LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

THEORIES OF THE EFFECTS OF DELEGATED PORTFOLIO MANAGERS' INCENTIVES

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Declaration

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

I warrant that this authorization does not, to the best of my belief, infringe the rights of any third party.

I confirm that Chapter 3 is jointly co-authored with Amil Dasgupta and Chapter 4 with Jason Roderick Donaldson.

Abstract

Delegated portfolio managers, such as hedge funds, mutual funds and pension funds, play a crucial role in financial markets. While it is well-known that their incentives are misaligned with those of their clients, the consequences of this misalignment are understudied. This thesis studies the effects of delegated portfolio managers' incentives in the real economy, in corporate governance and in portfolio allocation.

In the first paper, "Do Institutional Investors Improve Capital Allocation?" I show that delegated portfolio managers' misalignment of incentives—which I model as their career-concerns—has real and positive economic effects. I find that delegated portfolio managers allocate capital more efficiently than other investors who do not face similar incentives; this promotes investment, fosters firms' growth, and enriches shareholders.

In the second paper, "The Wall Street Walk When Investors Compete for Flows", Amil Dasgupta and I show a negative side of delegated portfolio managers' career-concerns. When delegated portfolio managers hold blocks of shares in firms, the more they care about their careers, the less effectively their exit threats discipline firm managers. Our result generates testable implications across different classes of funds: only those funds who have relatively high-powered incentives will be effective in using exit as a governance mechanism.

Finally, the third paper, “Investment Mandates and the Downside of Precise Credit Ratings”, co-authored with Jason Roderick Donaldson, studies whether the misalignment of incentives between delegated portfolio managers and their investors are tempered with contracts based on precise credit ratings. Surprisingly, we find that while, at equilibrium, portfolio managers write contracts making reference to credit ratings, this is inefficient; in particular, as the rating's precision increases everyone is worse off.

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Contents

Chapter 1

Introduction

In this thesis I study the effects of delegated portfolio managers' incentives in corporate finance, in corporate governance and in portfolio selection.

Nowadays, delegated portfolio managers are the main holders of public equity and blocks of shares in the United States. They invest on behalf of others and thus respond to different incentives from individual investors—the usual actors in finance models. They do not care about portfolio returns alone, but also about their reputation: they must retain old clients and gain new ones to expand their assets under management.

The first paper, "Do Institutional Investors Improve Capital Allocation?", studies delegated portfolio managers in a corporate finance framework. Adverse selection in financial markets increases firms' cost of external finance and may be so severe as to hinder constrained firms' investment. Speculators can reduce firms' adverse selection problems associated to external financing by acquiring information and impounding it into prices via their trades. As information about good firms gets reflected by prices, firms' cost of funding decreases, allowing them to raise capital more cheaply. I show that the agency problem caused by delegated portfolio mangers improves capital allocation: they have better incentives to provide information than individual investors. In fact, individual investors underprovide information generating an externality on firms' investment: they acquire information only when they can hide it, otherwise they cannot profit from it. Heterogeneous delegated portfolio mangers (funds) populate markets, some are skilled and some aren't, and only skilled funds can learn about firm quality. Skilled funds endogenously want to convey their information to attract clients and to grow their assets under management. But they can do so only when firms invest: When firms fail to obtain funding, they do not undertake their projects and the market learns neither about their true quality nor about funds' skills. To induce firms to invest, skilled speculators must acquire information and impound it into prices, and thereby reduce firms' financial constraints. But, on the other hand, unskilled funds trade in the hope of getting lucky, distorting order flows and potentially hampering the allocative role of prices. Unskilled funds behave, at equilibrium, like endogenous noise traders, but, surprisingly, it is their excessive trading that increases price informativeness and decreases good firms' cost of capital.

While in the first paper I unveil a positive side of delegated portfolio mangers' agency frictions on firms' financing constraints, in the second paper with Amil Dasgupta, "The Wall Street Walk When Investors Compete for Flows", I show that they impede corporate governance. Amil Dasgupta and I re-examine the corporate governance problem—the potential for managers of public firms to act against the interests of shareholders—within the contemporary context in which the true stakeholders are not in fact the owners: shareholders are typically institutional investors. Thus there is a two-layered agency problem, firstly between the firm and the fund and secondly between the fund and its investors. Rather than look at blockholders' ability to exert influence over managers by direct monitoring or interference—so-called voice—we focus on their liquidating their blocks or credibly threatening to—termed their exit—as a means to discipline management. Admati and Pfleider in their 2009 paper, model a dissatisfied blockholder selling his shares and show that the manager's anticipation of the blockholder's liquidation combined with market-indexed performance pay, suffices to induce him to act in the interest of all shareholders. We show that fund managers' concern for investor flows may prevent them from credibly threatening the manager by exit. When blockholding is delegated, exit may be informative about the ability of funds to generate value for investors and thus affects investor flows. The signalling role of exit impairs its disciplinary potential, undermining Admati and Pfleiderer's exit threat as a governance mechanism. Our result generates testable implications across different classes of funds: only those funds who have relatively high powered incentives will be effective in using exit as a governance mechanism.

In my paper with Jason Roderick Donaldson, "Investment Mandates and the Downside of Precise Credit Ratings", I set aside the career-concerns of delegated portfolio managers, to study the optimal contract between competing risk-averse delegated portfolio managers and their risk-averse clients, when a public signal about the underlying risk of an asset is contractible. The optimal contract is affine in wealth and implements both efficient investment and optimal risk sharing for each realization of the public signal, but agents' competition drives them to write the public signal into their contracts and prevent risk sharing over it. We show that increasing the signal's precision makes everyone worse off. The public signal may be a rating from a credit rating agency and delegated portfolio managers often tie their hands making explicit reference to credit ratings in their investment mandates. This practice leads to inefficient risk sharing; the inefficiency is more severe when the precision of the public signal increases. Since credit ratings are a primary example of public signals upon which delegated portfolio managers contract, we advocate regulation of credit rating agencies to prohibit their publishing information in forms conducive to their inclusion in rigid contracts. Our suggestion jives with regulators' assertions that institutions should quit responding robotically to ratings, as rigid contingent contracts fine-tuned to CRA announcements force them to.

Chapter 2

Do Institutional Investors Improve Capital Allocation?

2.1 Introduction

A fundamental task of the economy is to allocate capital efficiently, thus fostering economic growth. The stock market plays a crucial role in the efficient allocation of capital by aggregating information in prices and thereby mitigating the adverse selection problem associated with external financing. With asymmetric information prices may diverge from firms' fundamentals; this inhibits the flow of capital to good firms and prevents them from undertaking projects that generate positive net present value (NPV). Hence speculators' information acquisition and trade are both needed to mend markets: as information about a good firm becomes reflected in its stock price, the firm's cost of funding decreases, and this allows it to raise capital more cheaply.

Institutional investors have replaced individual investors as both capital providers and speculators.[1] Yet, even though they are now the main holders of public equity,

[1] There is considerable evidence for these facts. For example, Michaely and Vincent (2012) find that, by the end of 2009, institutional investors held 70 per cent of the aggregate US market capitalization.

their role in channeling funds efficiently has been neglected. How do institutional investors affect the allocation of capital? I contrast their role with the more generally studied one of individual investors.

Profit-maximizing speculators underprovide information, as expressed famously by the Grossman and Stiglitz (1980) paradox.[2] Speculators are willing to pay for information only if prices are noisy. As pointed out by Dow, Goldstein and Guembel (2011), the underprovision problem takes an extreme form when prices not only reflect but also influence fundamentals. In that case, speculators have little room to profit from market inefficiency even when prices are noisy. Low prices, which induce firms to cancel their investments, are perfectly informative in a self-fulfilling way. Speculators then have only weak incentives to acquire information, generating a negative externality on firms' investment.[3]

I ask whether delegated portfolio managers, a large class of institutional investors, help to solve the underprovision of information problem when prices feed back into investment. Many delegated portfolio managers respond mainly to implicit incentives linked to the value of assets under management. Thus they respond to so-called reputation concerns: such managers seek to increase flows by impressing investors, retaining old clients, and gaining new ones.[4] An example is given by US mutual funds, which do

According to Aggarwal, Prabhala and Puri (2002), the majority of equity in initial public offerings is allocated to institutional investors, and the Flow of Funds data provided by the Federal Reserve indicate that institutional investors hold nearly 86 per cent of the corporate bonds in the US corporate bond markets.

[2]If market prices reflected information fully, then profit-maximizing speculators would have no incentive to acquire it.

[3]The price at which a speculator and his counterparty transact conveys information to the funding market—a transaction spillover from the secondary to the primary market—and thus affects the firm's cost of capital.

[4]Empirical literature (see, e.g., Chevalier and Ellison (1997) and Sirri and Tufano (1998)) document

not charge performance fees and instead bill clients only a fixed percentage of assets under management.[5] I shall refer to such investors as *career-concerned* speculators.

Both the policy debate and the academic literature have demonstrated the negative effects of delegated portfolio managers' agency frictions on, for example, corporate governance and asset prices.[6] It has often been suggested that delegated portfolio managers should charge performance fees in order to align fund managers' interests with those of their clients, but there is only limited evidence supporting the benefits of such fees.[7] I discover a positive effect of portfolio managers' implicit incentives that has been largely neglected by the finance literature; I show that they assist prices in their allocative role.

In my model, heterogeneous delegated portfolio mangers, *funds*, populate markets; some are skilled and some are not, but only skilled funds can learn about firm quality. Funds are interested only in the growth of their assets under management. To attract clients, skilled funds want to signal their ability. However, doing so requires that firms raise capital and invest. Firms that fail to obtain funding do not undertake their projects, so the market learns neither about their true quality nor about funds' skills. Skilled speculators can induce firms to invest only by acquiring information and then impounding it into prices, thus reducing firms' financial constraints. Yet unlike

the strong relationship between an institutional investor's past performance and the flow of clients' funds: clients invest mainly with those that have out-performed in the past. Berk and Green (2004) demonstrate that this dynamic is theoretically consistent with clients searching for skilled management in order to maximize their own wealth.

[5]Elton, Gruber and Blake (2003) find that, in 1999, only 1.7 per cent of all bond and stock mutual funds charged performance fees.

[6]See, for example, Dasgupta and Piacentino (2012), Dasgupta and Prat (2008), Dasgupta, Prat and Verardo (2011a), Guerrieri and Kondor (2012), and Scharfstein and Stein (1990).

[7]Elton et al. (2003) show that, on average, the mutual funds that charge higher performance fees take on more risk; however, there is only weak evidence of higher returns resulting from this strategy.

individual investors, funds trade even when they are unskilled; this distorts order flows and may well hamper the allocative role of prices. However, I show that in equilibrium the negative effect of trading by an unskilled speculator complements the positive effect of the skilled speculator transmitting information via prices and thus serves to augment the beneficial effects of delegated portfolio management on capital allocation.

I use an extensive game of incomplete information to model an environment with asymmetric information between firms and capital providers. Good firms have positive NPV projects while bad firms have negative NPV ones, but bad firms' managers are willing to undertake them nonetheless because they gain private benefits from doing so. Firms rely on external finance to undertake their own projects because they have no cash, no mortgageable assets, and no access to credit—they are holding an asset that the market believes to have negative NPV. With no other information, the market breaks down and no investment takes place.

In order to avoid this fate, firms may rely on speculators to acquire information and trade, thus relaxing the firm's financial constraints by allowing it to raise funds more cheaply. Firms in the model presented here raise funds via equity—in particular, via a seasoned equity offering (SEO). I focus on equity finance because it is the most relevant form of funding for the firms being modeled: listed corporations with projects having negative average NPV and with no assets in place.[8]

Markets in the model are populated by a large speculator and a number of liquidity traders. The speculator is either profit maximizing or career concerned and may be

[8]Equity, as Myers and Majluf (1984) predict, is the financing instrument of last resort. Recent empirical evidence (see, e.g., DeAngelo, DeAngelo and Stulz (2010) and Park (2011)) suggests a strong correlation—in line with my assumption of negative NPV projects—between a firm's decision to issue equity and financial distress.

either skilled or unskilled. The skilled speculator can acquire perfect information about a firm's quality at a cost, whereas the unskilled speculator faces an infinite cost of acquiring information. The speculator trades with the liquidity traders; then, after observing the aggregate order flow, competitive risk-neutral market makers set the price while taking into account the effect that the price will have on a firm's ability to raise the required funds.

Firms issue public equity. In the baseline model I leave the mechanism by which firms issue equity unmodeled, but this mechanism is modeled explicitly in Section 2.3. The price set by the market maker determines the success of fund raising because it contains information that allows capital providers to update their beliefs about the firm's quality.

I begin by characterizing two equilibria in which the skilled speculator acquires information: one when he is profit maximizing and one when he is career concerned. I find that career-concerned speculators allocate capital more efficiently than do profit-maximizing speculators, which enables firms to fund a larger fraction of projects that have, on average, positive NPV. I also find that, under reasonable restrictions on the parameters, career concerns yield additional benefits at the level of both the firm and the economy. In particular, speculators' career concerns decrease total corporate losses brought about by undertaking bad projects and not undertaking good ones, and they reduce the underpricing of good firms.

Prices play a crucial role when they reflect information when it is "pivotal" for investment—that is, when the market would break down in the absence of such information. So, when information is pivotal for investment, prices that are more informative make it easier for good firms to raise funds and thus to undertake more expensive projects.

It is critical for price informativeness that the speculator be willing to acquire information when it is reflected by the price. Unlike the skilled profit-maximizing speculator, the skilled career-concerned speculator welcomes high and informative prices because they maximize the firm's investment; recall that only when investment is undertaken can the market learn the firm's true quality, thus allowing a skilled speculator to show off his ability. A profit-maximizer does not benefit from the firm's undertaking good investments when prices are already high.

Whereas an unskilled profit-maximizing speculator does not trade at equilibrium, an unskilled career-concerned speculator always trades. The former suffers a loss from trading fairly priced shares; the latter seeks to avoid revealing his lack of skill and therefore disguises himself as the skilled trader who always trades. Since he has no information about the firm's quality, he randomizes between buying and selling.

A skilled career-concerned speculator is keen for informative prices; he acquires information, follows his signal, and embeds the information into prices. Yet this positive effect on prices may be hindered by the random trading of an unskilled career-concerned speculator. Fortunately, the extra noise so generated in the order flow does not destroy the price's informativeness. In fact, the unskilled speculator trades in an unusual way: he sells relatively more often than he buys owing to the feedback (between prices and investment) that makes firm value endogenous. When the firm does not invest speculators are indistinguishable. Since the skilled speculator is always correct and since selling increases the possibility of investment failure, and thus of the unskilled pooling with the skilled, it follows that the feedback effects induce an unskilled speculator to sell frequently.

Because the unskilled speculator is usually selling, buy orders are likely to have come from a positively informed speculator in the career-concerned case. Thus, when prices matter for investment, they are more informative when speculators are career concerned than when they are profit maximizing.

I proceed to explore the effects of career concerns on economic welfare and on firms' wealth. The model predicts that, when prices are noisy, two inefficiencies can arise: bad projects may be funded and good ones may not be. For a wide range of parameters I find that firms invest less, at equilibrium, when career-concerned speculators trade than when profit maximizing speculators do. When the average NPV of the project is negative, undertaking bad projects is more costly for the economy than not undertaking good ones; hence career-concerned speculators reduce total inefficiency by curtailing their investment. At the firm level, a trade-off between profit-maximizing and career-concerned speculators arises when good firms hold less expensive projects. Although good firms are less likely to raise funds through a career-concerned speculator, when they do so it is (on average) at a lower cost of underpricing. Because the latter effect dominates the former, shareholder wealth is higher when career-concerned than when profit-maximizing speculators trade.

The baseline model is extended in Section 2.3 to accommodate one mechanism by which firms raise funds: a seasoned equity offering. I show that all the results from the baseline model still hold, and I prove the additional result that career-concerned speculators reduce the SEO discount.

This extension builds on the model of Gerard and Nanda (1993), adding a few ingredients to it. Extending the baseline model to incorporate an SEO requires adding some features—mainly, a stage that follows secondary market trading and in which firms choose the price at which to raise funds. The firm sets the SEO price so as to ensure its success and to compensate uninformed bidders for the "winner's curse" (à la Rock (1986)). The result is that SEO prices are often set lower than secondary market prices; the difference is known as the discount.

The SEO mechanism may exacerbate the effect of insufficient information on capital allocation given firms' discounts further inhibit their ability to raise funds. In addition to making market prices more informative, career-concerned speculators reduce the discount firms must offer by mitigating the effects of rationing (via the winner's curse) on capital providers' willingness to pay.

The SEO model allows me to engage with the literature on price manipulation and show that a speculator does not manipulate prices; in other words, he does not trade against his private information in the secondary market. Contrary to Gerard and Nanda's ((1993)) result, I show that a positively informed profit-maximizing speculator does not manipulate prices when prices feed back into investment: by selling or not trading, he depresses the price of the good firm; this causes the SEO to fail, in which case the speculator makes no profits. Likewise, by showing that neither does the unskilled speculator manipulate prices, I engage with Goldstein and Guembel's (2008)'s result that—when projects have ex ante positive NPV—the unskilled profit-maximizing speculator manipulates prices via selling.

This paper is closely related to recent empirical literature investigating the role of institutional investors in SEOs, which has uncovered positive effects of institutional investors on SEOs that are in line with my theoretical results. Chemmanur, He and Hu (2009) analyze a sample of 786 institutions (mutual funds and plan sponsors) who traded between 1999 and 2005. They find that greater secondary market institutional net buying and larger institutional share allocations are associated with a smaller SEO discount—consistent with my finding that the discount is larger when individual than when institutional investors trade. They also find that institutional investors do not engage in manipulation strategies before the SEO. In particular, more net buying in the secondary market is associated with more share allocations in the SEO and more post-offer net buying. These results accord with my finding that there is no price manipulation at equilibrium.

Gao and Mahmudi (2006) highlight the substantial monitoring role of institutional investors in SEOs, finding that firms with higher proportions of institutional shareholders have better SEO performance and are more likely to complete announced SEO deals. This evidence supports my model's prediction that firms whose SEO is subscribed to by institutional investors can invest in more expensive projects and thus, on average, perform better post-SEO than do those subscribed to by individual investors. It also supports the idea that institutional investors reduce the probability that bad projects are undertaken.

This paper is related as well to the research addressing the relation between stock prices and corporate investment. There is a wide empirical literature questioning whether the stock market is anything more than a side show.[9] Durnev, Morck and

[9]Levine (2005) summarizes the literature on the relationship between financial systems and growth, concluding that stock markets do matter for growth.

Yeung (2004) show that more informative stock prices facilitate more efficient corporate investment. My model suggests another question that could be investigated cross-sectionally: In a sample of distressed firms, do those with more institutional ownership exhibit greater price informativeness?

The results reported here hold also for cases other than firms raising funds via outside equity. In fact, if prices are more reflective of fundamentals with career-concerned than with profit-maximizing speculators, then investment responds more when those of the former type trade, and the firm's cost of capital should decrease irrespective of how funds are raised. In Section 2.4.1 I show that, conditional on issuing debt, career-concerned speculators loosen firms' financial constraints.

In the baseline model the speculator is one of two extremes: he can be either profit maximizing or career concerned. In Section 2.4.2, the baseline model is extended to incorporate a speculator who cares about profits *and* reputation. The results of the baseline model obtain in the limits (i.e., as the speculator cares about only profits or only reputation). I also extend the baseline model so that career-concerned and profit-maximizing speculators can trade together: Section 2.4.3 identifies a sufficient condition for the main result—that career-concerned speculators relax firms' financial constraints—to hold.

The rest of the paper is organized as follows. After the literature review in Section 2.1.1, Section 2.2 introduces the baseline model and finds the two equilibria where the profit-maximizing and career-concerned speculators acquire information. Section 2.2.3 compares the benefits created by career-concerned speculators with those created by profit-maximizing ones, and Section 2.3, solves for the seasoned equity model.

Section 2.4 extends the baseline model to include the firm's issuance of debt, preferences of a more general nature, and simultaneous trading of profit-maximizing and career-concerned speculators. Section 2.5 concludes.

2.1.1 Review of the Literature

This paper brings together two influential strands of literature. One is the feedback effect literature, which studies the fundamental role of prices in aggregating information and allocating resources efficiently. The other is research addressing the role of career-concerned speculators in finance—and especially in asset pricing.

The feedback effects literature underscores two important implications of the fundamental role of asset prices: They influence investment, firstly, by driving managerial learning (Dow et al. (2011), Dow and Gorton (1997), Goldstein, Ozdenoren and Yuan (2012), Subrahmanyam and Titman (2001)) and secondly, by affecting financing decisions (Baker, Stein and Wurgler (2003), Fulghieri and Lukin (2001)) thorough their impact on the cost of equity. In each case, research focuses on the feedback loop whereby prices reflect information about the cash flows and also influence them. In the managerial learning channel, prices guide managers toward undertaking good projects; in the financing channel, prices allow good firms to raise funds more cheaply and so reduce their the cost of capital.

The paper of Dow et al. (2011) is the closest to mine in spirit despite its use of the managerial learning channel rather than the equity financing channel. They point out that, in order for prices to perform their allocative role and guide managers' decisions, speculators must have the incentive to acquire information and then to trade, thus impounding their information into prices. But, if speculators are profit maximizing then, as the likelihood that a firm does not invest increases, the more likely their information is to lose its speculative value; this may lead to a drop in investment and market breakdown. The authors show that there is low information acquisition when a firm's fundamentals are low (e.g. in a recession). I introduce career concerns as a potential solution to this problem.

My paper is also closely related to Fulghieri and Lukin (2001), who study firms' preferences for debt versus equity when profit-maximizing speculators can produce noisy information on the firm's quality but when the average quality of the industry is ex ante positive. Information acquisition is also key to their paper; however, they study how the quantity of information produced in markets is affected by firms' capital structure decisions whereas I study how it is affected by speculators' preferences.

My paper extends the career concerns literature by revealing a new, positive dimension of career-concerned speculators. In particular, papers such as Dasgupta and Prat ((2006), (2008)), Dasgupta et al. (2011a), Guerrieri and Kondor (2012), and Scharfstein and Stein (1990) show that unskilled speculators' inefficient actions lead to an increase in noise and to excessive amounts of trading volume, price volatility and risk taking. Although my study confirms that unskilled speculators generate endogenous noise and increase trading volume, I find that they increase price informativeness when it is relevant for investment and benefit the economy and shareholders of good firms in a number of different ways.

Few papers attempt to model institutional investors' career concerns. I borrow delegated asset managers' payoffs from Dasgupta and Prat's ((2008)) in reduced form.

This allows me to abstract from the relationship of the fund and its clients that the authors have extensively explored, and that I take as given, in order to concentrate on the relationship between the fund and firms. Other notable exceptions are Guerrieri and Kondor (2012) and Berk and Green (2004). Guerrieri and Kondor show the emergence of career concerns among speculators in a defaultable bond market with labor market competition among portfolio managers. Berk and Green derive funds' career concerns endogenously in a model with competition, but they use an optimal contracting set up in which funds have market power.

Finally, Chemmanur and Jiao (2011) model an SEO theoretically in order to study the effect of institutional investors on underpricing and on the SEO discount. In their model, unlike mine, institutional investors do not face career concerns. Instead they are all profit-maximizing individuals who acquire information if they can profit from it. Whereas I study how speculators' preferences affect secondary market prices and discounts, Chemmanur and Jiao explore good firms' incentives to stimulate institutional investors' information acquisition in both the secondary market stage and the bidding stage. They report two main empirical findings. First, SEOs with greater secondary market buying by institutional investors experience more oversubscription and lower discounts. Second, higher discounts are associated with a greater extent of adverse selection faced by firms.

2.2 Baseline Model

2.2.1 Model

Firms and Projects

In my model economy there are two types of firms $\Theta \in \{\mathrm{G}, \mathrm{B}\}$, where G stands for "good" and B for "bad". A firm of type Θ is endowed with a project that costs I and pays off V_Θ. The firm's type is private information, and outsiders hold the prior belief θ that the firm is good. Only good firms' projects are profitable; in fact, $V_{\mathrm{G}} - I > 0 > V_{\mathrm{B}} - I$. Managers are in charge of the investment decision. Whereas the incentives of good firms' managers are aligned with those of shareholders, bad firms' managers secure private benefits when projects are implemented and so create an agency problem. Managers of bad firms are thus willing to undertake negative NPV projects.[10]

For simplicity, I assume that firms have no cash or any other assets in place.[11] The only exception is an old project $\tilde{\chi}$ that will pay off I with (small) probability ϵ[12]—thus, $\mathbb{P}(\tilde{\chi} = I) = \epsilon$—and will otherwise pay off zero. So, unless this project succeeds, the firm cannot self-finance its project. Furthermore, each firm holds a project that is viewed by the market as having negative NPV:

$$\bar{V} - I := \theta V_{\mathrm{G}} + (1 - \theta) V_{\mathrm{B}} - I < 0; \tag{2.1}$$

hence this project cannot be mortgaged to raise funding.

[10] This is in line with Jensen's (1986) overinvestment and empire building.

[11] In fact, my results depend only on the non-pledgeability of any assets in place—in other words, on the assumption that firms can no longer mortgage their assets to fund themselves.

[12] This asset adds uncertainty to players' payoffs and thus refines away unreasonable equilibria even as $\epsilon \to 0$.

Firms are publicly traded with a number n of shares outstanding.

The Speculator and Liquidity Traders

The firm's equity is traded by a risk-neutral speculator and liquidity traders. The speculator is one of two types, $\tau \in \{\mathrm{S}, \mathrm{U}\}$, where $\mathbb{P}(\tau = \mathrm{S}) = \gamma \in (0, 1)$.[13] The skilled speculator ($\tau = \mathrm{S}$) can acquire information at a finite cost whereas the unskilled one ($\tau = \mathrm{U}$) faces an infinite cost of acquiring information. The skilled speculator can acquire information $\eta = 1$ at cost c to observe a perfect signal $\sigma \in \{\sigma_{\mathrm{G}}, \sigma_{\mathrm{B}}\}$ of the underlying quality of the firm, namely $\mathbb{P}(\Theta \,|\, \sigma_{\Theta}) = 1$. Whether skilled or unskilled, the speculator can either buy ($a = +1$), not trade ($a = 0$) or sell ($a = -1$) a unit of the firm's equity. Liquidity traders submit orders $l \in \{-1, 0, 1\}$ each with equal probability.

Timing and Prices

If $\tilde{\chi} = 0$ then firms can invest only by raising I. Firms in my model raise capital through issuing equity. Section 2.4.1 shows that, conditional on a firm's raising capital by issuing debt, my analysis remains unchanged. Not only do the qualitative results of the propositions remain unchanged, but also the prices and the strategies of the players coincide at $t = 1$.

For simplicity, I assume that firms raise equity at the market price. The mechanism by which firms issue equity is temporarily left unmodeled. I address this issue in Section 2.3 by modeling explicitly an SEO.

[13] This restriction guarantees the existence of reputation concerns. If speculators are all either skilled or unskilled then none will be career concerned since there is no possibility of affecting clients' beliefs about their type.

There are four dates: $t = 0, 1, 2, 3$. At $t = 0$ the firm decides whether to raise I; then the skilled speculator decides whether to acquire information ($\eta = 1$) and thus to observe a signal of the firm's quality. At $t = 1$, the speculator trades $a = \{-1, 0, 1\}$ with liquidity traders and prices are set by a competitive market maker. After observing the total order flow $y = a + l$, the market maker sets the price $p_1(y)$ in anticipation of the effect that this price will have on the firm's ability to raise the required funds from capital providers. Competitive capital providers invest I in the firm by buying a proportion α of its shares that makes them break even. Capital providers are uninformed about the quality of the firm, but observing prices enables them to update their beliefs about that quality to $\hat{\theta}(y)$. When prices indicate that the firm is more likely to be good than bad, capital providers may be willing to fund it at $t = 2$. If not, then the issue fails and the project is not undertaken.

At $t = 2$, the firm can raise the required funds I from capital providers whenever it can issue a proportion α of shares such that competitive capital providers break even:

$$\alpha \, \mathbb{E} \left[V_{\tilde{\Theta}} + \tilde{\chi} \,|\, y \right] = I. \tag{2.2}$$

Because the firm cannot issue more than 100 per cent of its shares, a necessary condition for the issue to succeed is that $\alpha \leq 1$; put another way, we must have

$$\mathbb{E} \left[V_{\tilde{\Theta}} + \tilde{\chi} \,|\, y \right] - I \geq 0. \tag{2.3}$$

The manager is willing to invest whenever the issue is successful so inequality 2.3 is also a sufficient condition for the issue to succeed. In fact, by investing, a bad firm's manager earns private benefits whereas a good firm's manager maximizes shareholder wealth. Therefore,

$$\iota \equiv \iota(\alpha) := \begin{cases} 0 & \text{if } \alpha > 1 \\ 1 & \text{otherwise;} \end{cases} \tag{2.4}$$

here $\iota = 1$ signifies a firm's successful fund raising and $\iota = 0$ its failure.

Anticipating the effect of prices on the firm's fund raising and hence on investment, the market maker sets the price as

$$p_1^y := p_1(y) = \iota(1-\alpha) \cdot \mathbb{E}\left[V_{\tilde{\Theta}} + \tilde{\chi} \,|\, y\right] + \epsilon(1-\iota)\mathbb{E}\left[V_{\tilde{\Theta}} \,\middle|\, y\right]. \tag{2.5}$$

If the firm's fund raising is successful, then it raises a proportion α of shares and the secondary market price takes into account the dilution $(1-\alpha)$ as well as the new capital. If fund raising is unsuccessful, then the price is just the expected value of project $\tilde{\chi}$. Substituting α from (2.2) and ι from (2.4), we can write (2.5) equivalently as

$$p_1(y) = \mathbb{E}\left[\tilde{v} \,\middle|\, y, \iota\right], \tag{2.6}$$

where $\tilde{v} \in \{V_{\mathrm{B}}, V_{\mathrm{B}} - I, 0, V_{\mathrm{G}} - I, V_{\mathrm{G}}\}$ is the firm's endogenous payoff. The price setting is similar to the discrete version of Kyle (1985) due to Biais and Rochet (1997). Unlike in those models, here the final realization of the firm's value depends on its ability to raise funds via prices. In other words, that value is endogenous: there is a feedback effect from prices to realized asset values.

A Speculator's Payoff

Speculators' payoffs take different forms in different parts of the paper, reflecting the speculators' different preferences. For example, speculators can be personified in reality as hedge funds, mutual funds, or individual investors.

As mentioned previously, today most equity holders are delegated portfolio managers who invest on behalf of clients and are subject to different types of compensation contracts. This compensation typically consists of two parts: a percentage of the returns earned by the manager (the *performance fee*) and a percentage of the assets under management (the *fixed fee*). These percentages vary from fund to fund and sometimes are zero; for example most mutual funds do not charge a performance fee.[14]

Whereas the ability to make profits is key to obtaining the performance fee, the ability to build a good reputation is key to obtaining the fixed fee. That is, one way for funds to expand their compensation is to increase assets under management by retaining old clients and winning new ones. Contracts based on fixed fees drive delegated asset managers to behave differently from purely profit-maximizing speculators, whose rewards depend entirely on portfolio returns.

The following expected utility function captures these two main features of the speculators' preferences—namely, the performance and reputation components:

$$U = w_1\Pi + w_2\Phi - c\eta; \tag{2.7}$$

here $w_1 \geq 0$ is the weight that a speculator assigns to expected net returns on investment and $w_2 \geq 0$ is the weight that the speculator assigns to his expected reputation. Note that $\eta = 1$ whenever the speculator acquires information at cost c (and $\eta = 0$ otherwise). Explicitly, expected net returns are

$$\Pi := \mathbb{E}\left[a\tilde{R} \,\middle|\, \tau, \sigma\right] \equiv \mathbb{E}\left[a(\tilde{v} - \tilde{p}_1) \,\middle|\, \tau, \sigma\right]; \tag{2.8}$$

here the net return R is computed as the firm's net value v minus the price p, and

[14]See note 5.

expected reputation is

$$\Phi := \mathbb{E}\left[\tilde{r} \mid \tau, \sigma\right] \equiv \mathbb{E}\left[\mathbb{P}(\mathrm{S} \mid \Theta\iota, a, y) \mid \tau, \sigma\right]. \tag{2.9}$$

I define *reputation* r as the probability $\mathbb{P}$ that the speculator is skilled. In other words, reputation consists of a fund's client's posterior belief about the manager's type based on all observables;[15] these include the firm's type, which is observable only if $\iota = 1$, in addition to the fund's action a and the order flow y.[16] The speculator maximizes his reputation and returns conditional on knowing his type τ and his signal σ.

I export funds' career concerns from the dynamic setting of Dasgupta and Prat (2008) to a static one.[17] Reputation concerns usually arise in a repeated setting: a fund will seek to influence clients' beliefs about its type toward the end of increasing the fund's future fees, and clients seek to employ skilled funds that will earn them higher future returns. By considering career concerns in a static setting, I implicitly assume an unmodeled continuation period. In so doing I abstract from the relationship of the fund with its clients, which I take as given, to concentrate on the fund's relationship with firms.

For most of the analysis I study only the two limiting cases of a pure profit maximizer ($w_2 = 0$) and a pure careerist ($w_1 = 0$). In Section 2.4.2 I study the case in which the speculator cares both about profits and reputation.

[15]Clients are randomly matched to fund managers at $t = 0$ and update their beliefs about the fund at $t = 1$.

[16]The order flow is a sufficient statistic for the price because the price is determined by the market maker according to that order flow.

[17]For a microfoundation of these payoffs, see Dasgupta and Prat (2008).

2.2.2 Equilibria

No Information Acquisition: The Impossibility of Firms' Financing

Lemma 2.1 *When the speculator cannot acquire information about the firm's quality, the firm is unable to raise I.*

Proof. If the speculator cannot acquire information about the firm's quality, then the firm's price at $t = 0$ is

$$p_0 = \epsilon \bar{V}.$$

Given inequality (2.1) and given capital providers' posterior belief about the quality of the firm being equal to the prior belief θ, inequality (2.3) is not satisfied. In fact,

$$\mathbb{E}\left[V_{\tilde{\Theta}} + \tilde{\chi} \,\middle|\, y\right] - I = \mathbb{E}\left[V_{\tilde{\Theta}} + \tilde{\chi}\right] - I = \bar{V} + \epsilon I - I = \bar{V} - (1 - \epsilon)I$$

is less than zero (for small ϵ) because the project's NPV is strictly negative by assumption, which causes fund raising to fail. Therefore, in this case firms can invest only when $\tilde{\chi} = I$. ■

Because acquiring information is essential, I next study the effect of speculators' preferences on information acquisition.

Information Acquisition: Firms' Financing with Profit-Maximizing Speculators

I characterize the equilibrium where a speculator is profit-maximizing and acquires information if he is skilled. Here the speculator's payoff takes the form of equation (2.7) with $w_1 = 0$.

Lemma 2.2 *For*

$$I \le \frac{\theta V_{\mathrm{G}} + (1-\theta)(1-\gamma)V_{\mathrm{B}}}{[\theta + (1-\theta)(1-\gamma)](1-\epsilon)} =: \bar{I}_{\mathrm{pm}} \tag{2.10}$$

and

$$c \le \bar{c}_{\mathrm{pm}}, \tag{2.11}$$

there exists a unique perfect Bayesian equilibrium in which the unskilled speculator does not trade, the skilled speculator acquires information and follows his signal, and the firm chooses to issue equity. Formally, the following statements hold.

- *The unskilled speculator never trades:*

$$s^{\mathrm{U}}(\sigma = \emptyset) = 0. \tag{2.12}$$

- *The skilled speculator acquires and follows his signal:*

$$\begin{aligned} &\eta^* = 1; \\ &s^{\mathrm{S}}(\sigma) = \begin{cases} +1 & \text{if} \quad \sigma = \sigma_{\mathrm{G}}, \\ -1 & \text{if} \quad \sigma = \sigma_{\mathrm{B}}. \end{cases} \end{aligned}$$

- *Secondary market prices are*

$$\begin{aligned} p_1^{-2} &= \epsilon\, V_{\mathrm{B}} =: \epsilon\, p_\epsilon^{-2}, \\ p_1^{-1} &= \epsilon\, \frac{\theta(1-\gamma)V_{\mathrm{G}} + (1-\theta)V_{\mathrm{B}}}{\theta(1-\gamma) + 1 - \theta} =: \epsilon\, p_\epsilon^{-1}, \\ p_1^{0} &= \epsilon\, \bar{V} =: \epsilon\, p_\epsilon^{0}, \\ p_1^{1} &= \frac{\theta V_{\mathrm{G}} + (1-\theta)(1-\gamma)V_{\mathrm{B}}}{\theta + (1-\theta)(1-\gamma)} - (1-\epsilon)I, \\ p_1^{2} &= V_{\mathrm{G}} - (1-\epsilon)I. \end{aligned}$$

- *All firms' types choose to raise I at $t = 0$.*

Appendix 2.6.1 shows that this is an equilibrium; here I review the steps of the proof. Appendix 2.6.1 shows that this is the unique equilibrium in strictly dominant strategies.

At equilibrium, the feedback between prices and investment implies that the equity issue succeeds only when the order flow is $y \in \{1, 2\}$ (provided 2.10 holds). For all order flows below $y = 1$, the market's posterior about the quality of the firm is so low that the capital provider is unwilling to pay I in exchange for anything less than all of the shares; consequently the issue fails. When $y \in \{-2, -1, 0\}$ the project is not undertaken, so profits are zero provided $\epsilon = 0$.

At equilibrium, no speculator has any incentive to deviate. A skilled and positively informed speculator has no incentive to deviate from buying when he observes a positive signal since selling (or not trading) would decrease the odds that a good firm invests and thus would reduce his chances of making a profit. A skilled and negatively informed speculator prefers selling because, with small probability ϵ, he can profit from his short position. Finally, an unskilled speculator avoids trading fairly priced shares so as not to incur a loss. Skilled speculators, conditional on having acquired information, will find it optimal to follow their signal, and likewise, anticipating this optimal course of action, they find it optimal to acquire information for $c \leq \bar{c}_{\text{pm}}$.

Finally, all firms' types choose to issue equity at $t = 0$ because, with positive probability, they can raise I and invest. These actions lead the manager of a good (resp., bad) firm to maximize shareholder wealth (resp., private benefits).

Corollary 2.2.1 *If prices are sufficiently informative, then there is no perfect Bayesian equilibrium in which a skilled profit-maximizing speculator acquires information.*

The proof is given in Appendix 2.6.1. Intuitively, when prices are sufficiently informative, the skilled speculator has little room to profit and so his information loses its speculative value. This is what happens when investment fails given $y = 1$ (i.e., when (2.10) is not satisfied). If investment succeeds only when $y = 2$ then, since prices reveal the skilled speculator's private information, he has no room to profit (for sufficiently low ϵ) and thus no incentive to acquire costly information.

Information Acquisition: Firms' Financing with Career-Concerned Speculators

I now characterize the equilibrium where a speculator is career concerned and acquires information if he is skilled. Here the speculator's payoff takes the form of equation (2.7) with $w_1 = 0$.

Lemma 2.3 *For*

$$I \leq \frac{\theta[\gamma + (1-\gamma)\mu^*]V_{\mathrm{G}} + (1-\theta)(1-\gamma)\mu^* V_{\mathrm{B}}}{[\theta\gamma + (1-\gamma)\mu^*](1-\epsilon)} =: \bar{I}_{\mathrm{cc}} \tag{2.13}$$

and

$$c \leq \bar{c}_{\mathrm{cc}}, \tag{2.14}$$

there exists a perfect Bayesian equilibrium in which the skilled speculator acquires and follows his signal, the unskilled speculator randomizes between buying and selling (where μ^* is the probability with which he buys) and the firm chooses to issue equity. Formally, the following statements hold.

- *The unskilled speculator plays according to*

$$s^{\mathrm{U}}(\sigma = \emptyset) = \begin{cases} +1 & \text{with probability } \mu^*, \\ -1 & \text{with probability } 1-\mu^*, \end{cases} \tag{2.15}$$

where $\mu^* \in [0, \theta)$.

- *The skilled speculator plays according to*

$$\eta^* = 1; \tag{2.16}$$

$$s^{\mathrm{S}}(\sigma) = \begin{cases} +1 & \textit{if} \quad \sigma = \sigma_{\mathrm{G}}, \\ -1 & \textit{if} \quad \sigma = \sigma_{\mathrm{B}}. \end{cases} \tag{2.17}$$

- *Secondary market prices are*

$$p_1^{-2} = p_1^{-1} = \epsilon \, \frac{\theta(1-\gamma)(1-\mu^*)V_G + (1-\theta)[\gamma + (1-\gamma)(1-\mu^*)]V_B}{(1-\theta)\gamma + (1-\gamma)(1-\mu^*)} =: \epsilon \, p_\epsilon^{-1},$$

$$p_1^0 = \epsilon \, \bar{V} =: \epsilon \, p_\epsilon^0,$$

$$p_1^1 = p_1^2 = \frac{\theta[\gamma + (1-\gamma)\mu^*]V_{\mathrm{G}} + (1-\theta)(1-\gamma)\mu^* V_{\mathrm{B}}}{\theta\gamma + (1-\gamma)\mu^*} - (1-\epsilon)I.$$

- *All firms' types choose to raise* I *at* $t = 0$.

The proof is given in Appendix 2.6.1 and may be sketched as follows. Given the strategies of the skilled and the unskilled speculators, investment succeeds whenever $y \in \{1, 2\}$ provided inequality (2.13) is satisfied. Prices when the order flow is $y = 1$ or $y = 2$ contain the same information about firm quality because, since speculators always trade, each order flow occurs only when a speculator buys; as a result, the only distinction between these events is that noise is absent when $y = 1$ but noise is ubiquitous when $y = 2$. An analogous argument applies when the order flow is $y = -1$ or $y = -2$.

The payoff of the career-concerned speculator is linear in his ability—that is, in the client's posterior about his type. Clients observe the hired fund's action a and the firm's type Θ (if the firm invests) and then update their beliefs about the fund's ability.[18] If the firm's fund raising fails ($\iota = 0$) then the value of the firm is endogenously zero (unless $\chi = I$) and thus an inference channel is shut: clients' inferences are limited to the hired fund's action. In fact, because of the feedback between prices and investment, the value of the firm is zero whenever it does not invest; in that case, clients cannot observe neither the firm's type Θ nor the correctness of the speculators' trade. Note that a fund's selling results in failure to raise capital from the market because the order flow is $y = -2$, $y = -1$, or $y = 0$. I call selling "the pooling action" because it pools skilled and unskilled speculators on the selling action. I call buying "the separating action" because it can lead either to the fund's being right (buying a good firm) or wrong (buying a bad firm).

In an equilibrium where the skilled speculator acquires and follows his signal, the unskilled career-concerned speculator must trade or else reveal his type. He therefore randomizes between buying and selling; μ^* is the buy probability at which he is indifferent between buying and selling. The probability μ^* is always less than θ at equilibrium, which means that the unskilled speculator is more likely to sell than to buy. Selling allows him to pool with the skilled speculator, whereas buying may reveal that he is unskilled. It might thus seem that the unskilled speculator should always sell, but this is not always true because the probability with which he sells feeds back into his utility. If the client believes that the fund always sells, then her posterior upon observing such action is that the fund is most likely to be unskilled. Hence the unskilled may have an incentive to deviate.

[18] The order flow does not provide any information to the client beyond that contained in the fund's action and the firm's type.

I give here an intuitive proof that $\mu^* < \theta$ (the formal proof is in the Appendix). Suppose by way of contradiction that μ^* is greater than θ, and suppose that the client beliefs are (i) that the skilled speculator follows his signal and (ii) that the unskilled speculator mixes between buying and selling. Then, since $\mu^* > \theta$, upon observing a sale the client thinks it more likely that she is matched to a skilled speculator while the unskilled speculator obtains a payoff greater than γ from selling and being pooled with the skilled speculator. If the unskilled speculator buys instead, then it is possible that he is revealed to be right and also that he is revealed to be wrong; overall, then, he should expect a lower payoff than the one he obtains from selling. Hence this speculator is no longer indifferent between buying and selling and therefore sells all the time—a contradiction.

The key element of this proof is that μ^* is the *unique* probability that makes the unskilled speculator indifferent between buying and selling because that probability affects the payoff from either buying or selling: the less likely he is to sell, the higher is the payoff from selling (and vice versa).

Given the unskilled speculator's strategy, it is optimal for the skilled speculator to follow his signal conditional on having acquired information. Anticipating this optimal course of action, this speculator finds it optimal to acquire for $c \leq \bar{c}_{\text{cc}}$.

Finally, all firms' types always choose to issue equity at $t = 0$ since with positive probability they can raise I and invest. In so doing, the manager of a good firm maximizes shareholder wealth, whereas the manager of a bad firm maximizes his private benefits.

Corollary 2.3.1 *As long as the cost of acquiring information is not too high, there is* *always an equilibrium in which a skilled career-concerned speculator acquires information and follows his signal—even when prices are perfectly informative.*

Proof. Perfectly informative prices obtain when $\mu^* = 0$ and $\epsilon = 0$. In Lemma 2.3 I show that, for sufficiently low costs, a skilled speculator acquires information and follows his signal whenever $\mu^* = 0$. ■

Corollary 2.2.1 shows that a profit-maximizing speculator does not acquire information when prices are sufficiently informative. According to Corollary 2.3.1, however, a skilled career-concerned speculator is willing to acquire information even in those circumstances.

2.2.3 Results: Benefits of Career Concerns

In this section, for simplicity, I focus on the $\epsilon = 0$ limit because ϵ is relevant only for equilibrium selection.

Career Concerns and Firms' Financial Constraints

Proposition 2.1 *Firms can obtain funding for a larger fraction of projects when speculators are career concerned. In other words: there is a range of projects with funding costs $I \in (\bar{I}_{\text{pm}}, \bar{I}_{\text{cc}}]$ that can be undertaken only with career-concerned speculators, where*

$$\bar{I}_{\text{cc}} = \frac{\theta[\gamma + (1-\gamma)\mu^*]V_{\text{G}} + (1-\theta)(1-\gamma)\mu^* V_{\text{B}}}{\theta\gamma + (1-\gamma)\mu^*}$$

and

$$\bar{I}_{\text{pm}} = \frac{\theta V_{\text{G}} + (1-\theta)(1-\gamma)V_{\text{B}}}{\theta + (1-\theta)(1-\gamma)}.$$

Proof. Since $\bar{I}_{\text{cc}}$ is decreasing in μ and $\bar{I}_{\text{cc}} = \bar{I}_{\text{pm}}$ whenever $\mu = 1$, it follows that $\bar{I}_{\text{cc}} > \bar{I}_{\text{pm}}$ for any $\mu < 1$. Note that μ is always less than 1 because it is less than

$\theta \in (0,1)$ by Lemma 2.3. Hence, there is a range of projects with costs $I \in (\bar{I}_{\text{pm}}, \bar{I}_{\text{cc}}]$ that can be undertaken only when career-concerned speculators trade. ■

I now present two remarks that build the intuition for the main result of Proposition 2.1.

Remark 2.1 *Skilled speculators acquire information if and only if the equity issue succeeds at $y = 1$, which makes $y = 1$ the "pivotal" order flow for investment.*

An order flow is *pivotal* if it is the minimum order flow such that the market breaks down unless investment is undertaken at that order flow.

At equilibrium, if $y < 1$ then the equity issue fails and investment is not undertaken; this is shown in Lemmata 2.2 and 2.3. To prove that $y = 1$ is pivotal we need only demonstrate that, unless investment is undertaken in $y = 1$, the market breaks down and no capital flows to firms. I shall prove that a skilled speculator does not acquire information if the cost of capital is so high that investment succeeds only when $y = 2$. This is true both for skilled profit-maximizing and for skilled career-concerned speculators, but for different reasons.

The skilled profit-maximizing speculator is unwilling to acquire information at any cost when investment succeeds only if $y = 2$. When $y = 2$ the price reflects his private information, which then loses its speculative value (see Corollary 2.2.1): he is therefore unwilling to pay its cost.

When speculators are career concerned, order flows $y \in \{1, 2\}$ contain the same information about firm quality. Because such speculators always trade, each order flow occurs only when speculators buy; hence the distinction between these events is that only when $y = 2$ is there noise. Thus, the skilled career-concerned speculator acquires information if and only if investment succeeds in both order flows 1 and 2.

Remark 2.2 *The cost of capital in the pivotal order flow is always lower when career-concerned than when profit-maximizing speculators trade.*

Having identified in Remark 2.1 that $y = 1$ is the pivotal order flow for investment, I show that, conditional on information being acquired, when career-concerned speculators trade, the cost of capital in this order flow is always lower than when profit-maximizing speculators trade.

Observe that low cost of capital is equivalent to high secondary market prices that are more informative about the firm's being good.

Conditional on acquiring information, the actions of liquidity traders and of the skilled speculator are identical in the two models—the model where only career-concerned speculators trade and that in which only profit-maximizing speculators do. Therefore, the key to the result of Remark 2.2 is the different behavior of *unskilled* speculators in the two models. In particular: when the order flow is 1, do prices reveal more of the skilled speculator's private information in the model where career-concerned speculators trade?

Unskilled profit-maximizing speculators never trade and so noise is exogenously determined by liquidity traders, who confound the skilled speculator's private information. In contrast, an unskilled career-concerned speculator always trades—and thereby generates endogenous noise in the order flow—in order to avoid revealing his type and to emulate skilled traders who always follow their signal. But why is it that, if career-concerned speculators trade, the price when $y = 1$ then reveals more of the skilled's speculator private information?

The confounding of a skilled speculator's buy order occurs: (i) in the career-concerned model, when an unskilled speculator buys, and liquidity traders don't trade or (ii) in the profit-maximizing model, when an unskilled speculator doesn't trade, and liquidity traders submit a buy order. Because the likelihood of liquidity traders submitting any type of order is independent of whether the speculator is profit maximizing or career concerned, the only difference is the probability with which an unskilled speculator trades. An unskilled profit-maximizing speculator does not trade with probability 1, whereas a career-concerned speculator buys with probability $\mu^* < 1$.

Project Quality and Career-Concerned Speculators

Career-concerned speculators allow both good and bad firms to undertake their projects, so one may ask whether the economy would be better-off without such speculators. I show that the gains of allowing good firms to undertake their projects outweigh the costs of allowing bad firms to undertake theirs, which establishes that the overall effect of career concerns is indeed positive.

Proposition 2.2 *Career concerns allow firms to undertake, on average, positive NPV projects.*

Proof.

If $\epsilon = 0$ and $\tilde{v} \in \{V_{\mathrm{B}} - I, 0, V_{\mathrm{G}} - I\}$, then

$$\mathbb{E}(\tilde{v}) = \theta \mathbb{P}(\iota = 1 \,|\, \mathrm{G})(V_{\mathrm{G}} - I) + (1-\theta)\mathbb{P}(\iota = 1 \,|\, \mathrm{B})(V_{\mathrm{B}} - I) \geq 0.$$

In the model,

$$\mathbb{E}(\tilde{v}) = \frac{2}{3}\theta(\gamma + (1-\gamma)\mu^*)(V_{\mathrm{G}} - I) + \frac{2}{3}(1-\theta)(1-\gamma)\mu^*(V_{\mathrm{B}} - I) \geq 0; \tag{2.18}$$

this follows because the expectation is a decreasing function of I and because the equilibrium where career-concerned speculators acquire information exists if and only if (2.13) is satisfied—that is, iff

$$I \leq \frac{\theta[\gamma + (1-\gamma)\mu^*]V_{\mathrm{G}} + (1-\theta)(1-\gamma)\mu^* V_{\mathrm{B}}}{\theta\gamma + (1-\gamma)\mu^*}.$$

Since inequality (2.18) holds for the largest I, the proposition follows. ■

Additional Effects of Career Concerns

Notation

The threshold $\mu^*(\theta, \gamma) = \frac{1}{2}$ is crucial for results to follow—so much so that the two regions of parameters for which μ^* is less (greater) than one half merit their own notation.

Define $\Gamma(\theta)$ implicitly by $\mu^*(\theta, \Gamma(\theta)) = \frac{1}{2}$. Then the first region is defined as

$$R_{\mathrm{cc}} = \{(\theta, \gamma) \in [0,1]^2; \gamma \geq \Gamma(\theta)\}$$

and the second region, R_{pm}, as the complement of R_{cc} in $[0,1]^2$. These regions are illustrated graphically in Figure 1.

A sufficient condition for μ^* to be lower than $\frac{1}{2}$ is that θ be lower than $\frac{1}{2}$ (recall that $\mu^* < \theta$)—in other words, that the median firm in the industry be bad. This condition is realistic. In fact bad managers undertake only those negative NPV projects that destroy relatively little value. A manager who destroyed too much value—by undertaking excessively negative NPV projects—would invite unwanted scrutiny from the Board of Directors. Therefore,

$$\left|V_{\mathrm{G}} - I\right| > \left|V_{\mathrm{B}} - I\right|.$$

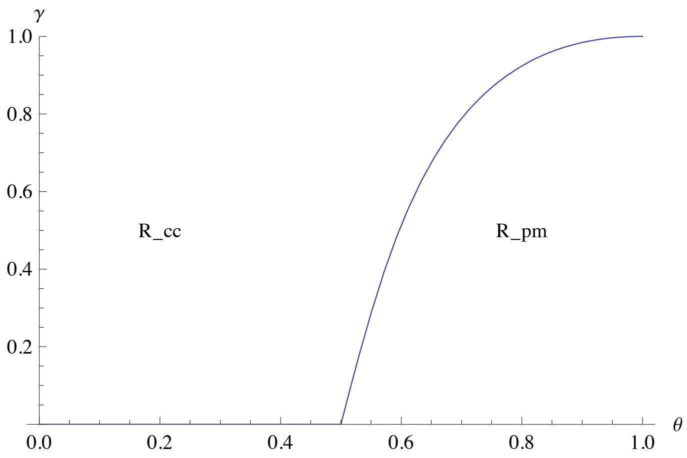

Figure 2.1: Regions

This condition, when combined with the assumption that the average industry NPV is negative (inequality (2.1)), implies that

$$\theta < \frac{1}{2}.$$

Total Inefficiency

Proposition 2.3 *For $(\theta, \gamma) \in R_{\mathrm{cc}}$, total inefficiency resulting from over- and under-investment is lower when speculators are career concerned than when they are profit maximizing.*

Proof. Two economic inefficiencies arise in my model,[19] one from not funding good projects and the other from funding bad ones. These two inefficiencies have an asymmetric effect on the economy because, by (2.1), the average losses that result from not funding good projects are smaller than those that result from funding bad ones. In fact, condition (2.1) can be re-written as

$$\theta |V_{\mathrm{G}} - I| < (1 - \theta) |V_{\mathrm{B}} - I|. \tag{2.19}$$

[19]Ignoring the deadweight loss caused by forgoing private benefits.

I define *total inefficiency* as the weighted average of these two inefficiencies weighted by the probability that each of them is realized. Thus,

$$\text{total inefficiency} = \theta \mathbb{P}(\iota = 0 \,|\, \mathrm{G})|V_{\mathrm{G}} - I| + (1-\theta)\mathbb{P}(\iota = 1 \,|\, \mathrm{B})|V_{\mathrm{B}} - I|. \tag{2.20}$$

The question is whether total inefficiency is greater with career-concerned or with profit-maximizing speculators.

The probability that a good project is not undertaken is

$$\mathbb{P}(\iota = 0 \,|\, \mathrm{G}) = \begin{cases} \big(1 - \frac{2}{3}(\gamma + (1-\gamma)\mu^*)\big) & \text{with career-concerned speculators,} \\ \big(1 - \frac{2}{3}\gamma - \frac{1}{3}(1-\gamma)\big) & \text{with profit-maximizing speculators;} \end{cases} \tag{2.21}$$

the probability that a bad project is undertaken is

$$\mathbb{P}(\iota = 1 \,|\, \mathrm{B}) = \begin{cases} \frac{2}{3}(1-\gamma)\mu^* & \text{with career-concerned speculators,} \\ \frac{1}{3}(1-\gamma) & \text{with profit-maximizing speculators.} \end{cases} \tag{2.22}$$

When $\mu^* < \frac{1}{2}$, underinvestment always occurs with career-concerned speculators: the probabilities of a good or a bad project being undertaken, $\mathbb{P}(\iota = 1 \,|\, \mathrm{G})$ and $\mathbb{P}(\iota = 1 \,|\, \mathrm{B})$, are always lower with career-concerned than with profit-maximizing speculators. Since (2.19) holds and since $\mathbb{P}(\iota = 0 \,|\, \mathrm{G}) + \mathbb{P}(\iota = 1 \,|\, \mathrm{B})$ is the same in both models, it follows that the average economic losses generated by undertaking bad projects are greater than those generated by not undertaking good ones and that both loss types are minimized when underinvestment occurs (i.e., when $\mu^* < \frac{1}{2}$). So if $\mu^* < \frac{1}{2}$ then inefficiency is minimized with career-concerned speculators.

More formally, when profit-maximizing speculators trade, I can substitute (2.21) and (2.22) in equation (2.20) and obtain

$$\theta \left(1 - \frac{2}{3}\gamma - \frac{1}{3}(1-\gamma)\right)|V_{\mathrm{G}} - I| + \frac{1}{3}(1-\theta)(1-\gamma)|V_{\mathrm{B}} - I|;$$

when career-concerned speculators trade, I obtain

$$\theta\left(1-\frac{2}{3}\gamma-\frac{2}{3}(1-\gamma)\mu^*\right)|V_{\mathrm{G}}-I|+\frac{2}{3}(1-\theta)(1-\gamma)\mu^*|V_{\mathrm{B}}-I|.$$

Subtracting the second expression from the first, then yields

$$\begin{aligned}-\theta\frac{(1-\gamma)}{3}(1-2\mu^*)(V_{\mathrm{G}}-I)-\frac{(1-\theta)(1-\gamma)}{3}(1-2\mu^*)(V_{\mathrm{B}}-I)=&\\ =-\frac{(1-\gamma)}{3}(1-2\mu^*)\left(\bar{V}-I\right),&\quad(2.23)\end{aligned}$$

which is greater than zero if and only if $\mu^*<\frac{1}{2}$ because the average project has negative NPV. This proves Proposition 2.3: in region R_{cc} total inefficiency is greater with profit-maximizing than with career-concerned speculators. ■

Shareholder Wealth

Proposition 2.4 *For $(\theta,\gamma)\in R_{cc}$, the trading of career-concerned speculators maximizes good firms' shareholders' wealth.*

Proof. Conditional on investment being undertaken, in good firms we have

$$\text{shareholder wealth}=\mathbb{E}\left[(1-\tilde{\alpha})V_G\right]\iota.$$

In firms traded by career-concerned speculators this wealth is equal to

$$\frac{2}{3}(\gamma+(1-\gamma)\mu^*)\left(1-\frac{I}{p_c^1+I}\right)V_{\mathrm{G}};\qquad(2.24)$$

in firms traded by profit-maximizing speculators, it is equal to

$$\frac{1}{3}\gamma\left(1-\frac{I}{V_G}\right)V_{\mathrm{G}}+\frac{1}{3}\left(1-\frac{I}{p_p^1+I}\right)V_{\mathrm{G}}.\qquad(2.25)$$

Here

$$p_c^1 = \frac{\theta[\gamma + (1-\gamma)\mu^*]V_{\mathrm{G}} + (1-\theta)(1-\gamma)\mu^* V_{\mathrm{B}}}{\theta\gamma + (1-\gamma)\mu^*} - I, \tag{2.26}$$

$$p_p^1 = \frac{\theta V_{\mathrm{G}} + (1-\gamma)(1-\theta)V_{\mathrm{B}}}{\theta + (1-\gamma)(1-\theta)} - I. \tag{2.27}$$

Normalizing $V_{\mathrm{B}} = 0$ and then subtracting (2.25) from (2.24) reveals the condition under which shareholders' wealth is higher when career-concerned speculators trade: when

$$(1-\gamma)(2\mu - 1) - I\left\{\frac{-2[\theta\gamma + (1-\gamma)\mu^*]}{\theta V_{\mathrm{G}}} + \frac{\gamma}{V_{\mathrm{G}}} + \frac{\theta + [(1-\gamma)(1-\theta)]}{\theta V_{\mathrm{G}}}\right\} > 0;$$

simplifying, I obtain

$$(1-\gamma)(2\mu^* - 1) > \frac{I}{\theta V_G}(1-\gamma)(2\mu^* - 1).$$

The last inequality holds if and only if $\mu^* < \frac{1}{2}$ because projects have negative average NPV ($I > \theta V_G$). ■

A trade-off between profit-maximizing and career-concerned speculators arises when good firms hold cheap projects. Although it is ex ante less likely that good firms raise I with career-concerned speculators when $\mu^* < \frac{1}{2}$, these firms do so at a significantly lower cost of underpricing when $y = 1$. Because, on average, the latter effect dominates the former, shareholder wealth is greater with career-concerned speculators.

2.3 A Seasoned Equity Offering

2.3.1 Model

Until now I have assumed that secondary market prices determine a firm's ability to raise funds, and I have refrained from explicitly modeling a firm's equity issue. A popular way for public firms to raise capital is through a seasoned equity offering, which I model by building on Gerard and Nanda's (1993) model.

I focus on equity finance because it is the most relevant form of funding for the firms I model: listed corporations that have projects with negative average NPV, no cash, and no assets in place.[20] The relevance of a well-functioning equity market is emphasized by DeAngelo et al. (2010); these authors report that, without the capital raised via SEOs, 62 per cent of issuers would run out of cash in the year after the offering. Nevertheless, results derived from the baseline model apply to more general settings than that of an SEO, as I show in Section 2.4.1.

Key to my model is the interaction between the secondary market price and the issuing price, which is typical of SEOs and central to Gerard and Nanda's (1993) paper: the issuer usually sets the SEO price lower than the secondary market price, where the difference in prices is referred to as the *discount*. Although my aim is different, their model is well suited to my analysis. Whereas Gerard and Nanda show that a skilled speculator manipulates prices around an SEO with the intention of concealing his information before the equity offering (his secondary market losses can be recouped through the purchase of shares in the SEO at lower prices), I study the effect of speculators' preferences on the SEO price when prices feed back into investment. Even so, I can address manipulation by engaging directly with Gerard and Nanda's message. I further engage with the literature on manipulation with feedback effects (see, e.g., Goldstein and Guembel (2008)) by also showing that an unskilled speculator has no incentive to manipulate prices—that is, to trade in the absence of information.

[20] See note 8.

Extending the model to incorporate an SEO requires adding a few assumptions to the baseline model of Section 2.2. First, at $t = 0$, the firm announces the SEO and the number n' of shares to be offered in the SEO; second, after the trading date and prior to realization of the payoffs, the issuer sets the SEO price and bidding occurs. Finally, at the time of the SEO, uninformed bidders (retail investors) bid for the firm's equity along with the speculator.

Timing and Prices

At $t = 0$, the firm announces the SEO, the timing, and the number of shares (n') to be issued; then the skilled speculator decides whether or not to acquire information, $\eta \in \{0, 1\}$. At $t = 1$, the speculator who is skilled (resp., unskilled) with probability γ (resp., $1 - \gamma$), submits an order in the secondary market: he either buys, sells, or does not trade, so $a \in \{-1, 0, 1\}$. He trades with liquidity traders who submit orders $l \in \{-1, 0, 1\}$ with equal probability. The market maker observes the aggregate order flow and sets the price p_1^y in anticipation of the effect that the price will have on the firm's ability to raise the required funds in the SEO. At $t = 2$, the firm sets the SEO price and bidding takes place; at $t = 3$ uncertainty resolves.

At $t = 2$, the issuer sets the SEO price p_2^y to ensure that enough bidders subscribe to the SEO while taking into account public information—the order flow. In the trading stage, the speculator trades with liquidity traders; in the bidding stage, uninformed bidders and the speculator submit bids.[21] Uninformed speculators have no information about the firm and may refrain from bidding if they expect losses (conditional on their

[21] Although both the unskilled speculator and uninformed bidders are unaware of the firm's underlying value, at $t = 1$ the latter has less information than the former—who knows whether or not the order flow is a consequence of his own trade.

available information), which is especially harmful because they are crucial for the SEO's success. The speculator cannot absorb the entire issue since $N_\tau < n' < N_\mathrm{N}$, where the total number of shares bid by each group is fixed and known: N_τ denotes the shares held by the speculator (where $\tau \in \{\mathrm{S}, \mathrm{U}\}$) and N_N denotes the shares held by uninformed bidders. Once the SEO price is set, a speculator and the uninformed bidders bid. If the offering is oversubscribed, then shares are distributed to participants on a pro rata basis. The uninformed bidders end up with the following proportion of shares:

$$\alpha_\mathrm{N} = \begin{cases} 1 & \text{if the speculator does not trade,} \\ \dfrac{N_\mathrm{N}}{N_\tau + N_\mathrm{N}} = \dfrac{1}{\beta} & \text{if the speculator trades;} \end{cases} \tag{2.28}$$

$1/\beta$ is the proportion of SEO shares allocated to the uninformed bidders when both the speculator and the uninformed bidders bid.

Prices in the SEO stage are set differently from prices in the secondary market trading stage. Recall that the issuer must set the SEO price so as to ensure the success of the equity offering and compensate the uninformed investors for the winner's curse. Thus the SEO price p_2^y is set according to

$$\mathbb{E}\left[\tilde{\alpha}_\mathrm{N}\left(\tilde{v} + I - p_2^y\right) \,\middle|\, y\right] = 0, \tag{2.29}$$

where $\tilde{v} \in \{V_\mathrm{B}, V_\mathrm{B} - I, 0, V_\mathrm{G} - I, V_\mathrm{G}\}$. In other words, it is set such that uninformed bidders break even conditional on public information.

The SEO price is often lower than the trading price, and the difference is a function of the secondary market price's informativeness and the rationing that occurs at $t = 2$. Prices in the secondary market ($t = 1$) are set in anticipation of the firm's successful fund raising and investment at $t = 2$. That investment succeeds if the firm can raise I by issuing n' new shares—that is, if

$$\frac{n'}{n+n'}\, p_2^y \geq I.$$

A necessary and sufficient condition for the success of the SEO is that

$$p_2^y > I. \tag{2.30}$$

Hence,

$$\iota = \begin{cases} 1 & \text{if } p_2^y > I, \\ 0 & \text{otherwise.} \end{cases} \tag{2.31}$$

Anticipating the effect of prices on firms' fund raising and subsequent investment, the market maker sets the secondary market price as

$$p^y := p_1(y) = \mathbb{E}\left[\tilde{v} \mid y, \iota\right]; \tag{2.32}$$

this is similar to p_1^y in equation (2.6).

Payoff to the Speculator

The speculator's payoff is similar in substance to the one introduced in equation (2.7). Here that equation is adjusted to account for the model's new ingredients. Thus,

$$U = w_1\Pi + w_2\Phi - c\eta. \tag{2.33}$$

Here

$$\Pi = \mathbb{E}\left[a(\tilde{v} - \tilde{p}_1) \mid \tau, \sigma\right] + \alpha_\tau \mathbb{E}\left[\tilde{v} + I - \tilde{p}_2 \mid \tau, \sigma\right] \tag{2.34}$$

because now, in addition to profiting from trades in the secondary market, the speculator can profit from acquiring the proportion α_τ of shares in the equity issue; and

$$\Phi = \mathbb{E}\big(\mathbb{P}(\mathrm{S} \mid \Theta\iota, a_1, a_2, y) \mid \tau, \sigma\big), \tag{2.35}$$

because the fund's clients now have an additional updating variable—namely, the fund's action at $t = 2$.

2.3.2 Equilibria

Information Acquisition: SEO with Profit-Maximizing Speculators

Lemma 2.4 below characterizes the equilibrium in which the skilled speculator acquires information and follows his signal at both $t = 1$ and $t = 2$ and in which the unskilled speculator does not trade at either $t = 1$ or $t = 2$. This is the most economically reasonable equilibrium and the only one satisfying a refinement. The proof consists of two steps: (i) showing that each speculator follows his signal at $t = 1$ independently of $t = 2$ strategies (this is proved in Appendix 2.6.2); and (ii) showing that, at $t = 2$, it is a strictly dominant strategy for each speculator to follow his signal given the refinement.

In Appendix 2.6.2 I argue that, at $t = 1$, neither a skilled nor an unskilled speculator profit from manipulating prices. *Manipulation* is defined as a speculator's trading against his private information. Gerard and Nanda (1993) show that a positively informed speculator may want to sell or not trade at $t = 1$ if his secondary market losses can be recouped by purchasing shares in the SEO at lower prices. In my model, prices feed back into investment and so a positively informed speculator does not manipulate prices: by selling or not trading he would push the good firm's price down; this would cause the SEO to fail and so he would make no profits.

I also find that the unskilled speculator does not manipulate prices. This result is contrary to Goldstein and Guembel (2008), who show that—in a dynamic model with feedback effects—the unskilled profit-maximizing speculator has an incentive to manipulate the price by selling at the first trading stage. There are three main differences between their paper and my SEO application, apart from their examining a managerial learning channel and not a financing channel.[22] First, Goldstein and Guembel study positive NPV projects. Second, at $t = 2$ their speculator has a wider action space in that he can buy, sell, or stay out; since I model an SEO, at $t = 2$ the speculator has only two options: either participate or not in the SEO. Third, they consider a secondary market price setting at $t = 2$ whereas I consider a price setting à la Rock (1986). Goldstein and Guembel argue that selling has a self-fulfilling nature: it depresses prices and leads firms to relinquish investment projects. In their model, the uninformed can profit by establishing a short position in the stock and subsequently driving down the firm's stock price by further sales. Such a strategy is not profitable in my model for two reasons. First, in the bidding stage, speculators can only either buy or stay out. Second, I assume average negative NPV projects and so selling always pushes prices to zero, leaving no room for manipulation.

At $t = 2$, both the skilled and unskilled speculator may be indifferent between buying and staying out if: (i) upon observing the order flow, they anticipate an SEO failure; or (ii) the private information of the skilled speculator is fully reflected by the price. Nevertheless, it is possible to break the indifference and so obtain the equilibrium of Lemma 2.4 as the unique one.[23] This equilibrium is the most reasonable; under it, a skilled speculator follows his signal and an unskilled one never trades—as is the case

[22] The effects of these two channels are identical.

[23] To do so, one must allow the speculator to be "confused", to anticipate observing the wrong SEO price with vanishingly small probability; this is similar to what Rashes (2001) has shown empirically. The following refinement breaks the indifference: The positively informed speculator will always face the possibility of buying underpriced shares, whereas a negatively informed or unskilled speculator will always face the possibility of buying shares in an overpriced firm.

for equilibria in which speculators are profit maximizing and there are no gains from manipulating prices.

Lemma 2.4 *Let*

$$I \leq \frac{\theta[\gamma + (1-\gamma)\beta]V_G + (1-\theta)(1-\gamma)\beta V_B}{[\theta\gamma + (1-\gamma)\beta](1-\epsilon)} =: \mathcal{I}_{\mathrm{pm}}, \tag{2.36}$$

$$c \leq \mathcal{C}_{\mathrm{pm}}. \tag{2.37}$$

Then there exists a unique (refined) perfect Bayesian equilibrium in which the unskilled speculator does not trade at $t = 1$ and stays out at $t = 2$, the skilled speculator acquires information and follows his signal, and firms issue the number of shares that maximizes the probability that investment succeeds. Formally, the following statements hold.

- *The unskilled speculator plays according to the following strategies:*

$$s_1^{\mathrm{U}}(\sigma = \emptyset) = 0,$$
$$s_2^{\mathrm{U}}(\sigma = \emptyset,\, y) = 0.$$

- *The skilled speculator acquires information and plays according to following strategies:*

$$\eta^* = 1,$$
$$s_1^{\mathrm{S}}(\sigma) = \begin{cases} +1 & \text{if} \quad \sigma = \sigma_{\mathrm{G}} \\ -1 & \text{if} \quad \sigma = \sigma_{\mathrm{B}} \end{cases}$$
$$s_2^{\mathrm{S}}(\sigma,\, y) = \begin{cases} +1 & \text{if} \quad \sigma = \sigma_{\mathrm{G}} \\ -1 & \text{if} \quad \sigma = \sigma_{\mathrm{B}}. \end{cases}$$

- *At $t=1$, prices are*

$$\begin{aligned}
p_1^{-2} &= \epsilon\, V_{\mathrm{B}} =: \epsilon\, p_\epsilon^{-2}, \\
p_1^{-1} &= \epsilon\, \frac{\theta(1-\gamma)V_{\mathrm{G}} + (1-\theta)V_{\mathrm{B}}}{\theta(1-\gamma)+1-\theta} =: \epsilon\, p_\epsilon^{-1}, \\
p_1^{0} &= \epsilon\, \bar{V} =: \epsilon\, p_\epsilon^{0}, \\
p_1^{1} &= \frac{\theta V_{\mathrm{G}} + (1-\theta)(1-\gamma)V_{\mathrm{B}}}{\theta+(1-\theta)(1-\gamma)} - (1-\epsilon)I, \qquad (2.38) \\
p_1^{2} &= V_{\mathrm{G}} - (1-\epsilon)I.
\end{aligned}$$

- *At $t=2$, the equity issue succeeds only if $y \in \{1,2\}$; the SEO prices are then*

$$\begin{aligned}
p_2^{1} &= \frac{\theta[\gamma+(1-\gamma)\beta]V_{\mathrm{G}} + (1-\theta)(1-\gamma)\beta V_{\mathrm{B}}}{\theta\gamma+(1-\gamma)\beta} + \epsilon I, \qquad (2.39) \\
p_2^{2} &= V_{\mathrm{G}} + \epsilon I.
\end{aligned}$$

- *All firms' types issue n' shares such that the equity issue succeeds when $y=1$.*

The proof is given in Appendix 2.6.2.

Observing the equilibria of Lemma 2.2 and Lemma 2.4 immediately yields the following corollary.

Corollary 2.4.1 *Given funding at $y=1$ in the baseline and SEO models, the baseline's strategies are restrictions of the SEO's strategies to $t=1$.*

All results depending only on $t=1$ quantities and $t=2$ funding are unchanged provided funding occurs in $y=1$. Observe that $y=1$ implying successful investment imposes different restrictions on projects in the two models. The reason is that rationing concerns increase the cost of capital in the SEO model.

Information Acquisition: SEO with Career-Concerned Speculators

Here I characterize the equilibrium in which a skilled career-concerned speculator acquires information.

Lemma 2.5 *Let*

$$
\begin{aligned}
&I \le \frac{\theta[\gamma + (1-\gamma)\mu^*]V_{\mathrm{G}} + (1-\theta)(1-\gamma)\mu^* V_{\mathrm{B}}}{[\theta\gamma + (1-\gamma)\mu^*](1-\epsilon)} =: \mathcal{I}_{\mathrm{cc}},\\
&c \le \mathcal{C}_{\mathrm{cc}}.
\end{aligned}
$$

Then there exists a perfect Bayesian equilibrium in which the following statements hold.

- *The unskilled speculator plays according to the following strategies:*

$$
s_1^{\mathrm{U}}(\sigma = \emptyset) = \begin{cases} +1 & \textit{with probability } \mu^*, \\ -1 & \textit{with probability } 1-\mu^*; \end{cases}
$$

$$
s_2^{\mathrm{U}}(\sigma = \emptyset,\, y) = \begin{cases} +1 & \textit{if} \quad a_1^{\mathrm{U}} = 1, \\ 0 & \textit{if} \quad a_1^{\mathrm{U}} = -1. \end{cases}
$$

  Here $\mu^* \in [0, \theta)$.

- *The skilled speculator plays according to the following strategies:*

$$
\eta^* = 1;
$$

$$
s_1^{\mathrm{S}}(\sigma) = \begin{cases} +1 & \textit{if} \quad \sigma = \sigma_{\mathrm{G}}, \\ -1 & \textit{if} \quad \sigma = \sigma_{\mathrm{B}}; \end{cases}
$$

$$
s_2^{\mathrm{S}}(\sigma) = \begin{cases} +1 & \textit{if} \quad \sigma = \sigma_{\mathrm{G}}, \\ 0 & \textit{if} \quad \sigma = \sigma_{\mathrm{B}}. \end{cases}
$$

- *At $t = 1$, prices are*

$$p_1^{-2} = p_1^{-1} = \epsilon\, \frac{\theta(1-\gamma)(1-\mu^*)V_{\mathrm{G}} + (1-\theta)[\gamma + (1-\gamma)(1-\mu^*)]V_{\mathrm{B}}}{(1-\theta)\gamma + (1-\gamma)(1-\mu^*)} =: \epsilon\, p_\epsilon^{-1},$$
$$p_1^0 = \epsilon\,[\theta V_{\mathrm{G}} + (1-\theta)V_{\mathrm{B}}] =: \epsilon\, p_\epsilon^0,$$
$$p_1^1 = p_1^2 = \frac{\theta[\gamma + (1-\gamma)\mu^*]V_{\mathrm{G}} + (1-\theta)(1-\gamma)\mu^* V_{\mathrm{B}}}{\theta\gamma + (1-\gamma)\mu^*} - (1-\epsilon)I.$$

- *At $t = 2$, the equity issue succeeds only if $y \in \{1, 2\}$, the SEO prices are then*

$$p_2^1 = p_2^2 = \frac{\theta[\gamma + (1-\gamma)\mu^*]V_{\mathrm{G}} + (1-\theta)(1-\gamma)\mu^* V_{\mathrm{B}}}{\theta\gamma + (1-\gamma)\mu^*} + \epsilon I.$$

- *All firms' types n' shares such that the equity issue succeeds when $y \in \{1, 2\}$.*

The proof is provided in Appendix 2.6.2.

Corollary 2.4.1 is now an immediate consequence of comparing Lemma 2.3 and Lemma 2.5.

2.3.3 Results: Benefits of Career Concerns

There are two main differences between the baseline model and the SEO model, and both arise at $t = 2$: the participants in the equity offering, and the issuer's price setting. In the baseline model, only uninformed capital providers participate in the capital raising. They all have the same information at the funding stage—namely, the public information contained in the price. In the SEO model, both uninformed capital providers and the speculator participate at the bidding stage, and the speculator may have private information. This additional asymmetric information may distort the $t = 2$ prices, which must be set to make the uninformed bidders break even. This distortion affects prices only when speculators are profit maximizing, which leads to the following result.

Proposition 2.5 *The SEO price may be set at a discount only if the speculator is profit maximizing, not if he is career concerned.*

The proof is in Appendix 2.6.2. The intuition behind this result is that career-concerned speculators mitigate the effect of the winner's curse: by participating in the SEO, even if unskilled, they reduce the likelihood of uninformed bidders ending up with too many shares in overpriced firms or, equivalently, of being rationed only when the firm is good.

Corollary 2.5.1 *When profit-maximizing speculators trade, the cost of capital may be higher in an SEO than in the baseline model.*

It follows from Proposition 2.5 that the winner's curse exacerbates the effect of under-provision of information on capital allocation in an SEO, since firms' discounts further inhibit their ability to raise funds. But the winner's curse rationing takes effect at equilibrium only when speculators are profit-maximizing; therefore, when speculators are career concerned, the cost of capital is as high in the SEO as in the baseline model. Finally, although differences between the baseline model and the SEO model affect prices at $t = 2$, they affect neither prices at $t = 1$ nor speculators' behaviors (cf. Corollary 2.4.1).

Loosening Firms' Financial Constraints

I show here that Proposition 2.1 holds, and is even starker when firms raise funds via an SEO. As in Section 2.2.3, I set $\epsilon = 0$ to prove the results.

Proposition 2.6 *Firms can obtain funding for a larger fraction of projects when speculators are career concerned. In other words, there is a range of projects with funding costs* $I \in (\mathcal{I}_{\text{pm}}, \mathcal{I}_{\text{cc}}]$ *that can be undertaken only with career-concerned speculators, where*

$$\mathcal{I}_{\text{cc}} = \frac{\theta[\gamma + (1-\gamma)\mu^*]V_G + (1-\theta)(1-\gamma)\mu^* V_B}{\theta\gamma + (1-\gamma)\mu^*},$$

$$\mathcal{I}_{\text{pm}} = \frac{\theta[\gamma + (1-\gamma)\beta]V_G + (1-\theta)(1-\gamma)\beta V_B}{\theta\gamma + (1-\gamma)\beta}.$$

Proof. Since $\mathcal{I}_{\text{cc}}$ and $\mathcal{I}_{\text{pm}}$ are decreasing functions of μ and β (respectively) and since these functions are equal when $\mu = \beta$, it follows that $\mathcal{I}_{\text{cc}} < \mathcal{I}_{\text{pm}}$ for any $\mu < \beta$. This inequality is always satisfied because $\beta > 1$ and $\mu < 1$. ■

Remarks 2.1 and 2.2 build the intuition of Proposition 2.1 in Section 2.2.3. Remark 2.1 proves that $y = 1$ is pivotal for investment, and Remark 2.2 proves that the cost of capital (given $y = 1$) is lower with career-concerned speculators than with profit-maximizing ones.

The argument that $y = 1$ is pivotal remains unchanged by virtue of Corollary 2.4.1. The intuition behind the lower cost of capital with career-concerned than with profit-maximizing speculators is similar to that for Remark 2.2. In an SEO, however, the winner's curse rationing—which arises when profit-maximizing speculators trade—increases firms' cost of capital (see Corollary 2.5.1). Hence there is an even wider range of projects that can be undertaken only with career-concerned speculators.

Other Benefits

It remains to show that Propositions 2.2–2.4 all hold also in the SEO model. Only the proof of Proposition 2.4 depends on $t = 2$ prices and therefore changes from the baseline model. That proposition states that career-concerned speculators maximize shareholder wealth for a range of parameters $(\theta, \gamma) \in R_{\text{cc}}$. In the case considered here of an SEO, there is a wider region of parameters (θ, γ) in which career-concerned speculators maximize good firms' shareholder wealth. This claim follows directly from Corollary 2.5.1 because, in an SEO when profit-maximizing speculators' trade, good firms face a higher cost of capital and thus a greater underpricing than in the baseline model.

2.4 Extensions

2.4.1 Raising Capital via Debt

I have shown that career-concerned speculators—more so than profit-maximizing ones—reduce a firm's financial constraints when they acquire information and embed it into prices in anticipation of an equity issue. The reader may wonder whether this beneficial effect of career concerns persists when speculators acquire information in anticipation of a debt issue. Here I establish that, conditional on issuing debt or equity, the beneficial effect does persist. However, it is beyond the scope of this paper to identify the conditions under which a firm chooses debt versus equity. (That question is addressed in a different setting by Fulghieri and Lukin (2001) for the case of profit-maximizing speculators.)

For simplicity, I set $\epsilon = 0$. Prices must now be set at $t = 1$ in anticipation of a debt issue. At $t = 2$ the firm is able to raise successfully the required funds I whenever it can issue debt with face value $F > I > V_{\text{B}}$ such that capital providers break even:

$$\hat{\theta}(y)F + \big(1 - \hat{\theta}(y)\big)V_{\text{B}} = I,$$

where $\hat{\theta}(y)$ is the market posterior upon observing y. Thus,

$$F = \frac{I - \big(1 - \hat{\theta}(y)\big)V_{\mathrm{B}}}{\hat{\theta}(y)}. \tag{2.40}$$

Note that I assume (for simplicity) that a good and a bad firm pay off V_{G} and V_{B}, respectively, for certain.

A necessary condition for the debt issue to succeed is that

$$\mathbb{E}\left[V_{\tilde{\Theta}} \,|\, y\right] - I = \hat{\theta}(y)V_{\mathrm{G}} + \big(1 - \hat{\theta}(y)\big)V_{\mathrm{B}} - I \geq 0; \tag{2.41}$$

in fact, if this inequality is not satisfied then there is no F that satisfies equation (2.40), since F must be less than or equal to V_{G}.

Inequality (2.41) is also a sufficient condition for the debt issue to succeed. A good firm issues debt as long as its shareholders gain, which they do if

$$V_{\mathrm{G}} - F = \frac{\mathbb{E}\left[V_{\tilde{\Theta}}|y\right] - I}{\hat{\theta}(y)} > 0, \tag{2.42}$$

that is if

$$\mathbb{E}\left[V_{\tilde{\Theta}} \,|\, y\right] - I \geq 0.$$

Since inequalities (2.41) and (2.3) are equivalent, it follows that a debt issue succeeds if and only if an equity issue succeeds. As in the equity issue case, I indicate by $\iota = 1$ the success of a debt issue and by $\iota = 0$ its failure.

In anticipation of a debt issue and its success, prices in the secondary market are set according to

$$p_1^y = \left[\hat{\theta}(y)(V_{\mathrm{G}} - F)\right]\iota,$$

which—after plugging in (2.42)—is equivalent to

$$p_1^y = \left(\mathbb{E}\left[V_{\Theta} \,\middle|\, y\right] - I\right)\iota = \mathbb{E}\left[\tilde{v} \,\middle|\, y, \iota\right].$$

Secondary market prices in anticipation of a debt issue thus coincide with those in anticipation of an equity issue (i.e., equation (2.6) when $\epsilon = 0$).

2.4.2 A Career-Concerned Speculator Who Cares Also about Profits

Let us now study the behavior of a speculator whose payoff is given by equation (2.7).

I show that the equilibria characterized in Lemmata 2.2 and 2.3 result from the limiting behavior of a speculator who cares both about profits and reputation by letting one of these concerns approach zero. It is interesting that, for sufficiently small w_2 (the weight assigned by the speculator to his reputation) and if $\epsilon = 0$, the skilled speculator never acquires information. This result reinforces the idea that career concerns help firms loosen their financial constraints: absent career concerns, there may be some equilibria in which information is not acquired for any I.

Proposition 2.7 *Depending on the relative degree to which speculators care about profits compared with their reputation, there are three types of equilibria.*

1. *Given vanishing ϵ, for w_2 sufficiently large a speculator behaves as in Lemma 2.3.*
2. *Given vanishing ϵ, for w_2 sufficiently small a speculator never acquires information.*
3. *For fixed $\epsilon > 0$ and w_2 sufficiently small, a speculator behaves as in Lemma 2.2.*

The proof is given in Appendix 2.6.3.

2.4.3 Simultaneous Trading by Profit-Maximizing and Career-Concerned Speculators

Let us now suppose that the speculator can be one of four types: he can be either a skilled or unskilled profit-maximizing speculator or a skilled or unskilled career-concerned speculator. There is a proportion r of career-concerned speculators and a proportion $1 - r$ of profit-maximizing ones. A speculator can be skilled or unskilled with respective probabilities γ and $1 - \gamma$. The timing and the other players are as in the baseline model.

Proposition 2.8 *For each r, γ, V_{G}, and V_{B} there is a $\hat{c}_{\mathrm{cc}} > 0$ such that, as long as $c_{\mathrm{cc}} > \hat{c}_{\mathrm{cc}}$, the main result of the baseline model (Proposition 2.1) obtains.*

The proof is in Appendix 2.6.4. Here I provide a brief intuition. In the baseline model I show that career-concerned speculators loosen firms' financial constraints (compared with profit-maximizing ones) by increasing price informativeness in the pivotal state for investment—that is, in $y = 1$. Here I show that if $y = 1$ is the pivotal state for investment then, as the proportion of career-concerned speculators increases, so does price informativeness and hence the fraction of projects that can be undertaken at equilibrium also increases. In fact, keeping the proportions of skilled and unskilled speculators constant, I show that price informativeness when $y = 1$ increases as the proportion of career-concerned speculators increases.

Proposition 2.8 identifies a sufficient condition for $y = 1$ to be pivotal. Namely, if career-concerned speculators are unwilling to acquire information when investment succeeds in $y = 2$ only (i.e., if $c_{\mathrm{cc}} > \hat{c}_{\mathrm{cc}}$), then profit-maximizing speculators are unwilling to acquire in $y = 2$ and so the market breaks down.

According to Corollary 2.2.1, if investment fails in $y = 1$ then speculators do not acquire information in $y = 2$ because there is no noise in the price. In this case, however, the trade of unskilled career-concerned speculators generates some extra noise in $y = 2$ that may leave some room for the skilled profit-maximizing speculators to profit—even when the equity issue fails in $y = 1$. But as long as $c_{\text{cc}} > \hat{c}_{\text{cc}}$, if investment fails in $y = 1$ then career-concerned speculators will not want to acquire information in $y = 2$. Thus, prices given $y = 2$, are perfectly informative and the skilled profit-maximizing speculator is unwilling to acquire information, just as in Proposition 2.1.

2.5 Conclusions

Traditional corporate finance theories—including the trade-off theory and the pecking order theory—identify the type of capital (internal funds, debt, equity) as an important determinant of its cost. In this paper I identify another determinant of the cost of capital: the type of market participant. This approach is based on the dichotomy between an individual investor and a delegated portfolio manager, where I represent the former as purely profit oriented and the latter as purely career concerned. I show that delegated portfolio managers reduce firms' cost of capital both indirectly, by participating in the secondary market and, directly, by subscribing to firms' capital in the primary market.

Adverse selection plagues markets; it pools firms with good projects and those with bad ones, thereby increasing good firms' cost of external finance. Speculators trade in stock markets and provide capital to firms. By acquiring information and embedding it into prices via their trades, speculators can reduce firms' costs associated with external financing. They transmit part of their private information through stock market prices, guiding uninformed participants in their capital decisions and thus helping good firms to raise funds more cheaply and to invest.

Yet, individual investors who care only about portfolio returns underprovide information. The reason is that speculators can profit from information only by hiding it. This problem is exacerbated when industry fundamentals are poor and prices feed back into investment.

Nowadays, however, it is not individual investors but rather portfolio managers who are the main market participants. Delegated portfolio managers respond to incentives that differ from those of individual investors; in particular, they are career concerned.

Even when the feedback loop caused by firms' financial constraints lead to a severe underprovision of information, career-concerned speculators provide more information to the stock market than do profit-maximizing ones, so the former are better able to loosen firms' financial constraints. These speculators care about signaling their skills to current and potential clients. However, they can do this only by inducing firms' investment and showing that they traded in the right direction—even if their price impact results in limited returns. Yet, career-concerned speculators trade even when they have no information, which distorts order flows and therefore may hamper the allocative role of prices. But I show that, in equilibrium, the trade of unskilled speculators augments the positive effects of delegated portfolio management on capital allocation.

I also show that career-concerned speculators relax firms' financial constraints even when firms raise funds via equity—the most expensive way to raise capital when there is adverse selection. I model an SEO and demonstrate that career-concerned speculators reduce the SEO discount when they provide capital to firms. Direct empirical evidence on the role of institutional investors in SEOs (Chemmanur et al. (2009), Gao and Mahmudi (2006)) is consistent with my results; it has been shown that institutional investors have beneficial effects on the SEO discount and on the likelihood of a successful SEO.

A large empirical literature studies the correlation between secondary market prices and investment. This literature establishes that the secondary market is not merely a side show (see, e.g., Durnev et al. (2004), Wurgler (2000))—in other words, that industries with more efficient prices grow more than do industries with less efficient prices. My model's predictions are in line with those in the work cited here and suggest a new test: Are firms that dependent on external finance for their growth relatively better-off in markets with delegated portfolio managers or in those with individual investors?

2.6 Appendix

2.6.1 Baseline Model

Proof of Lemma 2.2

I show here that there are no profitable deviations from the equilibrium of Lemma 2.2. Uniqueness is shown in the next section.

Prices: For sufficiently small ϵ, if the order flow is $y \in \{-2, -1, 0\}$ then inequality (2.3) does not hold and firms are unable to raise I from capital providers. For those order flows, the posterior probability of the firm being good is either lower than the prior (when $y \in \{-2, -1\}$) or equal to it (when $y = 0$). Since, by Lemma 2.1, firms are unable to raise I when the market believes that the firm is of average quality, it follow that this will also be the case for any posterior belief lower than the one associated with $y = 0$. Nevertheless, even when $y \in \{-2, -1, 0\}$, firms can invest if $\tilde{\chi} = I$.

When the order flow is $y \in \{1, 2\}$, the firm is able to raise I and undertake the project as long as inequality (2.10) is satisfied.

Unskilled speculator: The unskilled speculator has no information on the underlying value of the firm. He prefers not to trade rather than to buy if his payoff from not trading is higher than that from buying—that is,

$$\Pi(a^{\mathrm{U}} = 0) > \Pi(a^{\mathrm{U}} = +1). \tag{2.43}$$

This inequality is satisfied since the speculator's buying moves the price and since it is never profitable for him to buy into a firm of only average quality at a price that is higher than the average price. In fact, inequality (2.43) can be rewritten as

$$0 > \frac{1}{3}(\bar{V} - I + \epsilon I - p_1^2) + \frac{1}{3}(\bar{V} - I + \epsilon I - p_1^1),$$

which is satisfied because $p_1^y > \bar{V} - (1 - \epsilon)I$ for $y \in \{1, 2\}$.

The unskilled speculator prefers not to trade rather than to sell if

$$\Pi(a^{\mathrm{U}} = 0) > \Pi(a^{\mathrm{U}} = -1). \tag{2.44}$$

Given the feedback effect between prices and investment, selling always triggers a firm's funding failure because $y \in \{-2, -1, 0\}$ and inequality (2.3) is never satisfied. However, $\chi = I$ with probability ϵ. Thus, by selling, the unskilled speculator incurs the loss of selling a firm at a price below the average with probability ϵ. He therefore prefers not to. That inequality can be rewritten as

$$0 > \frac{\epsilon}{3}\left(p_\epsilon^{-2} - \bar{V}\right) + \frac{\epsilon}{3}\left(p_\epsilon^{-1} - \bar{V}\right),$$

which is satisfied since $p_\epsilon^y < \bar{V} - I$ for $y \in \{-2, -1\}$.

Skilled negatively informed speculator: A skilled negatively informed speculator prefers to sell rather than to buy or not to trade. He prefers selling to not trading because he can profit from his short position with probability ϵ when $\tilde{\chi} = I$. In fact,

$$\Pi(a^{\mathrm{S}} = -1,\, \sigma = \sigma_{\mathrm{B}}) > \Pi(a^{\mathrm{S}} = 0,\, \sigma = \sigma_{\mathrm{B}})$$

or

$$\frac{\epsilon}{3}\left(p_\epsilon^{-1} - V_{\mathrm{B}}\right) + \left(p_\epsilon^{0} - V_{\mathrm{B}}\right) > 0,$$

since $p_\epsilon^y > V_{\mathrm{B}}$ for $y \in \{-1, 0\}$.

A skilled negatively informed speculator prefers to sell than to buy a bad firm:

$$\Pi(a^{\mathrm{S}} = -1,\, \sigma = \sigma_{\mathrm{B}}) > \Pi(a^{\mathrm{S}} = +1,\, \sigma = \sigma_{\mathrm{B}}),$$

or

$$\frac{\epsilon}{3}\left(p_\epsilon^{-1} - V_{\mathrm{B}} + p_\epsilon^{0} - V_{\mathrm{B}}\right) > \frac{1}{3}\left(V_{\mathrm{B}} - I + \epsilon I - p_1^{2}\right) + \frac{1}{3}\left(V_{\mathrm{B}} - I + \epsilon I - p_1^{1}\right) + \frac{\epsilon}{3}\left(V_{\mathrm{B}} - p_\epsilon^{0}\right),$$

since $p_1^y > V_{\mathrm{B}} - I$ and $p_\epsilon^y > V_{\mathrm{B}}$ for $y \in \{-1, 0, 1, 2\}$.

Skilled positively informed speculator: This type of speculator has no incentive to deviate from buying when observing a positive signal. Not trading or selling would decrease the chances that a good firm invests and would thus reduce his chances of making profits.

The skilled positively informed speculator prefers to buy rather than to sell since

$$\Pi(a^{\mathrm{S}} = +1,\, \sigma = \sigma_{\mathrm{G}}) > \Pi(a^{\mathrm{S}} = -1,\, \sigma = \sigma_{\mathrm{G}})$$

or

$$\frac{1}{3}\left(V_{\mathrm{G}} - I + \epsilon I - p_1^1\right) + \frac{\epsilon}{3}\left(V_{\mathrm{G}} - p_\epsilon^0\right) > \frac{\epsilon}{3}\left(p_\epsilon^{-2} - V_{\mathrm{G}}\right) + \frac{\epsilon}{3}\left(p_\epsilon^{-1} - V_{\mathrm{G}}\right) + \frac{\epsilon}{3}\left(p_\epsilon^{0} - V_{\mathrm{G}}\right),$$

which is satisfied since $p_\epsilon^y < V_{\mathrm{G}} - I$ for $y \in \{-2, -1, 0\}$ and $p_1^1 > V_{\mathrm{G}} - I$. He prefers buying to not trading becuase

$$\Pi(a^{\mathrm{S}} = +1,\, \sigma = \sigma_{\mathrm{G}}) > \Pi(a^{\mathrm{S}} = 0,\, \sigma = \sigma_{\mathrm{G}})$$

or

$$\frac{1}{3}\left(V_{\mathrm{G}} - I + \epsilon I - p_1^1\right) + \frac{\epsilon}{3}\left(V_{\mathrm{G}} - p_\epsilon^0\right) > 0.$$

Information acquisition: Finally, let us look at the skilled speculator's incentives to acquire information. A skilled speculator who acquires information and plays according to the equilibrium strategy just described receives:

$$\begin{aligned}\Pi(s^{\mathrm{S}}(\sigma),\, \eta^* = 1) - c = {} & \theta\left[\frac{1}{3}\left(V_{\mathrm{G}} - I + \epsilon I - p_1^1\right) + \frac{\epsilon}{3}\left(V_{\mathrm{G}} - p_\epsilon^0\right)\right] + \\ & + (1-\theta)\left[\frac{\epsilon}{3}\left(p_\epsilon^{-1} - V_{\mathrm{B}} + p_\epsilon^0 - V_{\mathrm{B}}\right)\right] - c.\end{aligned}$$

If this speculator has not acquired information, it is optimal for him to behave like the unskilled speculator and not trade. He therefore acquires information and follows his signal only if his payoff from doing so is positive or if

$$c < \frac{1}{3}\left\{\frac{\theta(1-\theta)(1-\gamma)\Delta V}{\theta + (1-\theta)(1-\gamma)} + \epsilon\theta(1-\theta)\Delta V\left[2 + \frac{1-\gamma}{\theta(1-\gamma) + (1-\theta)}\right]\right\} := \bar{c}_{\mathrm{pm}}.$$

Good firms: A firm that does not issue equity cannot invest, and its shareholders earn zero profits. Thus, shareholders are better off if the firm invests whenever it has the opportunity because

$$(1-\alpha)V_{\mathrm{G}} \geq 0,$$

where $\alpha \leq 1$ at equilibrium.

Since at $t = 0$ there is a positive probability that the equity issue will succeed, the manager of the good firm will always choose to raise I.

Bad firms: Managers of bad firms receive a private benefit from investing; hence they always choose to issue equity at $t = 0$ because doing so maximizes the likelihood of their of raising I.

On the Uniqueness of the Equilibrium of Lemma 2.2

If $\epsilon = 0$ then there are multiple equilibria—that is, the equilibrium of Lemma 2.2 is not unique. However, none of these equilibria is strict, and the equilibrium of Lemma 2.2 is the only one surviving a refinement. In fact, it is an equilibrium in strictly dominant strategies. To refine away the equilibria, I assume that with some probability ϵ the firm ends up undertaking the project independently of market prices; for example it may obtain some unexpected cash at $t = 2$.

I shall argue that, conditional on the skilled speculator's acquiring information, the equilibrium of Lemma 2.2 is unique. I show this by iterative deletion of strictly dominated strategies.

Observe that

$$\mathbb{E}\left[\tilde{p}_1 \middle| \iota,\, \Theta,\, a\right] \in (\epsilon V_{\mathrm{B}}, V_{\mathrm{G}} - I + \epsilon I)$$

since, after any action, there is at least one order flow that is not fully revealing. In particular, $y = 0$ is never fully revealing and $\mathbb{P}(y = 0|\iota, \Theta, a) > 0$. Now a positively informed speculator strictly prefers to buy because

$$\mathbb{E}\left[\tilde{p}_1\middle|\iota,\, \Theta = \mathrm{G},\, a\right] < V_\mathrm{G} - I + \epsilon I,$$

and a negatively informed speculator strictly prefers to sell because

$$\mathbb{E}\left[\tilde{p}_1\middle|\iota,\, \Theta = \mathrm{B},\, a\right] > \epsilon V_\mathrm{B}.$$

From these inequalities it follows that the unskilled speculator prefers not trading rather than buying or selling fairly priced shares. Even if fund raising fails with probability 1—which makes the speculator indifferent between buying, selling and staying out—firms can invest when $\tilde{\chi} = I$ and thereby break this indifference.

Proof of Corollary 2.2.1

Suppose there exists an equilibrium in which the strategies of the players are as described in Lemma 2.2 but inequality (2.10) is not satisfied. Then secondary market prices are

$$\begin{aligned}
p_1^{-2} &= \epsilon\, V_\mathrm{B} =: \epsilon\, p_\epsilon^{-2},\\
p_1^{-1} &= \epsilon\, \frac{\theta(1-\gamma)V_\mathrm{G} + (1-\theta)V_\mathrm{B}}{\theta(1-\gamma) + 1 - \theta} =: \epsilon\, p_\epsilon^{-1},\\
p_1^{0} &= \epsilon\, \bar{V} =: \epsilon\, p_\epsilon^{0},\\
p_1^{1} &= \epsilon\left[\frac{\theta V_\mathrm{G} + (1-\theta)(1-\gamma)V_\mathrm{B}}{\theta + (1-\theta)(1-\gamma)} - I\right] =: \epsilon p_\epsilon^{1},\\
p_1^{2} &= V_\mathrm{G} - (1-\epsilon)I.
\end{aligned}$$

This cannot be an equilibrium for $\epsilon \to 0$ because the skilled speculator has a profitable deviation: if he acquires information and follows his signal he obtains positive profits with vanishing probability ϵ while incurring a cost c. He then prefers not to acquire information and the market breaks down.

Proof of Lemma 2.3

Prices: For sufficiently low ϵ, if the order flow is $y \in \{-2, -1, 0\}$, condition (2.3) is not satisfied and the equity issue fails. Nevertheless, prices take into account that $\tilde{\chi} = I$ with probability ϵ and so the firm can invest. When $y \in \{1, 2\}$, the firm is able to raise I from capital providers provided that (2.13) is satisfied.

Beliefs: Clients observe the hired fund's action and the firm's type when the investment is undertaken, after which clients update their beliefs about the fund's ability.[24] The client's posteriors are as follows:

$$\mathbb{P}(\mathrm{S} \,|\, \Theta\iota, a, y) \begin{cases} = 0 & \text{if } \Theta\iota = \mathrm{B} \text{ and } a = +1 \\ & \text{or if } \Theta\iota = \mathrm{G} \text{ and } a = -1, \\ = \dfrac{\theta\gamma}{\theta\gamma + (1-\gamma)\mu^*} & \text{if } \Theta\iota = 0 \text{ and } a = +1, \\ = \dfrac{(1-\theta)\gamma}{(1-\theta)\gamma + (1-\gamma)(1-\mu^*)} & \text{if } \Theta\iota = 0 \text{ and } a = -1, \\ = \dfrac{\gamma}{\gamma + (1-\gamma)\mu^*} & \text{if } \Theta\iota = \mathrm{G} \text{ and } a = +1, \\ = \dfrac{\gamma}{\gamma + (1-\gamma)(1-\mu^*)} & \text{if } \Theta\iota = \mathrm{B} \text{ and } a = -1, \\ \in [0,1] & \text{if } a = 0. \end{cases} \tag{2.45}$$

Action $a = 0$ is off the equilibrium path. Perfect Bayesian equilibrium imposes no restrictions. I choose to set

$$\mathbb{P}(\mathrm{S} \,|\, a = 0) = 0. \tag{2.46}$$

In the next section I provide a microfoundation for these out-of-equilibrium beliefs.

[24] The fund's action and the firm's type when the project is undertaken are a sufficient statistic for the order flow.

Unskilled speculator: An unskilled speculator who does not trade obtains no payoff owing to the out-of-equilibrium beliefs of equation (2.46). He mixes between buying and selling if his utility from the the two actions is the same and is greater than zero. His utility from buying is

$$\Phi(a^{\mathrm{U}} = +1) = \frac{1}{3}(1-\epsilon)\frac{\theta\gamma}{\theta\gamma + (1-\gamma)\mu} + \frac{1}{3}\theta\frac{\gamma}{\gamma + (1-\gamma)\mu}(2+\epsilon)\,. \tag{2.47}$$

When this speculator buys, the equity issue can either succeed or fail. If it succeeds, then the firm's value realizes, and so the client can infer the correctness of the fund's trade. If the issue fails, the project is not undertaken, the firm's value is not realized (unless the firm can self-finance the project) and so the client can observe only the fund's action. The firm's equity issue succeeds either when the order flow is $y \in \{1, 2\}$ or when $y = 0$ and $\tilde{\chi} = I$—that is, with overall probability $\left(\frac{2}{3} + \frac{\epsilon}{3}\right)$. In these circumstances, the speculator is wrong with probability $1 - \theta$ and earns nothing (the project is undertaken but the firm is bad) and he is right with probability θ. With remaining probability the firm's offering fails $\left(\frac{1}{3}(1-\epsilon)\right)$.

The unskilled speculator's utility from selling is

$$\Phi(a^{\mathrm{U}} = -1) = (1-\epsilon)\frac{(1-\theta)\gamma}{(1-\theta)\gamma + (1-\gamma)(1-\mu)} + (1-\theta)\epsilon\frac{\gamma}{\gamma + (1-\gamma)(1-\mu)}. \tag{2.48}$$

When this speculator sells, the firm can invest in the project only if $\chi = I$. That is, only with probability ϵ can the client observe the correctness of the fund's trade; otherwise, the firm does not invest and the client can only make inferences from the selling action.

The fund mixes between buying and selling if $\mu^*(\theta, \gamma, \epsilon)$ solves

$$f(\mu^*, \theta, \gamma, \epsilon) = 0,$$

where

$$f(\mu, \theta, \gamma, \epsilon) := \Phi(a^{\mathrm{U}} = +1) - \Phi(a^{\mathrm{U}} = -1). \tag{2.49}$$

I use continuity of the payoff functions to show that, for sufficiently small ϵ, the equilibria are close to those for $\epsilon = 0$. The function $\mu^*(\theta, \gamma, \epsilon)$ is continuous in ϵ at $\epsilon = 0$ because the derivative of μ with respect to ϵ evaluated at $\epsilon = 0$ exists and is finite. In fact,

$$\frac{\partial \mu^*}{\partial \epsilon}\Big|_{\epsilon=0} = -\frac{\partial f/\partial \mu^*}{\partial f/\partial \epsilon}\Big|_{\epsilon=0};$$

furthermore, $\partial f/\partial \epsilon$ is constant and it is different from zero. Thus, since I focus on small ϵ, it suffices to prove the optimality of the fund's action when $\epsilon = 0$.

At equilibrium, $\mu^*(\theta, \gamma, 0) \in [0, \theta)$. In fact, $\mu^*(\theta, \gamma, 0) \in (0, \theta)$ by the intermediate value theorem when one considers that $\gamma \in (0, 1)$ and $\theta \in (0, 1)$ and that f is continuous in μ, as well as

$$\begin{aligned} f(\theta, \theta, \gamma, 0) &= -\frac{3(1-\theta)}{(1-\gamma)(1-\theta) + \gamma(1-\theta)} + \frac{2\theta}{\gamma + (1-\gamma)\theta} + \frac{\theta}{(1-\gamma)\theta + \gamma\theta} \\ &= -\frac{2\gamma(1-\theta)}{\gamma(1-\theta) + \theta} < 0 \end{aligned}$$

and

$$f(0, \theta, \gamma, 0) = \frac{1}{\gamma} - \frac{3(1-\theta)}{1 - \gamma + \gamma(1-\theta)} + \frac{2\theta}{\gamma} > 0 \quad \text{when} \quad \gamma < \frac{1+2\theta}{3 - 2\theta + 2\theta^2}.$$

Whenever $\gamma \in \left[\frac{1+2\theta}{3-2\theta+2\theta^2}, 1\right]$, we have that $\mu^* = 0$. And, since f is strictly decreasing in μ, it follows that μ^* is unique.

The equation for μ^* when $\epsilon = 0$ is

$$\mu^*(\theta, \gamma, 0) = \frac{2\gamma\theta^2 + \theta(3-\gamma) - 3\gamma}{6(1-\gamma)} + \\ + \frac{1}{6}\sqrt{\frac{9\gamma^2 - 6\gamma\theta - 30\,\gamma^2\theta + 9\theta^2 + 18\gamma\theta^2 + 37\gamma^2\theta^2 - 12\,\gamma\theta^3 - 20\gamma^2\theta^3 + 4\gamma^2\theta^4}{(1-\gamma)^2}}. \quad (2.50)$$

Skilled speculator: I show (i) that the skilled speculator has no profitable deviation from following his signal after acquiring information (ii) that he prefers to acquire. A skilled speculator who acquires and obtains a positive signal prefers buying to selling or to not trading. In fact,

$$\Phi\left(a^{\mathrm{S}} = 1,\, \sigma = \sigma_{\mathrm{G}},\, \eta^* = 1\right) > \max\left\{\Phi\left(a^{\mathrm{S}} = 0,\, \sigma = \sigma_{\mathrm{G}},\, \eta^* = 1\right), \Phi\left(a^{\mathrm{S}} = -1,\, \sigma = \sigma_{\mathrm{G}},\, \eta^* = 1\right)\right\},$$

where

$$\Phi(a^{\mathrm{S}} = +1,\, \sigma = \sigma_{\mathrm{G}},\, \eta^* = 1) = \frac{1}{3}(2+\epsilon)\frac{\gamma}{\gamma + (1-\gamma)\mu^*} + \frac{1}{3}(1-\epsilon)\frac{\theta\gamma}{\theta\gamma + (1-\gamma)\mu^*},$$
$$\Phi(a^{\mathrm{S}} = 0,\, \sigma = \sigma_{\mathrm{G}},\, \eta^* = 1) = 0,$$
$$\Phi(a^{\mathrm{S}} = -1,\, \sigma = \sigma_{\mathrm{G}},\, \eta^* = 1) = (1-\epsilon)\frac{(1-\theta)\gamma}{\gamma(1-\theta) + (1-\gamma)(1-\mu^*)} + (1-\theta)\epsilon\frac{\gamma}{\gamma + (1-\gamma)(1-\mu^*)}.$$

I must therefore show that

$$\Phi(a^{\mathrm{S}} = +1,\, \sigma = \sigma_{\mathrm{G}},\, \eta^* = 1) - \Phi(a^{\mathrm{S}} = -1,\, \sigma = \sigma_{\mathrm{G}},\, \eta^* = 1) > 0, \quad (2.51)$$

since the payoff from buying is always greater than zero for $\gamma \in (0,1)$. This difference is continuous in both μ and ϵ, and it is strictly positive at $\epsilon = 0$. Again, since I focus on small ϵ, it suffices to prove the optimality of the fund's action when $\epsilon = 0$.

For $\epsilon = 0$, the fund prefers to buy if

$$\frac{2}{3}\frac{\gamma}{\gamma + (1-\gamma)\mu^*} + \frac{1}{3}\frac{\theta\gamma}{\theta\gamma + (1-\gamma)\mu^*} - \frac{(1-\theta)\gamma}{\gamma(1-\theta) + (1-\gamma)(1-\mu^*)} > 0. \quad (2.52)$$

This function is decreasing in μ and so if it is satisfied for $\mu = \theta$, then it is satisfied for all $\mu < \theta$. Rewriting inequality (2.52) for $\mu = \theta$ now yields

$$\frac{2}{3(\gamma + \theta(1-\gamma))};$$

this value is always strictly positive, which proves inequality (2.51).

Upon observing a bad signal, the skilled speculator must prefer to sell rather than to buy or to not trade:

$$\Phi(a^{\mathrm{S}} = -1,\, \sigma = \sigma_{\mathrm{B}},\, \eta^* = 1) > \max\left\{\Phi(a^{\mathrm{S}} = 0,\, \sigma = \sigma_{\mathrm{B}},\, \eta^* = 1), \Phi(a^{\mathrm{S}} = +1,\, \sigma = \sigma_{\mathrm{B}},\, \eta^* = 1)\right\},$$

where

$$\begin{aligned}
\Phi(a^{\mathrm{S}} = -1,\, \sigma = \sigma_{\mathrm{B}},\, \eta^* = 1) &= (1-\epsilon)\frac{(1-\theta)\gamma}{(1-\theta)\gamma + (1-\gamma)(1-\mu^*)} + \epsilon\frac{\gamma}{\gamma + (1-\gamma)(1-\mu^*)}, \\
\Phi(a^{\mathrm{S}} = 0,\, \sigma = \sigma_{\mathrm{B}},\, \eta^* = 1) &= 0, \\
\Phi(a^{\mathrm{S}} = +1,\, \sigma = \sigma_{\mathrm{B}},\, \eta^* = 1) &= \frac{1}{3}(1-\epsilon)\frac{\theta\gamma}{\theta\gamma + (1-\gamma)\mu^*}.
\end{aligned}$$

I must show that

$$\Phi(a^{\mathrm{S}} = -1, \sigma = \sigma_{\mathrm{B}}, \eta^* = 1) - \Phi(a^{\mathrm{S}} = +1, \sigma = \sigma_{\mathrm{B}}, \eta^* = 1) > 0; \tag{2.53}$$

for $\epsilon = 0$ this inequality can be rewritten as

$$\frac{(1-\theta)\gamma}{(1-\theta)\gamma + (1-\gamma)(1-\mu^*)} - \frac{1}{3}\frac{\theta\gamma}{\theta\gamma + (1-\gamma)\mu^*} > 0,$$

and is satisfied.

Having proved that the skilled speculator prefers to follow his signal, I must now show that he prefers to acquire information. His payoff from acquiring information and following his signal is

$$\begin{aligned}\Phi(s^{\mathrm{S}}(\sigma),\, \eta^*=1)-c = \theta\frac{1}{3}\,(2+\epsilon)\,\frac{\gamma}{\gamma+(1-\gamma)\mu^*} + \theta\frac{1}{3}(1-\epsilon)\frac{\theta\gamma}{\theta\gamma+(1-\gamma)\mu^*}+ \\ +(1-\theta)(1-\epsilon)\frac{(1-\theta)\gamma}{(1-\theta)\gamma+(1-\gamma)(1-\mu^*)}+ \\ +(1-\theta)\epsilon\frac{\gamma}{\gamma+(1-\gamma)(1-\mu^*)}-c.\end{aligned} \tag{2.54}$$

If the speculator does not acquire information, then what is his optimal deviation? When $\mu^* \in (0,\theta)$, the payoff from buying and selling is the same at equilibrium and is higher than the payoff from not trading; hence selling is an optimal deviation. When $\mu^*=0$, selling is the unique most profitable deviation. Thus, for all $\mu^* \in [0,\theta)$, selling is the most profitable deviation. I must therefore show that

$$g(\mu^*,\theta,\gamma,\epsilon) := \Phi(s^{\mathrm{S}}(\sigma),\, \eta^*=1) - \Phi(a^{\mathrm{S}}=-1,\, \eta^*=1) > 0. \tag{2.55}$$

Again, I show strict preference and continuity at $\epsilon = 0$ in order to prove the existence of an equilibrium for small ϵ. Since g is continuous in both μ and ϵ and g is strictly positive at $\epsilon=0$, I focus on $\epsilon=0$ and show that g is indeed strictly positive. In fact,

$$g(\mu^*,\theta,\gamma,0) = \frac{2\theta\gamma}{3(\gamma+(1-\gamma)\mu^*)} + \frac{\theta^2\gamma}{3(\theta\gamma+(1-\gamma)\mu^*)} - \frac{\theta(1-\theta)\gamma}{(1-\theta)\gamma+(1-\gamma)(1-\mu^*)} > 0;$$

the reason is that $g>0$ exactly when $\frac{g}{\theta\gamma}>0$ and when $\frac{\partial(\frac{g}{\theta\gamma})}{\partial\gamma}<0$ for all $\mu,\gamma\in(0,1)$ and θ. Since $g=0$ when $\gamma=1$, it follows that g is strictly positive for $\gamma\in(0,1)$.

Thus, the skilled speculator is better-off acquiring than not acquiring if

$$\Phi(s^{\mathrm{S}}(\sigma),\, \eta^*=1)-c \geq \Phi(a^{\mathrm{S}}=-1,\, \eta=0)$$

or

$$c < \frac{(2+\epsilon)\theta\gamma}{3(\gamma+(1-\gamma)\mu^*)} + \frac{(1-\epsilon)\theta^2\gamma}{3(\theta\gamma+(1-\gamma)\mu^*)} - \frac{(1-\epsilon)\theta(1-\theta)\gamma}{(1-\theta)\gamma+(1-\gamma)(1-\mu^*)} =: \bar{c}_{\mathrm{cc}}. \tag{2.56}$$

Firms: Firms have the same incentives as those described in the proof of Lemma 2.2.

Microfoundation of Out-of-Equilibrium Beliefs

The equilibrium in Lemma 2.3 relies on the out-of-equilibrium belief that

$$\mathbb{P}(\mathrm{S}|a = 0) = 0,$$

that is, on the career-concerned speculator's earning no profit if he abstains from trading. But is it reasonable to impose such a strict out-of-equilibrium belief?

Suppose there exists a small proportion of "naive" managers who always follow their signals; accordingly, they do not trade when they receive a signal $\sigma = \emptyset$. In this case, to refrain from trading is no longer an out-of-equilibrium event. I use $r(\cdot)$ to denote the equilibrium reputation. Now suppose that $r(\text{right})$, the reputation from being right, is greater than $r(\text{wrong})$; suppose also that $r(\text{right}) > 0 \geq r(\text{wrong})$.[25]

In any equilibrium in which these assumptions hold, it is optimal for a skilled speculator to follow his signal. Then, when the client observes his fund playing $a = 0$, it must be that the fund is unskilled, that is, $r(a = 0) = 0$. Moreover, since a skilled speculator can never be wrong, it must also be that a wrong speculator is unskilled; that is, $r(\text{wrong}) = 0$. Then, for any randomizing probability, the unskilled speculator is better-off randomizing between buying and selling than not trading, since by randomizing he at least has a chance of being right.

[25] It is possible to show that this is always the case when the career-concerned speculator cares enough about profits.

2.6.2 Seasoned Equity Offering

Proof of Lemma 2.4

Unskilled speculator: Let us check that his strategy at $t = 2$ is subgame perfect. For $y \in \{1, 2\}$, this speculator prefers staying out to buying:

$$0 > \alpha_{\mathrm{U}}\,(\bar{V} + \epsilon I - p_2^y) \quad \forall y \in \{1, 2\};$$

this follows because $p_2^y > \bar{V} + \epsilon I$ for $y \in \{1, 2\}$. For $y \in \{-2, -1, 0\}$, the SEO fails and the speculator is indifferent between buying and staying out.

By the one deviation property, I need only to check that the unskilled speculator has no incentive to deviate at $t = 1$ in order to prove that the strategy at $t = 1$ is subgame perfect. The proof is the same as the proof in Lemma 2.2, where I show that the unskilled speculator has no incentive to deviate from not trading.

Skilled positively informed speculator: Let us check that his strategy at $t = 2$ is subgame perfect. When $y = 1$, he clearly prefers buying to staying out:

$$\alpha_{\mathrm{S}}\,(V_{\mathrm{G}} + \epsilon I - p_2^1) > 0,$$

since $p_2^1 < V_{\mathrm{G}} + \epsilon I$. For any other y this speculator is indifferent. In fact, when $y = 2$ his private information is revealed and the price reflects the firm's fair value; he then makes zero profit regardless. When $y \in \{-2, -1, 0\}$, the SEO fails and he is indifferent between buying and staying out.

To show that the speculator's strategy at $t = 1$ is subgame perfect, it is enough to check deviations at $t = 1$. For the proof, refer to that of Lemma 2.2 for the skilled speculator.

Skilled negatively informed speculator: When $y \in \{-2, -1, 0\}$, this speculator is indifferent between buying and staying out because the SEO fails. When $y \in \{1, 2\}$ he prefers to stay out since he does not want to buy overpriced a bad firm. In fact,

$$0 > \alpha_{\mathrm{S}}(V_{\mathrm{B}} + \epsilon I - p_2^y), \quad \text{where} \quad y \in \{1, 2\}.$$

For the proof that his $t = 1$ strategy is subgame perfect, please refer to the proof of Lemma 2.2.

Information acquisition: The skilled speculator prefers to acquire information and follow his signal if

$$\begin{aligned}\Pi(s^{\mathrm{S}}(\sigma), \eta^* = 1) = \theta &\left[\frac{1}{3}\left(V_{\mathrm{G}} - I + \epsilon I - p_1^1\right) + \frac{\epsilon}{3}\left(V_{\mathrm{G}} - p_\epsilon^0\right)\right] + \\ &+ (1-\theta)\left[\frac{\epsilon}{3}\left(p_\epsilon^{-1} - V_{\mathrm{B}} + p_\epsilon^0 - V_{\mathrm{B}}\right)\right] + \\ &+ \frac{\theta}{3}\alpha_{\mathrm{S}}\left(V_{\mathrm{G}} + \epsilon I - p_2^1\right) - c > 0,\end{aligned}$$

that is, if

$$\begin{aligned}c < \mathcal{C}_{\mathrm{pm}} :=& \frac{\theta(1-\theta)(1-\gamma)\Delta V}{3[\theta + (1-\theta)(1-\gamma)]} + \\ &+ \frac{\epsilon\theta(1-\theta)\Delta V}{3}\left(2 + \frac{1-\gamma}{\theta(1-\gamma) + (1-\theta)}\right) + \frac{\theta}{3}\alpha_{\mathrm{S}}\frac{(1-\theta)(1-\gamma)\beta\Delta V}{\theta\gamma + (1-\gamma)\beta}.\end{aligned}$$

Good firm: The manager of the good firm seeks to maximize the probability of investment in order to maximize shareholders' wealth. Whenever investment succeeds (i.e., $p_2^y > I$), shareholders receive

$$\left(1 - \frac{I}{p_2^1}\right)(V_{\mathrm{G}} + \epsilon I);$$

this value is greater than zero, which is all any shareholders would receive if the manager did not issue shares or issued too small a number of shares.

At $t = 0$, the firm's manager issues the number of shares that will warrant the equity issue's success when the level of informativeness in prices is the lowest (i.e., when $y = 1$):

$$\frac{n'}{n + n'} p_2^1 = I. \tag{2.57}$$

Issuing a number of shares that satisfies equation (2.57), guarantees that, when the order flow is $y \in \{1, 2\}$, the firm can raise capital to undertake the project and shareholders are better-off.

Bad firm: The manager of the bad firm pools with the manager of the good firm by issuing the same number of shares, since choosing any other number of shares would reveal him to be bad. Therefore, with positive probability, the firm obtains funding and its manager earns private benefits.

On the Absence of Manipulation at $t = 1$

Two papers closely related to mine address manipulation: Gerard and Nanda (1993) and Goldstein and Guembel (2008). The former investigates the incentives to manipulate of a positively informed speculator; the latter those of an unskilled speculator. I show that the manipulation strategies outlined in these papers are unprofitable in my setting. The incentives to manipulate at $t = 1$ may arise for two reasons: to increase profits at $t = 1$ or to increase profits at $t = 2$ (and potentially suffering losses at $t = 1$).

Given a sufficiently small cost of acquiring information that the skilled speculator does so, I show that a speculator has no incentive to manipulate prices at $t = 1$. Toward this end, I show first that selling at $t = 1$ is a strictly dominant strategy for the negatively informed speculator and second that, in every equilibrium of the reduced game, all speculators follow their signals.

A negatively informed speculator does not profit from manipulating prices at $t = 1$ to increase his profits at $t = 2$ because he cannot short in the primary market. He can profit only at $t = 1$, so he chooses the action that maximizes his $t = 1$ expected profits. Since

$$\mathbb{E}\left[\tilde{p}_1 \middle| \iota, \Theta, a\right] \in (\epsilon V_{\mathrm{B}}, V_{\mathrm{G}} - I + \epsilon I), \tag{2.58}$$

he always prefers to sell.

Let us now study the reduced game. I have shown that the negatively informed speculator strictly prefers to sell at $t = 1$. Assume that the unskilled buys with probability ρ_1, does not trade with probability ρ_2, and sells with probability $1-\rho_1-\rho_2$. Assume further that the positively informed specualtor buys with probability δ_1, does not trade with probability δ_2 and sells with probability $1 - \delta_1 - \delta_2$. The equilibrium order flow at $t = 1$ is $y \in \{-2, 1, 0, 1, 2\}$, and prices are as follows:

$$\begin{aligned}
p_1^{-2} &= \epsilon \frac{\theta(1-\gamma)(1-\rho_1-\rho_2)V_{\mathrm{G}} + (1-\theta)[\gamma + (1-\gamma)(1-\rho_1-\rho_2)]V_{\mathrm{B}}}{(1-\gamma)(1-\rho_1-\rho_2) + (1-\theta)\gamma} =: \epsilon p_\epsilon^{-2}, \\
p_1^{-1} &= \frac{\theta[\gamma(1-\delta_1) + (1-\gamma)(1-\rho_1)]V_{\mathrm{G}} + (1-\theta)[\gamma + (1-\gamma)(1-\rho_1)]}{\theta\gamma(1-\delta_1) + (1-\gamma)(1-\rho_1) + (1-\theta)\gamma} =: \epsilon p_\epsilon^{-1}, \\
p_1^0 &= \epsilon \bar{V} =: \epsilon p_\epsilon^0, \\
p_1^1 &= \frac{\theta[\gamma(\delta_1+\delta_2) + (1-\gamma)(\rho_1+\rho_2)]V_{\mathrm{G}} + (1-\theta)(1-\gamma)(\rho_1+\rho_2)V_{\mathrm{B}}}{\theta\gamma(\delta_1+\delta_2) + (1-\gamma)(\rho_1+\rho_2)} - (1-\epsilon)I, \\
p_1^2 &= \frac{\theta[\gamma\delta_1 + (1-\gamma)\rho_1]V_{\mathrm{G}} + (1-\theta)(1-\gamma)\rho_1 V_{\mathrm{B}}}{\theta\gamma\delta_1 + (1-\gamma)\rho_1} - (1-\epsilon)I.
\end{aligned}$$

Secondary market prices are determined according to equation (2.32), and if inequality (2.30) holds then firms can raise enough funds to invest when $y \geq 1$. For $y \in \{-2, -1, 0\}$, (2.30) does not hold for any speculator strategy and the SEO fails.

Therefore, given the order flow, the firm sets the SEO prices at $t = 2$ such that

$$p_2^1 \leq p_1^1 + I,$$

$$p_2^2 \leq p_2^1 + I.$$

Because of the rationing problem, the SEO price per share (given $y = 1$) cannot be higher than the secondary market price per share. Whether this condition holds will depend on speculators' $t = 2$ strategies, about which I make no assumption. The inequalities just displayed constitute an equilibrium if the positively informed and the unskilled speculators are indifferent among buying, selling, and not trading.

If a positively informed speculator sells, the SEO then fails with probability 1, and he makes no profits at $t = 2$ irrespective of his strategy at $t = 1$. His profits are

$$\Pi(a_1^{\mathrm{S}} = -1,\, \sigma = \sigma_{\mathrm{G}},\, \eta^* = 1) = \frac{\epsilon}{3}\left(V_{\mathrm{G}} - p_\epsilon^{-2} + V_{\mathrm{G}} - p_\epsilon^{-1} + V_{\mathrm{G}} - p_\epsilon^0\right).$$

If he does not trade at $t = 1$ then the SEO succeeds when $y = 1$, in which case the speculators strictly prefers to buy at $t = 2$. His profits are then

$$\Pi(a_1^{\mathrm{S}} = 0,\, \sigma = \sigma_{\mathrm{G}},\, \eta^* = 1) = \frac{1}{3}\alpha_{\mathrm{S}}\left(V_{\mathrm{G}} + \epsilon I - p_2^1\right).$$

If the positively informed speculator buys at $t = 1$ then the SEO succeeds whether $y = 1$ or $y = 2$; he then strictly prefers to buy at $t = 2$ and his profits are

$$\begin{aligned}\Pi(a_1^{\mathrm{S}} = 1,\, \sigma = \sigma_{\mathrm{G}},\, \eta^* = 1) = {} & \frac{1}{3}(V_{\mathrm{G}} - I + \epsilon I - p_1^2) + \frac{1}{3}(V_{\mathrm{G}} - I + \epsilon I - p_1^1) + \frac{\epsilon}{3}(V_{\mathrm{G}} - p_\epsilon^0) + \\ & + \frac{1}{3}\alpha_{\mathrm{S}}\left(V_{\mathrm{G}} + \epsilon I - p_2^1\right) + \frac{1}{3}\alpha_{\mathrm{S}}\left(V_{\mathrm{G}} + \epsilon I - p_2^2\right).\end{aligned}$$

By equation (2.58) we have

$$\mathbb{E}\left[\tilde{p}_1 \middle| \iota, \Theta, a\right] < V_{\mathrm{G}} - I + \epsilon I$$

so, for $\epsilon \to 0$, the speculator strictly prefers to buy.

Let us now study the unskilled speculator. In Goldstein and Guembel (2008) there are no equilibria in which an unskilled speculator profits from buying at $t = 1$. Buying at $t = 1$ is never profitable for such a speculator in a game where prices feed back into investment. First, buying increases the firm's excepted value, but the unskilled speculator expects the firm's value to be lower than what is reflected by prices. Second, by increasing the price, this speculator may influence a firm's investment (through reducing its cost of equity) and thereby lead firms to overinvest, reducing the value of his long position. The exact same argument applies here.

Contrary to Goldstein and Guembel (2008), however, I find that selling is not profitable for the unskilled speculator, either. Projects in their model have ex ante positive NPV, and the unskilled speculator can profit by establishing a short position in a stock (at $t = 1$) and then driving down the stock price from further sales (at $t = 2$). The market will infer that the lower price may reflect negative information about the firm and thus lead the investment to fail. In my model such a strategy is not possible: The unskilled speculator cannot sell at $t = 2$ because the action space is restricted to buying or not buying shares in the equity issue. He will therefore choose his action to maximize his expected profits at $t = 1$.

Given that the skilled speculator always follows his signal, the unskilled speculator prefers not to trade rather than to buy or to sell at $t = 1$.

Proof of Lemma 2.5

Prices: The firm can successfully raise funds when $y = \{1, 2\}$ if $p_2^y > I$. If $y = \{-2, -1, 0\}$ the SEO fails, since then inequality (2.30) does not hold.

Beliefs: Clients' posteriors are now

$$\mathbb{P}(\mathrm{S} \,|\, \Theta\iota, y, a_1, a_2) \begin{cases} = 0 & \text{if } \Theta\iota = \mathrm{B} \text{ and } a_1 = a_2 = +1 \\ & \text{or if } \Theta\iota = \mathrm{G} \text{ and } a_1 = -1 \text{ and } a_2 = 0 \\ = \dfrac{\theta\gamma}{\theta\gamma + (1-\gamma)\mu^*} & \text{if } \Theta\iota = 0 \text{ and } a_1 = a_2 = +1 \\ = \dfrac{(1-\theta)\gamma}{(1-\theta)\gamma + (1-\gamma)(1-\mu^*)} & \text{if } \Theta\iota = 0 \text{ and } a_1 = -1 \text{ and } a_2 = 0 \\ = \dfrac{\gamma}{\gamma + (1-\gamma)\mu^*} & \text{if } \Theta\iota = \mathrm{G} \text{ and } a_1 = a_2 = +1 \\ = \dfrac{\gamma}{\gamma + (1-\gamma)(1-\mu^*)} & \text{if } \Theta\iota = \mathrm{B} \text{ and } a_1 = -1 \text{ and } a_2 = 0 \\ \in [0,1] & \text{if } a_1 = 0 \\ \in [0,1] & \text{if } a_1 \ncong a_2 \end{cases}$$

where by $a_1 \cong a_2$ I mean that (i) if the speculator buys at $t = 1$ then he buys at $t = 2$ and (ii) if the speculator sells at $t = 1$ he stays out at $t = 2$.

Since perfect Bayesian equilibrium does not impose any restrictions on the out-of-equilibrium beliefs, I choose to set

$$\mathbb{P}\left(\mathrm{S} \,\middle|\, a_1 = 0\right) = 0 \tag{2.59}$$

and

$$\mathbb{P}\left(\mathrm{S} \,\middle|\, a_1 \ncong a_2\right) = 0. \tag{2.60}$$

By imposing the out-of-equilibrium belief of (2.60), the problem reduces to the one already solved in Lemma 2.3. Clients observe two actions that, at equilibrium, contain the same information as what can be inferred by observing a_1 in the baseline model. Hence, the proof of the equilibrium behavior of unskilled and skilled speculators mirrors the proof of Lemma 2.3.

Firms: Firms have the same incentives as those described in the proof of Lemma 2.4 (Appendix 2.6.2).

SEO Discount

An SEO succeeds if and only if $y \in \{1, 2\}$, as shown in Propositions 2.4 and 2.5.

When profit-maximizing speculators trade and $y = 2$, the price per share at $t = 1$ equals the price at $t = 2$—since the speculator's private information is revealed in the $t = 1$ price and since uninformed bidders do not face the winner's curse. When $y = 1$, the $t = 1$ price per share is higher than its $t = 2$ counterpart. In fact, if $y = 1$ then n' (the number of shares issued at $t = 0$) solves for

$$\frac{n'}{n + n'} p_2^1 = I$$

as described in equation (2.57). Then, after substituting for n' from the previous equation in the $t = 2$ price per share

$$\frac{p_2^1}{n + n'} = \frac{p_2^1}{n + \frac{I \cdot n}{p_2^1 - I}} = \frac{p_2^1 - I}{n};$$

this value is always lower than the $t = 1$ price per share (p_1^1/n). Comparing the SEO price of (2.39) with the secondary market price of (2.38), it makes it clear that

$$p_1^1 > p_2^1 - I.$$

When career-concerned speculators trade, the price per share at $t = 1$ and at $t = 2$ is equal if the SEO succeeds. According to the equilibrium prices given in Lemma 2.5, if $y \in \{1, 2\}$ then

$$p_1^y = p_2^y - I.$$

2.6.3 Proof of Proposition 2.7

Suppose that for sufficiently low cost of information acquisition ($c < \mathcal{C}$) and for sufficiently low investment cost ($I < \mathcal{I}$) there exists an equilibrium in which the skilled speculator acquires information and follows his signal and in which the unskilled speculator mixes between buying and selling (and buys with probability μ^{**}).

Then, if inequality (2.3) is satisfied whenever $y > 0$, the prices at equilibrium are

$$p_1^{-2} = p_1^{-1} = \epsilon\,\frac{\theta(1-\gamma)(1-\mu^{**})V_{\mathrm{G}} + (1-\theta)[\gamma + (1-\gamma)(1-\mu^{**})]V_{\mathrm{B}}}{(1-\theta)\gamma + (1-\gamma)(1-\mu^{**})} =: \epsilon p_\epsilon^{-1},$$
$$p_1^0 = \epsilon\,\bar{V} =: \epsilon\, p_\epsilon^0,$$
$$p_1^1 = p_1^2 =: \frac{\theta[\gamma + (1-\gamma)\mu^{**}]V_{\mathrm{G}} + (1-\theta)(1-\gamma)\mu^{**}V_{\mathrm{B}}}{\theta\gamma + (1-\gamma)\mu^{**}} - (1-\epsilon)I.$$

Let us check that this is an equilibrium.

Unskilled speculator: The unskilled speculator's payoff from buying is:

$$\begin{aligned} U\left(a^{\mathrm{U}} = +1\right) =& w_1\Pi\left(a^{\mathrm{U}} = +1\right) + w_2\Phi\left(a^{\mathrm{U}} = +1\right) = \\ =& -\frac{2}{3}w_1\left[\frac{\Delta V\theta(1-\theta)\gamma}{\theta\gamma + (1-\gamma)\mu}\right] + \\ &+ \frac{1}{3}w_2\left[(1-\epsilon)\frac{\theta\gamma}{\theta\gamma + (1-\gamma)\mu} + (2+\epsilon)\,\frac{\theta\gamma}{\gamma + (1-\gamma)\mu}\right]. \end{aligned} \tag{2.61}$$

The unskilled speculator's payoff from selling is:

$$\begin{aligned} U\left(a^{\mathrm{U}} = -1\right) =& w_1\Pi\left(a^{\mathrm{U}} = -1\right) + w_2\Phi\left(a^{\mathrm{U}} = -1\right) = \\ =& -\frac{2}{3}\epsilon w_1\left[\frac{\Delta V\theta(1-\theta)\gamma}{\theta(1-\gamma) + (1-\gamma)(1-\mu)}\right] + \\ &+ w_2\left[(1-\epsilon)\frac{(1-\theta)\gamma}{(1-\theta)\gamma + (1-\gamma)(1-\mu)} + \epsilon\frac{(1-\theta)\gamma}{\gamma + (1-\gamma)(1-\mu)}\right] \end{aligned} \tag{2.62}$$

And the unskilled's payoff from not trading is:

$$U\left(a^{\mathrm{U}} = 0\right) = w_1\Pi\left(a^{\mathrm{U}} = 0\right) + w_2\Phi\left(a^{\mathrm{U}} = 0\right) = 0.$$

This speculator randomizes between buying and selling provided: (i) the utility from buying or selling is higher than that from not trading, which is the case whenever

$\epsilon = 0$ and $w_2 > 0$; and (ii) there exists a μ^{**} that makes him indifferent between buying and selling, or such that

$$\varphi\left(\mu^{**}, \theta, \gamma, \Delta V, w_1, w_2\right) = U\left(a^{\mathrm{U}} = +1\right) - U\left(a^{\mathrm{U}} = -1\right) = 0.$$

Note that

$$\varphi\left(\mu, \theta, \gamma, \Delta V, w_1, w_2\right) = f\left(\mu, \theta, \gamma, \epsilon\right) - h\left(\mu, \theta, \gamma, \Delta V, w_1, \epsilon\right),$$

where f is as defined in equation (2.49) and

$$h(\mu, \theta, \gamma, \Delta V, w_1, \epsilon) = \frac{2}{3} w_1 \Delta V \theta (1-\theta)\gamma \left[\frac{1}{\theta\gamma + (1-\gamma)\mu} - \frac{\epsilon}{\theta(1-\gamma) + (1-\gamma)(1-\mu)}\right].$$

Whenever $w_1 = 0$ we have $h = 0$ and so $\mu^{**} = \mu^*$, where $\mu^*(\epsilon = 0)$ is defined as in equation (2.50).

Now fix $\epsilon = 0$, which yields

$$\frac{d\mu^{**}}{dw_1} = -\frac{\partial\varphi/\partial w_1}{\partial\varphi/\partial\mu}.$$

Since at $\epsilon = 0$ we have

$$\frac{\partial\varphi}{\partial w_1} < 0,$$

it follows that $\frac{\partial\varphi}{\partial\mu}$ determines the sign of the derivative of μ^{**} with respect to w_1. And because

$$\begin{aligned}\frac{\partial\varphi}{\partial\mu^{**}} = &- \frac{3(1-\gamma)(1-\theta)}{(\gamma(1-\theta) + (1-\gamma)\ (1-\mu))^2} - \frac{2(1-\gamma)\theta}{(\gamma + (1-\gamma)\mu\ )^2} - \frac{(1-\gamma)\theta}{(\gamma\theta + (1-\gamma)\mu)^2} + \\ &+ \frac{w_1}{w_2} \frac{2\Delta V(1-\gamma\ )(1-\theta)\theta}{(\gamma\theta + (1-\gamma)\mu)^2},\end{aligned}$$

$\frac{d\mu^{**}}{dw_1} < 0$ if $\frac{\partial\varphi}{\partial\mu} < 0$ or, equivalently, if w_1 is low.

Furthermore, $\mu^{**} = 0$ whenever

$$\varphi\,|_{\mu^{**}=0} \leq 0$$

or, equivalently, when

$$w_1 \geq w_2 \frac{1 - 3\gamma + 2\theta + 2\gamma\theta - 2\gamma\theta^2}{2\,(1-\theta)(1-\gamma\theta)\Delta V} =: \underline{w}_1.$$

Since the derivative of μ^{**} with respect to w_1 changes sign at most once, μ^{**} is positive at $w_1 = 0$, and μ^{**} is nonnegative, the mixing probability decreases in w_1 on the interval $[0, \underline{w}_1]$ and is then absorbed by zero.

Finally, fix $\epsilon > 0$. In this case, if $w_2 = 0$ then the unskilled speculator deviates and does not trade because, when $w_2 = 0$, the payoff from either buying or selling is negative. Given the continuity of μ in w_2, this statement holds in a neighbourhood of w_2. Thus, for small w_2 and $\epsilon > 0$, the unskilled speculator prefers not to trade. Hence this is not an equilibrium.

A skilled speculator who follows his signal receives

$$U(s^{\mathrm{S}}(\sigma),\, \eta^* = 1) = w_1 \Pi(s^{\mathrm{S}}(\sigma),\, \eta^* = 1) + w_2 \Phi(s^{\mathrm{S}}(\sigma),\, \eta^* = 1).$$

He prefers to follow his signal if

$$U(s^{\mathrm{S}}(\sigma),\, \eta^* = 1) > \max\left\{U(a^{\mathrm{S}} = 0,\, \eta^* = 1), U(a^{\mathrm{S}} = -1,\, \eta^* = 1), U(a^{\mathrm{S}} = +1,\, \eta^* = 1)\right\};$$

in other words, he follows his signal if doing so makes him better-off than (respectively) not trading, buying, or selling, where

$$\begin{aligned} U(a^{\mathrm{S}} = 0, \eta^* = 1) &= 0, \\ U(a^{\mathrm{S}} = -1, \eta^* = 1) &= U(a^{\mathrm{D}} = -1), \\ U(a^{\mathrm{S}} = +1, \eta^* = 1) &= U(a^{\mathrm{D}} = +1). \end{aligned}$$

If the unskilled speculator randomizes between buying and selling, then the payoff from buying and selling is the same at equilibrium and is higher than the payoff from not trading. Hence selling is an optimal deviation for the skilled speculator. He therefore follows his signal if

$$\mathcal{G}(\mu^{**}, \theta, \gamma, \Delta V, w_1, w_2) = U(s^{\mathrm{S}}(\sigma),\, \eta^* = 1) - U(a^{\mathrm{S}} = -1,\, \eta^* = 1) > 0,$$

where

$$\mathcal{G}(\mu, \theta, \gamma, \Delta V, w_1, w_2) = l(\mu, \theta, \gamma, \Delta V, w_1, \epsilon) + g(\mu, \theta, \gamma, \epsilon).$$

Here g is as defined in equation (2.55) and

$$l = \frac{2}{3} w_1 \theta \Delta V (1-\theta) \left\{ \frac{(1-\gamma)\mu}{\theta\gamma + (1-\gamma)\mu} + \epsilon \left[\frac{\gamma + (1-\gamma)(1-\mu)}{(1-\theta)\gamma + (1-\gamma)(1-\mu)} + 1 \right] \right\}.$$

Fixing $\epsilon = 0$, if $w_1 = 0$ then $l = 0$ and the proof is as in Lemma 2.3.

Whenever $w_1 > 0$ we have $l \geq 0$ and so a skilled speculator is more inclined to acquire information than when $w_1 = 0$. In this case, the skilled speculator acquires information if

$$\begin{aligned} c < &\frac{2}{3} w_1 \theta \Delta V (1-\theta) \left\{ \frac{(1-\gamma)\mu^{**}}{\theta\gamma + (1-\gamma)\mu^{**}} + \epsilon \left[\frac{\gamma + (1-\gamma)(1-\mu^{**})}{(1-\theta)\gamma + (1-\gamma)(1-\mu^{**})} + 1 \right] \right\} + \\ &+ w_2 \left\{ \frac{(2+\epsilon)\theta\gamma}{3(\gamma + (1-\gamma)\mu^{**})} + \frac{(1-\epsilon)\theta^2\gamma}{3(\theta\gamma + (1-\gamma)\mu^{**})} - \frac{(1-\epsilon)\theta(1-\theta)\gamma}{(1-\theta)\gamma + (1-\gamma)(1-\mu^{**})} \right\} =: \mathcal{C}. \end{aligned}$$

In contrast, when $w_1 = 0$ the equilibrium of Lemma 2.3 follows.

When $\epsilon > 0$ and $w_2 = 0$ we have the equilibrium of Lemma 2.2. When $\epsilon = 0$ and $w_2 = 0$ we have $\mu^{**} = 0$. Then the skilled speculator does not acquire information and the market breaks down.

2.6.4 Proof of Proposition 2.8

I will use the following two lemmata to prove Proposition 2.8. For simplicity set $\epsilon = 0$.

Lemma 2.6 *For*

$$I \leq \frac{\theta\gamma V_{\mathrm{G}} + (1-\gamma)[1-r+\mu^* r]\bar{V}}{\theta\gamma + (1-\gamma)(1-r) + (1-\gamma)\mu^* r} =: \bar{I}, \tag{2.63}$$

$$c_{\mathrm{pm}} \leq c^*_{\mathrm{pm}}, \quad \text{and} \tag{2.64}$$

$$c_{\mathrm{cc}} \leq c^*_{\mathrm{cc}}, \tag{2.65}$$

there exists a perfect Bayesian equilibrium in which the unskilled profit-maximizing speculator does not trade, the unskilled career-concerned speculator randomizes between buying and selling (where μ^* is the probability with which he buys) the skilled speculator acquires information and follows his signal, and the firm chooses to issue equity. Formally, the following statements hold.

- *The unskilled profit-maximizing speculator never trades:*

$$s^{\mathrm{U}}_{\mathrm{pm}}(\sigma = \emptyset) = 0. \tag{2.66}$$

- *The unskilled career-concerned speculator plays according to*

$$s^{\mathrm{U}}_{\mathrm{cc}}(\sigma = \emptyset) = \begin{cases} +1 & \textit{with probability } \mu^*, \\ -1 & \textit{with probability } 1-\mu^*, \end{cases} \tag{2.67}$$

  where $\mu^* \in [0, \theta)$.

- *The skilled speculator acquires information and follows his signal:*

$$\eta^* = 1;$$

$$s^{\mathrm{S}}(\sigma) = \begin{cases} +1 & \textit{if} \quad \sigma = \sigma_{\mathrm{G}}, \\ -1 & \textit{if} \quad \sigma = \sigma_{\mathrm{B}}. \end{cases}$$

- *Secondary market prices are*

$$p_1^{-2} = p_1^{-1} = p_1^0 = 0,$$
$$p_1^1 = \frac{\theta\gamma V_{\mathrm{G}} + (1-\gamma)[(1-r)+\mu^* r]\bar{V}}{\theta\gamma + (1-\gamma)(1-r) + (1-\gamma)\mu^* r} - I,$$
$$p_1^2 = \frac{\theta\gamma V_{\mathrm{G}} + (1-\gamma)\mu^* r\bar{V}}{\theta\gamma + (1-\gamma)\mu^* r} - I.$$

- *All firms' types choose to raise I at $t = 0$.*

Proof. Since $\epsilon = 0$ there exist multiple equilibria. I focus on the equilibrium that would be unique if ϵ were both positive and small.

Investment succeeds when $y \in \{1, 2\}$ as long as inequality (2.63) is satisfied. For $y < 1$, the capital providers' posterior about the quality of the firm is too low for the equity issue to succeed.

The proof of the behavior of the profit-maximizing speculator follows exactly the same logic as the proof of Lemma 2.2. The proof of the behavior of the career-concerned speculator is identical to that in Lemma 2.3. I will therefore omit both proofs.

The equilibrium behavior of career-concerned speculators is identical to that of Lemma 2.3 because I assume that funds' clients can distinguish between profit-maximizing and career-concerned speculators.[26] Because the presence of profit-maximizing speculators does not affect the states in which investment is undertaken when condition (2.63) holds, career-concerned speculators play the signaling game of Lemma 2.3. So when $\epsilon = 0$, from (2.56) it follows that the upper bound on cost for the career-concerned

[26] This assumption does not contradict the assumption that market makers cannot distinguish between career-concerned and profit-maximizing speculators. Whereas market makers observe only the aggregate order flow and do not observe who submitted the trades, funds' clients can tell the difference between a career-concerned and profit-maximizing speculator when they make the hiring decision.

speculator is

$$c^*_{\text{cc}} \equiv \bar{c}_{\text{cc}} := \frac{2\theta\gamma}{3(\gamma + (1-\gamma)\mu^*)} + \frac{\theta^2\gamma}{3(\theta\gamma + (1-\gamma)\mu^*)} - \frac{\theta(1-\theta)\gamma}{(1-\theta)\gamma + (1-\gamma)(1-\mu^*)}; \tag{2.68}$$

where μ^* is as defined in equation (2.50).

The proof of the behavior of profit-maximizing speculators is not identical to that of Lemma 2.2, because prices are affected by the behavior of career-concerned speculators. Hence the proof consists of showing that there are no profitable deviations for each speculator. After showing that the unskilled profit-maximizing speculator does not trade and the skilled profit-maximizing speculator follows his own signal, I show that the latter acquires information if

$$c_{\text{pm}} < \frac{(1-\theta)(1-\gamma)}{3}\left[\frac{\mu^* r\Delta V}{\theta\gamma + (1-\gamma)\mu^* r} + \frac{(1-r+\mu^* r)\Delta V}{\theta\gamma + (1-\gamma)(1-r+\mu^* r)}\right] =: c^*_{\text{pm}}.$$

■

Lemma 2.7 *For*

$$I \leq \frac{\theta\gamma V_{\text{G}} + (1-\gamma)\hat{\mu}r\bar{V}}{\theta\gamma + (1-\gamma)\hat{\mu}r}, \tag{2.69}$$

$$c_{\text{pm}} \leq \hat{c}_{\text{pm}}, \tag{2.70}$$

$$c_{\text{cc}} \leq \hat{c}_{\text{cc}}, \tag{2.71}$$

there exists a perfect Bayesian equilibrium in which the unskilled profit-maximizing speculator does not trade, the unskilled career-concerned speculator randomizes between buying and selling (where $\hat{\mu}$ is the probability with which he buys), the skilled speculator acquires information and follows his signal, and the firm chooses to issue equity. Formally, the following statements hold.

- *The unskilled profit-maximizing speculator never trades*

$$s_{\text{pm}}^{\text{U}}(\sigma = \emptyset) = 0. \tag{2.72}$$

- *The unskilled career-concerned speculator plays according to*

$$s_{\text{cc}}^{\text{U}}(\sigma = \emptyset) = \begin{cases} +1 & \textit{with probability } \hat{\mu}, \\ -1 & \textit{with probability } 1-\hat{\mu}, \end{cases} \tag{2.73}$$

where $\hat{\mu} \in [0, \theta)$.

- *The skilled speculator acquires information and follows his signal*

$$\eta^* = 1;$$
$$s^{\text{S}}(\sigma) = \begin{cases} +1 & \textit{if} \quad \sigma = \sigma_{\text{G}}, \\ -1 & \textit{if} \quad \sigma = \sigma_{\text{B}}. \end{cases}$$

- *Secondary market prices are*

$$p_1^{-2} = p_1^{-1} = p_1^0 = p_1^1 = 0,$$
$$p_1^2 = \frac{\theta\gamma V_{\text{G}} + (1-\gamma)\hat{\mu}r\bar{V}}{\theta\gamma + (1-\gamma)\hat{\mu}r} - I.$$

- *All firms' types choose to raise* I *at* $t = 0$.

Proof. If inequality (2.63) does not hold, then investment fails in $y = 1$ as well. In that case, the skilled profit-maximizing speculator acquires information provided that

$$c_{\text{pm}} < \frac{1}{3}\left[\frac{(1-\theta)(1-\gamma)\hat{\mu}r\Delta V}{\theta\gamma + (1-\gamma)\hat{\mu}r}\right] =: \hat{c}_{\text{pm}}$$

and the skilled career-concerned speculator acquires information provided that

$$c_{\text{cc}} < \frac{\theta\gamma}{3(\gamma + (1-\gamma)\hat{\mu})} + \frac{2\theta^2\gamma}{3(\theta\gamma + (1-\gamma)\hat{\mu})} - \frac{\theta(1-\theta)\gamma}{(1-\theta)\gamma + (1-\gamma)(1-\hat{\mu})} =: \hat{c}_{\text{cc}}. \tag{2.74}$$

Unskilled career-concerned speculators are indifferent between buying and selling if the payoff from buying is identical to that from selling:

$$\frac{2}{3}\frac{\theta\gamma}{\theta\gamma+(1-\gamma)\mu}+\frac{1}{3}\theta\frac{\gamma}{\gamma+(1-\gamma)\mu}=\frac{(1-\theta)\gamma}{(1-\theta)\gamma+(1-\gamma)(1-\mu)};$$

this condition is satisfied for $\hat{\mu}\in[0,\theta)$, where

$$\hat{\mu}=\frac{-3\gamma+3\theta-2\gamma\theta-\gamma\theta^2}{6\ (1-\gamma)}+\sqrt{\frac{9\gamma^2+6\gamma\theta\ -24\gamma^2\theta+9\theta^2+22\gamma^2\theta^2-6\gamma\theta^3-8\ \gamma^2\theta^3+\gamma^2\theta^4}{36(1-\gamma)^2}}. \tag{2.75}$$

A skilled speculator who acquires information and obtains a positive signal prefers buying to selling or not trading. In fact,

$$\frac{\gamma}{3[\gamma+(1-\gamma)\hat{\mu}]}+\frac{2\theta\gamma}{3[\theta\gamma+(1-\gamma)\hat{\mu}]}>\max\left\{0,\frac{(1-\theta)\gamma}{\gamma(1-\theta)+(1-\gamma)(1-\hat{\mu})}\right\}.$$

A skilled speculator prefers to sell upon observing a bad signal rather than to buy or not to trade:

$$\frac{(1-\theta)\gamma}{(1-\theta)\gamma+(1-\gamma)(1-\hat{\mu})}>\max\left\{0,\frac{2\theta\gamma}{3[\theta\gamma+(1-\gamma)\hat{\mu}]}\right\}.$$

Thus, the skilled speculator follows his signal. To obtain the upper bound on the costs of equation (2.74) I check that he prefers to acquire information given that his most profitable deviation when he does not acquire is to sell. ■

I shall use Lemmata 2.6 and 2.7 to prove Proposition 2.8.

If $c_{\text{cc}}>\hat{c}_{\text{cc}}$ then, if the equity issue fails given $y=1$, the skilled career-concerned speculator is not willing to acquire when $y=2$. So, given reasonable out-of-equilibrium beliefs, neither the skilled nor the unskilled speculator trades conditional on the investment's failing in $y=1$. Hence, prices are perfectly informative of the skilled profit-maximizing speculator's order to buy and so information loses its speculative value and will not be acquired.

Therefore, a sufficient condition for $y = 1$ to be pivotal is that $c_{\text{cc}} > \hat{c}_{\text{cc}}$. The inequality $c^*_{\text{cc}} > \hat{c}_{\text{cc}}$ guarantees that if the skilled career-concerned speculators does not acquire given $y = 2$, then he acquires given $y = 1$. The proof (which I omit) consists of showing: (i) that $\mu^* < \hat{\mu}$, which follows by comparing (2.50) and (2.75); and (ii) that the upper bounds on costs are decreasing in μ (and that, given the same μ, $c^*_{\text{cc}} < \hat{c}_{\text{cc}}$).

Having shown that $y = 1$ is the pivotal state for investment, the cost of capital in the associated order flow decreases as the proportion of career-concerned speculators increases; this result is in line with Proposition 2.1, which states that career-concerned speculators loosen firms' financial constraints.

In fact, from equation (2.63) I compute

$$\frac{d\bar{I}(r;\gamma)}{dr} = \frac{\theta(1-\theta)(1-\gamma)\gamma(1-\mu^*)\Delta V}{[1-\gamma+\gamma\theta-r(1-\gamma)(1-\mu^*)]^2} > 0.$$

Observe that μ^* is a function of γ and that θ does not depend on r. So if we keep γ fixed, then as the proportion of career-concerned speculators increases, so does the upper bound on investment. Therefore in response to an increasing proportion of career-concerned speculators, firms' cost of capital decreases.

Chapter 3

The Wall Street Walk when Blockholders Compete for Flows

3.1 Introduction

Equity blockholders in publicly traded corporations who are dissatisfied with the actions of company management can usually sell their blocks—the so-called "Wall Street Walk". A growing theoretical literature starting with Admati and Pfleiderer (2009) and Edmans (2009) argues that the Wall Street Walk can be an effective form of governance. The exit of a blockholder will typically depress the stock price, punishing management whenever executive compensation is linked to the market price of equity. Thus, faced with a credible threat of exit, management will be reluctant to underperform. Admati and Pfleiderer argue that when blockholders observe managers underperforming, it is in their own best interest to exit early before information about the manager's underperformance becomes public. This makes exit a credible threat which ameliorates managerial underperformance and enhances firm value. Edmans argues that informed institutional trading enhances the informational efficiency of the firm's equity in the secondary market, enabling myopic managers to make better investment decisions and increase firm value.

The theoretical literature on exit treats the blockholder as a profit-maximizing principal: She acts as an individual owner of an equity block would. In contrast to this assumption, a significant proportion of equity blocks is held by institutional investors who are delegated portfolio managers.[1] This matters because delegated portfolio managers often face short-term incentives that may drive them to behave in ways that do not aid corporate governance. For example, the EU Corporate Governance Green Paper notes ((2011)):

> It appears that the way asset managers' performance is evaluated... encourages asset managers to seek short-term benefits... The Commission believes that short-term incentives... may contribute significantly to asset managers' short-termism, which probably has an impact on shareholder apathy.

Two well-documented factors interact to contribute significantly to fund managers' short-termism. First, funds' investors chase short-term performance, generating so-called flow-performance relationships (e.g., Chevalier and Ellison ((1997), (**?**)), Brown, Harlow and Starks (1996), and Agarwal, Daniel and Naik (2009)). Second, the funds'

[1]Institutional money managers hold over 70% of publicly traded US equity (see for example Gillan and Starks (2007)), and a significant measure of these holdings is quite concentrated. For example, Hawley and Williams (2007) point out that, in 2005, the hundred largest US institutions owned 52% of publicly held equity. In addition, Gopalan (2008) notes that in 2001 almost 60% of NYSE-listed firms had an institutional blockholder with at least 5% equity ownership. Finally, Davis and Yoo (2003) point out that large mutual fund families, such as Fidelity, own sizable blocks in a majority of large US corporations.

fees are often linked to the amount of money under management. Faced with short-term flow-performance relationships, funds that care about the amount of money under management will compete to retain existing clients and win new ones.

In this paper we ask how such competition for investor flows affects the ability of delegated blockholders to govern via the threat of exit. Taking as a baseline the model of Admati and Pfleiderer (2009), we show that fund managers' concern for investor flows may prevent them from credibly threatening the management of portfolio companies by exit. This is because, when blockholding is delegated, exit may be informative about the ability of funds to generate value for investors and thus affects investor flows. This signalling role of exit impairs its disciplinary potential. Our central theoretical finding generates two empirically relevant cross-sectional implications. First, we show that funds that are relatively more concerned about investor flows will be less effective at credibly using the threat of exit to govern. Second, we show that a credible threat of exit can support the delegated blockholder's costly efforts to use voice to enhance firm value. In turn, those funds which are more concerned about investor flows will be less likely to use voice. We discuss our model, results, and empirical implications below.

We model an economy in which funds hold blocks on behalf of their investors, and add value for investors by being good stock pickers. Funds that are good stock pickers are more likely to be able to invest in companies with better corporate governance. In such companies, management is less likely to underperform, making blockholder exit less likely to be necessary. Investors are able to observe the returns generated by their funds and make inferences about the ability of their funds as stock pickers.

Suppose that a fund manger—after acquiring a block in a company—observes that management is underperforming. She has the choice to sell her block in the underperforming company now—before the wider market has recognised management underperformance—or wait until a later date—when management underperformance will become publicly known. If she sells now, she may be able to hide her trade behind market noise and sell her block at a price not reflecting the full reduction in value implied by management underperformance. In contrast, if she waits and sells later, she will liquidate her block at a lower price. Thus, to the extent that the fund cares directly about her portfolio value, she will be inclined to sell early.

On the other hand, the fund may also be concerned about inferences made in the short-term by her investors, which may also affect her payoffs via flows. If she sells the block as soon as she sees management underperform, investors—upon inferring that a block sale has taken place—may rationally update their beliefs to conclude that the fund is more likely to be a bad stock picker: After all, good stock pickers are less likely to need to sell early in the first place. Thus the fund may lose some flows today. If she waits, in the future the market will learn of management underperformance, and eventually the fund's bad investment choice will be revealed to her investors and she will lose clients (in addition to liquidating the block at a lower price). But, in the meanwhile, until such a date, the fund continues to retain her investor base (prevent outflows), and is able to continue earning management fees. Thus, if the fund is sufficiently concerned about short-term investor flows, she may be tempted to hold on to the block even if she sees company management underperforming.

Thus, in our model, concern for investor flows and explicit profit incentives push the fund in opposite directions: The former tempts the fund to hold on to underperforming blocks, while the latter tempts her to dispose of them early. This is the case despite the fact that investor inflows are endogenously an *increasing* function of performance in the model: In equilibrium, investors withdraw money from funds with relatively low returns. Nevertheless, whether funds care about profits directly or indirectly (via investor flows) makes a significant difference to behaviour.

The *relative* degree to which funds care about short-term investor flows vs explicit profit-based compensation determines whether a fund will exit whenever management does not perform (and thus be able to credibly threaten management with exit). We refer to those funds who are principally concerned about investor flows as *flow-motivated*. In turn, we refer to funds whose compensation is formed mainly of payments explicitly related to portfolio value as being *profit-motivated*.

In our main result (Proposition 3.1) we show that as long as delegated blockholders are sufficiently flow-motivated, and as long as good and bad funds are sufficiently different (so that investors chase performance), the threat of exit cannot be credible in equilibrium, and thus exit fails as a governance mechanism. We complement this negative result with four further theoretical results. First, we generalize the negative result by showing that, under qualitatively similar conditions, even *stochastic* threats of exit are not credible: There is an upper bound on the probability with which flow-motivated blockholders can threaten management with exit (Proposition 3.2). Second, we provide two positive results in order to generate empirical implications: We show that when funds are highly flow-motivated, there exists an equilibrium in which funds never exit (Proposition 3.3), while when funds are highly profit-motivated, there exists an equilibrium in which funds can credibly use the threat of exit to govern company management (Proposition 3.4). Our final theoretical result (Proposition 3.5) derives conditions under which the threat of exit can support the use of blockholder *voice*, and thus shows why flow-motivated funds may engage less actively with company management than profit-motivated funds. This final result is discussed in detail later in the introduction in the context of the empirical literature.

Observed compensation contracts across different classes of delegated portfolio managers are characterized by significant variations in the degree of explicit profit-based compensation and thus the relative degree of flow-motivation. At one end of the spectrum, US mutual funds—subject to the 1970 amendment to the Investment Companies Act of 1940 which prohibits asymmetric performance fees—almost universally charge purely uncontingent assets-under-management fees. Even on those rare occasions when mutual funds charge performance fees, the size of such fees is necessarily small as a consequence of these regulations (Elton et al. (2003)). In contrast, hedge funds—relatively unconstrained by regulatory requirements—typically charge larger explicit profit-based performance fees. The former class of money managers are likely to be *relatively* more flow-motivated in comparison to the latter. Since such cross-sectional variation in the relative degree of flow-motivation is to some significant extent a consequence of the regulatory environment, we treat contracts as exogenous and we trace the impact of the resulting flow-motivation on governance via exit.

The growing empirical literature on exit as a governance mechanism[2] has not, to date, directly focussed on the impact of blockholder compensation. The literature nevertheless provides findings that are broadly consistent with our model. Parrino,

[2]See, for example, Bharath, Jayaraman and Nagar (2010), Helwege, Intintoli and Zhang (2012), and Gopalan (2008).

Sias and Starks (2003) were the first to empirically investigate the role of exit as a governance mechanism. Amongst other things, they showed that the degree to which institutions use exit may depend on their type. Using the CDA/Spectrum classification of institutions (into Bank Trusts, Insurance Companies, Independent Investment Advisors, Investment Companies and Others) they find that, for the years 1982 to 1993, bank trusts are greater users of exit than investment companies. While the aggregate nature of 13-F filings and the legal nature of the CDA/Spectrum classification warrant a degree of caution in interpreting their findings in the context of our model, it is likely that the average bank trust is less influenced by investor flows than, say, a traditional mutual fund company which would typically appear under investment companies under the CDA/Spectrum classification. Thus, this evidence is broadly consistent with our theoretical result that flow-motivated institutions would be less effective in using exit.

In contrast to the empirical literature on exit, there is established variation on the different degrees to which different types of institutional investors use *other* governance tools—collectively referred to as "voice"—to discipline management and deliver shareholder value. A growing body of empirical papers provides evidence that hedge funds produce substantial gains to shareholders of target companies by using voice (see, for example, Becht, Franks and Grant (2010), Brav, Jiang, Thomas and Partnoy (2008), and Klein and Zur (2009)). In contrast it is commonly observed that mutual funds do not use voice to a similar degree. For example, Kahan and Rock (2007) argue that mutual funds do not typically sponsor shareholder proposals, do not uniformly use proxy voting to improve corporate governance, and do not even seem to make significant demands to management during "behind-the-scenes" negotiations. The "silence" of mutual funds is also evident from the survey of Gillan and Starks (2007), who list the prominent roles of different institutional investors in using voice across different decades since the 1930s.

Our results linking blockholder compensation with the effectiveness of exit may also provide a basis for interpreting the empirical evidence on institutional voice. The link arises from the fact that shareholder voice is usually not legally binding on the company's management. As a result, it is sometimes asserted that the threat of exit *supports* shareholders' voice. This idea dates back at least to Hirschman (1970, p. 82), who writes: "The chances for voice to function effectively...are appreciably strengthened if voice is backed up by the threat of exit, whether it is made openly or whether the possibility of exit is merely well understood to be an element in the situation."

Motivated by Hirschman's complementarity hypothesis, in Section 3.7 we extend our model to incorporate active monitoring and ask whether exit and voice can be complementary to each other. We allow blockholding funds, who realize that their portfolio firm cannot be disciplined via the threat of exit alone, to use voice. Voice takes the form of making costly proposals for changes in business strategy that preserve firm value and deliver additional rewards to managers. We show that there exists a class of firms for which exit and voice are complementary: managers heed blockholder voice if and only if it is backed up by a credible threat of exit if voice is ignored (Proposition 3.5). This, in turn, implies that it is only those blockholding funds that can credibly threaten to use exit, which will pay the cost of using voice to complement their exit-based governance with active interventions. Thus, our results suggest, in line with the empirical evidence outlined above, that hedge funds would effectively use voice while mutual funds would remain silent.[3]

Our results on voice and exit taken together find further support in two recent empirical papers. Clifford and Lindsey (2011) provide the first empirical investigation directly linking how differences in compensation among institutional shareholders affect monitoring. Looking at hand-collected data from SEC blockholder filings for a panel of 1500 S&P firms, they provide evidence that shareholder organizations receiving higher incentive pay are more likely to declare themselves as active instead of passive—filing 13-Ds instead of 13-Gs—and appear to be effective monitors, measured via improvement of operating and stock performance. Edmans, Fang and Zur (2012) study a sample of 101 activist hedge funds and—in contrast to the rest of the literature—examine exit and voice together. They show that over half of the funds in their sample engage in either exit or voice, establishing that hedge funds are effective at both exit and voice, consistent with our findings.

At a theoretical level, our analysis relates most directly to the relatively recent literature that shows that the threat of exit is, in itself, a governance mechanism. Apart from the papers of Admati and Pfleiderer (2009) and Edmans (2009), this literature includes the work of Edmans and Manso (2011) who consider the trade-off between voice and exit and solve for the number of blockholders which maximizes firm value. In contrast to these papers, which treat the blockholder as a principal, we focus on the delegated nature of blockholding[4]. This new literature on exit, as well as our work,

[3]Needless to say, there may well be many reasons why mutual funds are not effective users of voice, such as, for example, business ties with portfolio firms (see Davis and Kim (2007) or Dasgupta and Zachariadis (2010)).

[4]Notably, Goldman and Strobl (2013) also studied the negative impact of institutional bockholders' short-termism on firms' agency problems.

builds on a large theoretical literature on the role of blockholders in corporate governance.[5] That literature typically focuses on the role and incentives of the blockholder to monitor, rather than focusing on exit itself as a governance mechanism.

Our paper also has a familial connection to the growing literature on the financial equilibrium implications of the career concerns of funds (see, for example, Dasgupta and Prat (2008), Dasgupta, Prat and Verardo (2011b), or Guerrieri and Kondor (2012)). These papers establish a link between fund managers' flow motivations and the equilibrium prices, returns, and volume of assets they trade. In contrast, we focus on the implications of funds' flow motivations on the nature of corporate governance in firms in which they hold equity blocks.

The rest of the paper is organised as follows. In section 3.2 we introduce the underlying governance problem. Section 3.3 reviews Admati and Pfleiderer's core result that exit can act as a governance mechanism when the blockholder is a principal. Then, in section 3.4 we enrich the analysis by introducing delegated blockholding by funds. Section 3.5 shows that when these funds are sufficiently flow-motivated the threat of exit fails to improve governance. Section 3.6 characterizes equilibria with and without exit. In section 3.7 we extend our model to include the possibility of active monitoring and demonstrate the potential complementarity between voice and exit. In section 3.8 we discuss our results and consider variations and extensions. Section 3.9 concludes.

[5] See, for example, Grossman and Hart (1980), Shleifer and Vishny (1986), Admati, Pfleiderer and Zechner (1994), Kahn and Winton (1998), Maug (1998), Mello and Repullo (2004), Burkart, Gromb and Panunzi (1997), Bolton and von Thadden (1998), Faure-Grimaud and Gromb (2004), Tirole (2001), and Noe (2002).

3.2 The Governance Problem

We consider a publicly traded all equity-financed firm with a given ownership structure. We ask how changes in the ownership structure—the presence of blockholders of different types—can influence the nature of corporate governance in that firm. The underlying model of the firm is identical to that of Admati and Pfleiderer (2009).[6]

The firm exists over three dates ($t = 0, 1, 2$). It is run by a manager and is characterized by a moral hazard problem. The manager may take an action (action 1) which is undesirable from the point of view of shareholders but generates private benefits β for him. We refer to this as the "perverse action," as in Admati and Pfleiderer. If the manager does not take action 1, we write that he takes action 0.

The value of the firm at $t = 2$ is affected by the manager's action choice at $t = 0$: $a \in \{0, 1\}$. If he chooses $a = 0$ the value of the firm is v. If he chooses $a = 1$, the value of the firm is $v - \tilde{\delta}$, where $\tilde{\delta}$ is distributed on $\left[0, \bar{\delta}\right]$ with density $f(\cdot)$. The manager observes the realisation of $\tilde{\delta}$ at $t = 0$ and then chooses his action. The value of v is common knowledge throughout, but realisation of $\tilde{\delta}$ is private information available only to the manager at $t = 0, 1$. All information about the firm becomes public at $t = 2$.

We assume, following Admati and Pfleiderer, that the manager's contractual payoff depends on the market prices at $t = 1$ and $t = 2$. If he takes action 0, his payoff

[6] To be precise, we focus on Admati and Pfleiderer's Model B. This is the version of the model in which they show exit to be most effective as a governance mechanism. In other variants of their model, they show that—even when the blockholder is a principal—exit has potentially less desirable effects. We wish to take as a starting point the version of their model that gives exit its best chance as a governance mechanism and still show (see Proposition 3.1 below) that agency frictions arising from the delegation of portfolio management can reduce its effectiveness.

is $\omega_1 P_1 + \omega_2 P_2$, where $\omega_1 > 0$ and $\omega_2 > 0$ represent the sensitivities of managerial compensation to market prices P_1 and P_2 at times 1 and 2. If the manager instead takes action 1, his payoff is $\omega_1 P_1 + \omega_2 P_2 + \beta$, where $\beta \geq 0$ is fixed and common knowledge.

The prices P_1 and P_2 are set by a risk-neutral market maker on the basis of all available public information. The firm's equity is the only risky asset in the economy. The only other available asset is a risk-free asset with unit gross rate of return that is in infinitely elastic supply.

The firm is owned by many small passive direct shareholders as well as by a large blockholder. The identity of the blockholder will change across different variants of our model. In the baseline case, which is identical to Admati and Pfleiderer's, the blockholder is a principal, and we think of her as a large private blockholding investor. In our paper—motivated by the significant degree of blockholding by institutional asset managers in Anglo-Saxon financial systems—we think of the blockholder as a fund who acts on behalf of a continuum of identical investors.

In all variants, the blockholder is able to observe the action chosen by the manager at $t = 0$, and is able to sell her stake in the firm at $t = 1$ in response. Because the blockholder's potential sales are based on her observation of the manager's action, which in turn affects firm value, the price at the interim date ($t = 1$) will be affected by the trading decision of the blockholder. This, in turn, will affect the payoffs of the manager, generating the core corporate governance mechanism. If the blockholder can credibly threaten to exit when the manager takes action 1, thus lowering the firm's traded price at $t = 1$, the resulting reduction in payoff to the manager can induce him to take the perverse action less often, thus reducing the agency costs and increasing the value of the firm.

It is useful at the outset to outline the incidence of the perverse action in the absence of a blockholder. In such a setting, since small shareholders are passive (implicitly, they have neither the skill nor the incentive to acquire private information about the manager's actions) the price of the firm at $t = 1$ is insensitive to the manager's choice of action. Accordingly, the manager compares his rents from taking the perverse action $\beta + \omega_1 P_1 + \omega_2(v - \delta)$ with that of taking the non-perverse action $\omega_1 P_1 + \omega_2 v$; he takes the perverse action if and only if $\tilde{\delta} \leq \frac{\beta}{\omega_2} =: \delta_{\text{No-L}}$.

In what follows, we consider whether the presence of different types of blockholders can reduce the incidence of the manager's perverse action. We begin with the important benchmark case in which the blockholder acts as a principal. This is the case considered by Admati and Pfleiderer.

3.3 The Blockholder as Principal: Governance via Exit

Admati and Pfleiderer (2009) show that when the blockholder acts as a principal, the threat of exit can act as a disciplining device. We sketch their result here.

Suppose that the blockholder sells her holdings at $t = 1$ whenever the manager takes the perverse action. Then, choosing $a = 1$ reduces the payoff to the manager via a lower interim price P_1, which makes him relatively reluctant to do so. Admati and Pfleiderer show that in the unique equilibrium of their model the blockholder will always sell her holdings at $t = 1$ if the manager chooses $a = 1$. Their equilibrium is characterised by a cutoff δ_{L} such that the manager takes the perverse action if and only if $\tilde{\delta} < \delta_{\text{L}}$, where $\delta_{\text{L}} < \delta_{\text{No-L}}$. The reduction in the threshold for taking the perverse action from $\delta_{\text{No-L}}$ to δ_{L} embodies the disciplining role of the threat of exit.

The intuition is as follows. Admati and Pfleiderer's blockholder may face a liquidity shock at $t = 1$ with probability $\theta \in (0, 1)$ which forces her to liquidate her position. The market maker does not observe the liquidity shock. When the blockholder observes that the manager has chosen $a = 1$, she realizes that the firm's value will be lower at $t = 2$ when all information becomes public. If she has not been hit by the liquidity shock she has the choice to hold her block until $t = 2$ and realize these losses, or to sell at $t = 1$. Of course, her sale at $t = 1$ will lower the price of the block, because her trade may reflect private information. However, because the market maker assigns positive probability to the sale being induced by the blockholder's liquidity shock, the loss in value from the early sale will be smaller than the loss from holding until $t = 2$. Thus, the blockholder will exit at $t = 1$, lowering P_1. Knowing this, the manager will hesitate to take the perverse action.

We now turn to the case where the blockholder is not a principal, but an agent: In the remainder of the paper, the blockholder is a delegated portfolio manager who holds shares on behalf of many (identical) small investors.

3.4 The Blockholder as Agent: A Model

We now consider the case where the blockholder is a delegated portfolio manager such as a mutual fund, hedge fund, pension fund, etc. We assume that these delegated blockholders act on behalf of a large number of small investors who would have no access to blockholding other than via delegation. We treat all investors symmetrically. As a result, in what follows, we shall often refer to this collection of investors simply as "the investor" (I). We refer to the delegated blockholder as the fund (F). The delegated blockholder, like the principal blockholder of the previous section, can observe the manager's actions at $t = 0$, and can choose whether to exit at $t = 1$ or to hold until $t = 2$.

As discussed in the introduction, an important strand of the empirical literature has documented that investors chase performance across funds of different ability, generating fund's competition for investor flows. We consider how such competition for flows may impact their effectiveness in monitoring via the threat of exit. In order to incorporate concerns for flows, we augment the model by adding some crucial, but minimal, ingredients.

First, we assume a degree of heterogeneity across funds, which affects their relative desirability as agents from the perspective of investors. Blockholding funds differ in their stock-picking ability, i.e. in how good they are in selecting firms in which to hold blocks. We introduce a class of firms with no agency problems, i.e. firms in which the manager behaves as if $\beta = 0$ and thus always chooses $a = 0$. There are two types of funds: good ($\tau^{\mathrm{F}} = \mathrm{g}$) and bad ($\tau^{\mathrm{F}} = \mathrm{b}$), with $\Pr(\tau^{\mathrm{F}} = \mathrm{g}) = \gamma_{\mathrm{F}}$. Blocks held by good funds are free of agency problems with probability $\gamma_{\mathrm{M}}^{\mathrm{g}} \leq 1$. Blocks held by bad funds are free of agency problems with probability $\gamma_{\mathrm{M}}^{\mathrm{b}} \in (0, \gamma_{\mathrm{M}}^{\mathrm{g}})$.[7] As is standard in experts models, we assume that funds do not know their own type. Because of their better stock

[7]We thus define the ability of funds as the precision of their ex ante information (before they form blocks). A different formulation, in which funds are distinguished by their ex post ability to spot problems in firms in which they have already established blocks, is discussed in Section 3.8.1.

picking ability, during an unmodelled final period (period 2+) a good fund if matched to the investor generates a continuation payoff to the investor of $\pi^{\mathrm{I}}_{\mathrm{g}}$. If, instead, the investor ends up matched to a bad fund, his payoff is $\pi^{\mathrm{I}}_{\mathrm{b}} < \pi^{\mathrm{I}}_{\mathrm{g}}$.[8] The fund that is employed by the investor during this final period, receives a payoff of $\pi^{\mathrm{F}} \geq 0$. In the formal analysis below, in order to achieve the most parsimonious characterization, we set $\gamma^{\mathrm{g}}_{\mathrm{M}} = 1$, and denote $\gamma^{\mathrm{b}}_{\mathrm{M}}$ by γ_{M}. This simplification does not change the qualitative features of the analysis, as we show in Section 3.10.2.

Second, we introduce a hiring and replacement process between investors and funds which induces funds to compete for flows. The set up is as follows. The investor enters the model at $t = 0$ matched to a fund who holds a block on his behalf.[9] He does not know the type of the fund that he is matched to. Both at $t = 1$ and $t = 2$ he can update his inference about the type of the fund to which he is matched: At $t = 1$ he observes the value of the fund's portfolio (which depends on whether the fund sold or not) and at $t = 2$ he observes the realisation of $\tilde{\delta}$ and the liquidation value of the firm. At either $t = 1$ or $t = 2$, the investor may either retain or fire his fund. The fund who is fired at t dies immediately and cannot be rehired.[10] If the investor hires a new fund,

[8] For concreteness, consider a final single period 2+ in which the fund employed by the investor chooses a block in one firm selected from a set of firms some of which have agency problems ($\beta > 0$) while others don't ($\beta = 0$). If the selected firm is free of agency problems, the expected value is v', but if it is not the expected value will be lowered to $v' - \delta'$ due to agency rent extraction. The good type of fund, if employed by the investor, will choose a block in a firm free from agency problems with higher probability than a bad type of fund, and can thus generate higher returns for investors in the future. This generates a difference in continuation values across matches with different types of funds.

More generally, such a continuation value will be endogenously generated (in equilibrium) of an infinitely repeated version of our game. Such an extended formulation would come at a significant algebraic cost, which would distract from our core message.

[9] Like Admati and Pfleiderer, we take the existence of the block as given, and do not model the block formation process.

[10] Implicitly, there is a sufficiently significant reputational loss from being fired. Alternatively, it

the match is random. Thus, both at $t = 1$ and at $t = 2$, the investor makes a rational decision in equilibrium to retain or fire his current fund on the basis of information observed up to that point.

Third, we introduce rents from employment for funds: The reason funds care about the investor's perception of their ability is that, for each period that they are employed, they receive a payment $w > 0$. In addition to this, the fund also receives a fraction $\alpha \in (0, 1)$ of any liquidating portfolio value (at $t = 1$ or at $t = 2$, depending on when the portfolio is liquidated), with the investor receiving the rest. The investor's payoff is complementary to the fund's in the sense that he pays w to the fund in each period he employs the fund and gets a fraction $(1 - \alpha)$ of the liquidating portfolio.

In our model, the parameters α and w represent, respectively, the fund's compensation sensitivity to earned profits and investor flows. The fund can be retained or fired at $t = 1$. While the profit-contingent component of compensation may either rise or fall, depending on the sequence of events, the uncontingent component of compensation is certainly higher if the fund is retained instead of fired at $t = 1$. It is in this sense that the size of w captures the fund's concern for flows: It is only by retaining the current investors (i.e., preventing outflows) that the fund can earn w for another period. The relative size of α vs w, in turn, captures the relative importance of explicit (profit-related) and implicit (flow-related) compensation. Funds with higher $\frac{\alpha}{w}$ ratios can be thought of as being profit-motivated, whereas funds with lower $\frac{\alpha}{w}$ ratios as being flow-motivated.

This simple (α, w)-parameterization is our attempt to parsimoniously model ob-

could be that funds are simply indistinguishable from each other by an investor who is not in a current employment relationship with them—thus a fired fund cannot be identified to be rehired.

served variations in the relative degree of profit-motivation vs flow-motivation (respectively, explicit vs implicit incentives) across different types of money managers. As already discussed in the introduction, such variation may arise as a consequence of the differential regulatory environments faced by different classes of money managers. It is clear that such a parsimonious parameterization precludes us from capturing the full richness of the real world fund management compensation contracts. Nevertheless, our analysis can be enriched to incorporate realistic features of money management contracts without affecting the qualitative results derived below. For example, we show in Section 3.8.2 that convex compensation – a common feature of hedge fund contracts – does not affect our core qualitative results.

Finally, to match the liquidity shock of Admati and Pfleiderer (2009) in our revised context, we assume that the investor is hit by a liquidity shock at $t = 1$ with probability $\theta \in (0, 1)$. The liquidity shock forces him to liquidate his holding at $t = 1$ and thus forces his fund to sell, terminating all strategic decisions. When a block liquidation occurs at $t = 1$, the market maker cannot tell whether the fund's sale was induced by the investor's liquidity shock. However, needless to say, the investor knows the source of the liquidation.[11]

3.4.1 Some useful notation

It is useful to introduce some notation at this stage. The objects for which we define notation here are equilibrium quantities, and thus will derive economic meaning only

[11] It would be possible, without changing the qualitative results, to replace this liquidity shock by some other form of inefficiency (e.g., noise traders) in the interim date market. In this case, the fund would still be able to "hide" behind the noise when trading at $t = 1$, while investors upon seeing a sale by their fund would still know that the fund *chose* to exit.

in our formal analysis below.

For $i = M, F, I$, we use $s_i(\cdot)$ to denote the strategy maps of the manager, the fund, and the investor. Since the manager observes $\tilde{\delta}$ before making his choice, his action is a random variable, which we denote as follows: $\tilde{a} := s_{\mathrm{M}}(\tilde{\delta})$. The market maker observes the fund's action and updates his beliefs in equilibrium about the value of the firm. Define

$$\mathbb{E}_s := \mathbb{E}\left(\tilde{a}\tilde{\delta}|\ a^{\mathrm{F}} = \mathrm{s}\right)$$

as the ex ante expected change in firm's value when the market maker observes the fund selling the shares ($a^{\mathrm{F}} = \mathrm{s}$) and

$$\mathbb{E}_{ns} := \mathbb{E}\left(\tilde{a}\tilde{\delta}|\ a^{\mathrm{F}} = \mathrm{ns}\right)$$

as the ex ante expected change in firm's value when he observes the fund not selling ($a^{\mathrm{F}} = \mathrm{ns}$).

At $t = 1$ the investor updates his expectation of his continuation payoff (for period 2+) using the information available to him. We denote this by:

$$\mathbb{E}\left(\tilde{\pi}^{\mathrm{I}}|a^{\mathrm{F}}\right).$$

In the special case where a^{F} is uninformative, then we denote the investor's continuation payoff by

$$\bar{\pi}^{\mathrm{I}} := \mathbb{E}(\tilde{\pi}^{\mathrm{I}}) = \gamma_{\mathrm{F}}\pi^{\mathrm{I}}_{\mathrm{g}} + (1 - \gamma_{\mathrm{F}})\pi^{\mathrm{I}}_{\mathrm{b}}.$$

Finally, denote the collection of model parameters with the exception of $\alpha, w, \pi^{\mathrm{I}}_{\mathrm{g}}$ and $\pi^{\mathrm{I}}_{\mathrm{b}}$ by Θ. Thus, our game is defined by payoff parameters $\left\{\Theta, \alpha, w, \pi^{\mathrm{I}}_{\mathrm{g}}, \pi^{\mathrm{I}}_{\mathrm{b}}\right\}$.

3.5 The Failure of Governance via Exit

We show that, with delegated blockholding, exit may no longer act as an effective disciplining device. In particular, we ask: Is it feasible for delegated blockholders to credibly threaten managers with exit conditional on a perverse action being taken? We answer this question as follows:

Proposition 3.1 *For* $\frac{\alpha}{w}$ *small enough and for* $\pi_{\mathrm{g}}^{\mathrm{I}} - \pi_{\mathrm{b}}^{\mathrm{I}}$ *large enough, there is never an equilibrium in which any type of fund chooses to sell if and only if she observes* $a = 1$.

In other words, this proposition highlights two conditions under which the beneficial effect of the threat of exit identified by Admati and Pfleiderer does not survive when the blockholder is an agent. First, the blockholder must be principally motivated by flows rather than by profits. Second, investors must be sufficiently interested in retaining only good funds, which in turn generates delegated blockholders' competition for investor flows.

Our argument will proceed as follows. We first establish conditions under which, if the fund adopts a strategy of selling the block at $t = 1$ if and only if she observes that the manager has taken the perverse action, then the investor chooses to retain the fund if and only if the fund has not sold at $t = 1$. We then establish conditions under which, such a retention strategy on the part of the investor induces the fund *not* to sell at $t = 1$ even if she has observed the manager taking the perverse action. This, then, establishes a set of conditions under which it is impossible for the fund to sell (in equilibrium) at $t = 1$ if and only if she observes the perverse action. We first establish the formal proof and then provide an intuitive discussion of the ingredients delivering our main result.

Proof: Consider any putative equilibrium in which the fund's strategy is as follows:

$$s_{\mathrm{F}}(a) = \begin{cases} \mathrm{ns} & \text{if } a = 0 \\ \mathrm{s} & \text{if } a = 1. \end{cases} \tag{3.1}$$

We first outline the manager's best response to the fund's behaviour.

To determine the manager's strategy we compare his expected utility from taking the perverse action with that from not taking the perverse action, once he observes the realization of $\tilde{\delta}$ at $t = 0$.

If he takes the perverse action, he knows that the fund will sell his shares at $t = 1$ so $P_1 = v - \mathbb{E}_s$ and $P_2 = v - \delta$. Thus his expected utility is

$$\beta + \omega_1 P_1 + \omega_2 P_2 = \beta + \omega_1(v - \mathbb{E}_s) + \omega_2(v - \delta). \tag{3.2}$$

If he does not take the perverse action, he knows that the fund will sell his shares at $t = 1$ only for liquidity reasons—which occurs with probability θ—and that $P_2 = v$. Thus his expected utility is

$$\omega_1 P_1 + \omega_2 P_2 = \omega_1[v - \theta\mathbb{E}_s - (1 - \theta)\mathbb{E}_{ns}] + \omega_2 v. \tag{3.3}$$

Hence, the manager's strategy is

$$s_{\mathrm{M}}(\delta) = \begin{cases} 1 & \text{if } \beta - \omega_1(1 - \theta)(\mathbb{E}_s - \mathbb{E}_{ns}) - \omega_2\delta \geq 0 \\ 0 & \text{otherwise.} \end{cases} \tag{3.4}$$

Since $\beta - \omega_1(1 - \theta)(\mathbb{E}_s - \mathbb{E}_{ns}) - \omega_2\delta$ is decreasing in δ, the manager's best response will be characterised by a cutoff point δ_{sep}, such that the he takes the perverse action for any $\delta \leq \delta_{\text{sep}}$, where the cutoff is equal to the fixed point of the following equation:

$$\delta_{\text{sep}} = \frac{\beta - \omega_1(1-\theta)[\mathbb{E}_s(\delta_{\text{sep}}) - \mathbb{E}_{ns}(\delta_{\text{sep}})]}{\omega_2}. \tag{3.5}$$

We can thus write the strategy of the manager as follows:

$$s_{\text{M}}(\delta) = \begin{cases} 1 & \text{if } \delta \leq \delta_{\text{sep}} \\ 0 & \text{otherwise.} \end{cases} \tag{3.6}$$

The cutoff point δ_{sep} is unique if $\mathbb{E}_s(\delta_{\text{sep}}) - \mathbb{E}_{ns}(\delta_{\text{sep}})$ is increasing in δ_{sep}. To establish this, we compute $\mathbb{E}_s$ and $\mathbb{E}_{ns}$ as functions of δ_{sep}.

When the fund sells her shares, the market does not know whether it is for liquidity or speculative reasons and hence

$$\mathbb{E}_s(\delta_{\text{sep}}) = \frac{(1-\gamma_{\text{F}})(1-\gamma_{\text{M}})\mathbb{E}(\tilde{\delta}|\tilde{\delta} \leq \delta_{\text{sep}})\mathbb{P}(\tilde{\delta} \leq \delta_{\text{sep}})}{\theta + (1-\theta)(1-\gamma_{\text{F}})(1-\gamma_{\text{M}})\mathbb{P}(\tilde{\delta} \leq \delta_{\text{sep}})}. \tag{3.7}$$

Computations for equations (3.7) are shown in the appendix.

If the fund does not sell, the market infers that the manager has not taken the perverse action and that the value of the firm is v. Hence,

$$\mathbb{E}_{ns}(\delta_{\text{sep}}) = 0. \tag{3.8}$$

Upon dividing both numerator and denominator of (3.7), it is immediate that $\mathbb{E}_s(\delta_{\text{sep}}) - \mathbb{E}_{ns}(\delta_{\text{sep}})$ is increasing in δ_{sep} establishing the uniqueness of δ_{sep}. We now proceed to compute the best response of the investor who has not been hit by a liquidity shock at $t = 1$.

The investor's decision at $t = 1$ relies on what inference he expects to make at $t = 2$. At $t = 2$, there are three mutually exclusive and exhaustive events:

$$\mathrm{E}_1 = \{\delta \leq \delta_{\text{sep}}\} \cap \{a = 0\} \tag{3.9}$$

$$\mathrm{E}_2 = \{\delta > \delta_{\text{sep}}\} \cap \{a = 0\} \tag{3.10}$$

$$\mathrm{E}_3 = \{a = 1\} \tag{3.11}$$

The investor also infers the action of the fund from the portfolio value. Thus, the investor's $t = 2$ information set consists of six possible paired events, which are the elements of

$$\{\mathrm{E}_1, \mathrm{E}_2, \mathrm{E}_3\} \times \{\mathrm{s}, \mathrm{ns}\}.$$

Each of these events conveys different information to the investor and may affect his retention vs firing decision at $t = 2$. We first consider the events that can arise on the putative equilibrium path. These are $\big(\mathrm{E}_1, a^{\mathrm{F}} = \mathrm{ns}\big)$, $\big(\mathrm{E}_2, a^{\mathrm{F}} = \mathrm{ns}\big)$, and $\big(\mathrm{E}_3, a^{\mathrm{F}} = \mathrm{s}\big)$. For each of these cases, the investor can compute the probability that he is matched with a good fund using Bayes Rule as follows:

$$\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g} | \mathrm{E}_1, a^{\mathrm{F}} = \mathrm{ns}) = \frac{\gamma_{\mathrm{F}}}{\gamma_{\mathrm{F}} + (1 - \gamma_{\mathrm{F}})\gamma_{\mathrm{M}}} > \gamma_{\mathrm{F}} \tag{3.12a}$$

$$\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g} | \mathrm{E}_2, a^{\mathrm{F}} = \mathrm{ns}) = \gamma_{\mathrm{F}}, \tag{3.12b}$$

$$\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g} | \mathrm{E}_3, a^{\mathrm{F}} = \mathrm{s}) = 0. \tag{3.12c}$$

Clearly, the investor retains at $t = 2$ in the events $\big(\mathrm{E}_1, a^{\mathrm{F}} = \mathrm{ns}\big)$ and $\big(\mathrm{E}_2, a^{\mathrm{F}} = \mathrm{ns}\big)$ and replaces at $t = 2$ in the event $\big(\mathrm{E}_3, a^{\mathrm{F}} = \mathrm{s}\big)$. For the other three events—$\big(\mathrm{E}_1, a^{\mathrm{F}} = \mathrm{s}\big)$, $\big(\mathrm{E}_2, a^{\mathrm{F}} = \mathrm{s}\big)$, and $\big(\mathrm{E}_3, a^{\mathrm{F}} = \mathrm{ns}\big)$—it is impossible to assign posteriors based on Bayes Rule, and, since we are proving an impossibility result, we make no assumption whatsoever on the investor's behaviour in these cases. It is easy to see that our arguments below will be unaffected by the specific posterior chosen by the investor under these off-(putative)-equilibrium events.[12]

Having thus computed the investor's decision rule at $t = 2$, we proceed to compute his strategy at $t = 1$. In order to make his $t = 1$ decision, he first observes the fund's portfolio value and infers her action, then computes the probability of ending up in one of the three events conditional on the action he observes. Finally, he computes his continuation payoff in each event conditional on his retention vs firing decision at $t = 2$ as specified above.

Note that, if the investor fires the fund at $t = 1$, it is dominated for him to immediately rehire a different fund, since the fund is inactive between $t = 1$ and $t = 2$ (and thus no further inferences can be made about this fund upon observation of additional information at $t = 2$) but costs w to employ. Thus, following firing at $t = 1$ the investor will only hire a new fund at $t = 2$, when the match will be random. Thus the investor's continuation value in the final period will be $\bar{\pi}^{\mathrm{I}} := \gamma_{\mathrm{F}}\pi^{\mathrm{I}}_{\mathrm{g}} + (1 - \gamma_{\mathrm{F}})\,\pi^{\mathrm{I}}_{\mathrm{b}}$.

If he observes $a^{\mathrm{F}} = \mathrm{ns}$, he must compute the following quantities: $\mathbb{P}\left(\mathrm{E}_1 \middle| a^{\mathrm{F}} = \mathrm{ns}\right)$, $\mathbb{P}(\mathrm{E}_2|a^{\mathrm{F}} = \mathrm{ns})$, and $\mathbb{P}(\mathrm{E}_3\big|a^{\mathrm{F}} = \mathrm{ns})$. It is easy to see that:

$$\mathbb{P}\left(\mathrm{E}_1\middle|a^{\mathrm{F}} = \mathrm{ns}\right) = \frac{\mathbb{P}\left(\tilde{\delta} \leq \delta_{\mathrm{sep}}\right)(\gamma_{\mathrm{F}} + (1-\gamma_{\mathrm{F}})\gamma_{\mathrm{M}})}{1-(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}\left(\tilde{\delta} \leq \delta_{\mathrm{sep}}\right)} \tag{3.13a}$$

$$\mathbb{P}(\mathrm{E}_2|a^{\mathrm{F}} = \mathrm{ns}) = \frac{1-\mathbb{P}\left(\tilde{\delta} \leq \delta_{\mathrm{sep}}\right)}{1-(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}\left(\tilde{\delta} \leq \delta_{\mathrm{sep}}\right)} \tag{3.13b}$$

$$\mathbb{P}(\mathrm{E}_3\big|a^{\mathrm{F}} = \mathrm{ns}) = 0. \tag{3.13c}$$

[12] In particular, since the investor assigns probability zero at $t = 1$ to each of these continuation events, his $t = 1$ decision (which is what determines the behaviour of the fund) is unaffected by any assumptions about his behaviour under these events.

In this putative equilibrium if the investor observes the fund not selling, it must be that the manager has taken action $a = 0$, hence E_3 will never realise. We have already shown above that, conditional on events E_1 and E_2, the investor will choose to retain at $t = 2$. Thus, if the investor observes $a^{\mathrm{F}} = \mathrm{ns}$ and retains the fund at $t = 1$, his expected payoff is:

$$(1-\alpha)\mathbb{E}\left(P_2 \mid a^{\mathrm{F}} = \mathrm{ns}\right) - 2w + \mathbb{E}\left(\tilde{\pi}^{\mathrm{I}} \mid a^{\mathrm{F}} = \mathrm{ns}\right),$$

where

$$\begin{aligned}
&\mathbb{E}\left(\tilde{\pi}^{\mathrm{I}}|a^{\mathrm{F}} = \mathrm{ns}\right) = \\
&\qquad \mathbb{P}\left(\mathrm{E}_1\middle|a^{\mathrm{F}} = \mathrm{ns}\right)\left[\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_1, a^{\mathrm{F}} = \mathrm{ns})\pi^{\mathrm{I}}_{\mathrm{g}} + (1 - \mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_1, a^{\mathrm{F}} = \mathrm{ns}))\pi^{\mathrm{I}}_{\mathrm{b}}\right] \\
&+ \mathbb{P}(\mathrm{E}_2|a^{\mathrm{F}} = \mathrm{ns})\left[\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_2, a^{\mathrm{F}} = \mathrm{ns})\pi^{\mathrm{I}}_{\mathrm{g}} + (1 - \mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_2, a^{\mathrm{F}} = \mathrm{ns}))\pi^{\mathrm{I}}_{\mathrm{b}}\right]. \quad (3.14)
\end{aligned}$$

Simplifying, we have that if the investor observes $a^{\mathrm{F}} = \mathrm{ns}$ and retains the fund at $t = 1$, his expected payoff is:

$$(1-\alpha)v - 2w + \bar{\pi}^{\mathrm{I}} + \frac{\mathbb{P}(\tilde{\delta} \leq \delta_{\mathrm{sep}})\gamma_{\mathrm{F}}(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})}{1-(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}(\tilde{\delta} \leq \delta_{\mathrm{sep}})}(\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}). \quad (3.15)$$

Instead, if the investor observes $a^{\mathrm{F}} = \mathrm{ns}$ and fires the fund, his expected payoff is:

$$(1-\alpha)P_1 - w + \mathbb{E}\left(\tilde{\pi}^{I}_{\mathrm{F}}\right) = (1-\alpha)(v - \mathbb{E}_s(\delta_{\mathrm{sep}})) - w + \bar{\pi}^{\mathrm{I}}, \quad (3.16)$$

because he gets his share of the liquidating portfolio, he pays the fixed wage only for one period, and receives the unconditional expected continuation payoff by being randomly matched to a new fund at $t = 2$.

Hence, the investor will choose to retain the fund conditional on no sale if

$$\begin{aligned}
&(1-\alpha)v - 2w + \bar{\pi}^{\mathrm{I}} + \frac{\mathbb{P}(\tilde{\delta} \leq \delta_{\mathrm{sep}})\gamma_{\mathrm{F}}(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})}{1-(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}(\tilde{\delta} \leq \delta_{\mathrm{sep}})}(\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}) \geq \\
&\qquad\qquad (1-\alpha)(v - \mathbb{E}_s(\delta_{\mathrm{sep}})) - w + \bar{\pi}^{\mathrm{I}} \quad (3.17)
\end{aligned}$$

i.e.

$$(1-\alpha)\mathbb{E}_s(\delta_{\text{sep}}) + \frac{\mathbb{P}(\tilde{\delta} \le \delta_{\text{sep}})\gamma_{\text{F}}(1-\gamma_{\text{F}})(1-\gamma_{\text{M}})}{1-(1-\gamma_{\text{F}})(1-\gamma_{\text{M}})\mathbb{P}(\tilde{\delta} \le \delta_{\text{sep}})}(\pi^{\text{I}}_{\text{g}} - \pi^{\text{I}}_{\text{b}}) \ge w \tag{3.18}$$

It is clear that, for a given $\{\alpha, w, \Theta\}$, as long as $\pi^{\text{I}}_{\text{g}} - \pi^{\text{I}}_{\text{b}}$ is large enough, inequality (3.18) holds. It is also clear that the lower bound on $\pi^{\text{I}}_{\text{g}} - \pi^{\text{I}}_{\text{b}}$ is increasing in α, since $\mathbb{E}_s(\delta_{\text{sep}}) > 0$. Let us denote the relevant lower bound on $\pi^{\text{I}}_{\text{g}} - \pi^{\text{I}}_{\text{b}}$ as a function of α by $B_{\Delta\pi}(\alpha, w, \Theta)$.

If, instead, the investor observes that the fund sold at $t = 1$, if he fires the fund he gets:

$$(1-\alpha)P_1 - w + \mathbb{E}(\tilde{\pi}^{\text{I}}) = (1-\alpha)\left(v - \mathbb{E}_s(\delta_{\text{sep}})\right) - w + \bar{\pi}^{\text{I}}. \tag{3.19}$$

If instead he retains the fund, he needs to compute his expected continuation value. For this we note:

$$\mathbb{P}\left(\text{E}_1 \middle| a^{\text{F}} = \text{s}\right) = 0 \tag{3.20}$$

$$\mathbb{P}\left(\text{E}_2 \middle| a^{\text{F}} = \text{s}\right) = 0 \tag{3.21}$$

$$\mathbb{P}(\text{E}_3 | a^{\text{F}} = \text{s}) = 1, \tag{3.22}$$

and we have already shown that

$$\mathbb{P}(\tau^{\text{F}} = \text{g} | \text{E}_3, a^{\text{F}} = \text{s}) = 0.$$

He knows, therefore, that in the only potential event that can arise at $t = 2$, he will wish to replace the fund. Thus, his expected payoff from retention is:

$$(1-\alpha)P_1 - 2w + \bar{\pi}^{\text{I}} = (1-\alpha)(v - \mathbb{E}_s(\delta_{\text{sep}})) - 2w + \bar{\pi}^{\text{I}}. \tag{3.23}$$

Thus, it is clear that the investor will fire at $t = 1$ if he observes a sale.

Thus, as long as $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$ is large enough, the investor retains the fund if and only if she chose not to sell at $t = 1$. We now show that, when α is small, the investor's behaviour leads the fund to deviate from her proposed equilibrium strategy.

Suppose the fund observes $a = 0$. If she chooses to hold, she is retained by the investor and thus gets

$$2w + \alpha\mathbb{E}\left(P_2 \mid a = 0\right) + \mathbb{P}(\text{retained in } t = 2)\pi^{\mathrm{F}} = 2w + \alpha v + \pi^{\mathrm{F}}.$$

If she chooses to sell she instead gets

$$w + \alpha P_1 = w + \alpha(v - \mathbb{E}_s(\delta_{\mathrm{sep}})).$$

It is clear that she will always choose to hold.

Suppose the fund observes $a = 1$. If she sells, given the investor's strategy above, she is fired and receives

$$w + \alpha P_1 = w + \alpha(v - \mathbb{E}_s(\delta_{\mathrm{sep}})).$$

If, instead, she chooses not to sell she will be retained at $t = 1$, but may or may not be fired at $t = 2$, depending on the investor's beliefs at the time. Upon observing $a = 1$, the fund realizes that the investor will observe event $(\mathrm{E}_3, \mathrm{ns})$ at $t = 2$. As noted above, we are agnostic about the investor's beliefs upon observing such off-equilibrium events. Thus, the argument here must hold for *all possible* beliefs $\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_3, a^{\mathrm{F}} = \mathrm{ns})$. From the fund's perspective, the *lowest possible* payoff from not selling arises if the investor fires for sure (which arises if $\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_3, a^{\mathrm{F}} = \mathrm{ns}) < \gamma_{\mathrm{F}}$). For all other possible off-equilibrium beliefs, the fund must assign at least positive probability to receiving, in addition to the payoffs at $t = 1$ and $t = 2$, a continuation payoff of $\pi_{\mathrm{F}} > 0$ at $t = 2+$.

Thus, a *lower bound* on the fund's payoff from not selling is:

$$2w + \mathbb{E}\left(P_2|a=1\right) = 2w + \alpha\left(v - \mathbb{E}(\tilde{\delta}|\tilde{\delta} \le \delta_{\text{sep}})\right).$$

Thus, a *necessary* condition for the the fund to adopt strategy

$$s_{\text{F}}(a) = \begin{cases} \text{ns} & \text{if } a = 0 \\ \text{s} & \text{if } a = 1, \end{cases} \tag{3.24}$$

is that

$$w + \alpha(v - \mathbb{E}_s(\delta_{\text{sep}})) \ge 2w + \alpha\left(v - \mathbb{E}(\tilde{\delta}|\tilde{\delta} \le \delta_{\text{sep}})\right), \tag{3.25}$$

which we can rewrite as:

$$\mathbb{E}(\tilde{\delta}|\tilde{\delta} \le \delta_{\text{sep}})\left[1 - \frac{(1-\gamma_{\text{F}})(1-\gamma_{\text{M}})\mathbb{P}(\tilde{\delta} \le \delta_{\text{sep}})}{\theta + (1-\theta)(1-\gamma_{\text{F}})(1-\gamma_{\text{M}})\mathbb{P}(\tilde{\delta} \le \delta_{\text{sep}})}\right] \ge \frac{w}{\alpha}. \tag{3.26}$$

It is clear that fixing Θ, as $\frac{w}{\alpha}$ increases, inequality (3.26) is harder to satisfy. Let's define $B_{\frac{\alpha}{w}}(\Theta)$ as the smallest $\frac{\alpha}{w}$ satisfying inequality (3.26). Define $\underline{\alpha}(w,\Theta) = wB_{\frac{\alpha}{w}}(\Theta)$ as the lowest α that satisfies inequality (3.26). Let

(i) $\frac{\alpha}{w} < \frac{\underline{\alpha}(w,\Theta)}{w}$,

(ii) $\pi_{\text{g}}^{\text{I}} - \pi_{\text{b}}^{\text{I}} > B_{\Delta\pi}\left(\underline{\alpha}(w,\Theta), w, \Theta\right)$.

Since $B_{\Delta\pi}\left(\underline{\alpha}(w,\Theta), w, \Theta\right)$ is increasing in α, for α and $\pi_{\text{g}}^{\text{I}} - \pi_{\text{b}}^{\text{I}}$ satisfying (i) and (ii) it is clear that inequality (3.18) holds and (3.26) does not, giving a contradiction. This concludes the formal argument.■

We now proceed to discuss the intuition behind our result.

For exit to impose discipline, funds must sell in equilibrium if they observe the perverse action being taken. We show that funds' competition for flows—their desire to be retained by clients—endogenously prevents them from acting in this manner. Since good funds only invest in companies with no agency problems, the only funds that can be seen to exit must be the bad ones. But then exit reveals that the fund is of the bad type, which will induce the investor to fire the fund—keeping a fund an extra period is expensive for investors because, for each period that they do so, they pay an uncontingent fee w. When observing the perverse action being taken, the bad fund therefore faces the choice between two options: She may either hold the block, be retained by the investor and earn w for an extra period, but suffer from an $\alpha-$share of smaller profits at $t = 2$ or she may sell the block early, be fired by the investor and lose the assets-under-management fee for the second period, but realize larger profits on the actual position. When $\frac{\alpha}{w}$ is small the former option is more attractive. This is the first of two conditions identified in Proposition 3.1.

However, notice that for the argument above to be valid, it is not just necessary for the investor to fire the fund conditional on an early block sale, but also to retain the fund in the absence of such a sale. Why would the investor choose to pay w for an extra period when the fund cannot take any further productive actions on his behalf during $t = 2$? He would do so because by retaining the fund, he gathers further information about her type: observing the realized value of $\tilde{\delta}$ helps to sharpen the investor's belief about whether his fund is good. Since in the continuation game the investor would rather be matched with a good than a bad fund, this additional information about the type is valuable to the investor. Indeed, it is most valuable—and worth paying w for an extra period—precisely when good and bad funds produce significantly different continuation values for the investor, i.e., when $\pi_{\mathrm{g}}^{\mathrm{I}} - \pi_{\mathrm{b}}^{\mathrm{I}}$ is large enough. This is the second condition identified in Proposition 3.1.

It is also worth commenting on the applied relevance of these two conditions. The second condition (a lower bound on $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$) identifies circumstances under which investors endogenously retain funds if and only if they have not sold at $t = 1$. When funds sell at $t = 1$ their portfolio value is lower than it would have been at $t = 1$ had they not sold. Thus, the second condition guarantees that investors retain funds with relatively high $t = 1$ portfolio values and replace those with low $t = 1$ portfolio values. In other words, investors chase short-term performance. Short-term performance chasing by investors appears to be a robust feature of the data, and holds *across* very different classes of delegated portfolio managers. For example, flow performance relationships have been identified both for mutual funds (e.g. Chevalier and Ellison (1997)) and for hedge funds (e.g. Agarwal et al. (2009)). In contrast, the first condition (a lower bound on $\frac{\alpha}{w}$) *separates* different types of funds. For example, at one end of the spectrum, US mutual funds receive typically purely uncontingent fees, perhaps as a consequence of regulatory restrictions, and thus are relatively flow-motivated. In contrast, at the other end of the spectrum, hedge funds receive a significant component of their compensation from contingent fees explicitly linked to portfolio value, and are relatively profit-motivated.

Finally, from a theoretical perspective, it is worth noting that while the two conditions in Proposition 3.1 are *jointly* sufficient for our result—absent restrictions on the set of parameters (Θ, w, α)—they are *individually* necessary. It is clear that, if $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$ is large enough to guarantee that investors will retain the fund if and only if she does not sell but α is large relative to w, the fund will still prefer (despite the presence of competition for flows) to sell upon observing $a = 1$. Similarly, even if α is sufficiently small relative to w, if $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$ is small, then—depending on the parameters (Θ, w, α)—it is possible that the fund would *always* be replaced at $t = 1$, and therefore may as well maximize her portfolio value by selling early whenever $a = 1$.

To conclude this section, we provide a variation of our main result. We have shown that sufficient flow-motivation on the part of delegated blockholders preclude the existence of equilibria in which blockholders can punish funds *non*-stochastically when they take the perverse action. The careful reader may wonder if it is possible, despite the competition for investor flows of delegated blockholders, to have equilibria in which, if the manager takes the perverse action, the delegated blockholder punishes him with *arbitrarily* high probability $\mu < 1$. While threats involving mixed strategies are, in our view, of limited applied relevance, we nevertheless show that even such stochastic punishment fails in the presence of sufficient flow-motivation. In particular, we show that:

Proposition 3.2 *There exists $\hat{\mu} \in (0, 1)$ such that for any $\mu \geq \hat{\mu}$ there are bounds $B_{\Delta\pi}(\alpha, \mu, w, \Theta)$ and $B_{\frac{\alpha}{w}}(\mu, \Theta)$ such that if $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}} > B_{\Delta\pi}(\alpha, \mu, w, \Theta)$ and $\frac{\alpha}{w} < B_{\frac{\alpha}{w}}(\mu, \Theta)$, it cannot be an equilibrium for the fund to choose to sell with probability μ if and only if she observes $a = 1$ because, upon observing $a = 1$, the fund will strictly prefer not to sell.*

This and all subsequent proofs are provided in the appendix. Taken together, Propositions 3.1 and 3.2 show that exit cannot act as an effective disciplining device when delegated blockholders are mostly concerned about retaining their clients. Needless to say, while Propositions 3.1 and 3.2 establish impossibility results, in order to have empirical content, we need to delineate what happens in equilibrium. In the next section, we address this question.

3.6 Who Exits in Equilibrium and Who Does Not

In this section, we construct equilibria with minimal and maximal amounts of exit. We begin with the case of minimal exit. For an important class of institutional investors, our result shows that exit can be an entirely ineffective disciplining device in equilibrium.

Proposition 3.3 *For $\frac{\alpha}{w}$ small enough and $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$ large enough, there is an equilibrium in which*

(i) The investor chooses to fire his fund if she sells at $t = 1$ and retains her otherwise;

(ii) Funds never choose to sell at $t = 1$ regardless of the action chosen by the manager.

The proposition identifies two conditions under which there is an equilibrium with no exit. The conditions are qualitatively similar to those of Proposition 3.1. First, the fund must be sufficiently more interested in flows than in profits. Second, the investor must care sufficiently more about being matched with a good than a bad fund. A voluntary sale at $t = 1$ is an off-equilibrium event which leads to the replacement of the fund. In contrast, the absence of a voluntary sale leads to retention, because by retaining the fund the investor gains further information about her type—which is most valuable exactly when $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$ is high. Since the investor is willing to pay w for an extra period if the fund does not sell at $t = 1$, a sufficiently flow-motivated fund does not sell even upon observing the perverse action because she is willing to sacrifice profits for flows.

We then move on to consider the polar opposite case, where exit occurs whenever the manager takes the perverse action. Needless to say, exit cannot arise in equilibrium if both the conditions identified in Proposition 3.1 are satisfied. However, as we have noted above, the two conditions are jointly sufficient but are individually necessary. Thus, there is a degree of freedom in relaxing these conditions in order to construct equilibria with exit. Since our main applied motivation in this section is to theoretically delineate the prevalence of exit across different classes of delegated portfolio managers, we feel that it is appropriate to motivate our choice on the basis of what is ex ante empirically plausible. Given the empirical relevance of short-term performance chasing by investors across different types of delegated portfolio managers (see the discussion in section 3.5), we therefore maintain the assumption that guarantees that investors retain only those funds who have performed relatively better in the recent past. Fixing this assumption, we show that, if $\frac{\alpha}{w}$ is large, exit can function effectively as a disciplining device. In particular, we show that:

Proposition 3.4 *For $\frac{\alpha}{w}$ and $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$ large enough, there is an equilibrium in which*

(i) The investor chooses to fire his fund if she sells at $t = 1$ and retains her otherwise.

(ii) The fund chooses to sell at $t = 1$ whenever the manager chooses $a = 1$.

Propositions 3.3 and 3.4 generate empirical implications. In Proposition 3.3, we have shown that for $\frac{\alpha}{w}$ *small* enough, a delegated blockholder will never be effective in using exit to discipline management. In Proposition 3.4, we have shown that for $\frac{\alpha}{w}$ *large* enough, delegated blockholders can credibly threaten management with exit. Thus, the effectiveness of exit as a governance mechanism will be determined by variations in the contractual incentives of the delegated blockholder.

As we have argued above, variations in $\frac{\alpha}{w}$ can be thought to be a proxy for variations in the degree to which funds are relatively flow- vs profit-motivated. Across the different classes of delegated portfolio managers, there is clear variation in the relative degree of flow-motivation. As mentioned above, mutual funds typically receive no explicit profit-based compensation. Such investment vehicles would be represented by low $\frac{\alpha}{w}$ funds in our model. Other portfolio managers, such as hedge funds, derive a significant fraction of their payoffs from explicit profit-based compensation. Such investment vehicles would be represented by relatively high $\frac{\alpha}{w}$ funds in our model. Thus, our results taken together suggest that mutual funds would be less effective in using exit as a disciplining device than hedge funds. This is a testable implication of our model. While we are aware of no direct empirical examination of this prediction, as we have pointed out in the introduction, this result is broadly consistent with some existing empirical evidence.[13]

[13] A critique of our results may argue that variation in the contractual parameters are not necessarily relevant for exit because, if $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$ is small, then even low $\frac{\alpha}{w}$ funds (i.e., mutual funds) will use exit. However, we note that this critique requires that $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$ is small for *low* $\frac{\alpha}{w}$ funds, i.e., for mutual funds, which implies that mutual fund investors do not chase performance. Empirical evidence seems to point to the contrary.

3.7 Exit, Voice, and Compensation

We have argued that institutions that are relatively flow-motivated such as mutual funds will be less effective in their use of exit as a governance device than relatively profit-motivated ones such as hedge funds. To date, we have not considered the possibility of active monitoring (the use of "voice") by delegated blockholders. However, Hirschman (1970) argued that exit and voice are potentially complementary governance mechanisms: the existence of the threat of exit makes blockholder voice worth listening to. Do our results on the effects of funds' compensation on the different use of exit correspond to different ability and willingness to use voice? We consider this question next.[14]

Recall our baseline model with a fund with $\frac{\alpha}{w}$ high enough to satisfy the conditions of Proposition 3.4. For firms with agency problems in which $\delta \geq \delta_{\text{sep}}$ the existence of the threat of exit, by itself, prevents perverse behaviour by the manager at no cost to the fund (since the threat of exit is not executed for these firms in equilibrium). However, for firms with $\delta < \delta_{\text{sep}}$, the perverse action cannot be prevented by the threat of exit, and the fund must engage in costly exit in equilibrium. Consider the following modification of the model. Imagine that, at $t = 0$, the fund learns whether the type of the firm is such that the threat of exit alone will discipline the manager, i.e., the fund learns whether $\delta < \delta_{\text{sep}}$ before the manager makes his action choice.[15] Where the

[14]An earlier literature (Bhide (1993), Coffee (1991), Maug (1998)) has treated exit and voice as being substitutes. The traditional message in these papers has been that liquidity enhances exit which reduces voice. In an important contribution, Maug (1998)—while retaining the substitutability of exit and voice—showed that liquidity can also enhance voice by facilitating block formation.

[15]Note that knowing whether $\delta < \delta_{\text{sep}}$ makes no difference to the arguments of Proposition 4, since this information is inferred in equilibrium. Also note that we are enabling the fund to observe whether $\delta < \delta_{\text{sep}}$ rather than infer it via some pre-choice declaration of the manager. Such additional pre-game

threat of exit alone is insufficient to preclude $a = 1$, could the fund be tempted to use voice to discipline management?

We model voice as follows. When the fund learns that the threat of exit alone is insufficient, she can make a proposal for a series of operational and financial remedies (e.g. changes in business strategy) to the firm. Formulating the proposal comes at cost e to the fund. The proposal may be accepted or rejected by the manager. If accepted, the resulting change in business strategy leads the manager to relinquish the perverse action (i.e., choose $a = 0$) and yields him benefits, $R \in (0, \beta - \omega_2\delta_{\text{sep}})$, over and above his normal compensation from choosing $a = 0$. The cost e is sunk regardless of whether the manager accepts or rejects the proposal. Our formulation for voice can be interpreted in the following way: The change in business strategy generates a reduction in the effort cost for the manager for choosing $a = 0$, which—in our baseline model of agency problems drawn from Admati and Pfleiderer (2009)—translates into an increase in benefits of choosing $a = 0$.[16] Our formulation for voice is consistent with the description of active monitoring by hedge funds given by Brav et al. (2008). They argue that hedge funds target underperforming firms and propose an array of strategic, operational, and financial remedies.

To keep things simple we assume that the voice pre-game described here is unobservable to the investors and the market. We show the following result:

Proposition 3.5 *For e small enough, there exists an equilibrium in which for $\delta \in \left(\delta_{\text{sep}} - \frac{R}{\omega_2}, \delta_{sep}\right)$:*

communication adds unnecessary complexity to this section.

[16]Our formal model of voice can be re-interpreted as one in which the use of voice results in a decrease in the manager's private benefits from choosing $a = 1$.

1. *A fund with sufficiently high $\frac{\alpha}{w}$, who can credibly threaten to exit when the perverse action is chosen, will successfully use voice to prevent the perverse action (and thus avoid exit).*

2. *A fund with sufficiently low $\frac{\alpha}{w}$, who cannot credibly threaten to exit when the perverse action is chosen, will not use voice.*

The proof is in the appendix. In words, there exists a class of firms for which the threat of exit and voice are complementary in generating good governance, because delegated blockholders will use voice if and only if they can credibly threaten to exit. The intuition is as follows. The manager's payoff from ignoring voice depends on whether the fund exits or not if voice is ignored, and is higher when the fund does not exit than when she does. This reduces the reward required to induce the manager to choose $a = 0$ when the fund uses voice. Indeed, for $R \in (0, \beta - \omega_2\delta_{\text{sep}})$ blockholders' voice will never induce the manager to choose $a = 0$ over $a = 1$ if he knows that the fund will not exit. This is not true when he instead rationally anticipates that the fund will exit if voice is ignored. This implies that for low cost e, sufficiently profit-motivated funds will use voice backed by the threat of exit. The use of voice reduces the range of δ for which the manager takes the perverse action from $\delta < \delta_{\text{sep}}$ to $\delta < \delta_{\text{sep}} - \frac{R}{\omega_2}$, thereby making voice an additional corporate governance instrument. In contrast, highly flow-motivated institutions, being unable to credibly threaten to exit, never induce the manager to take $a = 0$ through voice if $R \in (0, \beta - \omega_2\delta_{\text{sep}})$ and thus rationally refrain from paying the costs of using voice.

As noted in the introduction, our finding provides one potential explanation—based on the interaction between voice and exit—for the empirical regularity that hedge funds use voice and produce significant gains for shareholders in target companies (Brav et al. (2008), Becht et al. (2010)), while mutual funds choose to remain silent and do not deliver similar gains (Karpoff (2001), Barber (2007), and Kahan and Rock (2007)).

3.8 Discussion

In this section, we discuss some of our modelling assumptions and conclusions. We begin by discussing the nature of the inferences made by investors who observe early liquidation of blocks by their funds.

3.8.1 Could exit be a good signal of managerial ability?

Our core observation (Proposition 3.1) relies on the fact that investors who observe that their fund sold, conclude that she will not generate high returns for them in the future. This is because the need to execute on a threat to exit suggests that this fund was a poor stock picker (formed a block in a firm with agency problems) and thus is less likely to generate high future returns for investors. Needless to say, implicit in this conclusion is a modelling choice: observable evidence of governance via exit is a negative signal, because fund managers who hold blocks are distinguished by their ability to spot the potential for agency problems ex ante. While it is quite standard in the literature to think of fund managers differing in stock picking ability, it is conceivable to construct alternative models in which funds differ, instead, in their ability to spot perverse behaviour ex post. In such models, it is possible for exit to be a *positive* signal, because—since there is no question of ex ante information—exit simply signals to investors that the exiting fund knows that management is acting suboptimally. Are our results robust to such a modification?

We would argue that—as in our baseline model—the flow-motivations of delegated blockholders would again interfere with the ability of exit to effectively discipline management. If exit is a good signal of ability, flow-motivated blockholders would exit excessively, i.e., they would sometimes exit not because the manager had taken a perverse action but because they wished to attract or retain flows. Any incentive mechanism that breaks the precise link between the action of the manager and the exit of the blockholder would make exit less effective as a governance mechanism. To formalize this intuition, we develop a simple model in the appendix (see section 3.10.3) in which funds are distinguished by the quality of their information about the internal working of firms in which they hold blocks. Firms are heterogeneous in the degree to which they suffer from agency problems, with differences arising from the extent of private benefits that the management can extract by effort avoidance. We show that when blockholders are flow-motivated, excessive exit will arise—and thus limit the disciplinary ability of exit—exactly for those firms in which the moral hazard problem is most severe. It is for these firms that exit will endogenously be viewed as a positive signal of ability on the part of the delegated blockholder. Consequently, for these firms, a flow-motivated blockholder will exit too often, breaking the link between managerial misbehaviour and punishment by blockholders.

While the core economic content of our results are robust to this alternative formulation of managerial ability, we should note that the two alternative models of exit may differ in their empirical plausibility. If exit was viewed as a positive signal about ability (as in the alternative formulation), then exit should be associated with short-term inflows (or the lack of exit with outflows). Since exit lowers share prices, and thus indirectly the portfolio value of the fund (the sale of a block is likely to have a first-order effect on the value of even a large fund), the alternative model would require short-term investor flows to be *negatively* related to short-term performance at least over some range. The empirical literature presents persuasive evidence for the existence of an increasing short-term flow-performance relationship. In contrast to the alternative, our baseline mechanism is consistent with an *increasing* short-term flow-performance relationship. Indeed, such a flow performance relationship is (endogenously) instrumental in our baseline model: It is exactly when investors observe low performance at $t = 1$ that they fire the fund (i.e., withdraw their funds).

3.8.2 Non-linear compensation for money managers

In our baseline analysis we have assumed that, in addition to the essentially universal uncontingent assets under management fee, the fund receives an α-share of the realized portfolio value. In reality, funds often receive compensation that takes the form of a "2 and 20" contract: a 2% uncontingent assets under management fee plus 20% of realized *profits* (i.e., max(profits, 0)). It is worth noting that our core results would not change if we introduced such non-linear payoffs for funds.

Our results only rely on the relative value of the portfolio values from early vs late liquidation if the manager takes the perverse action. At no stage does our analysis require that the explicit compensation of the fund be negative. Thus, conditional on $a = 1$, if p_{E} represents the portfolio value from early liquidation, and p_{L} represents the portfolio value from late liquidation, our analysis uses only the fact that $p_{\mathrm{E}} >$

p_{L}. Suppose the block was initially established at some (unmodelled) price p_0. Then $p_{\mathrm{E}} > p_{\mathrm{L}}$ implies that $\max(p_{\mathrm{E}} - p_0, 0) \geq \max(p_{\mathrm{L}} - p_0, 0)$, with strict inequality unless $p_0 \geq p_{\mathrm{E}} > p_{\mathrm{L}}$. Except in this latter case, our qualitative analysis remains unchanged: the fund's flow-motivation push her in the direction of not exiting, while her profit motivations push her to do the opposite. Thus, more flow-motivated funds will not exit, while less flow-motivated funds will. In the case in which $p_0 \geq p_{\mathrm{E}} > p_{\mathrm{L}}$, profit motivations no longer affect the choice to exit, and the only remaining motivation remains the fund's career concerns. In this case, no fund would choose to exit, *regardless* of the relative sizes of α and w.

3.8.3 Is delegation rational?

The empirical relevance of Proposition 3.3 relies on the existence of investors who would choose to invest in delegated funds with low α and high w in spite of their inability to use exit as a disciplining mechanism. There are two separate components to this question. First, since funds with high α and low w (e.g. hedge funds) generate higher value through exit than funds with low α and high w, it is clear that investors would prefer to invest in hedge funds rather than in mutual funds. It is clear that there are a variety of frictions that lead to the segmentation of markets with regard to delegated portfolio management. Investment in hedge funds requires, for example, that the investors pass significant net-worth thresholds which make hedge funds inaccessible for large groups of retail investors. However, despite the evident existence of such a class of investors, it is also also relevant to ask whether those investors who can only access mutual funds would prefer to do so (despite the payment of fees and the perverse behaviour identified in Proposition 3.3) rather than invest in the storage asset.[17] To answer this question we compute the ex ante expected utility for the investor at time 0:

$$U^{\mathrm{I}}(\delta_{\mathrm{pool}}) = (1-\alpha)\left[v - \theta\mathbb{E}_s(\delta_{\mathrm{pool}}) - (1-\theta)\mathbb{E}_{ns}(\delta_{\mathrm{pool}})\right] - w(2-\theta)$$
$$+ (1-\theta)\left[\bar{\pi} + \gamma_{\mathrm{F}}(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})(\pi_{\mathrm{g}}^{\mathrm{I}} - \pi_{\mathrm{b}}^{\mathrm{I}})\right] \geq 1$$

The first term refers to the investors share of the liquidated portfolio value, the second term refers to the payment of the uncontingent fee, and the final term arises from the additional value obtained by each investor from learning about the fund from delegation. We can rewrite this as follows:

$$U^{\mathrm{I}}(\delta_{\mathrm{pool}}) = (1-\alpha)\left[v - (1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}(\tilde{\delta} \leq \delta_{\mathrm{pool}})\mathbb{E}(\tilde{\delta} \mid \tilde{\delta} \leq \delta_{\mathrm{pool}})\right] - w(2-\theta)$$
$$+ (1-\theta)\left[\bar{\pi} + \gamma_{\mathrm{F}}(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})(\pi_{\mathrm{g}}^{\mathrm{I}} - \pi_{\mathrm{b}}^{\mathrm{I}})\right] \geq 1. \quad (3.27)$$

Fixing $(\alpha, w, \Theta, \pi_{\mathrm{g}}^{\mathrm{I}} - \pi_{\mathrm{b}}^{\mathrm{I}})$ to satisfy the conditions of Proposition 3.3, it is clear that if v is large enough this inequality is satisfied.

3.9 Conclusions

Blockholders are often seen as a solution to problems arising from the separation of ownership and control in publicly traded corporation. Admati and Pfleiderer (2009) show that the threat of exit can be an effective form of corporate governance when the blockholder is a profit-maximizing principal. Motivated by the prevalence of equity

[17] One could think of the storage asset as some benchmark portfolio, so that the returns from investing in active management with blockholding are viewed as being *relative* to such an alternative.

blocks that are held by delegated portfolio managers, we analyze whether agency frictions arising from delegated portfolio management—funds' competition for flows—may affect the ability of blockholders to govern through exit.

We show that flow-motivated blockholders cannot use the threat of exit effectively as a governance device. Our results imply that delegated portfolio managers with high-powered contracts (e.g. hedge funds) will use exit effectively, while those with low-powered contracts (e.g. mutual funds) will fail to do so. This is a novel prediction testable in the cross-section of funds. While no systematic attempt has been made to empirically connect money-manager compensation with the effectiveness of exit, some existing empirical results are consistent with our theoretical prediction. In contrast, a significant empirical literature connects the type of asset manager to the effectiveness of blockholder voice. We provide theoretical support for this literature by demonstrating the potential complementarity between exit and voice: The threat of exit determines the effectiveness of voice, implying that only explicitly profit-motivated funds will succeed in disciplining management with voice and exit. Flow-motivated funds will be unsuccessful in using either mechanism.

Our analysis examines the interplay of two distinct agency problems: between the managers and equity holders of firms on the one hand, and between delegating investors and their portfolio managers on the other. Both of these problems are ubiquitous. Our results suggest that the two agency problems interact in crucial ways: the existence of the latter may undermine traditional solutions to the former. Needless to say, our analysis represents only a benchmark first step, and much remains to be done. It may be interesting, for example, to examine how the flow-motivations of delegated portfolio managers interact with Edmans's (2009) elegant formulation of governance via exit. Edmans shows how blockholder trading can impound information into prices giving rise to better governance. In a different context, Dasgupta and Prat ((2006), (2008)) have examined the link between career concerns of money managers and price-informativeness of assets they trade. The exploration of such interactions is an interesting direction for future research.

3.10 Appendix

3.10.1 Omitted Proofs and Derivations

Derivation of equation 3.7: We show that expected change of the firm when the fund sells is

$$\mathbb{E}\left(\tilde{a}\tilde{\delta}|\ a^{\mathrm{F}}=\mathrm{s}\right)=\mathbb{E}_s(\delta_{\mathrm{sep}})=\frac{(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{E}(\tilde{\delta}|\tilde{\delta}\leq\delta_{\mathrm{sep}})\mathbb{P}(\tilde{\delta}\leq\delta_{\mathrm{sep}})}{\theta+(1-\theta)(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}(\tilde{\delta}\leq\delta_{\mathrm{sep}})},\tag{3.28}$$

where

$$\tilde{a}:=s_{\mathrm{M}}(\tilde{\delta})\tag{3.29}$$

We call $\tilde{\mathrm{e}}\in\{\mathrm{e},\mathrm{ne}\}$ a random variable that is equal to ne if the fund picks a stock in a firm with no agency problems and to e if the fund picks a stock in a firm with agency problems and has only access to exit as a disciplining device. We also introduce another random variable $\tilde{\mathrm{l}}\in\{\mathrm{ls},\mathrm{nls}\}$ that indicates whether the fund has been hit by a liquidity shock, where $\tilde{\mathrm{l}}=\mathrm{ls}$ indicates that the fund has been hit by a liquidity shock.

Let's fix the strategy of the fund: she sells if she observes the perverse action or if she is hit by a liquidity shock, and does not sell otherwise. Recall that we have introduced the simplifying assumption that $\gamma_{\mathrm{M}}^{\mathrm{g}}=1$ and therefore only the bad fund can observe $a = 1$ because the good fund invested in firms with no agency problems. Hence,

$$s_{\mathrm{F}}(a, \tau^{\mathrm{F}}, \tilde{\mathrm{l}}\,) = \begin{cases} \mathrm{s} & \text{if } a = 1 \text{ and } \tau^{\mathrm{F}} = \mathrm{b} \text{ or if } \tilde{l} = \mathrm{ls}, \\ \mathrm{ns} & \text{otherwise.} \end{cases} \tag{3.30}$$

The manager's strategy is

$$s_{\mathrm{M}}(\delta, \tau^{\mathrm{F}}, \tilde{\mathrm{e}}) = \begin{cases} 1 & \text{if } \delta \leq \delta_{\mathrm{sep}} \text{ and } \tau^{\mathrm{F}} = \mathrm{b} \text{ and } \tilde{\mathrm{e}} = \mathrm{e} \\ 0 & \text{otherwise.} \end{cases} \tag{3.31}$$

Then,

$$\begin{aligned}
\mathbb{E}\left(\tilde{a}\tilde{\delta}|a^{\mathrm{F}} = \mathrm{s}\right) &= \mathbb{E}\left[\mathbf{1}_{\left\{s_{\mathrm{M}}\left(\tilde{\delta}, \tau^{\mathrm{F}}, \tilde{\mathrm{e}}\right) = 1\right\}} \tilde{\delta}\,|a^{\mathrm{F}} = \mathrm{s}\right] = \\
&= \frac{1}{\mathbb{P}\left(a^{\mathrm{F}} = \mathrm{s}\right)} \mathbb{E}\left[\mathbf{1}_{\left\{s_{\mathrm{M}}\left(\tilde{\delta}, \tau^{\mathrm{F}}, \tilde{\mathrm{e}}\right) = 1\right\}}\ \mathbf{1}_{\{a^{\mathrm{F}} = \mathrm{s}\}} \tilde{\delta}\right] \\
&= \frac{1}{\mathbb{P}\left(a^{\mathrm{F}} = \mathrm{s}\right)} \mathbb{E}\left[\ \mathbf{1}_{\left\{\{\tilde{\delta} \leq \delta_{\mathrm{sep}}\} \cap \{\tau^{\mathrm{F}} = \mathrm{b}\} \cap \{\tilde{\mathrm{e}} = \mathrm{e}\}\right\} \cap\ \left\{\{\tilde{\delta} \leq \delta_{\mathrm{sep}}\} \cap \{\tau^{\mathrm{F}} = \mathrm{b}\} \cup \{\tilde{\mathrm{l}} = \mathrm{ls}\}\right\}} \tilde{\delta}\right] \\
&= \frac{1}{\mathbb{P}\left(a^{\mathrm{F}} = \mathrm{s}\right)} \mathbb{E}\left[\ \mathbf{1}_{\left\{\tilde{\delta} \leq \delta_{\mathrm{sep}}\right\}}\ \mathbf{1}_{\{\tau^{\mathrm{F}} = \mathrm{b}\}}\ \mathbf{1}_{\ \{\tilde{\mathrm{e}} = \mathrm{e}\} \cap \{\tilde{\mathrm{l}} = \mathrm{ls}\}} \tilde{\delta}\right] \\
&= \frac{1}{\mathbb{P}\left(a^{\mathrm{F}} = \mathrm{s}\right)} \mathbb{E}\left[\ \mathbf{1}_{\left\{\tilde{\delta} \leq \delta_{\mathrm{sep}}\right\}}\ \mathbf{1}_{\{\tau^{\mathrm{F}} = \mathrm{b}\}}\ \mathbf{1}_{\{\tilde{\mathrm{e}} = \mathrm{e}\}} \tilde{\delta}\right]
\end{aligned}$$

Given independence, we have that

$$\begin{aligned}
\mathbb{E}\left(\tilde{a}\tilde{\delta}|\ a^{\mathrm{F}} = \mathrm{s}\right) &= \frac{1}{\mathbb{P}\left(a^{\mathrm{F}} = \mathrm{s}\right)} \mathbb{P}\left(\tilde{\mathrm{e}} = \mathrm{e}\right) \mathbb{P}\left(\tau^{\mathrm{F}} = \mathrm{b}\right) \mathbb{E}\left[\ \mathbf{1}_{\left\{\tilde{\delta} \leq \delta_{\mathrm{sep}}\right\}} \tilde{\delta}\right] \\
&= \frac{(1 - \gamma_{\mathrm{M}})(1 - \gamma_{\mathrm{F}}) \mathbb{E}\left[\ \mathbf{1}_{\left\{\tilde{\delta} \leq \delta_{\mathrm{sep}}\ \right\}} \tilde{\delta}\right]}{\theta + (1 - \theta)(1 - \gamma_{\mathrm{F}})(1 - \gamma_{\mathrm{M}}) \mathbb{P}(\tilde{\delta} \leq \delta_{\mathrm{sep}})} \\
&= \frac{(1 - \gamma_{\mathrm{F}})(1 - \gamma_{\mathrm{M}}) \mathbb{E}(\tilde{\delta}|\tilde{\delta} \leq \delta_{\mathrm{sep}}) \mathbb{P}(\tilde{\delta} \leq \delta_{\mathrm{sep}})}{\theta + (1 - \theta)(1 - \gamma_{\mathrm{F}})(1 - \gamma_{\mathrm{M}}) \mathbb{P}(\tilde{\delta} \leq \delta_{\mathrm{sep}})}.
\end{aligned}$$

Proof of Proposition 3.2: The structure of the proof is similar to that of Proposition 3.1. We sketch the proof here, highlighting only the points of departure from that argument. Consider any putative equilibrium in which the fund's strategy is to sell with probability μ if $a = 1$ and not to sell otherwise. The manager's expected utility from $a = 0$ remains unchanged (see equation (3.3)) whereas his utility from $a = 1$ changes from equation (3.2) to

$$\beta + \omega_1 \left\{ v - \theta \mathbb{E}_s - (1-\theta)[\mu \mathbb{E}_s + (1-\mu)\mathbb{E}_{ns}] \right\} + \omega_2 (v - \delta). \tag{3.32}$$

As before the manager's strategy will be characterized by a threshold δ_μ which is now implicitly defined by:

$$\delta_\mu = \frac{\beta - \omega_1 (1-\theta)\mu[\mathbb{E}_s(\delta_\mu) - \mathbb{E}_{ns}(\delta_\mu)]}{\omega_2}, \tag{3.33}$$

where

$$\mathbb{E}_s(\delta_\mu) = \frac{(1-\gamma_\mathrm{F})(1-\gamma_\mathrm{M})\mathbb{E}(\tilde{\delta}|\tilde{\delta} \leq \delta_\mu)\mathbb{P}(\tilde{\delta} \leq \delta_\mu)(\theta + (1-\theta)\mu)}{\theta + \mu(1-\theta)(1-\gamma_\mathrm{F})(1-\gamma_\mathrm{M})\mathbb{P}(\tilde{\delta} \leq \delta_\mu)} \tag{3.34}$$

and

$$\mathbb{E}_{ns}(\delta_\mu) = \frac{(1-\gamma_\mathrm{F})(1-\gamma_\mathrm{M})\mathbb{E}(\tilde{\delta}|\tilde{\delta} \leq \delta_\mu)\mathbb{P}(\tilde{\delta} \leq \delta_\mu)(1-\mu)}{1 - \mu(1-\gamma_\mathrm{F})(1-\gamma_\mathrm{M})\mathbb{P}(\tilde{\delta} \leq \delta_\mu)}. \tag{3.35}$$

The threshold δ_μ is uniquely defined as long as $\mathbb{E}_s(\delta_\mu) - \mathbb{E}_{ns}(\delta_\mu)$ is increasing in δ_μ. This is true as long as μ is not too small as the following lemma shows:

Lemma 3.1 *There exists a $\hat{\mu} \in (0,1)$ such that for $\mu \geq \hat{\mu}$, $\mathbb{E}_s(\delta_\mu) - \mathbb{E}_{ns}(\delta_\mu)$ is increasing in δ_μ.*

Proof of Lemma: Let $A = (1-\gamma_\mathrm{F})(1-\gamma_\mathrm{M})$, $\mathbb{E}(\delta_\mu) = \mathbb{E}(\tilde{\delta}|\tilde{\delta} \leq \delta_\mu)$, and $\mathbb{P}(\delta_\mu) = \mathbb{P}(\tilde{\delta} \leq \delta_\mu)$. Note that $\mathbb{E}(\delta_\mu)$ and $\mathbb{P}(\delta_\mu)$ are both increasing functions of δ_μ. Then,

$$\mathbb{E}_s(\delta_\mu) = \frac{A\mathbb{E}(\delta_\mu)(\theta + (1-\theta)\mu)}{\frac{\theta}{\mathbb{P}(\delta_\mu)} + \mu(1-\theta)A},$$

which is clearly monotone increasing in δ_μ. Denoting the denominator by D,

$$\frac{\partial}{\partial\delta_\mu}\mathbb{E}_s(\delta_\mu) = \frac{A(\theta+(1-\theta)\mu)}{D^2}\left[\left(\frac{\theta}{\mathbb{P}(\delta_\mu)} + \mu(1-\theta)A\right)\mathbb{E}(\delta_\mu)' + \mathbb{E}(\delta_\mu)\frac{\theta}{[\mathbb{P}(\delta_\mu)]^2}\mathbb{P}(\delta_\mu)'\right],$$

which is clearly bounded below by a strictly positive number for all μ. In addition,

$$\mathbb{E}_{ns}(\delta_\mu) = \frac{A\mathbb{E}(\delta_\mu)(1-\mu)}{\frac{1}{\mathbb{P}(\delta_\mu)} - \mu A},$$

which is clearly also monotone increasing δ_μ. Again, denoting the denominator by D:

$$\frac{\partial}{\partial\delta_\mu}\mathbb{E}_{ns}(\delta_\mu) = \frac{A(1-\mu)}{D^2}\left[\left(\frac{1}{\mathbb{P}(\delta_\mu)} - \mu A\right)\mathbb{E}(\delta_\mu)' + \mathbb{E}(\delta_\mu)\frac{1}{[\mathbb{P}(\delta_\mu)]^2}\mathbb{P}(\delta_\mu)'\right].$$

This implies that $\frac{\partial}{\partial\delta_\mu}\mathbb{E}_{ns}(\delta_\mu)$ converges continuously to 0 as $\mu \to 1$. Thus, there exists a $\hat{\mu} \in (0,1)$ such that for $\mu \geq \hat{\mu}$, $\mathbb{E}_s(\delta_\mu) - \mathbb{E}_{ns}(\delta_\mu)$ is increasing in δ_μ. This concludes the proof of the lemma. □

Consider first the best response of the investor at $t = 2$. Define the events E_1, E_2, and E_3 as before, so that at $t = 2$ the investor observes elements of the cross product $\{\mathrm{E}_1, \mathrm{E}_2, \mathrm{E}_3\} \times \{\mathrm{s}, \mathrm{ns}\}$. In contrast to the proof of Proposition 3.1, now events $\left(\mathrm{E}_1, a^{\mathrm{F}} = \mathrm{ns}\right)$, $\left(\mathrm{E}_2, a^{\mathrm{F}} = \mathrm{ns}\right)$, $\left(\mathrm{E}_3, a^{\mathrm{F}} = \mathrm{ns}\right)$, and $\left(\mathrm{E}_3, a^{\mathrm{F}} = \mathrm{s}\right)$ can arise in equilibrium, and the posterior attached at $t = 2$ for each of these events is as follows:

$$\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_1, a^{\mathrm{F}} = \mathrm{ns}) = \frac{\gamma_{\mathrm{F}}}{\gamma_{\mathrm{F}} + (1-\gamma_{\mathrm{F}})\gamma_{\mathrm{M}}} > \gamma_{\mathrm{F}} \tag{3.36}$$

$$\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_2, a^{\mathrm{F}} = \mathrm{ns}) = \gamma_{\mathrm{F}}, \tag{3.37}$$

$$\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_3, a^{\mathrm{F}} = \mathrm{ns}) = 0 \tag{3.38}$$

$$\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_3, a^{\mathrm{F}} = \mathrm{s}) = 0. \tag{3.39}$$

This implies that the investor retains at $t = 2$ in the first two events and replaces at $t = 2$ in the last two events. As before, we make no assumption about the investor's behaviour in the other two events.

At $t = 2$, if the investor observes $a^{\mathrm{F}} = \mathrm{ns}$, he computes:

$$\mathbb{P}\left(\mathrm{E}_1 \middle| a^{\mathrm{F}} = \mathrm{ns}\right) = \frac{\mathbb{P}\left(\tilde{\delta} \leq \delta_\mu\right)\left(\gamma_{\mathrm{F}} + (1-\gamma_{\mathrm{F}})\gamma_{\mathrm{M}}\right)}{1-(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}\left(\tilde{\delta} \leq \delta_\mu\right)\mu} \tag{3.40}$$

$$\mathbb{P}(\mathrm{E}_2|a^{\mathrm{F}} = \mathrm{ns}) = \frac{1-\mathbb{P}\left(\tilde{\delta} \leq \delta_\mu\right)}{1-(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}\left(\tilde{\delta} \leq \delta_\mu\right)\mu} \tag{3.41}$$

$$\mathbb{P}(\mathrm{E}_3 \middle| a^{\mathrm{F}} = \mathrm{ns}) = \frac{(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})(1-\mu)\mathbb{P}\left(\tilde{\delta} \leq \delta_\mu\right)}{1-(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}\left(\tilde{\delta} \leq \delta_\mu\right)\mu}. \tag{3.42}$$

Thus, if the investor observes $a^{\mathrm{F}} = \mathrm{ns}$ and retains the fund at $t = 1$, his expected payoff can be written as:

$$(1-\alpha)(v-\mathbb{E}_{ns}(\delta_\mu)) - 2w + \bar{\pi}^{\mathrm{I}} + \frac{\mathbb{P}(\tilde{\delta} \leq \delta_\mu)\gamma_{\mathrm{F}}(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})}{1-(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}(\tilde{\delta} \leq \delta_\mu)\mu}(\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}). \tag{3.43}$$

Instead, if the investor observes $a^{\mathrm{F}} = \mathrm{ns}$ and fires the fund, his expected payoff is:

$$(1-\alpha)P_1 - w + \mathbb{E}\left(\tilde{\pi}^{I}_{\mathrm{F}}\right) = (1-\alpha)(v-\mathbb{E}_s(\delta_\mu)) - w + \bar{\pi}^{\mathrm{I}}. \tag{3.44}$$

Hence, the investor will choose to retain the fund conditional on no sale if

$$(1-\alpha)(\mathbb{E}_s(\delta_\mu) - \mathbb{E}_{ns}(\delta_\mu)) + \frac{\mathbb{P}(\tilde{\delta} \leq \delta_\mu)\gamma_{\mathrm{F}}(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})}{1-(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}(\tilde{\delta} \leq \delta_\mu)\mu}(\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}) \geq w \tag{3.45}$$

It is clear that, for a given $\mu \geq \hat{\mu}$ and $\{\alpha, w, \Theta\}$, as long as $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$ is large enough, equation (3.45) holds. It is also clear that the lower bound on $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$ is increasing in α, since $\mathbb{E}_s(\delta_\mu) - \mathbb{E}_{ns}(\delta_\mu) > 0$. Let us denote the relevant lower bound on $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$ by $B_{\Delta\pi}(\alpha, \mu, w, \Theta)$.

If the investor observes a sale at $t = 1$, an argument identical to that in Proposition 3.1 establishes that it is optimal for him to fire the fund immediately.

Finally, we turn to the fund's best response. The case in which the fund observes $a = 0$ is identical to that in Proposition 3.1. When the fund observes $a = 1$, in the putative equilibrium with $\mu \in (0, 1)$ she must be indifferent between selling and not selling at $t = 1$. If she sells her expected payoff is:

$$\alpha P_1 + w = \alpha(v - \mathbb{E}_s(\delta_\mu)) + w \tag{3.46}$$

whereas if she does not sell and condition (3.45) holds then she is retained at $t = 1$ and gets:

$$\alpha(v - \mathbb{E}(\tilde{\delta}|\tilde{\delta} \leq \delta_\mu)) + 2w \tag{3.47}$$

Therefore, it must be the case that

$$\alpha(v - \mathbb{E}_s(\delta_\mu)) + w = \alpha(v - \mathbb{E}(\tilde{\delta}|\tilde{\delta} \leq \delta_\mu)) + 2w, \tag{3.48}$$

i.e.

$$\mathbb{E}(\tilde{\delta}|\tilde{\delta} \leq \delta_\mu) \left[\frac{\theta(1 - \big(1 - \gamma_{\mathrm{F}})(1 - \gamma_{\mathrm{M}})\mathbb{P}(\tilde{\delta} \leq \delta_\mu)\big)}{\theta + \mu(1 - \theta)(1 - \gamma_{\mathrm{F}})(1 - \gamma_{\mathrm{M}})\mathbb{P}(\tilde{\delta} \leq \delta_\mu)} \right] = \frac{w}{\alpha}. \tag{3.49}$$

It is clear that fixing Θ and $\mu \geq \hat{\mu}$, we can find a $\frac{\alpha}{w}$ that satisfies equation (3.49). Let's define $B_{\frac{\alpha}{w}}(\mu, \Theta)$ as the $\frac{\alpha}{w}$ satisfying the equality above. Let

(i) $\frac{\alpha}{w} < B_{\frac{\alpha}{w}}(\mu, \Theta)$

(ii) $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}} > B_{\Delta\pi}(\alpha, \mu, w, \Theta)$.

Since $B_{\Delta\pi}(\alpha, \mu, w, \Theta)$ is increasing in α, for α and $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$ satisfying (i) and (ii) it is clear that inequality (3.45) holds and (3.49) does not, giving a contradiction.[18] ■

[18]It is, of course, possible to violate equality (3.49) by picking $\frac{\alpha}{w} > B_{\frac{\alpha}{w}}(\mu, \Theta)$. However, in this case

Proof of Proposition 3.3: We construct a perfect Bayesian equilibrium in which the action of the bad fund who observes the perverse action is the same as the action of the fund who observes the non-perverse action.

We denote the equilibrium by a triplet $(s_{\mathrm{M}}, s_{\mathrm{F}}, s_{\mathrm{I}})$ of strategies for the three sets of players.

Let's start with the manager's strategy. The manager's expected utility if he chooses $a = 1$ is

$$\beta + \omega_1 [v - \theta\mathbb{E}_s - (1-\theta)\mathbb{E}_{ns}] + \omega_2(v - \delta). \tag{3.50}$$

This is because he knows that at time 1 the fund is going to sell only if the investor is hit by a liquidity shock (which happens with probability θ). Similarly, the manager's expected utility if $a = 0$ is

$$\omega_1 [v - \theta\mathbb{E}_s - (1-\theta)\mathbb{E}_{ns}] + \omega_2 v, \tag{3.51}$$

Hence, the manager's strategy is:

$$s_{\mathrm{M}}(\delta) = \begin{cases} 1 & \text{if } \beta - \omega_2\delta \geq 0 \\ 0 & \text{otherwise.} \end{cases} \tag{3.52}$$

Since $\beta - \omega_2\delta \geq 0$ is decreasing in δ if the manager prefers to take the perverse action for a given δ, he must strictly prefer to take action for all smaller values. An equilibrium is then characterised by a cutoff point δ_{pool}, such that the manager takes action for any $\delta \leq \delta_{\mathrm{pool}}$. The cutoff point δ_{pool} is

$$\delta_{\mathrm{pool}} = \frac{\beta}{\omega_2} \tag{3.53}$$

$\mu = 1$, because the fund strictly prefers selling to not selling. This case has been dealt with already in Proposition 3.1.

and is unique. Now, we can compute $\mathbb{E}_s$ and $\mathbb{E}_{ns}$ as functions of δ_{pool} as follows:

$$\mathbb{E}_s(\delta_{\text{pool}}) = \mathbb{E}_{ns}(\delta_{\text{pool}}) = (1-\gamma_{\text{F}})(1-\gamma_{\text{M}})\mathbb{E}(\tilde{\delta}|\tilde{\delta} \leq \delta_{\text{pool}})\mathbb{P}(\tilde{\delta} \leq \delta_{\text{pool}}). \tag{3.54}$$

We now proceed to compute the strategy of the investor who has not been hit by the liquidity shock.

The investor's decision at $t = 1$ relies on what inference he expects to make at $t = 2$. At $t = 2$ the investor will observe one of the following three mutually exclusive and exhaustive events:

$$\text{E}_1 = \{\delta \leq \delta_{\text{pool}}\} \cap \{a = 0\} \tag{3.55}$$

$$\text{E}_2 = \{\delta > \delta_{\text{pool}}\} \cap \{a = 0\} \tag{3.56}$$

$$\text{E}_3 = \{a = 1\} \tag{3.57}$$

In addition, the investor will have observed either $a^{\text{F}} = \text{s}$ or $a^{\text{F}} = \text{ns}$ at $t = 1$[19]. Thus, the investor's information set consists of six possible paired events, which are the elements of

$$\{\text{E}_1, \text{E}_2, \text{E}_3\} \times \{\text{s}, \text{ns}\}.$$

Each of these events conveys different information to the investor and may affect his retention vs firing decision at $t = 2$. We first consider the events that can arise on the putative equilibrium path. These are $\big(\text{E}_1, a^{\text{F}} = \text{ns}\big)$, $\big(\text{E}_2, a^{\text{F}} = \text{ns}\big)$, and $\big(\text{E}_3, a^{\text{F}} = \text{ns}\big)$. For each of these cases, the investor can compute the probability that he is matched

[19] In a pooling equilibrium $\mathbb{E}_{ns}(\delta_{\text{pool}}) = \mathbb{E}_s(\delta_{\text{pool}})$, thus by observing just portfolio values the investor cannot infer the action of the fund. It is enough to introduce an arbitrarily small number of naive investors who sell when the manager takes $a = 1$ to break the equivalence in portfolio values and allow the investor to infer the fund's action from the value of the portfolio.

with a good fund using Bayes Rule as follows:

$$\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_1, a^{\mathrm{F}} = \mathrm{ns}) = \frac{\gamma_{\mathrm{F}}}{\gamma_{\mathrm{F}} \ + (1-\gamma_{\mathrm{F}})\gamma_{\mathrm{M}}} > \gamma_{\mathrm{F}} \tag{3.58}$$

$$\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_2, a^{\mathrm{F}} = \mathrm{ns}) = \gamma_{\mathrm{F}} \tag{3.59}$$

$$\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_3, a^{\mathrm{F}} = \mathrm{ns}) = 0 \tag{3.60}$$

Clearly, the investor retains at $t = 2$ in the events $\left(\mathrm{E}_1, a^{\mathrm{F}} = \mathrm{ns}\right)$ and $\left(\mathrm{E}_2, a^{\mathrm{F}} = \mathrm{ns}\right)$ and fires at $t = 2$ in the event $\left(\mathrm{E}_3, a^{\mathrm{F}} = \mathrm{ns}\right)$. For the other three events, which are off-equilibrium, we assign $\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|\mathrm{E}_i, a^{\mathrm{F}} = \mathrm{s}) = 0$ for all i.[20]

Turning to $t = 1$, if the investor observes $a^{\mathrm{F}} = \mathrm{ns}$ he computes $\mathbb{P}\left(\mathrm{E}_1 \middle| a^{\mathrm{F}} = \mathrm{ns}\right)$, $\mathbb{P}(\mathrm{E}_2|a^{\mathrm{F}} = \mathrm{ns})$ and $\mathbb{P}(\mathrm{E}_3|a^{\mathrm{F}} = \mathrm{ns})$ as follows:

$$\mathbb{P}\left(\mathrm{E}_1 \middle| a^{\mathrm{F}} = \mathrm{ns}\right) = (\gamma_{\mathrm{F}} \ + (1-\gamma_{\mathrm{F}})\gamma_{\mathrm{M}} \ )\, \mathbb{P}\left(\tilde{\delta} \leq \delta_{\mathrm{pool}}\right) \tag{3.61}$$

$$\mathbb{P}(\mathrm{E}_2|a^{\mathrm{F}} = \mathrm{ns}) = 1 - \mathbb{P}\left(\tilde{\delta} \leq \delta_{\mathrm{pool}}\right) \tag{3.62}$$

$$\mathbb{P}(\mathrm{E}_3|a^{\mathrm{F}} = \mathrm{ns}) = (1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}\left(\tilde{\delta} \leq \delta_{\mathrm{pool}}\right). \tag{3.63}$$

In this equilibrium observing the fund not selling does not convey any information.

Hence, if the investor observes observes $a^{\mathrm{F}} = \mathrm{ns}$, by retaining the fund he gets

$$(1-\alpha)\mathbb{E}\left(P_2|a^{\mathrm{F}} = \mathrm{ns}\right) - 2w + \mathbb{E}\left(\tilde{\pi}^{\mathrm{I}} \middle| \, a^{\mathrm{F}} = \mathrm{ns}\right) \tag{3.64}$$

[20]It will be clear in the sequel that these off-equilibrium beliefs are consistent with the $t = 1$ off-equilibrium belief that $\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g}|a^{\mathrm{F}} = \mathrm{s}) = 0$.

where

$$
\begin{aligned}
&\mathbb{E}\left(\tilde{\pi}^{\mathrm{I}}\middle|a^{\mathrm{F}}=\mathrm{ns}\right)= \\
&\qquad \mathbb{P}\left(\mathrm{E}_1\middle|a^{\mathrm{F}}=\mathrm{ns}\right)\left[\mathbb{P}(\tau^{\mathrm{F}}=\mathrm{g}|\mathrm{E}_1,a^{\mathrm{F}}=\mathrm{ns})\pi^{\mathrm{I}}_{\mathrm{g}}+(1-\mathbb{P}(\tau^{\mathrm{F}}=\mathrm{g}|\mathrm{E}_1,a^{\mathrm{F}}=\mathrm{ns}))\pi^{\mathrm{I}}_{\mathrm{b}}\right]+ \\
&\qquad \mathbb{P}(\mathrm{E}_2|a^{\mathrm{F}}=\mathrm{ns})\left[\mathbb{P}(\tau^{\mathrm{F}}=\mathrm{g}|\mathrm{E}_2,a^{\mathrm{F}}=\mathrm{ns})\pi^{\mathrm{I}}_{\mathrm{g}}+(1-\mathbb{P}(\tau^{\mathrm{F}}=\mathrm{g}|\mathrm{E}_2,a^{\mathrm{F}}=\mathrm{ns}))\pi^{\mathrm{I}}_{\mathrm{b}})\right]+ \\
&\qquad \mathbb{P}(\mathrm{E}_3|a^{\mathrm{F}}=\mathrm{ns})\left[\mathbb{P}(\tau^{\mathrm{F}}=\mathrm{g}|\mathrm{E}_3,a^{\mathrm{F}}=\mathrm{ns})\pi^{\mathrm{I}}_{\mathrm{g}}+(1-\mathbb{P}(\tau^{\mathrm{F}}=\mathrm{g}|\mathrm{E}_3,a^{\mathrm{F}}=\mathrm{ns}))\pi^{\mathrm{I}}_{\mathrm{b}}\right].
\end{aligned}
$$

Simplifying we have that if the investor observes $a^{\mathrm{F}}=\mathrm{ns}$ and retains at $t=1$ his expected payoff is

$$(1-\alpha)(v-\mathbb{E}_{ns}(\delta_{\mathrm{pool}}))-2w+\bar{\pi}^{\mathrm{I}}+\gamma_{\mathrm{F}}\ (1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}\left(\tilde{\delta}\leq\delta_{\mathrm{pool}}\right)(\pi^{\mathrm{I}}_{\mathrm{g}}-\pi^{\mathrm{I}}_{\mathrm{b}}). \quad (3.65)$$

If at $t=1$ he observes $a^{\mathrm{F}}=\mathrm{ns}$ and fires the fund his expected payoff is

$$(1-\alpha)P_1-w+\mathbb{E}(\tilde{\pi}^{\mathrm{I}})=(1-\alpha)(v-\mathbb{E}_s(\delta_{\mathrm{pool}}))-w+\bar{\pi}^{\mathrm{I}}. \quad (3.66)$$

The investor would rather retain the fund when she does not sell if:

$$
\begin{aligned}
(1-\alpha)(v-\mathbb{E}_{ns}(\delta_{\mathrm{pool}}))-2w+\bar{\pi}^{I}+\gamma_{\mathrm{F}}\ (1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}\left(\tilde{\delta}\leq\delta_{\mathrm{pool}}\right)(\pi^{\mathrm{I}}_{\mathrm{g}}-\pi^{\mathrm{I}}_{\mathrm{b}})\geq \\
(1-\alpha)(v-\mathbb{E}_s(\delta_{\mathrm{pool}}))-w+\bar{\pi}^{\mathrm{I}} \quad (3.67)
\end{aligned}
$$

i.e.,

$$\gamma_{\mathrm{F}}\ (1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{P}\left(\tilde{\delta}\leq\delta_{\mathrm{pool}}\right)(\pi^{\mathrm{I}}_{\mathrm{g}}-\pi^{I}_{\mathrm{b}})\geq w \quad (3.68)$$

For a given Θ and w, for $\pi^{\mathrm{I}}_{\mathrm{g}}-\pi^{\mathrm{I}}_{\mathrm{b}}$ large enough, the investor would retain the fund if she does not sell. Let us denote the relevant lower bound on $\pi^{\mathrm{I}}_{\mathrm{g}}-\pi^{\mathrm{I}}_{\mathrm{b}}$ as $B_{\Delta\pi}(w,\Theta)$ which is independent of α.

Now, let's suppose that the fund sells at $t = 1$. This is an off-equilibrium action for the fund and we assign the investor's beliefs to be $\mathbb{P}(\tau^{\mathrm{F}} = \mathrm{g} | a^{\mathrm{F}} = \mathrm{s}) = 0$[21]. Hence, he computes

$$\mathbb{P}(\mathrm{E}_1 | a^{\mathrm{F}} = \mathrm{s}) = \mathbb{P}(\tilde{\delta} \leq \delta_{\mathrm{sep}})\gamma_{\mathrm{M}} \tag{3.69}$$

$$\mathbb{P}(\mathrm{E}_2 | a^{\mathrm{F}} = \mathrm{s}) = (1 - \mathbb{P}(\tilde{\delta} \leq \delta_{\mathrm{sep}})) \tag{3.70}$$

$$\mathbb{P}(\mathrm{E}_3 | a^{\mathrm{F}} = \mathrm{s}) = \mathbb{P}(\tilde{\delta} \leq \delta_{\mathrm{sep}})(1 - \gamma_{\mathrm{M}}). \tag{3.71}$$

We know from that in each of these events, the fund will be replaced at $t = 2$.

If the investor observes $a^{\mathrm{F}} = \mathrm{s}$ and fires the fund he gets

$$(1 - \alpha)P_1 - w + \mathbb{E}(\tilde{\pi}^{\mathrm{I}}) = (1 - \alpha)(v - \mathbb{E}_s(\delta_{\mathrm{pool}})) - w + \bar{\pi}^{\mathrm{I}},$$

whereas if he retains the fund his expected payoff is:

$$(1 - \alpha)\mathbb{E}\left(P_2 \mid a^{\mathrm{F}} = \mathrm{s}\right) - 2w + \mathbb{E}\left(\tilde{\pi}^{\mathrm{I}} \;\middle|\; a^{\mathrm{F}} = \mathrm{s}\right) = (1 - \alpha)(v - \mathbb{E}_s(\delta_{\mathrm{pool}})) - 2w + \bar{\pi}^{\mathrm{I}},$$

Therefore, the investor will always fire the fund. Thus, for $\pi^{\mathrm{I}}_{\mathrm{g}} - \pi^{\mathrm{I}}_{\mathrm{b}}$ large enough, the investor's strategy is

$$s_{\mathrm{I}}(a^{\mathrm{F}}) = \begin{cases} \mathrm{r} & \text{if } a^{\mathrm{F}} = \mathrm{ns} \\ \mathrm{f} & \text{if } a^{\mathrm{F}} = \mathrm{s}. \end{cases} \tag{3.72}$$

It remains for us to show that the fund will choose not to sell regardless of whether she observes $a = 0$ or $a = 1$.

If the fund observes $a = 0$ and chooses to hold, she is retained by the investor and thus receives

$$2w + \alpha\mathbb{E}\left(P_2 \mid a = 0\right) + \mathbb{P}(\text{retained in } t = 2)\pi^{\mathrm{F}} = 2w + \alpha v + \pi^{\mathrm{F}}$$

[21] Our selected belief is consistent with a natural perturbation of the model in which a small measure $\epsilon > 0$ of funds act naively: i.e., sell whenever they observe $a = 1$.

If, instead, she sells, she is fired by the investor and thus receives

$$w + P_1 = w + \alpha\left(v - \mathbb{E}_s(\delta_{\text{pool}})\right).$$

Clearly, she will choose to hold.

If, on the other hand, the fund observes $a = 1$ and chooses to hold, she is retained by the investor at $t = 1$ but fired at $t = 2$ and thus receives

$$2w + \alpha\left(v - \mathbb{E}\left(\tilde{\delta} \mid \tilde{\delta} \leq \delta_{\text{pool}}\right)\right) + \mathbb{P}(\text{retained at } t = 2)\pi^{\text{F}} = 2w + \alpha\left(v - \mathbb{E}\left(\tilde{\delta} \mid \tilde{\delta} \leq \delta_{\text{pool}}\right)\right).$$

Instead, if she chooses to sell, she is fired by the investor and thus receives

$$w + \alpha\left(v - \mathbb{E}_s\left(\delta_{\text{pool}}\right)\right).$$

Thus the fund will prefer not to sell upon observing $a = 1$ if

$$w + \alpha(v - \mathbb{E}_s(\delta_{\text{pool}})) \leq 2w + \alpha\left(v - \mathbb{E}\left(\tilde{\delta} \mid \tilde{\delta} \leq \delta_{\text{pool}}\right)\right), \tag{3.73}$$

which can be rewritten as:

$$\mathbb{E}\left(\tilde{\delta} \mid \tilde{\delta} \leq \delta_{\text{pool}}\right)\left(1 - (1 - \gamma_{\text{F}})(1 - \gamma_{\text{M}})\mathbb{P}\left(\tilde{\delta} \leq \delta_{\text{pool}}\right)\right) \leq \frac{w}{\alpha}. \tag{3.74}$$

Clearly for a given Θ as $\frac{\alpha}{w}$ gets small, the inequality holds and the fund does not sell even when she observes $a = 1$. Let $B_{\frac{\alpha}{w}}(\Theta)$ be the largest $\frac{\alpha}{w}$ satisfying inequality (3.74). Let

(i) $\frac{\alpha}{w} < B_{\frac{\alpha}{w}}(\Theta)$

(ii) $\pi^{\text{I}}_{\text{g}} - \pi^{\text{I}}_{\text{b}} > B_{\Delta\pi}(w, \Theta)$.

Both inequalities (3.68) and (3.74) are satisfied. This concludes the formal argument.■

Derivation of equation 3.54. Using the definitions provided when deriving equation (3.7) we show that

$$\mathbb{E}(\tilde{a}\tilde{\delta} \mid a^{\mathrm{F}} = \mathrm{s}) = \mathbb{E}_s(\delta_{\mathrm{pool}}) = (1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{E}(\tilde{\delta}|\tilde{\delta} \leq \delta_{\mathrm{pool}})\mathbb{P}(\tilde{\delta} \leq \delta_{\mathrm{pool}}) \tag{3.75}$$

In the equilibrium with minimal exit the strategy of the fund is

$$s_{\mathrm{F}}(\tilde{\mathrm{l}}) = \begin{cases} \mathrm{s} & \text{if } \tilde{\mathrm{l}} = \mathrm{ls}, \\ \mathrm{ns} & \text{otherwise} \end{cases} \tag{3.76}$$

and the strategy of the manager is

$$s_{\mathrm{M}}(\delta, \tilde{\mathrm{e}}, \tau^{\mathrm{F}}) = \begin{cases} 1 & \text{if } \delta \leq \delta_{\mathrm{pool}} \text{ and } \tilde{\mathrm{e}} = \mathrm{e} \text{ and } \tau^{\mathrm{F}} = \mathrm{b} \\ 0 & \text{otherwise.} \end{cases} \tag{3.77}$$

Then,

$$\begin{aligned}
\mathbb{E}\left(\tilde{a}\tilde{\delta}|\ a^{\mathrm{F}} = \mathrm{s}\right) &= \mathbb{E}\left[\ \mathbf{1}_{\left\{s_{\mathrm{M}}\left(\tilde{\delta},\tilde{\mathrm{e}},\tau^{\mathrm{F}}\right)=1\right\}}\tilde{\delta} \mid a^{\mathrm{F}} = \mathrm{s}\right] = \\
&= \frac{1}{\mathbb{P}\left(a^{\mathrm{F}} = \mathrm{s}\right)}\mathbb{E}\left[\ \mathbf{1}_{\left\{s_{\mathrm{M}}\left(\tilde{\delta},\tilde{\mathrm{e}},\tau^{\mathrm{F}}\right)=1\right\}}\ \mathbf{1}_{\{a^{\mathrm{F}}=\mathrm{s}\}}\tilde{\delta}\right] \\
&= \frac{1}{\mathbb{P}\left(a^{\mathrm{F}} = \mathrm{s}\right)}\mathbb{E}\left[\ \mathbf{1}_{\left\{\{\tilde{\delta}\leq\delta_{\mathrm{pool}}\}\cap\{\tilde{\mathrm{e}}=\mathrm{e}\}\cap\{\tau^{\mathrm{F}}=\mathrm{b}\}\cap\{\tilde{\mathrm{l}}=\mathrm{ls}\}\right\}}\tilde{\delta}\right] \\
&= \frac{1}{\mathbb{P}\left(a^{\mathrm{F}} = \mathrm{s}\right)}\mathbb{E}\left[\ \mathbf{1}_{\left\{\tilde{\delta}\leq\delta_{\mathrm{pool}}\right\}}\ \mathbf{1}_{\{\tilde{\mathrm{e}}=\mathrm{e}\}}\ \mathbf{1}_{\{\tau^{\mathrm{F}}=\mathrm{b}\}}\ \mathbf{1}_{\left\{\tilde{\mathrm{l}}=\mathrm{ls}\right\}}\tilde{\delta}\right] \\
&= \frac{1}{\mathbb{P}\left(a^{\mathrm{F}} = \mathrm{s}\right)}\mathbb{P}\left[\tilde{\mathrm{e}} = \mathrm{e}\right]\mathbb{P}\left[\tau^{\mathrm{F}} = \mathrm{b}\right]\mathbb{P}\left[\tilde{\mathrm{l}} = \mathrm{ls}\right]\mathbb{E}\left[\ \mathbf{1}_{\left\{\tilde{\delta}\leq\delta_{\mathrm{pool}}\right\}}\tilde{\delta}\right] \\
&= \frac{1}{\theta}\left(1-\gamma_{\mathrm{M}}\right)\left(1-\gamma_{\mathrm{F}}\right)\theta\ \mathbb{E}\left[\ \mathbf{1}_{\left\{\tilde{\delta}\leq\delta_{\mathrm{pool}}\right\}}\tilde{\delta}\right] \\
&= (1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}})\mathbb{E}(\tilde{\delta}|\tilde{\delta} \leq \delta_{\mathrm{pool}})\mathbb{P}(\tilde{\delta} \leq \delta_{\mathrm{pool}}).
\end{aligned}$$

Proof of Proposition 3.4: Referring to the proof of Proposition 3.1, recall that $\underline{\alpha}(w,\Theta) = wB_{\frac{\alpha}{w}}(\Theta)$ is the lowest α that satisfies inequality (3.26). Choose a particular $\alpha > \underline{\alpha}(w,\Theta)$ and then choose $\pi_{\mathrm{g}}^{\mathrm{I}} - \pi_{\mathrm{b}}^{\mathrm{I}} > B_{\Delta\pi}(\alpha, w, \Theta)$. Now it is clear that both inequality (3.18) and (3.26) hold, completing the construction of the equilibrium.■

Proof of Proposition 3.5: Consider the high $\frac{\alpha}{w}$ fund. We consider a pre-game to the exit game analyzed in Proposition 3.4 above. The structure of the game is as follows. If voice is not used by the fund, then the exit game follows as described above. If voice is used, and if the manager accepts the shareholder proposal and chooses $a = 0$, the game ends with the normal contractual payment of $a = 0$ to the manager augmented by the extra reward of R embodied in the fund's proposal. If the manager ignores voice and chooses $a = 1$ again the usual exit game begins. Since the conditions of Proposition 3.4 are satisfied, we know the continuation equilibrium in the exit game: conditional on $a = 1$, the fund exits and payoffs are as outlined in the baseline model.

In the pre-game, the following strategies constitute an equilibrium. If $\delta < \delta_{\mathrm{sep}}$ the fund uses voice, otherwise she does not. The manager knows δ and his strategy is to: ignore voice and choose $a = 1$ if $\delta < \delta_{\mathrm{sep}} - \frac{R}{\omega_2}$, accept voice and choose $a = 0$ if $\delta \geq \delta_{\mathrm{sep}} - \frac{R}{\omega_2}$. We check that these form an equilibrium.

Let's check the manager's strategy first. If $\delta \geq \delta_{\mathrm{sep}}$ voice is not used and thus the manager is in the baseline exit game, in which he chooses $a = 0$ for $\delta \geq \delta_{\mathrm{sep}}$.[22] If $\delta < \delta_{\mathrm{sep}}$ the manager is faced with the option to accept or reject the fund's proposal.

[22]Implicitly, we are imposing an off-equilibrium belief that if the fund sees that $\delta \geq \delta_{\mathrm{sep}}$ but the manager still chooses $a = 1$, she still exits.

If he accepts the fund's proposal he has to choose $a = 0$ and gets

$$\omega_1 \left(v - \theta \mathbb{E}_s - (1-\theta)\, \mathbb{E}_{ns}\right) + \omega_2 v + R;$$

he knows that the fund will not sell unless she is hit by a liquidity shock with probability θ.

If the manager ignores the proposal and chooses $a = 1$ then he gets

$$\omega_1 (v - \mathbb{E}_s) + \omega_2 \left(v - \delta\right) + \beta.$$

Obviously, the manager would never choose to ignore the proposal and still choose $a = 0$ since then he gets at most $\omega_1 \left(v - \theta \mathbb{E}_s - (1-\theta)\, \mathbb{E}_{ns}\right) + \omega_2 v$ which means that he forgoes R.

Thus, the manager will choose to accept the proposal and thus pick $a = 0$ if and only if

$$\omega_1 \left(v - \theta \mathbb{E}_s - (1-\theta)\, \mathbb{E}_{ns}\right) + \omega_2 v + R \geq \omega_1 (v - \mathbb{E}_s) + \omega_2 \left(v - \delta\right) + \beta$$

$$\text{i.e. if } \delta \geq \delta_{\text{sep}} - \frac{R}{\omega_2} \tag{3.78}$$

This completes the check of the manager's equilibrium strategy.

Let's now check the fund's strategy. Since the manager chooses $a = 0$ anyway whenever $\delta \geq \delta_{\text{sep}}$, there is no use for costly voice in such cases. For $\delta < \delta_{\text{sep}}$, if no voice is used, the manager chooses $a = 1$ and the fund exits, is fired, and earns $w + \alpha(v - \mathbb{E}_s)$. If, on the other hand voice is used, then the fund gets $2w + \alpha v - e$ if $\delta \geq \delta_{\text{sep}} - \frac{R}{\omega_2}$ and $w + \alpha(v - \mathbb{E}_s) - e$ if $\delta < \delta_{\text{sep}} - \frac{R}{\omega_2}$. So, the fund loses by using voice in cases where $\delta < \delta_{\text{sep}} - \frac{R}{\omega_2}$ and gains by using voice in cases where $\delta \geq \delta_{\text{sep}} - \frac{R}{\omega_2}$. Since the losses are on the order of e, and the gains are not, and e can be as small as desired, there exists an e small enough such that the fund always uses voice whenever $\delta < \delta_{\text{sep}}$. This completes the proof for the case of high $\frac{\alpha}{w}$.

To show that sufficiently low $\frac{\alpha}{w}$ funds will not successfully use voice for $\delta \in \left(\delta_{\text{sep}} - \frac{R}{\omega_2}, \delta_{\text{sep}}\right)$, it suffices to show that voice will not be used for $\delta < \delta_{\text{sep}}$ for $\alpha \to 0$. First, it is clear from our analysis that for $\alpha \to 0$ the fund will not exit conditional on $a = 1$ being chosen.[23] Now, suppose that the low $\frac{\alpha}{w}$ fund uses voice for $\delta < \delta_{\text{sep}}$. Then, if the manager accepts he gets

$$\omega_1 \left(v - \theta \mathbb{E}_s - (1-\theta) \mathbb{E}_{ns}\right) + \omega_2 v + R,$$

while if he rejects and chooses $a = 1$ (since the fund does not exit) he gets

$$\omega_1 \left(v - \theta \mathbb{E}_s - (1-\theta) \mathbb{E}_{ns}\right) + \omega_2 \left(v - \delta\right) + \beta.$$

Rejecting is better than accepting whenever $R < \beta - \omega_2 \delta$. Since by assumption $R < \beta - \omega_2 \delta_{\text{sep}}$, $R < \beta - \omega_2 \delta$ for all $\delta < \delta_{\text{sep}}$. Thus, the manager always rationally ignores fund's voice, knowing that exit will not occur if voice is ignored. Now, as $\alpha \to 0$, by using voice the fund gets $2w - e$ while by not using voice the fund gets $2w$. Thus the fund does not use voice.■

3.10.2 When good types can only stochastically discern managerial misbehaviour

In the baseline analysis we set $\gamma_{\text{M}}^{\text{g}} = 1$, and denoted $\gamma_{\text{M}}^{\text{b}}$ by γ_{M}. The general case in which $\gamma_{\text{M}}^{\text{g}} \in (0, 1]$ and $\gamma_{\text{M}}^{\text{b}} \in (0, \gamma_{\text{M}}^{\text{g}})$ is conceptually identical and generates the same

[23] Note that the fund's information set is slightly different here, since she knows at the point of choosing whether to exit or not whether $\delta < \delta_{\text{sep}}$ or not. However, for sufficiently low α this additional information will not change the fund's exit strategy.

qualitative results. The core reason is that, as in the baseline case in Section 3.5, the observation of exit indicates that the fund was unable to pick stocks free of agency problems and is evidence of weak ability. With $\gamma_{\mathrm{M}}^{\mathrm{g}}=1$, exit at $t=1$ implied that the fund was bad for sure. Instead, in the general case in which $\gamma_{\mathrm{M}}^{\mathrm{g}} \in (0,1]$ and $\gamma_{\mathrm{M}}^{\mathrm{b}} \in (0,\gamma_{\mathrm{M}}^{\mathrm{g}})$, exit at $t=1$ simply implies that it is more likely that the fund is bad. It is, however, still never in the investor's interest to retain the fund at $t=1$ conditional on an exit. This is because, conditional on exit (which, in equilibrium, implies that $a=1$) the investor will gain no further positive information about the fund at $t=2$. Thus, it is not worth retaining the fund and paying w for an extra period. Formally, with $\gamma_{\mathrm{M}}^{\mathrm{g}} \in (0,1]$ and $\gamma_{\mathrm{M}}^{\mathrm{b}} \in (0,\gamma_{\mathrm{M}}^{\mathrm{g}})$, equation (3.12c) will be replaced by

$$\mathbb{P}(\tau^{\mathrm{F}}=\mathrm{g}|\mathrm{E}_3,a^{\mathrm{F}}=\mathrm{s}) = \frac{\gamma_{\mathrm{F}}\ (1-\gamma_{\mathrm{M}}^{\mathrm{g}})}{\gamma_{\mathrm{F}}\ (1-\gamma_{\mathrm{M}}^{\mathrm{g}})+(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}}^{\mathrm{b}})} < \gamma_{\mathrm{F}}.$$

However, equation (3.13c) will remain unchanged. Thus, it remains the case that the fund is fired conditional on exit. Thus, in qualitative terms, the critical aspect—funds' incentives—which drives our main result does not change. Needless to say, the quantitative bounds are modified. For completeness, we present them here. The two bounds in the baseline analysis are generated by inequalities (3.18) and (3.26). In this more general case (3.18) is replaced by

$$(1-\alpha)\mathbb{E}_s(\delta_{\mathrm{sep}}) + \frac{\mathbb{P}(\tilde{\delta}\le\delta_{\mathrm{sep}})\gamma_{\mathrm{F}}(1-\gamma_{\mathrm{F}})(\gamma_{\mathrm{M}}^{\mathrm{g}}-\gamma_{\mathrm{M}}^{\mathrm{b}})}{1-\left[\gamma_{\mathrm{F}}\ (1-\gamma_{\mathrm{M}}^{\mathrm{g}})+(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}}^{\mathrm{b}}\ )\right]\mathbb{P}(\tilde{\delta}\le\delta_{\mathrm{sep}}\ )}(\pi_{\mathrm{g}}^{\mathrm{I}}-\pi_{\mathrm{b}}^{\mathrm{I}}) \ge w,$$

while inequality (3.26) is replaced by

$$\mathbb{E}(\tilde{\delta}|\tilde{\delta}\le\delta_{\mathrm{sep}})\left[1-\frac{\left[\gamma_{\mathrm{F}}(1-\gamma_{\mathrm{M}}^{\mathrm{g}})+(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}}^{\mathrm{b}}))\right]\mathbb{P}(\tilde{\delta}\le\delta_{\mathrm{sep}})}{\theta+(1-\theta)\left[\gamma_{\mathrm{F}}(1-\gamma_{\mathrm{M}}^{\mathrm{g}})+(1-\gamma_{\mathrm{F}})(1-\gamma_{\mathrm{M}}^{\mathrm{b}})\right]\mathbb{P}(\tilde{\delta}\le\delta_{\mathrm{sep}})}\right] \ge \frac{w}{\alpha}.$$

3.10.3 A Different Formulation of Managerial Ability

The purpose of this model is to illustrate that allowing exit to be a positive signal of ability (i.e. allowing the blockholders' ability to be determined by the precision of the information on the manager's perverse action once the block is acquired) does not eliminate our core result that the flow-motivations of blockholders will get in the way of discipline via exit. In particular, we show below that it is precisely for firms in which the moral hazard problem is most severe—and thus discipline is most necessary—that (i) exit will be viewed as a positive signal of ability and (ii) simultaneously, relatively more flow-motivated blockholders will engage in excessive exit, reducing the disciplining effect of exit.

Consider the following simple model of delegated blockholding. Firms are indexed by i. In each firm i there is a manager and a blockholder. Time runs over two periods $t = 1, 2$. At $t = 1$, the manager can take action $a = 0$ or $a = 1$, where 1 is the perverse action as before. The manager's payoff is proportional to the $t = 1$ share price. For any i, firm value v is $\bar{v}$ if $a = 0$ and $\underline{v}$ if $a = 1$, with $\bar{v} > \underline{v}$. The manager faces a moral hazard problem: if he takes action $a = 0$ he sacrifices private benefits β, where β is distributed according to CDF $f_i(\beta)$. Only the manager knows β. The market has prior beliefs $f_i(\beta)$.

For any two firms i and j, the the moral hazard problem will be greater in i than in j if f_i first order stochastically dominates f_j. We loosely refer to firms with greater moral hazard problems as firms with "high" f_i.

For any firm i, at $t = 1$, the blockholder observes the manager's action with noise. The type of the blockholder determines the precision of this information. In particular, he observes a signal ν, with type dependent precision: $\Pr(\tilde{\nu} = \underline{\nu}|\tilde{v} = \underline{v}) = \Pr(\tilde{\nu} = \bar{\nu}|\tilde{v} = \bar{v}) = \sigma_\tau$ for $\tau \in \{\mathrm{g}, \mathrm{b}\}$, where $\sigma_{\mathrm{g}} > \sigma_{\mathrm{b}} > \frac{1}{2}$. Blockholders do not know their type. The measure of type-g blockholders is $\pi_{\mathrm{g}} > 0$. Upon observing the signal, the blockholder has the choice to sell the block at $t = 1$ ($a^{\mathrm{F}} = \mathrm{s}$) or to hold it until $t = 2$ ($a^{\mathrm{F}} = \mathrm{ns}$). At $t = 1$, there is noise in the market, so that the blockholder may be mistaken with positive probability for a noise trader who trades without information. At $t = 2$ all information becomes public. The blockholder is a delegated fund manager whose action, as well as the final firm value v, are observed by a principal, who can make Bayesian inferences $\Pr(\tau = \mathrm{g}|a^{\mathrm{F}}, v)$. Denote by P_s and P_{ns} the firm's equity price at $t = 1$ corresponding to the action of the blockholder and by P_2 the full-information price at $t = 2$. The blockholder's payoff is given by

$$\eta\left(\mathbf{1}_{\{a^{\mathrm{F}}=\mathrm{s}\}}P_s + \mathbf{1}_{\{a^{\mathrm{F}}=\mathrm{ns}\}}P_2\right) + (1-\eta)\,\mathbb{P}(\tau = \mathrm{g}|a^{\mathrm{F}}, v),$$

Thus, η measures the weight placed on profits by the blockholder while $1-\eta$ measures the weight placed on flows. While the payoff structure here is ostensibly dissimilar to that of the baseline model, Dasgupta and Prat (2008) show how such a payoff can be microfounded in terms of fixed wages and profit shares.

What is the first best from the perspective of corporate governance? Since $\sigma_{\mathrm{g}} > \sigma_{\mathrm{b}} > \frac{1}{2}$, the information of blockholding funds is correct on average, hence the highest average discipline (which minimizes the incidence of $a = 1$ by the manager) is for the blockholder to sell if and only if $\tilde{\nu} = \underline{\nu}$. We refer to this as the first-best. We first show that if $\eta = 1$, the first-best is an equilibrium irrespective of $f_i(\cdot)$. We then show that, for any $\eta < 1$, for sufficiently high f_i, the first best is not an equilibrium.

Proposition 3.6 *For $\eta = 1$, the first-best is an equilibrium irrespective of $f_i(\cdot)$.*

Note that $P_s \in (\mathbb{E}(\tilde{v}|\tilde{\nu} = \underline{\nu}), \mathbb{E}(\tilde{v}|\tilde{\nu} = \bar{\nu}))$ because of the noise in the market. If the blockholder observes $\tilde{\nu} = \bar{\nu}$, then his payoff from selling—P_s—is lower than his payoff from not selling—$\mathbb{E}(\tilde{v}|\tilde{\nu} = \bar{\nu})$—and he is better-off not selling. If the blockholder observes $\tilde{\nu} = \underline{\nu}$, the opposite is true: his payoff from selling—P_s—is higher than his payoff from not selling—$\mathbb{E}(\tilde{v}|\tilde{\nu} = \underline{\nu})$—and he is better off selling.

Proposition 3.7 *For any $\eta < 1$, for sufficiently high f_i, the first best is not an equilibrium, and there is excessive exit.*

Suppose the first best is an equilibrium. Consider the manager's incentives in an arbitrarily chosen firm i. If the manager chooses $a = 0$, he receives

$$(\pi_{\mathrm{g}}\sigma_{\mathrm{g}} + (1 - \pi_{\mathrm{g}})\,\sigma_{\mathrm{b}})\,P_{ns} + (\pi_{\mathrm{g}}\,(1 - \sigma_{\mathrm{g}}) + (1 - \pi_{\mathrm{g}})\,(1 - \sigma_{\mathrm{b}}))\,P_s;$$

if he chooses $a = 1$ he receives

$$(\pi_{\mathrm{g}}\sigma_{\mathrm{g}} + (1 - \pi_{\mathrm{g}})\,\sigma_{\mathrm{b}})\,P_s + (\pi_{\mathrm{g}}\,(1 - \sigma_{\mathrm{g}}) + (1 - \pi_{\mathrm{g}})\,(1 - \sigma_{\mathrm{b}}))\,P_{ns} + \beta.$$

Thus, he chooses $a = 0$ if and only if

$$\beta < \beta_{\mathrm{FB}} \equiv \left[(\pi_{\mathrm{g}}\sigma_{\mathrm{g}} + (1 - \pi_{\mathrm{g}})\,\sigma_{\mathrm{b}}) - (\pi_{\mathrm{g}}\,(1 - \sigma_{\mathrm{g}}) + (1 - \pi_{\mathrm{g}})\,(1 - \sigma_{\mathrm{b}}))\right](P_{ns} - P_s)\,.$$

Note that $\beta_{\mathrm{FB}} > 0$ since $P_{ns} > P_s$ and $\sigma_{\mathrm{g}} > \sigma_{\mathrm{b}} > \frac{1}{2}$. Let $\pi_v = \mathbb{P}(a = 0) = \mathbb{P}(\tilde{v} = \bar{v}) = f_i(\beta_{\mathrm{FB}})$. High f_i corresponds to low π_v.

Now consider a blockholder who has observed signal $\nu = \bar{\nu}$. His payoff from not selling is

$$\begin{aligned}&\eta\mathbb{E}(\tilde{v}|\nu = \bar{\nu}) + (1 - \eta)\,\mathbb{E}(\mathbb{P}(\tau = \mathrm{g}|\mathrm{ns}, \tilde{v})|\nu = \bar{\nu}) = \\ &\eta\mathbb{E}(\tilde{v}|\nu = \bar{\nu}) + (1 - \eta)[\mathbb{P}(\tilde{v} = \bar{v}|\tilde{\nu} = \bar{\nu})\mathbb{P}(\tau = \mathrm{g}|\bar{\nu}, \bar{v}) + \mathbb{P}(\tilde{v} = \underline{v}|\tilde{\nu} = \bar{\nu})\mathbb{P}(\tau = \mathrm{g}|\bar{\nu}, \underline{v})].\end{aligned} \tag{3.79}$$

His payoff from selling is

$$\eta P_s + (1-\eta)\,\mathbb{E}(\mathbb{P}(\tau = \mathrm{g}|s, \tilde{v})|\tilde{\nu} = \bar{\nu}) =$$
$$\eta P_s + (1-\eta)\left[\mathbb{P}(\tilde{v} = \bar{v}|\tilde{\nu} = \bar{\nu})\mathbb{P}(\tau = \mathrm{g}|\underline{\nu}, \bar{v}) + \mathbb{P}(v = \underline{v}|\tilde{\nu} = \bar{\nu})\mathbb{P}(\tau = \mathrm{g}|\underline{\nu}, \underline{v})\right] \quad (3.80)$$

Note that:

1. $\mathbb{E}(\tilde{v}|\nu = \bar{\nu}) > P_s$, but as $\pi_v \to 0, \mathbb{E}(\tilde{v}|\nu = \bar{\nu}) - P_s \to 0$.
2. $\mathbb{P}(\tau = \mathrm{g}|\bar{\nu}, \bar{v}) > \mathbb{P}(\tau = \mathrm{g}|\underline{\nu}, \bar{v})$ and $\mathbb{P}(\tau = \mathrm{g}|\bar{\nu}, \underline{v}) < \mathbb{P}(\tau = \mathrm{g}|\underline{\nu}, \underline{v})$.
3. As $\pi_v \to 0$ $\mathbb{P}(v = \bar{v}|\tilde{\nu} = \bar{\nu}) \to 0$ and $\mathbb{P}(v = \underline{v}|\tilde{\nu} = \bar{\nu}) \to 1$.

Thus, combining these three remarks, we have that, fixing η, there exists a $\underline{\pi_v} \in (0,1)$ such that if $\pi_v < \underline{\pi_v}$, the blockholder will prefer to sell instead of not sell. Thus, the first best is not an equilibrium, because there will be excessive exit.

It is clear that $\underline{\pi_v}$ is decreasing in η, so more flow-motivated blockholders will engage in more excessive exit.

Chapter 4

Investment Mandates and the Downside of Precise Credit Ratings

4.1 Introduction

Delegated asset managers hold upwards of seventy percent of US publicly traded equity, assuming responsibility for private wealth management based on expertise they have and their clients lack. Unfortunately, finance professionals' incentives can never be perfectly aligned with the interests of their capital providers; the problem represents the theoretical trade-off between information and incentives for the economics of delegation and contracting and our model builds on a rich theoretical literature. The problem, in the partial equilibrium portfolio choice setting with asymmetric information, originates with Bhattacharya and Pfleiderer (1985), who consider the problem of an investor who must simultaneously screen talent and induce truth-telling. In their model, agents have CARA preferences and investors are approximately risk-neutral. Stoughton (1993) modifies the setting to include a moral hazard problem: managers take a costly action in order to become informed; he demonstrates the importance of nonlinear contracts.

Palomino and Prat (2003) study the problem when the agent chooses the portfolio's riskiness unobservably and demonstrate that the optimal non-linear contract need not be complicated: his optimal contract is a bonus contract that pays a fixed fee above a threshold.

The economic spirit of our model resembles Palomino and Prat's, since we study agents' incentives to shift risk in an optimal contracting setting, but our structure is more truly a simplification of Bhattacharya and Pfleiderer's as we consider a problem of portfolio choice with hidden information but dispense with agents' heterogeneity. We add a public contracting variable that correlates with the agents' information and focus on risk-averse investors—thereby bringing risk-sharing to the foreground—and we solve for the optimal direct mechanism as a function of the players' risk aversions and agents' reservation payoff.

While motivated by the suspicion that contracting on public information could mitigate incentive problems—inspired in particular by funds' investment mandates based on credit ratings—our results are reminiscent of papers relating risk-sharing to truthful revelation of private information on the one hand and speculation in the presence of public information on the other. In a 1984 paper about information revelation and joint production given a social planner's sharing rule, Wilson demonstrates that private knowledge may not lead to inefficient risk-sharing. A similar result in our model obviates the usefulness of the public signal; in fact, decreasing the informativeness of public information leads to Pareto improvements. Hirshleifer applied his famous 1971 argument that traders may be uniformly better off if they agree not to obtain privately valuable information to a market setting very different from our model of strategic agency, but his economics are robust: public information destroys risk-sharing and, since it fails to mitigate the agency problem, it does only harm.

Model and Results

In the model, competitive agents compete in contracts before learning their private information or observing the correlated public signal. They offer contracts to the investor that can depend on the portfolio allocation between a risky and a riskless asset, the final wealth, and the public signal. The investor, knowing that the agents learn the true state, employs one to invest his wealth on his behalf. All players have quadratic utility, but the investor's risk aversion differs from the agents'.

We firstly demonstrate that our extensive form game is equivalent to a family of principal-agent problems—one for each realization of the public signal—in which the investor offers the contract take-it-or-leave-it to a single agent; then we apply the revelation principle before transforming the agency problems into social planners' problems for appropriate welfare weights. Since the efficient risk-sharing rule does not depend on the true state (the agent's type in the formalism) and the optimal investment does not depend on the welfare weight, the efficient sharing rule composed with the optimal investment implements the agent's truth-telling and thus efficiency. The contracts do depend on the public signal, which proves a valuable tool for the agents to compete for the investor's business.

We then rank the public signals by informativeness according to the coarseness of the sigma algebras they generate and demonstrate that ex ante—namely, in expectation across the family of principal-agent problems—coarser public information Pareto dominates finer public information. Our proof uses the law of iterated expectations to show that one random variable second-order stochastically dominates another and then the result that the expectation of a concave function of a dominated random variable is less than the expectation of a dominating one.

Credit Ratings and Investment Mandates: An Application and Policy Prescription

Credit ratings are a prime example of public information that investment funds contract upon, and our paper explains why even expert asset managers write contracts on signals that are to them uninformative: it gives them a competitive edge in boom times. Our results suggest that such mandates, ostensibly imposed to protect investors, only impair risk-sharing and thus welfare.

Both the global financial crisis that climaxed in 2008-2009 and the ensuing Eurozone sovereign debt crisis (the climax of which EU politicians continue to fight to deter/postpone) have brought scrutiny to the major credit rating agencies. Much academic attention has focused on the agencies' incentives and information-provision (notably, Mathis, McAndrews and Rochet (2009), Bolton, Freixas and Shapiro (2009), Skreta and Veldkamp (2009), and Doherty, Kartasheva and Phillips (2012) among many others), but few papers have addressed the question of the effect of credit ratings on financial institutions and markets. Kurlat and Veldkamp (2011) do explore the problem in a two-asset rational expectations equilibrium and also rediscover some of Hirshleifer's reasoning: announcing credit ratings makes investors worse off, since more information about the payoff of the risky asset makes their securities too alike, thus preventing diversification—viz. public information impedes risk-sharing. Their paper uses a cardinal welfare measure to suggest that government enforcement of information disclosure may hurt investors. Given our model examines only a narrow channel of the effect of credit ratings, our regulatory advice is less bold: broaden ratings categories and focus on qualitative reporting, i.e. coarsen the contractible public information partition. Our suggestion jives with regulators' assertions that institutions should quit responding robotically to ratings, as rigid contingent contracts fine-tuned to CRA announcements force them to. For example, the Financial Stability Board told the G20 Finance Ministers that "Institutional investors must not mechanistically rely on CRA ratings...[by limiting] the proportion of a portfolio that is CRA ratings-reliant."

4.2 Model

The model constitutes an extensive game of incomplete information in which agents first compete in contracts in the hope of being employed by a single investor and then invest his capital on his behalf in assets with exogenous returns. The solution concept is perfect bayesian equilibrium.

The Economy

The economy comprises a large number of agents, viewed as asset managers, with von Neuman–Morganstern utility u_{A} and outside option $\bar{u}$ as well as a single investor with von Neuman–Morgenstern utility u_{I} and one unit of initial wealth. There are two securities, a risk-free bond with gross return R_f and a risky asset with random gross return $\tilde{R}$; initially no one knows the distribution of $\tilde{R}$. Finally, a public signal $\tilde{\rho}$ is informative about the distribution of returns. Call $\tilde{\rho}$ the credit rating of the risky security.

Two key assumptions give the model structure. Firstly, all players have quadratic utility.

$$u_n(W) = -\frac{1}{2}\big(\alpha_n - W\big)^2 \tag{4.1}$$

for $n \in \{\mathrm{A}, \mathrm{I}\}$. The investor differs from the agents in his risk aversion (note that the coefficient of absolute risk aversion is $(\alpha_i - W)^{-1}$ so α_i represents risk tolerance).

Secondly, the mean return $\bar{R}$ of the risky asset is known. Since, with quadratic utility, players' expected utility depends only on the mean and variance of the distribution, summarize the unknown payoff-relevant component of the distribution with the random variance $\tilde{\sigma}^2$,

$$\sigma^2 := \operatorname{Var}\left[\tilde{R} \,\middle|\, \tilde{\sigma} = \sigma\right]. \tag{4.2}$$

With this notation the assumption that all players know the mean return of the risky asset reads

$$\mathbb{E}\left[\tilde{R} \,\middle|\, \tilde{\sigma} = \sigma\right] = \bar{R} \tag{4.3}$$

for each σ^2. Note that this assumption implies that the credit rating is informative only about the asset's risk and not about its expected return,

$$\mathbb{E}\left[\tilde{R} \,\middle|\, \tilde{\rho} = \rho\right] = \mathbb{E}\big[\tilde{R}\big] \tag{4.4}$$

but, in general,

$$\mathbb{E}\left[\tilde{\sigma}^2 \,\middle|\, \tilde{\rho} = \rho\right] \neq \mathbb{E}\left[\tilde{\sigma}^2\right]. \tag{4.5}$$

With these preferences, players' marginal utility is decreasing when their wealth is large. To prevent its unrealistic implications, we aim to restrict the set of possible realizations of final wealth so that

$$\operatorname{supp} \tilde{w} \subset [0, \alpha_{\mathrm{I}} + \alpha_{\mathrm{A}}), \tag{4.6}$$

which will ensure the equilibrium contract satisfies our feasibility conditions (cf. equation 4.10). To this end, make the technical assumption that return on the risky asset is not too fat-tailed according to

$$\big(\bar{R} - R_f\big)\big(R - \bar{R}\big) \leq \sigma^2 \tag{4.7}$$

for all pairs (σ, R).[1]

Actions and Contracts

The investor's only action is employing an agent a who then forms a verifiable portfolio with weight x in the risky asset and $1 - x$ in the bond with the investor's capital. The investor wishes to delegate investment to an agent because he is better informed but anticipates a misalignment of investment incentives since the investor's risk tolerance differs from the agents'.

Contracts attempt to align incentives to mitigate the downside of delegated asset management, allocating decision rights to the players with the most information. Critically, credit ratings are verifiable but agents' true information about the distribution of returns is not. Thus the contracting variables are credit rating ρ, the portfolio weight x, and the final wealth, denoted

$$\tilde{w} \equiv w\big(x, \tilde{R}\big) := R_f + x\big(\tilde{R} - R_f\big). \tag{4.8}$$

Assume that agents' contracts do not depend on other agents' contracts. Thus write that each agent a offers a contract

$$\Phi_a : \big(w, x, \rho\big) \mapsto \Phi_a\big(w, x, \rho\big), \tag{4.9}$$

[1]Condition 4.7, sufficient for condition 4.6, comes from solving the game assuming that the agent's participation constraint binds, then writing a sufficient condition for it to bind in light of the equilibrium.

but to economize on notation we often omit the contract's arguments and write $\Phi(\tilde{w})$ for $\Phi\big((w(x,\tilde{R}),x,\rho\big)$. A feasible contract is a Lebesgue measurable function such that

$$w - \alpha_{\mathrm{I}} < \Phi(w) < \alpha_{\mathrm{A}}, \tag{4.10}$$

which ensures marginal utility is positive.

There is full commitment.

The dependence of contracts on portfolio weights and credit ratings are the investment mandates in the model.

Timing

Aiming to understand why asset managers themselves use investment mandates in addition to or instead of performance incentives—contract on x and ρ and not just w—we have agents offer the contracts in our model. While the problem is ultimately equivalent to one in which the investor offers the contract to a single agent take-it-or-leave-it, we think that our set-up is important both to get the information structure right in the single-agent model and to understand applications and larger economics better.

After agents announce their contracts, the investor observes the credit rating and employs an agent who, knowing the true distribution of returns, goes on to form a portfolio with the investor's wealth. Finally, the assets pay off and players divide final wealth according to the initial contract. Formally, the timing is as follows:

1. Agents simultaneously offer contracts Φ_a.

2. The variance of the risky security realizes, $\tilde{\sigma}^2 = \sigma^2$ and ratings are released, $\tilde{\rho} = \rho$.

3. The principal observes the profile of contracts $\{\Phi_a\}_a$ and credit rating ρ and hires an agent a^*.

4. Agent a^* invests x^* in the risky asset.

5. The return of the risky asset realize, $\tilde{R} = R$, and final wealth

$$w = R_f + x^*(R - R_f) \tag{4.11}$$

is distributed such that agent a^* is awarded $\Phi_{a^*}(w)$ and the investor keeps $w - \Phi_{a^*}(w)$.

Note that key to our timing is that players learn ratings after agents offer contracts but before investors have parted with their cash. Since employing lawyers to formalize the documents is both slow and costly for delegated asset managers, agents' fixing Φ before knowing ρ is consistent with our application. As the next section's results demonstrate, assuming ratings realize before, but do not change after, the investor's delegation decision is equivalent (in welfare and allocation terms) to the richer model in which credit ratings are also updated after the investor has committed to an agent.

4.3 Results

The main result that coarser credit ratings lead to Pareto improvements follows from first transforming the extensive form to look like a classical principal-agent problem and then rewriting it as a social planner's problem, where the challenge is to implement truth-telling and optimal risk-sharing simultaneously; the relationship of our result to Wilson's 1984 theorem on optimal sharing rules for joint production with dispersed information becomes apparent in this final formulation.

Competition Is Rating-by-Rating

The first lemma states that competition in contracts is Bertrand-like in the sense that the employed agent will receive his reservation utility conditional on any realization of the credit rating $\tilde{\rho}$; further the agents act so as to maximize the investor's expected utility conditional on every ρ subject to their participation constraints.

Lemma 4.1 *If Φ is the contract of the agent employed given rating $\hat{\rho}$ and there is another contract $\hat{\Phi}$ such that*

$$\mathbb{E}\left[u_{\mathrm{I}}\Big(\tilde{w}-\hat{\Phi}\big(\tilde{w}\big)\Big) \mid \tilde{\rho}=\hat{\rho}\right] > \mathbb{E}\left[u_{\mathrm{I}}\Big(\tilde{w}-\Phi\big(\tilde{w}\big)\Big) \mid \tilde{\rho}=\hat{\rho}\right], \tag{4.12}$$

then

$$\mathbb{E}\left[u_{\mathrm{A}}\Big(\hat{\Phi}\big(\tilde{w}\big)\Big) \mid \tilde{\rho}=\hat{\rho}\right] < \bar{u}. \tag{4.13}$$

Proof. Suppose, in anticipation of a contradiction, an equilibrium in which the employed agent offers contract Φ given credit rating $\hat{\rho}$ and there is another contract $\hat{\Phi}$ such that

$$\mathbb{E}\left[u_{\mathrm{I}}\Big(\tilde{w}-\hat{\Phi}\big(\tilde{w}\big)\Big) \mid \tilde{\rho}=\hat{\rho}\right] > \mathbb{E}\left[u_{\mathrm{I}}\Big(\tilde{w}-\Phi\big(\tilde{w}\big)\Big) \mid \tilde{\rho}=\hat{\rho}\right] \tag{4.14}$$

and

$$\mathbb{E}\left[u_{\mathrm{A}}\Big(\hat{\Phi}\big(\tilde{w}\big)\Big) \mid \tilde{\rho}=\hat{\rho}\right] \geq \bar{u}. \tag{4.15}$$

Suppose that agent $\hat{\mathrm{A}}$ offers the contract $\hat{\Phi}_{\varepsilon}$ constructed from $\hat{\Phi}$ given $\hat{\rho}$

$$\hat{\Phi}_{\varepsilon}(w,x,\hat{\rho}) := \alpha_{\mathrm{A}} - \sqrt{\big(\alpha_{\mathrm{A}}-\hat{\Phi}(w,x,\hat{\rho})\big)^2 - 2\varepsilon} \tag{4.16}$$

and that his action is according to the supposed equilibrium if $\rho \neq \hat{\rho}$. Note that

$$u_{\mathrm{A}}\big(\hat{\Phi}_{\varepsilon}\big) = u_{\mathrm{A}}\big(\hat{\Phi}\big) + \varepsilon \tag{4.17}$$

immediately by construction and the quadric form of the agents' utility. The contract does not change agents' incentives and the same portfolio weight x is chosen under either contract. Since x is unchanged and $u_I(w - \hat{\Phi}_\varepsilon(w))$ is continuous in ε, for $\varepsilon > 0$ sufficiently small

$$\mathbb{E}\left[u_{\mathrm{I}}\Big(\tilde{w} - \hat{\Phi}_\varepsilon\big(\tilde{w}\big)\Big) \,\big|\, \tilde{\rho} = \hat{\rho}\right] > \mathbb{E}\left[u_{\mathrm{I}}\Big(\tilde{w} - \Phi\big(\tilde{w}\big)\Big) \,\big|\, \tilde{\rho} = \rho\right]. \tag{4.18}$$

Thus the investor will employ agent $\hat{\mathrm{A}}$ who will receive utility greater than his utility at the supposed equilibrium given rating $\hat{\rho}$ where he was unemployed and obtaining $\bar{u}$ (and the same utility given all other ratings). Thus $\hat{\Phi}_\varepsilon$ is a profitable deviation for agent $\hat{\mathrm{A}}$ and Φ cannot be the contract of an agent employed at equilibrium given $\hat{\rho}$. ■

Principal-Agent Formulation and Revelation Principle

Lemma 4.1 asserts that agents compete rating-by-rating, maximizing investor welfare subject to their participation constraints, that is to say that for every realization ρ of the credit ratings the contract of the employed agent and the corresponding portfolio weight solve the principal-agent problem:

$$\begin{cases} \text{Maximize } \ \mathbb{E}\left[u_{\mathrm{I}}\Big(w(x,\tilde{R}\,) - \Phi\big(w(x,\tilde{R}\,),x,\rho\big)\Big) \,\big|\, \tilde{\rho} = \rho\right] \\[2ex] \text{subject to } \ \mathbb{E}\left[u_{\mathrm{A}}\Big(\Phi\big(w(x,\tilde{R}\,),x,\rho\big)\Big) \,\big|\, \tilde{\rho} = \rho\right] \geq \bar{u} \ \text{ and} \\[2ex] x \in \arg\max\Big\{\mathbb{E}\left[u_{\mathrm{A}}\big(\Phi\big(w(\xi,\tilde{R}\,),\xi,\rho\big) \,\big|\, \tilde{\sigma} = \sigma\right] \ ; \ \xi \in \mathbb{R}\Big\} \end{cases} \tag{P-A}$$

over all feasible contracts Φ. Applying the revelation principle allows us to restrict attention to direct mechanisms

$$\varphi\big(w\,;\,\hat{\sigma},\rho\big) := \Phi\big(w, x(\hat{\sigma}),\rho\big) \tag{4.19}$$

where x is an incentive compatible portfolio weight given Φ.

Replace the incentive compatibility of the portfolio allocation x with the truth-telling condition $\hat{\sigma} = \mathrm{Id}$:

$$\begin{cases} \text{Maximize } \ \mathbb{E}\left[u_{\mathrm{I}}\Big(W(\tilde{\sigma}, \tilde{R}) - \varphi\big(W(\tilde{\sigma}, \tilde{R}), \tilde{\sigma}, \rho\big)\Big) \mid \tilde{\rho} = \rho\right] \\[2ex] \text{subject to } \ \mathbb{E}\left[u_{\mathrm{A}}\Big(\varphi\big(W(\tilde{\sigma}, \tilde{R}), \tilde{\sigma}, \rho\big)\Big) \mid \tilde{\rho} = \rho\right] \geq \bar{u} \ \text{ and} \\[2ex] \sigma \in \arg\max \left\{\mathbb{E}\left[u_{\mathrm{A}}\big(\varphi\big(W(\hat{\sigma}, \tilde{R}), \hat{\sigma}, \rho\big) \mid \tilde{\sigma} = \sigma\right] \ ; \ \hat{\sigma} \in \mathbb{R}\right\} \end{cases} \tag{P-A(D)}$$

over all feasible contracts φ where W denotes the wealth as a function of the report $\hat{\sigma}$ rather than of the portfolio weight x directly,

$$W\big(\hat{\sigma}, R\big) := w\big(x(\hat{\sigma}), R\big). \tag{4.20}$$

Note while the contract and wealth do not depend directly on the true variance σ^2, we already plugged $\hat{\sigma}(\sigma) = \sigma$ from the truth-telling condition into the statement of the problem.

Equilibrium Contract as the Solution of a Social Planner's Problem

Use the method of Lagrange multipliers to eliminate the participation constraint and say that the problem is to maximize

$$\mathbb{E}\left[u_{\mathrm{I}}\Big(W(\tilde{\sigma}, \tilde{R}) - \varphi\big(W(\tilde{\sigma}, \tilde{R}), \tilde{\sigma}, \rho\big)\Big) + \mu\left(u_{\mathrm{A}}\Big(\varphi\big(W(\tilde{\sigma}, \tilde{R}), \tilde{\sigma}, \rho\big)\Big) - \bar{u}\right) \Bigg| \tilde{\rho} = \rho\right] \tag{4.21}$$

subject to

$$\sigma \in \arg\max \left\{\mathbb{E}\left[u_{\mathrm{A}}\big(\varphi\big(W(\hat{\sigma}, \tilde{R}), \hat{\sigma}, \rho\big) \mid \tilde{\sigma} = \sigma\right] \ ; \ \hat{\sigma} \in \mathbb{R}\right\} \tag{4.22}$$

over feasible φ and $\mu \in \mathbb{R}$. Defining the social welfare given credit rating ρ (with weight one on the investor and μ on the agent) as

$$\mathcal{S}_{\mu,\rho}(x)[\varphi] := \mathbb{E}\left[u_{\mathrm{I}}\Big(W(\tilde{\sigma},\tilde{R}\,) - \varphi\big(W(\tilde{\sigma},\tilde{R}\,),\tilde{\sigma},\rho\big)\Big)\,\Big|\,\tilde{\rho}=\rho\right] + \\ + \mu\,\mathbb{E}\left[u_{\mathrm{A}}\Big(\varphi\big(W(\tilde{\sigma},\tilde{R}\,),\tilde{\sigma},\rho\big)\Big)\,|\,\tilde{\rho}=\rho\right], \tag{SW}$$

observe that (since lemma 4.1 says that the agent's participation constraint binds) the principal-agent problem is the social planner's problem $\mathrm{SP}(\mu,\rho)$ to maximize $\mathcal{S}$ given ρ subject to truth-telling whenever μ is the welfare weight such that the agent breaks even,

$$\mathbb{E}\left[u_{\mathrm{A}}\Big(\varphi_{\mu,\rho}\big(W(\tilde{\sigma},\tilde{R}\,),\tilde{\sigma},\rho\big)\Big)\,\Big|\,\tilde{\rho}=\rho\right] = \bar{u}, \tag{4.23}$$

where $\varphi_{\mu,\rho}$ is the solution to the problem.

Transforming the game into a social planner's problem combined with the fixed-point problem reveals that the task is to trade off efficient risk sharing with implementing truth-telling.

The Efficient Sharing Rule Implements Truth-telling

Step back from the game under scrutiny to observe that the optimal risk sharing rule is linear for all μ and ρ by maximizing

$$\mathbb{E}\left[u_{\mathrm{I}}\big(w-\phi(w)\big) + \mu\,u_{\mathrm{A}}\big(\phi(w)\big)\,\big|\,\tilde{\sigma}=\sigma\right] \tag{4.24}$$

unconstrained over all feasible ϕ, which immediately decouples into a family of one-dimensional optimization problems solvable by differentiation:

$$u_{\mathrm{I}}'\big(w-\phi_{\mu}(w)\big) = \mu\,u_{\mathrm{A}}'\big(\phi_{\mu}(w)\big) \tag{4.25}$$

or, plugging in quadratic utility,

$$w - \phi_\mu(w) - \alpha_{\mathrm{I}} = \mu\big(\phi_\mu(w) - \alpha_{\mathrm{A}}\big) \tag{4.26}$$

for all w. Thus the unconstrained efficient sharing rule is

$$\phi_\mu(w) = \alpha_{\mathrm{A}} + \frac{w - \alpha_{\mathrm{I}} - \alpha_{\mathrm{A}}}{1+\mu}, \tag{4.27}$$

which is feasible whenever $\mu > 0$ and assumption 4.6 holds. Since the standard deviation σ does not enter the expression, the social planner need not know the true variance to implement optimal risk sharing.

Given the optimal sharing rule, the expression for the corresponding optimal investment X_μ in the risky security will be useful. The social planner finds it by computing the maximum of

$$\begin{aligned} &\mathbb{E}\left[u_{\mathrm{I}}\left(R_f + x\big(\tilde{R} - R_f\big) - \phi_\mu\Big(R_f + x\big(\tilde{R} - R_f\big)\Big)\right) \,\middle|\, \tilde{\sigma} = \sigma\right] \\ &\qquad + \mu\mathbb{E}\left[u_{\mathrm{A}}\left(\phi_\mu\Big(R_f + x\big(\tilde{R} - R_f\big)\Big)\right) \,\middle|\, \tilde{\sigma} = \sigma\right], \end{aligned} \tag{4.28}$$

over all x. Mechanical computations collected in Appendix 4.5.1 reveal that the optimal investment is

$$X_\mu(\sigma) \equiv X(\sigma) = \frac{\big(\bar{R} - R_f\big)\big(\alpha_{\mathrm{I}} + \alpha_{\mathrm{A}} - R_f\big)}{\sigma^2 + \big(\bar{R} - R_f\big)^2}. \tag{4.29}$$

Note that the optimal investment does not depend on the welfare weight μ; in fact, given the optimal sharing rule ϕ_μ the investment X maximizes the agent's utility:

$$\begin{aligned} &\mathbb{E}\left[u_{\mathrm{A}}\left(\phi_\mu\Big(R_f + X(\sigma)\big(\tilde{R} - R_f\big)\Big)\right) \,\middle|\, \tilde{\sigma} = \sigma\right] \\ &\qquad \geq \mathbb{E}\left[u_{\mathrm{A}}\left(\phi_\mu\Big(R_f + x\big(\tilde{R} - R_f\big)\Big)\right) \,\middle|\, \tilde{\sigma} = \sigma\right] \end{aligned} \tag{4.30}$$

for all $x \in \mathbb{R}$, in particular for all $x \in \operatorname{Im} X$ so

$$\begin{aligned}\mathbb{E}\left[u_{\mathrm{A}}\left(\phi_\mu\Big(R_f + X(\sigma)\big(\tilde{R} - R_f\big)\Big)\right) \Big| \, \tilde{\sigma} = \sigma\right] \\ \geq \mathbb{E}\left[u_{\mathrm{A}}\left(\phi_\mu\Big(R_f + X(\hat{\sigma})\big(\tilde{R} - R_f\big)\Big)\right) \Big| \, \tilde{\sigma} = \sigma\right]\end{aligned} \tag{4.31}$$

for all $\hat{\sigma}$, which proves the following essential lemma.

Lemma 4.2 *The efficient sharing rule composed with the optimal investment $\phi_\mu \circ X$,*

$$\varphi_\mu\Big(R_f + X(\hat{\sigma})\big(\tilde{R} - R_f\big), \hat{\sigma}, \rho\Big) = \phi_\mu\Big(R_f + X(\hat{\sigma})\big(\tilde{R} - R_f\big)\Big), \tag{4.32}$$

implements the agent's truth-telling for any credit rating ρ.

Lemma 4.2 is closely related to Wilson's (1984)'s result on the "revelation of information for joint production", where he proves that when the efficient sharing rule is affine, truthful revelation is a Nash equilibrium. We import the methodology for connecting risk-sharing with implementation into the principal-agent setting, emphasizing the explicit (direct) implementation and, further, that the optimal sharing rule is the investor's optimal contract by the equivalence of the principal-agent problem and social planner's problem above. Note that Wilson's proof exploits that when the efficient sharing rule is affine its derivative is constant and cancels out of his problem's first-order condition; we instead use that in our case the optimal allocation is independent of the welfare weight.

The Break-even Welfare Weight and Ex Ante Utility

In order to characterize the employed agent's contract via the social planner's problem, determine the welfare weight μ_ρ given the credit rating ρ; thanks to truth-telling, the equilibrium allocation depends on the credit rating only via the participation constraint:

$$\mathbb{E}\left[u_{\mathrm{A}}\Big(\phi_{\mu_\rho}\big(R_f + X(\tilde{\sigma})\big(\tilde{R} - R_f\big)\big)\Big) \,\Big|\, \tilde{\rho} = \rho\right] = \bar{u}, \tag{4.33}$$

which, via string of calculations employing the law of iterated expectations (cf. Appendix 4.5.2), says

$$\big(1 + \mu_\rho\big)^2 = \frac{\big(\alpha_{\mathrm{I}} + \alpha_{\mathrm{A}} - R_f\big)^2}{2\,|\bar{u}|}\,\mathbb{E}\left[\frac{\tilde{\sigma}^2}{\tilde{\sigma}^2 + \big(\tilde{R} - R_f\big)^2} \,\middle|\, \tilde{\rho} = \rho\right]. \tag{4.34}$$

A tangential remark: the mapping

$$\tilde{\sigma}^2 \mapsto \frac{\tilde{\sigma}^2}{\tilde{\sigma}^2 + \big(\tilde{R} - R_f\big)^2} \tag{4.35}$$

under the expectation operator is concave, so that if the distribution of $\tilde{\sigma}^2$ spreads out (for example in the the second-order stochastic dominance sense) then μ_ρ decreases, suggesting that the more distribution risk the agent faces, the less the investor must compensate him despite his risk aversion, as captured by the social planner's lower welfare weight. The reason is that his investment decision comes after the realization of the variance, and thus the riskier decisions come with option value: when $\tilde{\sigma}^2$ is very low he will invest a lot in the risky asset, while when it is high he will invest relatively more in the riskless bond.

Further, the equilibrium welfare weight provides a handy formula for the investor's equilibrium expected utility given the rating ρ,

$$\mathbb{E}\left[u_{\mathrm{I}}\Big(W(\tilde{\sigma}, \tilde{R}) - \varphi\big(W(\tilde{\sigma}, \tilde{R}), \tilde{\sigma}, \rho\big)\Big) \,\Big|\, \tilde{\rho} = \rho\right] = \bar{u}\,\mu_\rho^2 \tag{4.36}$$

(see Appendix 4.5.3 for the short calculation) and thus his ex ante expected utility

$$\mathbb{E}\left[u_{\mathrm{I}}\Big(W(\tilde{\sigma}, \tilde{R}) - \varphi\big(W(\tilde{\sigma}, \tilde{R}), \tilde{\sigma}, \rho\big)\Big)\right] = \bar{u}\,\mathbb{E}\left[\mu_{\tilde{\rho}}^2\right]. \tag{4.37}$$

Main Result: Coarser Credit Ratings Are Pareto-Improving

Since competition means that agents always receive their reservation utilities, the main result that coarsening credit ratings makes everyone better-off follows from directly comparing the ex ante expected utility of the investor across ratings systems, using the formula above combined with the connection between convex functions, second-order stochastic dominance, and the law of iterated expectations.

Proposition 4.1 *Coarser credit ratings Pareto-dominate finer ones: for any ratings $\tilde{\rho}_C$ and $\tilde{\rho}_F$ such that $\sigma(\tilde{\rho}_C) \subset \sigma(\tilde{\rho}_F)$, the ex ante equilibrium utility of all agencies is weakly higher given $\tilde{\rho}_C$ than $\tilde{\rho}_F$.*

Proof. Our proof has two main steps, firstly to show that the investor's ex ante expected utility is minus the expectation of a convex function,

$$\bar{u}\,\mathbb{E}\left[\mu_{\tilde{\rho}}^2\right] = -c\,\mathbb{E}\left[f\Big(\mathbb{E}\left[Y \mid \tilde{\rho}\right]\Big)\right] \tag{4.38}$$

for $c > 0$, $f'' > 0$ and a random variable Y; and secondly to show that the expectation conditional on coarse ratings second-order stochastically dominates the expectation conditional on fine ratings,

$$\mathbb{E}\left[Y \mid \tilde{\rho}_C\right] \overset{\text{SOSD}}{\succ} \mathbb{E}\left[Y \mid \tilde{\rho}_F\right], \tag{4.39}$$

whence utility is greater under coarse ratings because minus a convex function is a concave function, and, à la risk aversion, the expectation of a concave function of a stochastically dominated random variable is greater than the expectation of the function of the dominated variable.

Step 1: Rewrite the investor's ex ante expected utility:

$$\begin{aligned}
\bar{u}\,\mathbb{E}\left[\mu_{\tilde{\rho}}^2\right] &= \bar{u}\,\mathbb{E}\left[\left(\sqrt{\frac{(\alpha_{\mathrm{I}}+\alpha_{\mathrm{A}}-R_f)^2}{2|\bar{u}|}\mathbb{E}\left[\frac{\tilde{\sigma}^2}{\tilde{\sigma}^2+(\bar{R}-R_f)^2}\;\middle|\;\tilde{\rho}\right]}-1\right)^2\right] \\
&= \frac{\bar{u}(\alpha_{\mathrm{I}}+\alpha_{\mathrm{A}}-R_f)^2}{\sqrt{2|\bar{u}|}}\mathbb{E}\left[\left[\sqrt{\mathbb{E}\left[\frac{\tilde{\sigma}^2}{\tilde{\sigma}^2+(\bar{R}-R_f)^2}\;\middle|\;\tilde{\rho}\right]}-1\right]^2\right] \\
&= -c\,\mathbb{E}\left[f\Big(\mathbb{E}\left[Y|\tilde{\rho}\right]\Big)\right]
\end{aligned} \tag{4.40}$$

where

$$c := \sqrt{|\bar{u}|/2}\,(\alpha_{\mathrm{I}}+\alpha_{\mathrm{A}}-R_f)^2, \tag{4.41}$$

$$f(z) := \left(\sqrt{z}-1\right)^2, \tag{4.42}$$

and

$$Y := \frac{\tilde{\sigma}^2}{\tilde{\sigma}^2+\left(\bar{R}-R_f\right)^2}. \tag{4.43}$$

Note that $c>0$ and $f''(z)=z^{3/2}/2>0$.

Step 2: By definition,

$$\mathbb{E}\left[Y \mid \tilde{\rho}_C\right] \overset{\text{SOSD}}{\succ} \mathbb{E}\left[Y \mid \tilde{\rho}_F\right] \tag{4.44}$$

if there exists a random variable $\tilde{\varepsilon}$ such that

$$\mathbb{E}\left[Y \mid \tilde{\rho}_F\right] = \mathbb{E}\left[Y \mid \tilde{\rho}_C\right] + \tilde{\varepsilon} \tag{4.45}$$

and

$$\mathbb{E}\left[\tilde{\varepsilon}\,\middle|\,\mathbb{E}\left[Y \mid \tilde{\rho}_C\right]\right] = 0. \tag{4.46}$$

For $\tilde{\varepsilon} = \mathbb{E}\left[Y \mid \tilde{\rho}_F\right] - \mathbb{E}\left[Y \mid \tilde{\rho}_C\right]$ from the above, the condition is

$$\mathbb{E}\left[\mathbb{E}\left[Y \mid \tilde{\rho}_F\right] - \mathbb{E}\left[Y \mid \tilde{\rho}_C\right]\,\middle|\,\mathbb{E}\left[Y \mid \tilde{\rho}_C\right]\right] = 0 \tag{4.47}$$

or

$$\mathbb{E}\left[\mathbb{E}\left[Y \mid \tilde{\rho}_F\right] \middle| \mathbb{E}\left[Y \mid \tilde{\rho}_C\right]\right] = \mathbb{E}\left[Y \mid \tilde{\rho}_C\right]. \tag{4.48}$$

Given the assumption $\sigma(\tilde{\rho}_C) \subset \sigma(\tilde{\rho}_F)$ and since conditioning destroys information—$\sigma\big(\mathbb{E}\left[Y \mid \tilde{\rho}_C\right]\big) \subset \sigma(\tilde{\rho}_C)$—apply the law of iterated expectations firstly to add and then to delete conditioning information to calculate that

$$\begin{aligned}
\mathbb{E}\left[\mathbb{E}\left[Y \mid \tilde{\rho}_F\right] \middle| \mathbb{E}\left[Y \mid \tilde{\rho}_C\right]\right] &= \mathbb{E}\left[\mathbb{E}\left[\mathbb{E}\left[Y \mid \tilde{\rho}_F\right] \middle| \rho_C\right] \middle| \mathbb{E}\left[Y \mid \tilde{\rho}_C\right]\right] &(4.49)\\
&= \mathbb{E}\left[\mathbb{E}\left[Y \mid \tilde{\rho}_C\right] \middle| \mathbb{E}\left[Y \mid \tilde{\rho}_C\right]\right] &(4.50)\\
&= \mathbb{E}\left[Y \middle| \rho_C\right], &(4.51)
\end{aligned}$$

as desired. ■

4.4 Conclusions

We identify a negative effect of accurate credit ratings. Contractible public signals can decrease welfare in delegated portfolio management. They shut down risk-sharing. Outside the class of preferences for which the efficient sharing rule is linear (which Wilson (1984) investigates), a trade-off between risk-sharing and efficient investment emerges. Future work should investigate whether the public contracting variable can help to implement efficient investment in this more general problem.

4.5 Appendix

4.5.1 Computation of Optimal Investment

The problem stated in line 4.28 to find the optimal investment X_μ given the optimal sharing rule

$$\phi_\mu(w) = a + bw, \tag{4.52}$$

where the constants a and b are as in equation 4.27, is to maximize the expectation

$$-\frac{1}{2}\,\mathbb{E}\Bigg[\Big(R_f + x(\tilde{R} - R_f) - a - b\Big(R_f + x(\tilde{R} - R_f)\Big) - \alpha_{\mathrm{I}}\Big)^2 \\ + \mu\Big(\Big(a + \Big(R_f + x(\tilde{R} - R_f)\Big) - \alpha_{\mathrm{A}}\Big)^2\Big) \;\Big|\; \tilde{\sigma} = \sigma\Bigg] \tag{4.53}$$

over all x. Thus the first-order condition says that for optimum X_μ

$$\mathbb{E}\Bigg[(1-b)(\tilde{R} - R_f)\Big(R_f + X_\mu(\tilde{R} - R_f) - a - b\Big(R_f + X_\mu(\tilde{R} - R_f)\Big) - \alpha_{\mathrm{I}}\Big) \\ + \mu\, b(\tilde{R} - R_f)\Big(a + b\Big(R_f + X_\mu(\tilde{R} - R_f)\Big) - \alpha_{\mathrm{A}}\Big) \;\Big|\; \tilde{\sigma} = \sigma\Bigg] = 0 \tag{4.54}$$

$$X_\mu = \frac{\big(\bar{R} - R_f\big)}{\mathbb{E}\big[(\tilde{R} - R_f)^2 \,\big|\, \tilde{\sigma} = \sigma\big]}\left(\frac{(1-b)(a+\alpha_{\mathrm{I}}) - \mu\, b(a - \alpha_{\mathrm{A}})}{(1-b)^2 + \mu\, b^2} - R_f\right). \tag{4.55}$$

Substituting in for a and b from the expression in equation 4.27 gives that

$$(1-b)(a+\alpha_{\mathrm{I}}) - \mu b(a - \alpha_{\mathrm{A}}) = \frac{\mu\,(\alpha_{\mathrm{A}} + \alpha_{\mathrm{I}})}{1+\mu} \tag{4.56}$$

and

$$(1-b)^2 + b^2\mu = \frac{\mu}{1+\mu} \tag{4.57}$$

therefore

$$X_\mu = \frac{\big(\bar R - R_f\big)\big(\alpha_{\mathrm{I}} + \alpha_{\mathrm{A}} - R_f\big)}{\mathbb{E}\big[\,(\tilde R - R_f)^2 \,\big|\, \tilde\sigma = \sigma\big]} \tag{4.58}$$

$$= \frac{\big(\bar R - R_f\big)\big(\alpha_{\mathrm{I}} + \alpha_{\mathrm{A}} - R_f\big)}{\sigma^2 + \big(\bar R - R_f\big)^2}. \tag{4.59}$$

4.5.2 Computation of the Social Planner's Weight

Immediately from plugging in the expressions for u_{A}, ϕ_{μ_ρ}, and X into equation 4.33, observe that

$$\begin{aligned}
2|\bar u|\big(1+\mu_\rho\big)^2 &= \mathbb{E}\left[\left(R_f + \frac{\big(\bar R - R_f\big)\big(\alpha_{\mathrm{I}} + \alpha_{\mathrm{A}} - R_f\big)}{\tilde\sigma^2 + \big(\bar R - R_f\big)^2}\Big(\tilde R - R_f\Big) - \alpha_{\mathrm{I}} - \alpha_{\mathrm{A}}\right)^2 \,\middle|\, \tilde\rho = \rho\right] \\
&= \big(\alpha_{\mathrm{I}} + \alpha_{\mathrm{A}} - R_f\big)^2 \mathbb{E}\left[\left(\frac{\big(\bar R - R_f\big)\big(\tilde R - R_f\big)}{\tilde\sigma^2 + \big(\bar R - R_f\big)^2} - 1\right)^2 \,\middle|\, \tilde\rho = \rho\right] \\
&= \big(\alpha_{\mathrm{I}} + \alpha_{\mathrm{A}} - R_f\big)^2 \left\{1 - 2\mathbb{E}\left[\frac{\big(\bar R - R_f\big)\big(\tilde R - R_f\big)}{\tilde\sigma^2 + \big(\bar R - R_f\big)^2} \,\middle|\, \tilde\rho = \rho\right] + \right. \\
&\qquad \left. + \,\mathbb{E}\left[\left(\frac{\big(\bar R - R_f\big)\big(\tilde R - R_f\big)}{\tilde\sigma^2 + \big(\bar R - R_f\big)^2}\right)^2 \,\middle|\, \tilde\rho = \rho\right]\right\}.
\end{aligned} \tag{4.60}$$

Applying the law of iterated expectations gives

$$\begin{aligned}
&1 - \frac{2|\bar\mu|\big(1+\mu_\rho\big)^2}{\big(\alpha_{\mathrm{I}} + \alpha_{\mathrm{A}} - R_f\big)^2} \\
&= 2\mathbb{E}\left[\mathbb{E}\left[\frac{\big(\bar R - R_f\big)\big(\tilde R - R_f\big)}{\tilde\sigma^2 + \big(\bar R - R_f\big)^2} \,\middle|\, \tilde\sigma\right] \,\middle|\, \tilde\rho = \rho\right] - \mathbb{E}\left[\mathbb{E}\left[\left(\frac{\big(\bar R - R_f\big)\big(\tilde R - R_f\big)}{\tilde\sigma^2 + \big(\bar R - R_f\big)^2}\right)^2 \,\middle|\, \tilde\sigma\right] \,\middle|\, \tilde\rho = \rho\right] \\
&= 2\mathbb{E}\left[\frac{(\bar R - R_f)\mathbb{E}\left[\big(\tilde R - R_f\big) \,\middle|\, \tilde\sigma\right]}{\tilde\sigma^2 + \big(\bar R - R_f\big)^2} \,\middle|\, \tilde\rho = \rho\right] + \mathbb{E}\left[\frac{\big(\bar R - R_f\big)^2\mathbb{E}\left[\big(\tilde R - R_f\big)^2 \,\middle|\, \tilde\sigma\right]}{\left(\tilde\sigma^2 + \big(\bar R - R_f\big)^2\right)^2} \,\middle|\, \tilde\rho = \rho\right]
\end{aligned} \tag{4.61}$$

and since

$$\mathbb{E}\left[\left(\tilde{R}-R_f\right)^2 \,\middle|\, \tilde{\sigma}\right] = \tilde{\sigma}^2 + \left(\bar{R}-R_f\right)^2 \tag{4.62}$$

we have

$$\begin{aligned}
&1 - \frac{2|\bar{\mu}|\left(1+\mu_\rho\right)^2}{\left(\alpha_{\mathrm{I}}+\alpha_{\mathrm{A}}-R_f\right)^2} \\
&= \left(\bar{R}-R_f\right)^2 \left\{ \mathbb{E}\left[\frac{2}{\tilde{\sigma}^2+\left(\bar{R}-R_f\right)^2} \,\middle|\, \tilde{\rho}=\rho\right] - \mathbb{E}\left[\frac{1}{\tilde{\sigma}^2+\left(\bar{R}-R_f\right)^2} \,\middle|\, \tilde{\rho}=\rho\right]\right\} \\
&= \mathbb{E}\left[\frac{\left(\bar{R}-R_f\right)^2}{\tilde{\sigma}^2+\left(\bar{R}-R_f\right)^2} \,\middle|\, \tilde{\rho}=\rho\right].
\end{aligned} \tag{4.63}$$

Finally, solve for μ_ρ in equation 4.60 and cross multiply to recover equation 4.34.

4.5.3 Computation of Expected Utility Given ρ

Plug in to equation 4.36 and compute, maintaining at first the shorthand

$$\tilde{w} = W(\sigma, R) = R_f + X(\sigma)\left(R-R_f\right), \tag{4.64}$$

that is:

$$
\begin{aligned}
&\mathbb{E}\left[u_{\mathrm{I}}\Big(W(\tilde{\sigma},\tilde{R})-\varphi\big(W(\tilde{\sigma},\tilde{R}),\tilde{\sigma},\rho\big)\Big)\;\Big|\;\tilde{\rho}=\rho\right]\\
&=-\frac{1}{2}\mathbb{E}\left[\Big(\alpha_{\mathrm{I}}-\tilde{w}+\phi_{\mu_\rho}(\tilde{w})\Big)^2\;\Bigg|\;\tilde{\rho}=\rho\right]\\
&=-\frac{1}{2}\mathbb{E}\left[\alpha_{\mathrm{I}}-\tilde{w}+\alpha_{\mathrm{A}}+\frac{\tilde{w}-\alpha_{\mathrm{I}}-\alpha_{\mathrm{A}}}{1+\mu_\rho}\;\Bigg|\;\tilde{\rho}=\rho\right]\\
&=-\frac{1}{2}\mathbb{E}\left[\alpha_{\mathrm{I}}-\tilde{w}+\alpha_{\mathrm{A}}+\frac{\tilde{w}-\alpha_{\mathrm{I}}-\alpha_{\mathrm{A}}}{1+\mu_\rho}\;\Bigg|\;\tilde{\rho}=\rho\right]\\
&=-\frac{1}{2}\left(\frac{\mu_\rho}{1+\mu_\rho}\right)^2\mathbb{E}\left[\big(\alpha_{\mathrm{I}}+\alpha_{\mathrm{A}}-\tilde{w}\big)^2\;\Big|\;\tilde{\rho}=\rho\right]\\
&=-\frac{1}{2}\left(\frac{\mu_\rho}{1+\mu_\rho}\right)^2\mathbb{E}\left[\Big(\alpha_{\mathrm{I}}+\alpha_{\mathrm{A}}-R_f-X(\tilde{\sigma})\big(\tilde{R}-R_f\big)\Big)^2\;\Bigg|\;\tilde{\rho}=\rho\right]\\
&=-\frac{1}{2}\left(\frac{\mu_\rho}{1+\mu_\rho}\right)^2\mathbb{E}\left[\left(\alpha_{\mathrm{I}}+\alpha_{\mathrm{A}}-R_f-\big(\alpha_{\mathrm{I}}+\alpha_{\mathrm{A}}-R_f\big)\frac{\big(\bar{R}-R_f\big)\big(\tilde{R}-R_f\big)}{\tilde{\sigma}^2+\big(\bar{R}-R_f\big)^2}\right)^2\;\Bigg|\;\tilde{\rho}=\rho\right]\\
&=-\frac{\big(\alpha_{\mathrm{I}}+\alpha_{\mathrm{A}}-R_f\big)^2}{2}\left(\frac{\mu_\rho}{1+\mu_\rho}\right)^2\mathbb{E}\left[\left(1-\frac{\big(\bar{R}-R_f\big)\big(\tilde{R}-R_f\big)}{\tilde{\sigma}^2+\big(\bar{R}-R_f\big)^2}\right)^2\;\Bigg|\;\tilde{\rho}=\rho\right].
\end{aligned}
\tag{4.65}
$$

Now, from equation 4.60 above,

$$
\mathbb{E}\left[\left(1-\frac{\big(\bar{R}-R_f\big)\big(\tilde{R}-R_f\big)}{\tilde{\sigma}^2+\big(\bar{R}-R_f\big)^2}\right)^2\;\Bigg|\;\tilde{\rho}=\rho\right]=2|\bar{u}|\left(\frac{1+\mu_\rho}{\alpha_{\mathrm{I}}+\alpha_{\mathrm{A}}-R_f}\right)^2, \tag{4.66}
$$

so, finally,

$$
\mathbb{E}\left[u_{\mathrm{I}}\Big(W(\tilde{\sigma},\tilde{R})-\varphi\big(W(\tilde{\sigma},\tilde{R}),\tilde{\sigma},\rho\big)\Big)\;\Big|\;\tilde{\rho}=\rho\right]=\bar{u}\,\mu_\rho^2. \tag{4.67}
$$

Bibliography

Admati, A. R. and Pfleiderer, P. C. (2009). The "Wall Street Walk" and Shareholder Activism: Exit as a Form of Voice, *Review of Financial Studies* **22**(7): 2245–2285.

Admati, A. R., Pfleiderer, P. and Zechner, J. (1994). Large shareholder activism, risk sharing, and financial market equilibrium, *Journal of Political Economy* **102**(6): 1097–1130.

Agarwal, V., Daniel, N. D. and Naik, N. Y. (2009). Role of managerial incentives and discretion in hedge fund performance, *Journal of Finance* **64**(5): 2221–2256.

Aggarwal, R., Prabhala, N. R. and Puri, M. (2002). Institutional allocation in initial public offerings: Empirical evidence, *The Journal of Finance* **57**(3): 1421–1442.

Baker, M., Stein, J. C. and Wurgler, J. (2003). When does the market matter? stock prices and the investment of equity-dependent firms, *The Quarterly Journal of Economics* **118**(3): 969–1005.

Barber, B. M. (2007). Monitoring the Monitor: Evaluating CalPERS' Activism, *Journal of Investing* pp. 66–80.

Becht, M., Franks, J. R. and Grant, J. (2010). Hedge Fund Activism in Europe, *SSRN eLibrary, http://ssrn.com/paper=1616340* .

Berk, J. B. and Green, R. C. (2004). Mutual fund flows and performance in rational markets, *Journal of Political Economy* **112**(6): 1269–1295.

Bharath, S. T., Jayaraman, S. and Nagar, V. (2010). Exit as Governance: An Empirical Analysis, *SSRN eLibrary, http://ssrn.com/abstract=1572940* .

Bhattacharya, S. and Pfleiderer, P. (1985). Delegated portfolio management, *Journal of Economic Theory* **36**(1): 1–25.

Bhide, A. (1993). The hidden costs of stock market liquidity, *Journal of Financial Economics* **34**(1): 31–51.

Biais, B. and Rochet, J. C. (1997). Risk sharing, adverse selection and market structure, *in* B. Biais, T. Biork, J. Cvitanic and N. El Karoui (eds), *Financial Mathematics*, Springer-Verlag, Berlin, pp. 1–51.

Bolton, P., Freixas, X. and Shapiro, J. (2009). The credit ratings game, (14712).

Bolton, P. and von Thadden, E.-L. (1998). Blocks, liquidity, and corporate control, *Journal of Finance* **53**(1): 1–25.

Brav, A. P., Jiang, W., Thomas, R. S. and Partnoy, F. (2008). Hedge Fund Activism, Corporate Governance, and Firm Performance, *Journal of Finance* **63**: 1729.

Brown, K. C., Harlow, W. V. and Starks, L. T. (1996). Of tournaments and temptations: An analysis of managerial incentives in the mutual fund industry, *Journal of Finance* **51**(1): 85–110.

Burkart, M., Gromb, D. and Panunzi, F. (1997). Large shareholders, monitoring, and the value of the firm, *The Quarterly Journal of Economics* **112**(3): 693–728.

Chemmanur, T. J., He, S. and Hu, G. (2009). The role of institutional investors in seasoned equity offerings, *Journal of Financial Economics* **94**(3): 384–411.

Chemmanur, T. J. and Jiao, Y. (2011). Institutional trading, information production, and the seo discount: A model of seasoned equity offerings, *Journal of Economics & Management Strategy* **20**(1): 299–338.

Chevalier, J. and Ellison, G. (1997). Risk taking by mutual funds as a response to incentives, *Journal of Political Economy* **105**(6): 1167–1200.

Clifford, C. P. and Lindsey, L. A. (2011). Blockholder Compensation, Activism, and Efficacy, *SSRN eLibrary, http://ssrn.com/paper=1644995* .

Coffee, J. C. J. (1991). Liquidity versus control: The institutional investor as corporate monitor, *Columbia Law Review* **91**(6).

Dasgupta, A. and Piacentino, G. (2012). The wall street walk when blockholders compete for flows, *SSRN eLibrary, http://ssrn.com/abstract=1848001* .

Dasgupta, A. and Prat, A. (2006). Financial equilibrium with career concerns, *Theoretical Economics* **1**(1): 67–93.

Dasgupta, A. and Prat, A. (2008). Information Aggregation in Financial Markets with Career Concerns, *Journal of Economic Theory* **143**(1): 83–113.

Dasgupta, A., Prat, A. and Verardo, M. (2011a). Institutional Trade Persistence and Long-term Equity Returns, *Journal of Finance* **66**(2): 635–653.

Dasgupta, A., Prat, A. and Verardo, M. (2011b). The Price Impact of Institutional Herding, *Review of Financial Studies* **24**(3): 892–925.

Dasgupta, A. and Zachariadis, K. E. (2010). Delegated Activism and Disclosure, *SSRN eLibrary, http://ssrn.com/paper=1652148* .

Davis, G. F. and Kim, E. H. (2007). Business ties and proxy voting by mutual funds, *Journal of Financial Economics* **85**(2): 552–570.

Davis, G. F. and Yoo, M. (2003). Le mond toujours plus petite des grandes entreprises amricaines: Partecipations communes et liens dans le conseil d'administrations (1990-2001), *Gerer et Comprendre* **74**: 51–62.

DeAngelo, H., DeAngelo, L. and Stulz, R. M. (2010). Seasoned equity offerings, market timing, and the corporate lifecycle, *Journal of Financial Economics* **95**(3): 275–295.

Doherty, N. A., Kartasheva, A. and Phillips, R. D. (2012). Information Effect of Entry into Credit Ratings Market: The Case of Insurers' Ratings, *Journal of Financial Economics* .

Dow, J., Goldstein, I. and Guembel, A. (2011). Incentives for information production in markets where prices affect real investment, *SSRN eLibrary, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=956797* .

Dow, J. and Gorton, G. (1997). Stock market efficiency and economic efficiency: Is there a connection?, *Journal of Finance* **52**(3): 1087–1129.

Durnev, A., Morck, R. and Yeung, B. (2004). Value-enhancing capital budgeting and firm-specific stock return variation, *The Journal of Finance* **59**(1): 65–105.

Edmans, A. (2009). Blockholder trading, market efficiency, and managerial myopia, *Journal of Finance* **64**(6): 2481–2513.

Edmans, A., Fang, V. W. and Zur, E. (2012). The Effect of Liquidity on Governance, *SSRN eLibrary, http://ssrn.com/paper=1905224* .

Edmans, A. and Manso, G. (2011). Governance Through Trading and Intervention: A Theory of Multiple Blockholders, *Review of Financial Studies* **24**(7): 2395–2428.

Elton, E. J., Gruber, M. J. and Blake, C. R. (2003). Incentive Fees and Mutual Funds, *Journal of Finance* **58**(2).

European Commission (2011). The eu corporate governance framework, *Green Paper* .

Faure-Grimaud, A. and Gromb, D. (2004). Public trading and private incentives, *The Review of Financial Studies* **17**(4): pp. 985–1014.

Fulghieri, P. and Lukin, D. (2001). Information production, dilution costs, and optimal security design, *Journal of Financial Economics* **61**(1): 3–42.

Gao, H. and Mahmudi, H. (2006). Institutional holdings and seasoned equity offerings, *SSRN eLibrary, http://ssrn.com/abstract=1125683* .

Gerard, B. and Nanda, V. (1993). Trading and manipulation around seasoned equity offerings, *Journal of Finance* **48**(1): 213–45.

Gillan, S. L. and Starks, L. T. (2007). The Evolution of Shareholder Activism in the United States, *Journal of Applied Corporate Finance* **19**(1): 55–73.

Goldman, E. and Strobl, G. (2013). Large shareholder trading and the complexity of corporate investments, *Journal of Financial Intermediation* **22**(1): 106–122.

Goldstein, I. and Guembel, A. (2008). Manipulation and the allocational role of prices, *Review of Economic Studies* **75**(1): 133–164.

Goldstein, I., Ozdenoren, E. and Yuan, K. (2012). Trading frenzies and their impact on real investment, *Journal of Financial Economics* **Forthcoming**.

Gopalan, R. (2008). Institutional Stock Sales and Takeovers: The Disciplinary Role of Voting with Your Feet, *SSRN eLibrary, http://ssrn.com/paper=891515* .

Grossman, S. J. and Hart, O. D. (1980). Takeover bids, the free-rider problem, and the theory of the corporation, *Bell Journal of Economics* **11**(1): 42–64.

Grossman, S. and Stiglitz, J. (1980). On the impossibility of informationally efficient markets, *American Economic Review* **70**(3): 393–408.

Guerrieri, V. and Kondor, P. (2012). Fund managers, career concerns, and asset price volatility, *American Economic Review* **102**(5): 1986–2017.

Hawley, J. P. and Williams, A. T. (2007). Universal Owners: Challenges and Opportunities, *Corporate Governance: An International Review* **15**: 415–420.

Helwege, J., Intintoli, V. J. and Zhang, A. (2012). Voting with their feet or activism? institutional investors' impact on ceo turnover, *Journal of Corporate Finance* **18**(1): 22 – 37.

Hirschman, A. O. (1970). *Exit, Voice and Loyalty*, Harvard University Press.

Hirshleifer, J. (1971). The private and social value of information and the reward to inventive activity, *American Economic Review* **61**(4): 561–74.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers, *American Economic Review* **76**(2): 323–329.

Kahan, M. and Rock, E. B. (2007). Hedge Funds in Corporate Governance and Corporate Control, *University of Pennsylvania Law Review* **155**: 1021.

Kahn, C. and Winton, A. (1998). Ownership structure, speculation, and shareholder intervention, *The Journal of Finance* **53**(1): 99–129.

Karpoff, J. M. (2001). The Impact of Shareholder Activism on Target Companies: A Survey of Empirical Findings, *SSRN eLibrary, http://ssrn.com/paper=885365* .

Klein, A. and Zur, E. (2009). Entrepreneurial shareholder activism: Hedge funds and other private investors, *Journal of Finance* **64**(1): 187–229.

Kurlat, P. and Veldkamp, L. (2011). Deregulating markets for financial information, *Working paper*, NYU Stern.

Kyle, A. S. (1985). Continuous auctions and insider trading, *Econometrica* **53**(6): 1315–1335.

Levine, R. (2005). Finance and growth: Theory and evidence, *in* P. Aghion and S. Durlauf (eds), *Handbook of Economic Growth*, Vol. 1 of *Handbook of Economic Growth*, Elsevier, chapter 12, pp. 865–934.

Mathis, J., McAndrews, J. and Rochet, J.-C. (2009). Rating the raters: Are reputation concerns powerful enough to discipline rating agencies?, *Journal of Monetary Economics* **56**(5): 657–674.

Maug, E. (1998). Large shareholders as monitors: Is there a trade-off between liquidity and control?, *Journal of Finance* **53**(1): 65–98.

Mello, A. S. and Repullo, R. (2004). Shareholder activism is non-monotonic in market liquidity, *Finance Research Letters* **1**(1): 2–10.

Michaely, R. and Vincent, C. J. (2012). Do institutional investors influence capital structure decisions?, *Johnson School Research Paper Series No. 54-2011* .

Myers, S. C. and Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* **13**(2): 187–221.

Noe, T. H. (2002). Investor activism and financial market structure, *Review of Financial Studies* **15**(1): 289–319.

Palomino, F. and Prat, A. (2003). Risk taking and optimal contracts for money managers, *RAND Journal of Economics* **34**(1): 113–37.

Park, J. (2011). Equity issuance and returns to distressed firms, *Publicly accessible Penn Dissertations* **372**.

Parrino, R., Sias, R. W. and Starks, L. T. (2003). Voting with their feet: institutional ownership changes around forced ceo turnover, *Journal of Financial Economics* **68**(1): 3–46.

Rashes, M. S. (2001). Massively confused investors making conspicuously ignorant choices (mci-mcic), *Journal of Finance* **56**(5): 1911–1927.

Rock, K. (1986). Why new issues are underpriced, *Journal of Financial Economics* **15**(1-2): 187–212.

Scharfstein, D. S. and Stein, J. C. (1990). Herd behavior and investment, *American Economic Review* **80**(3): 465–479.

Shleifer, A. and Vishny, R. W. (1986). Large shareholders and corporate control, *Journal of Political Economy* **94**(3): 461–88.

Sirri, E. R. and Tufano, P. (1998). Costly search and mutual fund flows, *Journal of Finance* **53**(5): 1589–1622.

Skreta, V. and Veldkamp, L. (2009). Ratings shopping and asset complexity: A theory of ratings inflation, *Journal of Monetary Economics* **56**(5): 678–695.

Stoughton, N. M. (1993). Moral hazard and the portfolio management problem, *Journal of Finance* **48**(5): 2009–28.

Subrahmanyam, A. and Titman, S. (2001). Feedback from stock prices to cash flows, *Journal of Finance* **56**(6): 2389–2413.

Tirole, J. (2001). Corporate governance, *Econometrica* **69**(1): 1–35.

Wilson, R. (1984). A note on revelation of information for joint production, *Social Choice and Welfare* **1**: 69–73.

Wurgler, J. (2000). Financial markets and the allocation of capital, *Journal of Financial Economics* **58**(1-2): 187–214.