights the cost of increasing the manager's autonomy.

Thus far, we have focused on the *new investors'* valuation at $t = 1$. We now value *expected payoffs* using the manager's valuation rule, which is also the valuation rule for the old (initial) investors. With α given by (5), the manager maximizes the expected terminal ($t = 3$) wealth of the initial ($t = 0$) shareholders:[20]

$$[1 - \alpha]\, V_{old}^1(\rho, \eta_e), \tag{6}$$

$$V_{old}^1(\rho, \eta_e) = pH\rho + \eta_e pH[1-\rho] + [1-\eta_e] \times pR[1-\rho] + [1-p]R + \beta F,$$

and (7)

$$V_m^1 = R + \beta F. \tag{8}$$

Lemma 3. $\partial V_{old}^1(\rho, \eta_e)/\partial\rho > 0$ for any value of the autonomy parameter η_e.

[20] The firm's pre-security-issuance shareholder base at $t = 1$ is the same as at $t = 0$. Therefore, maximizing the wealth of the $t = 0$ shareholders is the same as maximizing the wealth of the $t = 1$ pre-equity-issuance shareholders.

Lemma 3 is merely Lemma 1 restated for the manager's valuation. The manager's valuation, V_{old}^1, is increasing in ρ because an increase in ρ makes it less likely that the manager will be blocked from investing in the innovative project when $x = H$. Furthermore, we assume

$$p[H - R] > \overline{\text{A}}, \tag{9}$$

where $\bar{A} \equiv \max_{\rho} \left\{ I \left[\frac{V_{old}^1(\rho,1)}{V_n^1(\rho,1)} - 1 \right] \right\}$. We can understand (9) as follows. As the manager chooses the mundane project over the innovative project when $x = L$, the manager views the expected value of having the innovative project with the option to reject as $pH + [1 - p]R$. The difference between this and the value of the mundane project, R, is $pH + [1 - p]R - R = p[H - R]$, which should be sufficiently high, according to (9). This condition is sufficient (although not necessary) for equity to be the optimal security over a non-empty set of exogenous parameters.

2.4 Valuation at *t* = 1, conditional on the firm issuing debt

We see in Theorem 1 that when $\overline{V}_{AIP} = F$, the debt contract gives the manager maximum autonomy ($\eta_d = 1$). We now establish that when $\overline{V}_{AIP} = 0$ and the variance of the lemon project, $\wedge_l$, is high enough, the firm efficiently gives bondholders all control ($\eta_d = 0$), and that, like η_e, $\eta_{e(d)}$ is independent of $\overline{V}_{AIP}$. We assume $\wedge_{lem}$ is sufficiently high that the shareholders prefer the lemon over the innovative project even if $x = y = H$:

$$\int_I^{\infty} [u - I]\, f\,(u\,|0, \wedge_{lem})\, du > \int_I^{\infty} [u - I]\, f\,(u\,|H, \wedge_{\text{I}})\, du. \tag{10}$$

Lemma 4. Suppose $\overline{V}_{AIP} = 0$. Then all control rests with the bondholders ($\eta_d = 0$) if debt is issued.

The bondholders have all control because an asset-substitution moral hazard is encountered when the value of the AIP is sufficiently low. Thus, when $\overline{V}_{AIP} = 0$, debt provides the manager with no autonomy ($\eta_d = 0$), whereas Theorem 1 asserted that $\eta_d = 1$ when $\overline{V}_{AIP} = F$. Equity is more flexible than debt when $\overline{V}_{AIP} = 0$ because the shareholders only have to worry about potential disagreement with the manager about the innovative project, whereas bondholders worry about that disagreement as well as the possibility of the lemon being chosen even when everyone agrees that the innovative project is a good investment. The cost of this moral hazard is borne *ex ante* by the initial shareholders, so the manager mitigates that cost by surrendering managerial autonomy when $\overline{V}_{AIP} = 0$.

We now determine the equity value at $t = 1$ when the firm issues debt and V_{AIP} is stochastic. The debt repayment, D, equals I because bondholders are never exposed to risk given the optimal debt contract (see Theorem 1 and Lemma 4). The value of the equity to the initial shareholders, as assessed by the manager, is

$$V^1_{old}(D^I = 1|\,\rho) = \beta \overline{V}^1_{old}(D^I = I\,\left|\overline{V}_{AIP} = F, \rho\right.) \\ + [1-\beta]\overline{V}^1_{old}(D^I = I\,\left|\overline{V}_{AIP} = 0\right.) = 0, \tag{11}$$

where

$$\overline{V}^1_{old}\left(D^I = I\,\left|\overline{V}_{AIP} = F, \rho\right.\right) = pH\rho + pH\,[1-\rho] + [1-p]\,R + F - I \tag{12}$$

and

$$\overline{V}^1_{old}\left(D^I = I\,\left|\overline{V}_{AIP} = 0\right.\right) = R - I, \tag{13}$$

where we have substituted $\eta_{e(d)} = 1$ in (12) in accordance with Theorem 1.

The new shareholders' valuation of the equity at $t = 1$ (i.e., the stock price), conditional on debt issuance, is $V^1_n\left(D^I = I\,|\rho\right)$, which is defined similarly to $V^1_{old}\left(D^I = I\,|\rho\right)$ in (11), with "old" replaced by n, and H replaced by L in the second term on the right-hand side of (12). If we compare debt and equity ((12) and (7)), we see that the allocation of control with debt is "bang-bang" ($\eta_d \in \{0,1\}$), whereas it is smoother with equity ($\eta_e \in [0,1]$).[21] These control allocations can be understood as follows. With debt, when $\overline{V}_{AIP} = 0$, the manager prefers the lemon and the bondholders prefer the mundane project regardless of x and y. Both preferences are inefficient, but the bondholders' project choice causes less dissipation of value, so bondholders get complete control. When $\overline{V}_{AIP} = F$, the manager prefers the innovative project if $x = H$, whereas bondholders are indifferent to the value of the innovative project, so the manager perceives no cost in allocating all control to himself.[22] With equity, neither the manager nor the shareholders have any *ex post* incentives to choose a non-value-maximizing project, so there is no bang-bang control allocation, and disagreement induces a trade-off between managerial control and the cost of capital.

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21 The finding that η_d depends on the value of assets in place and not on the stock price is consistent with debt covenants in practice, which are typically based on observable operating performance as reflected in accounting ratios (e.g., Sufi 2006).

22 This is based on our assumption that $\bar{V}_{AIP} = F$ allows bondholders to be paid in full regardless of the innovative project cash flows. Otherwise, bondholders would strictly prefer the mundane project even if $\bar{V}_{AIP} = F$ because their claim is concave in the firm's payoff and the mundane project is safer. However, what happens if bondholders anticipate being in control in the future when the firm is bankrupt, at which point they would take possession of the innovative project? Would they then care about the innovative project payoff? The answer is no. The reason is that there are only two possibilities: $\bar{V}_{AIP} = F$ or $\bar{V}_{AIP} = 0$. If $\bar{V}_{AIP} = F$, the firm does not go bankrupt, so the bondholders have no concerns about project cash flow. If $\bar{V}_{AIP} = 0$ and the bondholders have control, they invest in the mundane project (which they strictly prefer *ex ante* to the innovative project), so the bondholders do not get possession of the innovative project upon bankruptcy and they are once again unconcerned about its value.

2.5 The firm's optimal security issuance decision at $t = 1$

Security issuance at $t = 1$ is examined using the results of Subsections 2.3 and 2.4. Many of the subsequent results depend on η_e being in a particular range, even though η_e is endogenous. This is unavoidable in a backward induction analysis, as η_e is determined at $t = 0$ and we are examining events at $t = 1$. However, we show in Section 3.7 that η_e is increasing in μ_ρ, the mean of ρ. Thus, it is easy to interpret the ranges of η_e as the ranges of μ_ρ (an exogenous parameter).

Theorem 2. There exists a critical value of the probability that $\overline{V}_{AIP} = F$, say $\hat{\beta}$, such that for $\beta > \hat{\beta}$, the manager strictly prefers to finance the project with debt. For $\beta \leq \hat{\beta}$, there exists a critical value of the autonomy probability with equity financing, $\widehat{\eta}_e(\beta)$, with $\partial\widehat{\eta}_e / \partial\beta > 0$, such that the manager prefers to issue equity regardless of the value of the agreement parameter, ρ, as long as the manager finds it optimal to choose $\eta_e > \widehat{\eta}_e(\beta)$ *at* $t = 0$. For each $\eta_e \leq \widehat{\eta}_e(\beta)$, there exists a critical value of the agreement parameter, $\widehat{\rho}(\eta_e, \beta) \in (0, 1)$, such that the manager will find it optimal to finance the project with (a) an equity issue if the actual agreement parameter, ρ, exceeds $\widehat{\rho}$; and (b) a debt issue if $\rho \leq \hat{\rho}$.

The first part of the theorem highlights the fact that debt is preferred when $\overline{V}_{AIP}$ is sufficiently likely to be high. Debt then offers an autonomy advantage over equity. That is, with $\eta_d = 1$, bondholders do not constrain the manager at all. With equity financing, the manager's choice of η_e reflects its impact on the cost of incremental financing. If this causes the manager to choose $\eta_e < 1$, then equity financing constrains the manager more than debt financing and he will prefer debt. If $\eta_e = 1$, then managerial autonomy is identical for both debt and equity financing. Thus, the manager either weakly or strictly prefers debt when $\beta > \hat{\beta}$.

When $\beta \leq \hat{\beta}$, there is a sufficiently high likelihood that $\overline{V}_{AIP} = 0$ and $\eta_d = 0$. This will yield the manager higher expected autonomy with equity regardless of ρ as long as η_e is sufficiently high. For example, if $\eta_e = 1$, the manager prefers equity because, in the disagreement state, he can invest in the innovative project with a probability of 1 if he issues equity, and with either a probability of 1 (if $\overline{V}_{AIP} = F$) or a probability of 0 (if $\overline{V}_{AIP} = 0$) if he issues debt. By continuity, this argument holds for sufficiently high η_e even if $\eta_e < 1$.

However, as the optimal η_e declines, equity provides less autonomy and hence its attractiveness to the manager declines, so that at a low enough η_e, ρ makes a difference in terms of the attractiveness of equity relative to debt. If η_e is held fixed at some value in this range, the attractiveness of equity declines as ρ declines because the lower the ρ, the less likely it is that the manager will be able to invest in the innovative project when he prefers it ($x \geq R$). As the manager now anticipates investing in the mundane project with equity financing, he prefers debt in order to take advantage of the higher autonomy *vis-à-vis* initial

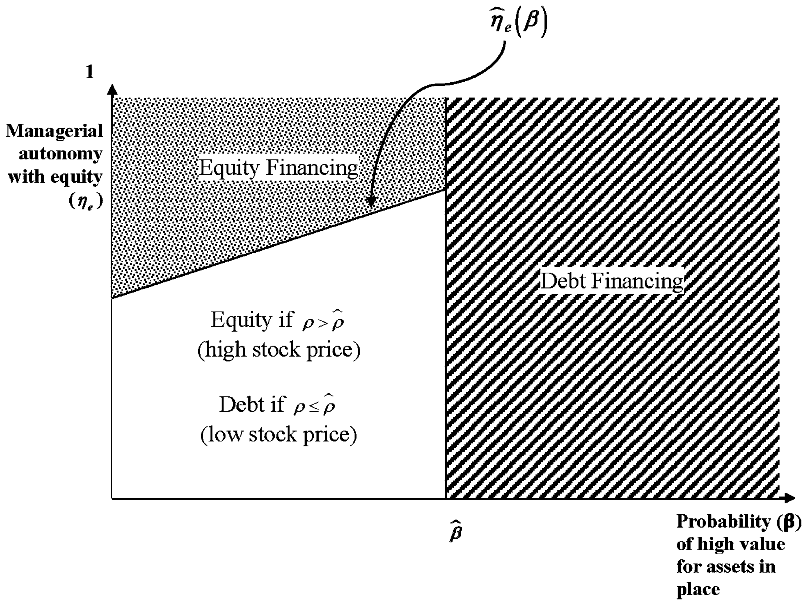

Figure 2
Relationship of security issuance to the value of assets in place and stock price

shareholders $\eta_{e(d)} = 1$. Thus, debt is preferred to equity for lower values of ρ because the *effective* managerial autonomy with debt, given the combined effect of η_d and $\eta_{e(d)}$, exceeds the effective managerial autonomy with equity, given η_e. At higher values of ρ, equity is preferred because it offers more autonomy than the effective managerial autonomy with debt given the combined effect of η_d and $\eta_{e(d)}$ (see Figure 2). It is useful to think of Theorem 2 as characterizing what occurs *along the path of play*, i.e., for optimal allocations of control, because the proof relies on η_d taking its equilibrium value.

Corollary 1. Assume $\beta < \widehat{\beta}, \hat{\eta}_e(\beta) < 1$ and that the optimally chosen autonomy probability $\eta_e < \widehat{\eta}_e(\beta)$. Then there is a Nash equilibrium in which the firm issues equity when its pre-issuance stock price is relatively high and issues debt when its pre-issuance stock price is relatively low.[23]

This result follows from combining Lemma 1 and Theorem 2. Lemma 1 says that if we assume that the firm will issue equity, then its pre-issuance stock price is increasing in ρ, and Theorem 2 states that the firm prefers equity financing if ρ is high enough. For relatively high ρ, the firm will prefer equity, the market will correctly anticipate this preference, and the stock price will

[23] This corollary exploits the one-to-one correspondence between the stock price and ρ. This means the manager can infer ρ from the stock price even if he does not directly observe ρ. We used that specification in an earlier version of the article and derived results that were essentially the same as in this version.

be high (reflecting a high ρ), which will lead the firm to issue equity, thereby confirming the market's conjecture. For relatively low ρ, the firm prefers debt, which the market correctly anticipates. The market then sets a pre-issuance stock price that reflects the probabilities of the innovative or mundane projects being chosen. In a Nash equilibrium, the firm's actual security issuance decision should mirror the market's conjecture. However, although the agreement parameter is irrelevant conditional on the mundane project being chosen, the pre-issuance stock price also reflects the probability of the innovative project being chosen, and this is increasing in ρ when debt issuance is (correctly) anticipated.

This result, which is consistent with the results in Lucas and McDonald (1990), provides a theoretical explanation for Baker and Wurgler's (2002) empirical finding that firms issue equity at high stock prices. This explanation is an alternative to market timing. Our result arises from the manager's inference that investors are more likely to agree with his future decisions and, hence, equity provides greater managerial autonomy when stock prices are high. In Section 2.7, we endogenously derive the optimal η_e. For now, we assume $\eta_e \in (0, 1)$.

In the next corollary, we summarize how the stringency of corporate governance affects the dependence of the equity issuance decision on the stock price. In other words, we turn to our base model and link $\hat{\rho}$ to η_e.

Corollary 2. Suppose $\beta < \hat{\beta}$ and $\eta_e < \widehat{\eta_e}(\beta)$. Then the critical agreement parameter, $\hat{\rho}$, such that equity is preferred whenever $\rho > \hat{\rho}$ and debt whenever $\rho \leq \hat{\rho}$, is decreasing in the optimally chosen autonomy probability η_e *if* η_e is relatively low and increasing in η_e if η_e is relatively high.

The optimally chosen η_e set at $t = 0$ balances the manager's benefit of choosing the innovative project when investors object to the adverse impact of autonomy on the cost of capital. This balance is struck on the basis of the *expected value* of ρ. It is the realized ρ at $t = 1$, however, that determines whether the manager issues equity or debt. This corollary indicates that among the firms that chose high η_e's, the cutoff $\hat{\rho}$ is higher for higher-η_e firms, and among firms that chose low η_e's, the cutoff $\hat{\rho}$ is lower for higher-η_e firms.This is because the cost of capital, α, is increasing and convex in η_e (Lemma 2), while the benefit of autonomy that the manager perceives is linear in η_e.

To see this, consider two firms with different η_e's, say $\eta_e^2 > \eta_e^1$, and let $\hat{\rho}_i$ be the cutoff for firm i. At $\hat{\rho}_1$, firm 1 with equity-linked autonomy η_e^1 is indifferent to equity or debt. Firm 2, with its higher autonomy, η_e^2, will have a higher cost of capital at $\rho = \hat{\rho}_1$ than firm 1. Given the convex nature of this cost, this higher cost will overwhelm the linearly increasing benefit of higher managerial autonomy for sufficiently high η_e. Thus, at $\rho = \hat{\rho}_1$, firm 2's manager strictly prefers debt and this manager's cutoff is $\hat{\rho}_2 > \hat{\rho}_1$. In contrast, among the low-η_e group, the increase in the cost of capital as one moves from η_e^1 to η_e^2

holding $\rho = \hat{\rho}_1$ fixed is smaller. Hence, the disadvantage of the higher cost is more than offset by the benefit of higher managerial autonomy, so the manager with η_e^2 strictly prefers equity at $\rho = \hat{\rho}_1$ if the manager with η_e^1 is indifferent at that ρ. Therefore, within the cross-section of the low-η_e group, $\hat{\rho}$ declines as η_e increases. Note that η_e is endogenously determined at $t = 0$. As Corollary 5 establishes, η_e is increasing in μ_ρ, the mean of ρ, so the implication is that equity is more likely to be issued when ρ is *expected* to be high. It is natural to then ask how the expected value of the innovative project affects the pre-issuance stock price.

Corollary 3. For a given autonomy probability, η_e, and values of agreement, ρ, such that equity issuance is optimal at $t = 2$, the pre-equity-issuance stock price is increasing in the value of future growth opportunities.

This corollary follows because an increase in the value of growth opportunities means that the innovative project is more valuable. Therefore, conditional on that project choice, the value of the firm is higher as g increases.

2.6 Additional results about conditions under which debt or equity will be issued at *t* = 1

We continue to assume $\beta < \hat{\hat{\beta}}$, so equity is not unequivocally dominated by debt. At $t = 1$, the realized value of the agreement parameter, ρ, is observed by the market. We now examine the inference problem of an econometrician who can observe the market price at $t = 1$ just prior to the firm's security issuance but who cannot directly observe ρ. The price will, of course, reflect the realized ρ. Just prior to the issuance of securities to raise *\$I*, the firm will trade at the following price:

$$\tilde{V}_n^1(\rho,\eta_e) = \left\{[1-\alpha]\, V_n^1(\rho,\eta_e)\, I^{(\rho)}_{(\widehat{\rho}(\eta_e),1]} + \left\{V_n^1\left(D^1 = I\,|\rho\right)\right\} I^{(\rho)}_{[0,\widehat{\rho},(\eta_e)]}\right\} \times I^{(\eta)}_{[0,\widehat{\eta}_e]} + [1-\alpha]\, V_n^1(\rho,\eta_e)\, I^{(\eta)}_{[\widehat{\eta}_e,1]}, \tag{14}$$

where the indicator function $\mathrm{I}_A^{(a)}$ over the set of A is $\mathrm{I}_A^{(a)} = 1$ if $a \in A$ and $\mathrm{I}_A^{(a)} = 0$ if $a \notin A$, and $V_n^1\left(D^1 = I\,|\rho\right)$ is the new shareholders' valuation at $t = 1$, conditional on the firm issuing debt. Thus, at $t = 1$, if the autonomy probability of η_e is below the cutoff of $\widehat{\eta}_e$ (see Theorem 2), the firm's security issuance depends on ρ. If $\rho < \hat{\rho}(\eta_e)$, where $\hat{\rho}(\eta_e)$ is a cutoff value, the firm will be expected to issue debt and its pre-issuance stock price is $V_n^1\left(D^1 = I\,|\rho\right)$. If $\rho \geq \hat{\rho}(\eta_e)$, the firm issues equity and its pre-issuance stock price is $[1-\alpha]\, V_n^1(\rho,\eta_e)$, where $V_n^1(\rho,\eta_e)$ is given by (3) and α is given by (5). If $\eta_e \geq \widehat{\eta}_e$, the firm issues equity regardless of ρ. This gives rise to Theorem 3.

Theorem 3. Assume $\beta < \hat{\beta}$ and hold fixed a commonly known stringency of corporate governance such that firms may issue either debt or equity, i.e., $\eta_e < \widehat{\eta}_e$. Equity issuance will be preceded by high stock prices in the sense that the probability of equity issuance at $t = 1$, as assessed by an econometrician who is *a priori* unaware of the agreement parameter ρ, is strictly increasing in the level of the pre-issuance stock price at $t = 1$.[24]

The intuition is clear from an examination of (14). For $\eta_e < \widehat{\eta}_e$, a higher ρ increases the stock price at $t = 1$, $\tilde{V}_n^1(\rho, \eta_e)$, as $V_n^1(\rho, \eta_e)$ is increasing in ρ and α is decreasing in ρ. Furthermore, the value of the firm with debt financing, $V_n^1(D^1 = I \mid \rho)$, rises more slowly with ρ than $V_n^1(\rho, \eta_e)$ does. That is, $\partial V_n^1(D^1 = I \mid \rho) / \partial \rho < \partial V_n^1(\rho, \eta_e) / \partial \rho$. Thus, for $\rho < \hat{\rho}(\eta_e)$, an increase in ρ increases the stock price but the stock price increase at $t = 1$ does not affect the probability of an equity issue at $t = 1$ because the firm is financing with debt. For $\rho > \hat{\rho}(\eta_e)$, the stock price at $t = 1$ is increasing in ρ and the probability of an equity issue is 1. Hence, the probability of an equity issue at $t = 1$ is not decreasing in the stock price at $t = 1$. This implies that equity issuances will be *preceded* by periods of high (and increasing) stock prices. This result is obtained even though the manager is not attempting to "time" the market, and it has an immediate implication for the predicted link between growth opportunities and security issuance (Corollary 4).

Corollary 4. Suppose we hold fixed a commonly known stringency of corporate governance such that firms may choose either debt or equity (i.e., $\eta_e < \widehat{\eta}_e$). Assume that β is sufficiently low and that there is a distribution of firms with agreement parameters $\rho \in (0, 1)$. Then the number of firms seeking equity financing is increasing in the value of future growth opportunities (g).

The intuition is that an increase in $g\,(\equiv pH)$ means that the innovative project becomes more valuable relative to the mundane project. For any ρ, therefore, equity becomes more attractive relative to debt. Thus, the cutoff $\hat{\rho}$ above which ρ must lie for the firm to prefer equity declines as g increases and more firms opt for equity.

2.7 Determination of optimal managerial autonomy with equity financing at $t = 0$

If $\beta < \hat{\beta}$ is assumed, the manager chooses the optimal managerial autonomy probability, η_e, at $t = 0$ to maximize the expected terminal ($t = 3$) wealth of initial shareholders:

24 An econometrician may be aware of the structure of the model but unaware of all the values of the parameters in the model, as these may not be obvious from the data, and may have to be estimated or inferred.

$$V_{old}^{0}\left(\mu_{\rho},\eta_{e}\,|\eta_{e}<\widehat{\eta}_{e}\right)=\int_{\widehat{\rho}(\eta_{e})}^{1}[1-\alpha(\hat{\rho},\eta_{e})]V_{old}^{1}(\hat{\rho},\eta_{e})\Phi(d\rho|\mu_{\rho})$$

$$+\int_{0}^{\widehat{\rho}(\eta_{e})}V_{old}^{1}(D^{1}=I|\hat{\rho})\Phi(d\rho|\mu_{\rho}) \quad (15a)$$

and

$$V_{old}^{0}\left(\mu_{\rho},\eta_{e}\,|\eta_{e}\geq\widehat{\eta}_{e}\right)=\int[1-\alpha\left(\widetilde{\rho},\eta_{e}\right)]\,V_{old}^{1}\left(\widetilde{\rho},\eta_{e}\right)\Phi\left(d\rho\left|\mu_{\rho}\right.\right), \quad (15b)$$

where μ_ρ is the mean of ρ, $V_{old}^1(\hat{\rho},\eta_e)$ is given by (7) with ρ replaced by the random $\hat{\rho}$, and $V_{old}^1(D^1 = I|\hat{\rho})$ is given by (11) with ρ replaced by the random. The optimal η_e, call it η_e^*, is now obtained as $\eta_e^* \in \arg\max_{\eta_e \in [0,1]} \left\{V_{old}^0\left(\mu_\rho,\eta_e\right)\right\}$. This leads to Theorem 4.

Theorem 4. There exists a unique optimum, η_e^*, *at* $t = 0$ with respect to the autonomy parameter, η_e, if $\eta_e^* > \widehat{\eta}_e$. For $\eta_e^* \leq \widehat{\eta}_e$, multiple optima may exist but all must satisfy the first-order condition $\partial V_{old}^0 / \partial\eta_e = 0$.

The intuition for this theorem is as follows. In setting η_e^*, the manager trades off two opposing forces: an increase in η_e enhances the manager's expectation of the initial shareholders' terminal wealth, but it also increases α (Lemma 2) and, hence, the cost of new equity, which dilutes the initial shareholders' claim. As the manager's perceived benefit from a higher η_e is linear in η_e, whereas the cost is convex in η_e (Lemma 2), the manager's objective function becomes concave in η_e and produces a unique optimum for $\eta_e^* > \widehat{\eta}_e$. The impact of η_e^*on the cutoff $\hat{\rho}$ can produce multiple optima for $\eta_e^* < \widehat{\eta}_e$, in which case any $\eta_e^* \in (0, 1)$ can be chosen.

Corollary 5. The optimal autonomy probability, η_e^*, is strictly increasing in μ_ρ, the mean of the agreement parameter, ρ, i.e., $d\eta_e^* / d\mu_\rho > 0$.

The intuition is that when ρ is higher, the marginal cost of autonomy is lower and the manager optimally retains greater autonomy. One implication of this corollary is when new technologies are emerging but have not been widely adopted, so that the potential for manager-investor disagreement is high, equity-linked corporate governance will be stringent, and shareholders will exercise substantial control. According to Theorem 2, the manager may prefer debt, provided there are valuable assets in place. However, emergent technologies may create new growth opportunities that require larger amounts of financing relative to the size of the assets in place, which would render assets in place less effective in attenuating the debt-related asset substitution moral hazard. As we show in Section 3, this may create an impetus for a manager to pile up cash within the firm.

3. Extensions and Implications for Capital Structure

In this section, we first examine the role of cash in the model and discuss the implications of our analysis for the firm's capital structure decision. We then examine the implications of assuming that the beliefs of initial investors are aligned with those of the new investors and that the manager cannot directly observe ρ but only infers it noisily from the stock price. Next, we examine why initial shareholders do not just sell the whole firm to new investors when they disagree. We end with a discussion of the roles played by the key features of the model in determining how control is optimally allocated. Again, we focus on the case in which $\beta < \hat{\beta}$, so that either equity or debt may be preferred.

3.1 Cash, managerial autonomy, and dynamic pecking order considerations

Thus far, we have limited the firm's financing choices to outside equity and debt. We now add internally generated cash to the mix. Our interest is in examining how cash may affect managerial autonomy and, in turn, the managers' incentives to accumulate cash. This analysis not only allows us to generate new predictions but also sheds new light on a growing stream of empirical literature on the value of corporate cash holdings (e.g., Almeida, Campello, and Weisbach 2004; Faulkender and Wang 2006). In this regard, the following corollary is useful.

Corollary 6. If internal cash can be used by the manager to reduce the amount of external financing needed for the project, then the manager's optimal autonomy probability with equity financing, η_e, is higher.

The intuition is that a reduction in the amount of the investment, I, that must be externally financed also reduces α, the ownership stake sold to outside shareholders. This reduces the marginal cost that the manager perceives in increasing managerial autonomy *vis-à-vis* shareholders. The finding that cash affects managerial autonomy with respect to equity provides another perspective on the notion that cash is not "negative debt" (see Acharya, Almeida, and Campello 2007). It also gives rise to numerous predictions, which we discuss in Section 5.

3.2 Implications for the firm's capital structure

Our analysis has considered an all-equity firm where the capital structure *changes* due to subsequent equity issues. What does this imply about the overall optimal capital structure of the firm given the importance of distinguishing between security issuance and capital structure decisions (e.g., Welch 2011)? Our analysis has two clear implications. First, in contrast to "trade-off theories" that rely on bankruptcy costs and taxes, the firm does not have a target capital structure. Rather, its capital structure at any point in time reflects the aggregate effect of previous security issuances, where each issuance is determined by manager-investor agreement and the other mediating variables in our analysis.[25] This is broadly consistent with the empirical evidence provided by Baker and Wurgler (2002) that capital structure is primarily determined by strategically timed security issuances rather than trade-offs between the costs and benefits of leverage.

Second, our analysis implies that the capital structure *will appear to move further away from that target as it responds to stock price signals* rather than adjust back to a static target. When a firm with an innovative project has low-value assets in place, an increase in its stock price signals higher agreement and produces two effects: an "auto-pilot" decline in its leverage ratio (Welch 2004) and an enhanced, autonomy-driven preference for equity. The first effect is mechanical and exists even if no new security is issued—the firm's stock price rises, but the firm does nothing proactively to adjust its leverage ratio, which declines. The second effect, which arises from the firm issuing equity, *reinforces* the first. The firm chooses to issue equity because the higher agreement makes an overall capital structure with a higher proportion of equity optimal. Similarly, a decrease in the firm's stock price produces two reinforcing effects: an "auto-pilot" increase in its leverage ratio and an enhanced desire to issue debt.

The overall implication of this finding for optimal capital structure is clear. Whenever agreement is low, the firm prefers debt to equity and its capital structure favors higher leverage, regardless of whether it issues new securities. Whenever agreement is high, the firm prefers equity and its capital structure tends to move toward lower leverage.

3.3 Beliefs of initial shareholders aligned with beliefs of new investors

We have assumed that the manager designs the corporate charter to maximize the initial shareholders' wealth, and that the beliefs of the initial shareholders and the manager coincide. What if the initial shareholders and the new investors have the same beliefs, and these diverge from the manager's?[26]

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[25] Because our analysis ignores bankruptcy costs and taxes (as in, e.g., Jensen and Meckling 1976), we do *not* claim to have accounted for all the factors that may impinge on capital structure (see, for example, Acharya, Sundaram, and John 2011 for an analysis of how the bankruptcy code affects capital structure). Our goal is to show that even if we limit our attention to disagreement, an optimal capital structure can arise in a manner that addresses important empirical anomalies related to trade-off theories.

[26] An interesting issue that arises when the manager may disagree with the initial shareholders is that of the preference for security issuance of the manager *vis-à-vis* initial shareholders. Suppose the manager's autonomy with respect to the shareholders is kept at η_e, as in our present analysis, and the value of the assets in place is low. If we compare (3) and (7), it is easy to show that $V^1_{old}(\rho, \eta_e) > V^1_n(\rho, \eta_e)\, \forall \rho \in [0, 1)$. This means that the cutoff agreement parameter, $\hat{\rho}_n$, beyond which the shareholders prefer equity issuance is higher than the corresponding cutoff $\hat{\rho}_{old}$ chosen by the manager; i.e., when $\rho \epsilon (\hat{\rho}_{old}, \hat{\rho}_n)$, management wants to issue equity but shareholders prefer debt. The intuition is that autonomy is valued positively by management and negatively by shareholders, so the latter value equity (with its greater autonomy) less than the former. Thus, for intermediate values of the stock price (those corresponding to $\rho \epsilon (\hat{\rho}_{old}, \hat{\rho}_n)$, a precommitment by the manager to issue debt will increase the firm's stock price at both $t = 0$ and $t = 1$.While such a precommitment would leave our

We have examined this case and verified that all of our major results hold if we assume that it is the manager who sets the autonomy probabilities. However, if the initial shareholders determine these probabilities, then it is apparent that they will see no benefit in giving the manager any autonomy with equity. Managerial autonomy increases the firm's cost of capital and dilutes the ownership of the initial shareholders but generates no benefits for the initial shareholders if their beliefs coincide with those of new investors. Thus, $\eta_e = \eta_{e(d)} = 0$. It is also clear that η_d will be unaffected, so that it will be set at 0 if $\overline{V}_{AIP} = 0$ and at 1 if $\overline{V}_{AIP} = F$.

The main finding that equity will be issued when the stock price is high and that debt will be issued otherwise, as well as the finding that the AIP's value has an effect on the security issuance decision, remains unaffected. As the agreement parameter associated with a high stock price is high, the manager will view equity as providing greater *effective autonomy* than debt as long as the value of the AIP is not high, even if $\eta_e = 0$.[27]

3.4 Noise in the manager's inference of agreement based on the stock price

In our model, everyone observes ρ when it is realized. What if the manager cannot directly observe ρ but merely infers it from the date-1 stock price, $V_n^1(\rho, \eta_e)$, given in (3)? In practice, this inference is likely to be noisy given the possibility of random shocks to V_n^1 from noise trading or other factors. In this case, we may express the date-1 stock price as $V_n^1(\rho, \eta_e, \widetilde{\in})$, where $\widetilde{\in}$ is a mean-zero random noise term. The manager does not observe the realization of $\widetilde{\in}$. Now, $V_n^1(\rho, \eta_e, \widetilde{\in})$ will merely be a *noisy*, yet informative, signal about ρ for the manager, which leaves room for the manager to acquire additional informative signals about ρ from sources like direct communications with analysts or analysts' earnings forecasts. Given $\widetilde{\in}$ and such additional signals, and using logic similar to that in Corollary 1, the prediction would be that for $\beta < \hat{\beta}$ and $\eta_e < \hat{\eta}_e(\beta)$, higher inferred values of ρ imply a higher likelihood of equity issuance *regardless of the stock price*. This provides a key way of empirically distinguishing our theory from market timing, as we show that even among firms with high stock prices, those with higher levels of agreement are more likely to issue equity.

3.5 Selling the whole firm to new investors

In our model, initial shareholders seek external financing because they are wealth-constrained. Financing is raised before the project-quality signal is

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analysis qualitatively unchanged—only the range of values of ρ for which equity is issued would decline to $(\hat{\rho}_n, 1)$—it would create a role for debt as an "autonomy-limiting" instrument for stock prices below a threshold. Debt can thus serve as a form of "investor protection" that is distinct from the usual protection from self-serving managerial expropriation (e.g., Shleifer and Wolfenzon 2002).

[27] We have also assumed that new investors are a monolithic block in terms of their beliefs. In Section 4.7, we discuss the implications of relaxing this assumption.

observed. After raising financing, the manager observes this signal and then proposes a project for investor approval. Therefore, there are three relevant possibilities; (i) both old and new shareholders agree that the innovative project is the best choice; (ii) old shareholders believe the innovative project is the best choice but new investors do not; and (iii) old shareholders believe the innovative project is not a good choice but new investors believe it is. In our base model, we consider only the first two cases. The third possibility was not relevant to our base model, as the manager—who is always aligned with the old shareholders—will simply refuse to propose a project that the old shareholders do not like. However, the third possibility may become relevant in a different setting. Specifically, if financing is raised after the project-quality signal is observed by both the manager and the new investors, then there would be no *a priori* justification for excluding case (iii). Either the entire innovative project or the entire firm can be sold to new investors in this case. Therefore, in this section, we allow for this possibility and examine the ramifications of raising financing after the signal.

As the autonomy probabilities in our model represent non-renegotiable pre-commitments, we have to reconsider the structure of the model in order to incorporate post-signal financing. We modify the structure in three ways. First, we view η_e, η_d, and $\eta_{e(d)}$ as the autonomy probabilities that apply only when the old shareholders still have ownership in the firm. These control-sharing rules are invalidated if 100% of the ownership is transferred to the new shareholders. Second, we maintain our assumption that the manager is indispensible for producing project cash flows but we relax it a bit by assuming that this indispensability applies only to the innovative project, which requires the manager's firm-specific expertise, so that without him the project cash flow is zero.[28] In other words, a replacement manager can be found to run the mundane project without a loss of value. Third, the manager makes an effort choice, $e \in \{0, 1\}$, that affects the expected value of the innovative project, and this effort cannot be contracted upon directly. The expected values are now expressed as $\widehat{x}$ and $\widehat{y}$ with $\widehat{x} \equiv ex$ and $\widehat{y} = ey$. So, conditional on a signal $x = H$, the expected value of the innovative project to the manager and old shareholders is H if $e = 1$ and 0 otherwise, and conditional on a signal $y = H$, the expected value of the innovative project to the new shareholders is H if $e = 1$ and 0 otherwise. Similarly, conditional on $x = L$ or $y = L, \widehat{x} = L$ if $e = 1$ and 0 otherwise, and $\widehat{y} = L$ if $e = 1$ and 0 otherwise. The manager derives a non-pecuniary private benefit, $b(m, x)$, from managing the innovative project. Assume $b(m, H) \equiv b(m) > 0$ and $b(m, L) \equiv 0$. The manager also experiences a non-pecuniary private cost from running the innovative project, $c(m, e)$, which depends on his effort, with $c(m, 1) \equiv c(m) > 0$ and $c(m, 0) \equiv 0$. This cost of running the innovative project is incurred with

[28] We could equivalently continue with our assumption that the manager is indispensible for both the mundane and innovative projects.

$e = 1$ regardless of whether $x = H$ or $x = L$. Assume that the incentive compatibility condition holds for all firms: $\{\rho + \eta_e [1 - \rho]\} b(m) > c(m)$, i.e., the expected private benefit to the manager of the innovative project exceeds the private cost. This effort choice formalizes the idea that managers will not undertake projects they consider to be bad.

In all cases, we consider the region of parameter values in which the firm may issue either equity or debt as opposed to a reliance on only one form of financing, i.e., $\beta < \hat{\beta}$ and $\eta_e < \hat{\eta}_e(\beta)$. First, consider case (i) in which both the old and the new shareholders like the innovative project. Qualitatively, nothing changes relative to our main analysis—the firm will choose to finance the innovative project with equity. The cost of raising equity will be relatively low because new shareholders agree with the manager and old shareholders about project choice.

In case (ii), the old shareholders believe the innovative project is good but the new shareholders do not. Financing is still possible because the mundane project has positive NPV. To see this, note that the firm could either finance the project with debt and guarantee the selection of the mundane project, or set the managerial autonomy parameter with equity low enough to ensure that the new shareholders—who prefer the mundane project—will have project-choice control with a high-enough probability to ensure their participation. In fact, as long as managerial autonomy with equity is below an upper bound, say η_U, where η_U satisfies $\eta_U L + [1 - \eta_U]R + \beta F = I$, new shareholders will be willing to provide the necessary financing, i.e., the total expected value of the firm after the investment exceeds the funds needed (I).[29] However, relative to the main analysis, this corresponds to a case in which the agreement parameter is zero, as funding is occurring after the project signal has been observed. We know from the earlier analysis that outside equity is very expensive, in this case, although this does not necessarily rule out equity. There are, in fact, two possibilities if the firm simply raises financing for the two projects as in our base model: (a) the firm prefers to issue debt; or (b) the firm prefers to issue equity. For (a), we know that the firm would invest in the mundane project. Thus, there is no reason for the old shareholders to sell the entire firm to the new investors, as the latter would choose the same mundane project (because case (ii) assumes that the new investors dislike the innovative project). For (b), the old shareholders would want to invest in the innovative project. The price at which they would be willing to sell their shares in the firm will reflect the value of that project. However, the new shareholders prefer the mundane project and hence will only be willing to pay a lower price. Therefore, as in the renegotiation-proofness analysis of Boot, Gopalan, and Thakor (2006), trade will *not* occur.

Finally, consider case (iii), in which the old shareholders believe that the innovative project should be rejected but new investors think it is good. Would

[29] Recall that $L < I < R$, so $\eta_U < 1$ if $L + \beta F < I$.

the old shareholders wish to sell the whole firm to the new shareholders so that they can invest in the innovative project? In this case, the new shareholders will recognize that they will have to retain the incumbent manager to extract value from the innovative project. The problem is that the state in which the new shareholders are making the offer to purchase the entire firm is precisely the state in which the manager believes $x = L$. As $b(m, L) = 0$, it will be impossible for the new shareholders to ensure that the *expected* private benefit to the manager from running the innovative project exceeds the private cost. Thus, if the new shareholders hire the manager to run the innovative project after they acquire 100% ownership, the manager will choose $e = 0$. For this reason, the new shareholders are better off investing in the mundane project. Therefore, the new shareholders would not find it beneficial to acquire the whole firm, as the mundane project would have been chosen even if the old shareholders retained their ownership. Therefore, issuing debt to finance the project is optimal for the firm.

To summarize, including the possibility of trading after the project-choice signal is observed provides two primary insights. First, if new investors are less bullish than old shareholders about the firm's prospects, they will not buy the entire firm from the old shareholders if the firm would have issued debt to finance the project in the absence of a buyout offer. Furthermore, the new shareholders are unlikely to be willing to pay a price that enables trade if the firm issues equity in the absence of a buyout offer. Second, if new investors are more bullish than the old shareholders and the manager about the firm's prospects, old shareholders will generally not find it optimal to sell the entire firm to new investors as long as the manager possesses unique human capital that is needed to manage the innovative project.

3.6 Disagreement, investment distortions, and control allocations

Our model has numerous features that interact to generate our results. In this section, we clarify the roles played by these features. We use the term "investment distortion" to represent a situation in which either the manager or investors would find it privately optimal *ex post* to choose a project that both the investors and the manager agree does not maximize total firm value. This should be distinguished from a situation in which an agent prefers a project that the agent *believes* is value-maximizing even though others disagree.

Theorem 5. The renegotiation-proof *ex ante* allocation of control has the following properties:

(1) If neither the manager nor the new investors have any investment distortion incentives and if there is no possibility of disagreement between them, then the manager is indifferent between debt and equity, the various autonomy probabilities are irrelevant, and all control can be given to the manager.

(2) If there is no possibility of disagreement but either the manager or the new investors may have an investment distortion incentive, then all control is allocated *ex ante* to the party that does not have an investment distortion incentive.

(3) If there is possible disagreement ($\rho < 1$) but neither the manager nor the new investors have any investment distortion incentive, then debt is strictly preferred to equity.

(4) If there is possible disagreement, and both the manager and the new investors have investment distortion incentives, then all control should be allocated *ex ante* in a particular state to the party that both the manager and the new investors agree would choose the higher-valued project in that state. In states in which the manager and the new investors disagree over which project choice is value maximizing, the allocation of control should be joint (probabilistic).

This theorem highlights the implications of various assumptions. Without investment distortions or disagreement, we not only get the classic irrelevance result that debt is no different from equity but we also find that the allocation of control between the manager and new investors is irrelevant. Investment distortions arise from the availability of the lemon project and the option of rejecting the innovative project in favor of a riskless (an NPV of at least zero) option like the mundane project or no investment at all. The riskless option tempts bondholders to eschew the (higher-valued) innovative project even when $y = H$, and the lemon project tempts the manager to eschew the innovative project even when $x = H$. If we permit disagreement but eliminate investment distortions, then the manager strictly prefers debt to equity even if debt is risky. This is because the bondholders' expected payoff is less sensitive to disagreement than the shareholders' expected payoff. The lemon project thus opens the door for equity preference with disagreement. The lemon project also makes bondholder control *ex ante* efficient in one or more states, and the riskless option makes managerial control *ex ante* efficient in some other states. Disagreement itself makes the allocation of control between the manager and new shareholders matter.

3.7 Is disagreement a first-order effect?

Given the long tradition of agency and asymmetric information approaches in theories of security issuance and capital structure, one might wonder whether disagreement's impact on these corporate policies is a first-order effect. There are two ways to address this concern. First, the motivation for building alternative theories of security issuance and capital structure is primarily empirical. As discussed in the introduction, recent empirical work has uncovered stylized facts that seem inconsistent with the predictions of asymmetric-information and agency models, which suggests the need for a fresh look. Second, we do not view disagreement as an alternative to asymmetric information and agency but rather as a complement. Disagreement is yet another factor that affects security issuance and capital structure, so it is appropriate to assess its *incremental* contribution to the explanation of these practices, in addition to the effects of asymmetric information and agency. Thus, the magnitude of this incremental contribution is perhaps best evaluated empirically. As an initial assessment, Dittmar and Thakor's (2007) paper shows that although market timing and asymmetric information are significant in explaining equity and debt issuances, disagreement has statistically significant incremental explanatory power. As predicted by our model, firms with high agreement issue equity to finance projects, and firms with low agreement use debt, even after controlling for asymmetric information. However, our article goes beyond Dittmar and Thakor (2007) to provide a host of *additional* predictions that can be tested.

In addition to the empirical evidence, the intuition that disagreement holds first-order importance in the determination of capital structure is based on two observations. First, an important responsibility of most CEOs is to find and invest in positive-NPV projects. CEOs recognize that investors will not always agree with them that a particular project has a positive NPV. Second, the CEO's ability to overcome investor objections and invest in the project depends on the firm's capital structure—a more highly levered firm has fewer "unencumbered" assets in place against which to borrow in order to avoid issuing costly equity when manager-investor agreement is low. If this is the starting point, the manager will prefer to finance the project using equity when manager-investor agreement is high and investors are more likely to endorse the project choice, and using debt when agreement is low, as the pricing of debt is less sensitive to agreement than the pricing of equity. Security issuance decisions then respond dynamically to shocks to agreement and determine how the capital structure evolves over time.

The beer manufacturer Carlsberg serves as an example. The company recently lowered its debt by $1.6 billion to create "more flexibility to invest." Investors suspected that the company might use this perceived "flexibility" to make acquisitions. They disagreed with the idea that this debt reduction provided the company with enough flexibility to pursue *value-enhancing* acquisitions and expressed their concern that, in their view, acquisitions were not a good idea for the company. "Carlsberg has limited flexibility in its balance sheet for further acquisitions . . . ," stated an analyst with Barclays Capital (Bloomberg 2010). Ostensibly in response to this investor disagreement over future acquisitions, Carlsberg recently announced that it would forgo any acquisition plans and instead pursue organic expansion in Asia and Russia. Its stock price responded by climbing 13% during 2010, outstripping the share price appreciation seen for other beer manufacturers (Bloomberg 2010).

Finally, our analysis views new shareholders as a monolithic block in which each investor agrees with management to the same extent. This may be interpreted literally or as a situation in which there is a large or prominent shareholder with a particular agreement parameter with management and other small shareholders who follow that shareholder's lead in deciding whether to endorse managerial decisions. A more complicated situation arises when new shareholders have different agreement parameters. In this case, the equilibrium allocation of shareholders to firms should display a "clientele effect," as the shareholders most likely to agree with the manager will value the firm the highest and will be long in the stock (see Boot, Gopalan, and Thakor 2008). This sorting will serve as an efficient market mechanism for matching investors to managers and minimizing disagreement. However, as long as the highest-agreement investors have $\rho < 1$ with the manager, disagreement will still shape governance, capital structures, and project choices (see Thakor 2010). More interestingly, if endowment constraints lead to investors in different belief clusters owning the firm's shares, then the effective agreement parameter that determines the stock price will be the ρ of the *marginal* investor. Inframarginal investors will have higher ρ's, so the manager may prefer to use cash to buy out the marginal investors through a stock repurchase, thereby increasing the level of agreement with the shareholders and elevating his autonomy.

4. Summary of Empirical Implications

In this section, we discuss the numerous empirical implications of our analysis. While the last two predictions are common to other theories, the remaining empirical implications are either entirely new or have aspects that are new. They may, therefore, be used to differentiate our theory from others and, potentially, to reject the model.

1. *A firm's capital structure is inherently dynamic and dependent on its stock price and the value of assets in place. Firms will issue equity when the stock price is high and the value of their assets in place is relatively low. Firms will issue debt either when the value of assets in place is very high (regardless of the stock price) or when the stock price is relatively low.*

This prediction follows from Theorem 2 and the discussion in Section 4.2. The statement dealing with the dependence of security issuance on stock prices is consistent with the empirical evidence in Baker and Wurgler (2002), Hovakimian, Opler, and Titman (2001), and Teoh, Welch, and Wong (1998). It is also consistent with the evidence provided by Antoniou, Guney, and Paudyal (2002), Barclay, Smith, and Watts (1995), and Rajan and Zingales (1995) that the cross-sectional relationship between market-to-book ratios and leverage ratios is negative for U.S. and OECD firms.

However, our prediction about the link between capital structure stock prices for firms issuing securities is predicated on two mediating factors: the value of assets in place and the stock price. If the value of assets in place is sufficiently high, the firm issues debt regardless of the stock price. While this implication is similar to the standard "pecking order" theory, an important distinction is that our prediction is based on a sufficiently high value for the assets in place. Thus, even for this special case, our prediction can be empirically distinguished from the pecking-order theory.[30] Furthermore, given a relatively low value of assets in place, if the stock price is sufficiently high, the firm always issues equity regardless of variations in stock price above that cutoff (see Figure 2). Outside these two extremes, the firm issues equity if its stock price is high and debt if its stock price is low, indicating equity preference for a large range of parameter values, in sharp contrast to the unconditional "equity aversion" found in pecking-order theory. Thus, not only does our prediction offer a somewhat different test of the dependence of capital structure on stock prices, but it also permits one to distinguish our theory from other explanations for this dependence, such as market timing (e.g., Baker and Wurgler 2002) or growth options with associated agency and bankruptcy costs (Rajan and Zingales 1995).

Although our primary focus is on the relationship between the stock price and ρ, this prediction also says that firms will issue debt when the value of assets in place is very high. As a high value of assets in place can lift the stock price, this implies that we may observe debt issues associated with high stock prices. Note, however, that our prediction clearly identifies *when* such debt issues will occur. Therefore, in contrast to existing theories, our theory allows for future empirical tests to distinguish between debt and equity issues during high stock price periods. To minimize the distortions of historical value accounting in empirical testing, one may focus on firms that have recently undergone mergers. The book values of merging firms are revised to reflect "fair market values" of assets in place, which reduces historical cost-based accounting distortions. One could then examine whether those firms with relatively high stock prices and high on-the-balance-sheet assets also have relatively high book leverage ratios and/or relatively more debt issues.[31]

In contrast to other theories, our theory predicts that capital structure will move in precisely the way it appears in the data, given the mediating conditions discussed. Optimal capital structure varies continuously with the stock price, as the firm's security issuance decision at any point in time is driven by the manager's comparison of the autonomy offered by debt and that offered by equity—a comparison that depends on the observed stock price. Moreover, even when controlling for price, higher manager-investor agreement makes equity issuance more likely.

2. *Even among high-stock-price firms with a low value of assets in place, the likelihood of equity issuance is increasing in manager-investor agreement.*

[30] For empirical testing, the pecking-order aversion to equity exists regardless of the value of assets in place or the stock price, whereas our prediction is that debt is preferred only for very high values of assets in place or low stock prices.

[31] It may not be enough to only examine reported external financing by these firms because they may be increasing borrowing by tapping bank credit lines, which may not be detectable in the data. Therefore, a careful empirical test may focus on book leverage ratios as well as *observed* debt issuances.

This prediction follows from the discussion in Section 4.4 and highlights three key differences between our theory and market timing theory. First, while both theories imply that equity issues are more likely at higher stock prices, ours implies that those firms with higher agreement are more likely to issue equity, even among firms with high stock prices.[32] Moreover, even when controlling for price, higher agreement makes equity issuance more likely. Empirical support is provided by Dittmar and Thakor (2007), who use various proxies for agreement and find direct evidence that shareholder-manager agreement has *incremental* power in explaining equity issuance timing. In particular, even when controlling for the stock price and asymmetric information, equity issuance is more likely when there is less disagreement as proxied by uncertainty-driven measures, such as dispersion in analysts' earnings forecasts. However, their tests do not consider the mediating effect of the value of assets in place.

Second, while market timing theory explains equity issuance patterns, it leaves the perplexing question of why investors irrationally purchase equity at inflated prices unanswered. In contrast, in our theory, investors rationally anticipate the actions of managers.

Finally, in contrast to market timing theory, which predicts that equity issuances are driven primarily by stock prices, our theory predicts that the link between security issuance and stock price depends on mediating variables—the stock price level, investor-manager agreement, and the value of assets in place. Thus, we predict that firms may engage in substantial security issuances due to changes in their investment opportunities, levels of manager-investor agreement, and values of assets in place, and that these issuances may be uncorrelated with changes in market-value-based measures of capital structure induced by stock returns (see Welch's 2011 discussion of corroborating evidence on security issuances and stock-return-induced capital structure changes, as well as DeAngelo and Roll's (2011) evidence that the firm's investment policy has an important effect on the time path of its leverage).

3. *Even in the absence of a security issuance, there will be an inverse relationship between the firm's leverage ratio and its stock price. When the firm's stock price changes, its leverage ratio will move in the direction implied by the mechanical (auto-pilot) effect of the price change on leverage. If the firm issues securities, then the change in leverage induced by a change in the stock price will exceed that implied by the auto-pilot effect, as long as the value of the firm's assets in place is not too high.*

This prediction follows from the discussion in Section 4.2. If no project is available at $t = 1$, our model implies *no* security issuances, so that the capital structure is driven only mechanically by stock returns. Welch (2004)

[32] Thus, if the stock price were to increase due to a positive shock to V_{AIP} without affecting ρ, our theory predicts that the probability of an equity issuance is unchanged (or reduced if β increases), whereas market timing theory would predict a higher probability of equity issuance.

shows that this auto-pilot effect is a striking part of the data—a significant proportion of the observed changes in capital structure is driven by the auto-pilot effect of stock returns.[33] Although this is puzzling, our theory predicts that it is exactly what we should expect. When the firm's stock price rises, the manager infers higher agreement (ρ), so the optimal capital structure shifts to lower leverage, which is precisely what is achieved by doing nothing but letting this ratio drift lower. In short, a security price change moves the firm's *optimal* capital structure in the direction of the price change.

4. *Equity issuance will be preceded by periods of relatively high stock prices.*

This prediction comes from Theorem 3. One implication is that if firms are issuing equity to time the market, it will appear that they are inexplicably delaying their equity issues while they wait for their stock prices to rise before issuing equity. Again, we are not aware of any direct test of this prediction. Furthermore, equity issuances will be preceded by positive stock returns (as in Baker and Wurgler 2002).

5. *Firms that have relatively highly valued assets in place will choose high debt-equity ratios. For firms with relatively low-valued assets in place, if the stringency in equity corporate governance (e.g., as measured by the number of independent and active boards of directors) is relatively low, the firm will issue equity regardless of the stock price. Alternatively, if the governance stringency is relatively high for these firms, then they will issue equity at high stock prices and debt at low stock prices.*

This prediction follows from Theorem 2 and Corollaries 1 and 2. The prediction that firms with highly valued assets in place will issue debt regardless of the stock price is novel and awaits testing. For firms with assets in place that are not highly valued and for which corporate governance stringency is relatively low, equity is issued even at low prices. Among firms with high governance stringency and assets in place that are not highly valued, equity is issued if the stock price is high and debt is issued if the stock price is low. This prediction also awaits testing.[34] The empirical proxies for monitoring intensity developed in the corporate governance literature may be useful in this regard.

6. *When the firm has access to more internal cash to finance projects, equity-linked corporate governance is less stringent/intrusive.*

This prediction follows from Corollary 6 in Section 4.1. Cash offers an advantage even if it is retained within the firm and not used to reduce external financing. For example, if debt financing is used, cash can augment the value

[33] Welch (2004, p. 106) concludes that "…U.S. corporations do little to counteract the influence of stock price changes on their capital structures."

[34] Although Novaes (2003) and Zwiebel (1996) also develop managerial models of security issuance, they would not produce a similar prediction, as in their models (in the absence of a takeover or bankruptcy), all control rests unilaterally with the manager ($\eta_e = 1$) when equity is issued and the mediating role of assets in place is absent.

of the assets in place if its level can be monitored by the bondholders. In turn, it can increase the range of values of the AIP for which debt can be used to finance a project without relinquishing control to the bondholders. Thus, cash can be effective in elevating managerial autonomy *vis-à-vis* bondholders.

We have not considered the more negative aspects of cash that are related to free-cash-flow problems in the organization below the manager (CEO; see Jensen 1986). However, the manager may believe that this organizational inefficiency is outweighed by the benefits of greater autonomy. In this case, our analysis suggests prediction 7.

7. *In the "autonomy pecking order," the firm prefers cash and then equity and then debt if the firm's stock price is high and the value of its assets in place is not too high. The firm prefers cash and then debt and then equity if the stock price is sufficiently low and/or the value of assets in place is sufficiently high.*

As disagreement is likely to loom larger while adopting new and unfamiliar technologies or during periods of high stock price volatility, the value of enhancing a manager's autonomy through cash is also likely to be higher during such periods. For example, pharmaceutical companies may operate with more cash than companies less dependent on research and development. That is, we have the following prediction:

8. *Cross-sectionally, firms with more novel business designs, firms with higher dependence on research and development for future growth, and firms experiencing higher stock price volatility will accumulate larger amounts of cash.*

While cash accumulation increases managerial autonomy, it also affects how shareholders value the firm. In Equation (3), we can see that if ρ is held fixed, the firm's stock price is decreasing in η_e. Thus, anything that increases managerial autonomy without affecting agreement (as in Corollary 6) will adversely affect the stock price. Of course, cash may be accumulated for other reasons as well—such as exogenous financial constraints or impaired capital market access—so that the negative impact of cash on the stock price arising from managerial autonomy will be tempered by these factors in the data. On average, however, these additional factors may cancel out and our analysis implies that \$1 in cash retained within the firm should be valued at less than \$1 by the market. This matches Faulkender and Wang's (2006) finding that \$1 of cash is worth \$0.94 in market value. Second, our model implies that the market value of cash should be higher in higher-ρ firms, as the marginal cost of an increase in managerial autonomy as perceived by shareholders in such firms should be lower. This prediction is untested.

9. *Cross-sectionally, firms will exhibit lower leverage ratios if they have a higher value of future growth opportunities.*

This prediction follows from Corollary 4. It is also encountered in other theories (e.g., Myers 1977). Empirical support can be found in Goyal, Lehn, and Racic (2002), who establish that the debt levels of U.S. weapons manufacturers increased as their growth opportunities declined from 1985 to 1995.

5. Conclusion

We have examined how shareholders' and bondholders' control rights are determined when a firm's financiers and its manager have no divergence of objectives *per se* but have "different models of the world," and how these control rights interact with capital structure decisions. In such a setting, the manager seeks *ex ante* to be free of *ex post* constraints imposed by financiers on his project-choice autonomy. Thus, he first seeks the "softest" claims—those that limit his autonomy the least—with which to finance projects. This reverses the "role of hard claims in constraining management" kinds of results seen in the agency literature (e.g., Hart and Moore 1995).[35]

Our analysis uncovers numerous empirical predictions. The firm's optimal capital structure is inherently dynamic, depending on both its stock returns and the value of its assets in place. Firms will issue equity following high stock returns and debt following low stock returns, even when they have no market-timing motivations. Debt is used even in the absence of taxes, agency cost, or signaling considerations. Control rights given to financiers—and, hence, managerial autonomy—depend endogenously on the security issued and on the amount of cash the firm accumulates. On average, a dollar of cash within the firm will be valued at less than a dollar by the market. Firms will let their capital structures drift with stock prices rather than make proactive adjustments. If proactive adjustments are made, they will *reinforce* the effect of the drift rather than counteract it. Our analysis takes debt and equity as givens. A useful sequel would be to endogenize debt and equity in a security-design framework with disagreement.[36]

In terms of future research, the ubiquitous nature of the twin pillars of our analysis—fundamental disagreement and the importance of managerial

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35 One could perhaps argue that there is a similarity between our result that the manager's autonomy *vis-à-vis* new financiers is limited in order to reduce the cost of capital and the agency viewpoint that the manager will wish to precommit to limit his *ex post* freedom in order to reduce *ex ante* agency costs. There is, however, a critical difference. In the agency model, the manager finds it *ex ante* optimal to give himself *no* project-choice autonomy, if this is feasible, because this minimizes agency costs. That is, he truly seeks the hardest claim available. For example, in Zwiebel's (1996) agency model, the manager chooses to issue debt as a precommitment to eliminating his project-choice autonomy as long as debt remains a sufficiently hard claim. Equity is preferred only when the disciplining role of debt is diminished and it becomes a "softer" claim. In contrast, in our model, the manager seeks as much autonomy as he can, consistent with the board's desire to trade this off against the cost of capital, which leads the manager to prefer the claim that limits his autonomy *the least*, which is debt when V_{AIP} is sufficiently high and equity when the stock price is high. This is also different from a standard Jensen and Meckling (1976) trade-off model in which agency costs are independent of stock price levels, so the manager responds to changes in the stock price by issuing equity when the price drops and debt when it rises, because this moves the firm closer to its target capital structure.

36 This would complement the existing information-based approaches, e.g., Fulghieri and Lukin (2001).

autonomy in the face of such disagreement—allows us to link our approach to other areas, such as law and economics. Consider, for example, the "business judgment rule." This rule recognizes that corporate directors cannot be held responsible for decisions others may consider to be bad decisions if the directors acted in good faith and in the honest belief that the action was taken in the best interests of the company (see Bainbridge 2003). The law thus acknowledges that a fundamental disagreement between shareholders and directors/managers does not necessarily imply agency or moral hazard problems. The framework developed here could be used to provide an economic rationale for this rule, and to help analyze issues connected with this and other economic phenomena, thereby creating new research avenues.

Appendix

Proof of Theorem 1. First, consider η_d. Bondholders have first lien on the cash flow from the AIP. When $\overline{V}_{AIP} = F > I$, the firm's cost of capital is unaffected by η_d. As the value of the firm, assessed by the manager, is increasing in η_d for any fixed cost of capital, it is optimal to set $\eta_d = 1$ when $\overline{V}_{AIP} = F$. Consider next the autonomy probabilities η_e and $\eta_{e(d)}$. Fix debt as the security to be issued at $t = 1$, so the manager must determine $\eta_{e(d)}$, the manager's autonomy with respect to the initial shareholders. As new equity capital is not being raised, there is no dilution and the impact of $\eta_{e(d)}$ on the stock price is irrelevant as long as the cost of debt is unaffected by $\eta_{e(d)}$. As the beliefs of the manager and the initial shareholders coincide, causing them to always agree on the project choice, the bondholders' expected payoff cannot be affected by the allocation of control between the manager and the initial shareholders for *any* $\overline{V}_{AIP}$ value. The manager thus sets $\eta_{e(d)} = 1$. Next, fix equity as the security being issued at $t = 1$. Then the manager will account for the impact of η_e on α, the cost of external equity financing (Lemma 2 establishes that $\partial\alpha / \partial\eta_e > 0$). This impact that will exist for any value of $\overline{V}_{AIP}$ and the manager will set η_e to reflect this effect. This means that, in general, we have $\eta_e \neq \eta_{e(d)}$.

Now we will establish that conditioning η_e on $\overline{V}_{AIP}$ serves no economic purpose. Note that there are only two contracting variables that can be conditioned on $\overline{V}_{AIP}$: η_e and α. Conditioning η_e on $\overline{V}_{AIP}$ is meaningless because $\overline{V}_{AIP}$ has no effect on x, y, or ρ, and thus has no impact on shareholder-manager disagreement at $t = 2$. Therefore, $\overline{V}_{AIP}$ does not affect η_e. As for α, we need to use (3)–(5). Note first that equity is issued at $t = 1$, so α is determined before the realization $\overline{V}_{AIP}$ is observed. This necessitates basing α on the expected value of $\overline{V}_{AIP}$, which is βF. Thus, α is given by (5). However, consider an alternative arrangement in which α is expressed as a function of $\overline{V}_{AIP}$, with $\alpha\left(\overline{V}_{AIP}\right) = F \equiv \alpha_F$ and $\alpha\left(\overline{V}_{AIP}\right) \equiv \alpha_0$, and both α_F and α_0 set at $t = 1$. Define $\overline{\overline{V_n^1}} \equiv V_n^1(\rho, \eta_e, \theta) - \beta F$. Then, similar to (5), we can write

$$\alpha_F \overline{\overline{V_n^1}} + \alpha_F F = I, \text{ and} \tag{A1}$$

$$\alpha_o \overline{\overline{V_n^1}} = I. \tag{A2}$$

Clearly, $\alpha_0 > \alpha > \alpha_F$. Now, the expected terminal wealth of the initial shareholders with α not contingent on $\overline{V}_{AIP}$ is

$$[1-\alpha]\left[\overline{\overline{V_n^1}} + \beta F\right]. \tag{A3}$$

With α_F and α_0, the corresponding expected values are

$$[1-\alpha_F]\left[\overline{\overline{V_n^1}}+F\right], \text{ and} \tag{A4}$$

$$\left[1-\alpha_0\right]\left[\overline{\overline{V_n^1}}\right]. \tag{A5}$$

We can write (A3) as

$$\overline{\overline{V_n^1}}+\beta F-\alpha\left[\overline{\overline{V_n^1}}+\beta F\right]=\overline{\overline{V_n^1}}+\beta F-I \text{ using } (5).$$

Similarly, the expected terminal wealth of the initial shareholders across the different $\overline{V}_{AIP}$ realizations using α_F and α_0 is:

$$\begin{aligned}
&\beta\,[1-\alpha_F]\left[\overline{\overline{V_n^1}}+F\right]+[1-\beta]\left[1-\alpha_0\right]\left[\overline{\overline{V_n^1}}\right]\\
&=\beta\left[\overline{\overline{V_n^1}}+F\right]+[1-\beta]\left[\overline{\overline{V_n^1}}\right]-\beta\alpha_F\left[\overline{\overline{V_n^1}}+F\right]-[1-\beta]\,\overline{\overline{V_n^1}}\alpha_0\\
&=\overline{\overline{V_n^1}}+\beta F-I \text{ using (A1) and (A2).}
\end{aligned}$$

Thus, making α contingent on $\overline{V}_{AIP}$ leaves the expected terminal wealth of the initial shareholders unaffected. ■

Proof of Lemma 1. Differentiating (3) with respect to ρ yields

$$\begin{aligned}
\partial V_n^1\big/\partial\rho &= pH-\eta_e pL-[1-\eta_e]\,Rp\\
&= p\,[H-R]+\eta_e p\,[R-L]>0.
\end{aligned} \tag{A6}$$

Differentiating (5) with respect to ρ yields

$$\alpha\left(\partial V_n^1\big/\partial\rho\right)+V_n^1\left[\partial\alpha\big/\partial\rho\right]=0, \text{ which means } \partial\alpha\big/\partial\rho=\frac{-\alpha\left[\partial V_n^1\big/\partial\rho\right]}{V_n^1}<0. \quad ■$$

Proof of Lemma 2. From (5), we know that

$$\alpha\left[\partial V_n^1(\rho,\eta_e)/\partial\eta_e\right]+V_n^1\left(\rho,\eta_e\right)\left[\partial\alpha\big/\partial\eta_e\right]=0, \text{ so} \tag{A7}$$

$$\partial\alpha\big/\partial\eta_e=\frac{-\alpha\left[\partial V_n^1(\rho,\eta_e)\big/\partial\eta_e\right]}{V_n^1\left(\rho,\eta_e\right)}.$$

From (3), we see that $\partial V_n^1\big/\partial\eta_e=p\,[1-\rho]\,[L-R]<0$. Hence, $\partial\alpha\big/\partial\eta_e>0$.

Differentiating (A7) again with respect to η_e yields

$$\begin{aligned}
&\alpha\left[\partial^2 V_n^1(\rho,\eta_e)\big/\partial\eta_e^2\right]+\left[\partial\alpha\big/\partial\eta_e\right]\left[\partial V_n^1(\rho,\eta_e)\big/\partial\eta_e\right]\\
&+\left[\partial^2\alpha\big/\partial\eta_e^2\right]V_n^1\left(\rho,\eta_e\right)+\left[\partial\alpha\big/\partial\eta_e\right]\left[\partial V_n^1(\rho,\eta_e)\big/\partial\eta_e\right]=0.
\end{aligned}$$

As $\partial^2 V_n^1(\rho,\eta_e)\big/\partial\eta_e^2=0$, we have

$$\begin{aligned}
\partial^2\alpha\big/\partial\eta_e^2 &= -\left[V_n^1\left(\rho,\eta_e\right)\right]^{-1}\left[2\partial\alpha\big/\partial\eta_e\right]\left\{\partial V_n^1\left(\rho,\eta_e\right)\big/\partial\eta_e\right\}\\
&> 0 \text{ since } \partial\alpha\big/\partial\eta_e>0 \text{ and } \partial V_n^1\left(\rho,\eta_e\right)\big/\partial\eta_e<0.
\end{aligned} \quad ■$$

Proof of Lemma 3. The proof of $\partial V^1_{old}(\rho,\eta_e)\big/\partial\rho > 0$ is very similar to that for Lemma 1 and therefore omitted to conserve space. The fact that $\partial\alpha\big/\partial\rho < 0$ follows from (5) and Lemma 1. ■

Proof of Lemma 4. Note $\overline{V}_{AIP} = 0$. Given (10), the bondholders know that the shareholders will always choose the lemon regardless of the signal. As the expected value of the lemon is zero, the bondholders will adjust the repayment obligation D to correspond to *any* project-choice autonomy the manager has, so that the entire cost of choosing the lemon is internalized *ex ante* by the initial shareholders. Thus, $\eta_d = 0$ when $\overline{V}_{AIP} = 0$. ■

Proof of Theorem 2. We first show that the manager prefers debt financing such that $\exists\beta > \hat{\beta}$. The expected terminal ($t = 3$) wealth of those who are shareholders at $t = 0$, as assessed by management, when equity is chosen is $[1-\alpha]\,V^1_{old}(\rho,\eta_e)$, and is given by (6) and (7). With debt financing, the expected terminal wealth of those who are shareholders at $t = 0$ is $V^1_{old}\left(D^1 = I\,|\rho\right)$, given by (11). Debt is strictly preferred to equity if

$$[1-\alpha]\,V^1_{old}(\rho,\eta_e) < \beta\left[\overline{V^1_{old}}\left(D^1 = I\left|\overline{V}_{AIP} = F,\rho\right.\right) + I\right] + [1-\beta][R] - I, \tag{A8}$$

where $V^1_{old}(\rho,\eta_e)$ is given in (7) and $\overline{V^1_{old}}\left(D^1 = I\left|\overline{V}_{AIP} = F,\rho\right.\right)$ is given in (12). Also note that $\alpha = I\big/V^1_n(\rho,\eta_e)$, where $V^1_n(\rho,\eta_e)$ is defined in (3). Now we can write (A8) as

$$\frac{IV^1_{old}(\rho,\eta_e)}{V^1_n(\rho,\eta_e)} > \left\{\begin{array}{l}\hat{V}^1_{old}(\rho,\eta_e) - \beta F\\ -\beta\left[\overline{V}^1_{old}\left(D^1 = 1\left|\overline{V}_{AIP} = F,\rho\right.\right)\right] + [1-\beta][R]\\ +I\end{array}\right\}, \tag{A9}$$

which means

$$\frac{IV^1_{old}(\rho,\eta_e)}{V^1_n(\rho,\eta_e)} > \left\{\begin{array}{l}\left[V^1_{old}(\rho,\eta_e) - \beta F\right] - \beta\left[\overline{V}^1_{old}\left(D^1 = I\left|\overline{V}_{AIP} = F,\rho\right.\right) + I - F\right]\\ -[1-\beta]\{R\}\\ +I\end{array}\right\}. \tag{A10}$$

The right-hand side (RHS) of (A10) is strictly decreasing in β, as

$$\overline{V}^1_{old}(D^1 = I|\overline{V}_{AIP} = F,\rho) - F + I > R$$

.

Note that as $\eta_e < 1$, we know that for

$$\begin{aligned}V^1_{old}(\rho,\eta_e) - \beta F &= pH\rho + \eta_e p[1-\rho]H + [1-\eta_e]Rp[1-\rho] + R[1-p] + \beta F - \beta F\\ &\le \beta\left[\overline{V}^1_{old}\left(D^1 = I\left|\overline{V}_{AIP} = F,\rho\right.\right) +\right] + I[1-\beta]R\\ &= \beta[pH\rho + p[1-\rho]H + R[1-p] + F] + [1-\beta]R.\end{aligned}$$

Thus, the RHS of (A10) is no bigger than I when $\beta = 1$.

We will now show that the left-hand side (LHS) of (A10) exceeds I. From (3) and (7), note that

$$V^1_{old}(\rho,\eta_e) > V^1_n(\rho,\eta_e). \tag{A11}$$

For external equity financing to be viable (see (5)), we know that

$$V^1_n(\rho,\eta_e) > I. \tag{A12}$$

(A11) and (A12) jointly imply that the LHS of (A10) is strictly greater than I. As we have already shown that the RHS of (A10) is no bigger than I for $\beta = 1$, debt financing is strictly preferred by the manager for $\beta = 1$. By continuity, for a sufficiently large $\beta \in (0, 1)$, debt financing must be preferred $\forall \eta_e$ and $\forall \rho$.

Next, we show that for sufficiently low β, equity is strictly preferred to debt for η_e sufficiently high and $\forall \rho$. Hence, reversing the inequality in (A10), we want to show that at $\beta = 0$, the following holds $\forall \rho$ and η_e sufficiently high:

$$\frac{I V_{old}^1(\rho, \eta_e)}{V_n^1(\rho, \eta_e)} < \left\{ V_{old}^1(\rho, \eta_e) - R + I \right\}. \tag{A13}$$

Note that $\partial V_{old}^1(\rho, \eta_e) \big/ \partial \rho > 0$, so $V_{old}^1(\rho, \eta_e)$ is minimized at $\rho = 0$. Thus, defining $V_{old}^1(0, \eta_e)$ as the value of V_{old}^1 at $\rho = 0$, (A13) becomes

$$V_{old}^1(0, \eta_e) > \left\{ [R - I] + [I] \left[\frac{V_{old}^1(\rho, \eta_e)}{V_n^1(\rho, \eta_e)} \right] \right\}, \tag{A14}$$

which can be rewritten as

$$V_{old}^1(0, \eta_e) > R - I + [I] \left[\frac{V_{old}^1(\rho, \eta_e)}{V_n^1(\rho, \eta_e)} \right]. \tag{A15}$$

Observe that (see (7))

$$V_{old}^1(0, \eta_e) = \eta_e p H + 1 [1 - \eta_e] R p + R [1 - p]. \tag{A16}$$

If $\eta_e = 1$, substituting (A16) in (A15) yields

$$p [H - R] > I \left\{ \frac{V_{old}^1(\rho, 1)}{V_n^1(\rho, 1)} - 1 \right\}. \tag{A17}$$

Define $A \equiv I \left\{ \frac{V_{old}^1(\rho,1)}{V_n^1(\rho,1)} - 1 \right\}$ and $\bar{A} \equiv \max_{\rho} \left\{ I \left[\frac{V_{old}^1(\rho,1)}{V_n^1(\rho,1)} - 1 \right] \right\}$. We can now write the above inequality as $p [H - R] > \overline{A}$, which we know is satisfied given (9). Thus, as $\partial V_{old}^1(\rho, \eta_e) \big/ \partial \rho > 0$, we have shown that (A15) holds for the smallest value $V_{old}^1(\rho, \eta_e)$ can take with respect to ρ, which implies that $V_{old}^1(\rho, \eta_e) > \left\{ R - I + [I] \left[\frac{V_{old}^1(\rho,1)}{V_n^1(\rho,1)} \right] \right\} \forall \rho \in [0, 1]$. Thus, (A13) holds for all ρ and $\eta_e = 1$. This means that for $\beta = 0$, $[1 - \alpha] V_{old}^1(\rho, 1) > V_{old}^1 \left(D^1 = I \,|\rho \right) \forall \rho$. Note that $V_{old}^1 \left(D^I = I |\, \rho \right) = R - I$ at $\beta = 0$. By continuity of $V_{old}^1(\rho, \eta_e)$ in η_e, we know that $[1 - \alpha] V_{old}^1(\rho, \eta_e) > [R - I]$ in a neighborhood of $\eta_e = 1$. Moreover, $[1 - \alpha] V_{old}^1(\rho, \eta_e) - V_{old}^1 \left(D^1 = I \,|\rho \right)$ is continuous in β. So, if $[1 - \alpha] V_{old}^1(\rho, \eta_e) - V_{old}^1 \left(D^1 = I \,|\rho \right) > 0$ for $\beta = 0$, then it is also positive for $\beta > 0$ in a neighborhood of $\beta = 0$. Thus, we have proven that equity is strictly preferred to debt for all ρ and η_e sufficiently high (in a neighborhood of $\eta_e = 1$) and β sufficiently low.

Staying in the range in which β takes low values, we next wish to show that debt is preferred to equity when η_e and ρ are both sufficiently low, and equity is preferred to debt when η_e is sufficiently low and ρ is sufficiently high. Suppose first that $\eta_e = 0$, $\rho = 0$, and $\beta > 0$ is small. Then,

$$\begin{aligned} V_{old}^1 \left(D^1 = I \,|0 \right) &= \beta [pH - pR] + R - I + \beta F \\ &= \beta p [H - R] + R - I + \beta F. \end{aligned} \tag{A18}$$

Moreover,

$$[1-\alpha]\,V^1_{old}(0,0) < V^1_{old}(0,0) - \alpha V^1_n(0,0)$$
$$= V^1_{old}(0,0) - I = R + \beta F - I. \tag{A19}$$

A comparison of (A18) and (A19) shows that debt is strictly preferred to equity for $\eta_e = 0$, $\rho = 0$. By continuity, debt is strictly preferred for η_e and ρ sufficiently small, and a sufficiently small $\beta > 0$. Now, let $\eta_e = 0$, $\rho = 1$, and a small $\beta > 0$. Then,

$$V^1_{old}\left(D^1 = I\,|1\right) = \theta\beta p\,[H-R] + R - I + \beta F, \text{ and} \tag{A20}$$

$$[1-\alpha]\,V^1_{old}(1,0) = V^1_{old}(1,0) - \alpha V^1_{old}(1,0) = V^1_{old}(1,0) - \alpha V^1_n(1,0) = V^1_{old}(1,0) - I$$
$$= p\,[H-R] + R - I + \beta F \tag{A21}$$

A comparison of (A20) and (A21) shows that equity is strictly preferred to debt for $\rho = 1$. By continuity, therefore, equity is strictly preferred to debt for η_e sufficiently small and ρ sufficiently high.

Returning to (A10), note that both the LHS and the RHS of (A10) are decreasing in β, with the LHS convex in β and the RHS linear in β. Moreover, we have proven that the LHS strictly exceeds the RHS ((A10) holds) and hence debt is strictly preferred at $\beta = 1$, whereas the RHS strictly exceeds the LHS (inequality in (A10) is reversed) and hence equity is strictly preferred at $\beta = 0$ (for η_e sufficiently high). This means that the LHS, as a function of β, must cross the RHS, as a function of β, only once at some point $\hat{\beta} \in (0,1)$. The firm will strictly prefer debt for all $\beta > \hat{\beta}$. For $\beta < \hat{\beta}$, the firm strictly prefers equity of $\eta_e > \widehat{\eta}_e$, where $\widehat{\eta}_e \in (0,1)$ is sufficiently large. For $\beta < \hat{\beta}$ and $\eta_e < \widehat{\eta}_e$, we have proven that the firm prefers equity if $\rho > \hat{\rho}$ and debt if $\rho < \hat{\rho}$.

Finally, we can prove that $\partial\widehat{\eta}_e(\beta)\big/\partial\beta > 0$. Note that for $\beta < \widehat{\beta}$, $\widehat{\eta}_e$ solves (using (6) and (11)):

$$\beta\,\{pH\rho + p\,[1-\rho]\,H - Rp\} + R - I + \beta F$$
$$= [1-\alpha]\,\{[pH\rho + \widehat{\eta}_e\,p\,[1-\rho]\,H + [1-\widehat{\eta}_e]\,p\,[1-\rho]\,R - Rp] + R + \beta F\}. \tag{A22}$$

Now consider two values of β, say $\beta_1 < \beta_2 < \widehat{\beta}$. Define

$$C(\beta) \equiv [pH\rho + \widehat{\eta}_e(\beta)\,p\,[1-\rho]\,H + [1-\widehat{\eta}_e]\,p\,[1-\rho]\,R - Rp] \text{ and}$$
$$D(\beta) \equiv \beta\,\{pH\rho + p\,[1-\rho]\,H - Rp\}.$$

Then we can write (A22) for $\beta = \beta_1$ as

$$D(\beta_1) + R - I + \beta F = C(\beta_1) + R + \beta F - \alpha\left[C(\beta_1) + R + \beta F\right]. \tag{A23}$$

Note that $\alpha\left[C(\beta_1) + R + \beta F\right] > \alpha V^1_n(\rho, \widehat{\eta}_e) = I$ because $V^1_{old}(\rho, \widehat{\eta}_e) > V^1_n(\rho, \widehat{\eta}_e)$. Thus, (A23) implies

$$C(\beta_1) + R + \beta F > D(\beta_1) + R + \beta F, \text{ or}$$
$$pH\rho + \widehat{\eta}_e(\beta_1)\,p\,[1-\rho]\,H + \left[1 - \widehat{\eta}_e(\beta_1)\right]p\,[1-\rho]\,R - Rp$$
$$> \beta_1\,[pH\rho + p\,[1-\rho]\,H - Rp]. \tag{A24}$$

■

Let $\widehat{\beta} > \beta_1$ be such that $C(\beta_1) = D(\widehat{\beta})$, i.e., (A24) holds as an equality. Then, if we choose $\beta_2 > \widehat{\beta}$, the only way to ensure that (A24) holds is to increase $\widehat{\eta}_e$ because $C(\beta)$ is increasing in $\widehat{\eta}_e$. Thus, $\widehat{\eta}_e(\beta_2) > \eta_e(\beta_1)$.

Proof of Corollary 1. Suppose that $\eta_e < \widehat{\eta}_e(\beta)$. Also suppose that $\rho \geq \hat{\rho}(\eta_e)$. Then, in the conjectured Nash equilibrium, the market believes the firm will issue equity. It thus sets the pre-equity-issuance stock price of the firm at $[1-\alpha]\, V_n^1(\rho, \eta_e)$. We know that $V_n^1(\rho, \eta_e)$ is continuously differentiable in ρ and $\partial V_n^1 \big/ \partial \rho > 0$, so $V_n^1(\rho, \eta_e)$: $[-1, 1] \times [0, 1] \to R^+$ is one-to-one in ρ and invertible (here R^+ is the non-negative real line). Moreover, from (5) we know that $\partial \alpha \big/ \partial \rho < 0$, so $[1-\alpha]\, V_n^1(\rho, \eta_e)$ is also strictly increasing in ρ and invertible in ρ. There is, therefore, a one-to-one correspondence between the stock price and ρ. Given its knowledge of ρ, management recognizes that $\rho \geq \hat{\rho}(\eta_e)$ and thus finds it optimal to issue equity (Theorem 2). This is consistent with the market's beliefs about what the firm will do, so equity is issued when the firm's pre-issuance stock price is high.

Now suppose $\rho < \hat{\rho}(\eta_e)$. In the conjectured Nash equilibrium, the market believes the firm will issue debt and sets the pre-debt-issuance stock price at $V_n^1\left(D^1 = I \,|\rho\right)$, which is continuously differentiable and increasing in ρ. With $\rho < \hat{\rho}(\eta_e)$, the manager issues debt (Theorem 2), confirming the market's belief that debt will be issued at a sufficiently low pre-issuance stock price. ■

Proof of Corollary 2. The manager seeks to maximize $[1-\alpha]\, V_{old}^1(\rho, \eta_e)$. It is straightforward to verify that $[1-\alpha(\rho, \eta_e)]\, V_{old}^1(\rho, \eta_e)$ is concave in η_e. To see this, let $Q \equiv [1-\alpha(\rho, \eta_e)]\, V_{old}^1(\rho, \eta_e)$. Then,

$$\partial^2 Q \big/ \partial \eta_e^2 = -\left[\partial^2 \alpha \big/ \partial \eta_e^2\right] V_{old}^1(\rho, \eta_e) - 2\left[\partial \alpha / \partial \eta_e\right]\left[\partial V_{old}^1(\rho, \eta_e) \big/ \partial \eta_e\right] + [1-\alpha]\left[\partial^2 V_{old}^1(\rho, \eta_e) \big/ \partial \eta_e^2\right].$$

From Lemma 2, we know that $\partial \alpha \big/ \partial \eta_e > 0$, $\partial^2 \alpha \big/ \partial \eta_e^2 > 0$. Moreover, $\partial V_{old}^1(\rho, \eta_e) / \partial \eta_e > 0$ and $\partial^2 V_{old}^1(\rho, \eta_e) \big/ \partial \eta_e^2 = 0$. Thus, it follows that $\partial^2 Q \big/ \partial \eta_e^2 < 0$. Now consider a particular η_e that is chosen at $t = 0$. The cutoff $\hat{\rho}(\eta_e)$ is given by

$$[1-\alpha(\eta_e, \hat{\rho}(\eta_e))] V_{old}^1(\hat{\rho}(\eta_e), \eta_e) = V_{old}^1(D^1 = I|\hat{\rho}(\eta_e)). \text{ This means}$$

$$[1-\alpha(\eta_e, \hat{\rho}(\eta_e))] V_{old}^1(\hat{\rho}(\eta_e), \eta_e) - V_{old}^1(D^1 = I|\hat{\rho}(\eta_e)) = 0. \tag{A25}$$

Defining and $V_{old}^1(\hat{\rho}(\eta_e), \eta_e) \equiv V_{old}^1(E)$, and $V_{old}^1(D^1 = I|\hat{\rho}(\eta_e)) \equiv V_{old}^1(D)$, and differentiating with respect to η_e,

$$\begin{aligned} dLHS/d\eta_e = {} & [1-\alpha]\left[\partial V_{old}^1(E)/\partial \hat{\rho}\right] + [1-\alpha]\left[\partial V_i^1(E)/\partial \eta_e\right] \\ & - \left[\partial \alpha / \partial \eta_e\right] V_{old}^1(E) - \left[\partial \alpha / \partial \hat{\rho}\right]\left[d\hat{\rho}/d\eta_e\right] V_{old}^1(E) \\ & - \left[\partial V_{old}^1(D) \big/ \partial \hat{\rho}\right]\left[d\hat{\rho}/d\eta_e\right] \\ = {} & 0, \end{aligned}$$

where LHS is the left-hand side of (A25). Rearranging yields

$$d\hat{\rho}/d\eta_e = \frac{-\left[\partial Q / \partial \eta_e\right]}{\left\{[1-\alpha]\left[\partial V_i^1(E)/\partial \rho\right] - \left[\partial \alpha / \partial \hat{\rho}\right] V_{old}^1(E) - \left[\partial V_{old}^1(D) \big/ \partial \hat{\rho}\right]\right\}}. \tag{A26}$$

Now, as equity is preferred if $\rho > \hat{\rho}$ and debt is preferred if $\rho < \hat{\rho}(\eta_e)$, with indifference at $\rho = \hat{\rho}(\eta_e)$, this means that

$$\partial \left\{[1-\alpha]\, V^1_{old}(E)\right\} \partial\rho \,\Big|_{\rho=\hat{\rho}(\eta_e)} > \partial V^1_{old}(D) \Big/ \partial\rho \,\Big|_{\rho=\hat{\rho}(\eta_e)}.$$

This also implies that the denominator on the RHS of (A26) is strictly positive. Moreover, given the concavity of Q in η_e, $\partial Q/\partial\eta_e > 0$ if η_e is less than the value η^0_e at which Q achieves stationarity ($\partial Q \big/ \partial \eta^0_e = 0$), given $\rho > \hat{\rho}$, and $\partial Q/\partial\eta_e < 0$ if η_e exceeds η^0_e. Thus, $\frac{d\hat{\rho}}{d\eta_e} > 0$ if η_e is relatively high, and $\frac{d\hat{\rho}}{d\eta_e} < 0$ if η_e is relatively low. ■

Proof of Corollary 3. The pre-equity-issuance stock price is $[1-\alpha]\, V^1_n(\rho, \eta_e)$. The proof follows from (3) and (4). ■

Proof of Theorem 3. The theorem assumes $\beta < \hat{\beta}$ and $\eta_e < \widehat{\eta}_e$. The pre-issuance stock price is $\widehat{V}^1_n(\rho, \eta_e)$, given by (14). We know that $\partial \left\{[1-\alpha]\, V^1_n(\rho, \eta_e)\right\} \big/ \partial\rho > \partial V^1_n\left(D^1 = I\,|\rho\right) \big/ \partial\rho$.

Moreover, $\partial V^1_n(\rho, \eta_e)/\partial\rho > 0$. A similar relationship holds for the manager's assessment.

Furthermore, $\partial \Pr\left[[1-\alpha]\, V^1_{old}(\rho, \eta_e) > V^1_{old}\left(D^1 = I\,|\rho\right)\right] \big/ \partial\rho > 0$.

Thus, increases in ρ lead to higher stock prices as well as higher probabilities of equity issuance based on the inference of ρ from stock prices, given that equity is issued when $\rho > \hat{\rho}$. ■

Proof of Corollary 4. Firms with $\rho > \hat{\rho}(\eta_e)$ issue equity, and firms with $\rho \le \hat{\rho}(\eta_e)$ issue debt. As $\partial\left\{[1-\alpha]\, V^1_{old}(\rho, \eta_e)\right\}/\partial g > 0$ and $\partial\left\{[1-\alpha]\, V^1_{old}(\rho, \eta_e)\right\}/\partial g > \partial V^1_{old}\left(D^1 = I\,|\rho\right) \big/ \partial g$ for sufficiently low β, and $\hat{\rho}(\eta_e)$ solves $[1-\alpha]\, V^1_{old}(\hat{\rho}, (\eta_e), \eta_e) = V^1_{old}\left(D^1 = I\,|\rho\right)$, it follows that $\partial\hat{\rho}(\eta_e)/\partial g < 0$. Hence, an increase in g strictly increases the number of firms for which $\rho > \hat{\rho}(\eta_e)$, leading to more equity issues. ■

Proof of Theorem 4. Consider (15b) first, which applies to $\eta_e \ge \widehat{\eta}_e$. The first-order condition for the optimal autonomy probability, η^*_e, is

$$\partial V^0_{old} \big/ \partial\eta_e = \int \left\{[1-\alpha]\left[\partial V^1_{old} \big/ \partial\eta_e\right] - [\partial\alpha/\partial\eta_e]\, V^1_{old}(\hat{\rho}, \eta^*_e)\right\} \Phi\,(d\rho/\mu_\rho) = 0. \tag{A27}$$

We now verify the second-order condition for a unique maximum (note $\partial^2 V^1_{old}(\rho, \eta^*_e) \big/ \partial\eta^2_e = 0$) :

$$\partial^2 V^0_{old} \big/ \partial\eta^2_e = -2\int [\partial\alpha/\partial\eta_e]\left[\partial V^1_{old} \big/ \partial\eta_e\right] \Phi\,(d\rho\,|\mu_\rho) - \int \left[\partial^2\alpha \big/ \partial\eta^2_e\right] V^1_{old}(\hat{\rho}, \eta^*_e)\, \Phi\,(d\rho\,|\mu_\rho). \tag{A28}$$

From Lemma 2, we know that $\partial\alpha/\partial\eta_e > 0$ and $\partial^2\alpha \big/ \partial\eta^2_e > 0$, and we use (7) to see that $\partial V^1_{old} \big/ \partial\eta_e > 0$. Thus, $\partial^2 V^o_{old} \big/ \partial\eta^2_e < 0$ and η^*_e is a unique global optimum.

The manager will first solve the problem above to calculate η^*_e. If $\eta^*_e \ge \widehat{\eta}_e$, then the manager is done. However, if $\eta^*_e < \widehat{\eta}_e$, the manager will need to solve (15a). In this case, the first-order condition is

$$\partial V_{old}^{0} \big/ \partial \eta_e = \int_{\hat{\rho}(\eta_e^*)}^{1} \left\{ [1-\alpha] \left[\partial V_{old}^{1} \big/ \partial \eta_e \right] - \left[\partial \alpha / \partial \eta_e \right] V_{old}^{1} \left(\rho, \eta_e^* \right) \right\} \Phi \left(d\rho \left| \mu_\rho \right. \right)$$
$$- \left[1 - \alpha \left(\hat{\rho} \left(\eta_e^* \right), \eta_e^* \right) \right] V_{old}^{1} \left(\hat{\rho} \left(\eta_e^* \right), \eta_e^* \right) \left[d\hat{\rho} / d\eta_e^* \right]$$
$$+ V_{old}^{1} \left(D^1 = 1 \left| \hat{\rho} \left(\eta_e^* \right) \right. \right) \left[d\hat{\rho} / d\eta_e^* \right]$$
$$= 0. \tag{A29}$$

Using (A25), we can simplify (A29) to

$$\partial V_{old}^{0} \big/ \partial \eta_e = \int_{\hat{\rho}(\eta_e^*)}^{1} \left\{ [1-\alpha] \left[\partial V_{old}^{1} \big/ \partial \eta_e \right] - \left[\partial \alpha / \partial \eta_e \right] V_{old}^{1} \left(\hat{\rho}, \eta_e^* \right) \right\} \Phi \left(d\rho \left| \mu_\rho \right. \right) = 0. \tag{A30}$$

The second-order condition is

$$\partial^2 V_{old}^{0} \big/ \partial \eta_e^2 = -2 \int_{\hat{\rho}(\eta_e^*)}^{1} \left[\partial \alpha / \partial \eta_e \right] \left[\partial V_{old}^{1} \big/ \partial \eta_e \right] \Phi \left(d\rho \left| \mu_\rho \right. \right)$$
$$- \int_{\hat{\rho}(\eta_e^*)}^{1} \left[\partial^2 \alpha \big/ \partial \eta_e^2 \right] V_{old}^{1} \left(\hat{\rho}, \eta_e \right) \Phi \left(d\rho \left| \mu_\rho \right. \right) + K < 0, \tag{A31}$$

where $K \equiv - \left[\frac{d\hat{\rho}}{d\eta_e^*} \right] \left[\frac{\partial Q}{\partial \eta_e^*} \right]$ and Q was defined in the proof of Corollary 2. From the proof of Corollary 2, we also know that $\frac{d\hat{\rho}}{d\eta_e^*}$ and $\partial Q / \partial \eta_e^*$ take opposite signs. Thus, $K > 0$. This means that even though the terms other than K are negative, we cannot guarantee that $\partial^2 V_{old}^{0} \big/ \partial \eta_e^2 < 0$. However, any $\eta_e^* < \widehat{\eta}_e$ must satisfy the stationarity condition (A30). To see why this is also true for $\eta_e^* \leq \widehat{\eta}_e$, note that if $V_{old}^{0} \left(\mu_\rho, \widehat{\eta}_e \right)$ exceeds $V_{old}^{0} \left(\mu_\rho, \eta_e^* \right) \forall \eta_e^* < \widehat{\eta}_e$ and $\partial V_{old}^{0} \big/ \partial \eta_e > 0$ at $\widehat{\eta}_e$, then clearly $\eta_e^* > \widehat{\eta}_e$ and we are solving a different optimization for which the second-order condition for a unique optimum, η_e^*, has already been verified. Thus, (A30) must be zero for any candidate $\eta_e^* \leq \widehat{\eta}_e$. If multiple η_e's satisfy (A30), with all being less than $\widehat{\eta}_e$, then the η_e^* chosen is $\underset{\eta_e \in [0, \widehat{\eta}_e)}{\arg\max} \left\{ V_{old}^{0} \left(\mu_\rho, \eta_e \right) \right\}$. ■

Proof of Corollary 5. The manager maximizes $V_{old}^{0} \left(\mu_\rho, \eta_e \right)$ at $t = 0$. Now consider a specific mean of ρ, μ_ρ^1, corresponding to a distribution Φ^1. Consider a first-order-stochastic dominance (FOSD) shift in this distribution to Φ^2, with a corresponding mean μ_ρ^2. Now, let $\eta_e^* \left(\mu_\rho^1 \right)$ and $\eta_e^* \left(\mu_\rho^2 \right)$ be the optimal autonomy probability choices corresponding to μ_ρ^1 and μ_ρ^2, respectively. Observe from (15a) and (15b) that holding η_e fixed and taking an increase in μ_ρ as an FOSD shift of the distribution, we have $\partial V_{old}^{0} \big/ \partial \mu_\rho > 0$, because $\partial \alpha / \partial \rho < 0$, $\partial V_{old}^{1} (\rho, \eta_e) / \partial \rho > 0$, and $\partial V_{old}^{1} \left(D^1 = I \left| \rho \right. \right) \big/ \partial \rho > 0$. Thus,

$$V_{old}^{o} \left(\mu_\rho^1, \eta_e^* \left(\mu_\rho^1 \right) \right) < V_{old}^{o} \left(\mu_\rho^2, \eta_e^* \left(\mu_\rho^1 \right) \right) < V_{old}^{o} \left(\mu_\rho^2, \eta_e^* \left(\mu_\rho^2 \right) \right).$$

This proves $d\eta_e^* / d\mu_\rho > 0$. ■

Proof of Corollary 6. The proof requires showing that $d\eta_e^* / dI < 0$. Totally differentiating the first-order condition (A27),

$$d\eta_e^*/dI = \frac{\int [\partial\alpha/\partial I]\left[\partial V_{old}^1(\rho,\eta_e)/\partial\eta_e\right]\Phi\left(d\rho\,|\mu_\rho\right)}{-\int\left\{2\left[\partial\alpha/\partial\eta_e\right]\left[\partial V_{old}^1(\rho,\eta_e)/\partial\eta_e\right]+\left[\partial^2\alpha/\partial\eta_e^2\right]V_{old}^1(\rho,\eta_e)\,\Phi\left(d\rho\,|\mu_\rho\right)\right\}}.$$

As $\partial\alpha/\partial I = \frac{1}{V_n^1(\rho,\eta_e)} > 0$, α is increasing and convex in η_e (Lemma 2), and $\partial V_{old}^1(\rho,\eta_e)/\partial\eta_e > 0$, we have $d\eta_e^*/dI < 0$. This means that if the manager uses internal cash to reduce I, η_e^* will optimally increase. ■

Proof of Theorem 5. From standard results, we know that maximizing the wealth of the initial shareholders is equivalent *ex ante* to maximizing the total value of the firm. Let $S_n^1(\rho,\eta)$ be the investors' assessment of the share of firm value going to new investors. Let $V_{old}^1(\rho,\eta)$ be the total value of the firm as assessed by the manager (and initial shareholders) and $S_{old}^1(\rho,\eta)$ be the manager's assessment of this share. The manager makes his project choice, c, to maximize $V_{old}^1(\rho,\eta,c) - S_{old}^1(\rho,\eta,c)$ subject to $S_n^1(\rho,\eta,c) = I$. Now consider case (1). Without disagreement and any possible investment distortions, it is clear that η is irrelevant, as the manager and investors both prefer the same (value-maximizing) project. Moreover, without disagreement, $S_n^1(\rho,\eta,c) = S_{old}^1(\rho,\eta,c) = I$, so the manager is indifferent to debt or equity.

Next, consider case (2) and suppose new investors have an investment distortion incentive. Suppose, counterfactually, that $\eta \in (0,1)$. Then, *ex post* in the state in which investors prefer the non-value-maximizing project, the manager can get them to relinquish control to the manager by offering to pay them a higher share of the project payoff, so that investors expect an arbitrarily small $\varepsilon > 0$ above their payoff with their original share of the non-value-maximizing project's payoff. Investors will accept and the manager will be better off choosing the value-maximizing project, which means $\eta \in (0,1)$ is not renegotiation-proof. The proof of the case in which the manager has the distorted investment incentive is similar.

Now consider case (3). If riskless debt can be issued to raise \$$I$, then it is obvious from the analysis thus far that debt dominates equity with $\rho < 1$. So, consider risky debt with $V_{AIP} = 0$ almost surely, $R = I$, $p = 1$, and $H > I > L$. The proof is similar with $R > I$ and $p < 1$. Let η_e be the optimal autonomy with equity and η_d be the optimal autonomy with debt. With equity, the manager chooses his project to maximize $[1-\alpha]\,V_{old}^1(\rho,\eta_e,c)$ subject to $\alpha V_n^1(\rho,\eta_e,c) = I$. Then we can write $\alpha V_n^1(\rho,\eta_e,c) = \alpha\left[\rho H + [1-\rho]\,\widehat{L}\right] = I$, where $\widehat{L} \equiv \eta_e L + [1-\eta_e]\,I < I$. With debt, the manager maximizes $V_{old}^1(\rho,\eta_d,c) - S_{old}^1(\rho,\eta_d,c)$ subject to $S_n^1(\rho,\eta_d,c) = I$. If D is the firm's debt repayment obligation, then replacing η_d with η_e (which implies a weakly dominated payoff with debt for the manager relative to using η_d), we can write $S_n^1(\rho,\eta_e,c) = \rho D + [1-\rho]\,\widehat{L} = I$. Now, differentiating the equity pricing condition, we have

$$d\alpha/d\rho = \frac{-\alpha\left[H-\widehat{L}\right]}{\left\{\rho\left[H-\widehat{L}\right]+\widehat{L}\right\}}, \tag{A32}$$

and differentiating the debt pricing condition, we have

$$dD/d\rho = \frac{-\left[D-\widehat{L}\right]}{\rho}. \tag{A33}$$

It is clear that the manager prefers the security that implies a lower financing cost for the initial shareholders. The financing cost with equity as assessed by the manager, call it EC, is $EC = \alpha V_{old}^1(\rho,\eta_e,C) = \alpha[\rho H + [1-\rho]\hat{H}]$, where $\hat{H} \equiv \eta_e H = [1-\eta_e]I$, and with the debt financing cost assessed by the manager, call it DC, is $DC = \rho D + [1-\rho]\hat{D}$, where $\hat{D} \equiv \eta_e D + [1-\eta_e]I$. Clearly, at $\rho = 1$, these financing costs are equal at the equilibrium values of α and D. Then, for any fixed η_e

$$\partial EC/\partial\rho = \alpha\left[H-\hat{H}\right] + \left[\rho H + \{1-\rho\}\,\hat{H}\right]\left[d\alpha/d\rho\right] = \alpha\left[H-\hat{H}\right] - \frac{\alpha\left[H-\hat{L}\right]\left[\rho H+\{1-\rho\}\hat{H}\right]}{\left[\rho H+[1-\rho]\hat{L}\right]}$$
$$< 0 \text{ since } H > \hat{H} > \hat{L}.$$

In addition, $\left|\frac{\partial EC}{\partial\rho}\right| > -\alpha\left[H-\hat{H}\right]+\alpha\left[\hat{H}-\hat{L}\right]$. Similarly, $\frac{\partial DC}{\partial\rho} = \left[\frac{\hat{\rho}dD}{d\rho}\right] + [1-\rho]\eta_e\frac{dD}{d\rho} + D-\widehat{D}$. If we use (A33) and a little algebra, we can see that $\left|\frac{\partial DC}{\partial\rho}\right|_{\rho=1} = \eta_e D+[1-\eta_e]I-\widehat{L} = \widehat{D}-\widehat{L}$. Thus, $\left|\frac{\partial EC}{\partial\rho}\right|_{\rho=1} > \alpha[\hat{H}-\hat{L}] > [\hat{D}-\hat{L}] = \left|\frac{\partial DC}{\partial\rho}\right|_{\rho=0}$. To see this, note that after substituting for α, $\widehat{H}$, $\widehat{L}$, $\widehat{D}$, and D all evaluated at $\rho = 1$ and simplified, proving that $\alpha[\widehat{H}-\widehat{L}] > [\widehat{D}-\widehat{L}]$ requires only showing that $I[H-L] > H[I-L]$, which is true because $I < H$. Moreover, $\partial^2 EC\big/\partial\rho^2 > 0$ and $\partial^2 DC\big/\partial\rho^2 > 0$. Now, note that $\rho_{\min} > 0$ is the minimum ρ, such that external financing of I can be raised (i.e., $V_n^1(\rho_{\min},\eta_e) = I$ and $\rho_{\min}H + \left[1-\rho_{\min}\right]\widehat{L} = I$), and $\rho_{\min}$ is identical across debt and equity, with $EC = DC$ at $\rho_{\min}$. As $EC = DC$ at $\rho = 1$, both EC and DC are convex in ρ, and $\left|\partial EC\big/\partial\rho\right|_{\rho=1} > \left|\partial DC\big/\partial\rho\right|_{\rho=1}$, it follows that $EC > DC\forall\rho\in(\rho_{\min},1)$, so debt strictly dominates equity $\forall\rho\in(\rho_{\min},1)$. The proof of case (4) follows from the earlier results in the article. ■

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