Investing in Security Price Informativeness: The Role of IPO Underpricing

by

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Firms can enhance the information content of their future stock prices by using underwriters to direct underpriced IPO allocations to information-producing investors. Sufficiently large allocations and the promise of future, profitable IPO participation provide incentives for investors to increase information production *after* the IPO. Increasing underpricing strengthens these incentives, resulting in a more informative post-IPO price and higher firm value. Firms' desires for more informative post-IPO pricing lead to new rationales for IPO underpricing and the intermediating role of underwriters. Using significant changes in institutions' quarterly holdings to measure post-IPO information production, empirical tests provide support for the model's novel implications.

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Chapter 1

Introduction

The systematic underpricing of initial public offerings (IPOs) remains an open puzzle within the finance literature. One explanation, put forth in Ritter [2011], suggests that underpricing reflects agency-conflict-enabled rent extraction by underwriters and investors and that popular asymmetric information-based models are unable to explain the observed magnitude of underpricing.[1] Supporting this view, several studies associate underpricing with pecuniary benefits to underwriters. However, such findings do not preclude explanations that associate underpricing with firms' maximizing value. For example, directed and underpriced allocations can benefit the firm by increasing management control [Brennan and Franks, 1997, Zingales, 1995], increasing monitoring by outside blockholders [Stoughton and Zechner, 1998], or improving secondary market liquidity [Booth and Chua, 1996]. While underpricing may increase an underwriter's revenue, the underpricing can also secure participation by key groups of investors, increasing firm value.[2] An additional benefit to being public, which to my knowledge has not been related to IPO underpricing, is having an informative stock price going forward.

Firms benefit from observable, market-determined stock prices when prices: (i) aggregate outside information (incremental to that possessed by firms' managers) and (ii) guide decisions to improve real economic outcomes.[3] For example, some investors may be able to produce costly

[1] Evidence consistent with this view is provided in Goldstein et al. [2011], Nimalendran et al. [2007], Reuter [2006], Ritter and Zhang [2007], among others.

[2] Bubna and Prabhala [2011] provides evidence that underwriters make significant use of their allocation powers.

[3] A growing literature in finance embraces the idea that securities prices affect firm value and decision making. Bond et al. [2012] surveys a number of theoretical and empirical studies that highlight the importance of price feedback in firm decisions.

information regarding competitors' positioning, industry growth potential, or consumers' demands in new markets.[4] When firms benefit by having an informative stock price, I show analytically that underpricing allocations to information-producing investors can maximize firm value. Rather than inducing information revelation as in Benveniste and Spindt [1989], or information production before the IPO as in Sherman and Titman [2002], firms' underpricing influences investors' post-IPO information production.[5] As a result, more investors will produce information after receiving underpriced IPO allocations and firms' future prices will more accurately reflect the evolving values of their real growth options, leading to better investment decisions. My analysis provides a novel, future-information-production-based motivation for underpricing, originating from firms' desires to make better future investment decisions and maximize value.

I first consider the case of a monopolistic, outside investor.[6] The investor rationally produces information, which when incorporated into prices, increases firm value by informing an investment decision. The firm directs IPO shares to the investor, leading him to partially endogenize information's impact on firm value and to increase his information production accordingly. Moreover, the firm can select the size of the allocation, and thereby the level of incentives for future information production, that maximizes firm value. Underpricing arises to compensate the investor's incremental information production costs. Unfortunately, the monopolistic investor setting does not capture concerns regarding potentially insufficient allocations and information-production free-riding that are likely to accompany a more realistic setting with dispersed, non-cooperative investors.

To address such concerns, I extend the theoretical analysis to the case of dispersed investors, each of which can produce relevant post-IPO information. When providing sufficiently large allocations to multiple investors is infeasible, an underwriter allows for additional information production by coordinating between one-time issuing firms and investors who repeatedly purchase IPO shares. In a sequence of IPOs, investors produce information after receiving an underpriced allocation if

[4] Alternatively, these investors may be able to synthesize more accurately the valuation implications of public information.

[5] Yung [2005] also considers how underpricing can be used to elicit endogenous, pre-IPO information production.

[6] The model follows the general structure of Subrahmanyam and Titman [1999]. While their analysis focuses on a firm's ability to access exogenously-determined information by going public, I analyze the firm's ability to endogenously influence its future information environment when going public.

the promise of future IPO participation is sufficiently profitable. Higher underpricing is associated with more profitable future IPO participation, which allows the underwriter to direct smaller, incentive-compatible allocations to more investors, increasing total information production. Firms' desires to make better investment decisions give a potential explanation for dispersed institutional investor ownership, and underwriters' abilities to facilitate investors' future information production provide a new rationale for underwriters' roles as IPO intermediaries.

Analyzing the model produces predictions consistent with many empirical regularities in the IPO literature. Because firms that value information more highly will incentivize more information production, underpricing should be positively related to the size of the firm's expansion project (i.e. growth options) [Benveniste et al., 2003, Chung et al., 2005] and the firm's productivity uncertainty [Beatty and Ritter, 1986]. Firms' abilities to endogenously influence price feedback increase the probability of firms' issuing seasoned equity after a price increase *and* imply a positive relation between underpricing and the probability of issuing seasoned equity [Jegadeesh et al., 1993].

The model also provides several novel empirical predictions. If underpricing leads to more production of post-IPO information, we should expect positive relations between underpricing and both the number of allocations directed to information-producing investors and the subsequent informed trading activity of those investors. Furthermore, if underwriters facilitate post-IPO information production, investors with a history of informed trading after receiving underpriced IPO allocations should be more likely to receive new underpriced allocations, and also more likely to make informed trades after receiving allocations. Finally, firms that encourage more information production should be more likely to adapt their future investment decisions to realized, post-IPO returns.

To test the model's implications, I use 13F institutional holdings data to proxy for IPO allocations and to generate a measure of post-IPO informed trading. I follow Binay et al. [2007] and Reuter [2006] and proxy for IPO allocations using the first reported institutional holdings data after issuance. I develop a measure of informed trading based on the intuition that investors trade more aggressively when they possess more valuable information. Specifically, I consider funds as

having produced information when their quarterly position increases by at least 50%. In support of these large position changes being informationally motivated, aggregate net buying (by funds that report initial holdings in the firm, the proxy for IPO allocations) predicts next quarter's returns. I aggregate the informed trading measure over time to generate funds' reputations for information production and subsequent trading. Aggregating informed trades across funds allows post-IPO informed trading to be related to firm and offer characteristics.

The empirical evidence is consistent with firms' using their IPOs to encourage future information production. Institutional investors' having a stronger history of issuer-specific post-IPO trading are more likely to receive underpriced allocations, and are more likely to make large, likely informed trades of the issuing firm's stock after receiving underpriced allocations. This evidence is consistent with information production being supported by a repeated game between underwriters and institutional investors. At the IPO level, the number of allocations to institutional investors and the expected level of future informed trading are both significant determinants of underpricing. Economically, the number of allocations explains a larger portion of underpricing variation than any control variables besides offer price revisions and contemporaneous underpricing. The economic significance of the number and quality of allocations nearly doubles for firms likely to benefit from price feedback (young, high-tech growth firms). Expected informed trading is similar in economic significance to Carter and Manaster's [1990] underwriter rank and to whether a firm is in a high-tech industry. Furthermore, evidence suggests that encouraging information production through the IPO affects future investments. Firms who encourage more information production via the IPO increase investment more following positive returns, and decrease investment more following negative returns, relative to firms who encourage less information production.

Beyond contributing to the IPO underpricing literature, my analysis contributes to literatures considering the intermediating role of underwriters in equity issuance, the value of large, active investors and the role of prices in guiding firm decisions. Existing theories consider how repeated interactions with IPO investors allow underwriters to reduce underpricing [Benveniste and Spindt, 1989, Sherman, 2000]. In contrast, and consistent with empirical evidence in Hoberg [2007], I show

that repeated interactions between underwriters and investors can create incentives for investors' post-IPO information production, increasing the incentive to underprice and allocate strategically. Existing theories suggest that large, active investors and blockholders can add value directly through intervention and indirectly through disciplinary trading [Shleifer and Vishny, 1986, Admati and Pfleiderer, 2009, Edmans, 2009, Edmans and Manso, 2011]. I highlight that dispersed, information-producing investors can add value to firms by informing firms' investment decisions through trading *and* that firms have the ability to influence those investors' incentives. My research analyzes a new channel, supported by empirical evidence and complementing an existing literature, through which firms can influence their own stocks' price informativeness.[7]

In summary, I link two important features of public markets – that prices affect firm decisions [Bond et al., 2012] and that large amounts of firm equity are held by institutional investors [Blume and Keim, 2012] – to provide new predictions and evidence related to the observed underpricing of IPOs, the holdings of information-producing investors, and information production in secondary markets.

1.1 Summary of Contributions

My dissertation contributes to theoretical and empirical finance literatures. From a theoretical perspective, I present a new explanation for IPO underpricing that incorporates literatures relating to price feedback and underwriters' roles in the IPO process. From an empirical perspective, my dissertation develops a new measure of institutional investors' informed trading, and uses this measure to document new results relating IPO underpricing, institutional allocations and post-IPO trading activity.

My dissertation's most direct theoretical contribution is to the IPO underpricing literature.

[7] Firms voluntarily disclose information to improve price efficiency in Fishman and Hagerty [1989]. Foucault and Gehrig [2008] motivate cross listing as a firm's means to increase outsider's demand to acquire information, increasing the informativeness of the firm's price. Cuny and Pirinsky [2004], Habib and Johnsen [2000], Hennessy [2009], and Sunder [2006] consider the implications of capital structure on the informativeness of prices. Gao and Liang [2013] considers how a firm's disclosures reduce incentives to produce private information. Dow et al. [2006] examine how overinvestment can be used to entice outsiders to produce additional information to enhance decision making. Tetlock and Hahn [2008] discusses a firm's motivation to provide costly liquidity in order to encourage a more informative price for improved decision making.

In particular, a large literature considers the revelation and production of information surrounding IPOs. Benveniste and Spindt [1989] presents a mechanism-design approach that utilizes underpricing to elicit truthful revelation of private information. Chemmanur [1993], Sherman and Titman [2002] and Yung [2005] endogenize information production within a bookbuilding framework, and show that underpricing can be used to encourage information production and learning about firm value at the time of the IPO. My work builds upon these papers by considering firms' desires for informative post-IPO prices and demonstrates that IPO underpricing can be used to promote *future* information production.

I extend the literature on price feedback by highlighting that underpriced IPO allocations can enhance price informativeness. Subrahmanyam and Titman [1999] shows that firms can benefit by going public when prices convey investors' widely-dispersed, private information. My model builds from Subrahmanyam and Titman [1999] by adding an IPO stage, thereby endogenizing the amount of information production in the secondary market. Utilizing underpricing to encourage information production complements a number of other mechanisms that have been proposed. For example, Fishman and Hagerty [1989] and Gao and Liang [2013] consider how firms' disclosures can influence price informativeness, and Cuny and Pirinsky [2004], Habib and Johnsen [2000], Hennessy [2009], and Sunder [2006] consider capital structure implications for price informativeness. Foucault and Gehrig [2008] and Tetlock and Hahn [2008] show that cross-listing and liquidity provision can also improve price informativeness by encouraging more production of private information. Dow et al. [2011] also focuses on investors' incentives to produce information, and solves a model in which investors' information production affects firm value. My work relates to the preceding papers and the microstructure literature by numerically solving a Kyle [1985] model that incorporates price feedback.

My work presents a novel explanation for the role of underwriters in the IPO process, which is a topic that has received considerable attention in the literature. Beginning with Beatty and Ritter [1986], a number of studies have argued that underwriters provide certification of IPO firms. For example, Chemmanur and Fulghieri [1994] theoretically analyzes underwriter reputation acquisition,

while Carter and Manaster [1990] and Carter et al. [1998] show that more prestigious underwriters' IPOs have less underpricing and less underperformance over a three-year holding period following IPOs. Benveniste et al. [2003] demonstrates that underwriters can serve an alternative role, effectively bundling IPOs together to prevent a coordination failure in firms' going public. In Benveniste and Spindt [1989] and Sherman [2000], underwriters can use their repeated involvement in IPOs to reduce underpricing. However, Hoberg [2007] presents evidence that underwriters who have higher underpricing have gained market share over time, inconsistent with underwriters' using their role to lower underpricing. I extend this literature by proposing that underwriters solve a coordination problem between one-time issuing firms and investors who repeatedly purchase shares in IPO offerings. By enforcing post-IPO information production, via the threat of exclusion from future offerings, underwriters are able to support a high-information-production, high-underpricing equilibrium that benefits both firms and investors (consistent with Hoberg [2007]). In a sense, the underwriter serves to certify the quality of investors rather than the quality of firms.

To test the empirical implications of my theory, I develop a new measure of investors' information production and informed trading, complementing existing measures such as the probability of informed trading (PIN) [Easley and O'Hara, 1987, 1992] and price synchronicity [Roll, 1988]. Rather than focusing on aggregate trading and price data, the measure considers funds' large, quarterly-position changes as likely to be informationally-motivated. The measure is better suited to studying IPO underpricing and information production than existing measures for two reasons. First, it directly measures activity by the funds that receive allocations, avoiding the noise inherent in using aggregate trading and price data. Second, it considers only information that is likely to be incremental to management's information. For instance, price synchronicity will reflect the total information content of prices, including that which is known, and potentially released, by management. Therefore, a more informative price as measured through price synchronicity does not necessarily imply that management has more information for decision making.[8] By focusing

[8] A similar argument can be made regarding PIN. Public information disclosure can lead to increased trading and price movements, without providing additional information to management through price feedback.

on long-term, institutional investor behavior, I contribute an alternative measure of information production that is designed to be well-suited to studying price feedback.[9]

Adding to an extensive empirical literature on IPO underpricing, and in support of my theory, I provide evidence of positive relations among underpricing, the number of institutional investors that receive allocations and the amount of informed trading activity following the IPO. While a number of previous studies have documented relations between underpricing and aggregate allocations to institutional investors [Field and Lowry, 2009, Hanley and Wilhelm, 1995, Ljungqvist and Wilhelm, 2002], my dissertation complements Zheng and Li [2008] by providing evidence that the number of institutional investors that receive allocations is strongly related to underpricing. Economically, the number of institutional investors that receive allocations is among the most significant determinants of underpricing. In addition, my dissertation is the first study documenting a positive relationship between underpricing and future informed trading activity. Not only does the number of allocations to institutional investors matter, but also investors' quality (i.e. information production reputation) matters. Furthermore, I demonstrate that these relations are strongest for relatively young, high-tech growth firms (i.e. those firms that may be most likely to benefit from price feedback). Overall, I extend the literature relating underpricing and institutional investors by showing the importance of the number *and* composition of the investors who receiving allocations.

Researchers have extensively studied the allocations made in IPOs, and I contribute to this area of the literature by demonstrating that allocations are more likely for funds with reputations for post-IPO information production. Bookbuilding theories suggest that investors are rewarded for truthfully revealing private information through allocations, and a number of studies including Bubna and Prabhala [2011], Chiang et al. [2010] and Ljungqvist and Wilhelm [2002] find corroborating evidence. Both Binay et al. [2007] and Gondat-Larralde and James [2008] study underwriter-investor relationships, and show that underwriters favor investors to whom they have allocated shares in the past. My findings are consistent with their results, and extend their analyses

[9] Papers utilizing price synchronicity and *PIN* to study price feedback effects include Bakke and Whited [2010] and Chen et al. [2007].

by showing that past behaviors of the funds also influence allocations. Funds that have produced information following past IPO allocations are more likely to receive future allocations, and when they do, they are also more likely to produce information following those IPOs.

Chapter 2

Theoretical Analysis

I first develop the model in a setting having one information-producing investor. After developing several results in the simplified setting, I show the robustness of the results in a setting which incorporates dispersed investors and information production.

2.1 Monopolist Setting

I analyze how firms' abilities to influence outside information production affects decisions to go public, the underpricing of IPOs and the informational content of firms' stock prices. I extend the model of Subrahmanyam and Titman [1999] by adding an IPO stage in which the firm can sell shares to a future-information-producing outsider.[1] As in Subrahmanyam and Titman [1999], the firm balances the benefit of improved decision-making based on its stock price against the cost of investors' trading alongside a better informed counterparty.

I depart from Subrahmanyam and Titman [1999] in three important ways. First, I consider outsiders' endogenous production of costly information (rather than exogenously-given and costless, i.e. serendipitous, information). Second, to highlight the firm's potential to influence outside information production, I model the firm's choice of IPO allocations and pricing. Third, I consider a firm that has an expansion project of fixed size (rather than variable investment size conditioned on expected profitability). Separating investment size from expected profitability allows for additional cross-sectional predictions relating underpricing to firm characteristics.

[1] Maug [2001] models the firm's decision to go public while considering the informational advantages of an outsider relative to an insider where the outsider's information production occurs prior to the IPO.

The timing of the model involves three phases. The firm first decides whether to go public, and if so, how much of the firm to sell to the future-information-producing outsider. As there is no immediate need for financing, the only modeled benefit to going public is having an observable stock price. Second, the outsider acquires information and through trading incorporates his information into the stock price. Third, the firm decides whether to invest in the expansion project and subsequently cash flows are realized.

2.1.1 Model Set-Up

Firms are characterized by their mix of assets and those assets' productivity. Assets consist of assets-in-place, $A \in (0, \infty)$, and an expansion project to invest $I \in (0, \infty)$ to grow the business by scaling up existing assets-in-place. The assets' common productivity is a normally distributed random variable $\tilde{v} \sim N(1, \Sigma)$ where $\Sigma \in (0, \infty)$.[2] The assets' productivity is made up of $N \in (0, \infty)$ components such that $\tilde{v} = 1 + \sum_{j=1}^{N} \tilde{u}_j$, where $\tilde{u}_j \sim N(0, \sigma_s^2)$, $\tilde{u}_j$ and $\tilde{u}_k$ are i.i.d. for $j \neq k$, and $\sigma_s^2 = \frac{\Sigma}{N}$. The assets-in-place and expansion assets (if the investment is made) produce cash flows equal to $A\tilde{v}$ and $I\tilde{v}$, respectively. Firm characteristics (A, I, Σ, N) are common knowledge.

A monopolistic information producer (the outsider) controls each of N different information production technologies. Technology j can produce a signal equivalent to $\tilde{u_j}$ at fixed cost $\frac{c}{N}, c \in (0, \infty)$. When the monopolist uses $n \in [0, N]$ of the available N information technologies (ignoring the integer problem), the cumulative signal s (the summation of the individually produced signals) has a correlation of $\sqrt{\frac{n}{N}} \equiv \rho$ with the firm's productivity. The cost of producing n signals is $\frac{cn}{N} = c\rho^2$. Given the one-to-one mapping between ρ and n, I consider the outsider's choice of correlation, rather than n, to simplify exposition. This information structure allows for a natural transition from the current monopolist setting to the dispersed information setting considered in Section 3.

The firm's manager maximizes the present value of current (at the time of a decision) share-

[2] Dow et al. [2011] examines how firm fundamentals analogous to mean productivity impact information production. I leave the analysis of varying expected productivity in this setting to future research.

holders' invested wealth. I assume that any new financing is raised via equity and that the firm has complete bargaining power in such transactions.[3] The firm's initial shareholders face costly liquidity shocks while the secondary markets are open, and financial frictions lead to shareholders' satisfying their liquidity shocks by trading. This assumption creates "noise traders" whose exogenously-specified, aggregate order flow is $\tilde{w} \sim N(0, \sigma_w^2)$ where $\sigma_w \in (0, \infty)$. In order to emphasize the incremental liquidity costs that arise due to incentivizing information production, I assume that if the firm stays private the individual shareholders satisfy their liquidity shocks by trading with the firm's treasury account. The risk-free rate is zero and all agents are risk-neutral.

If the firm goes public, the presence of noise traders allows for a microstructure setting similar to Kyle [1985]. However, incorporating price feedback into a market microstructure framework is complicated due to a firm's prices' reflecting expected cash flows and also affecting those cash flows through the firm's decisions. To avoid this complication, Subrahmanyam and Titman [1999] and Foucault and Gehrig [2008] assume a "split-security" where the traded security provides cash flows only from the assets-in-place and therefore does not reflect the investment decision.[4] Subrahmanyam and Titman [1999] justifies this assumption by noting that "the price of a claim on the firm's assets in place provides the same information about the optimal investment in the growth opportunity as would the price of the entire firm." I adopt a related simplification, assuming expected trading profits are a linear function of the information produced by the outsider and can be written as

$$\rho g(\sigma_w, \Sigma, A, I) \tag{2.1}$$

where $g(\sigma_w, \Sigma, A, I)$ is positive and weakly increasing in its arguments. This assumption is consistent with a Kyle [1985] model applied to a "split-security", and is also consistent with a numerically-estimated model that fully incorporates price feedback into equilibrium strategies.[5] The increasing

[3] Restricting the firm to raise equity focuses the analysis on information production and price feedback. Several studies consider the implications of capital structure on the feedback of information to firms, including Cuny and Pirinsky [2004], Habib and Johnsen [2000], Hennessy [2009], and Sunder [2006]. The firm's complete bargaining power is consistent with a competitive fringe of investors which is considered explicitly in Section 3.

[4] Alternatively, Dow et al. [2011] addresses the problem by restricting the order size of the informed trader.

[5] Details of the numerical estimation procedure and resulting equilibrium strategies are available in Chapter 4.

relationship between information produced and expected trading profits captures the tension that a more informative price creates additional information asymmetry when initial investors face liquidity shocks. For clarity, note that trading is a zero-sum game in which the outsider's trading profits are equal in magnitude to the initial investors' liquidity costs.

To focus attention on the firm's desire to incentivize outside information production, I assume that the market price reflects the outsider's private signal after trading is complete. This is consistent with there being sufficient time and opportunity for the signal to become public. Given the time frames over which investment decisions are made, price is likely to reflect the private information.[6] Continuous trading of a split-security, as in Kyle [1985], or information leakage within an investment fund are plausible means for the signal to become public.

2.1.2 Extensive Form and Solution

Figure 2.1 diagrams the extensive form game tree, listing the acting agents along the left-hand side.[7] I use backward induction to solve for a sub-game perfect equilibrium. At $t = 5$, the productivity of the firm is realized and cash flows are produced. The produced cash flows are allocated according to each group's final equity ownership in the firm. The initial investors receive

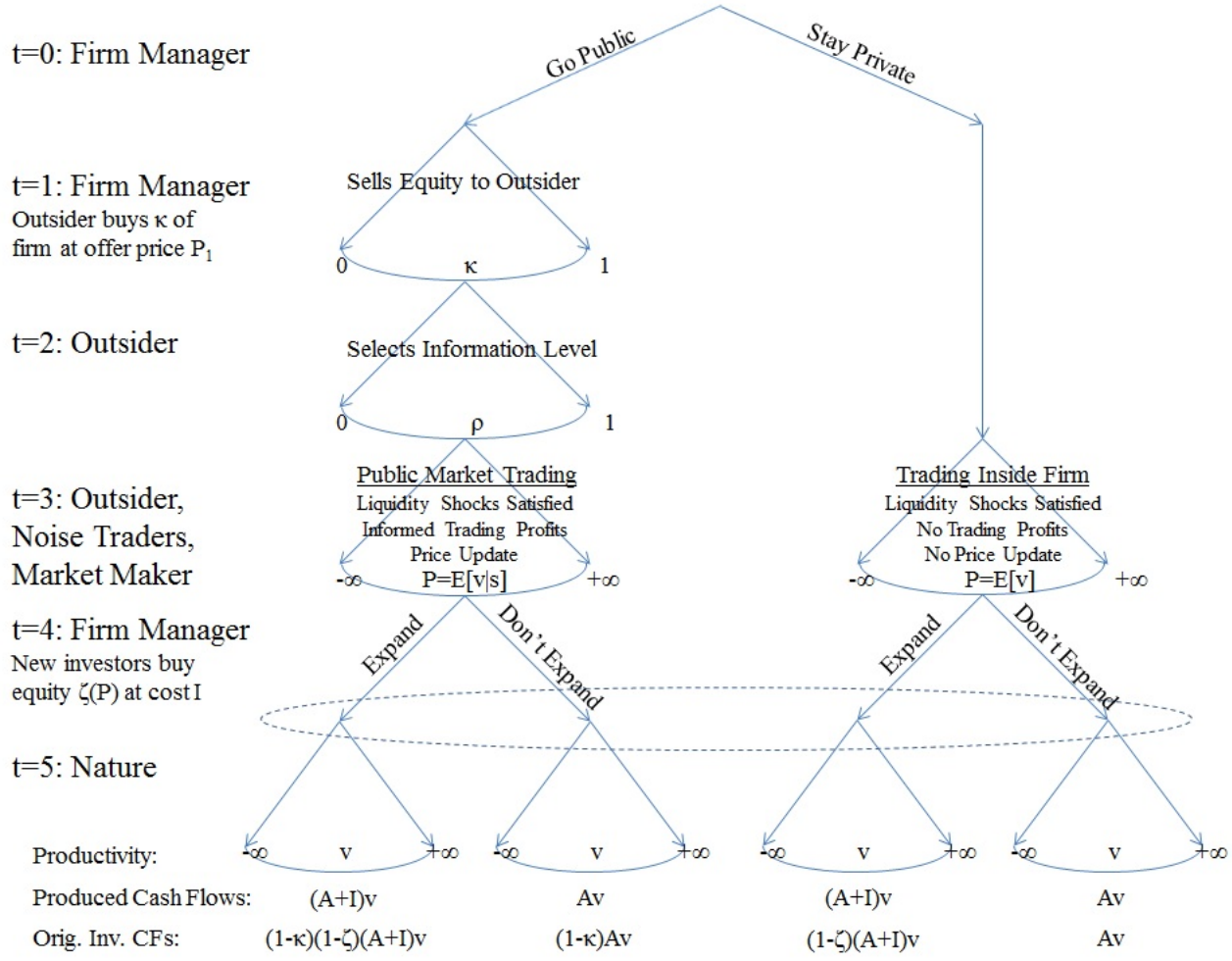
$$(1 - \kappa)(1 - \zeta)(Av + \mathbb{1}_{Expand} Iv), \tag{2.2}$$

where κ is the amount of the firm sold to the information-producing outsider at the IPO, ζ is the amount of the firm sold to new investors who finance the expansion project via a seasoned equity offering (SEO), and $\mathbb{1}_{Expand}$ is an indicator function that equals one if the firm expanded at $t = 4$ and zero otherwise. The first two parts of Equation (2.2) reflect the portions of the firm retained by the initial investors in the IPO and the SEO, respectively, and the third part is the total cash

[6] Chen et al. [2007] and Bakke and Whited [2010] show that firms' yearly investments depend on the prior year's Q-ratio (and more so for firms with more informative stock prices), indicating price feedback is evident over a one-year horizon.

[7] A third possible initial option for firms, besides staying private or going public, is to access public markets through an acquisition by a public firm. I leave the consideration of incentivizing information production through M&A transactions to future research.

Figure 2.1: Extensive Form Game Tree. The left-hand column lists the agent(s) acting at each time.



flows produced by the firm. The outsider receives

$$\kappa(1-\zeta)(Av + \mathbb{1}_{Expand} Iv) \tag{2.3}$$

and the new investors providing I at $t = 4$ receive

$$\zeta(Av + \mathbb{1}_{Expand} Iv). \tag{2.4}$$

At $t = 4$, the manager decides whether to raise additional capital I to fund the expansion project.[8] Let $\mathcal{F}_M = \{A, I, \Sigma, N, c, s\}$ denote the information set if the firm is traded in the secondary market (i.e. the firm went public) and let $\mathcal{F}_0 = \{A, I, \Sigma, N, c\}$ denote the information set otherwise. For a public firm, the price reflects the signal produced by the outsider, and incorporates the manager's action that will be taken conditional on the signal inferred from the price:

$$P_4|\mathcal{F}_M = \begin{cases} (A+I)E[\tilde{v}|s] - I & \text{if } E[\tilde{v}|s] \geq 1 \\ AE[\tilde{v}|s] & \text{if } E[\tilde{v}|s] < 1 \end{cases} \tag{2.5}$$

where $E[\tilde{v}|s] = 1+\rho(s-1)$. Market participants correctly anticipate that the manager will undertake the expansion project if the expected productivity is greater than one. The price reflects the value of the firm prior to raising I (the pre-money valuation), and fully incorporates the expected value created by investing in the expansion project. If the firm remains private, growth options are zero NPV and the price at $t = 4$ is based only on the unconditional expected value of the assets-in-place:

$$P_4|\mathcal{F}_0 = A. \tag{2.6}$$

To fund the expansion, the firm's manager sells a portion ζ of the firm's equity to new investors in a SEO. The portion of the firm's equity sold to new investors is equal to the portion of post-financing (post-money) value contributed by the new investors, where the post-financing value is the price of the firm prior to investment plus the amount invested.[9]

$$\zeta_i = \frac{I}{(A+I)E[v|\mathcal{F}_i]}, \quad i \in \{M, 0\} \tag{2.7}$$

[8] The amount of equity raised to fund the expansion project is inconsequential to the results of my analysis due to the availability of zero NPV financing. Beyond information production motivations, the amount of proceeds from the IPO are also inconsequential.

[9] Note that the manager will only sell equity at this stage when $E[v|\mathcal{F}_i] \geq 1$, so Equation (2.7) is well defined.

Using Equation (2.7) in the combined cash flows to the initial investors and the outsider (Equation (2.2) plus Equation (2.3)) gives the combined value of the initial investors' and outsider's pre-SEO claims:

$$\begin{aligned}(1-\zeta_i)(A+I)E[v|\mathcal{F}_i] &= \left(\frac{(A+I)E[v|\mathcal{F}_i]-I}{(A+I)E[v|\mathcal{F}_i]}\right)((A+I)E[v|\mathcal{F}_i]) &(2.8)\\ &= ((A+I)E[v|\mathcal{F}_i]-I) &(2.9)\\ &= P_4|\mathcal{F}_i &(2.10)\end{aligned}$$

The manager's objective function reduces to maximizing the value of all pre-SEO investors' holdings. Because SEO financing is NPV neutral, the value of pre-SEO investors' holdings is equal to the net present value of the firm.

At $t = 3$, trading produces informed trading profits for the outsider, liquidity costs for the firm's shareholders (opposite of the informed trading profits), and the publicly observable price used at $t = 4$.

At $t = 2$, the outsider produces costly information to maximize his profit. The outsider earns cash flows from informed trading profits and from his share (κ) of the firm's cash flows. The outsider's expected trading profits (before information costs) are given by Equation (2.1). At $t = 2$, the expected value of the firm's cash flows is equal to the expected price of the firm after trading. Using Equation (2.5) and that $E[v|s] \geq 1$ if $s \geq 1$, the expected post-trading price is

$$E_2[P_4] = \int_{-\infty}^{1} AE[\tilde{v}|s]\phi(s)ds + \int_{1}^{\infty} ((A+I)E[\tilde{v}|s]-I)\,\phi(s)ds \tag{2.11}$$

where ϕ is the normal probability density function and the two terms split the expected cash flows of the firm according to the firm's decision to invest. This equation simplifies to

$$E_2[P_4] = \frac{1}{2}AE[\tilde{v}|s<1] + \frac{1}{2}\{(A+I)E[\tilde{v}|s\geq 1]-I\}, \tag{2.12}$$

and the bivariate normality of s and v implies

$$E_2[P_4] = A + \frac{1}{2}\rho I\sqrt{\Sigma}\sqrt{2/\pi} \tag{2.13}$$

where π is the number. Firm value, which is equal to the expected price, consists of two parts. The first term, A, is the value of the assets-in-place. The second term represents the expected value of the firm's expansion project, which is increasing in the correlation of the outsider's signal and productivity variance. A more informative signal increases the value of the expansion project by making it less likely that a positive signal is received ($s \geq 1$) when the realized productivity will not warrant investment ($v < 1$). Also, consistent with options intuition, the value of the expansion project is increasing in the size of the project, I, and the variance of the project's cash flows, Σ.

The outsider maximizes

$$\underset{\rho}{\text{Max}} \qquad \rho g(\sigma_w, \Sigma, A, I) + \kappa \left(A + \frac{1}{2}\rho I \sqrt{\Sigma}\sqrt{2/\pi} - P_1 \right) - c\rho^2 \tag{2.14}$$

which consists of his informed trading profit, his share of the firm's cash flows, the cost of acquiring his share of the firm's equity (at primary market price, or offer price, P_1) and his cost of information.[10] This optimization problem gives a first-order condition that can be expressed as

$$\hat{\rho}(\kappa) = \frac{g(\sigma_w, \Sigma, A, I) + \frac{1}{2}\kappa I \sqrt{\Sigma}\sqrt{2/\pi}}{2c}. \tag{2.15}$$

The first term of the numerator gives the contribution of the trading profits to the incentive to produce information, while the second term gives the contribution from the outsider's ownership, or toe-hold, in the firm. When $\kappa = 0$ the second term is zero and the outsider is only incentivized by trading profits. The outsider's maximization gives expected profits equal to:

$$\Pi(\kappa, P_1) = \frac{g(\sigma_w, \Sigma, A, I)^2}{4c} + \kappa \left(A + \frac{\kappa I^2 \Sigma (2/\pi)}{16c} - P_1 \right). \tag{2.16}$$

Having characterized the outsider's optimal information production at $t = 2$, I analyze the firm's $t = 1$ choice of the outsider's IPO allocation. The firm's initial shareholders' expected wealth includes their portion of the firm's cash flows, the liquidity costs they pay during trading, and the revenue from selling shares to the outsider during the IPO (SEO proceeds are offset by the

[10] For convenience, the outsider's cost of acquiring shares in the firm is paid as a cash transfer to initial shareholders. This simplifies notation to emphasize the role of the allocation in promoting information production. Alternatively, the cash flows raised during the IPO could be paid out alongside production cash flows according to ownership at $t = 5$. This does not change the analysis of the outsider's or firm's problem, so I adopt the simplifying assumption.

subsequent investment, eliminating both from expected wealth). Given the outsider's response function, $\hat{\rho}(\kappa)$, the manager selects the percentage of the firm to sell to the outsider that maximizes the wealth of initial investors. However, for any percentage of the firm offered, the manager must ensure that the outsider will agree to participate. Because the outsider always has the option to not purchase IPO shares and instead generate profits from trading alone, the manager sets P_1 to ensure that the outsider earns at least that level of expected profits when $\kappa > 0$. The manager solves:

$$\begin{aligned} \underset{\kappa, P_1}{\text{Max}} \quad & (1-\kappa)\left(A + \frac{1}{2}\hat{\rho}(\kappa) I\sqrt{\Sigma}\sqrt{2/\pi}\right) + \kappa P_1 - \hat{\rho}(\kappa) g(\sigma_w, \Sigma, A, I) \\ & \text{subject to:} \quad \Pi(\kappa, P_1) \geq \Pi(0, P_1). \end{aligned} \tag{2.17}$$

I focus on parameter sets that result in interior solutions to the information level selected by the outsider. As a signal with perfect correlation can not be improved upon, the outsider's choice of information is bounded above. While a corner solution of $\hat{\rho} = 1$ is clearly possibly, in such cases c can be increased to give an interior solution. Given the arbitrary nature of the parameters, analyzing interior solutions is more economically interesting as such parameters balance the relevant tensions. An interior solution to the firm's problem is given in the following proposition.

Proposition 1. *Given the model's assumptions, if the firm goes public then the manager allocates*

$$\kappa^* = 1 - \frac{2g(\sigma_w, \Sigma, A, I)}{I\sqrt{\Sigma}\sqrt{2/\pi}} \tag{2.18}$$

of the firm to the outsider to induce information production

$$\rho^* = \frac{I\sqrt{\Sigma}\sqrt{2/\pi}}{4c}. \tag{2.19}$$

Furthermore, the firm sets its offer price in the primary market to satisfy the outsider's participation constraint, i.e.

$$P_1^* = A + \frac{I^2\Sigma(2/\pi) + 2I\sqrt{\Sigma}\sqrt{2/\pi} g(\sigma_w, \Sigma, A, I)}{16c} \tag{2.20}$$

yielding underpricing equal to

$$\frac{E[P_4^*] - P_1^*}{P_1^*} = \frac{I^2\Sigma(2/\pi) - 2I\sqrt{\Sigma}\sqrt{2/\pi} g(\sigma_w, \Sigma, A, I)}{I^2\Sigma(2/\pi) + 2I\sqrt{\Sigma}\sqrt{2/\pi} g(\sigma_w, \Sigma, A, I) + 16cA} \geq 0. \tag{2.21}$$

Proof of Proposition 1: See Appendix A.

Lacking an inefficiency-introducing tension when the firm chooses to go public, the IPO allocation is used to align the outsider's and firm's marginal benefits of information.[11] The larger the initial gap between the outsider's and firm's marginal benefits, the larger an allocation is provided to the outsider. With this intuition, interpreting κ^* is straightforward. Equation (2.18) implies that the outsider's allocation is decreasing in $g(\sigma_w, \Sigma, A, I)$. Increasing the profitability of trading results in better alignment of the outsider's and firm's incentives, so less additional incentives are needed. Equation (2.18) also implies that κ^* is increasing in the size of the firm's expansion project (I) and productivity variance (Σ). Because the firm's value of information is increasing in I and Σ, the firm provides more incremental incentives when I and Σ are large. Given that the cost of information is strictly positive, c does not affect κ^* because it symmetrically affects the outsider's and firm's marginal incentives for information production.

The firm induces first-best information production (as if it directly controlled information production) through its selection of the IPO allocation. By wielding full bargaining power, the firm is able to set the price of the offering such that the outsider is indifferent between participation and abstention. As a result, the firm keeps all of the valued created through additional information production. Lacking a tension to prevent first-best information production, the firm selects the allocation resulting in the marginal cost of information's being equal to its marginal benefit to the firm. While a true monopolist is unlikely to have no bargaining power, the monopolist outsider represents a broad group of information producers (considered in Section 3), which are more likely to have little to no bargaining power with the firm.[12]

Underpricing provides compensation for the outsider's incremental, future information production costs, which is a novel explanation of the widely-documented underpricing phenomenon.[13]

[11] The firm's complete bargaining power over the outsider eliminates one source of potential inefficiency. While the complete bargaining power assumption is extreme, the lack of inefficiency maintains if the firm keeps a constant portion of the value created by additional information production. However, inefficiency results if the firm's portion depends on the total value created. Liquidity costs provide a second potential source of inefficiency, but only introduce inefficiency by preventing the firm from going public when such costs are excessive. When the firm chooses to go public, liquidity costs are a flexible portion of the wealth transfer used to meet the outsider's participation constraint.

[12] Information producers are arguably relatively scarce, particularly during IPO waves. In such a case, the firm would likely lose value to the information producers through increased underpricing.

Without this additional source of compensation, the outsider would not participate in the IPO, so underpricing can be thought of as a means of securing the outsider's participation. The firm's direct compensation of additional net production costs is provided by the "money left on the table", which is equal to

$$\left(\frac{I^2\Sigma(2/\pi)}{16c} - \frac{g(\sigma_w,\Sigma,A,I)^2}{4c}\right) - \left(\frac{g(\sigma_w,\Sigma,A,I)I\sqrt{\Sigma}\sqrt{2/\pi}}{4c} - \frac{g(\sigma_w,\Sigma,A,I)^2}{2c}\right). \tag{2.22}$$

The first term in parentheses captures the incremental cost of information production, while the second term in parentheses adjusts for the incremental trading revenues earned from having more information. The firm pays for the increased information production partially through money left on the table, and partially through increased liquidity costs to its initial investors.

The solution given in Proposition 1 is conditioned on the firm's deciding to go public. Given the firm's and outsider's decisions if the firm goes public, the manager makes a $t = 0$ comparison between the firm's public and private values. The firm will choose to go public if the maximized value given by Equation (2.17) is greater than the expected value of the private firm. This is the case when

$$I\sqrt{\Sigma}\sqrt{2/\pi} \geq 2g(\sigma_w,\Sigma,A,I). \tag{2.23}$$

The decision to go public is very similar to the decision in Subrahmanyam and Titman [1999].[14] The benefit provided by an informative price is weighed against the liquidity costs born by investors. As the liquidity costs to investors increase, through $g(\sigma_w,\Sigma,A,I)$, the firm becomes less likely to go public. On the other hand, a larger I or Σ, which benefits more from price feedback, makes a firm more likely to go public.[15] The analysis highlights that firm characteristics, and the associated desire for an informative price, can impact the decision to go public.

[13] Several examples of early work in this area include Ibbotson [1975], Ibbotson and Jaffe [1975] and Ritter [1984].

[14] Chemmanur [1993] provides an alternative, information-production-based motivation for going public. In that context, information production at an IPO affects the secondary-market price for an SEO, and the firm maximizes joint proceeds from the IPO and the SEO.

[15] Several studies provide empirical support for these benefits and costs of going public. Poulson and Stegemoller [2008] finds that firms with greater growth opportunities are more likely to go public, and Boehmer and Ljungqvist [2004] and Pagano et al. [1998] show that the likelihood of a firm going public is increasing in the firm's investment opportunities. Bharath and Dittmar [2010] provides evidence consistent with liquidity concerns' impacting firms' decisions to go and stay public.

Figure (2.2) provides an example of how optimal allocations and underpricing vary with firm characteristics by letting $A = 10$, $I = 10$, $\Sigma = 5$, $c = 10$, $\sigma_w = 1$ and $g(\sigma_w, \Sigma, A, I) = (1 + \frac{I}{2A})\sigma_w\sqrt{\Sigma}$.[16] Panel (1) shows that allocations and underpricing are both increasing in the size of the investment opportunity. $\underline{I}$ indicates where Equation (2.23) is binding; hence, for investment opportunities smaller than $\underline{I}$ the firm stays private. Panels (2) and (3) show that productivity variance and the cost of information impact underpricing but not allocations. This is true for productivity variance because the functional form of trading profits used in this example is linear in $\sqrt{\Sigma}$, as is the value of information to the firm. Panel (4) highlights that as trading costs increase (through higher noise trading order flow standard deviation) they eventually become prohibitively costly and the firm elects to stay private (for values greater than $\underline{\sigma_w}$).

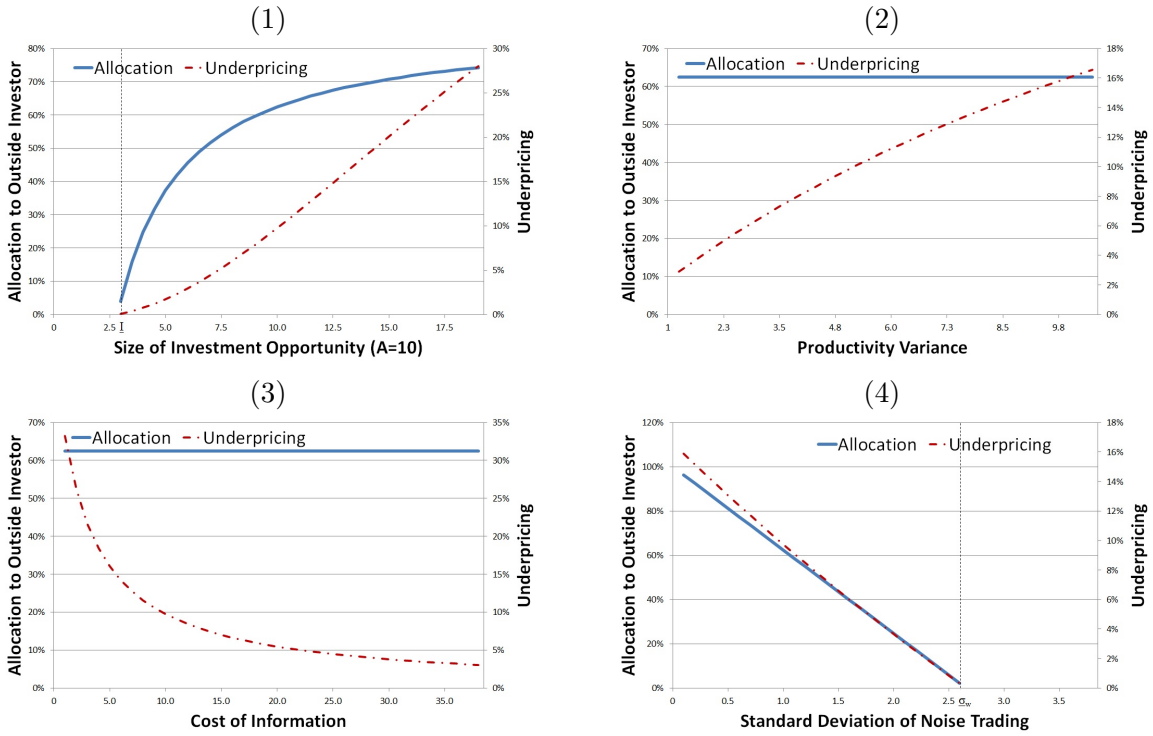
This section demonstrates that the firm can use its IPO to incentivize future information production. Using a single, monopolistic information producer highlights two features: (i) underpriced IPO allocations can align the firm's and outsider's information production incentives; and (ii) IPOs allow firms to indirectly control information production and maximize firm value. The next section shows that these same features result from a model explicitly addressing dispersed information.

2.2 Incorporating Dispersed Information and Intermediaries

This section analyzes the effects of dispersed information and intermediation on a firm's ability to incentivize future information production through its IPO. While dividing information among multiple investors introduces a free-rider problem, underwriters are able to provide new incentives for information production by enforcing a repeated game with investors. Allocating underpriced shares to multiple investors is shown to be an effective means to induce future information production and to maximize firm value.

[16] This functional form is given by the numerically-approximated expected trading profits when price feedback is incorporated into a one-period Kyle [1985] model. Details of the numerical analysis are available in Chapter 4.

Figure 2.2: Underpricing, Allocations and Firm Characteristics: Monopolistic Information Producer. Over regions where the allocations and underpricing are not present the firm does not go public. The non-varying parameters for each panel are set at $A = 10$, $I = 10$, $\Sigma = 5$, $c = 10$ and $\sigma_w = 1$. Expected trading profits in these graphs are assumed to take the form $\rho(1 + \frac{I}{2A})\sigma_w\sqrt{\Sigma}$.



2.2.1 Model Set-Up

The structure of the firm's productivity and the information production technologies are unchanged from the previous model. Rather than a monopolist's controlling all of the technologies, each member of a countably infinite set of investors controls one of the N information production technologies. The countably infinite set creates a competitive fringe of potential investors for each individual technology.

Dispersing control of the information production technologies weakens the incentives for individuals to produce information. The marginal value of information to the firm is given by substituting $\sqrt{\frac{n}{N}}$ for ρ in Equation (2.13) and then differentiating with respect to n:

$$\frac{I\sqrt{\Sigma}\sqrt{2/\pi}}{4\sqrt{n}\sqrt{N}} \tag{2.24}$$

which is decreasing in the amount of information produced, n. This is not problematic when the firm, or a monopolistic outsider, controls information production. However, when dispersed individuals control their own information production, the incentive provided by helping the firm make better decisions decreases as more investors become involved.

Individual allocation size is less relevant than in the previous model because each investor's decision to produce information is discrete. While a larger allocation size will increase an investor's incentive to produce information, the zero-one nature of the information technology prevents, in equilibrium, individual allocation size from having an impact on aggregate information production. Given the relative unimportance of individual allocation size, to simplify the firm's problem I assume $\hat{\kappa}$ of the firm is sold in the IPO.[17] Fixing the portion of the firm sold focuses the firm's problem on choosing the level of information production through the number of allocations, n.

The individual information producers have trading profit incentives similar to the prior model. I continue to assume that trading profits are a linear function of the correlation between the

[17] When analyzing the model's equilibrium, varying $\hat{\kappa}$ has little impact on the value of the firm. In reality, higher underwriter fees (which are typically 7% of the proceeds Chen and Ritter [2000] and other costs associated with larger offerings (see, e.g., Leland and Pyle [1977]) are likely to weigh against any information-production motivation for increasing the offer size. Were κ allowed to vary, the first-best equilibrium would result when possible, and otherwise a corner solution of $\kappa = 100\%$ would result if the firm chooses to go public.

cumulative signal and the true productivity, so expected trading profits are assumed to be $\sqrt{\frac{n}{N}} \times h(\sigma_w, \Sigma, I, A)$. Because the individual signals are i.i.d., for each of the n information producers that purchase a signal, individual expected trading profits are given by $\frac{h(\sigma_w,\Sigma,I,A)}{\sqrt{n}\sqrt{N}}$. To ensure proper sub-games exist, I assume that all individual signals are publicly revealed after trading is complete.

Including an intermediating underwriter increases the realism of the model and provides a potential source of incentives for future information production. Underwriters have become ubiquitous in IPO offerings and bookbuilding has become the dominant method of issuing in most countries [Jenkinson and Jones, 2009]. Underwriters also have a tendency to include investors in their offerings repeatedly [Binay et al., 2007, Gondat-Larralde and James, 2008]. The repeated game implied by these underwriter-investor relationships introduces the possibility that future benefits could incentivize investors' information production.

I make several assumptions regarding the underwriter. First, I assume the underwriter earns non-monetary utility $\epsilon > 0$ for each IPO it facilitates, and that the underwriter can costlessly monitor information production.[18] Furthermore, I assume that the underwriter's actions are fully observable to firms and investors. These assumptions give the underwriter a reputation and a desire to continue facilitating IPOs in the future.[19] I also assume that any particular underwriter only issues IPOs for one type of firm, making firm characteristics homogeneous within an underwriter's issues. Finally, I assume investors discount future benefits from an underwriter at rate r, which can reflect the underwriter's frequency of offerings, which are assumed to occur indefinitely.

2.2.2 Repeated-Game Equilibrium

Including the underwriter in each sub-game of the infinitely-repeated game modifies the game structure slightly from that presented in Figure (2.1). The firm has an additional choice at $t = 0$:

[18] Monitoring could reasonably be accomplished by tracking an investor's trading activity or by regularly speaking with an investor's research division. Underwriters routinely monitor trading activity over the month after the IPO [Aggarwal, 2003]. Given the relationships between investors and underwriters, it is also likely that regular communication continues after individual IPOs.

[19] Chemmanur and Fulghieri [1994] considers theoretical motivations for underwriters to acquire reputation and Beatty and Ritter [1986] and Carter and Manaster [1990] are among the first to empirically examine underwriters' reputations.

it can either go public using the underwriter (and the associated repeated-game incentives), or go public without using the underwriter. Additionally, after observing the offer price and allocations, the underwriter decides whether or not to monitor information production and how to punish any identified non-producers. As a result of the underwriter's ability to monitor information production, and the observability of the underwriter's monitoring and individual investors' signals after trading, there is no asymmetric information present at any of the decision nodes within this infinitely-repeated game. The appropriate equilibrium concept is that of a sub-game perfect Nash equilibrium.

Definition 1. *A sub-game perfect Nash equilibrium of this game consists of:*
(i) firms' strategies for using the underwriter, offer prices $P_1(t)$ *and allocation vectors* $\vec{a}(t)$ *to* $n(t)$ *investors;*
(ii) investors' strategies for IPO participation and producing information after receiving an allocation; and
(iii) the underwriter's strategies for monitoring information production and punishing investors who do not produce information;
such that no single firm, investor or the underwriter can make a profitable one-time deviation from the equilibrium strategies.

Using this definition, an equilibrium to the game is given by:

Proposition 2. *A sub-game perfect, stationary Nash equilibrium is given by the following strategies:*
(i) Firms will utilize the underwriter if the underwriter-supported equilibrium maximizes firm value and the underwriter's reputation is intact, that is, the underwriter has not deviated from its equilibrium strategy in the past. Firms set offer prices equal to P_1^* *and allocate* $\frac{\hat{\kappa}}{n^*}$ *of the firm to each of* n^* *investors in order to satisfy investors' participation and information production conditions.*
(ii) Investors pay offer price P_1^* *for* $\frac{\hat{\kappa}}{n^*}$ *of the firm if all current and future profits from participation are weakly greater than zero. Investors produce information after receiving an allocation if their benefits from information production, including trading profits, their share of the firm's value*

increase, and all future profits from participation, exceed the cost of producing information, and the underwriter's reputation is intact.

(iii) The underwriter will monitor information production if the firm sets P_1 *and* $\vec{a}$ *such that all investors' receiving allocations will participate in the offering and produce information subsequently. If the underwriter monitors, the underwriter will exclude from all future offerings investors who do not produce information.*

Proof: See Appendix A.

The proposed equilibrium's stationary nature makes it likely to be the relevant equilibrium for analysis. The folk theorem suggests that alternative, non-stationary equilibria exist. However, non-stationarity suggests that the underwriter treats at least two homogeneous firms differently, which is seemingly counter-intuitive. Additionally, if competition among underwriters is introduced, then firms would avoid underwriters during sub-games with abnormally high underpricing. The potential for firms to avoid such undesirable IPO conditions makes a non-stationary equilibrium unlikely. Another set of equilibria exists where each equilibrium is stationary after the first IPO, but the equilibria vary in the first IPO's underpricing. In the proposed equilibrium, the positive underpricing in the first IPO leads to investors' having positive expected profits from participation in the infinitely-repeated game. However, to ensure investors' initial participation, all that is necessary is that participation gives non-negative expected profits. Accordingly, the offer price in the first IPO can be raised until this point is met, or alternatively, the offer price could be lowered until the firm is indifferent between using or not using the underwriter.[20] While this set of equilibria are distinct from the proposed equilibrium, the differences are isolated to the first period of an infinitely-repeated game, making the differences among equilibria insignificant.

[20] Similar alterations are not possible for later IPOs. Investors' future information production decisions depend on the promise of future profits, so lowering any future profits by increasing the offer price will reduce the future-profit incentive and inhibit information production. While the offer price could be lowered for later IPOs, any competition in underwriting would likely prevent such rent extraction from firms.

2.2.3 Equilibrium Solution

To solve for P_1^* and n^*, I begin by analyzing the investors' conditions for participation and information production. As in the prior model, investors will only participate in an offering if they expect to be weakly better off. Anticipating that they will produce information if provided an allocation and that they will continue to participate in all future IPOs (as both are optimal in equilibrium, see Proposition 2), the investors participate if:

$$\frac{h(\sigma_w, \Sigma, I, A)}{\sqrt{n}\sqrt{N}} + \frac{\hat{\kappa}}{n}(E[P_4] - P_1) + \sum_{1}^{\infty} \frac{f(n, I, \Sigma, \sigma_w, A, c)}{(1+r)^t} - \frac{c}{N} \geq 0 \tag{2.25}$$

where $\frac{\hat{\kappa}}{n}$ is the portion of the firm allocated to each of the n investors, $f(n, I, \Sigma, \sigma_w, A, c)$ is the expected profit in each offering, and r is the discount rate.[21] Given the stationary nature of the equilibrium, the expected profit in the current offering will be equal to the expected profit in each future offering:

$$f(n, I, \Sigma, \sigma_w, A, c) = \frac{h(\sigma_w, \Sigma, I, A)}{\sqrt{n}\sqrt{N}} + \frac{\hat{\kappa}}{n}(E[P_4] - P_1) - \frac{c}{N}. \tag{2.26}$$

By substituting Equation (2.26) into Equation (2.25) the investors' participation constraint simplifies to:

$$\frac{h(\sigma_w, \Sigma, I, A)}{\sqrt{n}\sqrt{N}} + \frac{\hat{\kappa}}{n}(E[P_4] - P_1) - \frac{c}{N} \geq 0. \tag{2.27}$$

If $P_1 < E[P_4]$ and Equation (2.27) at least weakly binds, underpricing provides compensation ensuring outsider participation. Due to outsiders' participation depending on profits from the underpriced allocation, those not receiving an allocation will not participate in equilibrium since informed trading profits will be insufficient to cover the information acquisition costs.

Investors purchasing allocations in the IPO will weigh the benefits of information production against the cost of acquiring their signal. Benefits accrue from trading profits, the investor's share of the value they create, and repeated-game incentives introduced by the underwriter. The investors

[21] The existence of the competitive fringe reduces the investors' outside option to zero. Were the number of investors finite, the outside option would be positive due to expected positive trading profits (as in the monopolist setting).

will produce information if:

$$\frac{h(\sigma_w, \Sigma, I, A)}{\sqrt{n}\sqrt{N}} + \frac{\hat{\kappa}}{n}\frac{I\sqrt{\Sigma}\sqrt{2/\pi}}{4\sqrt{n}\sqrt{N}} + \sum_{1}^{\infty}\frac{f(n, I, \Sigma, \sigma_w, A, c)}{(1+r)^t} \geq \frac{c}{N}. \tag{2.28}$$

Substituting Equation (2.26) for $f(n, I, \Sigma, \sigma_w, A, c)$, investors will produce information if:

$$\frac{\hat{\kappa}}{n}E[P_4 - P_1] + \frac{r\hat{\kappa}I\sqrt{\Sigma}\sqrt{2/\pi}}{4n^{3/2}\sqrt{N}} + \frac{(1+r)h(\sigma_w, \Sigma, I, A)}{\sqrt{n}\sqrt{N}} - \frac{rc}{N} \geq \frac{c}{N} \tag{2.29}$$

Before addressing the firm's problem, notice that the repeated game only provides incentives when Equation (2.27) holds with strict inequility, i.e. when IPO participation is strictly profitable.

The firm's problem is similar to the prior model with the exception that the firm now selects n rather than κ. The firm solves:

$$\begin{aligned} \underset{n, P_1}{\text{Max}} \quad & (1-\hat{\kappa})\left(A + \frac{1}{2}\sqrt{\frac{n}{N}}I\sqrt{\Sigma}\sqrt{2/\pi}\right) + \hat{\kappa}P_1 - n\left(\frac{h(\sigma_w, \Sigma, I, A)}{\sqrt{n}\sqrt{N}}\right) \\ \text{subject to:} \quad & \text{Equation (2.27) and Equation (2.29)} \end{aligned} \tag{2.30}$$

The firm's problem assumes the offer price and allocation vector is set to ensure the participation and information production of outsiders who receive allocations. The solution to the firm's problem is given in the following proposition, which describes three different equilibria that correspond to varying ranges of firm characteristics' parameter space. Only one of these equilibria utilizes the sub-game perfect, repeated-game equilibrium described in Proposition 2. The delineations between equilibria depend on all of the model's parameters, and therefore the proposition characterizes the regions based on the relative value of information (e.g. information is more valuable when I and Σ are larger) and the degree of information dispersion (N).

Proposition 3. *Given the model's assumptions, if the firm goes public, then when information value or dispersion is:*

(i) low, the firm can allocate shares to multiple outsiders such that the marginal benefit of information to the firm is equal to its marginal cost and the firm does not use the underwriter;

(ii) moderate, the firm cannot provide sufficient allocations to induce first-best information production, and does not provide additional underpricing through the underwriter;

(iii) high, the firm cannot provide sufficient allocations to induce first-best information production, but uses the underwriter and additional underpricing to create repeated-game incentives for information production.

In all cases, the firm underprices its shares in the primary market.

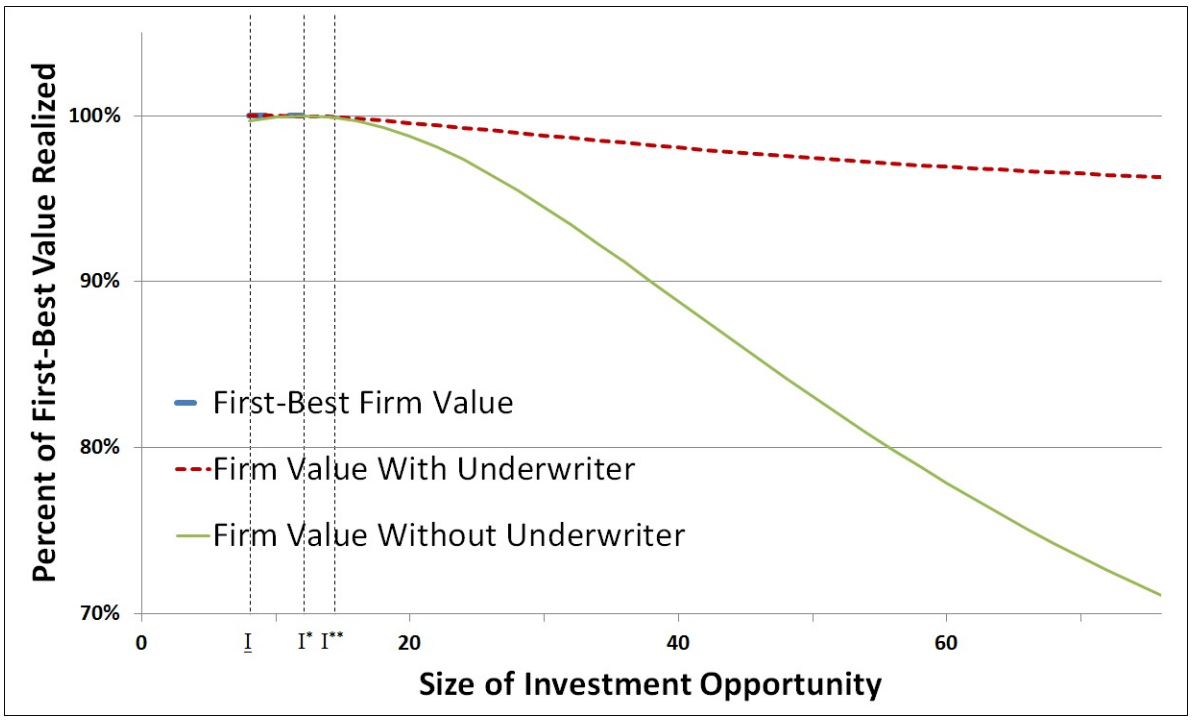
Proof of Proposition 3: See Appendix A.

Before discussing the characteristics of the possible equilibria, note that the underwriter-supported equilibrium is easily feasible for realistic parameter values (on a relative basis). For illustration, I set $A = 10$, $\Sigma = 5$, $c = 40$, $N = 50$, $\sigma_w = 1$, $r = 8\%$, $\hat{\kappa} = 30\%$ and Figure (2.3) shows the possible equilibria as the size of the investment opportunity (I) is varied.[22] The underwriter-supported equilibrium dominates for values of I greater than I^{**}, which is the majority of Figure (2.3). While the first-best equilibrium (between $\underline{I}$ and I^*) and the second-best equilibrium without underwriter support (between I^* and I^{**}) do exist, they occur over parameters that likely represent a small subset of IPO firms. Given the other parameters of the model, the first-best equilibrium applies when growth option make up less than 6.7% of firm value, and the second-best equilibrium without the underwriter applies when growth options make up between 6.7% and 8.8% of firm value. On the other hand, when growth options make up 71% of firm value, as is estimated by Benveniste et al. [2003], this corresponds to $I = 72$, which is on the right edge of Figure (2.3). At $I = 72$, the first-best equilibrium is not attainable, and utilizing the underwriter to increase information production results in 36% higher firm value than is possible without the underwriter. Underwriters' abilities to facilitate increased information production, allowing for higher firm values, provides a new explanation for their intermediating role in IPOs.

In the low information value/dispersion equilibrium, the firm is able to use IPO allocations alone to incentivize future information production. In particular, the firm is able to incentivize first-best information production, and retains all of the value created. Competition reduces the net profits of the information producers to zero. While this is the most appealing equilibrium to the

[22] In this figure and those that follow, the aggregate expected trading profits have been assumed to be of the same functional form as in the preceding section. Specifically, $h(\sigma_w, \Sigma, I, A) = (1 + \frac{I}{2A})\sigma_w\sqrt{\Sigma}$.

Figure 2.3: Firm Value Comparison and Relevance of Equilibria: Dispersed Information Producers. First-best firm value is only feasible between $\underline{I}$ and I^*. In other regions where the firm goes public, firm value with and without the underwriter are both feasible. I^{**} delineates where the two strategies produce equal firm values, and thus divides the optimal strategy between the regions. The highest line in any region is the optimal strategy over that regions parameters. The non-varying parameters for each panel are set at $A = 10$, $\Sigma = 5$, $c = 40$, $N = 50$, $\sigma_w = 1$, $r = 8\%$ and $\hat{\kappa} = 30\%$. Expected trading profits in these graphs are assumed to take the form $\sqrt{\frac{n^*}{N}}(1 + \frac{I}{2A})\sigma_w\sqrt{\Sigma}$.



firm, it only arises for sufficiently large $\hat{\kappa}$ given the firm's characteristics and the firm chooses to go public.[23] Panel (1) of Figure (2.4) shows this region as a function of I.[24] Between $\underline{I}$ and I^* the firm is able to achieve the first-best outcome. For values less than $\underline{I}$, the firm stays private, and for values greater than I^*, the total allocation is insufficient to support first-best information production.

In the equilibrium having moderate information value/dispersion, the firm cannot achieve first-best information production through allocations, and reduces the number of information producers who receive allocations accordingly. Technically, this equilibrium is defined by both of the outsiders' constraints binding. In the interior of the first-best case, the incentive compatibility constraint is slack as the allocations are more than sufficient for aligning incentives. However, when the allocations are no longer sufficient to achieve first-best, the number of information producers must be reduced. In this case, the firm achieves second-best information production, but still retains all of the value created by information production, again due to competition. Panel (1) of Figure (2.4) shows this region between I^* and I^{**}.[25] Figure (2.5) highlights that in this region the number of information producers receiving allocations decreases, as a percentage of the first-best level, as the value of information increases.

In the high information value/dispersion equilibrium, the firm uses additional underpricing to provide repeated-game incentives via the underwriter. In this equilibrium, the firm trades off increased information production against reduced proceeds associated with additional underpricing.[26] The use of additional underpricing implies that the outsiders' participation constraint is slack, and only the incentive compatibility constraint binds. Panel (1) of Figure (2.4) shows this region to the right of I^{**}. Figure (2.5) shows that information production is higher (when information is more valuable) in this equilibrium relative to the case without underwriter-supported, additional underpricing, although information production in this case is still less than first-best.

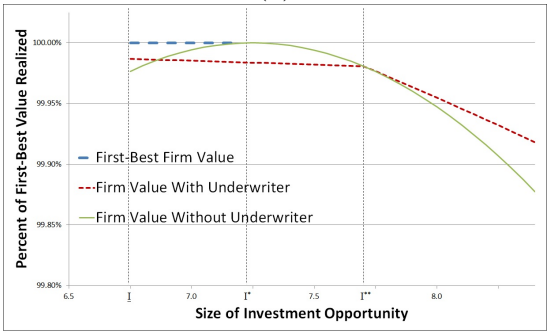
In each of the possible equilibria, underpricing is used to either ensure outsider participation,

[23] These conditions are given in the proof of Proposition 3.

[24] To highlight the differences between possible equilibria, Figure (2.4) focuses on a small subset of the parameter space in Figure (2.3), and as a result the value differences between the equilibria are relatively small. Firm values

Figure 2.4: Firm Value Comparison: Dispersed Information Producers. Panels (1) through (4) show firm value as a percentage of first-best firm value for each of the three equilibria described in Proposition 2. First-best firm value is only feasible between $\underline{X}$ and X^*, where X represents any of the parameters being varied. In other regions where the firm goes public, firm value with and without the underwriter are both feasible. X^{**} delineates where the two strategies produce equal firm values, and thus divides the optimal strategy between the regions. The highest line in any region is the optimal strategy over that regions parameters. The non-varying parameters for each panel are set at $A = 10$, $I = 8$, $\Sigma = 5$, $c = 10$, $N = 50$, $\sigma_w = 1$, $r = 8\%$ and $\hat{\kappa} = 30\%$. Expected trading profits in these graphs are assumed to take the form $\sqrt{\frac{n^*}{N}}(1 + \frac{I}{2A})\sigma_w\sqrt{\Sigma}$.

(1)



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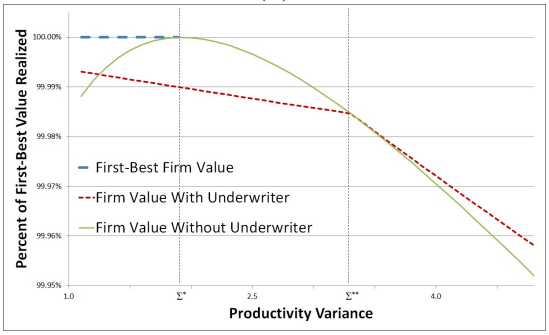
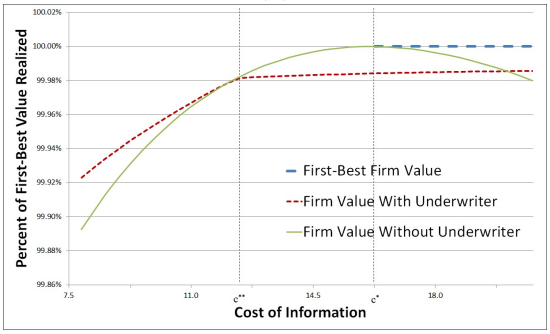


(3)



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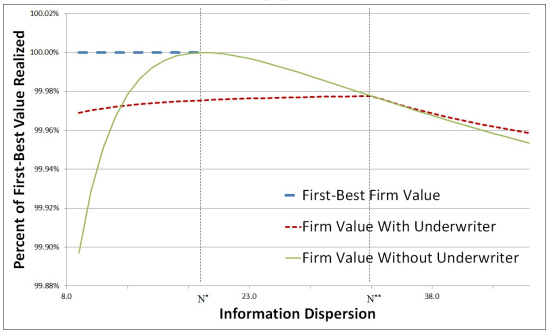
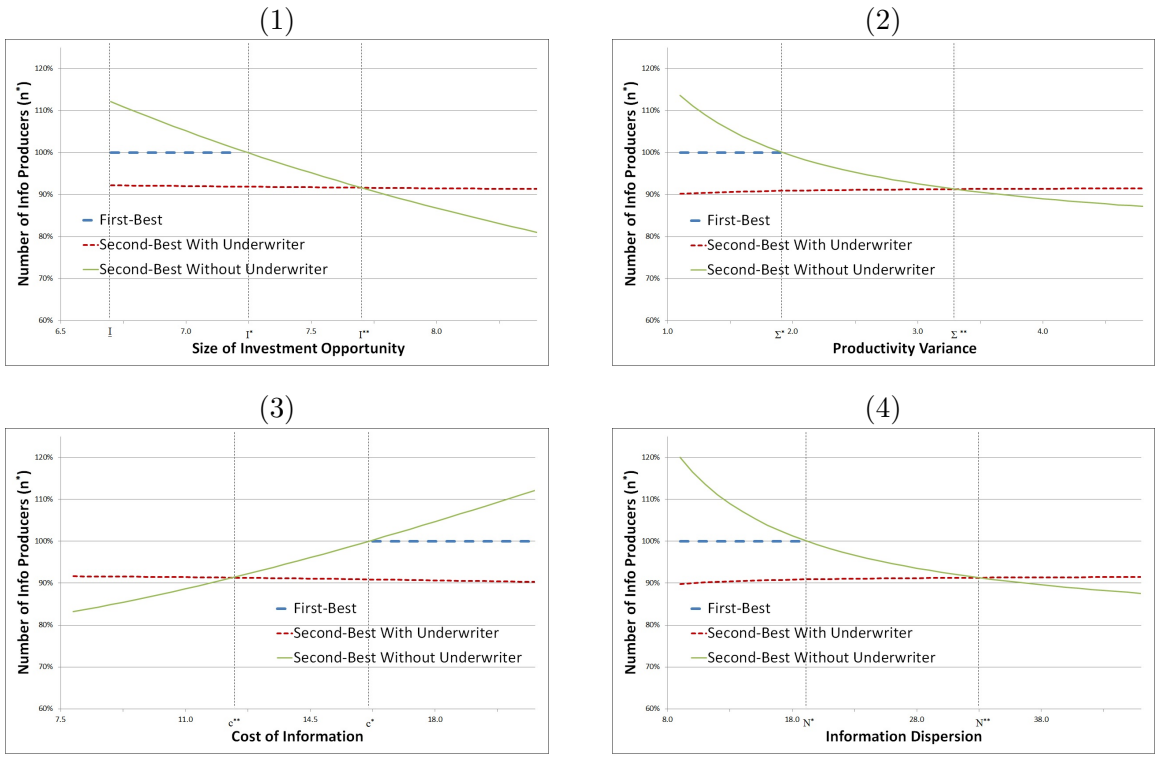


Figure 2.5: Number of Information Producers: Dispersed Information Producers. Panels (1) through (4) show the optimal n^* as a percentage of n^* under first-best information production for each of the three equilibria described in Proposition 2. First-best information production is only feasible between $\underline{X}$ and X^*, where X represents any of the parameters being varied. The second-best strategies, with and without the underwriter, are feasible in all regions. X^{**} delineates where the two strategies produce equal firm values, and thus divides the optimal strategy between the regions. The non-varying parameters for each panel are set at $A = 10$, $I = 8$, $\Sigma = 5$, $c = 10$, $N = 50$, $\sigma_w = 1$, $r = 8\%$ and $\hat{\kappa} = 30\%$. Expected trading profits in these graphs are assumed to take the form $\sqrt{\frac{n^*}{N}}(1 + \frac{I}{2A})\sigma_w\sqrt{\Sigma}$.



or to provide additional information production incentives via the underwriter. Figure (2.6) shows how the degree of underpricing varies with firm characteristics across the various equilibria. Panels (1) through (4) show that when first-best is feasible, or when the underwriter is utilized, underpricing is increasing as the value/dispersion (cost) of information increases (decreases). However, in the regions where first-best is not feasible and the underwriter is not utilized, the opposite relationships result. This is because individual trading profits increase faster than the optimal number of information producers, reducing the need for underpricing to satisfy the outsiders' participation constraint. Given the prevalence of bookbuilding in IPOs, only a small subset of firms are likely to be characterized by parameters in the region where underpricing decreases in the value or dispersion of information.

Underpricing is also dependent on the characteristics of the underwriter and offering. Figure (2.7) shows how underpricing varies with the discount rate applied to future IPO profits and with the percentage of the firm sold in the IPO. Panel (1) shows that underpricing is decreasing in the discount rate. This is because at low discount rates, future IPO profits serve as a more effective incentive for future information production, so the firm allocates shares to more outsiders. When the discount rate is high, additional underpricing is not an effective means of incentivizing information production, and the firm does not utilize the underwriter (above r^*). Panel (2) shows that underpricing is decreasing in the percentage of the firm sold in the IPO. As the percentage of the firm sold in the IPO decreases, the allocation per outsider also decreases. To provide the same level of incentives underpricing must increase. This is consistent with evidence in Ljungqvist and Wilhelm [2002] showing that the percent of the offering allocated to institutional investors is negatively related to underpricing.

The underpricing required to induce future information production is likely larger than the underpricing required for truthful revelation of information during bookbuilding. In the high value/dispersion equilibrium, additional underpricing is required beyond that which would be re-

are shown as a percentage of first-best firm value, regardless of whether first-best is attainable.

[25] I^{**} is where equilibrium (ii) and (iii) give equivalent values and is discussed in the proof of Proposition 3.

[26] This is similar to the trade-off highlighted in Sherman and Titman [2002].

Figure 2.6: Underpricing and Firm Characteristics: Dispersed Information Producers. Panels (1) through (4) show underpricing as a function of firm characteristics. The first-best equilibrium is feasible between $\underline{X}$ and X^*, where X represents any of the parameters being varied. Between X^* and X^{**} the second-best equilibrium without the underwriter is optimal. In the remaining region the second-best equilibrium with the underwriter is optimal. The non-varying parameters for each panel are set at $A = 10$, $I = 8$, $\Sigma = 5$, $c = 10$, $N = 50$, $\sigma_w = 1$, $r = 8\%$ and $\hat{\kappa} = 30\%$. Expected trading profits in these graphs are assumed to take the form $\sqrt{\frac{n^*}{N}}(1 + \frac{I}{2A})\sigma_w\sqrt{\Sigma}$.

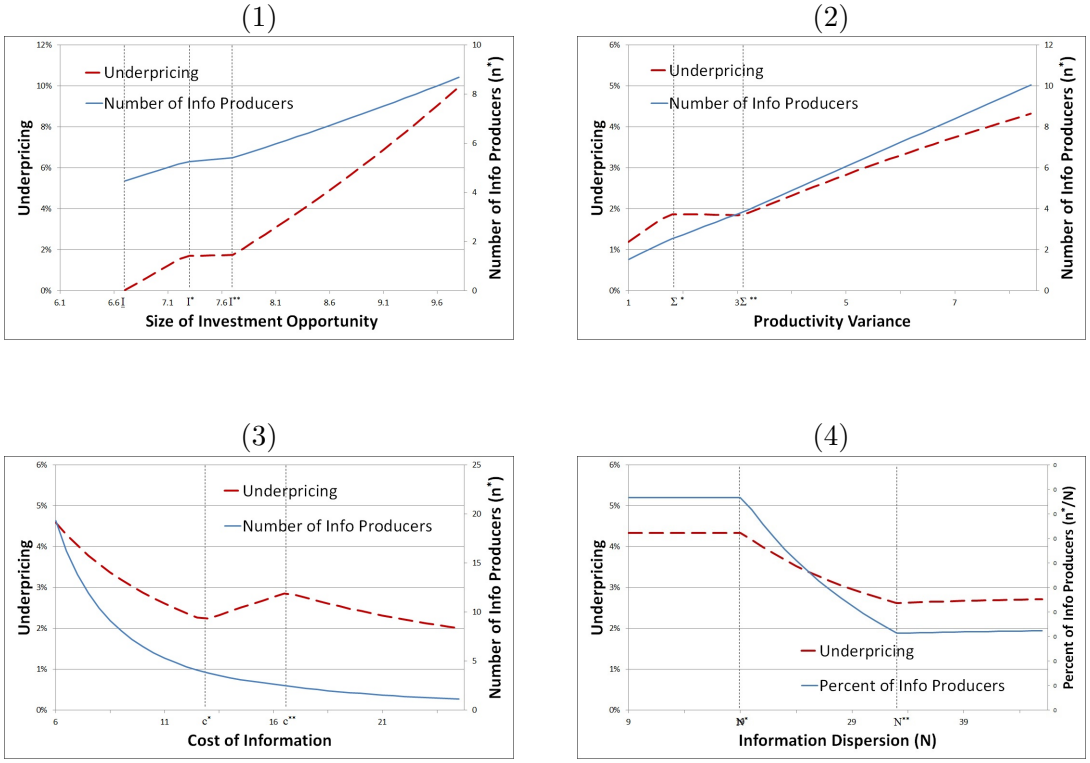
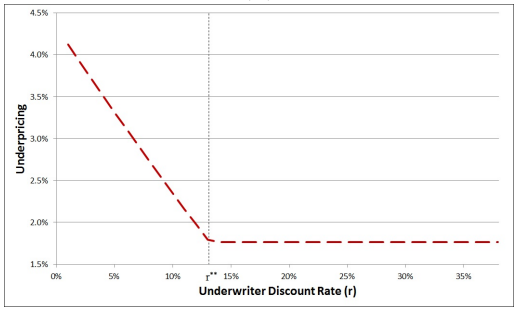


Figure 2.7: Underpricing and Underwriter and Offering Characteristics: Dispersed Information Producers. Panels (1) and (2) show underpricing as a function of the underwriter and offering characteristics. The second-best equilibrium with the underwriter occurs in the region to the left of r^{**} in Panel (1), and to the right the second-best equilibrium without the underwriter is optimal. In Panel (2), only the second-best equilibrium with the underwriter is shown. The non-varying parameters for each panel are set at $A = 10$, $I = 8$, $\Sigma = 5$, $c = 10$, $N = 50$, $\sigma_w = 1$, $r = 8\%$ and $\hat{\kappa} = 30\%$. Expected trading profits in these graphs are assumed to take the form $\sqrt{\frac{n^*}{N}}(1+\frac{I}{2A})\sigma_w\sqrt{\Sigma}$.

(1)



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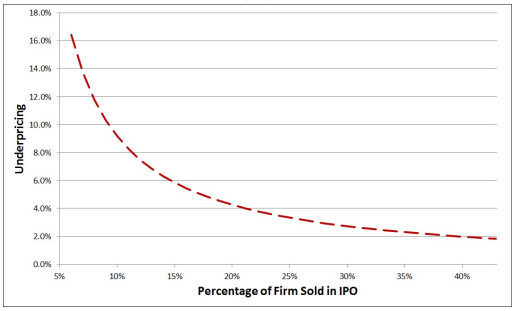


quired for participation. The additional profits support the repeated-game incentives, and are not needed in a one-time game. Because information is acquired prior to receiving underpriced allocations in bookbuilding models, the additional underpricing is unnecessary. The need for post-IPO incentive alignment increases the underpricing required for future information production.

In either monopolistic or dispersed information settings, the firm is able to incentivize future information production through underpriced IPO allocations. While allocations do not always provide sufficient incentives when information is dispersed, the ability of an underwriter to coordinate between one-time issuers and repeat investors allows for additional incentives. The underwriter enforces a repeated game in which investors produce information for current IPOs, and are subsequently rewarded with more profitable IPO allocations.

2.3 Empirical Implications

The prevailing characteristics of IPO firms and the IPO process place focus on the implications of the underwriter-supported model and equilibrium. First, firms conducting IPOs typically have a majority of their value attributed to growth options versus assets-in-place.[27] When growth option value dominates the value of assets-in-place, the desire for information is often high and the underwriter-supported equilibrium maximizes firm value. Second, Jenkinson and Jones [2009] note that bookbuilding has become the dominant method of issuing in most countries. Taken together, these characteristics suggest that the relevant equilibrium is that in which firms utilize underwriters to incentivize high levels of information production.

The parameters representing firm characteristics link the model's implications to several established IPO underpricing regularities. Investment opportunity size, productivity variance and information cost all impact the firm's desire for information, and therefore:

Empirical Implication 1. *Underpricing of the IPO is:*

(i) increasing in the size of the firm's investment opportunity;

[27] Aggarwal et al. [2009] documents that growth options make up a majority of firm value for firms who go public and Benveniste et al. [2003] estimates that 71% of the average IPO firm's offer price represents growth opportunities.

(ii) increasing in productivity variance (post-IPO uncertainty); and

(iii) decreasing in the cost of information.

Figure 2.6 provides graphical evidence supporting these relations.[28] When information is more desirable (larger investment opportunity, more productivity variance, or less costly information) the firm will incentivize more information production by allocating shares to more investors.[29] This reduces the size of individual allocations and therefore more underpricing is needed to align post-IPO information production incentives.

Several empirical studies provide evidence supporting Empirical Implication 1. Consistent with parts (i) and (ii), Benveniste et al. [2003] and Chung et al. [2005] provide evidence that firms with more growth options experience more underpricing. Beatty and Ritter [1986] relates underpricing to uncertainty surrounding the firm at the time of the IPO by analyzing the number of uses of the proceeds. Their result is consistent with part (ii) if a portion of uncertainty at the time of the IPO is only resolvable in the future.

The motivation for future information production also gives rise to an alternative explanation for the documented empirical relation between underpriced IPOs and subsequent SEOs. Within the model, firms optimally invest in the expansion project when the expected productivity exceeds a threshold (i.e., greater than one, giving an NPV positive project, see Equation (2.5)). Given a sufficient return, the firm will invest I to expand, and because underpricing at the IPO is increasing in I:

Empirical Implication 2. *Underpricing is positively related to post-IPO investment for firms that experience sufficiently high returns.*

To the extent that this investment is financed using a SEO, this implication is similar to Welch [1989]. While underpricing in Welch [1989] signals the firm's type in the presence of asymmetric information at the IPO, my model provides a similar prediction with symmetric information at

[28] The relevant region in each graph is the right-most, representing the equilibrium in which the underwriter facilitates information production.

[29] Sherman and Titman [2002] also endogenizes costly information production and predicts a positive relation between underpricing and the value of information.

the IPO and the investment decision, but asymmetric information in the market microstructure. Additionally, because the firm is learning from prices, the firm's subsequent decision depends on the realized returns. This prediction is consistent with both major findings in Jegadeesh et al. [1993]: (i) firms with more underpricing are more likely to conduct an SEO, and (ii) firms with higher post-IPO abnormal returns are more likely to conduct an SEO.[30] Jegadeesh et al. [1993] hypothesizes that only the second effect is due to price feedback (which they term "market-feedback"); in contrast, my analysis shows that both effects can be due to price feedback.

While not differentiating among firms regarding investment probability, my analysis does predict differences in return variance from the IPO to the investment decision. Firms that incentivize higher levels of information production will expect more volatile returns post-IPO:

Empirical Implication 3. *Underpricing and the level of future information production are positively related to realized, pre-investment return volatility.*

Underpricing and future information production, as reflected by n^*, are positively related (see the right-most regions of Figure 2.6), and from Equation (2.13), price variance is increasing in $\frac{n^*}{N} = \rho^2$. A more informative signal leads to larger price dispersion from the *ex-ante* expectation. The firm encourages "good variance" as the increased variance coincides with a more informative signal, improving decision making [Leach, 1994]. Unfortunately, difficulties in identifying investment-decision dates, varying potential for price feedback, and the continuous nature of information arrival make identifying such increased variance problematic. For example, a firm's use of price feedback can actually diminish return volatility. Consider two firms with identical, positive-NPV projects to expand their assets-in-place, with either high or low payoffs, where only one firm utilizes its market price in decision making.[31] The firm ignoring prices will experience the same high payoff, but experiences a more negative return in a down state due to always undertaking the expansion. The firm utilizing price feedback will have a higher initial price and less return volatility going forward, as it abandons the expansion project in poor states of the world.

[30] Hovakimian and Hutton [2010] provide similar evidence of price-feedback for firms issuing repeated SEOs.

[31] The other firm may have to make a decision sooner, may be irrational, or may be otherwise prevented from utilizing the market signal.

Rather than focusing on future information production alone, the following implications emphasize future information production *and* trading. Unlike bookbuilding theories where information revelation can occur directly, post-IPO direct disclosure of information to the firm is unlikely. However, dispersed investors can inform management through trading. This distinguishes a future-information-production motivation for underpricing from pre-IPO information revelation and post-IPO holding and monitoring motivations. Information revelation at the IPO gives no predictions regarding future behavior, and passive long-term holding is not likely to inform future investment decisions. On the other hand, active information production *and* corresponding trading activity is consistent with a feedback channel where allocations and underpricing lead to better future investment decisions.

The firm's ability to incentivize information production and trading when information is sufficiently dispersed or valuable relies on repeated-game incentives. Information producers must expect to receive underpriced allocations in the future as compensation for their costly information production. Within the model, investors are homogeneous and there is no ambiguity regarding who should receive future allocations. In reality, investors differ along a number of dimensions, including quality of information production, and firms likely value other characteristics besides the ability to improve price informativeness. Holding these other investor characteristics fixed,

Empirical Implication 4. *Investors with a stronger history of informed trading should be more likely to receive allocations in future IPOs, and in particular, they should be more likely to receive allocations in underpriced IPOs.*

For firms to engage in the repeated game they must expect informed trading after directing underpriced allocations to information producers. Again holding other investor characteristics fixed,

Empirical Implication 5. *Investors with a stronger history of informed trading should be more likely to produce information and subsequently trade in the future.*

While firms interested in encouraging a more informative stock price may target information producing investors, such firms may also use underpricing to secure allocations and to influence

those investors' incentives. As information is symmetric during the IPO, setting underpricing secures allocations because information producers will only accept sufficiently underpriced allocations. Underpricing can also influence information production by altering investors' expectations for future underpricing. While expectations of future underpricing are likely not completely determined by current underpricing, that current underpricing influences those expectations is sufficient for underpricing to affect outsiders' motivations. Whether to secure particular allocations or to motivate future information production,

Empirical Implication 6. *Underpricing and money left on the table should be positively related to future informed trading.*

Future informed trading depends on n^*, which is positively related to underpricing, and money left on the table is mechanically tied to underpricing. The relation between underpricing and future information production applies in the aggregate and at the investor level. However, different types of investors are likely to be more or less sensitive to underpricing. Based on the prediction that better information producers are more likely to receive underpriced allocations in the future, these investors likely expect a longer, more valuable string of future allocations. This would effectively reduce the discount rate in Equation (2.29), allowing the degree of underpricing to decrease. In other words, because better information producers expect to receive more underpriced allocations in the future, the amount of underpricing required in each offering decreases.

Empirical Implication 7. *Investors with a stronger history of informed trading should require less underpricing to produce future information.*

Firms can also encourage increased information production by directing allocations to a large number of information producers. When investors produce less than perfectly correlated information, incentivizing a larger investor base is likely to lead to more informed trading and ultimately a more informative stock price. However, increasing the number of allocations necessarily reduces the size of each allocation. Holding underpricing constant, smaller allocations provide less

money left on the table to each information producer. To maintain proper incentives, underpricing must then increase to make up for the shortfall caused by smaller allocations.

Empirical Implication 8. *Underpricing should be positively related to the number of allocations.*

A counteracting force has the potential to reduce information production when the number of allocations increases. If larger allocations lead to more information production, then reducing allocation size may reduce price informativeness. However, existing empirical evidence suggests that larger allocations do not lead to more information production. Brockman et al. [2009] shows that block ownership (greater than 5% of outstanding shares) does not contribute to informational frictions in bid-ask spreads, suggesting that blockholders do not produce information that is incorporated through price. Field and Sheehan [2004] finds no difference in blockholder ownership between firms that underprice and those that do not. While the evidence does not preclude a role for allocation size in information production, it suggests that the number of allocations is more important.

Two notes are worth making regarding Empirical Implication 8. First, the relation between underpricing and the number of allocations is not specific to information producers' allocations. While future information production is the only motivation for allocations within the model, in reality there are likely other reasons to place shares with specific investors. The important implication is that as the number of allocations increases, and the size of the allocations to the information producers decrease, more underpricing is required to support those investors' information production. Second, a number of existing theories of IPO underpricing generate a similar prediction. Information revelation theories, such as Benveniste and Spindt [1989] and Sherman and Titman [2002], predict larger underpricing when more informed investors participate. Quid pro quo explanations Ljungqvist and Wilhelm [2003], Loughran and Ritter [2002] can also generate this relation if underwriters can capture a larger portion of the money left on the table from smaller allocations.[32]

[32] For empirical evidence of this practice see Griffin et al. [2007].

The novel emphasis on future information production and trading provides a number of untested empirical implications that could potentially falsify the model. In the following sections, I discuss the data, empirical methods and results of testing these implications. The data fail to reject the model by providing evidence consistent with robust correlations among underpricing, allocations and informed trading.

Chapter 3

Empirical Analysis

I first discuss the data and methods used to test the empirical implications laid out in the prior chapter. I then present results supporting firms' using underpriced IPO allocations as a means to increase institutional participation in their offering and to increase information production by those institutions following the IPO.

3.1 Sample and Data

3.1.1 Sample Selection

I identify IPOs using the Thomson Securities Data Corporation (SDC) Platinum Global New Issues database. The sample includes IPOs of U.S. firms' common stocks completed between 1985 and 2011, excluding unit offerings, spinoffs, real estate investment trusts, rights issues, closed-end funds and trusts, and IPOs with an offer price less than five dollars. To be included in the sample, I require that the firm be in the Center for Research in Security Prices (CRSP) database and that at least one institution reports owning shares at the end of the first post-IPO reporting quarter in the Thomson-Reuters 13F Institutional Holdings (13F) database. While data are available beginning in 1980, I reserve the first five years of data in order to establish historical measures used in the analyses. The resulting sample consists of 5,848 IPOs. Table 3.1 provides annual details of the sample.

I supplement data from the SDC, CRSP and 13F databases from several sources. Accounting data is from COMPUSTAT except when pre-IPO data is missing and the data is available from

SDC. I/B/E/S data is used to determine analyst coverage and Laurie Krigman provided all-star analyst data. Consumer Price Index (CPI) data from the Bureau of Labor Statistics is used to adjust dollar values to year 2000 dollars. Founding dates, monthly underpricing and issuance activity, and underwriter rankings are taken from Jay Ritter's website.[1] Data are winsorized at the 1% and 99% levels to reduce the influence of outliers on the analyses.

Lacking direct data on IPO allocations, I follow Binay et al. [2007] and Reuter [2006] and proxy for allocations using the first reported institutional holdings data after issuance. Using 13F holdings data to proxy for allocations has several shortcomings. First, only institutional investment managers that exercise investment discretion over $100 million or more of Section 13(f) securities must report their holdings. Second, the time between the IPO date and the end of the quarter is often considerable, allowing funds' reported holdings opportunity to deviate from initial allocations. However, several studies provide evidence that this proxy is highly correlated with actual IPO allocations. Using proprietary data on a sample of 38 IPOs managed by a single underwriter, Hanley and Wilhelm [1995] finds that the correlation between 13F holdings data and actual allocations is 0.91.[2] Using seven of the IPOs with known allocations featured in Ritter and Zhang [2007], Banerjee et al. [2012] confirms that reported holdings are highly correlated with allocations for the IPOs in their sample. Furthermore, studies by Aggarwal [2003] and Ellis [2006] suggest that immediate flipping by institutional investors is small relative to their allocations.

Reported holdings are not always available for IPOs occurring near the end of a quarter. For a small portion of IPOs occuring within two weeks of the quarter's end (334 IPOs, less than 6% of the sample), holdings data are not reported at the end of that IPO quarter, but are reported in the following quarter by a large number of funds. Additionally, for some other firms' having IPOs within two weeks of the quarter's end, a very small number of funds will report holdings immediately after the IPO, but a much larger number reports at the end of the following quarter. When the

[1] The data are available at http://bear.warrington.ufl.edu/ritter/ipodata.htm.

[2] Binay et al. [2007] note that "this number could be misleadingly high. This is because most institutions that are allocated zero shares subsequently hold zero shares. The more relevant correlation would be computed conditional on an institution receiving a positive allocation."

number of investors in the following quarter exceeds three times that of the first quarter (79 IPOs, less than 2% of the sample), the second quarter's holdings are used to proxy for allocations. The sample includes both of these sets of IPOs, using second-quarter holdings as allocations. The sample includes 138,159 allocations to 3,308 different funds. Table 3.1 displays annual allocations and the number of funds receiving allocations in each year.

3.1.2 A Proxy for Future Information Production

My analysis links underpricing to future information production and trading through allocations to information producers, which I interpret to be institutional investors, or "funds".[3] Direct observation of a fund's information production is difficult, and information production alone is insufficient to guide firm actions. For information to be incorporated into a firm's stock price it must be credibly communicated.[4] Secondary markets provide a mechanism for this communication and funds' post-IPO trading activity can proxy for the level of information produced and incorporated into prices.

Using funds' quarterly holdings data, I develop a measure intended to identify informed trades.[5] Following an insight from market microstructure (e.g. Kyle [1985]) that investors trade more aggressively when they possess more valuable information, larger trades are more likely to be information motivated. I consider a fund's trading in a stock as informed when the fund's position increases by at least 50%. I focus on a fund's buying activity as informed selling is more likely confounded by other post-IPO selling motivations. For example, significant selling activity can result from funds' systematically selling their IPO allocations in the quarters following issuance.[6]

[3] More precisely, the holdings I analyze are for "fund families" as the 13F data does not delineate at the individual fund level.

[4] While feasible in some cases, dispersed ownership makes direct communication between the firm and investors likely impractical. What mechanism would elicit truth-telling from investors to management without additional compensation in such a setting is also not clear.

[5] An extensive literature shows that some institutional investors possess private information. Chiang et al. [2010] and Chemmanur et al. [2010] show that institutional investors appear to be informed at IPOs, while Baker et al. [2010], Puckett and Yan [2011] and Wermers [2000] provide evidence that institutional investors' trades are informed. In addition, institutional investors are often favored in IPO allocations Binay et al. [2007], Boehmer et al. [2006], Goyal and Tam [2012].

Table 3.1: Yearly Sample Summary Statistics. Dollar values are adjusted to year 2000 dollars. The final row tabulates the total number of IPOs, the average proceeds, average underpricing, the total number of unique funds over the sample, the total number of allocations and the average fund value.

Year	Number of IPOs	Avg. Proceeds (Millions)	Average Underpricing	Number of Funds	Number of Allocations	Average Fund Value (Billions)
1985	178	$37.01	7.2%	490	1,929	$2.07
1986	400	$62.34	7.2%	618	4,265	$2.45
1987	266	$54.09	6.2%	654	2,809	$2.82
1988	104	$52.12	6.1%	661	1,499	$2.11
1989	100	$73.15	8.3%	654	1,541	$2.38
1990	95	$52.60	11.0%	657	1,893	$2.36
1991	238	$69.48	13.3%	709	5,240	$2.46
1992	317	$78.91	9.7%	789	6,115	$2.71
1993	412	$71.64	13.8%	872	8,027	$3.01
1994	322	$58.77	9.4%	863	5,249	$3.20
1995	385	$77.97	21.0%	936	8,700	$3.35
1996	581	$73.34	15.2%	980	11,215	$4.51
1997	400	$81.82	14.1%	1,085	8,460	$5.20
1998	251	$80.51	21.4%	1,101	5,200	$6.36
1999	414	$138.74	75.4%	1,204	14,470	$8.36
2000	319	$129.42	56.2%	1,272	11,085	$7.26
2001	63	$236.63	15.7%	1,212	2,893	$7.26
2002	63	$153.66	8.4%	1,170	2,441	$6.42
2003	61	$147.85	12.7%	1,115	2,205	$7.22
2004	169	$142.38	12.3%	1,215	5,836	$8.32
2005	159	$160.26	10.1%	1,263	5,211	$8.08
2006	157	$171.06	10.7%	1,318	5,695	$8.69
2007	158	$181.60	11.9%	1,395	6,062	$9.67
2008	24	$209.59	2.1%	1,356	987	$6.70
2009	29	$298.25	12.0%	1,328	1,569	$6.05
2010	97	$269.95	6.0%	1,388	3,932	$7.06
2011	86	$179.58	12.6%	1,415	3,631	$7.03
Total / Avg	5,848	$97.80	19.1%	3,308	138,159	$5.92

Furthermore, identifying informed trades using only buying activity may bias against finding significant results from informationally-motivated trades. The potential bias originates in the fact that firms with more valuable growth options are less likely to experience positive returns and associated buying activity.

To construct a measure of a fund's information production and incorporation, I aggregate quarterly informed trading over the three quarters following the IPO. Considering multiple quarters allows for the uncertain timing of information arrival and attempts to create a less noisy measure. I measure information production using the indicator variable $Informed_{i,j}$ where

$$Informed_{i,j} = \begin{cases} 1 & \text{if fund } j\text{'s position in firm } i \text{ increased by at least 50\% in Q2, Q3 or Q4} \\ 0 & \text{otherwise.} \end{cases} \tag{3.1}$$

Alternative thresholds of 25% and 100% provide qualitatively similar results. Furthermore, funds' propensities to increase their positions following the IPO are not significantly related to initial allocation sizes.

To consider the possibility that $Informed_{i,j}$ is capturing non-information-based motivations for buying, I conduct three tests of the measure. First, I consider an alternative measure utilizing only position changes in either Q3 or Q4. By eliminating Q2, possible buying motivations including portfolio rebalancing and price support are less likely to influence the measure.[7] The main results of the paper are unchanged using this alternative measure. Second, I consider the possibility that firms desire long-term holding rather than information production. Long-term holders may be hesitant to sell, leading to more post-IPO buying activity than selling activity. To control for this possibility, I include a measure of funds' average holding time of IPO allocations, and doing so does not change the main results (see robustness tests for more details). Third, if funds' position changes are indicative of information production, then the aggregate buying of funds that receive initial allocations may predict future returns.[8]

[6] Chemmanur et al. [2010] finds that funds on average hold only 30% of their initial allocations one year after the IPO.

[7] Aggarwal [2000] finds price support activities by underwriters conclude within a month of the IPO for 93% of firms.

[8] While abnormal returns would provide evidence consistent with information production, a lack of abnormal

I test whether funds' aggregate trading is informative by calculating the abnormal returns from buying stocks receiving the most aggregate buying and selling those receiving the most aggregate selling. Expected returns are calculated by one of three methods; a market-model (adjusting for broad-market returns), a 4-factor model, and matched-firms following Yung et al. [2008].[9] Table 3.2 shows abnormal returns (differences between mean returns for buys versus sells) based on several percentile thresholds for buying/selling post-IPO firms. In all specifications, the abnormal returns are positive and statistically significant at conventional levels. This is consistent with funds' quarter-over-quarter, substantial trading activity originating from long-lived information.

The measure of information production and incorporation can be aggregated at the IPO level in order to relate offering characteristics to future informed trading, and at the fund level to relate fund characteristics to future allocations and trading behavior. At the IPO level, aggregating $Informed_{i,j}$ provides a measure of realized post-IPO informed trading. Letting J_i represent the set of funds' receiving allocations in firm i's IPO,

$$TotalInformed_i = \sum_{j \in J_i} Informed_{i,j}. \tag{3.2}$$

At the fund level, past informed trading establishes the fund's reputation for post-IPO informed trading. Using a fund's allocations received over the previous five years, I determine the proportion in which $Informed_{i,j} = 1$. However, I exclude IPOs without four quarters of reported holdings as of the reporting date in order to ensure the reputation measure is measurable as of that date. Letting $I_{j,t}$ denote the set of IPOs' having sufficient data in which fund j received an allocation over the past five years,

$$AvgInformed_{j,t} = \frac{\sum_{i \in I_{j,t}} Informed_{i,j}}{|I_{j,t}|} \tag{3.3}$$

where t indexes quarters and $|\cdot|$ gives the size of the set $I_{j,t}$. When $|I_{j,t}|$ is small, $AvgInformed_{j,t}$ is likely to be noisy and may not accurately reflect an established reputation due to the fund's

returns does not disprove information production as information may be incorporated into prices prior to quarterly reporting.

[9] In Yung et al. [2008], matched firms are within the same 2-digit SIC code, have a market capitalization between 70% and 130% of the target firm, and have the closest market-to-book ratio to the target.

Table 3.2: Abnormal Returns from Following Funds' Net Buying. Abnormal returns are calculated by buying stocks having the most aggregate post-IPO buying activity (by funds that report holdings in the quarter of the firms' IPOs) and selling those with the most aggregate post-IPO selling activity (by the same funds). Percentiles indicate the thresholds used for determining which firms to buy or sell. For example, the first row shows abnormal returns when firms in the top 20th percentile of aggregate buying are bought, and those in the bottom 20th percentile are sold. Matched firms are established following Yung et al. [2008].

	Market Model	Four-Factor Model	Matched Firms
Top 20% - Bottom 20%			
Return Difference	2.29%	2.63%	4.93%
P-Value	(0.023)	(0.002‘)	(0.045)
Top 10% - Bottom 10%			
Return Difference	3.90%	2.90%	7.10%
P-Value	(0.005)	(0.010)	(0.024)
Top 5% - Bottom 5%			
Return Difference	5.76%	3.83%	13.90%
P-Value	(0.003)	(0.017)	(0.001)

limited participation in IPOs. Accordingly, I require that $I_{j,t}$ includes at least eight IPOs (two per year) to calculate the measure.

Summary statistics suggest that funds with a reputation for informed trading have characteristics consistent with information production capabilities and benefit from their reputation in future allocations. Table 3.3 displays fund-quarter characteristics for the full sample, new funds (those receiving an allocation in quarter t without sufficient data to calculate $AvgInformed_{j,t}$), and quarterly terciles formed on $AvgInformed_{j,t}$. Funds ranked in the highest tercile for informed trading tend to be older, larger funds that potentially have more resources to direct towards information production (t-tests of the differences between the top tercile and other two terciles are significant at the 0.01% level). In addition, funds in the highest tercile of informed trading activity tend to receive more IPO allocations in the following quarter, and their portion of the total money left on the table tends to be greater (differences between the top tercile and other two terciles are significant at the 0.01% level). However, allocations do not appear to be larger on average for funds with a reputation for more informed trading.

To control more directly for funds' propensities to sell their initial allocations following the IPO, I create two new variables. The first, *Flipped*, is equal to one for firms that report holdings in the first quarter following the IPO and have no holdings at the end of the subsequent quarter, and zero otherwise. The second, *SystematicSell*, is equal to one for firms that report holdings in the first quarter following the IPO, have no holdings at the end of the fourth quarter following the IPO, and do not increase their positions in the interim period, and zero otherwise. Similarly to $AvgInformed$, I then average these indicator variables over funds' previous allocations to establish their reputations for flipping and systematic selling activity. Formally,

$$AvgFlipped_{j,t} = \frac{\sum_{i \in I_{j,t}} Flipped_{i,j}}{|I_{j,t}|} \tag{3.4}$$

and

$$AvgSystematicSell_{j,t} = \frac{\sum_{i \in I_{j,t}} SystematicSell_{i,j}}{|I_{j,t}|}. \tag{3.5}$$

Table 3.3: Summary Statistics for Fund-Quarter Classifications. Variable definitions are available in the appendix. The number of observations in each tercile varies slightly as quarterly terciles can be uneven due to repeat observations being placed in the same tercile.

	Full Sample	New Funds	Bottom Tercile	Middle Tercile	Top Tercile
$AvgInformed$	22.0%	N/A	7.7%	20.3%	37.9%
$FundAge$	9.5	8.2	10.5	12.2	12.5
$FundValue$	\$6.52	\$1.96	\$4.74	\$11.40	\$27.00
$Churn$	14%	13%	19%	16%	13%
Num Portfolio Positions	386	213	396	604	1050
Num Allocations Next Qrtr	1.4	0.4	1.9	3.3	4.2
Mean of *AllocationPct*	3.47%	3.88%	3.48%	2.93%	3.2%
Median of *AllocationPct*	1.28%	0.85%	1.31%	1.78%	1.74%
Avg. $MoneyLeft$ / Fund-Qrtr	\$730,123	\$178,633	\$870,626	\$1,836,348	\$2,333,540
Observations (Fund-Qrtrs)	96,434	61,145	11,563	11,960	11,766

3.2 Empirical Methods and Results

The empirical investigation is separated into three sections. I first test for fund-level effects consistent with a repeated game between underwriters and institutional investors to demonstrate that the proposed mechanism is potentially at work. Second, I test for evidence of the proposed mechanism at the IPO level and thereby relate allocations and underpricing to future information production and its incorporation into prices. Third, I relate abnormal asset growth rates to post-IPO returns and IPO allocations to provide evidence of a real investment effect following from firms' encouraging information production via IPOs.

3.2.1 Estimating Fund-Level Effects

The model's repeated-game mechanism supports the information-production equilibrium by providing incentives to funds and firms. For funds, the promise of receiving underpriced allocations in the future provides an incentive for current information production. For firms, providing underpriced allocations to specific information producers increases firm value by encouraging a more informative price, via more informed trading. I first demonstrate that funds with better reputations for information production receive more allocations, particularly in underpriced IPOs. I then demonstrate that those same funds are more likely to produce information and incorporate it though trading in the future, particularly when they receive compensation via underpricing.

Testing whether better information producers are more likely to receive allocations requires a defined set of available funds. I consider a fund as eligible to receive an allocation in a particular IPO if the fund received any allocation within the previous five years and the fund reported holdings in the quarter of the IPO.[10] The allocations dataset is assembled by aggregating the available funds for each IPO and identifying those funds that received allocations. The resulting dataset includes 4,718,170 fund-IPO observations.

Established relationships between funds and underwriters are an important determinant of

[10] Occasionally, a fund that does not fit the preceding eligibility requirements receives an allocation. In these exceptional cases, the fund is included in the set of eligible funds.

allocations. Within the context of the model, relationships are necessary to support the repeated-game motivations that give rise to information production. In reality, underwriters may learn about a fund's characteristics through direct communication, so relationships provide an alternative means of identifying likely information producers.[11] Furthermore, Binay et al. [2007] and Gondat-Larralde and James [2008] show that underwriters' allocations favor funds they have previously worked with. I follow Gondat-Larralde and James [2008] in constructing two measures of underwriter-fund relationships. $OneTime_{j,t,u}$ equals one if fund j participated in only one of underwriter u's previous ten IPOs relative to date t (within the last five years) and zero otherwise, while $MultipleTimes_{j,t,u}$ equals one if fund j participated in at least two of those ten IPOs, and zero otherwise. To account for mergers between underwriters, I use the mergers listed in Corwin and Schultz [2005] and Ljungqvist et al. [2006] to determine the relationships in existence at the time of an IPO.[12]

Including control variables accounts for other motivations for providing allocations to different types of funds. Reuter [2006] and Nimalendran et al. [2007] provide evidence consistent with underwriters' having provided allocations to funds that generated substantial brokerage commissions. To control for allocations to actively trading funds (with more potential for commissions), I include the churn measure ($Churn$) used by Chang et al. [2012] and Yan and Zhang [2009]. Funds' receiving allocations to earn kickbacks for underwriters may be more likely to flip their shares or sell them systematically over the first year, so I control for funds' reputation for these behaviors through $AvgFlipped$ and $AvgSystematicSell$. Larger, older funds may also be more well connected, and these connections may lead to more allocations. Accordingly, I include control variables for the value of the fund's reported assets ($FundValue$) and how long the fund has reported in the 13F data ($FundAge$). A myriad of other, often unobservable, fund characteristics may also contribute to the probability a fund receives an allocation. Such factors are likely to have affected past allo-

[11] While using previous interactions to identify information producers may drive allocations, other explanations have been presented for repeated interactions between underwriters and funds. For example, repeated interactions can reduce underpricing as in Benveniste and Spindt [1989] or allow "block-booking" as in Gondat-Larralde and James [2008].

[12] The combined list of mergers goes through the end of 2001, so the variables may understate the actual relationships for IPOs from 2002 forward.

cation decisions as well, so I include the number of IPO allocations a fund has received in the last five years as an additional control variable ($NumPrevIPOs$). Finally, I control for firms' holding periods for past IPO allocations using $AvgIPOHoldTime$.

I test for the effect of a firm's past information production and trading behavior on the probability of receiving an IPO allocation by estimating, via probit regression,

$$\begin{aligned} RecAllocation_{i,j} &= \beta_0 + \beta_1 AvgInformed_{j,t(i)} + \beta_2 OneTime_{j,t(i),u(i)} \\ &\quad + \beta_3 MultipleTimes_{j,t(i),u(i)} + \Gamma X_{j,t(i)} + \Lambda Y_{t(i)} + \epsilon_{i,j} \end{aligned} \tag{3.6}$$

where $RecAllocation_{i,j}$ is observed as one if fund j received an allocation in firm i's IPO and zero otherwise, $X_{j,t(i)}$ is the vector of fund-level control variables, $Y_{t(i)}$ is a vector of year indicator variables and $t(i)$ and $u(i)$ indicate the time and underwriter of firm i's IPO.[13] If β_1 is positive, this would be consistent with past informed trading leading to more future allocations. Standard errors are clustered at the IPO and year levels to allow the error terms to be correlated within each IPO and within each year [Petersen, 2009, Cameron et al., 2011]. Alternatively, clustering at the firm and fund levels yields qualitatively similar results. As I require a minimum amount of past allocations to calculate $AvgInformed_{j,t}$, some funds eligible for allocations have an empty value for this variable. These "unclassified" funds are likely to be younger and smaller, so I estimate Equation (3.6) separately for "New" and "Established" funds. Table 3.4 provides the results of these estimations in the first two columns.

The data indicate that funds with more past informed trading activity are more likely to receive allocations in IPOs. The coefficient for $AvgInformed$ is significant at the 0.01% level and has an economically meaningful impact on allocation probability. Holding the other characteristics of the observations constant, a one standard deviation increase in $AvgInformed$ is estimated to increase the probability of receiving an allocation from 6.0% to 6.8%, an increase of 13%. The relationship between an underwriter and fund is also a significant determinant of allocations. Holding other characteristics constant, a fund without a relationship with the underwriter has a 3.0%

[13] Estimating Equation (3.6) via logit regression provides qualitatively similar results to those presented.

Table 3.4: Probit Estimation of IPO Allocations. 'Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are available in the appendix. Standard errors, clustered at the IPO and fund levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1062***	0.0912***	0.0781***
	(0.0064)	(0.0063)	(0.0070)
Log($FundAge$)	-0.0082***	-0.0019***	-0.0020***
	(0.0004)	(0.0004)	(0.0004)
$Churn$	0.1721***	0.1689***	0.1065***
	(0.0280)	(0.0313)	(0.0362)
$OneTime$	0.6684***	0.5162***	0.4910***
	(0.0133)	(0.0090)	(0.0113)
$MultipleTimes$	1.2378***	0.8974***	0.8472***
	(0.0302)	(0.0163)	(0.0189)
$NumPrevIPOs$	0.0067**	0.0026***	0.0023***
	(0.0033)	(0.0001)	(0.0001)
$AvgSystematicSell$		0.5047***	0.5678***
		(0.0729)	(0.0770)
$AvgFlipped$		-0.4272***	-0.5354***
		(0.0739)	(0.0834)
$AvgIPOHoldTime$		0.0075**	0.0138***
		(0.0035)	(0.0036)
$AvgInformed$		0.5421***	0.4305***
		(0.0727)	(0.0798)
$HighUP$			-0.4119***
			(0.1357)
$HighUP\times$ Log($FundValue$)			0.0242***
			(0.0065)
$HighUP\times$ Log($FundAge$)			0.0001
			(0.0004)
$HighUP \times Churn$			0.1104***
			(0.0350)
$HighUP \times OneTime$			0.0350***
			(0.0131)
$HighUP \times MultipleTimes$			0.0690***
			(0.0179)
$HighUP \times NumPrevIPO$			0.0007***
			(0.0001)
$HighUP \times AvgSystematicSell$			-0.1033
			(0.0721)

$HighUP \times AvgFlipped$			0.1801**
			(0.0754)
$HighUP \times AvgIPOHoldTime$			-0.0111***
			(0.0030)
$HighUP \times AvgInformed$			0.1995***
			(0.0663)
Constant	-4.2123***	-3.9860***	-3.8606***
	(0.2124)	(0.1540)	(0.1694)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	9.84%	19.04%	19.60%
Observations	2,940,445	1,777,725	1,777,725

probability of receiving an allocation, while funds with one or many past IPO allocations have probabilities of 8.3% and 29.7%, respectively.

Future, non-underpriced, allocations alone would not motivate funds to produce information, so I next test whether information producing funds are more likely to receive allocations in more underpriced IPOs. After calculating each IPO's abnormal underpricing (relative to the average underpricing for IPOs in the same month), offerings are classified as having above or below-median abnormal underpricing, where $HighUP$ is set equal to one for above-median abnormal underpricing and to zero otherwise. Interacting $HighUP$ with $AvgInformed_{j,t}$, $OneTime_{j,t,u}$ and $MultipleTimes_{j,t,u}$ tests for the incremental effects of informed trading history and relationships on allocation probability in highly underpriced allocations. For robustness, interaction terms using the other control variables are also included.

Column 3 of Table 3.4 provides evidence that funds with more past informed trading are more likely to receive allocations in more underpriced offerings. The interacted variables for $AvgInformed$, $OneTime$ and $MultipleTimes$ are all significantly positive at the 1% significance level.[14] Economically, an increase of one standard deviation in $AvgInformed$ leads to a 9.8% increase in probability for below-median offerings and a 14.4% increase in probability for above median offerings. The differences are less stark for the relationship measures. Allocations to firms with one previous IPO with the underwriter have probabilities of 8.0% and 8.5% for below and above-median offerings, respectively. Allocations to firms with multiple previous IPOs with the underwriter have probabilities of 27.2% and 30.6% for below and above-median offerings, respectively. This evidence is consistent with funds' having an incentive to produce information following an IPO in order to receive underpriced allocations in the future, and provides support for Empirical Implication 4.

For firms to provide funds with profitable allocations (via additional underpricing), two effects should be present. First, funds with a reputation of producing and trading on information should

[14] This evidence is consistent with underpricing theories considering endogenous, costly information production as in this analysis and in Sherman and Titman [2002]. This is in contrast to Benveniste and Spindt [1989], where repeated relationships can be used to reduce, rather than increase, underpricing.

be more likely to do so in the future. Second, funds generally should be more likely to produce information and trade after receiving a more underpriced allocation. Modeling the probability of future informed trading based on fund and allocation characteristics tests whether directed allocations can be used to promote a more informative stock price. The dataset consists of 138,159 allocations to 3,308 funds in 5,848 IPOs.

As current IPO profits may influence expectations regarding future profits, funds may be more likely to produce information after receiving an underpriced allocation. A component of a fund's IPO profit is its portion of the money left on the table in the offering, defined as

$$MoneyLeft_{i,j} = Shares_{i,j} * OfferPrice_i * Underpricing_i \tag{3.7}$$

where $MoneyLeft_{i,j}$ is the money left on the table to fund j in firm i's IPO and $Shares_{i,j}$ is the proxy for fund j's allocation, i.e. its reported shareholdings following the IPO. Because funds with strong reputations for informed trading may require less underpricing to participate in an offering and subsequently produce information, the interaction of $AvgInformed_{j,t(i)}$ and $MoneyLeft_{i,j}$ is also included as an explanatory variable.

Including additional variables, beyond those used in the tests of allocations, controls for other factors that may drive future information production. First, I include the percentage of the offering allocated to each fund ($AllocationPct$). On the one hand, if funds only produce information after receiving sufficiently large allocations, or if larger allocations provide more incentives for information production, then allocation size may be positively related to future information production. On the other hand, if large allocations establish blockholders who can exercise "voice", communicating information through trading is less important, so the relation may be negative. $Shares$ is also included to control for the raw number of shares received. Second, I include a measure of the firm's stock return over the first 90 days ($90DayReturn$).[15] The relationship between early returns and future trading could be positive if funds engage in momentum-based trading, or if funds begin buying on information soon after the IPO and continue their buying into subsequent

[15] The return from the offer price to the first day's closing price is excluded from the return calculation.

quarters. Finally, I include a number of other variables proxing for analyst coverage for the firm, VC backing, post-IPO liquidity, firm uncertainty, and the portfolio holdings of funds that receive allocations.

I analyze the effect of allocation and fund characteristics on future informed trading by estimating, via probit regression:

$$\begin{aligned} Informed_{i,j} &= \beta_0 + \beta_1 AvgInformed_{j,t(i)} + \beta_2 MoneyLeft_{i,j} \\ &\quad + \beta_3 AvgInformed_{j,t(i)} \times MoneyLeft_{i,j} + \Gamma X_{j,t(i)} + \Lambda Y_{t(i)} + \epsilon_{i,j}. \end{aligned} \quad (3.8)$$

Summarizing the predictions of Empirical Implications 5, 6, and 7, I expect β_1 and β_2 to be positive, while β_3 is expected to be negative. Standard errors are clustered at the firm and year levels, so errors are allowed to be correlated within IPOs and within funds [Petersen, 2009, Cameron et al., 2011]. Alternatively, clustering at the firm and year levels yields qualitatively similar results. Similar to the previous test, I estimate the model separately for "New" and "Established" funds.

Table 3.5 provides evidence that: (i) funds are more likely to produce information and trade if they have a history of doing so; (ii) funds are more likely to trade when they receive more money left on the table; and (iii) funds with a stronger reputation for informed trading are less sensitive to money left on the table. The coefficients of interest are of the predicted sign and statistically significant at better than the 0.01% level for "established" funds (the majority of the sample). Economically, a one standard deviation increase in past informed trading increases the probability of future informed trading by 29% (from 26.9% to 34.7%), while a one-standard deviation increase in the fund's money left on the table increases the probability by 17% (from 27.7% to 32.4%). To demonstrate the reduced sensitivity to money left on the table for higher reputation funds, I compare the effect of increasing money left on the table by one standard deviation for an average firm versus a firm with an above average reputation (where $AvgInformed$ is one standard deviation above the mean). Holding all other variables constant, the average firm's probability of informed trading increases by 18.0% while the high reputation firm's probability increases by only 15.3%.

The coefficient estimates for several control variables are statistically and economically signif-

Table 3.5: Probit Estimation of Future Informed Trading. "Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are available in the appendix. Standard errors, clustered at the IPO and fund levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0174*	-0.0115*
	(0.0094)	(0.0063)
$UWInfoProd$	0.0061	0.0178***
	(0.0047)	(0.0031)
$OneTime$	-0.0324	-0.0019
	(0.0263)	(0.0129)
$MultipleTimes$	0.0664	0.0429***
	(0.0436)	(0.0158)
$FirstNumAnalysts$	0.0041	0.0223***
	(0.0436)	(0.0158)
$OneYearNumAnalysts$	-0.0174*	-0.0115*
	(0.0094)	(0.0063)
$VCBacked$	0.0750***	0.0406***
	(0.0246)	(0.0140)
$90DayReturn$	0.1522***	0.2831***
	(0.0320)	(0.0201)
$Spread$	-4.2088**	-6.0518***
	(1.9523)	(1.1334)
$AvgVolume$	0.0000***	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	0.2960	0.4380
	(1.2091)	(0.7185)
$IndustryOverweight$	0.0440***	0.0536***
	(0.0103)	(0.0084)
$IndWeightStdDev$	-0.1107**	-0.0630
	(0.0447)	(0.0421)
$NumPrevIPOs$	0.0022	0.0002
	(0.0084)	(0.0001)
$AllocationPct$	-0.8691*	-0.8819***
	(0.4553)	(0.2857)
$Shares$	-0.0232***	-0.0384***
	(0.0063)	(0.0040)
$Churn$	-1.4245***	-1.3338***
	(0.1180)	(0.0899)
Log($FundValue$)	0.0664***	0.0058
	(0.0187)	(0.0091)

Log($FundAge$)	-0.0024***	-0.0004
	(0.0009)	(0.0005)
$AvgFlipped$		-0.9307***
		(0.1368)
$AvgSystematicSell$		0.6393***
		(0.1270)
$AvgIPOHoldTime$		0.0209***
		(0.0036)
$AvgInformed$		1.5408***
		(0.1279)
$MoneyLeft$	0.0199*	0.1018***
	(0.0108)	(0.0117)
$AvgInformed \times MoneyLeft$		-0.1804***
		(0.0401)
Constant	-1.7113***	-0.9996***
	(0.3756)	(0.2387)
Year Dummy Variables	Yes	Yes
Pseudo R^2	4.01%	9.15%
Observations	22,936	106,453

icant. Funds that overweight the IPO firm's industry in their portfolios are more likely to produce information and trade, consistent with synergies in information production within industries. Funds with repeated relationships with the underwriter are also more likely to make informed trades. Interestingly, more actively trading funds, as measured by the churn rate, are less likely to produce information for IPOs. These funds may follow momentum-based strategies rather than producing fundamental information. Funds receiving large percentage allocations trade less, suggesting that information production is better modeled as coming from many diverse information producers rather than being an increasing function of individual allocation size. Finally, the 90-day return is also significantly positive, consistent with either momentum trading playing a role in motivating future trade or funds' trading on information soon after the IPO and continuing to do so.

The findings in Table 3.5 provide support for Empirical Implications 5, 6, and 7, and confirm that firms have an incentive, when future information production and trading is valuable, to direct underpriced allocations to specific funds. Taken together, the previous two tests provide evidence consistent with a repeated game serving as a means of incentivizing funds to produce future information.

3.2.2 Estimating IPO-Level Effects

While fund-level effects show the plausibility of a repeated-game mechanism for inducing future information production, showing an aggregate effect provides evidence consistent with firms using allocations and underpricing to promote information production. Within the model framework, a firm simultaneously determines its desired level of future information production and the costly underpricing required to support it. As a result, a causal relation from underpricing to future information production is not necessarily expected, nor from expected future information production to underpricing. I therefore test for correlations between underpricing and future informed trading using both, in separate tests, as the dependent variable. Underpricing is defined as the percentage change from the offer price to the closing price at the end of the first day of trading reported in CRSP. The total money left on the table is also used in several specifications. Total

money left on the table is calculated similarly to the fund-level money left on the table with the number of shares sold in the offering replacing a fund's shareholdings at the end of the quarter.

I define two variables summarizing an allocation schedule's anticipated level of information production. First, the number of funds receiving allocations will be strongly related to the amount of future trading and possibly related to underpricing. Second, a measure of the likelihood of information production for an IPO's average allocation is calculated. The second measure takes into account the identity and characteristics of the funds receiving allocations, as well as the sizes of the allocations and the realized underpricing. My intention is to separate the "how many" from the "how good" in characterizing an IPO's allocations.

The number of funds receiving allocations, $NumInstInv_i$, should mechanically relate to future informed trading. As an example, if no firms produced information, chance would lead some funds' trades to be categorized as informed. Firms making allocations to more funds would then expect to have a higher level of $TotalInformed_i$. However, in regards to underpricing the relation is not clear. If underpricing is used to compensate funds' costs (e.g. future information production or current information production à la Sherman and Titman [2002]), then underpricing is likely higher when more funds receive allocations, as each then receives a smaller allocation and a given level of underpricing provides less compensation. Alternatively, increasing the number of allocations could more efficiently elicit truth-telling or reduce the winner's curse problem in Rock [1986], and thereby reduce underpricing.

The second variable focuses on the characteristics of investors who receive allocations in an IPO. Loosely speaking, if IPOs' allocations tend towards high reputation information producers, then one would expect more information production and that underpricing is more likely to be used to secure the allocations that lead to information production. To identify allocation schedules that are likely to lead to more informed trading, I calculate the probability that each fund produces information in a given IPO based on the fund's and allocation's characteristics. The probability is calculated based on the coefficient estimates from estimating Equation (3.8) using only data that is available as of the IPO date. After repeating the probit estimation for each IPO, I capture the

overall quality (for future information production) of the firm's allocations by averaging the fitted probabilities for each fund:

$$AvgProbability_i = \frac{\sum_{j \in J_i} \Phi(\widehat{Informed}_{i,j})}{|J_i|} \tag{3.9}$$

where $\widehat{Informed}_{i,j}$ is the fitted value rather than the indicator variable, $\Phi(\cdot)$ is the cumulative normal density function, and the dataset for estimating $\widehat{Informed}_{i,j}$ includes all information available at the time of firm i's IPO. $AvgProbability_i$ measures the "how good" of the allocations while $NumInstInv_i$ measures the "how many."

To control for the possibility that underwriters specialize in promoting information production, I create a measure of an underwriters' reputation for doing so. Following the methodology of Hoberg [2007], I calculate an abnormal measure of post-IPO trading activity using an underwriter's IPOs from the last five years:

$$UWInfoProd_{u,t} = \frac{\sum_{i \in U_t} \left(AvgProbability_i - \overline{AvgProbability_{i,t(i)}} \right)}{|U_t|} \tag{3.10}$$

where U_t is the set of underwriter u's IPOs over the last five years and $\overline{AvgProbability_{i,t(i)}}$ is the mean of $AvgProbability_i$ for firms going public in the same month as firm i. Using this measure requires that the IPO occurred more than three quarters prior to the quarter of measurement to ensure that trading activity is known at that time.

Given the depth of the literature on IPOs and the relative lack of literature examining the post-IPO trading behavior of funds, I rely on established control variables from the IPO literature in tests of underpricing and future informed trading. Appendix B contains definitions of well-known determinants of IPO underpricing that serve as control variables. Table 3.6 presents summary statistics of the test and control variables.

Beginning with $TotalInformed_i$ as the dependent variable, I estimate:

$$\begin{aligned} TotalInformed_i &= \beta_0 + \beta_1 NumInstInv_i + \beta_2 OfferCharacteristic_i \\ &\quad + \beta_3 UWInfoProd_{u(i),t(i)} + \Gamma Z_i + \Lambda Y_t + \epsilon_i \end{aligned} \tag{3.11}$$

Table 3.6: Summary Statistics of IPO Characteristics. Variable definitions are available in the appendix.

Characteristic	Observations	Mean	Std. Dev.	Min	Median	Max
$AvgUPConcurrentIPO$	5,216	21%	22%	-7%	14%	121%
$AvgIndustryOverweight$	5,216	0.30	0.42	-1.06	0.22	7.82
$AvgProbabilityInfo$	5,216	0.28	0.06	0.00	0.29	0.40
$AvgVolume$	5,216	0.2	0.4	0.0	0.1	16.5
$FirmAge$	5,216	16	22	1	8	165
$FirstNumAnalysts$	5,216	1.3	1.7	0	1	17
$MktReturn$	5,216	0.97%	3.04%	-16.27%	1.15%	12.51%
$MktStdDeviation$	5,216	0.75%	0.35%	0.25%	0.66%	3.85%
$NumConcurrentIPO$	5,216	36	19	1	36	90
$NumInstInv$	5,216	25	21	1	19	255
$OfferPriceRevision$	5,216	1%	22%	-93%	0%	220%
$OneYearNumAnalysts$	5,216	2.3	3.2	0	1	34
$PercentInst$	5,216	63%	31%	0%	65%	100%
$PercentSold$	5,216	33%	18%	3%	30%	100%
Percent $TechFirm = 1$	5,216	40%	N/A	N/A	N/A	N/A
Percent $VCBacked = 1$	5,216	45%	N/A	N/A	N/A	N/A
$Proceeds$	5,216	$97	$213	$0.5	$49	$6,412
$ReturnStdDev$	5,216	0.04	0.02	0.01	0.04	0.18
$Spread$	5,216	0.03	0.01	0.00	0.02	0.15
$TotalInformed$	5,216	7	8	0	4	98
$TotalMoneyLeft$	5,216	0.15	2.99	-14.54	0.18	12.52
$Underpricing$	5,216	20%	44%	-64%	8%	698%
$UnderwriterRank$	5,216	7.6	1.9	1.0	8.0	9.0
$UWAvgUP$	5,216	0.27%	11.80%	-112.58%	-0.71%	165.22%
$UWInfoProd$	5,216	0.1	3.0	-14.5	0.2	12.5

where $OfferCharacteristic_i$ represents either underpricing, total money left on the table, or $AvgProbability_i$, Z_i is the vector of firm and IPO control variables, and standard errors are heteroscedasticity-consistent. Bootstrapped standard errors give qualitatively similar results.

The estimation results provided in Table 3.7 show the number of allocations, underpricing and money left on the table are positively correlated with future informed trading. The results also indicate that IPOs from underwriters with a reputation for facilitating information production have a higher level of future informed trading. The coefficients on underpricing and $AvgProbability$ are positive and significant at the 0.1% level, while the coefficient on $TotalMoneyLeft$ is significant at the 10% level. As expected, the coefficient on the number of institutional investors is also significantly positive. For the average firm, a one-standard deviation increase in underpricing increases future informed trading by 7%, a one-standard deviation increase in total money left on the table increases future informed trading by 3%, and a one standard deviation increase in $AvgProbability$ leads to an increase of over 20%. A one standard deviation increase in the underwriter's reputation for information production in its IPOs is also economically significant as it increases future informed trading by 6%. Several of the control variables are also statistically and economically significant. Firms with high future trading volume have more future informed trading, while large offerings (by dollar proceeds or percentage of the firm sold) have less future informed trading. Offerings during periods of high underpricing and offerings with a large portion allocated to institutional investors also have less future informed trading.

To further validate the relations among underpricing, allocations and future informed trading, I test these relations within the more established setting of underpricing estimation. As the underpricing literature is relatively mature, this provides a stricter test of whether future informed trading is related to underpricing by controlling for many known determinants of underpricing. I estimate

$$Underpricing_i = \beta_0 + \beta_1 NumInstInv + \beta_2 InfoMeasure + \Gamma Z_i + \Lambda Y_t + \epsilon_i \tag{3.12}$$

where $InfoMeasure$ is either $TotalInformed_i$ or $AvgProbability_i$, and errors are heteroscedastic-

Table 3.7: OLS Estimation of Total Future Informed Trading. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.0146	0.0263	0.0183	0.0159
	(0.0440)	(0.0439)	(0.0439)	(0.0414)
$LogProceeds$	-1.2344***	-1.1365***	-1.2067***	-0.9343***
	(0.0959)	(0.0976)	(0.0976)	(0.0918)
$UnderwriterRank$	-0.1191***	-0.1323***	-0.1224***	-0.1091***
	(0.0327)	(0.0327)	(0.0327)	(0.0313)
$VCBacked$	0.1296	0.1224	0.1277	0.0115
	(0.1024)	(0.1022)	(0.1023)	(0.0945)
$NumConcurrentIPO$	0.0014	0.0019	0.0012	0.0002
	(0.0036)	(0.0036)	(0.0036)	(0.0033)
$AvgUPConcurrentIPO$	-0.0207***	-0.0255***	-0.0229***	-0.0167***
	(0.0048)	(0.0051)	(0.0050)	(0.0044)
$TechFirm$	0.0545	0.0536	0.0614	0.0313
	(0.1042)	(0.1042)	(0.1041)	(0.0958)
$OfferPriceRevision$	-0.2646	-0.9246***	-0.4801	-0.4026
	(0.3322)	(0.3406)	(0.3241)	(0.3051)
$PercentSold$	-1.2181***	-1.1168***	-1.1765***	-0.7957***
	(0.2631)	(0.2608)	(0.2618)	(0.2472)
$PercentInst$	-0.5028**	-0.5272**	-0.4328**	-0.3369*
	(0.2118)	(0.2122)	(0.2154)	(0.1980)
$UWAvgUP$	-0.9375**	-1.5384***	-1.1130***	-0.8093**
	(0.4147)	(0.4356)	(0.4167)	(0.3938)
$UWInfoProd$	0.1381***	0.1457***	0.1418***	0.0721***
	(0.0234)	(0.0237)	(0.0237)	(0.0221)
$NumInstInv$	0.3260***	0.3218***	0.3212***	0.3084***
	(0.0067)	(0.0067)	(0.0072)	(0.0063)
$AvgIndOverweight$	0.0149	-0.0166	0.0092	-0.0853
	(0.0986)	(0.0984)	(0.0987)	(0.0935)
$Spread$	-19.5562***	-18.6359***	-19.5546***	1.8968
	(4.5875)	(4.5780)	(4.5832)	(4.4966)
$AvgVolume$	2.9516***	2.7295***	2.6373***	2.6255***
	(0.5236)	(0.5322)	(0.5557)	(0.4985)
$ReturnStdDev$	-7.6958*	-9.8565**	-7.7620*	-7.4830*
	(4.2249)	(4.1977)	(4.2150)	(4.0259)
$FirstNumAnalysts$	-0.2914***	-0.2733***	-0.2840***	-0.2234***
	(0.0731)	(0.0734)	(0.0734)	(0.0690)
$OneYearNumAnalysts$	0.3332***	0.3234***	0.3276***	0.2434***
	(0.0426)	(0.0426)	(0.0427)	(0.0404)

$Underpricing$		1.0552***		
		(0.2955)		
$TotalMoneyLeft$			0.0050*	
			(0.0026)	
$AvgProbability$				22.8774***
				(0.7549)
Constant	7.2193***	7.0804***	7.2739***	-1.1556
	(0.7958)	(0.7949)	(0.8037)	(0.8461)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	80.95%	81.06%	80.98%	83.54%
Observations	5,216	5,216	5,216	5,216

ity consistent. As before, bootstrapped standard errors give qualitatively similar results.

Consistent with prior evidence, Table 3.8 shows that underpricing is significantly related to the number of institutional allocations and the propensity of those institutions to produce information. The first column shows a baseline specification without variables reflecting allocations to institutional investors. The allocation-based variables add to the explanatory power of the model in all three additional specifications, increasing R^2 by over 1% from a baseline level of 59%. The number of institutional investors receiving allocations is significant at the 0.1% level in all specifications.[16] Both $TotalInformed_i$ and $AvgProbability_i$ are also significantly related to underpricing at the 0.1% significance level. Interestingly, the coefficient on the underwriter's history of information production is negative and highly significant. This is consistent with underwriters with a history of information production being able to more easily incentivize information production.

Firms that have more growth options should be expected to use underpricing to promote information production more intensively. To test whether this is the case, I segment firms based on measures that are likely correlated with the extent of the firm's growth options. I classify firms as "High Growth" if they are a young technology firm ($TechFirm = 1$ and at or below median $FirmAge$) and a large portion of their value comes from growth options (the $PVGO$ measure of Benveniste et al. [2003] is above the sample median), and "Low Growth" otherwise.[17] If a desire to promote information production is motivating underpricing, then the evidence should show a stronger relation to $NumInstInv$ for "High Growth" firms.

Table 3.9 confirms that $NumInstInv$ is more strongly related to underpricing for "High Growth" firms relative to "Low Growth" firms. The coefficient estimates for $NumInstInv$ are almost three times as large for "High Growth" firms, and the differences in coefficient estimates are statistically significant. The coefficient estimates of the amount of future information production, as reflected by $AvgProbability$ and $TotalInformed$, are greater for "High Growth" firms, but are not significantly different between firm types. This is consistent with underwriters' being able to

[16] Zheng and Li [2008] also provides evidence that the number of non-block institutional investors after the IPO is positively related to underpricing.

[17] Using each qualification separately gives qualitatively similar results.

Table 3.8: OLS Estimation of Underpricing. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0099***	-0.0110***	-0.0111***	-0.0110***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
LogProceeds	-0.0612***	-0.0921***	-0.0855***	-0.0880***
	(0.0065)	(0.0071)	(0.0072)	(0.0071)
UnderwriterRank	0.0078***	0.0125***	0.0131***	0.0127***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)
VCBacked	0.0014	0.0068	0.0061	0.0052
	(0.0074)	(0.0073)	(0.0073)	(0.0073)
NumConcurrentIPO	-0.0006*	-0.0004	-0.0005	-0.0005
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
AvgUPConcurrentIPO	0.0045***	0.0043***	0.0045***	0.0044***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
MktReturn	5.8031***	5.6935***	5.6653***	5.5940***
	(2.1308)	(2.0878)	(2.0892)	(2.0842)
MktStdDeviation	1.3487	1.6339	1.1885	1.3962
	(1.4397)	(1.4030)	(1.4103)	(1.3995)
TechFirm	0.0012	0.0005	0.0001	0.0001
	(0.0083)	(0.0081)	(0.0081)	(0.0081)
OfferPriceRevision	0.6960***	0.6256***	0.6265***	0.6235***
	(0.0290)	(0.0291)	(0.0291)	(0.0291)
PercentSold	-0.0869***	-0.0952***	-0.0887***	-0.0895***
	(0.0162)	(0.0162)	(0.0161)	(0.0162)
PercentInst	0.1110***	0.0222	0.0251	0.0246
	(0.0148)	(0.0173)	(0.0174)	(0.0173)
UWAvgUP	0.5708***	0.5706***	0.5754***	0.5722***
	(0.0405)	(0.0401)	(0.0399)	(0.0398)
UWInfoProd	-0.0049***	-0.0072***	-0.0079***	-0.0081***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
AvgIndOverweight	0.0223***	0.0297***	0.0297***	0.0284***
	(0.0081)	(0.0081)	(0.0081)	(0.0081)
Spread	-0.7984**	-0.8629**	-0.7600**	-0.5728
	(0.3845)	(0.3749)	(0.3721)	(0.3746)
AvgVolume	0.2956***	0.2070***	0.1915***	0.2028***
	(0.0418)	(0.0433)	(0.0433)	(0.0432)
ReturnStdDev	1.9203***	2.1005***	2.1415***	2.1026***
	(0.3465)	(0.3410)	(0.3401)	(0.3403)
FirstNumAnalysts	-0.0186***	-0.0173***	-0.0158***	-0.0164***
	(0.0045)	(0.0045)	(0.0045)	(0.0045)

$OneYearNumAnalysts$	0.0111***	0.0094***	0.0077***	0.0082***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$NumInstInv$		0.0040***	0.0022***	0.0037***
		(0.0004)	(0.0006)	(0.0004)
$TotalInformed$			0.0053***	
			(0.0015)	
$AvgProbability$				0.3101***
				(0.0611)
Constant	0.0858	0.1125**	0.0796	0.0019
	(0.0550)	(0.0570)	(0.0579)	(0.0617)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	58.85%	59.91%	60.14%	60.11%
Observations	5,216	5,216	5,216	5,216

better enforce information production after "High Growth" IPOs, making information producers' quality less important.

The effects of institutional investor allocations are economically meaningful, and even more so for "High Growth" firms. Table 3.10 shows how changes in a variety of independent variables impact expected underpricing. A one standard deviation increase in the number of institutional investors is associated with an increase in underpricing of almost 8% when considering all firms, and 16% when considering "High Growth" firms. Only offer price revisions (14% and 21%), and concurrent average underpricing (10% and 16%) have larger economic impacts on underpricing. A one standard deviation increase in $AvgProbability_i$ is associated with an increase in underpricing of 1.8%. The economic impact of $AvgProbability_i$ is of a similar magnitude to several well-known determinants of underpricing including underwriter rank, whether the firm is VC-backed, and the market-return during the bookbuilding period. The statistical evidence, and its economic significance, is consistent with firms using underpricing and directed allocations to incentivize future information production and trading, particularly for firms likely to have significant growth options.

While the evidence presented is consistent with allocations and underpricing leading to information production and higher price informativeness, alternative explanations for these results are possible. For example, funds who produce information and subsequently trade are the same funds who provide information to the underwriter during bookbuilding. Underpricing may then provide compensation for costly information production prior to the IPO, but not after the IPO. Separating these motivations is difficult; however, to the extent that offer price revisions reflect information disclosed during bookbuilding, there is additional explanatory power for underpricing from future informed trading. This is consistent with a future-information-production motivation for underpricing operating separate from a bookbuilding motivation.

3.2.3 Price Feedback and Investment

If firms use their IPO to encourage a more informative stock price, then firms who use this channel more aggressively may be more likely to factor post-IPO returns into their investment

Table 3.9: OLS Estimation of Underpricing: High vs. Low Growth Firms. High growth firms are defined as being below the median firm age, above the median percentage of firm value from growth options ($PVGO$), and in a high-technology industry ($TechSIC = 1$). Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing					
	Low Growth	High Growth	Difference	Low Growth	High Growth	Difference
LogFirmAge	-0.0109***	-0.0140	-0.0031	-0.0109***	-0.0118	-0.0009
	(0.0024)	(0.0205)	(0.0204)	(0.0024)	(0.0207)	(0.0205)
LogProceeds	-0.0591***	-0.2347***	-0.1756***	-0.0598***	-0.2422***	-0.1824***
	(0.0066)	(0.0236)	(0.0243)	(0.0065)	(0.0233)	(0.0239)
UnderwriterRank	0.0115***	0.0158**	0.0043	0.0112***	0.0156**	0.0044
	(0.0024)	(0.0068)	(0.0071)	(0.0024)	(0.0070)	(0.0073)
VCBacked	0.0134*	-0.0066	-0.0201	0.0123*	-0.0053	-0.0176
	(0.0070)	(0.0247)	(0.0254)	(0.0070)	(0.0249)	(0.0255)
NumConcurrentIPO	0.0003	-0.0024***	-0.0027***	0.0003	-0.0024***	-0.0026***
	(0.0003)	(0.0008)	(0.0008)	(0.0003)	(0.0008)	(0.0008)
AvgUPConcurrentIPO	0.0038***	0.0058***	0.0019	0.0038***	0.0055***	0.0017
	(0.0006)	(0.0011)	(0.0012)	(0.0006)	(0.0011)	(0.0012)
MktReturn	6.3769***	7.7528	1.3758	6.2136***	8.1561	1.9424
	(1.9420)	(5.4963)	(5.7678)	(1.9397)	(5.4751)	(5.7473)
MktStdDeviation	2.3001*	-3.3011	-5.6012	2.2818*	-2.0895	-4.3713
	(1.3374)	(3.8299)	(4.0137)	(1.3364)	(3.7612)	(3.9495)
OfferPriceRevision	0.5420***	0.7019***	0.1599**	0.5392***	0.7023***	0.1630**
	(0.0323)	(0.0622)	(0.0695)	(0.0323)	(0.0626)	(0.0698)
PercentSold	-0.0793***	-0.1882***	-0.1089*	-0.0789***	-0.1879***	-0.1090*
	(0.0149)	(0.0559)	(0.0573)	(0.0149)	(0.0562)	(0.0575)
PercentInst	-0.0013	0.0676	0.0689	-0.0012	0.0668	0.0680
	(0.0161)	(0.0480)	(0.0501)	(0.0160)	(0.0482)	(0.0503)
UWAvgUP	0.4826***	0.6424***	0.1597*	0.4810***	0.6370***	0.1561*
	(0.0444)	(0.0748)	(0.0863)	(0.0441)	(0.0750)	(0.0862)
UWInfoProd	-0.0070***	-0.0065	0.0005	-0.0073***	-0.0068	0.0004
	(0.0018)	(0.0043)	(0.0046)	(0.0018)	(0.0043)	(0.0046)
AvgIndOverweight	0.0215***	0.0561***	0.0346	0.0207***	0.0529**	0.0322
	(0.0080)	(0.0217)	(0.0229)	(0.0080)	(0.0219)	(0.0230)
Spread	-0.5848*	-1.1491	-0.5642	-0.4388	-0.9134	-0.4746
	(0.3489)	(1.2438)	(1.2774)	(0.3502)	(1.2531)	(1.2866)
AvgVolume	0.1207***	0.3394***	0.2186**	0.1269***	0.3575***	0.2307**
	(0.0414)	(0.0907)	(0.0987)	(0.0411)	(0.0905)	(0.0984)
ReturnStdDev	2.0551***	1.6605*	-0.3946	2.0590***	1.5072*	-0.5519
	(0.3326)	(0.9094)	(0.9582)	(0.3319)	(0.9098)	(0.9583)
FirstYearNumAnalysts	-0.0116**	-0.0142	-0.0026	-0.0116***	-0.0186	-0.0070
	(0.0045)	(0.0120)	(0.0127)	(0.0045)	(0.0117)	(0.0124)
OneYearNumAnalysts	0.0076***	0.0039	-0.0037	0.0075***	0.0069	-0.0007
	(0.0027)	(0.0065)	(0.0070)	(0.0027)	(0.0064)	(0.0068)
NumInstInv	0.0021***	0.0058***	0.0037**	0.0029***	0.0085***	0.0056***
	(0.0006)	(0.0017)	(0.0017)	(0.0004)	(0.0013)	(0.0014)

$AvgProbability$	0.0031**	0.0088**	0.0057			
	(0.0015)	(0.0035)	(0.0038)			
$TotalInformed$				0.2414***	0.3249*	0.0835
				(0.0581)	(0.1674)	(0.1753)
Constant	0.0146	0.5802***	0.5687***	-0.0519	0.4913***	0.5462***
	(0.0539)	(0.1209)	(0.1314)	(0.0578)	(0.1359)	(0.1464)
Year Dummy Variables	Yes	Yes		Yes	Yes	
R^2	51.61%	68.67%		51.69%	68.44%	
Observations	4,089	1,127		4,089	1,127	

Table 3.10: Economic Significance of Underpricing Determinants. Coefficient estimates for the full sample are from Column (4) of Table 3.8, and from Table 3.9 for the low and high growth firms. Standard deviations are calculated using only the observations included in estimation of Equation (3.12). Variable definitions are available in the appendix. Results are qualitatively similar using percentile changes (e.g. from the 25th to 75th percentile) rather than standard deviation changes.

	Full Sample			Low Growth Firms			High Growth Firms		
Independent Variable	Coef. Est.	Std. Dev.	+1 S.D. Δ UP	Coef. Est.	Std. Dev.	+1 S.D. Δ UP	Coef. Est.	Std. Dev.	+1 S.D. Δ UP
$OfferPriceRevision$	0.624	0.22	13.5%	0.539	0.18	9.8%	0.702	0.30	21.3%
$AvgUPConcurrentIPO$	0.440	0.22	9.9%	0.380	0.19	7.2%	0.550	0.30	16.4%
$NumInstInv$	0.004	21.15	7.8%	0.003	21.69	6.3%	0.009	18.99	16.1%
$UWAvgUP$	0.572	0.12	6.7%	0.481	0.11	5.3%	0.637	0.14	9.0%
$UWInfoProd$	-0.008	3.00	-2.4%	-0.007	2.91	-2.1%	-0.007	3.27	-2.2%
$PercentSold$	-0.090	0.18	-1.6%	-0.079	0.18	-1.4%	-0.188	0.15	-2.9%
$UnderwriterRank$	0.013	1.86	2.4%	0.011	1.84	2.1%	0.016	1.89	3.0%
$AvgProbability$	0.310	0.06	1.8%	0.241	0.06	1.4%	0.325	0.06	2.0%
$MktReturn$	5.594	0.00	1.1%	6.214	0.00	1.2%	8.156	0.00	1.8%
$VCBacked$	0.005	0.50	0.3%	0.012	0.48	0.6%	-0.005	0.40	-0.2%

decisions. A natural way to empirically test this notion is by cross-sectionally analyzing the sensitivity of investment to either stock returns or Tobin's Q. Unfortunately, the *ex-ante* predictions for firms' relative sensitivities of investment are not clear. For example, high information firms will be more likely than low information firms to initiate fixed-size investment projects after experiencing negative returns (due to the higher *ex-ante* value of the high information firms' growth options), leading to lower investment sensitivities for high information firms. However, variable-sized investment projects can lead to higher investment sensitivities for high information firms. As predicted investment sensitivities depend on modeling assumptions, separating firms based on their likelihood to adapt their investment decisions to returns may be more appropriate.

In reality, the noise in firms' prices creates an inference problem for managers, and likely separates firms based on their use of price feedback in decision making. On the one hand, holding the amount of noise constant, the inference problem is likely less severe for managers whose firms' prices reflect more information from outsiders, leading them to rely on prices in their decision making. On the other hand, firms with low information may ignore price feedback altogether, concluding that the signal-to-noise ratio is too low for the price to be meaningful in decision making. Assuming that firms choose to use price feedback based on the signal-to-noise ratio, the model would suggest that firms with more information in their price invest more after positive returns and invest less after negative returns, relative to firms with less information in their price.

To measure whether investment behavior depends on the information production incentivized via the IPO, I first measure investment by comparing the asset growth in the year of the IPO (controlling for the increase in assets due to the IPO itself) with the asset growth in the first fiscal year following the IPO. I then segment firms two ways. First, I segment firms into high and low information firms based on the expected trading for the firm, given by

$$ExpectedTrading_i = TotalInst_i * AvgProbability_i \tag{3.13}$$

which is then adjusted for the median level of $ExpectedTrading$ in the quarter. Firms above the median are classified as high information firms. Second, I segment firms based on positive or

negative returns from the day after the IPO to the end of the firm's fiscal year.[18] While the amount of time for price feedback to affect investment varies among firms, using fiscal year ends allows for clean separation between post-IPO returns and the timing of investment decisions.[19] The returns are segmented at zero as this is a natural division between positive and negative news the firm may learn about the value of its investment opportunities.

Using the expected trading and return classifications, I compare median abnormal asset growth rates to test for a differential price feedback effect. Table 3.11 displays results of Wilcoxon Rank Sum tests indicating the overall, abnormal growth rates are not different between high and low information firms. However, when returns are positive, high information firms grow faster than low information firms (p-value 0.055), and when returns are negative, high information firms grow slower than low information firms (p-value 0.006). The stronger effect occurs for negative returns, which would align with projects' being easier to cancel than start. Both pieces of evidence are consistent with firms that incentivize a higher level of information adapting their investment to returns more so than low information firms. The evidence is suggestive of a real effect on firm activity resulting from the underpricing and allocations selected in the IPO.

[18] Alternatively, the presented results are robust to considering the sign of firms' market-adjusted returns.
[19] As a robustness test, using returns over 6, 9 or 12 months after the IPO give qualitatively similar results.

Table **3.11**: Investment Sensitivity to Returns. Abnormal investment is measured as the growth in assets in the first fiscal year after being public less the growth in assets in the year in which the firm goes public (excluding the proceeds from the IPO). Returns are calculated using the closing price on the first day of trading and the closing price on the last day of the firm's fiscal year in the year of the IPO. IPOs are segmented into low and high information IPOs based on whether $ExpectedTrading$ is below or above the median value for the quarter of the IPO, respectively.

	Low Information IPOs		High Information IPOs
All Observations			
Median Abnormal Investment	0.349		0.339
Z-Score for Equality of Medians		0.331	
P-value		(0.741)	
Return > 0			
Median Abnormal Investment	0.396		0.436
Z-Score for Equality of Medians		2.750	
P-value		(0.006)	
Return < 0			
Median Abnormal Investment	0.292		0.231
Z-Score for Equality of Medians		-1.915	
P-value		(0.055)	

Chapter 4

Robustness Tests and Extensions

I extend the empirical analysis to rule out several alternative explanations for my results. Additionally, I repeat the analyses of the preceding chapter using alternative definitions of information production, additional control variables, and using sub-samples of the data.

4.1 Robustness Tests

In the main analyses, a number of choices have been made regarding how to measure key dependent and independent variables, including current and historical information production. The following robustness tests consider alternative thresholds and measurement techniques, providing confidence in the results of the main analyses.

4.1.1 Alternative Measures of Future Informed Trading

While the measure of informed trading used in the main analyses is theoretically justified, other alternative measurements may be equally justified and provide a means of testing the robustness of the main results. In this section, I repeat the main analyses using alternative measures of informed trading, and show that the main results are robust to these alternatives.

4.1.1.1 Alternative Percent Change Thresholds

The main analysis measures informed trading based on the idea that large position changes are likely informationally motivated. However, the threshold used to determine sufficiently large

position changes is arbitrarily set at 50%. To test the robustness of the measure and results to this arbitrary choice, I repeat the analyses using two alternative thresholds: 25% and 100%. Tables 4.1, 4.2, 4.3 and 4.4 mirror the results of the main analyses for a 25% threshold, and Tables 4.5, 4.6, 4.7 and 4.8 do the same for a 100% threshold. The results are qualitatively similar to those of the main analyses.

4.1.1.2 Adjusting $Informed$ for Allocation Size

Using a percentage threshold to calculate $Informed$ introduces a concern that funds with larger reported holdings at the end of the quarter following the IPO (proxy for allocations) will be less likely to satisfy the threshold due to larger-sized trades' being more difficult to complete (and conversely, smaller holdings will be more likely to satisfy the threshold). First, I show that this concern is apparent in the data, as very large allocations have lower proportions of $Informed = 1$ while very small allocations have higher proportions. Second, I use two alternative measures of $Informed$ to show that the results are qualitatively unchanged when the size of the initial allocation is taken into account in the thresholds used to determine informed trading.

I analyze the relation between $Informed$ and initial allocations by calculating the mean value of $Informed$ for each of twenty quantiles based on funds' number of shares held at the end of the quarter following the IPO. As shown in Table 4.9, the mean value of $Informed$ tends to be high for low share quantiles, and low for high share quantiles. This is consistent with funds' being less likely to substantially increase their positions after receiving larger allocations (or possibly increasing their positions before the end of the quarter). As a result, the main results of the paper could be driven by biasing large allocations against being regarded as subsequently informed.

To develop an alternative measure of $Informed$, I first construct a variable, $MaxPctChange$, measuring the maximum position increase over quarters 2, 3 and 4 following the IPO. Formally,

$$MaxPctChange = Max\left(\frac{Shares_{Q2}}{Shares_{Q1}} - 1, \frac{Shares_{Q3}}{Shares_{Q2}} - 1, \frac{Shares_{Q4}}{Shares_{Q3}} - 1, 2.5\right) \tag{4.1}$$

and note that $Informed = 1$ when $MaxPctChange >= 0.5$.[1] I then use $MaxPctChange$ to

[1] $MaxPctChange$ is capped at 2.5 to prevent very large outliers from driving the results. The cap at 2.5 does not

Table 4.1: Probit Estimation of IPO Allocations Using $AvgInformed\_25$. $AvgInformed\_25$ is based on $Informed\_25$, which considers position increases of over 25% as being indicative of information production. 'Established Funds" observations have a value for $AvgInformed\_25$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are available in the appendix. Standard errors, clustered at the IPO and fund levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1062***	0.0916***	0.0791***
	(0.0064)	(0.0063)	(0.0071)
Log($FundAge$)	-0.0082***	-0.0020***	-0.0021***
	(0.0004)	(0.0004)	(0.0004)
$Churn$	0.1721***	0.1678***	0.1056***
	(0.0280)	(0.0315)	(0.0365)
$OneTime$	0.6684***	0.5151***	0.4903***
	(0.0133)	(0.0090)	(0.0113)
$MultipleTimes$	1.2378***	0.8977***	0.8480***
	(0.0302)	(0.0164)	(0.0190)
$NumPrevIPOs$	0.0067**	0.0026***	0.0023***
	(0.0033)	(0.0001)	(0.0001)
$AvgSystematicSell$		0.5750***	0.5934***
		(0.0815)	(0.0832)
$AvgFlipped$		-0.4457***	-0.5478***
		(0.0738)	(0.0835)
$AvgIPOHoldTime$		0.0077**	0.0138***
		(0.0036)	(0.0038)
$AvgInformed\_25$		0.5127***	0.3596***
		(0.0727)	(0.0775)
$HighUP$			-0.4656***
			(0.1371)
$HighUP\times$ Log($FundValue$)			0.0232***
			(0.0065)
$HighUP\times$ Log($FundAge$)			0.0001
			(0.0004)
$HighUP \times Churn$			0.1104***
			(0.0350)
$HighUP \times OneTime$			0.0342***
			(0.0131)
$HighUP \times MultipleTimes$			0.0682***
			(0.0179)
$HighUP \times NumPrevIPO$			0.0007***
			(0.0001)

$HighUP \times AvgSystematicSell$			-0.0232
			(0.0756)
$HighUP \times AvgFlipped$			0.1687**
			(0.0754)
$HighUP \times AvgIPOHoldTime$			-0.0107***
			(0.0030)
$HighUP \times AvgInformed\_25$			0.2727***
			(0.0669)
Constant	-4.2123***	-4.0528***	-3.8977***
	(0.2124)	(0.1569)	(0.1728)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	9.84%	19.02%	19.59%
Observations	2,940,445	1,777,725	1,777,725

Table 4.2: Probit Estimation of Future Informed Trading Using $AvgInformed\_25$. $AvgInformed\_25$ is based on $Informed\_25$, which considers position increases of over 25% as being indicative of information production. "Established Funds" observations have a value for $AvgInformed\_25$ while "New Funds" observations do not due to an insufficient data history. Additional variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed\_25$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0204**	-0.0099*
	(0.0089)	(0.0060)
$UWInfoProd$	0.0047	0.0137***
	(0.0043)	(0.0030)
$OneTime$	-0.0372	0.0040
	(0.0250)	(0.0127)
$MultipleTimes$	0.1150***	0.0497***
	(0.0417)	(0.0157)
$FirstNumAnalysts$	0.0070	0.0204***
	(0.0417)	(0.0157)
$OneYearNumAnalysts$	-0.0204**	-0.0099*
	(0.0089)	(0.0060)
$VCBacked$	0.0599**	0.0272*
	(0.0241)	(0.0142)
$90DayReturn$	0.1476***	0.2948***
	(0.0312)	(0.0208)
$Spread$	-3.7087**	-6.8541***
	(1.8372)	(1.0858)
$AvgVolume$	0.0000***	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	-1.4013	-0.9062
	(1.1488)	(0.7245)
$IndustryOverweight$	0.0417***	0.0473***
	(0.0097)	(0.0080)
$IndWeightStdDev$	-0.1497***	-0.0634*
	(0.0437)	(0.0359)
$NumPrevIPOs$	0.0075	0.0001
	(0.0085)	(0.0001)
$AllocationPct$	-0.3051	0.3505
	(0.3944)	(0.2662)
$Shares$	-0.0095*	-0.0268***
	(0.0055)	(0.0033)
$Churn$	-1.6020***	-1.5014***
	(0.1178)	(0.0912)

Log($FundValue$)	0.0568***	0.0015
	(0.0166)	(0.0086)
Log($FundAge$)	-0.0024***	-0.0003
	(0.0008)	(0.0006)
$AvgFlipped$		-0.9108***
		(0.1332)
$AvgSystematicSell$		0.8937***
		(0.1444)
$AvgIPOHoldTime$		0.0272***
		(0.0044)
$AvgInformed\_25$		1.6063***
		(0.1307)
$MoneyLeft$	0.0107	0.0878***
	(0.0117)	(0.0128)
$AvgInformed\_25 \times MoneyLeft$		-0.1045***
		(0.0346)
Constant	-1.2292***	-0.9609***
	(0.3394)	(0.2462)
Year Dummy Variables	Yes	Yes
Pseudo R^2	4.01%	9.00%
Observations	22,936	106,453

Table 4.3: OLS Estimation of Total Future Informed Trading Using $TotalInformed\_25$. $TotalInformed\_25$ is based on $Informed\_25$, which considers position increases of over 25% as being indicative of information production. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed\_25$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.0468	0.0563	0.0501	0.0435
	(0.0479)	(0.0479)	(0.0478)	(0.0453)
$LogProceeds$	-1.0497***	-0.9703***	-1.0253***	-0.7610***
	(0.1054)	(0.1072)	(0.1070)	(0.1017)
$UnderwriterRank$	-0.1717***	-0.1825***	-0.1747***	-0.1426***
	(0.0353)	(0.0353)	(0.0353)	(0.0341)
$VCBacked$	0.1057	0.0999	0.1040	0.0276
	(0.1123)	(0.1122)	(0.1123)	(0.1037)
$NumConcurrentIPO$	0.0006	0.0010	0.0005	-0.0022
	(0.0040)	(0.0040)	(0.0040)	(0.0037)
$AvgUPConcurrentIPO$	-0.0237***	-0.0276***	-0.0257***	-0.0202***
	(0.0053)	(0.0055)	(0.0054)	(0.0049)
$TechFirm$	-0.0518	-0.0525	-0.0457	-0.0096
	(0.1157)	(0.1157)	(0.1156)	(0.1074)
$OfferPriceRevision$	-1.1300***	-1.6648***	-1.3195***	-1.0503***
	(0.3559)	(0.3682)	(0.3496)	(0.3303)
$PercentSold$	-0.8854***	-0.8034***	-0.8488***	-0.5775**
	(0.3001)	(0.2988)	(0.2990)	(0.2807)
$PercentInst$	-0.1194	-0.1392	-0.0579	-0.1541
	(0.2314)	(0.2321)	(0.2332)	(0.2165)
$UWAvgUP$	-0.7913*	-1.2782***	-0.9455**	-0.6646
	(0.4560)	(0.4775)	(0.4560)	(0.4380)
$UWInfoProd$	0.1154***	0.1216***	0.1187***	0.0597**
	(0.0261)	(0.0264)	(0.0263)	(0.0249)
$NumInstInv$	0.3918***	0.3884***	0.3875***	0.3784***
	(0.0072)	(0.0073)	(0.0076)	(0.0069)
$AvgIndOverweight$	-0.0924	-0.1179	-0.0974	-0.1577
	(0.1095)	(0.1095)	(0.1097)	(0.1034)
$Spread$	-23.8009***	-23.0552***	-23.7995***	-0.3733
	(5.1124)	(5.1241)	(5.1129)	(4.9827)
$AvgVolume$	2.3141***	2.1342***	2.0378***	2.0421***
	(0.5567)	(0.5657)	(0.5917)	(0.5358)
$ReturnStdDev$	-13.9475***	-15.6983***	-14.0058***	-7.4432*
	(4.6238)	(4.6078)	(4.6151)	(4.4628)
$FirstNumAnalysts$	-0.2784***	-0.2637***	-0.2718***	-0.2368***
	(0.0780)	(0.0783)	(0.0783)	(0.0752)

$OneYearNumAnalysts$	0.3418***	0.3339***	0.3369***	0.2663***
	(0.0453)	(0.0454)	(0.0455)	(0.0438)
$Underpricing$		0.8551***		
		(0.3128)		
$TotalMoneyLeft$			0.0044	
			(0.0029)	
$AvgProbability\_25$				27.5535***
				(0.9643)
Constant	7.1895***	7.0770***	7.2376***	-3.8873***
	(0.9564)	(0.9538)	(0.9613)	(1.0372)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	83.78%	83.83%	83.80%	85.72%
Observations	5,216	5,216	5,216	5,216

Table 4.4: OLS Estimation of Underpricing Using $TotalInformed\_25$. $TotalInformed\_25$ is based on $Informed\_25$, which considers position increases of over 25% as being indicative of information production. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
$LogFirmAge$	-0.0099***	-0.0110***	-0.0112***	-0.0111***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$LogProceeds$	-0.0612***	-0.0921***	-0.0883***	-0.0889***
	(0.0065)	(0.0071)	(0.0072)	(0.0071)
$UnderwriterRank$	0.0078***	0.0125***	0.0131***	0.0128***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)
$VCBacked$	0.0014	0.0068	0.0064	0.0060
	(0.0074)	(0.0073)	(0.0073)	(0.0073)
$NumConcurrentIPO$	-0.0006*	-0.0004	-0.0005	-0.0005
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
$AvgUPConcurrentIPO$	0.0045***	0.0043***	0.0044***	0.0044***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
$MktReturn$	5.8031***	5.6935***	5.6438***	5.5994***
	(2.1308)	(2.0878)	(2.0908)	(2.0867)
$MktStdDeviation$	1.3487	1.6339	1.2938	1.4683
	(1.4397)	(1.4030)	(1.4061)	(1.4001)
$TechFirm$	0.0012	0.0005	0.0006	0.0009
	(0.0083)	(0.0081)	(0.0081)	(0.0081)
$OfferPriceRevision$	0.6960***	0.6256***	0.6293***	0.6263***
	(0.0290)	(0.0291)	(0.0291)	(0.0291)
$PercentSold$	-0.0869***	-0.0952***	-0.0920***	-0.0918***
	(0.0162)	(0.0162)	(0.0162)	(0.0161)
$PercentInst$	0.1110***	0.0222	0.0228	0.0219
	(0.0148)	(0.0173)	(0.0173)	(0.0173)
$UWAvgUP$	0.5708***	0.5706***	0.5733***	0.5719***
	(0.0405)	(0.0401)	(0.0399)	(0.0399)
$UWInfoProd$	-0.0049***	-0.0072***	-0.0076***	-0.0078***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
$AvgIndOverweight$	0.0223***	0.0297***	0.0301***	0.0291***
	(0.0081)	(0.0081)	(0.0081)	(0.0081)
$Spread$	-0.7984**	-0.8629**	-0.7771**	-0.6059
	(0.3845)	(0.3749)	(0.3732)	(0.3755)
$AvgVolume$	0.2956***	0.2070***	0.1988***	0.2042***
	(0.0418)	(0.0433)	(0.0433)	(0.0433)
$ReturnStdDev$	1.9203***	2.1005***	2.1511***	2.1712***
	(0.3465)	(0.3410)	(0.3422)	(0.3442)

$FirstNumAnalysts$	-0.0186***	-0.0173***	-0.0163***	-0.0169***
	(0.0045)	(0.0045)	(0.0045)	(0.0045)
$OneYearNumAnalysts$	0.0111***	0.0094***	0.0082***	0.0086***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$NumInstInv$		0.0040***	0.0025***	0.0038***
		(0.0004)	(0.0007)	(0.0004)
$TotalInformed\_25$			0.0036***	
			(0.0013)	
$AvgProbability\_25$				0.3029***
				(0.0731)
Constant	0.0858	0.1125**	0.0905	-0.0072
	(0.0550)	(0.0570)	(0.0577)	(0.0654)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	58.85%	59.91%	60.04%	60.05%
Observations	5,216	5,216	5,216	5,216

Table 4.5: Probit Estimation of IPO Allocations Using $AvgInformed\_100$. $AvgInformed\_100$ is based on $Informed\_100$, which considers position increases of over 100% as being indicative of information production. 'Established Funds" observations have a value for $AvgInformed\_100$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are available in the appendix. Standard errors, clustered at the IPO and fund levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1062***	0.0913***	0.0775***
	(0.0064)	(0.0063)	(0.0071)
Log($FundAge$)	-0.0082***	-0.0019***	-0.0020***
	(0.0004)	(0.0004)	(0.0004)
$Churn$	0.1721***	0.1593***	0.0968***
	(0.0280)	(0.0312)	(0.0361)
$OneTime$	0.6684***	0.5167***	0.4915***
	(0.0133)	(0.0090)	(0.0113)
$MultipleTimes$	1.2378***	0.8966***	0.8461***
	(0.0302)	(0.0163)	(0.0189)
$NumPrevIPOs$	0.0067**	0.0026***	0.0022***
	(0.0033)	(0.0001)	(0.0001)
$AvgSystematicSell$		0.4227***	0.5169***
		(0.0699)	(0.0744)
$AvgFlipped$		-0.4292***	-0.5376***
		(0.0747)	(0.0837)
$AvgIPOHoldTime$		0.0049	0.0117***
		(0.0033)	(0.0035)
$AvgInformed\_100$		0.6419***	0.5639***
		(0.0910)	(0.1039)
$HighUP$			-0.3789***
			(0.1341)
$HighUP\times$ Log($FundValue$)			0.0254***
			(0.0065)
$HighUP\times$ Log($FundAge$)			0.0000
			(0.0004)
$HighUP \times Churn$			0.1109***
			(0.0348)
$HighUP \times OneTime$			0.0350***
			(0.0131)
$HighUP \times MultipleTimes$			0.0694***
			(0.0179)
$HighUP \times NumPrevIPO$			0.0007***
			(0.0001)

$HighUP \times AvgSystematicSell$			-0.1578**
			(0.0689)
$HighUP \times AvgFlipped$			0.1801**
			(0.0752)
$HighUP \times AvgIPOHoldTime$			-0.0119***
			(0.0030)
$HighUP \times AvgInformed\_100$			0.1434*
			(0.0816)
Constant	-4.2123***	-3.9078***	-3.8014***
	(0.2124)	(0.1520)	(0.1665)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	9.84%	19.05%	19.61%
Observations	2,940,445	1,777,725	1,777,725

Table 4.6: Probit Estimation of Future Informed Trading Using $AvgInformed\_100$. $AvgInformed\_100$ is based on $Informed\_100$, which considers position increases of over 100% as being indicative of information production. "Established Funds" observations have a value for $AvgInformed\_100$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed\_100$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0016	-0.0046
	(0.0100)	(0.0072)
$UWInfoProd$	0.0020	0.0174***
	(0.0053)	(0.0034)
$OneTime$	-0.0458	0.0019
	(0.0293)	(0.0143)
$MultipleTimes$	0.1117**	0.0479***
	(0.0477)	(0.0180)
$FirstNumAnalysts$	0.0024	0.0210***
	(0.0477)	(0.0180)
$OneYearNumAnalysts$	-0.0016	-0.0046
	(0.0100)	(0.0072)
$VCBacked$	0.0837***	0.0638***
	(0.0280)	(0.0148)
$90DayReturn$	0.0916***	0.2682***
	(0.0331)	(0.0201)
$Spread$	-4.5477**	-7.2968***
	(2.2582)	(1.3205)
$AvgVolume$	0.0000***	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	2.0490	1.9648**
	(1.3413)	(0.8130)
$IndustryOverweight$	0.0548***	0.0603***
	(0.0118)	(0.0096)
$IndWeightStdDev$	-0.0719	-0.0226
	(0.0497)	(0.0460)
$NumPrevIPOs$	-0.0062	0.0003**
	(0.0095)	(0.0001)
$AllocationPct$	-2.3907***	-2.4706***
	(0.5914)	(0.3686)
$Shares$	-0.0334***	-0.0547***
	(0.0077)	(0.0057)
$Churn$	-1.1002***	-1.0695***
	(0.1218)	(0.0958)

Log($FundValue$)	0.0762***	0.0190*
	(0.0200)	(0.0102)
Log($FundAge$)	-0.0027***	-0.0003
	(0.0010)	(0.0005)
$AvgFlipped$		-0.9894***
		(0.1570)
$AvgSystematicSell$		0.6325***
		(0.1183)
$AvgIPOHoldTime$		0.0156***
		(0.0035)
$AvgInformed\_100$		1.8840***
		(0.1550)
$MoneyLeft$	0.0197	0.1057***
	(0.0135)	(0.0123)
$AvgInformed\_100 \times MoneyLeft$		-0.2820***
		(0.0676)
Constant	-2.4318***	-1.6164***
	(0.4055)	(0.2587)
Year Dummy Variables	Yes	Yes
Pseudo R^2	4.72%	11.22%
Observations	22,936	106,453

Table 4.7: OLS Estimation of Total Future Informed Trading Using $TotalInformed\_100$. $TotalInformed\_100$ is based on $Informed\_100$, which considers position increases of over 100% as being indicative of information production. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed\_100$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.0360	0.0500	0.0419	0.0426
	(0.0374)	(0.0372)	(0.0373)	(0.0349)
$LogProceeds$	-1.2283***	-1.1106***	-1.1842***	-0.9679***
	(0.0821)	(0.0831)	(0.0835)	(0.0781)
$UnderwriterRank$	-0.0365	-0.0525**	-0.0418	-0.0632**
	(0.0263)	(0.0261)	(0.0262)	(0.0251)
$VCBacked$	0.1549*	0.1461*	0.1518*	-0.0039
	(0.0854)	(0.0849)	(0.0850)	(0.0790)
$NumConcurrentIPO$	0.0011	0.0016	0.0008	0.0013
	(0.0030)	(0.0030)	(0.0030)	(0.0027)
$AvgUPConcurrentIPO$	-0.0162***	-0.0220***	-0.0198***	-0.0113***
	(0.0040)	(0.0042)	(0.0041)	(0.0037)
$TechFirm$	0.0459	0.0448	0.0569	0.0485
	(0.0871)	(0.0868)	(0.0867)	(0.0805)
$OfferPriceRevision$	0.4535	-0.3403	0.1110	-0.0197
	(0.2824)	(0.2871)	(0.2762)	(0.2556)
$PercentSold$	-1.3111***	-1.1893***	-1.2449***	-0.9062***
	(0.2311)	(0.2277)	(0.2291)	(0.2148)
$PercentInst$	-0.8100***	-0.8394***	-0.6988***	-0.5530***
	(0.1799)	(0.1800)	(0.1829)	(0.1665)
$UWAvgUP$	-0.4631	-1.1859***	-0.7420**	-0.4120
	(0.3462)	(0.3655)	(0.3471)	(0.3335)
$UWInfoProd$	0.1005***	0.1096***	0.1065***	0.0407**
	(0.0195)	(0.0197)	(0.0197)	(0.0181)
$NumInstInv$	0.2337***	0.2287***	0.2260***	0.2154***
	(0.0059)	(0.0059)	(0.0064)	(0.0054)
$AvgIndOverweight$	0.0324	-0.0055	0.0233	-0.1038
	(0.0808)	(0.0807)	(0.0809)	(0.0770)
$Spread$	-14.2342***	-13.1272***	-14.2316***	4.0553
	(3.7666)	(3.7316)	(3.7472)	(3.7272)
$AvgVolume$	3.6386***	3.3715***	3.1389***	3.1904***
	(0.4439)	(0.4527)	(0.4738)	(0.4212)
$ReturnStdDev$	-2.6456	-5.2446	-2.7509	-8.8593***
	(3.5135)	(3.4622)	(3.4888)	(3.3509)
$FirstNumAnalysts$	-0.2051***	-0.1833***	-0.1932***	-0.1457***
	(0.0601)	(0.0605)	(0.0602)	(0.0556)

$OneYearNumAnalysts$	0.2628***	0.2511***	0.2539***	0.1741***
	(0.0350)	(0.0350)	(0.0350)	(0.0324)
$Underpricing$		1.2693***		
		(0.2517)		
$TotalMoneyLeft$			0.0079***	
			(0.0023)	
$AvgProbability\_100$				17.9775***
				(0.5985)
Constant	6.3343***	6.1672***	6.4211***	1.4928**
	(0.6593)	(0.6729)	(0.6826)	(0.6439)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	76.88%	77.15%	77.03%	80.31%
Observations	5,216	5,216	5,216	5,216

Table 4.8: OLS Estimation of Underpricing Using $TotalInformed\_100$. $TotalInformed\_100$ is based on $Informed\_100$, which considers position increases of over 100% as being indicative of information production. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0099***	-0.0110***	-0.0114***	-0.0109***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
LogProceeds	-0.0612***	-0.0921***	-0.0809***	-0.0878***
	(0.0065)	(0.0071)	(0.0072)	(0.0071)
UnderwriterRank	0.0078***	0.0125***	0.0128***	0.0121***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)
VCBacked	0.0014	0.0068	0.0054	0.0042
	(0.0074)	(0.0073)	(0.0073)	(0.0073)
NumConcurrentIPO	-0.0006*	-0.0004	-0.0005	-0.0004
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
AvgUPConcurrentIPO	0.0045***	0.0043***	0.0045***	0.0044***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
MktReturn	5.8031***	5.6935***	5.6092***	5.6131***
	(2.1308)	(2.0878)	(2.0854)	(2.0839)
MktStdDeviation	1.3487	1.6339	0.9487	1.3458
	(1.4397)	(1.4030)	(1.4124)	(1.4010)
TechFirm	0.0012	0.0005	0.0000	0.0005
	(0.0083)	(0.0081)	(0.0081)	(0.0081)
OfferPriceRevision	0.6960***	0.6256***	0.6207***	0.6175***
	(0.0290)	(0.0291)	(0.0291)	(0.0292)
PercentSold	-0.0869***	-0.0952***	-0.0833***	-0.0886***
	(0.0162)	(0.0162)	(0.0160)	(0.0161)
PercentInst	0.1110***	0.0222	0.0299*	0.0266
	(0.0148)	(0.0173)	(0.0174)	(0.0174)
UWAvgUP	0.5708***	0.5706***	0.5745***	0.5713***
	(0.0405)	(0.0401)	(0.0398)	(0.0398)
UWInfoProd	-0.0049***	-0.0072***	-0.0081***	-0.0082***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
AvgIndOverweight	0.0223***	0.0297***	0.0295***	0.0276***
	(0.0081)	(0.0081)	(0.0080)	(0.0081)
Spread	-0.7984**	-0.8629**	-0.7355**	-0.5642
	(0.3845)	(0.3749)	(0.3708)	(0.3752)
AvgVolume	0.2956***	0.2070***	0.1744***	0.1999***
	(0.0418)	(0.0433)	(0.0436)	(0.0431)
ReturnStdDev	1.9203***	2.1005***	2.1242***	1.9982***
	(0.3465)	(0.3410)	(0.3375)	(0.3378)

$FirstNumAnalysts$	-0.0186***	-0.0173***	-0.0155***	-0.0163***
	(0.0045)	(0.0045)	(0.0045)	(0.0045)
$OneYearNumAnalysts$	0.0111***	0.0094***	0.0071***	0.0080***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$NumInstInv$		0.0040***	0.0018***	0.0037***
		(0.0004)	(0.0006)	(0.0004)
$TotalInformed\_100$			0.0091***	
			(0.0018)	
$AvgProbability\_100$				0.2945***
				(0.0561)
Constant	0.0858	0.1125**	0.0634	0.0368
	(0.0550)	(0.0570)	(0.0591)	(0.0588)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	58.85%	59.91%	60.37%	60.14%
Observations	5,216	5,216	5,216	5,216

Table 4.9: Summary Statistics by Allocation-Size Quantiles. Twenty quantiles are formed based on the number of shares reported at the end of the quarter following an IPO (proxy for allocations). Thresholds for determining informed trading (indicated by $Informed\_SizeAdj$) in each quantile are given by the 26.25^{th} percentile of $MaxPctChange$. Variable definitions are provided in the appendix.

Quantile	Maximum of *Shares*	Mean of $Informed$	Mean of $MaxPctChange$	26.25 Percentile $MaxPctChange$	Mean of $Informed\_SizeAdj$
1	1,650	0.3813	5.2753	2.3913	0.2625
2	5,000	0.3005	2.7725	1.0000	0.2683
3	10,000	0.2713	1.6950	0.6139	0.2626
4	12,565	0.2931	1.5239	0.7662	0.2625
5	16,500	0.2671	1.3029	0.5333	0.2631
6	20,725	0.2582	1.0779	0.5000	0.2665
7	26,000	0.2734	1.1538	0.5913	0.2626
8	33,000	0.2642	1.0114	0.5112	0.2625
9	41,000	0.2611	0.8751	0.5000	0.2648
10	50,000	0.2443	0.7810	0.4379	0.2625
11	62,824	0.2816	0.8980	0.6150	0.2626
12	78,250	0.2616	0.7775	0.5000	0.2629
13	100,000	0.2499	0.6927	0.4696	0.2625
14	121,046	0.2696	0.7499	0.5219	0.2627
15	152,300	0.2557	0.6243	0.4846	0.2625
16	200,000	0.2436	0.6067	0.4405	0.2626
17	270,000	0.2481	0.5995	0.4586	0.2626
18	395,500	0.2367	0.5684	0.4260	0.2625
19	683,300	0.2141	0.5613	0.3751	0.2625
20	300,000,000	0.1902	0.4619	0.3260	0.2626

set thresholds separately for each share quantile, thereby ensuring the same proportion of trades in each quantile are classified as indicative of information production. Specifically, as 26.25% of allocations have $Informed = 1$, I calculate the 26.25^{th} percentile for each share quantile, and then set $Informed\_SizeAdj = 1$ if $MaxPctChange$ exceeds the threshold for the allocations share quantile (thresholds are listed in Table 4.9). Note that the mean values of $Informed\_SizeAdj$ are approximately equal across share quantiles (slight differences are due to quantiles where multiple observations are equal to the threshold value, leading to more observations' being indicative of information production).

The main results are not qualitatively changed when the measurement of information production accounts for the initial allocation size. Table 4.10 shows the results from estimating the probability of future trading activity using the same set of control variables as in the main analysis, but substituting an alternative measure of funds' history of informed trading, $AvgInformed\_SizeAdj$, which is constructed analogously to $AvgInformed$ using funds' historic values of $Informed\_SizeAdj$. As in the main analysis, funds' reputations for information production are positively related to future informed trading actively, as is funds' amount of money left on the table received. Also consistent with the main analysis, the coefficient reflecting the interaction between information production reputation and money left on the table is negative. While $Informed\_SizeAdj$ does account for the initial allocation size based on share quantiles, the initial allocation size is still negatively related to future informed trading, consistent with larger allocations' being less likely to reach the trading thresholds within share quantiles.

Given the relation between initial allocation size and future informed trading present after controlling for share quantiles, I conduct an additional test utilizing a linear adjustment of trading thresholds based on initial allocation size. I first regress $MaxPctChange$, the measure used to determine thresholds, on $Shares$ and save the predicted residuals, which represent the incremental buying percentages not explained by the size of the initial allocation. I then consider those in the top 26.25^{th} percentile as being informed trades, and define this measure of information production

affect the thresholds used in each quantile.

Table 4.10: Probit Estimation of Future Informed Trading Using $AvgInformed\_SizeAdj$. $AvgInformed\_SizeAdj$ is based on $Informed\_SizeAdj$, which considers position increases over initial-allocation-size-based thresholds (available in Table 4.9) as being indicative of information production. "Established Funds" observations have a value for $AvgInformed\_SizeAdj$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are available in the appendix. Standard errors, clustered at the IPO and fund levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

		$Informed\_SizeAdj$	
	New Funds	Established Funds	Established Funds
$UnderwriterRank$	-0.0186**	-0.0092	-0.0090
	(0.0094)	(0.0063)	(0.0063)
$UWInfoProd$	0.0063	0.0163***	0.0168***
	(0.0046)	(0.0032)	(0.0032)
$OneTime$	-0.0359	-0.0015	-0.0021
	(0.0259)	(0.0130)	(0.0129)
$MultipleTimes$	0.0561	0.0472***	0.0371**
	(0.0481)	(0.0154)	(0.0151)
$FirstNumAnalysts$	-0.0032	-0.0177***	-0.0184***
	(0.0075)	(0.0056)	(0.0057)
$OneYearNumAnalysts$	0.0037	0.0212***	0.0218***
	(0.0043)	(0.0032)	(0.0032)
$VCBacked$	0.0685***	0.0350**	0.0380***
	(0.0246)	(0.0142)	(0.0142)
$90DayReturn$	0.1277***	0.2830***	0.2823***
	(0.0342)	(0.0201)	(0.0200)
$Spread$	-3.7536*	-6.0338***	-5.9282***
	(1.9545)	(1.1201)	(1.1163)
$AvgVolume$	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)
$6MonthReturnStdDev$	-0.4595	-0.0625	-0.0730
	(1.2005)	(0.7077)	(0.7076)
$IndustryOverweight$	0.0529***	0.0621***	0.0616***
	(0.0103)	(0.0083)	(0.0082)
$IndWeightStdDev$	-0.0546	-0.0828*	-0.0796*
	(0.0449)	(0.0447)	(0.0462)
$NumPrevIPOs$	-0.0066	0.0002*	0.0002
	(0.0085)	(0.0001)	(0.0001)
$AllocationPct$	-1.0452**	-0.4011	-0.3867
	(0.4192)	(0.2729)	(0.2685)
$Shares$	-0.0031	-0.0220***	-0.0181***
	(0.0056)	(0.0035)	(0.0034)
$Churn$	-1.2561***	-1.3181***	-1.3320***
	(0.1185)	(0.0872)	(0.0850)

Log($FundValue$)	0.0718***	0.0132	0.0103
	(0.0187)	(0.0091)	(0.0093)
Log($FundAge$)	-0.0023***	-0.0006	-0.0005
	(0.0009)	(0.0006)	(0.0006)
$AvgFlipped$		-0.6977***	-0.6446***
		(0.1318)	(0.1318)
$AvgSystematicSell$		0.5008***	0.4384***
		(0.1240)	(0.1179)
$AvgIPOHoldTime$		0.0198***	0.0169***
		(0.0039)	(0.0040)
$MoneyLeft$	0.0284***	0.0976***	0.0957***
	(0.0107)	(0.0131)	(0.0112)
$AvgInformed\_SizeAdj$		1.4499***	
		(0.1248)	
$AvgInformed\_SizeAdj \times MoneyLeft$		-0.1454***	
		(0.0409)	
$AvgMaxPctChange$			0.7759***
			(0.0641)
$AvgMaxPctChange \times MoneyLeft$			-0.0836***
			(0.0198)
Constant	-1.9180***	-1.0835***	-1.0429***
	(0.3771)	(0.2408)	(0.2379)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	3.37%	8.26%	8.34%
Observations	22,936	106,453	106,453

as $Informed\_LinearAdj$.

Table 4.11 shows the results from estimating the probability of future trading activity using the linearly-adjusted measure of informed trading. The first specification utilizes $AvgInformed$ to measure funds' reputations for information production, while the second specification uses $AvgMaxPctChange$ (calculated analogously to $AvgInformed$, but using $MaxPctChange$ instead of $Informed$). Similar to the previous tests, the results are qualitatively unchanged from the main analysis. However, in these tests, the relations between future information production and the initial allocation sizes are much weaker, and in the second specification, are only significant at the 10% level. Taken together, the previous two tables provide confidence that measuring informed trading as a percentage is not driving the main results. Furthermore, using $AvgInformed\_SizeAdj$ and $AvgProbability\_SizeAdj$ in the other analyses does not alter the main results (see Tables 4.12, 4.13, and 4.14).

4.1.1.3 Including Significant Selling Activity

The main analyses utilize a measure of informed trading that relies on only buying activity in quarters following the IPO. This is due to the common and systematic selling activity of many funds in the first year following an IPO. If this selling is not informationally motivated, then classifying this selling as informed may add noise to the measure. Conversely, ignoring all selling necessarily ignores some informed selling, and it may be the case that information is the strongest determinant of post-IPO selling and the noise from other selling motivations is minimal. Accordingly, I consider an alternative measure of informed trading that considers position increases of more than 50% or position decreases by more than 50% as informationally motivated. Formally,

$$Informed\_BuyOrSell_{i,j} = \begin{cases} 1 & \text{if fund } j\text{'s position in firm } i \text{ increased or decreased} \\ & \text{by at least 50\% in Q2, Q3 or Q4} \\ 0 & \text{otherwise.} \end{cases} \tag{4.2}$$

Tables 4.15, 4.16, 4.17 and 4.18 repeat the main analyses of the paper using the alternative

Table 4.11: Probit Estimation of Future Informed Trading Using $Informed\_LinearAdj$. $Informed\_LinearAdj$ considers abnormal position increases beyond those predicted based on the fund's initial allocation size as being indicative of information production. "Established Funds" observations have a value for $AvgInformed\_LinearAdj$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are available in the appendix. Standard errors, clustered at the IPO and fund levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

		$Informed\_LinearAdj$	
	New Funds	Established Funds	Established Funds
$UnderwriterRank$	-0.0193**	-0.0136**	-0.0134**
	(0.0093)	(0.0063)	(0.0063)
$UWInfoProd$	0.0055	0.0171***	0.0177***
	(0.0047)	(0.0031)	(0.0031)
$OneTime$	-0.0295	0.0007	0.0001
	(0.0261)	(0.0130)	(0.0129)
$MultipleTimes$	0.0686	0.0513***	0.0393**
	(0.0431)	(0.0162)	(0.0155)
$FirstNumAnalysts$	0.0001	-0.0207***	-0.0215***
	(0.0071)	(0.0056)	(0.0057)
$OneYearNumAnalysts$	0.0040	0.0223***	0.0230***
	(0.0042)	(0.0032)	(0.0032)
$VCBacked$	0.0810***	0.0433***	0.0465***
	(0.0246)	(0.0141)	(0.0141)
$90DayReturn$	0.1447***	0.2839***	0.2836***
	(0.0319)	(0.0203)	(0.0202)
$Spread$	-3.3413*	-5.6328***	-5.5558***
	(1.9347)	(1.1503)	(1.1458)
$AvgVolume$	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)
$6MonthReturnStdDev$	0.3540	0.4434	0.4299
	(1.1909)	(0.7278)	(0.7295)
$IndustryOverweight$	0.0429***	0.0513***	0.0501***
	(0.0102)	(0.0085)	(0.0081)
$IndWeightStdDev$	-0.1009**	-0.0630	-0.0577
	(0.0443)	(0.0476)	(0.0412)
$NumPrevIPOs$	0.0022	0.0002*	0.0002
	(0.0083)	(0.0001)	(0.0001)
$AllocationPct$	-1.6499***	-1.3761***	-1.3404***
	(0.4189)	(0.2764)	(0.2708)
$Shares$	0.0051	-0.0101***	-0.0061*
	(0.0054)	(0.0036)	(0.0034)
$Churn$	-1.3831***	-1.3778***	-1.4002***
	(0.1142)	(0.0926)	(0.0872)

Log($FundValue$)	0.0683***	0.0078	0.0031
	(0.0181)	(0.0093)	(0.0089)
Log($FundAge$)	-0.0025***	-0.0006	-0.0004
	(0.0009)	(0.0005)	(0.0005)
$AvgFlipped$		-0.9635***	-0.9071***
		(0.1378)	(0.1343)
$AvgSystematicSell$		0.5715***	0.5688***
		(0.1247)	(0.1157)
$AvgIPOHoldTime$		0.0198***	0.0167***
		(0.0038)	(0.0036)
$MoneyLeft$	0.0164	0.0889***	0.0901***
	(0.0103)	(0.0136)	(0.0113)
$AvgInformed\_SizeAdj$		1.4257***	
		(0.1228)	
$AvgInformed\_SizeAdj \times MoneyLeft$		-0.1360***	
		(0.0446)	
$AvgMaxPctChange$			0.8291***
			(0.0644)
$AvgMaxPctChange \times MoneyLeft$			-0.0838***
			(0.0216)
Constant	-1.8132***	-0.9202***	-0.9049***
	(0.3647)	(0.2439)	(0.2248)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	3.78%	8.81%	9.04%
Observations	22,936	106,453	106,453

Table 4.12: Probit Estimation of IPO Allocations Using $AvgInformed\_SizeAdj$. $AvgInformed\_SizeAdj$ is based on $Informed\_SizeAdj$, which considers position increases over initial-allocation-size-based thresholds (available in Table 4.9) as being indicative of information production. "Established Funds" observations have a value for $AvgInformed\_SizeAdj$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are available in the appendix. Standard errors, clustered at the IPO and fund levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1062***	0.0920***	0.0778***
	(0.0064)	(0.0063)	(0.0071)
Log($FundAge$)	-0.0082***	-0.0020***	-0.0021***
	(0.0004)	(0.0004)	(0.0004)
$Churn$	0.1721***	0.1651***	0.1012***
	(0.0280)	(0.0313)	(0.0364)
$OneTime$	0.6684***	0.5163***	0.4912***
	(0.0133)	(0.0090)	(0.0113)
$MultipleTimes$	1.2378***	0.8990***	0.8479***
	(0.0302)	(0.0163)	(0.0189)
$NumPrevIPOs$	0.0067**	0.0026***	0.0023***
	(0.0033)	(0.0001)	(0.0001)
$AvgSystematicSell$		0.4632***	0.5616***
		(0.0702)	(0.0748)
$AvgFlipped$		-0.4486***	-0.5545***
		(0.0737)	(0.0831)
$AvgIPOHoldTime$		0.0070**	0.0137***
		(0.0035)	(0.0036)
$AvgInformed\_SizeAdj$		0.4234***	0.3875***
		(0.0675)	(0.0752)
$HighUP$			-0.3900***
			(0.1351)
$HighUP\times$ Log($FundValue$)			0.0261***
			(0.0065)
$HighUP\times$ Log($FundAge$)			0.0000
			(0.0004)
$HighUP \times Churn$			0.1131***
			(0.0352)
$HighUP \times OneTime$			0.0348***
			(0.0131)
$HighUP \times MultipleTimes$			0.0708***
			(0.0179)
$HighUP \times NumPrevIPO$			0.0007***
			(0.0001)

$HighUP \times AvgSystematicSell$			-0.1653**
			(0.0691)
$HighUP \times AvgFlipped$			0.1750**
			(0.0756)
$HighUP \times AvgIPOHoldTime$			-0.0117***
			(0.0030)
$HighUP \times AvgInformed\_SizeAdj$			0.0663
			(0.0577)
Constant	-4.2123***	-3.9268***	-3.8106***
	(0.2124)	(0.1529)	(0.1689)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	9.84%	19.00%	19.56%
Observations	2,940,445	1,777,725	1,777,725

Table 4.13: OLS Estimation of Total Future Informed Trading Using $TotalInformed\_SizeAdj$. $TotalInformed\_SizeAdj$ is based on $Informed\_SizeAdj$, which considers position increases over initial-allocation-size-based thresholds (available in Table 4.9) as being indicative of information production. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed\_SizeAdj$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.0124	0.0222	0.0151	0.0228
	(0.0432)	(0.0431)	(0.0431)	(0.0403)
$LogProceeds$	-0.9625***	-0.8799***	-0.9423***	-0.7084***
	(0.0929)	(0.0951)	(0.0946)	(0.0883)
$UnderwriterRank$	-0.1463***	-0.1575***	-0.1488***	-0.1245***
	(0.0318)	(0.0319)	(0.0318)	(0.0304)
$VCBacked$	0.0873	0.0812	0.0859	-0.0122
	(0.1003)	(0.1002)	(0.1002)	(0.0916)
$NumConcurrentIPO$	0.0010	0.0013	0.0008	-0.0001
	(0.0036)	(0.0036)	(0.0036)	(0.0032)
$AvgUPConcurrentIPO$	-0.0193***	-0.0234***	-0.0210***	-0.0150***
	(0.0046)	(0.0048)	(0.0047)	(0.0042)
$TechFirm$	0.0808	0.0801	0.0859	0.0629
	(0.1024)	(0.1024)	(0.1023)	(0.0936)
$OfferPriceRevision$	-0.7075**	-1.2646***	-0.8651***	-0.6324**
	(0.3231)	(0.3296)	(0.3149)	(0.2945)
$PercentSold$	-1.0696***	-0.9841***	-1.0392***	-0.6559***
	(0.2552)	(0.2533)	(0.2544)	(0.2372)
$PercentInst$	-0.3227	-0.3432*	-0.2715	-0.3854**
	(0.2055)	(0.2058)	(0.2079)	(0.1904)
$UWAvgUP$	-0.9023**	-1.4095***	-1.0306**	-0.7667**
	(0.4018)	(0.4215)	(0.4058)	(0.3871)
$UWInfoProd$	0.1271***	0.1336***	0.1299***	0.0508**
	(0.0230)	(0.0233)	(0.0233)	(0.0217)
$NumInstInv$	0.3201***	0.3166***	0.3166***	0.3050***
	(0.0065)	(0.0065)	(0.0069)	(0.0061)
$AvgIndOverweight$	0.0987	0.0721	0.0945	-0.0506
	(0.0971)	(0.0970)	(0.0973)	(0.0917)
$Spread$	-18.1259***	-17.3491***	-18.1248***	1.8772
	(4.4746)	(4.4724)	(4.4729)	(4.3965)
$AvgVolume$	2.5968***	2.4093***	2.3670***	2.2195***
	(0.4929)	(0.5020)	(0.5301)	(0.4666)
$ReturnStdDev$	-9.9530**	-11.7769***	-10.0015**	-7.4900*
	(4.1199)	(4.0911)	(4.1121)	(3.9335)
$FirstNumAnalysts$	-0.2781***	-0.2628***	-0.2726***	-0.2201***

	(0.0701)	(0.0703)	(0.0703)	(0.0656)
$OneYearNumAnalysts$	0.3274***	0.3191***	0.3233***	0.2314***
	(0.0406)	(0.0406)	(0.0407)	(0.0381)
$Underpricing$		0.8907***		
		(0.2801)		
$TotalMoneyLeft$			0.0036	
			(0.0025)	
$AvgProbability\_SizeAdj$				23.7848***
				(0.7433)
Constant	6.0470***	5.9298***	6.0869***	-2.5328***
	(0.7176)	(0.7151)	(0.7215)	(0.7643)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	81.19%	81.27%	81.21%	83.97%
Observations	5,216	5,216	5,216	5,216

Table 4.14: OLS Estimation of Underpricing Using $TotalInformed\_SizeAdj$. $TotalInformed\_SizeAdj$ is based on $Informed\_SizeAdj$, which considers position increases over initial-allocation-size-based thresholds (available in Table 4.9) as being indicative of information production. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Underpricing$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	-0.0099***	-0.0110***	-0.0111***	-0.0109***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$LogProceeds$	-0.0612***	-0.0921***	-0.0876***	-0.0890***
	(0.0065)	(0.0071)	(0.0072)	(0.0071)
$UnderwriterRank$	0.0078***	0.0125***	0.0132***	0.0128***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)
$VCBacked$	0.0014	0.0068	0.0064	0.0056
	(0.0074)	(0.0073)	(0.0073)	(0.0073)
$NumConcurrentIPO$	-0.0006*	-0.0004	-0.0005	-0.0005
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
$AvgUPConcurrentIPO$	0.0045***	0.0043***	0.0044***	0.0044***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
$MktReturn$	5.8031***	5.6935***	5.6276***	5.6364***
	(2.1308)	(2.0878)	(2.0907)	(2.0857)
$MktStdDeviation$	1.3487	1.6339	1.2335	1.4236
	(1.4397)	(1.4030)	(1.4112)	(1.4005)
$TechFirm$	0.0012	0.0005	0.0001	0.0002
	(0.0083)	(0.0081)	(0.0081)	(0.0081)
$OfferPriceRevision$	0.6960***	0.6256***	0.6284***	0.6263***
	(0.0290)	(0.0291)	(0.0290)	(0.0291)
$PercentSold$	-0.0869***	-0.0952***	-0.0902***	-0.0902***
	(0.0162)	(0.0162)	(0.0161)	(0.0162)
$PercentInst$	0.1110***	0.0222	0.0239	0.0216
	(0.0148)	(0.0173)	(0.0173)	(0.0172)
$UWAvgUP$	0.5708***	0.5706***	0.5746***	0.5721***
	(0.0405)	(0.0401)	(0.0400)	(0.0399)
$UWInfoProd$	-0.0049***	-0.0072***	-0.0078***	-0.0081***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
$AvgIndOverweight$	0.0223***	0.0297***	0.0293***	0.0280***
	(0.0081)	(0.0081)	(0.0081)	(0.0081)
$Spread$	-0.7984**	-0.8629**	-0.7798**	-0.6213*
	(0.3845)	(0.3749)	(0.3728)	(0.3744)
$AvgVolume$	0.2956***	0.2070***	0.1952***	0.2026***
	(0.0418)	(0.0433)	(0.0433)	(0.0432)
$ReturnStdDev$	1.9203***	2.1005***	2.1464***	2.1299***

	(0.3465)	(0.3410)	(0.3408)	(0.3416)
$FirstNumAnalysts$	-0.0186***	-0.0173***	-0.0160***	-0.0166***
	(0.0045)	(0.0045)	(0.0045)	(0.0045)
$OneYearNumAnalysts$	0.0111***	0.0094***	0.0079***	0.0083***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$NumInstInv$		0.0040***	0.0025***	0.0038***
		(0.0004)	(0.0006)	(0.0004)
$TotalInformed\_SizeAdj$			0.0046***	
			(0.0015)	
$AvgProbability\_SizeAdj$				0.2880***
				(0.0621)
Constant	0.0858	0.1125**	0.0894	0.0112
	(0.0550)	(0.0570)	(0.0575)	(0.0618)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	58.85%	59.91%	60.08%	60.08%
Observations	5,216	5,216	5,216	5,216

measure of information production and information production reputation incorporating significant selling activity in the quarters following the IPO. While the sign and statistical significance of the coefficients of interest in the probit regressions of Tables 4.15 and 4.16 are qualitatively unchanged, other coefficients change substantially, suggesting $Informed\_BuyOrSell$ is capturing different behavior than $Informed$. For example, funds with high values of $AvgFlipped$ and $Churn$ are more likely to trade following the IPO using the $Informed\_BuyOrSell$ measure, and those with large portfolio concentrations in the IPO firm's industry are less likely to trade following the IPO. Economically, one would expect the opposite relations for true information producers, suggesting $Informed$ is the more appropriate measure. Additionally, Tables 4.17 and 4.18 show $AvgProbability\_BuyOrSell$ negatively predicts total future informed trading and underpricing, in contradiction to the results of the main analyses. This is consistent with $Informed\_BuyOrSell$ capturing behavior that may be inconsistent with information production. However, the relations between total number of allocations to institutional investors and both total future informed trading and underpricing are unchanged from the main analyses. These tests suggest an alternative method of accounting for potentially informed selling activity may be more appropriate.

4.1.1.4 Accounting for Systematic Selling

An alternative to considering all significant buying and selling activity as information motivated is to selectively exclude selling activity that fits a pattern of systematic selling. As the average fund only holds 30% of its initial allocation one year after the IPO [Chemmanur et al., 2010], there seems to be a large amount of systematic selling of IPO allocations that occurs. To account for systematic selling that is not likely to be informationally motivated, I develop an indicator for when a position is systematically sold. Specifically, $SystematicSell = 1$ when the position is completely sold by the end of the fourth quarter following the IPO, and there is no buying activity in the second or third quarter following the IPO, and $SystematicSell = 0$ otherwise. I then exclude systematic selling from a new information production measure by defining $Informed\_NoSysSell = 1$ if there is a position increase or decrease of at least 50% in the three quarters following the IPO

Table 4.15: Probit Estimation of IPO Allocations Using $AvgInformed\_BuyOrSell$. $AvgInformed\_BuyOrSell$ is based on $Informed\_BuyOrSell$, which considers position increases or decreases of more than 50% as being indicative of information production. "Established Funds" observations have a value for $AvgInformed\_BuyOrSell$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1062***	0.0904***	0.0779***
	(0.0064)	(0.0063)	(0.0071)
Log($FundAge$)	-0.0082***	-0.0020***	-0.0020***
	(0.0004)	(0.0004)	(0.0004)
$Churn$	0.1721***	0.1636***	0.1029***
	(0.0280)	(0.0315)	(0.0366)
$OneTime$	0.6684***	0.5162***	0.4911***
	(0.0133)	(0.0090)	(0.0113)
$MultipleTimes$	1.2378***	0.8971***	0.8475***
	(0.0302)	(0.0164)	(0.0189)
$NumPrevIPOs$	0.0067**	0.0026***	0.0023***
	(0.0033)	(0.0001)	(0.0001)
$AvgSystematicSell$		0.0544	0.2189**
		(0.0778)	(0.0870)
$AvgFlipped$		-0.4420***	-0.5470***
		(0.0742)	(0.0837)
$AvgIPOHoldTime$		0.0101***	0.0156***
		(0.0035)	(0.0038)
$AvgInformed\_BuyOrSell$		0.5213***	0.3896***
		(0.0772)	(0.0819)
$HighUP$			-0.4472***
			(0.1367)
$HighUP\times$ Log($FundValue$)			0.0231***
			(0.0065)
$HighUP\times$ Log($FundAge$)			0.0001
			(0.0004)
$HighUP \times Churn$			0.1075***
			(0.0347)
$HighUP \times OneTime$			0.0347***
			(0.0131)
$HighUP \times MultipleTimes$			0.0680***
			(0.0179)
$HighUP \times NumPrevIPO$			0.0007***
			(0.0001)

$HighUP \times AvgSystematicSell$			-0.2833***
			(0.0672)
$HighUP \times AvgFlipped$			0.1745**
			(0.0754)
$HighUP \times AvgIPOHoldTime$			-0.0095***
			(0.0031)
$HighUP \times AvgInformed\_BuyOrSell$			0.2343***
			(0.0664)
Constant	-4.2123***	-4.0514***	-3.9070***
	(0.2124)	(0.1585)	(0.1740)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	9.84%	19.03%	19.60%
Observations	2,940,445	1,777,725	1,777,725

Table 4.16: Probit Estimation of Future Informed Trading Using $AvgInformed\_BuyOrSell$. $AvgInformed\_BuyOrSell$ is based on $Informed\_BuyOrSell$, which considers position increases or decreases of more than 50% as being indicative of information production. "Established Funds" observations have a value for $AvgInformed\_BuyOrSell$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed\_BuySell50$	
	New Funds	Established Funds
$UnderwriterRank$	0.0075	-0.0060
	(0.0112)	(0.0066)
$UWInfoProd$	0.0130**	0.0135***
	(0.0055)	(0.0033)
$OneTime$	0.0599**	0.0008
	(0.0294)	(0.0156)
$MultipleTimes$	-0.0242	-0.0335*
	(0.0587)	(0.0204)
$FirstNumAnalysts$	-0.0017	0.0059*
	(0.0587)	(0.0204)
$OneYearNumAnalysts$	0.0075	-0.0060
	(0.0112)	(0.0066)
$VCBacked$	0.0127	0.0513***
	(0.0282)	(0.0159)
$90DayReturn$	0.0121	-0.0284
	(0.0347)	(0.0255)
$Spread$	-3.5533*	-3.4462***
	(1.8244)	(1.1052)
$AvgVolume$	0.0000**	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	12.3566***	12.7643***
	(1.3673)	(0.9362)
$IndustryOverweight$	-0.0257**	-0.0076
	(0.0104)	(0.0122)
$IndWeightStdDev$	0.2593***	-0.0011
	(0.0430)	(0.0387)
$NumPrevIPOs$	-0.0078	0.0002
	(0.0079)	(0.0002)
$AllocationPct$	-4.6754***	-5.2272***
	(0.4186)	(0.2847)
$Shares$	-0.0386***	-0.0366***
	(0.0059)	(0.0040)
$Churn$	3.0735***	2.0862***
	(0.1657)	(0.1322)

Log($FundValue$)	0.0270**	0.0441***
	(0.0127)	(0.0105)
Log($FundAge$)	-0.0036***	-0.0006
	(0.0008)	(0.0006)
$AvgFlipped$		0.3815**
		(0.1557)
$AvgSystematicSell$		-0.2236
		(0.1561)
$AvgIPOHoldTime$		-0.0178***
		(0.0059)
$AvgInformed\_BuyOrSell$		1.1619***
		(0.1339)
$MoneyLeft$	0.0216*	0.1186***
	(0.0126)	(0.0346)
$AvgInformed\_BuyOrSell \times MoneyLeft$		-0.1160***
		(0.0398)
Constant	-0.6038**	-1.4096***
	(0.2815)	(0.2460)
Year Dummy Variables	Yes	Yes
Pseudo R^2	13.29%	12.06%
Observations	22,936	106,453

Table 4.17: OLS Estimation of Total Future Informed Trading Using $TotalInformed\_BuyOrSell$. $TotalInformed\_BuyOrSell$ is based on $Informed\_BuyOrSell$, which considers position increases or decreases of more than 50% as being indicative of information production. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed\_BuyOrSell$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	-0.1134***	-0.1046**	-0.1116***	-0.0965**
	(0.0417)	(0.0417)	(0.0417)	(0.0392)
$LogProceeds$	-0.8264***	-0.7531***	-0.8130***	-0.9607***
	(0.0886)	(0.0902)	(0.0893)	(0.0844)
$UnderwriterRank$	0.1557***	0.1458***	0.1541***	0.1395***
	(0.0276)	(0.0274)	(0.0275)	(0.0265)
$VCBacked$	0.1504*	0.1449	0.1494*	-0.0385
	(0.0904)	(0.0903)	(0.0903)	(0.0851)
$NumConcurrentIPO$	-0.0023	-0.0019	-0.0023	-0.0009
	(0.0031)	(0.0031)	(0.0031)	(0.0028)
$AvgUPConcurrentIPO$	0.0000	-0.0036	-0.0011	0.0010
	(0.0036)	(0.0038)	(0.0037)	(0.0034)
$TechFirm$	0.2104**	0.2097**	0.2137**	0.1167
	(0.0874)	(0.0873)	(0.0874)	(0.0826)
$OfferPriceRevision$	4.0870***	3.5931***	3.9828***	3.1099***
	(0.2835)	(0.2916)	(0.2812)	(0.2633)
$PercentSold$	-0.7650***	-0.6893**	-0.7449***	-0.5914**
	(0.2692)	(0.2693)	(0.2690)	(0.2492)
$PercentInst$	-1.9390***	-1.9573***	-1.9052***	-1.8295***
	(0.1864)	(0.1858)	(0.1889)	(0.1765)
$UWAvgUP$	-0.4458	-0.8955**	-0.5307	-0.7158*
	(0.3910)	(0.4168)	(0.3977)	(0.3730)
$UWInfoProd$	0.0746***	0.0803***	0.0765***	0.0503**
	(0.0217)	(0.0217)	(0.0217)	(0.0200)
$NumInstInv$	0.8519***	0.8487***	0.8495***	0.8463***
	(0.0062)	(0.0062)	(0.0066)	(0.0059)
$AvgIndOverweight$	0.1007	0.0771	0.0979	0.0418
	(0.0895)	(0.0893)	(0.0894)	(0.0868)
$Spread$	-12.1179***	-11.4293***	-12.1172***	-4.5446
	(3.7217)	(3.7081)	(3.7149)	(3.7166)
$AvgVolume$	2.0098***	1.8436***	1.8578***	1.6919***
	(0.3789)	(0.3800)	(0.3999)	(0.3676)
$ReturnStdDev$	43.6959***	42.0790***	43.6639***	8.9306***
	(3.2693)	(3.2233)	(3.2624)	(3.3944)
$FirstNumAnalysts$	0.0017	0.0152	0.0053	-0.0015
	(0.0536)	(0.0537)	(0.0537)	(0.0497)

$OneYearNumAnalysts$	0.0411	0.0338	0.0384	0.0256
	(0.0278)	(0.0279)	(0.0279)	(0.0258)
$Underpricing$		0.7897***		
		(0.1928)		
$TotalMoneyLeft$			0.0024	
			(0.0019)	
$AvgProbability\_BuyOrSell$				-19.5309***
				(0.7175)
Constant	-1.2852**	-1.3891**	-1.2588**	6.4554***
	(0.6283)	(0.6271)	(0.6300)	(0.6897)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	97.39%	97.40%	97.39%	97.71%
Observations	5,216	5,216	5,216	5,216

Table 4.18: OLS Estimation of Underpricing Using $TotalInformed\_BuyOrSell$. $TotalInformed\_BuyOrSell$ is based on $Informed\_BuyOrSell$, which considers position increases or decreases of more than 50% as being indicative of information production. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively

	Underpricing			
	(1)	(2)	(3)	(4)
$LogFirmAge$	-0.0099***	-0.0110***	-0.0105***	-0.0109***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$LogProceeds$	-0.0612***	-0.0921***	-0.0878***	-0.0933***
	(0.0065)	(0.0071)	(0.0072)	(0.0071)
$UnderwriterRank$	0.0078***	0.0125***	0.0117***	0.0124***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)
$VCBacked$	0.0014	0.0068	0.0060	0.0051
	(0.0074)	(0.0073)	(0.0073)	(0.0073)
$NumConcurrentIPO$	-0.0006*	-0.0004	-0.0004	-0.0004
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
$AvgUPConcurrentIPO$	0.0045***	0.0043***	0.0044***	0.0044***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
$MktReturn$	5.8031***	5.6935***	5.5474***	5.5590***
	(2.1308)	(2.0878)	(2.0852)	(2.0867)
$MktStdDeviation$	1.3487	1.6339	1.6161	1.6215
	(1.4397)	(1.4030)	(1.4019)	(1.4010)
$TechFirm$	0.0012	0.0005	-0.0006	-0.0004
	(0.0083)	(0.0081)	(0.0081)	(0.0081)
$OfferPriceRevision$	0.6960***	0.6256***	0.6046***	0.6165***
	(0.0290)	(0.0291)	(0.0295)	(0.0296)
$PercentSold$	-0.0869***	-0.0952***	-0.0913***	-0.0936***
	(0.0162)	(0.0162)	(0.0162)	(0.0162)
$PercentInst$	0.1110***	0.0222	0.0322*	0.0233
	(0.0148)	(0.0173)	(0.0175)	(0.0172)
$UWAvgUP$	0.5708***	0.5706***	0.5729***	0.5681***
	(0.0405)	(0.0401)	(0.0403)	(0.0402)
$UWInfoProd$	-0.0049***	-0.0072***	-0.0076***	-0.0074***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
$AvgIndOverweight$	0.0223***	0.0297***	0.0292***	0.0292***
	(0.0081)	(0.0081)	(0.0080)	(0.0081)
$Spread$	-0.7984**	-0.8629**	-0.8009**	-0.7926**
	(0.3845)	(0.3749)	(0.3728)	(0.3757)
$AvgVolume$	0.2956***	0.2070***	0.1968***	0.2041***
	(0.0418)	(0.0433)	(0.0435)	(0.0432)
$ReturnStdDev$	1.9203***	2.1005***	1.8750***	1.7759***
	(0.3465)	(0.3410)	(0.3438)	(0.3594)

$FirstNumAnalysts$	-0.0186***	-0.0173***	-0.0173***	-0.0173***
	(0.0045)	(0.0045)	(0.0045)	(0.0045)
$OneYearNumAnalysts$	0.0111***	0.0094***	0.0092***	0.0093***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$NumInstInv$		0.0040***	-0.0004	0.0039***
		(0.0004)	(0.0011)	(0.0004)
$TotalInformed\_BuyOrSell$			0.0051***	
			(0.0013)	
$AvgProbability\_BuyOrSell$				-0.1817***
				(0.0613)
Constant	0.0858	0.1125**	0.1193**	0.1847***
	(0.0550)	(0.0570)	(0.0569)	(0.0611)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	58.85%	59.91%	60.07%	59.98%
Observations	5,216	5,216	5,216	5,216

and $SystematicSell = 0$, and otherwise $Informed\_NoSysSell = 0$.

Tables 4.19, 4.20, 4.21 and 4.22 display the results of repeating the main analyses using $Informed\_NoSysSell$ in place of $Informed$. The results are qualitatively similar and supportive of the main results.

4.1.1.5 A Continuous Alternative to $AvgInformed$

Using a discrete variable to proxy for information production may be better than using a continuous variable due to the noise inherent in the non-information-motivations for trading. For this reason, $Informed$ is calculated as a discrete variable. However, $AvgInformed$ becomes continuous as $Informed$ is averaged over past allocations. An alternative means to create a history of information production is to use the maximum position change over the quarters following the IPO ($MaxPctChange$), and average that raw measure over past allocations. Doing so gives an alternative information production reputation measure: $AvgMaxPctChange$.

Tables 4.23, 4.24, 4.25 and 4.26 show the results of re-estimating the main analyses using the more continuous reputation measure based on $MaxPctChange$. These results are consistent with those of the main analyses.

4.1.1.6 Minimum of Past Buying or Selling

While the previously used measures attempt to capture informed trading in several ways, the measures focused on buying may capture other motivations for buying, and those incorporating selling may simply be adding noise. Theoretically, funds that produce information should both buy and sell on their information, so we would expect relatively symmetric trading coming from information producers. On the other hand, systematic sells are not likely to buy after the IPO, and if some funds are habitual buyers without information motivations, then they are not likely to sell following IPOs. To rule out the possibility that the reasons for buying are not informationally motivated, I create an additional measure of the trading history based on the minimum of a fund's buying or selling activity in its previous IPOs. Mechanically, the measure $Informed\_MinBuySell$

Table 4.19: Probit Estimation of IPO Allocations Using $AvgInformed\_NoSysSell$. $AvgInformed\_NoSysSell$ is based on $Informed\_NoSysSell$, which considers position increases or decreases of more than 50% as being indicative of information production, provided the fund does not "systematically sell" the entire position before the end of the fourth quarter following the IPO (i.e., no position increases occurred in either the second or third quarter following the IPO). "Established Funds" observations have a value for $AvgInformed\_NoSysSell$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1062***	0.0903***	0.0778***
	(0.0064)	(0.0063)	(0.0071)
Log($FundAge$)	-0.0082***	-0.0020***	-0.0021***
	(0.0004)	(0.0004)	(0.0004)
$Churn$	0.1721***	0.1644***	0.1034***
	(0.0280)	(0.0315)	(0.0366)
$OneTime$	0.6684***	0.5160***	0.4910***
	(0.0133)	(0.0090)	(0.0113)
$MultipleTimes$	1.2378***	0.8970***	0.8474***
	(0.0302)	(0.0164)	(0.0189)
$NumPrevIPOs$	0.0067**	0.0026***	0.0023***
	(0.0033)	(0.0001)	(0.0001)
$AvgSystematicSell$		0.5731***	0.6067***
		(0.0785)	(0.0821)
$AvgFlipped$		-0.4353***	-0.5418***
		(0.0740)	(0.0836)
$AvgIPOHoldTime$		0.0105***	0.0159***
		(0.0036)	(0.0038)
$AvgInformed\_NoSysSell$		0.5309***	0.3972***
		(0.0717)	(0.0776)
$HighUP$			-0.4489***
			(0.1367)
$HighUP\times$ Log($FundValue$)			0.0231***
			(0.0065)
$HighUP\times$ Log($FundAge$)			0.0000
			(0.0004)
$HighUP \times Churn$			0.1080***
			(0.0348)
$HighUP \times OneTime$			0.0346***
			(0.0131)
$HighUP \times MultipleTimes$			0.0681***
			(0.0179)

$HighUP \times NumPrevIPO$			0.0007***
			(0.0001)
$HighUP \times AvgSystematicSell$			-0.0492
			(0.0752)
$HighUP \times AvgFlipped$			0.1772**
			(0.0754)
$HighUP \times AvgIPOHoldTime$			-0.0093***
			(0.0031)
$HighUP \times AvgInformed\_NoSysSell$			0.2398***
			(0.0677)
Constant	-4.2123***	-4.0496***	-3.9046***
	(0.2124)	(0.1571)	(0.1729)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	9.84%	19.03%	19.60%
Observations	2,940,445	1,777,725	1,777,725

Table 4.20: Probit Estimation of Future Informed Trading Using $AvgInformed\_NoSysSell$. $AvgInformed\_NoSysSell$ is based on $Informed\_NoSysSell$, which considers position increases or decreases of more than 50% as being indicative of information production, provided the fund does not "systematically sell" the entire position before the end of the fourth quarter following the IPO (i.e., no position increases occurred in either the second or third quarter following the IPO). "Established Funds" observations have a value for $AvgInformed\_NoSysSell$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed\_NoSysSell$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0192**	-0.0044
	(0.0084)	(0.0055)
$UWInfoProd$	0.0066	0.0134***
	(0.0043)	(0.0029)
$OneTime$	-0.0042	-0.0028
	(0.0256)	(0.0124)
$MultipleTimes$	0.0926**	0.0488***
	(0.0400)	(0.0149)
$FirstNumAnalysts$	0.0042	0.0170***
	(0.0400)	(0.0149)
$OneYearNumAnalysts$	-0.0192**	-0.0044
	(0.0084)	(0.0055)
$VCBacked$	0.0505**	0.0142
	(0.0236)	(0.0134)
$90DayReturn$	0.1237***	0.2612***
	(0.0300)	(0.0186)
$Spread$	-3.8427**	-6.7007***
	(1.7117)	(1.0242)
$AvgVolume$	0.0000***	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	-0.4251	-0.0267
	(1.0569)	(0.6552)
$IndustryOverweight$	0.0390***	0.0441***
	(0.0098)	(0.0087)
$IndWeightStdDev$	-0.0990**	-0.0859**
	(0.0408)	(0.0376)
$NumPrevIPOs$	0.0061	0.0002
	(0.0074)	(0.0001)
$AllocationPct$	-0.1485	0.1058
	(0.4054)	(0.2471)
$Shares$	-0.0117**	-0.0165***
	(0.0056)	(0.0029)

$Churn$	-1.3514***	-1.4169***
	(0.1026)	(0.0883)
Log($FundValue$)	0.0567***	-0.0010
	(0.0159)	(0.0087)
Log($FundAge$)	-0.0019**	-0.0003
	(0.0008)	(0.0005)
$AvgFlipped$		-0.9394***
		(0.1333)
$AvgSystematicSell$		0.8665***
		(0.1178)
$AvgIPOHoldTime$		0.0212***
		(0.0033)
$AvgInformed\_NoSysSell$		1.5831***
		(0.1186)
$MoneyLeft$	0.0268***	0.1148***
	(0.0089)	(0.0146)
$AvgInformed\_NoSysSell \times MoneyLeft$		-0.1781***
		(0.0382)
Constant	-1.3389***	-0.9167***
	(0.3236)	(0.2088)
Year Dummy Variables	Yes	Yes
Pseudo R^2	3.28%	7.61%
Observations	22,936	106,453

Table 4.21: OLS Estimation of Total Future Trading Activity Using $TotalInformed\_NoSysSell$. $TotalInformed\_NoSysSell$ is based on $Informed\_NoSysSell$, which considers position increases or decreases of more than 50% as being indicative of information production, provided the fund does not "systematically sell" the entire position before the end of the fourth quarter following the IPO (i.e., no position increases occurred in either the second or third quarter following the IPO). Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed\_NoSysSell$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.0562	0.0630	0.0587	0.0612
	(0.0473)	(0.0473)	(0.0472)	(0.0449)
$LogProceeds$	-0.9873***	-0.9307***	-0.9688***	-0.7703***
	(0.1016)	(0.1031)	(0.1031)	(0.0986)
$UnderwriterRank$	-0.1639***	-0.1716***	-0.1661***	-0.1442***
	(0.0336)	(0.0336)	(0.0336)	(0.0321)
$VCBacked$	0.0201	0.0159	0.0188	-0.0198
	(0.1085)	(0.1085)	(0.1084)	(0.1010)
$NumConcurrentIPO$	0.0040	0.0042	0.0038	0.0010
	(0.0039)	(0.0039)	(0.0039)	(0.0036)
$AvgUPConcurrentIPO$	-0.0257***	-0.0285***	-0.0272***	-0.0233***
	(0.0052)	(0.0055)	(0.0054)	(0.0049)
$TechFirm$	0.0565	0.0560	0.0611	0.0564
	(0.1129)	(0.1130)	(0.1128)	(0.1051)
$OfferPriceRevision$	-1.0273***	-1.4086***	-1.1712***	-0.8860***
	(0.3409)	(0.3518)	(0.3336)	(0.3163)
$PercentSold$	-0.8693***	-0.8108***	-0.8416***	-0.6099**
	(0.2808)	(0.2805)	(0.2804)	(0.2657)
$PercentInst$	-0.2290	-0.2431	-0.1822	-0.2326
	(0.2257)	(0.2263)	(0.2287)	(0.2120)
$UWAvgUP$	-1.0854**	-1.4326***	-1.2026***	-1.0044**
	(0.4357)	(0.4595)	(0.4364)	(0.4178)
$UWInfoProd$	0.1214***	0.1258***	0.1239***	0.0711***
	(0.0250)	(0.0252)	(0.0252)	(0.0239)
$NumInstInv$	0.4120***	0.4096***	0.4088***	0.3994***
	(0.0068)	(0.0069)	(0.0073)	(0.0066)
$AvgIndOverweight$	-0.0937	-0.1120	-0.0976	-0.1976*
	(0.1075)	(0.1077)	(0.1076)	(0.1018)
$Spread$	-18.1054***	-17.5736***	-18.1043***	2.6634
	(5.0841)	(5.0968)	(5.0853)	(4.9345)
$AvgVolume$	2.4476***	2.3193***	2.2377***	2.2621***
	(0.5469)	(0.5539)	(0.5716)	(0.5279)
$ReturnStdDev$	-11.4352**	-12.6838***	-11.4794**	-8.2395*

	(4.6129)	(4.6104)	(4.6058)	(4.4543)
$FirstNumAnalysts$	-0.2254***	-0.2150***	-0.2204***	-0.2071***
	(0.0753)	(0.0755)	(0.0756)	(0.0731)
$OneYearNumAnalysts$	0.3114***	0.3057***	0.3076***	0.2620***
	(0.0442)	(0.0443)	(0.0445)	(0.0431)
$Underpricing$		0.6098**		
		(0.3089)		
$TotalMoneyLeft$			0.0033	
			(0.0028)	
$AvgProbability\_NoSysSell$				27.8100***
				(0.9891)
Constant	5.7196***	5.6394***	5.7561***	-5.1384***
	(0.8529)	(0.8499)	(0.8517)	(0.9295)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	85.91%	85.94%	85.92%	87.48%
Observations	5,216	5,216	5,216	5,216

Table 4.22: OLS Estimation of Underpricing Using $TotalInformed\_NoSysSell$. $TotalInformed\_NoSysSell$ is based on $Informed\_NoSysSell$, which considers position increases or decreases of more than 50% as being indicative of information production, provided the fund does not "systematically sell" the entire position before the end of the fourth quarter following the IPO (i.e., no position increases occurred in either the second or third quarter following the IPO). Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
$LogFirmAge$	-0.0099***	-0.0110***	-0.0112***	-0.0110***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$LogProceeds$	-0.0612***	-0.0921***	-0.0894***	-0.0902***
	(0.0065)	(0.0071)	(0.0072)	(0.0071)
$UnderwriterRank$	0.0078***	0.0125***	0.0130***	0.0127***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)
$VCBacked$	0.0014	0.0068	0.0068	0.0065
	(0.0074)	(0.0073)	(0.0073)	(0.0073)
$NumConcurrentIPO$	-0.0006*	-0.0004	-0.0005	-0.0005
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
$AvgUPConcurrentIPO$	0.0045***	0.0043***	0.0044***	0.0044***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
$MktReturn$	5.8031***	5.6935***	5.6492***	5.6185***
	(2.1308)	(2.0878)	(2.0915)	(2.0887)
$MktStdDeviation$	1.3487	1.6339	1.3697	1.5166
	(1.4397)	(1.4030)	(1.4100)	(1.4013)
$TechFirm$	0.0012	0.0005	0.0003	0.0005
	(0.0083)	(0.0081)	(0.0081)	(0.0081)
$OfferPriceRevision$	0.6960***	0.6256***	0.6281***	0.6267***
	(0.0290)	(0.0291)	(0.0291)	(0.0291)
$PercentSold$	-0.0869***	-0.0952***	-0.0928***	-0.0930***
	(0.0162)	(0.0162)	(0.0163)	(0.0162)
$PercentInst$	0.1110***	0.0222	0.0230	0.0223
	(0.0148)	(0.0173)	(0.0173)	(0.0173)
$UWAvgUP$	0.5708***	0.5706***	0.5735***	0.5712***
	(0.0405)	(0.0401)	(0.0401)	(0.0400)
$UWInfoProd$	-0.0049***	-0.0072***	-0.0075***	-0.0076***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
$AvgIndOverweight$	0.0223***	0.0297***	0.0300***	0.0289***
	(0.0081)	(0.0081)	(0.0081)	(0.0081)
$Spread$	-0.7984**	-0.8629**	-0.8139**	-0.6860*
	(0.3845)	(0.3749)	(0.3735)	(0.3764)

$AvgVolume$	0.2956***	0.2070***	0.2004***	0.2055***
	(0.0418)	(0.0433)	(0.0433)	(0.0433)
$ReturnStdDev$	1.9203***	2.1005***	2.1317***	2.1271***
	(0.3465)	(0.3410)	(0.3418)	(0.3422)
$FirstNumAnalysts$	-0.0186***	-0.0173***	-0.0167***	-0.0172***
	(0.0045)	(0.0045)	(0.0045)	(0.0045)
$OneYearNumAnalysts$	0.0111***	0.0094***	0.0086***	0.0090***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$NumInstInv$		0.0040***	0.0028***	0.0038***
		(0.0004)	(0.0007)	(0.0004)
$TotalInformed\_NoSysSell$			0.0027**	
			(0.0014)	
$AvgProbability\_NoSysSell$				0.2374***
				(0.0788)
Constant	0.0858	0.1125**	0.1001*	0.0213
	(0.0550)	(0.0570)	(0.0573)	(0.0659)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	58.85%	59.91%	59.98%	59.98%
Observations	5,216	5,216	5,216	5,216

Table 4.23: Probit Estimation of IPO Allocations Using $AvgMaxPctChange$. $AvgMaxPctChange$ is based on a fund's history of maximum position increases following previous allocations."Established Funds" observations have a value for $AvgMaxPctChange$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1062***	0.0904***	0.0769***
	(0.0064)	(0.0063)	(0.0070)
Log($FundAge$)	-0.0082***	-0.0019***	-0.0020***
	(0.0004)	(0.0004)	(0.0004)
$Churn$	0.1721***	0.1609***	0.0990***
	(0.0280)	(0.0311)	(0.0360)
$OneTime$	0.6684***	0.5164***	0.4913***
	(0.0133)	(0.0090)	(0.0113)
$MultipleTimes$	1.2378***	0.8961***	0.8459***
	(0.0302)	(0.0163)	(0.0189)
$NumPrevIPOs$	0.0067**	0.0026***	0.0022***
	(0.0033)	(0.0001)	(0.0001)
$AvgSystematicSell$		0.4893***	0.5700***
		(0.0732)	(0.0773)
$AvgFlipped$		-0.4210***	-0.5297***
		(0.0744)	(0.0835)
$AvgIPOHoldTime$		0.0058*	0.0126***
		(0.0033)	(0.0035)
$AvgMaxPctChange$		0.3221***	0.2756***
		(0.0441)	(0.0496)
$HighUP$			-0.3948***
			(0.1350)
$HighUP\times$ Log($FundValue$)			0.0250***
			(0.0065)
$HighUP\times$ Log($FundAge$)			0.0000
			(0.0004)
$HighUP \times Churn$			0.1097***
			(0.0348)
$HighUP \times OneTime$			0.0348***
			(0.0131)
$HighUP \times MultipleTimes$			0.0690***
			(0.0179)
$HighUP \times NumPrevIPO$			0.0007***
			(0.0001)

$HighUP \times AvgSystematicSell$			-0.1336*
			(0.0729)
$HighUP \times AvgFlipped$			0.1804**
			(0.0754)
$HighUP \times AvgIPOHoldTime$			-0.0117***
			(0.0030)
$HighUP \times AvgMaxPctChange$			0.0843**
			(0.0403)
Constant	-4.2123***	-3.9591***	-3.8440***
	(0.2124)	(0.1520)	(0.1672)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	9.84%	19.06%	19.62%
Observations	2,940,445	1,777,725	1,777,725

Table 4.24: Probit Estimation of Future Informed Trading Using $AvgMaxPctChange$. $AvgMaxPctChange$ is based on a fund's history of maximum position increases following previous allocations. "Established Funds" observations have a value for $AvgMaxPctChange$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0174*	-0.0114*
	(0.0094)	(0.0063)
$UWInfoProd$	0.0061	0.0180***
	(0.0047)	(0.0031)
$OneTime$	-0.0324	-0.0011
	(0.0263)	(0.0129)
$MultipleTimes$	0.0664	0.0384**
	(0.0436)	(0.0156)
$FirstNumAnalysts$	0.0041	0.0227***
	(0.0436)	(0.0156)
$OneYearNumAnalysts$	-0.0174*	-0.0114*
	(0.0094)	(0.0063)
$VCBacked$	0.0750***	0.0407***
	(0.0246)	(0.0140)
$90DayReturn$	0.1522***	0.2847***
	(0.0320)	(0.0200)
$Spread$	-4.2088**	-6.1057***
	(1.9523)	(1.1317)
$AvgVolume$	0.0000***	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	0.2960	0.4299
	(1.2091)	(0.7219)
$IndustryOverweight$	0.0440***	0.0533***
	(0.0103)	(0.0081)
$IndWeightStdDev$	-0.1107**	-0.0605
	(0.0447)	(0.0417)
$NumPrevIPOs$	0.0022	0.0001
	(0.0084)	(0.0001)
$AllocationPct$	-0.8691*	-0.8342***
	(0.4553)	(0.2862)
$Shares$	-0.0232***	-0.0383***
	(0.0063)	(0.0040)
$Churn$	-1.4245***	-1.3829***
	(0.1180)	(0.0882)

Log($FundValue$)	0.0664***	0.0028
	(0.0187)	(0.0091)
Log($FundAge$)	-0.0024***	-0.0004
	(0.0009)	(0.0005)
$AvgFlipped$		-0.8904***
		(0.1351)
$AvgSystematicSell$		0.5580***
		(0.1187)
$AvgIPOHoldTime$		0.0174***
		(0.0038)
$AvgMaxPctChange$		0.8293***
		(0.0659)
$MoneyLeft$	0.0199*	0.0977***
	(0.0108)	(0.0107)
$AvgMaxPctChange \times MoneyLeft$		-0.0930***
		(0.0201)
Constant	-1.7113***	-0.8602***
	(0.3756)	(0.2287)
Year Dummy Variables	Yes	Yes
Pseudo R^2	4.01%	9.27%
Observations	22,936	106,453

Table 4.25: OLS Estimation of Total Future Informed Trading Using *AvgMaxPctChange*. *AvgMaxPctChange* is based on a fund's history of maximum position increases following previous allocations. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	TotalInformed			
	(1)	(2)	(3)	(4)
LogFirmAge	0.0146	0.0263	0.0183	0.0165
	(0.0440)	(0.0439)	(0.0439)	(0.0415)
LogProceeds	-1.2344***	-1.1365***	-1.2067***	-0.9361***
	(0.0959)	(0.0976)	(0.0976)	(0.0918)
UnderwriterRank	-0.1191***	-0.1323***	-0.1224***	-0.1094***
	(0.0327)	(0.0327)	(0.0327)	(0.0313)
VCBacked	0.1296	0.1224	0.1277	0.0078
	(0.1024)	(0.1022)	(0.1023)	(0.0945)
NumConcurrentIPO	0.0014	0.0019	0.0012	0.0002
	(0.0036)	(0.0036)	(0.0036)	(0.0033)
AvgUPConcurrentIPO	-0.0207***	-0.0255***	-0.0229***	-0.0164***
	(0.0048)	(0.0051)	(0.0050)	(0.0044)
TechFirm	0.0545	0.0536	0.0614	0.0345
	(0.1042)	(0.1042)	(0.1041)	(0.0958)
OfferPriceRevision	-0.2646	-0.9246***	-0.4801	-0.4101
	(0.3322)	(0.3406)	(0.3241)	(0.3052)
PercentSold	-1.2181***	-1.1168***	-1.1765***	-0.7912***
	(0.2631)	(0.2608)	(0.2618)	(0.2474)
PercentInst	-0.5028**	-0.5272**	-0.4328**	-0.3251
	(0.2118)	(0.2122)	(0.2154)	(0.1980)
UWAvgUP	-0.9375**	-1.5384***	-1.1130***	-0.8171**
	(0.4147)	(0.4356)	(0.4167)	(0.3936)
UWInfoProd	0.1381***	0.1457***	0.1418***	0.0722***
	(0.0234)	(0.0237)	(0.0237)	(0.0221)
NumInstInv	0.3260***	0.3218***	0.3212***	0.3083***
	(0.0067)	(0.0067)	(0.0072)	(0.0063)
AvgIndOverweight	0.0149	-0.0166	0.0092	-0.0863
	(0.0986)	(0.0984)	(0.0987)	(0.0935)
Spread	-19.5562***	-18.6359***	-19.5546***	1.9053
	(4.5875)	(4.5780)	(4.5832)	(4.5013)
AvgVolume	2.9516***	2.7295***	2.6373***	2.6234***
	(0.5236)	(0.5322)	(0.5557)	(0.4986)
ReturnStdDev	-7.6958*	-9.8565**	-7.7620*	-7.4838*
	(4.2249)	(4.1977)	(4.2150)	(4.0281)
FirstNumAnalysts	-0.2914***	-0.2733***	-0.2840***	-0.2234***
	(0.0731)	(0.0734)	(0.0734)	(0.0690)

$OneYearNumAnalysts$	0.3332***	0.3234***	0.3276***	0.2426***
	(0.0426)	(0.0426)	(0.0427)	(0.0404)
$Underpricing$		1.0552***		
		(0.2955)		
$TotalMoneyLeft$			0.0050*	
			(0.0026)	
$AvgProbability\_AvgMaxPctChange$				22.9020***
				(0.7574)
Constant	7.2193***	7.0804***	7.2739***	-1.1284
	(0.7958)	(0.7949)	(0.8037)	(0.8469)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	80.95%	81.06%	80.98%	83.54%
Observations	5,216	5,216	5,216	5,216

Table 4.26: OLS Estimation of Underpricing Using *AvgMaxPctChange*. *AvgMaxPctChange* is based on a fund's history of maximum position increases following previous allocations. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0099***	-0.0110***	-0.0111***	-0.0110***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
LogProceeds	-0.0612***	-0.0921***	-0.0855***	-0.0880***
	(0.0065)	(0.0071)	(0.0072)	(0.0071)
UnderwriterRank	0.0078***	0.0125***	0.0131***	0.0127***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)
VCBacked	0.0014	0.0068	0.0061	0.0051
	(0.0074)	(0.0073)	(0.0073)	(0.0073)
NumConcurrentIPO	-0.0006*	-0.0004	-0.0005	-0.0005
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
AvgUPConcurrentIPO	0.0045***	0.0043***	0.0045***	0.0044***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
MktReturn	5.8031***	5.6935***	5.6653***	5.5980***
	(2.1308)	(2.0878)	(2.0892)	(2.0839)
MktStdDeviation	1.3487	1.6339	1.1885	1.3903
	(1.4397)	(1.4030)	(1.4103)	(1.3991)
TechFirm	0.0012	0.0005	0.0001	0.0002
	(0.0083)	(0.0081)	(0.0081)	(0.0081)
OfferPriceRevision	0.6960***	0.6256***	0.6265***	0.6233***
	(0.0290)	(0.0291)	(0.0291)	(0.0291)
PercentSold	-0.0869***	-0.0952***	-0.0887***	-0.0893***
	(0.0162)	(0.0162)	(0.0161)	(0.0162)
PercentInst	0.1110***	0.0222	0.0251	0.0248
	(0.0148)	(0.0173)	(0.0174)	(0.0173)
UWAvgUP	0.5708***	0.5706***	0.5754***	0.5721***
	(0.0405)	(0.0401)	(0.0399)	(0.0398)
UWInfoProd	-0.0049***	-0.0072***	-0.0079***	-0.0081***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
AvgIndOverweight	0.0223***	0.0297***	0.0297***	0.0284***
	(0.0081)	(0.0081)	(0.0081)	(0.0081)
Spread	-0.7984**	-0.8629**	-0.7600**	-0.5672
	(0.3845)	(0.3749)	(0.3721)	(0.3744)
AvgVolume	0.2956***	0.2070***	0.1915***	0.2027***
	(0.0418)	(0.0433)	(0.0433)	(0.0432)
ReturnStdDev	1.9203***	2.1005***	2.1415***	2.1027***
	(0.3465)	(0.3410)	(0.3401)	(0.3403)
FirstNumAnalysts	-0.0186***	-0.0173***	-0.0158***	-0.0164***

	(0.0045)	(0.0045)	(0.0045)	(0.0045)
$OneYearNumAnalysts$	0.0111***	0.0094***	0.0077***	0.0082***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$NumInstInv$		0.0040***	0.0022***	0.0037***
		(0.0004)	(0.0006)	(0.0004)
$TotalInformed$			0.0053***	
			(0.0015)	
$AvgProbability\_AvgMaxPctChange$				0.3163***
				(0.0612)
Constant	0.0858	0.1125**	0.0796	0.0002
	(0.0550)	(0.0570)	(0.0579)	(0.0616)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	58.85%	59.91%	60.14%	60.12%
Observations	5,216	5,216	5,216	5,216

is constructed as the lesser of $Informed$ or a measure analogous to $Informed$ calculated using only selling activity greater than 50%.

Tables 4.27, 4.28, 4.29 and 4.30 show the results from repeating the main analyses: these results are generally consistent (although weaker) with those of the main analyses with one exception. The coefficient on the interaction term between $AvgInformed\_MinBuySell$ and $MoneyLeft$ is not significantly negative in the probit estimation of the future trading activity of individual funds (the point estimate is negative). The requirement of both strong buying and selling activity may make $Informed\_MinBuySell$ a noisier measure of information production, leading to weaker results. Nonetheless, the results are generally consistent with the main results, providing confidence that neither non-informationally-motivated buying nor selling alone are driving the main results.

4.1.1.7 Excluding Second Quarter Trading

Several additional motivations for significant trading activity, particularly buying activity, exist in the months directly following an IPO. In many IPOs, funds do not receive their desired allocations, so the stock will likely not be at an optimal portfolio weight, and therefore funds may acquire additional stock in the secondary market. This additional buying can be thought of as somewhat mechanical, and may not be informationally motivated. Furthermore, underwriters conduct price support activity in the days and weeks following IPOs, and institutional investors may be expected to aid in such activities as a *quid pro quo* for receiving underpriced IPO allocations. As such, funds may buy additional shares soon after an IPO in order to be viewed favorably by the underwriter in their next IPO. To avoid these possible reasons for buying that are unrelated to information, I recreate $Informed$ using only trading activity in the third and fourth quarters following the IPO. This allows for between three and six months to transpire between the IPO and the measurement of any informed trading activity. Price support activities are likely concluded in this time frame, and portfolio rebalancing could be reasonably concluded over this time frame.

Tables 4.31, 4.32, 4.33 and 4.34 show the results of conducting the main analyses while excluding trading activity in the second quarter following the IPO. The results are consistent with

Table 4.27: Probit Estimation of IPO Allocations Using $AvgInformed\_MinBuySell$. $AvgInformed\_MinBuySell$ is the minimum of $AvgInformed$ and $AvgInformed\_Sell$. "Established Funds" observations have a value for $AvgInformed\_MinBuySell$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1062***	0.0932***	0.0799***
	(0.0064)	(0.0065)	(0.0073)
Log($FundAge$)	-0.0082***	-0.0022***	-0.0022***
	(0.0004)	(0.0004)	(0.0004)
$Churn$	0.1721***	0.1752***	0.1101***
	(0.0280)	(0.0315)	(0.0365)
$OneTime$	0.6684***	0.5160***	0.4909***
	(0.0133)	(0.0090)	(0.0113)
$MultipleTimes$	1.2378***	0.9006***	0.8498***
	(0.0302)	(0.0167)	(0.0193)
$NumPrevIPOs$	0.0067**	0.0026***	0.0023***
	(0.0033)	(0.0001)	(0.0001)
$AvgSystematicSell$		0.3782***	0.4652***
		(0.0814)	(0.0885)
$AvgFlipped$		-0.3995***	-0.5146***
		(0.0735)	(0.0827)
$AvgIPOHoldTime$		0.0100***	0.0157***
		(0.0035)	(0.0036)
$AvgInformed\_MinBuySell$		0.3431***	0.2649***
		(0.0897)	(0.1005)
$HighUP$			-0.3890***
			(0.1348)
$HighUP\times$ Log($FundValue$)			0.0244***
			(0.0066)
$HighUP\times$ Log($FundAge$)			0.0000
			(0.0004)
$HighUP \times Churn$			0.1153***
			(0.0352)
$HighUP \times OneTime$			0.0347***
			(0.0131)
$HighUP \times MultipleTimes$			0.0701***
			(0.0179)
$HighUP \times NumPrevIPO$			0.0007***
			(0.0001)

$HighUP \times AvgSystematicSell$			-0.1455**
			(0.0676)
$HighUP \times AvgFlipped$			0.1916**
			(0.0757)
$HighUP \times AvgIPOHoldTime$			-0.0099***
			(0.0031)
$HighUP \times AvgInformed\_MinBuySell$			0.1401**
			(0.0686)
Constant	-4.2123***	-3.9151***	-3.7993***
	(0.2124)	(0.1502)	(0.1651)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	9.84%	18.96%	19.52%
Observations	2,940,445	1,777,725	1,777,725

Table 4.28: Probit Estimation of Future Informed Trading Using $AvgInformed\_MinBuySell$. $AvgInformed\_MinBuySell$ is the minimum of $AvgInformed$ and $AvgInformed\_Sell$. "Established Funds" observations have a value for $AvgInformed\_MinBuySell$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0174*	-0.0119*
	(0.0094)	(0.0063)
$UWInfoProd$	0.0061	0.0168***
	(0.0047)	(0.0031)
$OneTime$	-0.0324	0.0004
	(0.0263)	(0.0133)
$MultipleTimes$	0.0664	0.0615***
	(0.0436)	(0.0174)
$FirstNumAnalysts$	0.0041	0.0216***
	(0.0436)	(0.0174)
$OneYearNumAnalysts$	-0.0174*	-0.0119*
	(0.0094)	(0.0063)
$VCBacked$	0.0750***	0.0385***
	(0.0246)	(0.0140)
$90DayReturn$	0.1522***	0.2818***
	(0.0320)	(0.0202)
$Spread$	-4.2088**	-5.9793***
	(1.9523)	(1.1499)
$AvgVolume$	0.0000***	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	0.2960	0.5440
	(1.2091)	(0.7189)
$IndustryOverweight$	0.0440***	0.0624***
	(0.0103)	(0.0093)
$IndWeightStdDev$	-0.1107**	-0.0841
	(0.0447)	(0.0512)
$NumPrevIPOs$	0.0022	0.0002
	(0.0084)	(0.0001)
$AllocationPct$	-0.8691*	-1.0393***
	(0.4553)	(0.3083)
$Shares$	-0.0232***	-0.0415***
	(0.0063)	(0.0042)
$Churn$	-1.4245***	-1.2850***
	(0.1180)	(0.0930)

Log($FundValue$)	0.0664***	0.0171
	(0.0187)	(0.0115)
Log($FundAge$)	-0.0024***	-0.0013
	(0.0009)	(0.0008)
$AvgFlipped$		-0.7627***
		(0.1408)
$AvgSystematicSell$		0.0708
		(0.1582)
$AvgIPOHoldTime$		0.0310***
		(0.0054)
$AvgInformed\_MinBuySell$		0.6871***
		(0.2276)
$MoneyLeft$	0.0199*	0.0631***
	(0.0108)	(0.0162)
$AvgInformed\_MinBuySell \times MoneyLeft$		-0.0454
		(0.0566)
Constant	-1.7113***	-0.7303***
	(0.3756)	(0.2631)
Year Dummy Variables	Yes	Yes
Pseudo R^2	4.01%	8.40%
Observations	22,936	106,453

Table 4.29: OLS Estimation of Total Future Informed Trading Using $AvgInformed\_MinBuySell$. $AvgInformed\_MinBuySell$ is the minimum of $AvgInformed$ and $AvgInformed\_Sell$, and is used to estimate each fund's probability of future informed trading based on allocation, fund and offering characteristics. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.0146	0.0263	0.0183	0.0141
	(0.0440)	(0.0439)	(0.0439)	(0.0415)
$LogProceeds$	-1.2344***	-1.1365***	-1.2067***	-0.9374***
	(0.0959)	(0.0976)	(0.0976)	(0.0918)
$UnderwriterRank$	-0.1191***	-0.1323***	-0.1224***	-0.1109***
	(0.0327)	(0.0327)	(0.0327)	(0.0314)
$VCBacked$	0.1296	0.1224	0.1277	0.0149
	(0.1024)	(0.1022)	(0.1023)	(0.0946)
$NumConcurrentIPO$	0.0014	0.0019	0.0012	0.0003
	(0.0036)	(0.0036)	(0.0036)	(0.0033)
$AvgUPConcurrentIPO$	-0.0207***	-0.0255***	-0.0229***	-0.0168***
	(0.0048)	(0.0051)	(0.0050)	(0.0044)
$TechFirm$	0.0545	0.0536	0.0614	0.0327
	(0.1042)	(0.1042)	(0.1041)	(0.0959)
$OfferPriceRevision$	-0.2646	-0.9246***	-0.4801	-0.3759
	(0.3322)	(0.3406)	(0.3241)	(0.3054)
$PercentSold$	-1.2181***	-1.1168***	-1.1765***	-0.7783***
	(0.2631)	(0.2608)	(0.2618)	(0.2474)
$PercentInst$	-0.5028**	-0.5272**	-0.4328**	-0.3452*
	(0.2118)	(0.2122)	(0.2154)	(0.1981)
$UWAvgUP$	-0.9375**	-1.5384***	-1.1130***	-0.7838**
	(0.4147)	(0.4356)	(0.4167)	(0.3936)
$UWInfoProd$	0.1381***	0.1457***	0.1418***	0.0702***
	(0.0234)	(0.0237)	(0.0237)	(0.0221)
$NumInstInv$	0.3260***	0.3218***	0.3212***	0.3086***
	(0.0067)	(0.0067)	(0.0072)	(0.0063)
$AvgIndOverweight$	0.0149	-0.0166	0.0092	-0.0874
	(0.0986)	(0.0984)	(0.0987)	(0.0935)
$Spread$	-19.5562***	-18.6359***	-19.5546***	1.2801
	(4.5875)	(4.5780)	(4.5832)	(4.4996)
$AvgVolume$	2.9516***	2.7295***	2.6373***	2.6686***
	(0.5236)	(0.5322)	(0.5557)	(0.4991)
$ReturnStdDev$	-7.6958*	-9.8565**	-7.7620*	-7.4738*
	(4.2249)	(4.1977)	(4.2150)	(4.0337)

$FirstNumAnalysts$	-0.2914***	-0.2733***	-0.2840***	-0.2283***
	(0.0731)	(0.0734)	(0.0734)	(0.0691)
$OneYearNumAnalysts$	0.3332***	0.3234***	0.3276***	0.2459***
	(0.0426)	(0.0426)	(0.0427)	(0.0404)
$Underpricing$		1.0552***		
		(0.2955)		
$TotalMoneyLeft$			0.0050*	
			(0.0026)	
$AvgProbability\_MinBuySell$				22.6306***
				(0.7481)
Constant	7.2193***	7.0804***	7.2739***	-1.1673
	(0.7958)	(0.7949)	(0.8037)	(0.8440)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	80.95%	81.06%	80.98%	83.53%
Observations	5,216	5,216	5,216	5,216

Table 4.30: OLS Estimation of Underpricing Using $AvgInformed\_MinBuySell$. $AvgInformed\_MinBuySell$ is the minimum of $AvgInformed$ and $AvgInformed\_Sell$, and is used to estimate each fund's probability of future informed trading based on allocation, fund and offering characteristics. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
$LogFirmAge$	-0.0099***	-0.0110***	-0.0111***	-0.0110***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$LogProceeds$	-0.0612***	-0.0921***	-0.0855***	-0.0884***
	(0.0065)	(0.0071)	(0.0072)	(0.0071)
$UnderwriterRank$	0.0078***	0.0125***	0.0131***	0.0126***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)
$VCBacked$	0.0014	0.0068	0.0061	0.0054
	(0.0074)	(0.0073)	(0.0073)	(0.0073)
$NumConcurrentIPO$	-0.0006*	-0.0004	-0.0005	-0.0005
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
$AvgUPConcurrentIPO$	0.0045***	0.0043***	0.0045***	0.0044***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
$MktReturn$	5.8031***	5.6935***	5.6653***	5.6152***
	(2.1308)	(2.0878)	(2.0892)	(2.0847)
$MktStdDeviation$	1.3487	1.6339	1.1885	1.4134
	(1.4397)	(1.4030)	(1.4103)	(1.4002)
$TechFirm$	0.0012	0.0005	0.0001	0.0002
	(0.0083)	(0.0081)	(0.0081)	(0.0081)
$OfferPriceRevision$	0.6960***	0.6256***	0.6265***	0.6240***
	(0.0290)	(0.0291)	(0.0291)	(0.0291)
$PercentSold$	-0.0869***	-0.0952***	-0.0887***	-0.0897***
	(0.0162)	(0.0162)	(0.0161)	(0.0162)
$PercentInst$	0.1110***	0.0222	0.0251	0.0243
	(0.0148)	(0.0173)	(0.0174)	(0.0173)
$UWAvgUP$	0.5708***	0.5706***	0.5754***	0.5724***
	(0.0405)	(0.0401)	(0.0399)	(0.0398)
$UWInfoProd$	-0.0049***	-0.0072***	-0.0079***	-0.0080***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
$AvgIndOverweight$	0.0223***	0.0297***	0.0297***	0.0285***
	(0.0081)	(0.0081)	(0.0081)	(0.0081)
$Spread$	-0.7984**	-0.8629**	-0.7600**	-0.6036
	(0.3845)	(0.3749)	(0.3721)	(0.3747)
$AvgVolume$	0.2956***	0.2070***	0.1915***	0.2036***
	(0.0418)	(0.0433)	(0.0433)	(0.0432)

ReturnStdDev	1.9203***	2.1005***	2.1415***	2.1027***
	(0.3465)	(0.3410)	(0.3401)	(0.3405)
FirstNumAnalysts	-0.0186***	-0.0173***	-0.0158***	-0.0165***
	(0.0045)	(0.0045)	(0.0045)	(0.0045)
OneYearNumAnalysts	0.0111***	0.0094***	0.0077***	0.0083***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
NumInstInv		0.0040***	0.0022***	0.0037***
		(0.0004)	(0.0006)	(0.0004)
TotalInformed			0.0053***	
			(0.0015)	
AvgProbability_MinBuySell				0.2823***
				(0.0607)
Constant	0.0858	0.1125**	0.0796	0.0106
	(0.0550)	(0.0570)	(0.0579)	(0.0618)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	58.85%	59.91%	60.14%	60.08%
Observations	5,216	5,216	5,216	5,216

those of the main analyses in each case, suggesting that alternative motivations for buying in the months immediately following the IPO are not driving the results.

4.1.2 Alternative Data Requirement: 4 Recent IPOs

To develop a reputation for information production following IPO allocations, a fund must have received some allocations in the past. In the main analyses, a minimum of eight allocations are required in the past five years. While this is an arbitrary requirement, it serves to provide a sample size that aims to reduce noise in the measurement of past information production. However, a reduced sample size requirement may allow more funds' past trading activity to be quantified, providing a larger sample size for analysis. To analyze the robustness of the requirement of eight IPO allocations (proxied by reported holdings at the end of the quarter) in the previous five years, I repeat the analyses while requiring that a fund receive at least four IPO allocations in the past five years. Tables 4.35, 4.36, 4.37 and 4.38 show that using this alternative data requirement provides results qualitatively consistent with those of the main analyses.

4.1.3 Institutional Holdings as a Proxy for Allocations

Quarterly holdings data are a coarse proxy for the true allocations made in an IPO due to funds' opportunities to trade in the secondary market prior to reporting their holdings. This can lead to either under or over-reporting as some funds may flip out of their allocations soon after the IPO, while others may acquire additional shares. However, as flipping activity is often monitored over the first month of trading [Aggarwal, 2003], and acquiring large positions in a stock may take place over several days or weeks, reporting done soon after the IPO may more accurately reflect true allocations. Accordingly, I repeat the analyses reported using an alternative sample including only those IPOs occurring within the last month of the quarter that have reporting data as of that quarter.[2] Tables 4.39, 4.40, 4.41 and 4.42 display the results.

[2] Using a one month cut-off is also likely to avoid any bias due to the origination of analyst coverage at the end of the quiet period (which usually ends 40 days after the IPO, but can end as early as 25 days after the IPO).

Table 4.31: Probit Estimation of IPO Allocations Using $AvgInformed\_Q3Q4$. $AvgInformed\_Q3Q4$ is based on $Informed\_Q3Q4$, which only considers position changes in the third quarter or fourth quarter following the IPO as being indicative of information production. "Established Funds" observations have a value for $AvgInformed\_Q3Q4$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1062***	0.0921***	0.0785***
	(0.0064)	(0.0064)	(0.0072)
Log($FundAge$)	-0.0082***	-0.0020***	-0.0021***
	(0.0004)	(0.0004)	(0.0004)
$Churn$	0.1721***	0.1706***	0.1067***
	(0.0280)	(0.0311)	(0.0360)
$OneTime$	0.6684***	0.5169***	0.4917***
	(0.0133)	(0.0090)	(0.0113)
$MultipleTimes$	1.2378***	0.8983***	0.8478***
	(0.0302)	(0.0164)	(0.0190)
$NumPrevIPOs$	0.0067**	0.0026***	0.0022***
	(0.0033)	(0.0001)	(0.0001)
$AvgSystematicSell$		0.3947***	0.4890***
		(0.0683)	(0.0731)
$AvgFlipped$		-0.4242***	-0.5328***
		(0.0746)	(0.0837)
$AvgIPOHoldTime$		0.0043	0.0113***
		(0.0034)	(0.0036)
$AvgInformed\_Q3Q4$		0.6135***	0.5170***
		(0.0982)	(0.1101)
$HighUP$			-0.3716***
			(0.1344)
$HighUP\times$ Log($FundValue$)			0.0251***
			(0.0065)
$HighUP\times$ Log($FundAge$)			0.0000
			(0.0004)
$HighUP \times Churn$			0.1133***
			(0.0350)
$HighUP \times OneTime$			0.0349***
			(0.0131)
$HighUP \times MultipleTimes$			0.0695***
			(0.0179)
$HighUP \times NumPrevIPO$			0.0007***
			(0.0001)

$HighUP \times AvgSystematicSell$			-0.1590**
			(0.0664)
$HighUP \times AvgFlipped$			0.1801**
			(0.0754)
$HighUP \times AvgIPOHoldTime$			-0.0123***
			(0.0030)
$HighUP \times AvgInformed\_Q3Q4$			0.1739**
			(0.0848)
Constant	-4.2123***	-3.8925***	-3.7907***
	(0.2124)	(0.1517)	(0.1662)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	9.84%	19.00%	19.56%
Observations	2,940,445	1,777,725	1,777,725

Table 4.32: Probit Estimation of Future Informed Trading Using $AvgInformed\_Q3Q4$. $AvgInformed\_Q3Q4$ is based on $Informed\_Q3Q4$, which only considers position changes in the third quarter or fourth quarter following the IPO as being indicative of information production. "Established Funds" observations have a value for $AvgInformed\_Q3Q4$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed\_Q3Q4$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0018	-0.0122
	(0.0112)	(0.0083)
$UWInfoProd$	0.0039	0.0186***
	(0.0057)	(0.0037)
$OneTime$	-0.0136	-0.0024
	(0.0301)	(0.0156)
$MultipleTimes$	0.1046**	0.0459**
	(0.0512)	(0.0186)
$FirstNumAnalysts$	0.0100**	0.0283***
	(0.0512)	(0.0186)
$OneYearNumAnalysts$	-0.0018	-0.0122
	(0.0112)	(0.0083)
$VCBacked$	0.1045***	0.0602***
	(0.0312)	(0.0187)
$90DayReturn$	0.2064***	0.3409***
	(0.0352)	(0.0205)
$Spread$	-4.9093**	-4.2206***
	(2.0246)	(1.3191)
$AvgVolume$	0.0000**	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	-0.5129	-1.3081
	(1.3371)	(0.8672)
$IndustryOverweight$	0.0494***	0.0456***
	(0.0116)	(0.0099)
$IndWeightStdDev$	-0.1033**	-0.0617*
	(0.0527)	(0.0349)
$NumPrevIPOs$	0.0108	0.0003**
	(0.0090)	(0.0001)
$AllocationPct$	-0.3069	-0.4742
	(0.4885)	(0.2891)
$Shares$	-0.0236***	-0.0333***
	(0.0074)	(0.0037)
$Churn$	-1.4089***	-1.1662***
	(0.1213)	(0.1026)

Log($FundValue$)	0.0749***	0.0166*
	(0.0175)	(0.0093)
Log($FundAge$)	-0.0024***	-0.0005
	(0.0009)	(0.0005)
$AvgFlipped$		-1.1427***
		(0.1439)
$AvgSystematicSell$		0.4818***
		(0.1137)
$AvgIPOHoldTime$		0.0198***
		(0.0036)
$AvgInformed\_Q3Q4$		1.4333***
		(0.1519)
$MoneyLeft$	0.0187	0.0729***
	(0.0122)	(0.0102)
$AvgInformed\_Q3Q4 \times MoneyLeft$		-0.1271**
		(0.0529)
Constant	-2.3640***	-1.3703***
	(0.3735)	(0.2385)
Year Dummy Variables	Yes	Yes
Pseudo R^2	4.41%	9.88%
Observations	22,936	106,453

Table 4.33: OLS Estimation of Total Future Informed Trading Using $TotalInformed\_Q3Q4$. $TotalInformed\_Q3Q4$ is based on $Informed\_Q3Q4$, which only considers position changes in the third quarter or fourth quarter following the IPO as being indicative of information production. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed\_Q3Q4$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	-0.0047	0.0050	-0.0010	0.0160
	(0.0401)	(0.0400)	(0.0400)	(0.0368)
$LogProceeds$	-1.1237***	-1.0424***	-1.0961***	-0.7603***
	(0.0881)	(0.0888)	(0.0894)	(0.0813)
$UnderwriterRank$	-0.0722**	-0.0832***	-0.0755**	-0.0564**
	(0.0301)	(0.0301)	(0.0302)	(0.0287)
$VCBacked$	0.0874	0.0813	0.0854	-0.0977
	(0.0933)	(0.0931)	(0.0931)	(0.0853)
$NumConcurrentIPO$	0.0020	0.0024	0.0019	0.0123***
	(0.0032)	(0.0032)	(0.0032)	(0.0028)
$AvgUPConcurrentIPO$	-0.0179***	-0.0219***	-0.0201***	-0.0163***
	(0.0042)	(0.0046)	(0.0044)	(0.0038)
$TechFirm$	0.0347	0.0340	0.0417	0.0134
	(0.0918)	(0.0919)	(0.0916)	(0.0843)
$OfferPriceRevision$	-0.3661	-0.9142***	-0.5811**	-0.0461
	(0.2956)	(0.2966)	(0.2925)	(0.2660)
$PercentSold$	-1.5231***	-1.4390***	-1.4816***	-0.9663***
	(0.2406)	(0.2390)	(0.2402)	(0.2238)
$PercentInst$	0.0092	-0.0110	0.0791	0.0949
	(0.1893)	(0.1891)	(0.1930)	(0.1720)
$UWAvgUP$	-0.3462	-0.8454**	-0.5214	-0.1494
	(0.3574)	(0.3828)	(0.3604)	(0.3454)
$UWInfoProd$	0.0958***	0.1021***	0.0996***	0.0285
	(0.0214)	(0.0217)	(0.0216)	(0.0199)
$NumInstInv$	0.1994***	0.1960***	0.1946***	0.1885***
	(0.0062)	(0.0063)	(0.0067)	(0.0057)
$AvgIndOverweight$	-0.1044	-0.1306	-0.1101	-0.0987
	(0.0856)	(0.0856)	(0.0857)	(0.0808)
$Spread$	-12.9990***	-12.2346***	-12.9974***	5.3793
	(3.8246)	(3.8241)	(3.8219)	(3.8590)
$AvgVolume$	2.7592***	2.5748***	2.4455***	2.0774***
	(0.4699)	(0.4759)	(0.4945)	(0.4317)
$ReturnStdDev$	-11.9720***	-13.7666***	-12.0381***	-8.5489**
	(3.5401)	(3.5404)	(3.5350)	(3.3898)
$FirstNumAnalysts$	-0.3067***	-0.2916***	-0.2992***	-0.1842***

	(0.0651)	(0.0655)	(0.0653)	(0.0590)
$OneYearNumAnalysts$	0.3219***	0.3138***	0.3163***	0.1934***
	(0.0386)	(0.0388)	(0.0387)	(0.0350)
$Underpricing$		0.8765***		
		(0.2653)		
$TotalMoneyLeft$			0.0050**	
			(0.0024)	
$AvgProbability\_Q3Q4$				22.2903***
				(0.7533)
Constant	6.1668***	6.0514***	6.2213***	-1.0439
	(0.6517)	(0.6502)	(0.6560)	(0.6621)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	68.00%	68.15%	68.07%	73.46%
Observations	5,216	5,216	5,216	5,216

Table 4.34: OLS Estimation of Underpricing Using $TotalInformed\_Q3Q4$. $TotalInformed\_Q3Q4$ is based on $Informed\_Q3Q4$, which only considers position changes in the third quarter or fourth quarter following the IPO as being indicative of information production. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
$LogFirmAge$	-0.0099***	-0.0110***	-0.0110***	-0.0108***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$LogProceeds$	-0.0612***	-0.0921***	-0.0860***	-0.0888***
	(0.0065)	(0.0071)	(0.0072)	(0.0072)
$UnderwriterRank$	0.0078***	0.0125***	0.0129***	0.0127***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)
$VCBacked$	0.0014	0.0068	0.0064	0.0051
	(0.0074)	(0.0073)	(0.0073)	(0.0073)
$NumConcurrentIPO$	-0.0006*	-0.0004	-0.0005	-0.0004
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
$AvgUPConcurrentIPO$	0.0045***	0.0043***	0.0044***	0.0044***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
$MktReturn$	5.8031***	5.6935***	5.5776***	5.5894***
	(2.1308)	(2.0878)	(2.0891)	(2.0914)
$MktStdDeviation$	1.3487	1.6339	1.2238	1.4591
	(1.4397)	(1.4030)	(1.4071)	(1.4031)
$TechFirm$	0.0012	0.0005	0.0003	0.0003
	(0.0083)	(0.0081)	(0.0081)	(0.0081)
$OfferPriceRevision$	0.6960***	0.6256***	0.6271***	0.6283***
	(0.0290)	(0.0291)	(0.0290)	(0.0291)
$PercentSold$	-0.0869***	-0.0952***	-0.0870***	-0.0901***
	(0.0162)	(0.0162)	(0.0161)	(0.0161)
$PercentInst$	0.1110***	0.0222	0.0224	0.0231
	(0.0148)	(0.0173)	(0.0173)	(0.0173)
$UWAvgUP$	0.5708***	0.5706***	0.5723***	0.5723***
	(0.0405)	(0.0401)	(0.0400)	(0.0401)
$UWInfoProd$	-0.0049***	-0.0072***	-0.0077***	-0.0078***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
$AvgIndOverweight$	0.0223***	0.0297***	0.0304***	0.0298***
	(0.0081)	(0.0081)	(0.0081)	(0.0081)
$Spread$	-0.7984**	-0.8629**	-0.7940**	-0.6959*
	(0.3845)	(0.3749)	(0.3727)	(0.3741)
$AvgVolume$	0.2956***	0.2070***	0.1924***	0.2009***
	(0.0418)	(0.0433)	(0.0434)	(0.0433)
$ReturnStdDev$	1.9203***	2.1005***	2.1642***	2.1308***
	(0.3465)	(0.3410)	(0.3424)	(0.3421)

$FirstNumAnalysts$	-0.0186***	-0.0173***	-0.0157***	-0.0162***
	(0.0045)	(0.0045)	(0.0045)	(0.0045)
$OneYearNumAnalysts$	0.0111***	0.0094***	0.0077***	0.0083***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$NumInstInv$		0.0040***	0.0029***	0.0039***
		(0.0004)	(0.0005)	(0.0004)
$TotalInformed\_Q3Q4$			0.0054***	
			(0.0016)	
$AvgProbability\_Q3Q4$				0.2032***
				(0.0624)
Constant	0.0858	0.1125**	0.0843	0.0489
	(0.0550)	(0.0570)	(0.0576)	(0.0606)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	58.85%	59.91%	60.10%	60.00%
Observations	5,216	5,216	5,216	5,216

Table 4.35: Probit Estimation of IPO Allocations Requiring 4 Recent IPO Allocations. $AvgInformed\_Min4IPOs$ is based on $Informed$, but only requires that funds have received at least 4 allocations in IPOs over the prior 5 years. "Established Funds" observations have a value for $AvgInformed\_Min4IPOs$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1071***	0.1052***	0.0927***
	(0.0072)	(0.0057)	(0.0064)
Log($FundAge$)	-0.0084***	-0.0020***	-0.0020***
	(0.0005)	(0.0004)	(0.0004)
$Churn$	0.1809***	0.1745***	0.1171***
	(0.0302)	(0.0285)	(0.0332)
$OneTime$	0.6562***	0.5548***	0.5279***
	(0.0159)	(0.0090)	(0.0112)
$MultipleTimes$	1.2313***	0.9386***	0.8841***
	(0.0330)	(0.0162)	(0.0188)
$NumPrevIPOs$	-0.1072***	0.0028***	0.0024***
	(0.0081)	(0.0001)	(0.0001)
$AvgSystematicSell$		0.4143***	0.4450***
		(0.0570)	(0.0606)
$AvgFlipped$		-0.2986***	-0.3657***
		(0.0560)	(0.0636)
$AvgIPOHoldTime$		0.0034	0.0080***
		(0.0027)	(0.0028)
$AvgInformed\_Min4IPOs$		0.4378***	0.3645***
		(0.0589)	(0.0641)
$HighUP$			-0.4056***
			(0.1205)
$HighUP\times$ Log($FundValue$)			0.0230***
			(0.0058)
$HighUP\times$ Log($FundAge$)			0.0000
			(0.0004)
$HighUP \times Churn$			0.1023***
			(0.0316)
$HighUP \times OneTime$			0.0385***
			(0.0126)
$HighUP \times MultipleTimes$			0.0772***
			(0.0177)
$HighUP \times NumPrevIPO$			0.0007***
			(0.0001)

$HighUP \times AvgSystematicSell$			-0.0502
			(0.0531)
$HighUP \times AvgFlipped$			0.1121**
			(0.0518)
$HighUP \times AvgIPOHoldTime$			-0.0080***
			(0.0024)
$HighUP \times AvgInformed\_Min4IPOs$			0.1281***
			(0.0481)
Constant	-4.0797***	-4.3548***	-4.2161***
	(0.2355)	(0.1403)	(0.1536)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	10.44%	21.04%	21.53%
Observations	2,238,673	2,479,497	2,479,497

Table 4.36: Probit Estimation of Future Informed Trading Requiring 4 Recent IPO Allocations. $AvgInformed\_Min4IPOs$ is based on $Informed$, but only requires that funds have received at least 4 allocations in IPOs over the prior 5 years. "Established Funds" observations have a value for $AvgInformed\_Min4IPOs$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0142	-0.0122**
	(0.0115)	(0.0060)
$UWInfoProd$	0.0045	0.0170***
	(0.0057)	(0.0030)
$OneTime$	-0.0187	-0.0037
	(0.0336)	(0.0125)
$MultipleTimes$	0.0865	0.0466***
	(0.0567)	(0.0159)
$FirstNumAnalysts$	0.0028	0.0211***
	(0.0567)	(0.0159)
$OneYearNumAnalysts$	-0.0142	-0.0122**
	(0.0115)	(0.0060)
$VCBacked$	0.0940***	0.0404***
	(0.0295)	(0.0137)
$90DayReturn$	0.1066**	0.2813***
	(0.0429)	(0.0196)
$Spread$	-4.5085*	-5.9718***
	(2.3077)	(1.1174)
$AvgVolume$	0.0000***	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	-0.1587	0.5204
	(1.4014)	(0.7057)
$IndustryOverweight$	0.0495***	0.0509***
	(0.0124)	(0.0079)
$IndWeightStdDev$	-0.0894*	-0.0755*
	(0.0527)	(0.0392)
$NumPrevIPOs$	-0.0157	0.0002
	(0.0175)	(0.0001)
$AllocationPct$	-1.2768**	-0.8787***
	(0.5866)	(0.2766)
$Shares$	-0.0202***	-0.0382***
	(0.0077)	(0.0039)
$Churn$	-1.4671***	-1.3060***
	(0.1497)	(0.0867)

Log($FundValue$)	0.0488**	0.0171*
	(0.0219)	(0.0090)
Log($FundAge$)	-0.0009	-0.0007
	(0.0010)	(0.0006)
$AvgFlipped$		-0.8037***
		(0.1226)
$AvgSystematicSell$		0.5323***
		(0.1176)
$AvgIPOHoldTime$		0.0195***
		(0.0038)
$AvgInformed\_Min4IPOs$		1.3282***
		(0.1227)
$MoneyLeft$	0.0278**	0.0942***
	(0.0130)	(0.0110)
$AvgInformed\_Min4IPOs \times MoneyLeft$		-0.1583***
		(0.0378)
Constant	-1.3792***	-1.1399***
	(0.4333)	(0.2257)
Year Dummy Variables	Yes	Yes
Pseudo R^2	4.09%	8.71%
Observations	15,648	113,741

Table 4.37: OLS Estimation of Total Future Informed Trading Requiring 4 Recent IPO Allocations. *AvgProbability_Min4IPOs* is similar to *AvgProbability*, but only requires that funds have received at least 4 allocations in IPOs over the prior 5 years. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.0146	0.0263	0.0183	0.0159
	(0.0440)	(0.0439)	(0.0439)	(0.0414)
$LogProceeds$	-1.2344***	-1.1365***	-1.2067***	-0.9343***
	(0.0959)	(0.0976)	(0.0976)	(0.0918)
$UnderwriterRank$	-0.1191***	-0.1323***	-0.1224***	-0.1091***
	(0.0327)	(0.0327)	(0.0327)	(0.0313)
$VCBacked$	0.1296	0.1224	0.1277	0.0115
	(0.1024)	(0.1022)	(0.1023)	(0.0945)
$NumConcurrentIPO$	0.0014	0.0019	0.0012	0.0002
	(0.0036)	(0.0036)	(0.0036)	(0.0033)
$AvgUPConcurrentIPO$	-0.0207***	-0.0255***	-0.0229***	-0.0167***
	(0.0048)	(0.0051)	(0.0050)	(0.0044)
$TechFirm$	0.0545	0.0536	0.0614	0.0313
	(0.1042)	(0.1042)	(0.1041)	(0.0958)
$OfferPriceRevision$	-0.2646	-0.9246***	-0.4801	-0.4026
	(0.3322)	(0.3406)	(0.3241)	(0.3051)
$PercentSold$	-1.2181***	-1.1168***	-1.1765***	-0.7957***
	(0.2631)	(0.2608)	(0.2618)	(0.2472)
$PercentInst$	-0.5028**	-0.5272**	-0.4328**	-0.3369*
	(0.2118)	(0.2122)	(0.2154)	(0.1980)
$UWAvgUP$	-0.9375**	-1.5384***	-1.1130***	-0.8093**
	(0.4147)	(0.4356)	(0.4167)	(0.3938)
$UWInfoProd$	0.1381***	0.1457***	0.1418***	0.0721***
	(0.0234)	(0.0237)	(0.0237)	(0.0221)
$NumInstInv$	0.3260***	0.3218***	0.3212***	0.3084***
	(0.0067)	(0.0067)	(0.0072)	(0.0063)
$AvgIndOverweight$	0.0149	-0.0166	0.0092	-0.0853
	(0.0986)	(0.0984)	(0.0987)	(0.0935)
$Spread$	-19.5562***	-18.6359***	-19.5546***	1.8968
	(4.5875)	(4.5780)	(4.5832)	(4.4966)
$AvgVolume$	2.9516***	2.7295***	2.6373***	2.6255***
	(0.5236)	(0.5322)	(0.5557)	(0.4985)
$ReturnStdDev$	-7.6958*	-9.8565**	-7.7620*	-7.4830*
	(4.2249)	(4.1977)	(4.2150)	(4.0259)
$FirstNumAnalysts$	-0.2914***	-0.2733***	-0.2840***	-0.2234***

	(0.0731)	(0.0734)	(0.0734)	(0.0690)
$OneYearNumAnalysts$	0.3332***	0.3234***	0.3276***	0.2434***
	(0.0426)	(0.0426)	(0.0427)	(0.0404)
$Underpricing$		1.0552***		
		(0.2955)		
$TotalMoneyLeft$			0.0050*	
			(0.0026)	
$AvgProbability\_Min4IPOs$				22.8774***
				(0.7549)
Constant	7.2193***	7.0804***	7.2739***	-1.1556
	(0.7958)	(0.7949)	(0.8037)	(0.8461)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	80.95%	81.06%	80.98%	83.54%
Observations	5,216	5,216	5,216	5,216

Table 4.38: OLS Estimation of Underpricing Requiring 4 Recent IPO Allocations. *AvgProbability_Min4IPOs* is similar to *AvgProbability*, but only requires that funds have received at least 4 allocations in IPOs over the prior 5 years. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0099***	-0.0110***	-0.0111***	-0.0111***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
LogProceeds	-0.0612***	-0.0921***	-0.0855***	-0.0880***
	(0.0065)	(0.0071)	(0.0072)	(0.0071)
UnderwriterRank	0.0078***	0.0125***	0.0131***	0.0128***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)
VCBacked	0.0014	0.0068	0.0061	0.0053
	(0.0074)	(0.0073)	(0.0073)	(0.0073)
NumConcurrentIPO	-0.0006*	-0.0004	-0.0005	-0.0004
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
AvgUPConcurrentIPO	0.0045***	0.0043***	0.0045***	0.0044***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
MktReturn	5.8031***	5.6935***	5.6653***	5.7178***
	(2.1308)	(2.0878)	(2.0892)	(2.0834)
MktStdDeviation	1.3487	1.6339	1.1885	1.5020
	(1.4397)	(1.4030)	(1.4103)	(1.3990)
TechFirm	0.0012	0.0005	0.0001	0.0003
	(0.0083)	(0.0081)	(0.0081)	(0.0081)
OfferPriceRevision	0.6960***	0.6256***	0.6265***	0.6243***
	(0.0290)	(0.0291)	(0.0291)	(0.0291)
PercentSold	-0.0869***	-0.0952***	-0.0887***	-0.0890***
	(0.0162)	(0.0162)	(0.0161)	(0.0162)
PercentInst	0.1110***	0.0222	0.0251	0.0250
	(0.0148)	(0.0173)	(0.0174)	(0.0173)
UWAvgUP	0.5708***	0.5706***	0.5754***	0.5742***
	(0.0405)	(0.0401)	(0.0399)	(0.0398)
UWInfoProd	-0.0049***	-0.0072***	-0.0079***	-0.0081***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
AvgIndOverweight	0.0223***	0.0297***	0.0297***	0.0281***
	(0.0081)	(0.0081)	(0.0081)	(0.0081)
Spread	-0.7984**	-0.8629**	-0.7600**	-0.5955
	(0.3845)	(0.3749)	(0.3721)	(0.3750)
AvgVolume	0.2956***	0.2070***	0.1915***	0.2028***
	(0.0418)	(0.0433)	(0.0433)	(0.0432)
ReturnStdDev	1.9203***	2.1005***	2.1415***	2.1033***
	(0.3465)	(0.3410)	(0.3401)	(0.3405)

$FirstNumAnalysts$	-0.0186***	-0.0173***	-0.0158***	-0.0166***
	(0.0045)	(0.0045)	(0.0045)	(0.0045)
$OneYearNumAnalysts$	0.0111***	0.0094***	0.0077***	0.0084***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$NumInstInv$		0.0040***	0.0022***	0.0037***
		(0.0004)	(0.0006)	(0.0004)
$TotalInformed$			0.0053***	
			(0.0015)	
$AvgProbability\_Min4IPOs$				0.2940***
				(0.0598)
Constant	0.0858	0.1125**	0.0796	0.0045
	(0.0550)	(0.0570)	(0.0579)	(0.0619)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	58.85%	59.91%	60.14%	60.10%
Observations	5,216	5,216	5,216	5,216

In general, the results are consistent with those conducted on the full sample. The probit estimations of allocations and future information production are very similar to those of the full sample; however, high reputations for information production are not significantly associated with more allocations in highly underpriced IPOs for this sub-sample, possibly due to reduced sample size and consequently larger standard errors. In the OLS estimations, $AvgProbability$ remains very strongly related to underpricing and total future information production, but underpricing and total money left on the table are not significantly related to total future informed trading nor is $TotalInformed$ significantly related to underpricing. While this result is also partially attributable to the reduced sample size, the smaller point-estimates of the coefficients suggest that allocations retained for several months after the IPO may better reflect informationally-motivated allocations.[3]

4.1.4 Sample Period

A number of studies have documented agency conflicts affecting IPO underpricing in the years surrounding the tech-bubble, and Ritter [2011] argues that firms' objective functions may have changed over time. While I attempt to control directly for some concerns (e.g. by including the churn measure which is correlated with a fund's level of trading and thus commissions paid by a fund), I also examine results for sub-periods before, during and after the bubble period. Tables 4.43, 4.44, 4.45 and 4.46 show results from analyses considering 1985 - 1997, Tables 4.47, 4.48, 4.49 and 4.50 show results from analyses considering 1998 - 2000, and Tables 4.51, 4.52, 4.53 and 4.54 show results from analyses considering 2001 - 2011.

The results suggest that the importance of information production for allocations, future information production and underpricing has increased over time, but was less significant during the bubble period of 1998 - 2000. While the relation between a fund's history of information production and the probability of receiving an allocation is always significant, this relation has

[3] Capturing more allocations to non-information-producers could add noise to the measurement of future information production and total money left on the table, possibly resulting in the smaller magnitude coefficient estimates.

Table 4.39: Probit Estimation of IPO Allocations Using Last Month of Quarter. Only IPOs occurring in the last month of the quarter are included in this sub-sample. "Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are available in the appendix. Standard errors, clustered at the IPO and fund levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.0893***	0.0666***	0.0574***
	(0.0076)	(0.0082)	(0.0088)
Log($FundAge$)	-0.0092***	-0.0025***	-0.0024***
	(0.0006)	(0.0005)	(0.0005)
$Churn$	0.2421***	0.1823***	0.1270***
	(0.0373)	(0.0413)	(0.0485)
$OneTime$	0.7610***	0.5513***	0.5036***
	(0.0214)	(0.0135)	(0.0192)
$MultipleTimes$	1.2765***	0.8941***	0.8140***
	(0.0354)	(0.0215)	(0.0273)
$NumPrevIPOs$	0.0086**	0.0028***	0.0025***
	(0.0040)	(0.0002)	(0.0002)
$AvgSystematicSell$		0.3430***	0.4447***
		(0.0858)	(0.0895)
$AvgFlipped$		-0.1184	-0.2048*
		(0.0986)	(0.1084)
$AvgIPOHoldTime$		-0.0070	0.0032
		(0.0043)	(0.0042)
$AvgInformed$		0.3646***	0.2834***
		(0.0848)	(0.0937)
$HighUP$			-0.1695
			(0.1912)
$HighUP\times$ Log($FundValue$)			0.0171*
			(0.0088)
$HighUP\times$ Log($FundAge$)			-0.0003
			(0.0005)
$HighUP \times Churn$			0.1055*
			(0.0541)
$HighUP \times OneTime$			0.0722***
			(0.0234)
$HighUP \times MultipleTimes$			0.1224***
			(0.0319)
$HighUP \times NumPrevIPO$			0.0007***
			(0.0002)

$HighUP \times AvgSystematicSell$			-0.1792*
			(0.0970)
$HighUP \times AvgFlipped$			0.1466
			(0.1046)
$HighUP \times AvgIPOHoldTime$			-0.0183***
			(0.0043)
$HighUP \times AvgInformed$			0.1376
			(0.0889)
Constant	-4.1647***	-3.3886***	-3.3933***
	(0.1626)	(0.1977)	(0.2171)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	10.99%	16.88%	17.43%
Observations	966,325	587,577	587,577

Table 4.40: Probit Estimation of Future Informed Trading Using Last Month of Quarter. Only IPOs occurring in the last month of the quarter are included in this sub-sample. "Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0497***	-0.0235***
	(0.0159)	(0.0089)
$UWInfoProd$	0.0013	0.0157***
	(0.0085)	(0.0050)
$OneTime$	0.0213	0.0061
	(0.0464)	(0.0242)
$MultipleTimes$	0.0961	0.0285
	(0.0625)	(0.0245)
$FirstNumAnalysts$	-0.0004	0.0145***
	(0.0625)	(0.0245)
$OneYearNumAnalysts$	-0.0497***	-0.0235***
	(0.0159)	(0.0089)
$VCBacked$	0.0241	0.0644***
	(0.0426)	(0.0221)
$90DayReturn$	0.0673	0.2342***
	(0.0443)	(0.0285)
$Spread$	-6.0069*	-7.6043***
	(3.2055)	(1.7434)
$AvgVolume$	0.0000	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	1.2707	0.3299
	(2.0308)	(1.1558)
$IndustryOverweight$	0.0477***	0.0526***
	(0.0171)	(0.0115)
$IndWeightStdDev$	-0.0848	-0.0293
	(0.0671)	(0.0571)
$NumPrevIPOs$	-0.0016	0.0003**
	(0.0105)	(0.0001)
$AllocationPct$	-1.5612**	-0.6123
	(0.7837)	(0.4099)
$Shares$	-0.0189	-0.0323***
	(0.0130)	(0.0075)
$Churn$	-1.5679***	-1.1523***
	(0.1683)	(0.1083)

Log($FundValue$)	0.0763***	-0.0060
	(0.0232)	(0.0117)
Log($FundAge$)	-0.0038***	-0.0007
	(0.0012)	(0.0007)
$AvgFlipped$		-0.7624***
		(0.1678)
$AvgSystematicSell$		0.2663*
		(0.1534)
$AvgIPOHoldTime$		0.0175***
		(0.0064)
$AvgInformed$		1.4176***
		(0.1599)
$MoneyLeft$	0.0506**	0.1298***
	(0.0228)	(0.0228)
$AvgInformed \times MoneyLeft$		-0.1760**
		(0.0724)
Constant	-1.6864***	-0.3925
	(0.5066)	(0.2864)
Year Dummy Variables	Yes	Yes
Pseudo R^2	4.67%	7.56%
Observations	6,831	31,500

Table 4.41: OLS Estimation of Total Future Informed Trading Using Last Month of Quarter. Only IPOs occurring in the last month of the quarter are included in this sub-sample. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.0005	0.0044	0.0002	0.0250
	(0.0588)	(0.0589)	(0.0587)	(0.0532)
$LogProceeds$	-0.6575***	-0.6322***	-0.6583***	-0.4028***
	(0.1252)	(0.1266)	(0.1252)	(0.1175)
$UnderwriterRank$	-0.2056***	-0.2082***	-0.2057***	-0.1857***
	(0.0450)	(0.0449)	(0.0450)	(0.0431)
$VCBacked$	0.3575**	0.3567**	0.3570**	0.2227*
	(0.1469)	(0.1470)	(0.1469)	(0.1340)
$NumConcurrentIPO$	-0.0023	-0.0020	-0.0023	-0.0025
	(0.0058)	(0.0059)	(0.0058)	(0.0052)
$AvgUPConcurrentIPO$	-0.0129**	-0.0140**	-0.0127*	-0.0090
	(0.0064)	(0.0067)	(0.0066)	(0.0057)
$TechFirm$	-0.0783	-0.0762	-0.0788	-0.1528
	(0.1437)	(0.1438)	(0.1438)	(0.1304)
$OfferPriceRevision$	-0.2600	-0.5047	-0.2272	-0.3080
	(0.5046)	(0.5067)	(0.4829)	(0.4528)
$PercentSold$	-1.1272***	-1.0882***	-1.1340***	-0.9132***
	(0.3259)	(0.3223)	(0.3257)	(0.2955)
$PercentInst$	-0.4632	-0.4507	-0.4730	-0.2601
	(0.3063)	(0.3067)	(0.3116)	(0.2816)
$UWAvgUP$	-1.4533**	-1.6466**	-1.4357**	-1.4682**
	(0.6401)	(0.6743)	(0.6533)	(0.5863)
$UWInfoProd$	0.1189***	0.1218***	0.1187***	0.0723**
	(0.0367)	(0.0371)	(0.0368)	(0.0340)
$NumInstInv$	0.2897***	0.2880***	0.2903***	0.2721***
	(0.0095)	(0.0098)	(0.0102)	(0.0088)
$AvgIndOverweight$	-0.1645	-0.1817	-0.1627	-0.2385*
	(0.1434)	(0.1461)	(0.1448)	(0.1343)
$Spread$	-28.5109***	-28.1205***	-28.5023***	-3.1121
	(6.6923)	(6.7285)	(6.6873)	(6.2101)
$AvgVolume$	1.4723**	1.4254**	1.4992**	1.1356**
	(0.5893)	(0.5910)	(0.6016)	(0.5152)
$ReturnStdDev$	2.3892	1.7229	2.4105	-0.3939
	(5.6529)	(5.6887)	(5.6601)	(5.1514)
$FirstNumAnalysts$	-0.0912	-0.0839	-0.0925	-0.0316
	(0.0885)	(0.0881)	(0.0884)	(0.0809)

$OneYearNumAnalysts$	0.1812***	0.1763***	0.1823***	0.1139***
	(0.0464)	(0.0462)	(0.0465)	(0.0422)
$Underpricing$		0.3826		
		(0.4286)		
$TotalMoneyLeft$			-0.0007	
			(0.0038)	
$AvgProbability$				19.7330***
				(1.1391)
Constant	7.3323***	7.2540***	7.3193***	0.5693
	(1.7624)	(1.7678)	(1.7644)	(1.7421)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	77.88%	77.90%	77.88%	81.32%
Observations	1,754	1,754	1,754	1,754

Table 4.42: OLS Estimation of Underpricing Using Last Month of Quarter. Only IPOs occurring in the last month of the quarter are included in this sub-sample. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0109**	-0.0109**	-0.0109**	-0.0106**
	(0.0043)	(0.0043)	(0.0043)	(0.0043)
LogProceeds	-0.0364***	-0.0665***	-0.0646***	-0.0630***
	(0.0102)	(0.0115)	(0.0118)	(0.0115)
UnderwriterRank	0.0025	0.0067	0.0073*	0.0070
	(0.0043)	(0.0043)	(0.0043)	(0.0043)
VCBacked	-0.0029	0.0026	0.0016	0.0008
	(0.0119)	(0.0118)	(0.0120)	(0.0119)
NumConcurrentIPO	-0.0009*	-0.0008	-0.0008	-0.0008
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
AvgUPConcurrentIPO	0.0033***	0.0030***	0.0030***	0.0030***
	(0.0009)	(0.0009)	(0.0009)	(0.0009)
MktReturn	3.0909	3.1607	3.2730	3.5625
	(3.8112)	(3.7166)	(3.7167)	(3.7001)
MktStdDeviation	-5.0250	-4.3465	-4.5918	-4.4780
	(3.3350)	(3.2514)	(3.2467)	(3.2467)
TechFirm	-0.0042	-0.0062	-0.0060	-0.0073
	(0.0135)	(0.0133)	(0.0133)	(0.0132)
OfferPriceRevision	0.7380***	0.6336***	0.6341***	0.6327***
	(0.0482)	(0.0495)	(0.0495)	(0.0494)
PercentSold	-0.0901***	-0.1032***	-0.1000***	-0.1002***
	(0.0276)	(0.0268)	(0.0270)	(0.0267)
PercentInst	0.0726***	-0.0324	-0.0310	-0.0297
	(0.0238)	(0.0328)	(0.0331)	(0.0329)
UWAvgUP	0.5166***	0.5038***	0.5080***	0.5039***
	(0.0637)	(0.0630)	(0.0632)	(0.0624)
UWInfoProd	-0.0046	-0.0076**	-0.0079**	-0.0082**
	(0.0032)	(0.0032)	(0.0033)	(0.0033)
AvgIndOverweight	0.0385***	0.0455***	0.0460***	0.0444***
	(0.0132)	(0.0130)	(0.0130)	(0.0131)
Spread	-1.0801	-1.0732	-0.9925	-0.7239
	(0.6803)	(0.6614)	(0.6623)	(0.6635)
AvgVolume	0.1746***	0.1251*	0.1210*	0.1205*
	(0.0673)	(0.0687)	(0.0686)	(0.0684)
ReturnStdDev	1.6699***	1.7877***	1.7829***	1.7527***
	(0.5383)	(0.5290)	(0.5290)	(0.5270)

$FirstNumAnalysts$	-0.0189**	-0.0186**	-0.0183**	-0.0178**
	(0.0079)	(0.0079)	(0.0079)	(0.0079)
$OneYearNumAnalysts$	0.0123***	0.0128***	0.0123***	0.0119***
	(0.0045)	(0.0044)	(0.0044)	(0.0044)
$NumInstInv$		0.0045***	0.0036***	0.0043***
		(0.0009)	(0.0013)	(0.0009)
$TotalInformed$			0.0029	
			(0.0030)	
$AvgProbability$				0.2726**
				(0.1133)
Constant	0.2239***	0.2437***	0.2245***	0.1512*
	(0.0679)	(0.0718)	(0.0778)	(0.0851)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	59.45%	60.63%	60.68%	60.80%
Observations	1,754	1,754	1,754	1,754

strengthened since the pre-bubble period. Few variables differentially affect highly underpriced IPOs in the most recent period, consistent with IPOs being marketed more similarly over this time period. Regarding individual funds' future information production, the relation between past and future information production is generally stronger in the bubble and post-bubble periods, but remains highly significant in all periods. At the IPO level, there are significant relations between underpricing, money left on the table and total future information production in the pre and post-bubble periods, but not during the bubble period. This is consistent with other motivations dominating the allocation and pricing decisions during this time, such as firms' agency problems and underwriters' desires to receive kick-backs. Additionally, the coefficient estimations on the relations are stronger in the post-bubble period than the pre-bubble period, consistent with the results of the probit estimations that suggest a more important role for information production in the latter years of the sample.

4.1.5 All-Star Analyst Following

In addition to institutional investors, analysts engage in information production after the IPO, and several studies have linked analyst coverage to underpricing.[4] In regards to institutions' informed trading, it may follow from analyst coverage (by analysts' making information production less costly) or it may lead to analyst coverage (as a large institutional ownership base provides customers for analysts), or both.[5] While the main results include controls for initial analyst coverage and analyst coverage one year after the IPO, a desire for all-star analyst coverage may have an incremental effect. Unfortunately, the sample size is reduced as I do not have all-star analyst coverage data for the entire sample period. Accordingly, I display the baseline results of the main OLS regressions results for this reduced sample in Tables 4.55 and 4.57. Tables 4.56 and 4.58 display the results controlling for all-star analyst coverage over the same sample. The results indicate

[4] Loughran and Ritter [2004] presents the analyst lust hypothesis, positing that excessive underpricing is tolerated in order to gain the following of a highly ranked analyst. Bradley et al. [2008] shows that underpricing relates to initial analyst coverage, but not analyst coverage one year after the IPO. Bradley et al. [2012] find that underpricing is associated with all-star analyst coverage for firms backed by top VCs.

[5] Investor relations may be able to have a similar effect on incremental information production.

Table 4.43: Probit Estimation of IPO Allocations: 1985 - 1997. "Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1142***	0.0854***	0.0745***
	(0.0111)	(0.0087)	(0.0096)
Log($FundAge$)	-0.0124***	-0.0027***	-0.0022***
	(0.0009)	(0.0007)	(0.0008)
$Churn$	0.1180***	0.0975**	-0.0143
	(0.0383)	(0.0381)	(0.0466)
$OneTime$	0.7386***	0.5291***	0.4848***
	(0.0187)	(0.0114)	(0.0144)
$MultipleTimes$	1.2582***	0.8886***	0.8020***
	(0.0398)	(0.0221)	(0.0246)
$NumPrevIPOs$	0.0185***	0.0027***	0.0023***
	(0.0044)	(0.0002)	(0.0002)
$AvgSystematicSell$		0.3929***	0.4551***
		(0.0960)	(0.0988)
$AvgFlipped$		-0.3563***	-0.4271***
		(0.1046)	(0.1159)
$AvgIPOHoldTime$		-0.0034	0.0043
		(0.0037)	(0.0042)
$AvgInformed$		0.3148***	0.1777*
		(0.0868)	(0.0971)
$HighUP$			-0.3214*
			(0.1654)
$HighUP\times$ Log($FundValue$)			0.0198**
			(0.0082)
$HighUP\times$ Log($FundAge$)			-0.0009
			(0.0007)
$HighUP \times Churn$			0.1898***
			(0.0477)
$HighUP \times OneTime$			0.0749***
			(0.0173)
$HighUP \times MultipleTimes$			0.1420***
			(0.0228)
$HighUP \times NumPrevIPO$			0.0009***
			(0.0002)
$HighUP \times AvgSystematicSell$			-0.1013
			(0.0984)

$HighUP \times AvgFlipped$			0.1194
			(0.1029)
$HighUP \times AvgIPOHoldTime$			-0.0132***
			(0.0045)
$HighUP \times AvgInformed$			0.2437***
			(0.0882)
Constant	-4.6778***	-4.1386***	-3.9696***
	(0.2146)	(0.1878)	(0.2033)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	10.83%	16.30%	16.84%
Observations	1,520,851	1,013,511	1,013,511

Table 4.44: Probit Estimation of Future Informed Trading: 1985 - 1997. "Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0165	-0.0274***
	(0.0136)	(0.0075)
$UWInfoProd$	0.0206**	0.0165***
	(0.0089)	(0.0051)
$OneTime$	-0.0004	-0.0194
	(0.0386)	(0.0181)
$MultipleTimes$	0.0222	0.0174
	(0.0602)	(0.0199)
$FirstNumAnalysts$	-0.0075	0.0251***
	(0.0602)	(0.0199)
$OneYearNumAnalysts$	-0.0165	-0.0274***
	(0.0136)	(0.0075)
$VCBacked$	0.0523*	0.0504***
	(0.0306)	(0.0169)
$90DayReturn$	0.1929***	0.3085***
	(0.0542)	(0.0327)
$Spread$	-3.5095	-5.9903***
	(2.1913)	(1.3139)
$AvgVolume$	-0.0000	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	0.7866	-0.8277
	(1.7575)	(0.9661)
$IndustryOverweight$	0.0328**	0.0781***
	(0.0166)	(0.0110)
$IndWeightStdDev$	-0.0297	-0.1169*
	(0.0678)	(0.0608)
$NumPrevIPOs$	-0.0052	-0.0001
	(0.0102)	(0.0002)
$AllocationPct$	-0.7504	-0.5791
	(0.5876)	(0.3555)
$Shares$	-0.0444***	-0.0413***
	(0.0133)	(0.0064)
$Churn$	-1.8220***	-1.4458***
	(0.2280)	(0.1139)
Log($FundValue$)	0.0913***	0.0288**
	(0.0296)	(0.0132)

Log($FundAge$)	-0.0057***	-0.0022**
	(0.0018)	(0.0010)
$AvgFlipped$		-0.5192**
		(0.2061)
$AvgSystematicSell$		0.1949
		(0.1851)
$AvgIPOHoldTime$		0.0058
		(0.0054)
$AvgInformed$		1.1658***
		(0.2135)
$MoneyLeft$	0.0854**	0.1397***
	(0.0347)	(0.0332)
$AvgInformed \times MoneyLeft$		-0.1957*
		(0.1137)
Constant	-2.0837***	-1.1196***
	(0.5902)	(0.3054)
Year Dummy Variables	Yes	Yes
Pseudo R^2	5.20%	5.34%
Observations	10,535	50,700

Table 4.45: OLS Estimation of Total Future Informed Trading: 1985 - 1997. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	-0.0498	-0.0413	-0.0465	-0.0468
	(0.0388)	(0.0391)	(0.0388)	(0.0358)
$LogProceeds$	-0.8632***	-0.8061***	-0.8361***	-0.5941***
	(0.0975)	(0.1022)	(0.1013)	(0.0951)
$UnderwriterRank$	-0.1249***	-0.1290***	-0.1266***	-0.1147***
	(0.0282)	(0.0282)	(0.0282)	(0.0262)
$VCBacked$	0.2238**	0.2273**	0.2294**	0.1123
	(0.0932)	(0.0934)	(0.0936)	(0.0857)
$NumConcurrentIPO$	0.0007	0.0006	0.0003	-0.0004
	(0.0034)	(0.0034)	(0.0034)	(0.0031)
$AvgUPConcurrentIPO$	-0.0046	-0.0098	-0.0081	0.0082
	(0.0086)	(0.0089)	(0.0085)	(0.0081)
$TechFirm$	-0.2836***	-0.2915***	-0.2793***	-0.2809***
	(0.0965)	(0.0963)	(0.0965)	(0.0880)
$OfferPriceRevision$	0.0940	-0.2461	-0.0327	-0.1605
	(0.3399)	(0.3550)	(0.3354)	(0.3109)
$PercentSold$	-0.7417***	-0.7071***	-0.6986***	-0.4155**
	(0.2231)	(0.2219)	(0.2245)	(0.2054)
$PercentInst$	-0.2577	-0.2741	-0.1555	-0.0741
	(0.2219)	(0.2218)	(0.2310)	(0.2094)
$UWAvgUP$	-0.7068	-1.2965**	-0.8487*	-0.9029**
	(0.4525)	(0.5533)	(0.4543)	(0.4463)
$UWInfoProd$	0.1392***	0.1413***	0.1409***	0.0637**
	(0.0314)	(0.0316)	(0.0318)	(0.0291)
$NumInstInv$	0.2758***	0.2738***	0.2690***	0.2646***
	(0.0094)	(0.0095)	(0.0105)	(0.0090)
$AvgIndOverweight$	0.0497	0.0257	0.0482	-0.0429
	(0.0936)	(0.0934)	(0.0934)	(0.0885)
$Spread$	-22.9593***	-21.5435***	-22.4671***	-7.3544**
	(3.4452)	(3.3672)	(3.4180)	(3.2527)
$AvgVolume$	5.7354***	5.3671***	5.0886***	4.8496***
	(1.2161)	(1.2533)	(1.3258)	(1.2394)
$ReturnStdDev$	-11.4784***	-11.9694***	-11.5588***	-5.9493*
	(3.6514)	(3.5547)	(3.6347)	(3.4971)
$FirstNumAnalysts$	-0.1789**	-0.1744*	-0.1650*	-0.1631**
	(0.0895)	(0.0900)	(0.0901)	(0.0805)
$OneYearNumAnalysts$	0.2017***	0.1966***	0.1887***	0.1424***
	(0.0488)	(0.0489)	(0.0477)	(0.0448)

$Underpricing$		0.8626*		
		(0.4749)		
$TotalMoneyLeft$			0.0096*	
			(0.0055)	
$AvgProbability$				17.4771***
				(0.7085)
Constant	4.1810***	3.9999***	4.1723***	-2.6000***
	(0.3997)	(0.4152)	(0.4063)	(0.4754)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	75.72%	75.79%	75.80%	79.61%
Observations	3,308	3,308	3,308	3,308

Table 4.46: OLS Estimation of Underpricing: 1985 - 1997. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0097***	-0.0097***	-0.0096***	-0.0097***
	(0.0021)	(0.0021)	(0.0021)	(0.0021)
LogProceeds	-0.0502***	-0.0655***	-0.0628***	-0.0631***
	(0.0069)	(0.0068)	(0.0068)	(0.0069)
UnderwriterRank	0.0025	0.0047***	0.0051***	0.0048***
	(0.0017)	(0.0017)	(0.0017)	(0.0017)
VCBacked	-0.0057	-0.0040	-0.0047	-0.0050
	(0.0053)	(0.0052)	(0.0052)	(0.0052)
NumConcurrentIPO	0.0002	0.0002	0.0002	0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
AvgUPConcurrentIPO	0.0059***	0.0058***	0.0058***	0.0059***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
MktReturn	5.7881***	5.4920***	5.6159***	5.5509***
	(1.5600)	(1.5619)	(1.5436)	(1.5552)
MktStdDeviation	1.8194*	1.8165*	1.9111*	1.8429*
	(1.0783)	(1.0674)	(1.0576)	(1.0683)
TechFirm	0.0088	0.0092	0.0101*	0.0093
	(0.0063)	(0.0062)	(0.0060)	(0.0062)
OfferPriceRevision	0.4207***	0.3940***	0.3937***	0.3917***
	(0.0232)	(0.0234)	(0.0234)	(0.0233)
PercentSold	-0.0364***	-0.0407***	-0.0384***	-0.0378***
	(0.0126)	(0.0126)	(0.0124)	(0.0124)
PercentInst	0.0556***	0.0181	0.0189	0.0197
	(0.0114)	(0.0120)	(0.0121)	(0.0120)
UWAvgUP	0.6886***	0.6861***	0.6885***	0.6844***
	(0.0468)	(0.0474)	(0.0472)	(0.0468)
UWInfoProd	-0.0015	-0.0025	-0.0029	-0.0031
	(0.0021)	(0.0021)	(0.0021)	(0.0022)
AvgIndOverweight	0.0268***	0.0276***	0.0274***	0.0268***
	(0.0065)	(0.0064)	(0.0064)	(0.0064)
Spread	-1.6256***	-1.6450***	-1.5730***	-1.5065***
	(0.2583)	(0.2571)	(0.2503)	(0.2550)
AvgVolume	0.5270***	0.4246***	0.4064***	0.4167***
	(0.0949)	(0.0987)	(0.0989)	(0.0973)
ReturnStdDev	0.4627	0.5980**	0.6349**	0.6474**
	(0.2954)	(0.2954)	(0.2975)	(0.2960)
FirstNumAnalysts	-0.0058	-0.0056	-0.0051	-0.0055
	(0.0057)	(0.0057)	(0.0058)	(0.0057)

$OneYearNumAnalysts$	0.0063**	0.0062**	0.0056*	0.0057**
	(0.0029)	(0.0029)	(0.0029)	(0.0029)
$NumInstInv$		0.0022***	0.0013**	0.0021***
		(0.0004)	(0.0006)	(0.0004)
$TotalInformed$			0.0032*	
			(0.0017)	
$AvgProbability$				0.1552***
				(0.0428)
Constant	0.1731***	0.1930***	0.1791***	0.1326***
	(0.0303)	(0.0299)	(0.0298)	(0.0363)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	46.16%	46.85%	47.00%	47.04%
Observations	3,308	3,308	3,308	3,308

Table 4.47: Probit Estimation of IPO Allocations: 1998 - 2000. "Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1485***	0.1069***	0.0980***
	(0.0153)	(0.0106)	(0.0110)
Log($FundAge$)	-0.0090***	-0.0029***	-0.0023***
	(0.0010)	(0.0008)	(0.0007)
$Churn$	0.2036***	0.2715***	0.1688**
	(0.0788)	(0.0707)	(0.0691)
$OneTime$	0.8747***	0.6069***	0.5915***
	(0.0312)	(0.0211)	(0.0251)
$MultipleTimes$	1.4531***	1.0053***	0.9567***
	(0.0602)	(0.0301)	(0.0327)
$NumPrevIPOs$	-0.0047	0.0020***	0.0018***
	(0.0092)	(0.0002)	(0.0002)
$AvgSystematicSell$		0.5973***	0.6228***
		(0.1703)	(0.1570)
$AvgFlipped$		-0.3521**	-0.4844***
		(0.1715)	(0.1711)
$AvgIPOHoldTime$		0.0226***	0.0227***
		(0.0079)	(0.0077)
$AvgInformed$		0.6415***	0.6323***
		(0.1851)	(0.1832)
$HighUP$			-0.4239*
			(0.2369)
$HighUP\times$ Log($FundValue$)			0.0227**
			(0.0104)
$HighUP\times$ Log($FundAge$)			-0.0012**
			(0.0006)
$HighUP \times Churn$			0.2177***
			(0.0687)
$HighUP \times OneTime$			0.0044
			(0.0298)
$HighUP \times MultipleTimes$			0.0553
			(0.0387)
$HighUP \times NumPrevIPO$			0.0008***
			(0.0002)
$HighUP \times AvgSystematicSell$			-0.0479
			(0.1540)

$HighUP \times AvgFlipped$			0.2678*
			(0.1422)
$HighUP \times AvgIPOHoldTime$			0.0003
			(0.0057)
$HighUP \times AvgInformed$			0.0330
			(0.1391)
Constant	-5.4330***	-4.8743***	-4.7068***
	(0.3102)	(0.2432)	(0.2474)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	16.76%	22.95%	23.52%
Observations	560,543	387,194	387,194

Table 4.48: Probit Estimation of Future Informed Trading: 1998 - 2000. "Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0323*	-0.0036
	(0.0179)	(0.0123)
$UWInfoProd$	0.0149	0.0197***
	(0.0119)	(0.0064)
$OneTime$	-0.1172*	0.0486*
	(0.0662)	(0.0290)
$MultipleTimes$	0.0118	0.0978***
	(0.0672)	(0.0328)
$FirstNumAnalysts$	0.0154*	0.0324***
	(0.0672)	(0.0328)
$OneYearNumAnalysts$	-0.0323*	-0.0036
	(0.0179)	(0.0123)
$VCBacked$	0.0284	0.0001
	(0.0690)	(0.0319)
$90DayReturn$	0.1363***	0.2629***
	(0.0480)	(0.0274)
$Spread$	-9.0592*	-7.2182***
	(5.1412)	(2.6176)
$AvgVolume$	0.0000***	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	2.5468	0.9201
	(2.6009)	(1.3927)
$IndustryOverweight$	0.0853***	0.0238
	(0.0265)	(0.0177)
$IndWeightStdDev$	-0.1858*	-0.0230
	(0.1013)	(0.0654)
$NumPrevIPOs$	0.0428***	0.0003*
	(0.0159)	(0.0002)
$AllocationPct$	1.0656	-0.1954
	(1.0349)	(0.5709)
$Shares$	-0.0336**	-0.0580***
	(0.0135)	(0.0078)
$Churn$	-1.4387***	-1.2138***
	(0.2579)	(0.1946)
Log($FundValue$)	0.0361	-0.0273
	(0.0255)	(0.0207)

Log($FundAge$)	-0.0010	0.0003
	(0.0018)	(0.0011)
$AvgFlipped$		-1.6516***
		(0.3067)
$AvgSystematicSell$		1.4840***
		(0.2644)
$AvgIPOHoldTime$		0.0506***
		(0.0091)
$AvgInformed$		1.7255***
		(0.2651)
$MoneyLeft$	0.0145	0.1167***
	(0.0160)	(0.0141)
$AvgInformed \times MoneyLeft$		-0.2189***
		(0.0473)
Constant	-1.0194*	-1.0300**
	(0.5863)	(0.4974)
Year Dummy Variables	Yes	Yes
Pseudo R^2	5.15%	11.37%
Observations	4,162	25,231

Table 4.49: OLS Estimation of Total Future Informed Trading: 1998 - 2000. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.3669**	0.3754**	0.3658**	0.3261**
	(0.1607)	(0.1596)	(0.1595)	(0.1520)
$LogProceeds$	-1.8881***	-1.7335***	-1.8937***	-1.3534***
	(0.3134)	(0.3348)	(0.3236)	(0.2896)
$UnderwriterRank$	-0.1909*	-0.1997*	-0.1911*	-0.1099
	(0.1064)	(0.1063)	(0.1062)	(0.0997)
$VCBacked$	-0.3996	-0.4112	-0.4000	-0.3886
	(0.3284)	(0.3279)	(0.3285)	(0.2891)
$NumConcurrentIPO$	0.0074	0.0085	0.0074	0.0056
	(0.0100)	(0.0101)	(0.0100)	(0.0088)
$AvgUPConcurrentIPO$	-0.0224***	-0.0240***	-0.0222***	-0.0201***
	(0.0059)	(0.0061)	(0.0060)	(0.0053)
$TechFirm$	1.0126***	1.0101***	1.0108***	0.7338***
	(0.2971)	(0.2980)	(0.2977)	(0.2644)
$OfferPriceRevision$	-1.0125	-1.5512*	-0.9662	-0.3751
	(0.7318)	(0.8132)	(0.7799)	(0.6540)
$PercentSold$	-1.0902	-0.9774	-1.1084	-0.3961
	(0.9425)	(0.9298)	(0.9420)	(0.8605)
$PercentInst$	0.3310	0.2942	0.3230	-0.2929
	(0.5934)	(0.5946)	(0.5965)	(0.5291)
$UWAvgUP$	-1.2103*	-1.5113**	-1.1945*	-0.6170
	(0.6953)	(0.7198)	(0.7104)	(0.6276)
$UWInfoProd$	0.1630***	0.1680***	0.1626***	0.0541
	(0.0563)	(0.0566)	(0.0568)	(0.0519)
$NumInstInv$	0.3561***	0.3506***	0.3570***	0.3208***
	(0.0150)	(0.0157)	(0.0168)	(0.0141)
$AvgIndOverweight$	0.0861	0.0829	0.0856	0.2669
	(0.3072)	(0.3073)	(0.3073)	(0.2840)
$Spread$	-34.1712*	-35.6880*	-34.1421*	-3.2806
	(19.3663)	(19.4641)	(19.3731)	(18.1685)
$AvgVolume$	3.1782***	2.9863***	3.2093***	2.5159***
	(0.7933)	(0.8191)	(0.8432)	(0.7309)
$ReturnStdDev$	4.7442	4.4062	4.6916	-4.2940
	(10.8682)	(10.9007)	(10.8928)	(10.2267)
$FirstNumAnalysts$	-0.6082***	-0.5924***	-0.6086***	-0.3589**
	(0.1539)	(0.1561)	(0.1542)	(0.1475)
$OneYearNumAnalysts$	0.5063***	0.4982***	0.5065***	0.3095***
	(0.0851)	(0.0860)	(0.0853)	(0.0831)

$Underpricing$		0.5468		
		(0.4268)		
$TotalMoneyLeft$			-0.0005	
			(0.0039)	
$AvgProbability$				32.8700***
				(2.0709)
Constant	6.7688***	6.2904***	6.7881***	-4.3835***
	(1.3199)	(1.3034)	(1.3225)	(1.4892)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	76.00%	76.06%	76.00%	80.29%
Observations	952	952	952	952

Table 4.50: OLS Estimation of Underpricing: 1998 - 2000. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0111	-0.0165	-0.0183	-0.0170
	(0.0130)	(0.0126)	(0.0128)	(0.0126)
LogProceeds	-0.1936***	-0.2795***	-0.2709***	-0.2737***
	(0.0249)	(0.0266)	(0.0277)	(0.0268)
UnderwriterRank	0.0087	0.0158*	0.0166*	0.0167*
	(0.0097)	(0.0093)	(0.0091)	(0.0093)
VCBacked	-0.0048	0.0196	0.0212	0.0197
	(0.0323)	(0.0308)	(0.0307)	(0.0309)
NumConcurrentIPO	-0.0027**	-0.0022**	-0.0023**	-0.0022**
	(0.0011)	(0.0010)	(0.0010)	(0.0010)
AvgUPConcurrentIPO	0.0029***	0.0025***	0.0026***	0.0026***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
MktReturn	11.7456**	11.2499**	11.3728**	11.0877**
	(5.7047)	(5.4555)	(5.4533)	(5.4715)
MktStdDeviation	0.3254	2.4700	1.3992	1.7903
	(5.2404)	(4.9091)	(4.9727)	(4.9074)
TechFirm	0.0072	0.0037	-0.0007	0.0007
	(0.0316)	(0.0300)	(0.0302)	(0.0300)
OfferPriceRevision	1.1805***	0.9855***	0.9884***	0.9915***
	(0.0711)	(0.0732)	(0.0732)	(0.0735)
PercentSold	-0.1752**	-0.1946**	-0.1910**	-0.1880**
	(0.0737)	(0.0762)	(0.0758)	(0.0759)
PercentInst	0.2973***	0.0669	0.0655	0.0601
	(0.0539)	(0.0597)	(0.0597)	(0.0597)
UWAvgUP	0.5289***	0.5475***	0.5527***	0.5539***
	(0.0778)	(0.0744)	(0.0741)	(0.0734)
UWInfoProd	-0.0018	-0.0086	-0.0092	-0.0097
	(0.0063)	(0.0062)	(0.0062)	(0.0063)
AvgIndOverweight	-0.0228	0.0076	0.0074	0.0097
	(0.0325)	(0.0321)	(0.0321)	(0.0318)
Spread	2.1301	2.7094	2.8267	3.0289
	(2.1110)	(1.9536)	(1.9574)	(1.9550)
AvgVolume	0.4839***	0.3410***	0.3273***	0.3343***
	(0.0778)	(0.0784)	(0.0791)	(0.0784)
ReturnStdDev	0.9953	0.8405	0.8277	0.7416
	(1.1949)	(1.1140)	(1.1149)	(1.1133)
FirstNumAnalysts	-0.0310**	-0.0294**	-0.0268**	-0.0268**
	(0.0131)	(0.0127)	(0.0130)	(0.0128)

$OneYearNumAnalysts$	0.0199***	0.0152**	0.0130**	0.0131**
	(0.0064)	(0.0062)	(0.0065)	(0.0064)
$NumInstInv$		0.0100***	0.0084***	0.0096***
		(0.0013)	(0.0017)	(0.0013)
$TotalInformed$			0.0045	
			(0.0035)	
$AvgProbability$				0.3611
				(0.2256)
Constant	0.6567***	0.8589***	0.8424***	0.7449***
	(0.1494)	(0.1478)	(0.1481)	(0.1690)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	62.52%	65.47%	65.55%	65.56%
Observations	952	952	952	952

Table 4.51: Probit Estimation of IPO Allocations: 2001 - 2011. "Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.0862***	0.0908***	0.0693***
	(0.0068)	(0.0082)	(0.0102)
Log($FundAge$)	-0.0060***	-0.0015***	-0.0017***
	(0.0004)	(0.0004)	(0.0005)
$Churn$	0.2191***	0.2441***	0.3354***
	(0.0423)	(0.0564)	(0.0637)
$OneTime$	0.4943***	0.4171***	0.4071***
	(0.0179)	(0.0148)	(0.0228)
$MultipleTimes$	0.9714***	0.7895***	0.7923***
	(0.0465)	(0.0248)	(0.0331)
$NumPrevIPOs$	0.0038	0.0032***	0.0030***
	(0.0049)	(0.0002)	(0.0003)
$AvgSystematicSell$		0.5727***	0.6579***
		(0.1089)	(0.1393)
$AvgFlipped$		-0.5876***	-0.7063***
		(0.1084)	(0.1423)
$AvgIPOHoldTime$		0.0126**	0.0191***
		(0.0053)	(0.0062)
$AvgInformed$		0.6241***	0.5349***
		(0.1025)	(0.1218)
$HighUP$			-0.5161**
			(0.2330)
$HighUP\times$ Log($FundValue$)			0.0354***
			(0.0107)
$HighUP\times$ Log($FundAge$)			0.0003
			(0.0005)
$HighUP \times Churn$			-0.1371**
			(0.0629)
$HighUP \times OneTime$			0.0023
			(0.0274)
$HighUP \times MultipleTimes$			-0.0279
			(0.0379)
$HighUP \times NumPrevIPO$			0.0004
			(0.0003)
$HighUP \times AvgSystematicSell$			-0.1162
			(0.1187)

$HighUP \times AvgFlipped$			0.1710
			(0.1342)
$HighUP \times AvgIPOHoldTime$			-0.0096**
			(0.0047)
$HighUP \times AvgInformed$			0.1619
			(0.1080)
Constant	-3.8470***	-4.0342***	-3.8333***
	(0.2190)	(0.1888)	(0.2245)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	5.76%	19.37%	20.12%
Observations	859,051	377,020	377,020

Table 4.52: Probit Estimation of Future Informed Trading: 2001 - 2011. "Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0070	0.0020
	(0.0195)	(0.0130)
$UWInfoProd$	-0.0016	0.0127***
	(0.0070)	(0.0040)
$OneTime$	-0.0408	0.0131
	(0.0426)	(0.0256)
$MultipleTimes$	0.1379	0.0446
	(0.1055)	(0.0287)
$FirstNumAnalysts$	0.0025	0.0151***
	(0.1055)	(0.0287)
$OneYearNumAnalysts$	-0.0070	0.0020
	(0.0195)	(0.0130)
$VCBacked$	0.1110**	0.0544*
	(0.0448)	(0.0296)
$90DayReturn$	0.1214*	0.3302***
	(0.0666)	(0.0424)
$Spread$	4.2098	-0.7584
	(5.5383)	(3.1674)
$AvgVolume$	0.0000***	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	-3.3817	-0.0703
	(2.7925)	(1.7296)
$IndustryOverweight$	0.0349**	0.0443**
	(0.0142)	(0.0182)
$IndWeightStdDev$	-0.1552**	-0.0336
	(0.0661)	(0.0914)
$NumPrevIPOs$	0.0003	0.0004**
	(0.0135)	(0.0002)
$AllocationPct$	-2.0765**	-1.8243***
	(0.9237)	(0.4785)
$Shares$	-0.0086	-0.0254***
	(0.0104)	(0.0052)
$Churn$	-1.0276***	-1.2938***
	(0.1349)	(0.1557)
Log($FundValue$)	0.0472**	0.0102
	(0.0231)	(0.0165)

Log($FundAge$)	-0.0011	-0.0002
	(0.0010)	(0.0006)
$AvgFlipped$		-0.9325***
		(0.2227)
$AvgSystematicSell$		0.7613***
		(0.1885)
$AvgIPOHoldTime$		0.0195***
		(0.0059)
$AvgInformed$		1.7383***
		(0.1685)
$MoneyLeft$	0.0025	0.0863***
	(0.0168)	(0.0192)
$AvgInformed \times MoneyLeft$		-0.1801***
		(0.0566)
Constant	-1.4853***	-1.4366***
	(0.4990)	(0.4207)
Year Dummy Variables	Yes	Yes
Pseudo R^2	3.11%	11.47%
Observations	8,239	30,522

Table 4.53: OLS Estimation of Total Future Informed Trading: 2001 - 2011. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	-0.1158	-0.1063	-0.1150	-0.0721
	(0.1402)	(0.1395)	(0.1397)	(0.1314)
$LogProceeds$	-0.7381**	-0.4508	-0.6464**	-0.3364
	(0.3118)	(0.3149)	(0.3225)	(0.3046)
$UnderwriterRank$	-0.0650	-0.1232	-0.0720	-0.0558
	(0.1163)	(0.1182)	(0.1163)	(0.1160)
$VCBacked$	0.5944*	0.5066	0.5657*	0.4245
	(0.3427)	(0.3442)	(0.3423)	(0.3278)
$NumConcurrentIPO$	-0.0022	0.0001	-0.0038	0.0120
	(0.0275)	(0.0275)	(0.0274)	(0.0254)
$AvgUPConcurrentIPO$	0.0310	0.0102	0.0247	0.0321
	(0.0222)	(0.0221)	(0.0220)	(0.0204)
$TechFirm$	0.0366	0.0820	0.0534	0.0732
	(0.3493)	(0.3466)	(0.3455)	(0.3208)
$OfferPriceRevision$	-1.0951	-2.2969***	-1.2275	-1.6088**
	(0.8446)	(0.8521)	(0.8364)	(0.8130)
$PercentSold$	-3.5079***	-3.2554***	-3.4779***	-3.5532***
	(1.0539)	(1.0432)	(1.0417)	(0.9894)
$PercentInst$	-1.7123***	-1.6723***	-1.5036**	-0.5457
	(0.5894)	(0.5915)	(0.6121)	(0.5881)
$UWAvgUP$	-1.9918*	-2.5168**	-2.1263*	-1.6653
	(1.1216)	(1.1097)	(1.1148)	(1.0713)
$UWInfoProd$	0.1028**	0.1125**	0.1081**	0.0062
	(0.0467)	(0.0471)	(0.0470)	(0.0454)
$NumInstInv$	0.3535***	0.3450***	0.3457***	0.3211***
	(0.0125)	(0.0127)	(0.0136)	(0.0121)
$AvgIndOverweight$	-0.1745	-0.1994	-0.2246	-0.3328
	(0.3037)	(0.3050)	(0.3063)	(0.2949)
$Spread$	46.8380	48.5014	49.8928	65.1462
	(49.1791)	(49.4262)	(49.6153)	(47.2135)
$AvgVolume$	1.4716	1.1950	0.8816	1.6329*
	(0.9675)	(0.9845)	(1.0487)	(0.9320)
$ReturnStdDev$	-40.5659	-41.7562	-39.4609	-46.3944
	(30.8609)	(30.9715)	(31.5370)	(29.9311)
$FirstNumAnalysts$	-0.1628	-0.1492	-0.1558	-0.1073
	(0.1197)	(0.1211)	(0.1197)	(0.1122)
$OneYearNumAnalysts$	0.2440***	0.2147***	0.2280***	0.1458**
	(0.0768)	(0.0783)	(0.0785)	(0.0731)

$Underpricing$		3.5005***		
		(1.0854)		
$TotalMoneyLeft$			0.0094*	
			(0.0054)	
$AvgProbability$				39.3620***
				(3.1416)
Constant	4.7079**	4.1708**	4.6211**	-8.4264***
	(1.8541)	(1.8395)	(1.8531)	(2.0711)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	80.97%	81.21%	81.05%	83.34%
Observations	956	956	956	956

Table 4.54: OLS Estimation of Underpricing: 2001 - 2011. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0004	-0.0026	-0.0021	-0.0023
	(0.0042)	(0.0041)	(0.0041)	(0.0041)
LogProceeds	-0.0632***	-0.0819***	-0.0795***	-0.0797***
	(0.0103)	(0.0105)	(0.0105)	(0.0105)
UnderwriterRank	0.0130***	0.0166***	0.0168***	0.0167***
	(0.0043)	(0.0041)	(0.0041)	(0.0041)
VCBacked	0.0210*	0.0252**	0.0232*	0.0243**
	(0.0124)	(0.0119)	(0.0119)	(0.0119)
NumConcurrentIPO	-0.0007	-0.0007	-0.0008	-0.0006
	(0.0009)	(0.0009)	(0.0009)	(0.0009)
AvgUPConcurrentIPO	0.0060***	0.0058***	0.0057***	0.0059***
	(0.0009)	(0.0009)	(0.0009)	(0.0009)
MktReturn	1.2221	1.4180	1.3274	1.1303
	(2.4285)	(2.3538)	(2.3441)	(2.3367)
MktStdDeviation	0.1924	0.3673	-0.4707	-0.0404
	(1.6627)	(1.6570)	(1.6375)	(1.6752)
TechFirm	-0.0123	-0.0133	-0.0137	-0.0131
	(0.0117)	(0.0114)	(0.0113)	(0.0114)
OfferPriceRevision	0.4122***	0.3433***	0.3460***	0.3397***
	(0.0327)	(0.0349)	(0.0347)	(0.0349)
PercentSold	-0.0699***	-0.0719***	-0.0593**	-0.0724***
	(0.0254)	(0.0251)	(0.0245)	(0.0248)
PercentInst	0.0776***	-0.0115	-0.0043	-0.0042
	(0.0167)	(0.0212)	(0.0213)	(0.0216)
UWAvgUP	0.1529***	0.1499***	0.1565***	0.1515***
	(0.0480)	(0.0474)	(0.0471)	(0.0481)
UWInfoProd	-0.0018	-0.0028	-0.0031*	-0.0034*
	(0.0018)	(0.0017)	(0.0017)	(0.0017)
AvgIndOverweight	0.0013	0.0070	0.0076	0.0061
	(0.0123)	(0.0121)	(0.0120)	(0.0121)
Spread	-1.0445	-0.4713	-0.6677	-0.3730
	(1.2114)	(1.1596)	(1.1777)	(1.1650)
AvgVolume	0.1339***	0.0779**	0.0731**	0.0793**
	(0.0348)	(0.0352)	(0.0357)	(0.0354)
ReturnStdDev	0.4242	0.3547	0.5239	0.3253
	(0.6683)	(0.6572)	(0.6716)	(0.6599)
FirstNumAnalysts	-0.0050	-0.0039	-0.0033	-0.0036
	(0.0040)	(0.0039)	(0.0039)	(0.0039)

$OneYearNumAnalysts$	0.0090***	0.0084***	0.0076***	0.0079***
	(0.0025)	(0.0024)	(0.0024)	(0.0024)
$NumInstInv$		0.0024***	0.0011**	0.0022***
		(0.0004)	(0.0005)	(0.0004)
$TotalInformed$			0.0037***	
			(0.0011)	
$AvgProbability$				0.2325**
				(0.1157)
Constant	0.1159*	0.1458**	0.1396**	0.0742
	(0.0629)	(0.0619)	(0.0614)	(0.0710)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	43.64%	45.96%	46.66%	46.18%
Observations	956	956	956	956

that all-star analyst coverage is not associated with increased aggregate information production, but is associated with increased underpricing. Furthermore, the main results of the analyses are unchanged, suggesting that institutional investors' information production is a motivation for underpricing separate from inducing all-star analyst coverage. An additional note regarding the main regressions is also in order. In contrast to Bradley et al. [2008], which examines analyst coverage in 1999 and 2000, the results indicate that the number of analysts initiating coverage at the end of the quiet period is negatively related to underpricing, while the number of analysts covering the firm at the end of the first year is positively related to underpricing. This finding suggests that reconciling these conflicting results may provide additional insight into the relation between analyst coverage and underpricing.

4.1.6 Investor Holding

Banerjee et al. [2012] proposes a model in which firms underprice IPO shares to secure long-term shareholding from investors. My measure of informed buying is likely highly correlated with holding, as investors who make large purchases in the quarters following the IPO are also likely to hold the positions for above-average periods. To distinguish my measure from a measure of holding, I create several new variables that only reflect holding behavior. First, I consider an investor to be a long-term holder of an allocation if the allocation is held for at least 4 quarters. Formally,

$$LongHolder_{i,j} = \begin{cases} 1 & \text{if fund } j \text{ reports holdings in each of the four quarters after firm } i\text{'s IPO} \\ 0 & \text{otherwise.} \end{cases} \tag{4.3}$$

I then create two measures, $TotalLongHolder_i$ and $AvgLongHolder_{j,t}$, which are analogous to $TotalInformed_i$ and $AvgInformed_{j,t}$, respectively. I then sum $AvgLongHolder_{j,t}$ at the IPO level to generate a measure of expected long-term holding, $ExpectedLongHolder$. Tables 4.59 and 4.60, repeat the probit analyses while including a control for long-term holding, while Tables 4.61 and 4.62, and 4.63 and 4.64 repeat the OLS regressions for total future informed trading and underpricing, using $ExpectedLongHolder$ and $TotalLongHolder$, respectively. The main results

Table 4.55: OLS Estimation of Total Future Informed Trading Controlling for All-Star Analyst Coverage: Baseline. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.1704*	0.1808*	0.1742*	0.1078
	(0.1002)	(0.0996)	(0.0999)	(0.0960)
$LogProceeds$	-1.3128***	-1.1002***	-1.2812***	-0.8608***
	(0.2149)	(0.2188)	(0.2187)	(0.2052)
$UnderwriterRank$	-0.1756**	-0.2018***	-0.1772**	-0.1363*
	(0.0728)	(0.0726)	(0.0726)	(0.0697)
$VCBacked$	-0.1786	-0.1818	-0.1818	-0.1872
	(0.2094)	(0.2081)	(0.2091)	(0.1901)
$NumConcurrentIPO$	0.0003	0.0023	0.0006	0.0022
	(0.0077)	(0.0078)	(0.0077)	(0.0069)
$AvgUPConcurrentIPO$	-0.0249***	-0.0296***	-0.0264***	-0.0195***
	(0.0058)	(0.0061)	(0.0060)	(0.0053)
$TechFirm$	0.5787***	0.5770***	0.5803***	0.4261**
	(0.1954)	(0.1957)	(0.1954)	(0.1771)
$OfferPriceRevision$	-0.8304	-1.8081***	-1.0772**	-0.8444*
	(0.5394)	(0.5707)	(0.5424)	(0.4903)
$PercentSold$	-2.0041***	-1.8566***	-1.9334***	-1.5408**
	(0.6478)	(0.6425)	(0.6462)	(0.6073)
$PercentInst$	-0.1143	-0.2101	-0.0663	-0.2535
	(0.3842)	(0.3853)	(0.3876)	(0.3541)
$UWAvgUP$	-1.2705**	-1.8946***	-1.4125**	-0.8860
	(0.5824)	(0.5973)	(0.5911)	(0.5628)
$UWInfoProd$	0.1473***	0.1580***	0.1513***	0.0505
	(0.0343)	(0.0346)	(0.0349)	(0.0330)
$NumInstInv$	0.3389***	0.3329***	0.3347***	0.3122***
	(0.0098)	(0.0099)	(0.0105)	(0.0092)
$AvgIndOverweight$	0.1415	0.1020	0.1265	0.0859
	(0.2085)	(0.2085)	(0.2092)	(0.1969)
$Spread$	-24.2176	-27.2447	-24.4587	8.3374
	(17.8839)	(17.7934)	(17.9129)	(16.9983)
$AvgVolume$	2.6887***	2.3679***	2.4463***	2.1839***
	(0.6432)	(0.6575)	(0.6834)	(0.6018)
$ReturnStdDev$	-1.6631	-2.7318	-1.3863	-11.3195
	(10.8847)	(10.8763)	(10.9187)	(10.2847)
$FirstNumAnalysts$	-0.3780***	-0.3579***	-0.3729***	-0.2680***
	(0.0943)	(0.0946)	(0.0946)	(0.0895)

$OneYearNumAnalysts$	0.3840***	0.3723***	0.3801***	0.2573***
	(0.0562)	(0.0562)	(0.0564)	(0.0532)
$Underpricing$		1.1826***		
		(0.3604)		
$TotalMoneyLeft$			0.0037	
			(0.0031)	
$AvgProbability$				30.4781***
				(1.4542)
Constant	5.2470***	4.7778***	5.2190***	-5.1305***
	(0.9631)	(0.9450)	(0.9606)	(1.0624)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	78.46%	78.64%	78.49%	81.72%
Observations	2,002	2,002	2,002	2,002

Table 4.56: OLS Estimation of Total Future Informed Trading Controlling for All-Star Analyst Coverage. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.1708*	0.1809*	0.1746*	0.1082
	(0.1003)	(0.0997)	(0.1000)	(0.0960)
$LogProceeds$	-1.3358***	-1.1240***	-1.3044***	-0.8724***
	(0.2158)	(0.2203)	(0.2198)	(0.2065)
$UnderwriterRank$	-0.1801**	-0.2050***	-0.1815**	-0.1385**
	(0.0725)	(0.0724)	(0.0723)	(0.0694)
$VCBacked$	-0.1698	-0.1744	-0.1731	-0.1831
	(0.2090)	(0.2079)	(0.2087)	(0.1900)
$NumConcurrentIPO$	0.0004	0.0023	0.0007	0.0022
	(0.0077)	(0.0078)	(0.0077)	(0.0069)
$AvgUPConcurrentIPO$	-0.0247***	-0.0293***	-0.0262***	-0.0194***
	(0.0058)	(0.0061)	(0.0060)	(0.0052)
$TechFirm$	0.5888***	0.5855***	0.5901***	0.4311**
	(0.1955)	(0.1957)	(0.1955)	(0.1774)
$OfferPriceRevision$	-0.8306	-1.7870***	-1.0709**	-0.8445*
	(0.5384)	(0.5720)	(0.5413)	(0.4898)
$PercentSold$	-1.9713***	-1.8324***	-1.9033***	-1.5266**
	(0.6487)	(0.6433)	(0.6472)	(0.6083)
$PercentInst$	-0.1049	-0.2002	-0.0584	-0.2489
	(0.3841)	(0.3853)	(0.3875)	(0.3540)
$UWAvgUP$	-1.2898**	-1.8972***	-1.4277**	-0.8957
	(0.5809)	(0.5961)	(0.5891)	(0.5623)
$UWInfoProd$	0.1342***	0.1468***	0.1384***	0.0446
	(0.0357)	(0.0361)	(0.0363)	(0.0343)
$NumInstInv$	0.3385***	0.3326***	0.3343***	0.3120***
	(0.0098)	(0.0099)	(0.0105)	(0.0092)
$AvgIndOverweight$	0.1483	0.1085	0.1335	0.0892
	(0.2083)	(0.2083)	(0.2090)	(0.1968)
$Spread$	-22.7797	-25.9782	-23.0510	8.9348
	(18.0143)	(17.9474)	(18.0481)	(17.1284)
$AvgVolume$	2.6278***	2.3239***	2.3932***	2.1567***
	(0.6441)	(0.6579)	(0.6840)	(0.6038)
$ReturnStdDev$	-1.6980	-2.7378	-1.4276	-11.3153
	(10.8393)	(10.8372)	(10.8753)	(10.2612)
$FirstNumAnalysts$	-0.3774***	-0.3579***	-0.3724***	-0.2679***
	(0.0944)	(0.0947)	(0.0947)	(0.0896)

$OneYearNumAnalysts$	0.3817***	0.3706***	0.3779***	0.2565***
	(0.0562)	(0.0563)	(0.0565)	(0.0532)
$Underpricing$		1.1569***		
		(0.3614)		
$TotalMoneyLeft$			0.0037	
			(0.0031)	
$AvgProbability$				30.4141***
				(1.4507)
$AllStarAnalyst$	0.3466	0.2895	0.3378	0.1605
	(0.2383)	(0.2370)	(0.2384)	(0.2165)
Constant	5.2196***	4.7651***	5.1931***	-5.1214***
	(0.9647)	(0.9463)	(0.9621)	(1.0629)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	78.49%	78.66%	78.51%	81.73%
Observations	2,002	2,002	2,002	2,002

Table 4.57: OLS Estimation of Underpricing Controlling for All-Star Analyst Coverage: Baseline. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0067	-0.0088	-0.0100	-0.0097
	(0.0067)	(0.0066)	(0.0066)	(0.0066)
LogProceeds	-0.1332***	-0.1789***	-0.1697***	-0.1726***
	(0.0155)	(0.0168)	(0.0169)	(0.0168)
UnderwriterRank	0.0171***	0.0220***	0.0232***	0.0225***
	(0.0063)	(0.0062)	(0.0061)	(0.0062)
VCBacked	-0.0055	0.0031	0.0042	0.0029
	(0.0171)	(0.0167)	(0.0166)	(0.0167)
NumConcurrentIPO	-0.0020***	-0.0017**	-0.0018**	-0.0017**
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
AvgUPConcurrentIPO	0.0038***	0.0036***	0.0038***	0.0037***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
MktReturn	8.8745**	8.4934**	8.4116**	8.0109**
	(3.7215)	(3.6350)	(3.6424)	(3.6456)
MktStdDeviation	3.4539	4.3486*	3.6039	3.8105*
	(2.3308)	(2.2721)	(2.2845)	(2.2761)
TechFirm	0.0009	0.0015	-0.0026	-0.0007
	(0.0171)	(0.0168)	(0.0168)	(0.0167)
OfferPriceRevision	0.9409***	0.8308***	0.8356***	0.8300***
	(0.0459)	(0.0476)	(0.0475)	(0.0476)
PercentSold	-0.1082***	-0.1181***	-0.1046***	-0.1121***
	(0.0396)	(0.0399)	(0.0399)	(0.0395)
PercentInst	0.2066***	0.0793**	0.0806**	0.0777**
	(0.0303)	(0.0349)	(0.0350)	(0.0348)
UWAvgUP	0.5259***	0.5291***	0.5377***	0.5344***
	(0.0561)	(0.0555)	(0.0551)	(0.0553)
UWInfoProd	-0.0065**	-0.0090***	-0.0099***	-0.0103***
	(0.0029)	(0.0029)	(0.0029)	(0.0029)
AvgIndOverweight	0.0178	0.0319*	0.0311	0.0313
	(0.0194)	(0.0193)	(0.0193)	(0.0192)
Spread	2.3181	2.6349*	2.7810*	3.0766**
	(1.5074)	(1.4444)	(1.4402)	(1.4447)
AvgVolume	0.3581***	0.2651***	0.2469***	0.2585***
	(0.0533)	(0.0546)	(0.0548)	(0.0546)
ReturnStdDev	0.9418	1.0078	1.0282	0.8713
	(0.8523)	(0.8180)	(0.8167)	(0.8164)
FirstNumAnalysts	-0.0193***	-0.0169***	-0.0144**	-0.0154**

	(0.0062)	(0.0062)	(0.0063)	(0.0062)
$OneYearNumAnalysts$	0.0125***	0.0099***	0.0074**	0.0082**
	(0.0037)	(0.0037)	(0.0037)	(0.0037)
$NumInstInv$		0.0051***	0.0028***	0.0048***
		(0.0007)	(0.0010)	(0.0007)
$TotalInformed$			0.0069***	
			(0.0021)	
$AvgProbability$				0.4250***
				(0.1371)
Constant	0.2399***	0.3537***	0.3230***	0.2134**
	(0.0764)	(0.0779)	(0.0782)	(0.0920)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	62.12%	63.35%	63.65%	63.54%
Observations	2,002	2,002	2,002	2,002

Table 4.58: OLS Estimation of Underpricing Controlling for All-Star Analyst Coverage. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0067	-0.0087	-0.0099	-0.0096
	(0.0066)	(0.0066)	(0.0066)	(0.0066)
LogProceeds	-0.1373***	-0.1820***	-0.1729***	-0.1758***
	(0.0157)	(0.0168)	(0.0170)	(0.0169)
UnderwriterRank	0.0165***	0.0214***	0.0226***	0.0219***
	(0.0063)	(0.0062)	(0.0061)	(0.0062)
VCBacked	-0.0041	0.0042	0.0053	0.0040
	(0.0171)	(0.0166)	(0.0165)	(0.0167)
NumConcurrentIPO	-0.0020***	-0.0017**	-0.0017**	-0.0017**
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
AvgUPConcurrentIPO	0.0038***	0.0037***	0.0038***	0.0037***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
MktReturn	8.5327**	8.1913**	8.1247**	7.7423**
	(3.7192)	(3.6317)	(3.6386)	(3.6415)
MktStdDeviation	3.0537	3.9765*	3.2648	3.4775
	(2.3286)	(2.2700)	(2.2808)	(2.2741)
TechFirm	0.0024	0.0028	-0.0013	0.0007
	(0.0170)	(0.0167)	(0.0167)	(0.0167)
OfferPriceRevision	0.9387***	0.8304***	0.8350***	0.8296***
	(0.0456)	(0.0474)	(0.0473)	(0.0474)
PercentSold	-0.1037***	-0.1139***	-0.1010**	-0.1084***
	(0.0396)	(0.0399)	(0.0398)	(0.0396)
PercentInst	0.2063***	0.0808**	0.0820**	0.0791**
	(0.0301)	(0.0348)	(0.0349)	(0.0347)
UWAvgUP	0.5229***	0.5264***	0.5349***	0.5316***
	(0.0561)	(0.0555)	(0.0552)	(0.0553)
UWInfoProd	-0.0086***	-0.0107***	-0.0116***	-0.0120***
	(0.0030)	(0.0030)	(0.0030)	(0.0030)
AvgIndOverweight	0.0191	0.0330*	0.0321*	0.0323*
	(0.0193)	(0.0192)	(0.0192)	(0.0192)
Spread	2.5317*	2.8227*	2.9573**	3.2381**
	(1.5124)	(1.4500)	(1.4468)	(1.4495)
AvgVolume	0.3477***	0.2571***	0.2396***	0.2511***
	(0.0527)	(0.0541)	(0.0542)	(0.0540)
ReturnStdDev	0.9368	1.0024	1.0226	0.8716
	(0.8495)	(0.8159)	(0.8153)	(0.8142)
FirstNumAnalysts	-0.0192***	-0.0169***	-0.0144**	-0.0154**
	(0.0062)	(0.0062)	(0.0063)	(0.0062)

$OneYearNumAnalysts$	0.0122***	0.0097***	0.0072*	0.0080**
	(0.0037)	(0.0037)	(0.0037)	(0.0037)
$NumInstInv$		0.0051***	0.0028***	0.0047***
		(0.0007)	(0.0010)	(0.0007)
$TotalInformed$			0.0067***	
			(0.0021)	
$AvgProbability$				0.4084***
				(0.1376)
$AllStarAnalyst$	0.0527***	0.0473***	0.0452**	0.0450**
	(0.0181)	(0.0178)	(0.0178)	(0.0178)
Constant	0.2408***	0.3530***	0.3230***	0.2183**
	(0.0763)	(0.0778)	(0.0780)	(0.0920)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	62.30%	63.50%	63.78%	63.67%
Observations	2,002	2,002	2,002	2,002

of the empirical analysis are not qualitatively changed by including any variables that control for long-term holding. In fact, the control variables' coefficients are significantly negative in the underpricing regressions. This evidence suggests that allocations and underpricing are used to encourage future information production and not simply long-term holding.

4.1.7 Average Future Informed Trading

While the main analysis considers total future informed trading, firms who are concerned with future price informativeness will likely encourage more information production per allocation made. Accordingly, I repeat the OLS regression analysis of future informed trading using the total future informed trading normalized by the number of institutional allocations as the dependent variable (results reported in Table 4.65). This removes the mechanical relation between the number of allocations and the amount of future informed trading, and as expected, the R^2 of the regression falls from over 80% to between 10% and 27%. However, the conclusions from this analysis are consistent with those of the main analysis. Furthermore, *AvgProbability* is a strongly significant determinant of average future informed trading, and adds over 16% to the R^2 of the regression. As *AvgProbability* is estimated out of sample for each firm, this suggests that the factors affecting funds' individual future trading activity has been relatively stable over time.

4.1.8 Alternative Measurements of Underpricing

The dissertation's main analyses rely on a measure of underpricing using the first day's closing price to capture initial returns. Using the first day's closing price assumes that the market has reached a stable price and the firm is then properly valued. However, institutional practices such a price support may interfere with establishing a fair value for the firm in the secondary market, so waiting to establish an alternative closing price may be prudent. I test the robustness of the main results by considering two alternative measures of underpricing. The first uses the closing price on the fifth day of trading to calculate underpricing, while the second uses the closing price on the twentieth day of trading. Tables 4.66, 4.67, 4.68 and 4.69 replicate the main analyses when using

Table 4.59: Probit Estimation of IPO Allocations Controlling for Long-Term Holding. *AvgLongHolder*, a measure of a fund's propensity to hold IPO allocations at least one year in previous IPOs, is included as a control variable. "Established Funds" observations have a value for *AvgInformed* while "New Funds" observations do not due to an insufficient data history. Variable definitions are available in the appendix. Standard errors, clustered at the IPO and fund levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log(*FundValue*)	0.1062***	0.0857***	0.0706***
	(0.0064)	(0.0064)	(0.0072)
Log(*FundAge*)	-0.0082***	-0.0019***	-0.0020***
	(0.0004)	(0.0004)	(0.0004)
Churn	0.1721***	0.1767***	0.1186***
	(0.0280)	(0.0313)	(0.0363)
OneTime	0.6684***	0.5165***	0.4915***
	(0.0133)	(0.0090)	(0.0113)
MultipleTimes	1.2378***	0.8952***	0.8445***
	(0.0302)	(0.0163)	(0.0189)
NumPrevIPOs	0.0067**	0.0026***	0.0023***
	(0.0033)	(0.0001)	(0.0001)
AvgSystematicSell		0.5451***	0.6242***
		(0.0726)	(0.0762)
AvgFlipped		-0.1705**	-0.1768*
		(0.0834)	(0.0924)
AvgIPOHoldTime		0.0044	0.0097***
		(0.0036)	(0.0037)
AvgLongHolder		0.2984***	0.4106***
		(0.0645)	(0.0771)
AvgInformed		0.5314***	0.4179***
		(0.0725)	(0.0794)
HighUP			-0.3302**
			(0.1382)
HighUP× Log(*FundValue*)			0.0276***
			(0.0067)
HighUP× Log(*FundAge*)			0.0000
			(0.0004)
HighUP × *Churn*			0.1035***
			(0.0351)
HighUP × *OneTime*			0.0346***
			(0.0131)
HighUP × *MultipleTimes*			0.0698***
			(0.0179)

$HighUP \times NumPrevIPO$			0.0007***
			(0.0001)
$HighUP \times AvgSystematicSell$			-0.1300*
			(0.0744)
$HighUP \times AvgFlipped$			0.0083
			(0.0838)
$HighUP \times AvgIPOHoldTime$			-0.0092***
			(0.0030)
$HighUP \times AvgLongHolder$			-0.1893***
			(0.0716)
$HighUP \times AvgInformed$			0.2028***
			(0.0657)
Constant	-4.2123***	-4.0954***	-4.0195***
	(0.2124)	(0.1540)	(0.1690)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	9.84%	19.07%	19.63%
Observations	2,940,445	1,777,725	1,777,725

Table 4.60: Probit Estimation of Future Informed Trading Controlling for Long-Term Holding. *AvgLongHolder*, a measure of a fund's propensity to hold IPO allocations at least one year in previous IPOs, is included as a control variable. "Established Funds" observations have a value for *AvgInformed* while "New Funds" observations do not due to an insufficient data history. Variable definitions are available in the appendix. Standard errors, clustered at the IPO and fund levels, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Informed	
	New Funds	Established Funds
UnderwriterRank	-0.0192**	-0.0039
	(0.0084)	(0.0055)
UWInfoProd	0.0066	0.0134***
	(0.0043)	(0.0029)
OneTime	-0.0042	-0.0028
	(0.0256)	(0.0124)
MultipleTimes	0.0926**	0.0433***
	(0.0400)	(0.0148)
FirstNumAnalysts	0.0055	-0.0125**
	(0.0400)	(0.0148)
OneYearNumAnalysts	0.0042	0.0172***
	(0.0041)	(0.0029)
VCBacked	0.0505**	0.0141
	(0.0236)	(0.0134)
90*DayReturn*	0.1237***	0.2616***
	(0.0300)	(0.0186)
Spread	-3.8427**	-6.8222***
	(1.7117)	(1.0207)
AvgVolume	0.0000***	0.0000***
	(0.0000)	(0.0000)
6*MonthReturnStdDev*	-0.4251	0.0402
	(1.0569)	(0.6546)
IndustryOverweight	0.0390***	0.0429***
	(0.0098)	(0.0087)
IndWeightStdDev	-0.0990**	-0.0778**
	(0.0408)	(0.0370)
NumPrevIPOs	0.0061	0.0002*
	(0.0074)	(0.0001)
AllocationPct	-0.1485	0.1165
	(0.4054)	(0.2498)
Shares	-0.0117**	-0.0159***
	(0.0056)	(0.0029)
Churn	-1.3514***	-1.3925***
	(0.1026)	(0.0879)

Log($FundValue$)	0.0567***	-0.0130
	(0.0159)	(0.0091)
Log($FundAge$)	-0.0019**	-0.0002
	(0.0008)	(0.0005)
$AvgFlipped$		-0.3078*
		(0.1621)
$AvgSystematicSell$		0.9331***
		(0.1200)
$AvgIPOHoldTime$		0.0165***
		(0.0035)
$AvgLongHolder$		0.6304***
		(0.1177)
$AvgInformed$		1.5911***
		(0.1175)
$MoneyLeft$	0.0268***	0.1155***
	(0.0089)	(0.0147)
$AvgInformed \times MoneyLeft$		-0.1765***
		(0.0382)
Constant	-1.3389***	-1.1940***
	(0.3236)	(0.2149)
Year Dummy Variables	Yes	Yes
Pseudo R^2	3.28%	7.70%
Observations	22,936	106,453

Table 4.61: OLS Estimation of Total Future Informed Trading Controlling for Expected Long-Term Holding. *ExpectedLongHolder* reflects the number of initial investors expected to hold their position for at least one year. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.0238	0.0356	0.0286	0.0219
	(0.0436)	(0.0435)	(0.0435)	(0.0413)
$LogProceeds$	-1.1377***	-1.0390***	-1.1016***	-0.8843***
	(0.0956)	(0.0969)	(0.0973)	(0.0917)
$UnderwriterRank$	-0.1392***	-0.1526***	-0.1437***	-0.1226***
	(0.0324)	(0.0324)	(0.0324)	(0.0312)
$VCBacked$	0.1184	0.1110	0.1157	0.0093
	(0.1013)	(0.1011)	(0.1011)	(0.0941)
$NumConcurrentIPO$	0.0019	0.0024	0.0017	0.0006
	(0.0036)	(0.0036)	(0.0036)	(0.0033)
$AvgUPConcurrentIPO$	-0.0212***	-0.0260***	-0.0239***	-0.0172***
	(0.0047)	(0.0050)	(0.0049)	(0.0044)
$TechFirm$	0.0468	0.0459	0.0552	0.0273
	(0.1027)	(0.1027)	(0.1026)	(0.0951)
$OfferPriceRevision$	-0.5660*	-1.2310***	-0.8377***	-0.5928*
	(0.3269)	(0.3347)	(0.3207)	(0.3030)
$PercentSold$	-0.9903***	-0.8880***	-0.9344***	-0.6656***
	(0.2598)	(0.2578)	(0.2585)	(0.2465)
$PercentInst$	-0.9268***	-0.9520***	-0.8490***	-0.6199***
	(0.2102)	(0.2106)	(0.2127)	(0.1990)
$UWAvgUP$	-0.8591**	-1.4640***	-1.0739***	-0.7638*
	(0.4053)	(0.4271)	(0.4072)	(0.3902)
$UWInfoProd$	0.1193***	0.1269***	0.1236***	0.0627***
	(0.0229)	(0.0232)	(0.0232)	(0.0219)
$NumInstInv$	0.1942***	0.1898***	0.1856***	0.2234***
	(0.0177)	(0.0177)	(0.0183)	(0.0170)
$AvgIndOverweight$	0.2380**	0.2067**	0.2355**	0.0642
	(0.0993)	(0.0991)	(0.0994)	(0.0954)
$Spread$	-22.0759***	-21.1533***	-22.1245***	-0.6642
	(4.5638)	(4.5527)	(4.5551)	(4.4849)
$AvgVolume$	3.3372***	3.1142***	2.9575***	2.8905***
	(0.5155)	(0.5241)	(0.5475)	(0.4960)
$ReturnStdDev$	-8.9171**	-11.0945***	-9.0234**	-8.2869**
	(4.2179)	(4.1884)	(4.2049)	(4.0342)
$FirstNumAnalysts$	-0.3033***	-0.2851***	-0.2943***	-0.2341***
	(0.0712)	(0.0715)	(0.0714)	(0.0680)

$OneYearNumAnalysts$	0.3243***	0.3145***	0.3172***	0.2415***
	(0.0415)	(0.0415)	(0.0416)	(0.0398)
$Underpricing$		1.0625***		
		(0.2911)		
$TotalMoneyLeft$			0.0061**	
			(0.0026)	
$AvgProbability$				21.8947***
				(0.7554)
$ExpectedLongHolder$	0.2592***	0.2596***	0.2644***	0.1687***
	(0.0316)	(0.0315)	(0.0318)	(0.0305)
Constant	6.4372***	6.2962***	6.4889***	-1.3048
	(0.7596)	(0.7601)	(0.7666)	(0.8231)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	81.42%	81.53%	81.47%	83.74%
Observations	5,216	5,216	5,216	5,216

Table 4.62: OLS Estimation of Total Future Informed Trading Controlling for Total Long-Term Holding. $TotalLongHolder$ is the number of initial investors that hold their position for at least one year. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	-0.0251	-0.0121	-0.0211	-0.0193
	(0.0396)	(0.0395)	(0.0396)	(0.0376)
$LogProceeds$	-1.1571***	-1.0466***	-1.1274***	-0.9211***
	(0.0859)	(0.0873)	(0.0875)	(0.0831)
$UnderwriterRank$	-0.0368	-0.0514*	-0.0403	-0.0385
	(0.0288)	(0.0285)	(0.0287)	(0.0278)
$VCBacked$	0.1268	0.1186	0.1247	0.0307
	(0.0916)	(0.0913)	(0.0914)	(0.0861)
$NumConcurrentIPO$	0.0011	0.0017	0.0010	0.0002
	(0.0031)	(0.0031)	(0.0031)	(0.0029)
$AvgUPConcurrentIPO$	-0.0134***	-0.0188***	-0.0158***	-0.0110***
	(0.0039)	(0.0041)	(0.0040)	(0.0037)
$TechFirm$	-0.0310	-0.0324	-0.0237	-0.0398
	(0.0904)	(0.0902)	(0.0903)	(0.0847)
$OfferPriceRevision$	0.9052***	0.1676	0.6761**	0.6529**
	(0.2916)	(0.2982)	(0.2837)	(0.2750)
$PercentSold$	-0.7679***	-0.6522***	-0.7232***	-0.4766**
	(0.2382)	(0.2362)	(0.2372)	(0.2272)
$PercentInst$	-0.6996***	-0.7278***	-0.6251***	-0.5405***
	(0.1919)	(0.1921)	(0.1964)	(0.1816)
$UWAvgUP$	-0.7520**	-1.4272***	-0.9390**	-0.6694*
	(0.3663)	(0.3828)	(0.3651)	(0.3490)
$UWInfoProd$	0.1066***	0.1150***	0.1106***	0.0564***
	(0.0211)	(0.0213)	(0.0213)	(0.0201)
$NumInstInv$	0.1617***	0.1563***	0.1564***	0.1669***
	(0.0091)	(0.0093)	(0.0096)	(0.0087)
$AvgIndOverweight$	0.0211	-0.0143	0.0151	-0.0614
	(0.0880)	(0.0878)	(0.0881)	(0.0843)
$Spread$	-12.7426***	-11.6797***	-12.7365***	3.9696
	(3.8874)	(3.8625)	(3.8773)	(3.7996)
$AvgVolume$	2.9155***	2.6655***	2.5802***	2.6534***
	(0.4407)	(0.4479)	(0.4758)	(0.4274)
$ReturnStdDev$	10.5631***	8.2066**	10.5041***	8.5576**
	(3.5789)	(3.5092)	(3.5649)	(3.4240)
$FirstNumAnalysts$	-0.1428**	-0.1218*	-0.1347**	-0.1050*
	(0.0625)	(0.0629)	(0.0627)	(0.0602)

$OneYearNumAnalysts$	0.2062***	0.1948***	0.2002***	0.1481***
	(0.0363)	(0.0364)	(0.0364)	(0.0351)
$Underpricing$		1.1870***		
		(0.2575)		
$TotalMoneyLeft$			0.0053**	
			(0.0023)	
$AvgProbability$				18.6890***
				(0.6708)
$TotalLongHolder$	0.2528***	0.2538***	0.2529***	0.2226***
	(0.0114)	(0.0114)	(0.0115)	(0.0111)
Constant	4.7312***	4.5649***	4.7879***	-1.8134**
	(0.7522)	(0.7500)	(0.7592)	(0.7871)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	84.64%	84.77%	84.68%	86.32%
Observations	5,216	5,216	5,216	5,216

Table 4.63: OLS Estimation of Underpricing Controlling for Expected Long-Term Holding. *ExpectedLongHolder* reflects the number of initial investors expected to hold their position for at least one year. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0106***	-0.0110***	-0.0112***	-0.0111***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
LogProceeds	-0.0850***	-0.0922***	-0.0859***	-0.0885***
	(0.0068)	(0.0072)	(0.0073)	(0.0072)
UnderwriterRank	0.0113***	0.0126***	0.0133***	0.0128***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)
VCBacked	0.0057	0.0068	0.0062	0.0052
	(0.0073)	(0.0073)	(0.0073)	(0.0073)
NumConcurrentIPO	-0.0005	-0.0004	-0.0005	-0.0005
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
AvgUPConcurrentIPO	0.0044***	0.0043***	0.0045***	0.0044***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
MktReturn	5.8894***	5.6863***	5.6193***	5.5482***
	(2.0920)	(2.0874)	(2.0902)	(2.0844)
MktStdDeviation	1.4177	1.6409	1.2192	1.4307
	(1.4084)	(1.4048)	(1.4113)	(1.4008)
TechFirm	0.0004	0.0005	0.0002	0.0002
	(0.0081)	(0.0081)	(0.0081)	(0.0081)
OfferPriceRevision	0.6280***	0.6259***	0.6285***	0.6253***
	(0.0296)	(0.0294)	(0.0294)	(0.0294)
PercentSold	-0.0881***	-0.0954***	-0.0900***	-0.0907***
	(0.0162)	(0.0163)	(0.0162)	(0.0162)
PercentInst	0.0245	0.0227	0.0279	0.0272
	(0.0174)	(0.0174)	(0.0176)	(0.0175)
UWAvgUP	0.5726***	0.5705***	0.5750***	0.5718***
	(0.0401)	(0.0401)	(0.0399)	(0.0398)
UWInfoProd	-0.0073***	-0.0072***	-0.0078***	-0.0080***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
AvgIndOverweight	0.0344***	0.0295***	0.0283***	0.0270***
	(0.0082)	(0.0082)	(0.0082)	(0.0082)
Spread	-0.9182**	-0.8603**	-0.7407**	-0.5488
	(0.3764)	(0.3754)	(0.3724)	(0.3752)
AvgVolume	0.2299***	0.2066***	0.1886***	0.2003***
	(0.0428)	(0.0434)	(0.0434)	(0.0432)
ReturnStdDev	2.0445***	2.1017***	2.1501***	2.1097***
	(0.3418)	(0.3413)	(0.3406)	(0.3407)

$FirstNumAnalysts$	-0.0178***	-0.0173***	-0.0156***	-0.0163***
	(0.0045)	(0.0045)	(0.0045)	(0.0045)
$OneYearNumAnalysts$	0.0095***	0.0094***	0.0077***	0.0082***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$NumInstInv$		0.0041***	0.0030***	0.0045***
		(0.0010)	(0.0011)	(0.0010)
$TotalInformed$			0.0055***	
			(0.0015)	
$AvgProbability$				0.3192***
				(0.0615)
$ExpectedLongHolder$	0.0066***	-0.0003	-0.0017	-0.0016
	(0.0008)	(0.0018)	(0.0018)	(0.0018)
Constant	0.0908	0.1132**	0.0831	0.0029
	(0.0563)	(0.0572)	(0.0581)	(0.0617)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	59.75%	59.91%	60.14%	60.12%
Observations	5,216	5,216	5,216	5,216

Table 4.64: OLS Estimation of Underpricing Controlling for Total Long-Term Holding. $TotalLongHolder$ is the number of initial investors that hold their position for at least one year. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
$LogFirmAge$	-0.0109***	-0.0109***	-0.0107***	-0.0108***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$LogProceeds$	-0.0751***	-0.0923***	-0.0838***	-0.0881***
	(0.0069)	(0.0071)	(0.0072)	(0.0071)
$UnderwriterRank$	0.0110***	0.0123***	0.0125***	0.0122***
	(0.0027)	(0.0026)	(0.0026)	(0.0026)
$VCBacked$	0.0040	0.0068	0.0059	0.0051
	(0.0073)	(0.0073)	(0.0073)	(0.0073)
$NumConcurrentIPO$	-0.0005*	-0.0004	-0.0005	-0.0005
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
$AvgUPConcurrentIPO$	0.0045***	0.0043***	0.0044***	0.0044***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
$MktReturn$	5.7756***	5.6861***	5.6309***	5.5735***
	(2.1135)	(2.0875)	(2.0882)	(2.0833)
$MktStdDeviation$	1.2478	1.7045	1.2365	1.4906
	(1.4220)	(1.3998)	(1.4121)	(1.3971)
$TechFirm$	-0.0002	0.0008	0.0010	0.0006
	(0.0082)	(0.0081)	(0.0081)	(0.0081)
$OfferPriceRevision$	0.6755***	0.6216***	0.6145***	0.6169***
	(0.0289)	(0.0293)	(0.0293)	(0.0293)
$PercentSold$	-0.0857***	-0.0968***	-0.0910***	-0.0915***
	(0.0161)	(0.0163)	(0.0162)	(0.0162)
$PercentInst$	0.0664***	0.0229	0.0283	0.0258
	(0.0164)	(0.0173)	(0.0174)	(0.0173)
$UWAvgUP$	0.5727***	0.5700***	0.5753***	0.5714***
	(0.0402)	(0.0402)	(0.0399)	(0.0399)
$UWInfoProd$	-0.0063***	-0.0071***	-0.0079***	-0.0080***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
$AvgIndOverweight$	0.0260***	0.0297***	0.0296***	0.0283***
	(0.0081)	(0.0081)	(0.0081)	(0.0081)
$Spread$	-0.7515**	-0.8860**	-0.7926**	-0.5858
	(0.3803)	(0.3723)	(0.3693)	(0.3734)
$AvgVolume$	0.2529***	0.2071***	0.1858***	0.2026***
	(0.0426)	(0.0433)	(0.0434)	(0.0432)
$ReturnStdDev$	2.2169***	2.0379***	1.9599***	2.0011***
	(0.3509)	(0.3491)	(0.3445)	(0.3470)
$FirstNumAnalysts$	-0.0163***	-0.0178***	-0.0168***	-0.0171***

	(0.0045)	(0.0045)	(0.0045)	(0.0045)
$OneYearNumAnalysts$	0.0088***	0.0098***	0.0083***	0.0088***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$NumInstInv$		0.0045***	0.0033***	0.0046***
		(0.0007)	(0.0007)	(0.0007)
$TotalInformed$			0.0074***	
			(0.0016)	
$AvgProbability$				0.3364***
				(0.0607)
$TotalLongHolder$	0.0029***	-0.0009	-0.0027***	-0.0014*
	(0.0005)	(0.0008)	(0.0008)	(0.0008)
Constant	0.0729	0.1202**	0.0908	0.0050
	(0.0563)	(0.0571)	(0.0575)	(0.0614)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	59.30%	59.93%	60.28%	60.16%
Observations	5,216	5,216	5,216	5,216

Table 4.65: OLS Estimation of Average Future Informed Trading. The ratio of $TotalInformed$ to $NumInstInv$ is used as the dependent variable in order to measure the relative amount of information production per allocation. Variable definitions are available in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed/NumInstInv$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.0001	0.0006	0.0005	-0.0001
	(0.0022)	(0.0022)	(0.0022)	(0.0020)
$LogProceeds$	-0.0131***	-0.0097**	-0.0133***	-0.0041
	(0.0039)	(0.0040)	(0.0039)	(0.0036)
$UnderwriterRank$	-0.0086***	-0.0091***	-0.0086***	-0.0069***
	(0.0021)	(0.0021)	(0.0021)	(0.0019)
$VCBacked$	0.0063	0.0062	0.0064	0.0011
	(0.0049)	(0.0049)	(0.0049)	(0.0044)
$NumConcurrentIPO$	-0.0000	0.0000	-0.0000	-0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
$AvgUPConcurrentIPO$	-0.0007***	-0.0010***	-0.0008***	-0.0005***
	(0.0002)	(0.0002)	(0.0002)	(0.0001)
$TechFirm$	0.0011	0.0010	0.0011	-0.0004
	(0.0051)	(0.0051)	(0.0051)	(0.0045)
$OfferPriceRevision$	0.0465***	0.0081	0.0315**	0.0214*
	(0.0123)	(0.0140)	(0.0139)	(0.0111)
$PercentSold$	-0.0520***	-0.0472***	-0.0488***	-0.0306***
	(0.0125)	(0.0124)	(0.0125)	(0.0115)
$PercentInst$	0.0275***	0.0214**	0.0306***	0.0149*
	(0.0092)	(0.0093)	(0.0092)	(0.0083)
$UWAvgUP$	-0.0022	-0.0336	-0.0216	0.0048
	(0.0281)	(0.0283)	(0.0277)	(0.0256)
$UWInfoProd$	0.0079***	0.0082***	0.0083***	0.0037***
	(0.0012)	(0.0012)	(0.0012)	(0.0011)
$AvgIndOverweight$	0.0040	0.0028	0.0036	0.0003
	(0.0068)	(0.0068)	(0.0068)	(0.0064)
$Spread$	-0.9529**	-0.9084**	-0.9412**	0.2204
	(0.3739)	(0.3735)	(0.3733)	(0.3608)
$AvgVolume$	0.0700***	0.0535***	0.0558***	0.0301**
	(0.0136)	(0.0138)	(0.0148)	(0.0119)
$ReturnStdDev$	-0.2585	-0.3614	-0.2517	-0.2020
	(0.2524)	(0.2531)	(0.2520)	(0.2352)
$FirstNumAnalysts$	-0.0068***	-0.0058***	-0.0065***	-0.0027
	(0.0020)	(0.0020)	(0.0021)	(0.0017)
$OneYearNumAnalysts$	0.0085***	0.0079***	0.0083***	0.0032***
	(0.0011)	(0.0011)	(0.0011)	(0.0010)

Underpricing		0.0551***		
		(0.0090)		
AvgMoneyLeft			0.0101**	
			(0.0042)	
AvgProbability				1.2684***
				(0.0448)
Constant	0.4132***	0.4076***	0.4110***	-0.0437
	(0.0343)	(0.0341)	(0.0342)	(0.0372)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	10.56%	11.17%	10.77%	27.12%
Observations	5,216	5,216	5,216	5,216

Table 4.66: OLS Estimation of Total Future Informed Trading: 5 Day Measurement Delay. *Underpricing_5* is measured from the offer price to the price at the end of the fifth-day of trading. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	TotalInformed			
	(1)	(2)	(3)	(4)
LogFirmAge	0.0146	0.0269	0.0162	0.0159
	(0.0440)	(0.0439)	(0.0439)	(0.0414)
LogProceeds	-1.2344***	-1.0671***	-1.1516***	-0.9343***
	(0.0959)	(0.0959)	(0.0969)	(0.0918)
UnderwriterRank	-0.1191***	-0.1357***	-0.1266***	-0.1091***
	(0.0327)	(0.0323)	(0.0325)	(0.0313)
VCBacked	0.1296	0.1324	0.1367	0.0115
	(0.1024)	(0.1014)	(0.1013)	(0.0945)
NumConcurrentIPO	0.0014	0.0028	0.0014	0.0002
	(0.0036)	(0.0036)	(0.0036)	(0.0033)
AvgUPConcurrentIPO	-0.0207***	-0.0270***	-0.0248***	-0.0167***
	(0.0048)	(0.0050)	(0.0048)	(0.0044)
TechFirm	0.0545	0.0509	0.0604	0.0313
	(0.1042)	(0.1036)	(0.1034)	(0.0958)
OfferPriceRevision	-0.2646	-1.0399***	-0.6247*	-0.4026
	(0.3322)	(0.3318)	(0.3214)	(0.3051)
PercentSold	-1.2181***	-1.0711***	-1.1267***	-0.7957***
	(0.2631)	(0.2598)	(0.2603)	(0.2472)
PercentInst	-0.5028**	-0.5353**	-0.3492	-0.3369*
	(0.2118)	(0.2117)	(0.2158)	(0.1980)
UWAvgUP	-0.9375**	-1.7315***	-1.2547***	-0.8093**
	(0.4147)	(0.4260)	(0.4162)	(0.3938)
UWInfoProd	0.1381***	0.1461***	0.1449***	0.0721***
	(0.0234)	(0.0235)	(0.0236)	(0.0221)
NumInstInv	0.3260***	0.3182***	0.3143***	0.3084***
	(0.0067)	(0.0068)	(0.0073)	(0.0063)
AvgIndOverweight	0.0149	-0.0341	-0.0042	-0.0853
	(0.0986)	(0.0979)	(0.0985)	(0.0935)
Spread	-19.5562***	-16.0409***	-18.4601***	1.8968
	(4.5875)	(4.5671)	(4.5673)	(4.4966)
AvgVolume	2.9516***	2.6702***	2.3886***	2.6255***
	(0.5236)	(0.5298)	(0.5482)	(0.4985)
ReturnStdDev	-7.6958*	-12.2361***	-8.7244**	-7.4830*
	(4.2249)	(4.1828)	(4.1814)	(4.0259)
FirstNumAnalysts	-0.2914***	-0.2634***	-0.2697***	-0.2234***
	(0.0731)	(0.0733)	(0.0736)	(0.0690)
OneYearNumAnalysts	0.3332***	0.3163***	0.3155***	0.2434***

	(0.0426)	(0.0426)	(0.0430)	(0.0404)
$Underpricing\_5$		1.3652***		
		(0.2461)		
$TotalMoneyLeft\_5$			0.0098***	
			(0.0023)	
$AvgProbability$				22.8774***
				(0.7549)
Constant	7.2193***	6.9783***	7.2962***	-1.1556
	(0.7958)	(0.7859)	(0.8092)	(0.8461)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	80.95%	81.22%	81.11%	83.54%
Observations	5,216	5,216	5,216	5,216

Table 4.67: OLS Estimation of Underpricing: 5 Day Measurement Delay. *Underpricing_5* is measured from the offer price to the price at the end of the fifth-day of trading. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing_5			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0073**	-0.0090***	-0.0091***	-0.0089***
	(0.0033)	(0.0033)	(0.0033)	(0.0033)
LogProceeds	-0.0773***	-0.1218***	-0.1092***	-0.1135***
	(0.0080)	(0.0086)	(0.0087)	(0.0086)
UnderwriterRank	0.0054	0.0122***	0.0134***	0.0125***
	(0.0033)	(0.0032)	(0.0032)	(0.0032)
VCBacked	-0.0100	-0.0022	-0.0035	-0.0054
	(0.0094)	(0.0092)	(0.0092)	(0.0092)
NumConcurrentIPO	-0.0012***	-0.0010***	-0.0011***	-0.0011***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
AvgUPConcurrentIPO	0.0046***	0.0044***	0.0046***	0.0045***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
MktReturn	5.7177**	5.5594**	5.5051**	5.3563**
	(2.5658)	(2.4900)	(2.4830)	(2.4709)
MktStdDeviation	1.9663	2.3780	1.5196	1.8926
	(1.8281)	(1.7631)	(1.7629)	(1.7513)
TechFirm	0.0033	0.0023	0.0017	0.0016
	(0.0104)	(0.0101)	(0.0100)	(0.0100)
OfferPriceRevision	0.6705***	0.5688***	0.5707***	0.5646***
	(0.0345)	(0.0343)	(0.0341)	(0.0342)
PercentSold	-0.0949***	-0.1070***	-0.0945***	-0.0953***
	(0.0191)	(0.0190)	(0.0188)	(0.0188)
PercentInst	0.1507***	0.0226	0.0281	0.0274
	(0.0180)	(0.0208)	(0.0209)	(0.0208)
UWAvgUP	0.5833***	0.5831***	0.5923***	0.5864***
	(0.0511)	(0.0503)	(0.0497)	(0.0492)
UWInfoProd	-0.0025	-0.0059***	-0.0073***	-0.0077***
	(0.0021)	(0.0021)	(0.0021)	(0.0021)
AvgIndOverweight	0.0249**	0.0356***	0.0356***	0.0329***
	(0.0098)	(0.0098)	(0.0097)	(0.0096)
Spread	-2.4707***	-2.5638***	-2.3655***	-1.9716***
	(0.4820)	(0.4684)	(0.4628)	(0.4627)
AvgVolume	0.3302***	0.2024***	0.1725***	0.1937***
	(0.0530)	(0.0559)	(0.0560)	(0.0555)
ReturnStdDev	3.1167***	3.3768***	3.4558***	3.3811***
	(0.4522)	(0.4451)	(0.4418)	(0.4416)

$FirstNumAnalysts$	-0.0226***	-0.0207***	-0.0177***	-0.0188***
	(0.0054)	(0.0054)	(0.0055)	(0.0053)
$OneYearNumAnalysts$	0.0149***	0.0125***	0.0091***	0.0100***
	(0.0033)	(0.0033)	(0.0033)	(0.0033)
$NumInstInv$		0.0057***	0.0024***	0.0052***
		(0.0006)	(0.0007)	(0.0005)
$TotalInformed$			0.0103***	
			(0.0018)	
$AvgProbability$				0.6331***
				(0.0726)
Constant	0.1097	0.1482**	0.0848	-0.0776
	(0.0710)	(0.0725)	(0.0732)	(0.0768)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	50.03%	51.81%	52.48%	52.48%
Observations	5,216	5,216	5,216	5,216

Table 4.68: OLS Estimation of Total Future Informed Trading: 20 Day Measurement Delay. *Underpricing_20* is measured from the offer price to the price at the end of the twentieth-day of trading. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	TotalInformed			
	(1)	(2)	(3)	(4)
LogFirmAge	0.0146	0.0304	0.0167	0.0159
	(0.0440)	(0.0438)	(0.0439)	(0.0414)
LogProceeds	-1.2344***	-1.0084***	-1.0958***	-0.9343***
	(0.0959)	(0.0968)	(0.0980)	(0.0918)
UnderwriterRank	-0.1191***	-0.1358***	-0.1290***	-0.1091***
	(0.0327)	(0.0321)	(0.0323)	(0.0313)
VCBacked	0.1296	0.1237	0.1250	0.0115
	(0.1024)	(0.1009)	(0.1006)	(0.0945)
NumConcurrentIPO	0.0014	0.0035	0.0017	0.0002
	(0.0036)	(0.0036)	(0.0036)	(0.0033)
AvgUPConcurrentIPO	-0.0207***	-0.0242***	-0.0237***	-0.0167***
	(0.0048)	(0.0048)	(0.0047)	(0.0044)
TechFirm	0.0545	0.0580	0.0736	0.0313
	(0.1042)	(0.1025)	(0.1022)	(0.0958)
OfferPriceRevision	-0.2646	-0.8179**	-0.5550*	-0.4026
	(0.3322)	(0.3270)	(0.3247)	(0.3051)
PercentSold	-1.2181***	-1.0778***	-1.1200***	-0.7957***
	(0.2631)	(0.2599)	(0.2586)	(0.2472)
PercentInst	-0.5028**	-0.5783***	-0.3082	-0.3369*
	(0.2118)	(0.2105)	(0.2144)	(0.1980)
UWAvgUP	-0.9375**	-1.5462***	-1.2317***	-0.8093**
	(0.4147)	(0.4164)	(0.4159)	(0.3938)
UWInfoProd	0.1381***	0.1435***	0.1472***	0.0721***
	(0.0234)	(0.0234)	(0.0236)	(0.0221)
NumInstInv	0.3260***	0.3163***	0.3086***	0.3084***
	(0.0067)	(0.0067)	(0.0073)	(0.0063)
AvgIndOverweight	0.0149	-0.0734	-0.0415	-0.0853
	(0.0986)	(0.0976)	(0.0982)	(0.0935)
Spread	-19.5562***	-12.8711***	-16.7962***	1.8968
	(4.5875)	(4.6168)	(4.5544)	(4.4966)
AvgVolume	2.9516***	2.5162***	2.1952***	2.6255***
	(0.5236)	(0.5348)	(0.5509)	(0.4985)
ReturnStdDev	-7.6958*	-13.7603***	-9.9731**	-7.4830*
	(4.2249)	(4.1738)	(4.1369)	(4.0259)
FirstNumAnalysts	-0.2914***	-0.2651***	-0.2641***	-0.2234***
	(0.0731)	(0.0728)	(0.0730)	(0.0690)

$OneYearNumAnalysts$	0.3332***	0.3134***	0.3090***	0.2434***
	(0.0426)	(0.0424)	(0.0429)	(0.0404)
$Underpricing\_20$		1.1903***		
		(0.1709)		
$TotalMoneyLeft\_20$			0.0113***	
			(0.0020)	
$AvgProbability$				22.8774***
				(0.7549)
Constant	7.2193***	6.8498***	7.3145***	-1.1556
	(0.7958)	(0.7936)	(0.8228)	(0.8461)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	80.95%	81.31%	81.27%	83.54%
Observations	5,216	5,216	5,216	5,216

Table 4.69: OLS Estimation of Underpricing: 20 Day Measurement Delay. *Underpricing_20* is measured from the offer price to the price at the end of the twentieth-day of trading. Variable definitions are provided in the appendix. Heteroscedasticity-robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing_20			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0109**	-0.0133***	-0.0135***	-0.0132***
	(0.0046)	(0.0046)	(0.0045)	(0.0045)
LogProceeds	-0.1269***	-0.1904***	-0.1706***	-0.1720***
	(0.0105)	(0.0117)	(0.0117)	(0.0115)
UnderwriterRank	0.0043	0.0141***	0.0160***	0.0147***
	(0.0044)	(0.0044)	(0.0043)	(0.0043)
VCBacked	-0.0061	0.0051	0.0030	-0.0022
	(0.0122)	(0.0119)	(0.0118)	(0.0117)
NumConcurrentIPO	-0.0020***	-0.0017***	-0.0018***	-0.0018***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
AvgUPConcurrentIPO	0.0035***	0.0031***	0.0035***	0.0034***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)
MktReturn	-4.0986	-4.3243	-4.4097	-4.7779
	(3.5611)	(3.4306)	(3.3959)	(3.3442)
MktStdDeviation	-1.9918	-1.4047	-2.7537	-2.4886
	(2.4436)	(2.3512)	(2.3310)	(2.2907)
TechFirm	-0.0012	-0.0027	-0.0037	-0.0042
	(0.0137)	(0.0132)	(0.0130)	(0.0129)
OfferPriceRevision	0.6095***	0.4645***	0.4674***	0.4550***
	(0.0436)	(0.0439)	(0.0435)	(0.0431)
PercentSold	-0.1011***	-0.1183***	-0.0987***	-0.0923***
	(0.0274)	(0.0272)	(0.0269)	(0.0265)
PercentInst	0.2469***	0.0642**	0.0728***	0.0749***
	(0.0229)	(0.0267)	(0.0266)	(0.0263)
UWAvgUP	0.5108***	0.5105***	0.5249***	0.5178***
	(0.0709)	(0.0701)	(0.0692)	(0.0666)
UWInfoProd	0.0001	-0.0046*	-0.0068**	-0.0086***
	(0.0027)	(0.0027)	(0.0027)	(0.0026)
AvgIndOverweight	0.0589***	0.0742***	0.0742***	0.0682***
	(0.0140)	(0.0139)	(0.0137)	(0.0135)
Spread	-5.4909***	-5.6237***	-5.3121***	-4.3013***
	(0.6532)	(0.6352)	(0.6257)	(0.6172)
AvgVolume	0.5508***	0.3685***	0.3217***	0.3491***
	(0.0673)	(0.0701)	(0.0702)	(0.0682)
ReturnStdDev	4.6840***	5.0549***	5.1792***	5.0645***
	(0.5929)	(0.5862)	(0.5795)	(0.5707)

$FirstNumAnalysts$	-0.0247***	-0.0220***	-0.0173***	-0.0178***
	(0.0066)	(0.0066)	(0.0066)	(0.0064)
$OneYearNumAnalysts$	0.0199***	0.0165***	0.0112***	0.0110***
	(0.0040)	(0.0040)	(0.0040)	(0.0039)
$NumInstInv$		0.0081***	0.0029***	0.0071***
		(0.0007)	(0.0010)	(0.0007)
$TotalInformed$			0.0161***	
			(0.0022)	
$AvgProbability$				1.4137***
				(0.1006)
Constant	0.2721***	0.3270***	0.2273**	-0.1772*
	(0.0875)	(0.0920)	(0.0939)	(0.0961)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	44.55%	46.77%	47.80%	48.83%
Observations	5,216	5,216	5,216	5,216

these alternative measures of underpricing and provide qualitatively consistent results.

4.1.9 Alternative Estimates of Standard Errors

The main analyses utilize standard errors intended to be most economically appropriate. However, alternative methods may be attractive to some readers, and at the least, conducting alternative tests provides robustness to the main results. In the main probit analyses, standard errors are calculated using two-way clustering on IPO offerings and funds. Tables 4.70 and 4.71 also calculate standard errors using two-way clustering, but the clusters are formed on IPO offerings and years. The results are qualitatively similar. An additional alternative is to bootstrap robust standard errors, the results of which are shown in Tables 4.72 and 4.73. The results provided in both sets of robustness tests provide additional confidence in the results of the main analyses.

Bootstrapping can also be used to test the robustness of the linear regressions results in the main analyses. Tables 4.74 and 4.75 utilize bootstrapped standard errors in reproducing the future informed trading and underpricing regressions. Again, results are qualitatively similar to the main results, providing additional confidence in the main results.

4.2 Relating $Informed$ to Fund Characteristics

Throughout the analyses, a number of fund characteristics and historical measures of funds' behaviors are used as control variables. This section examines the relations between these control variables and several fund classifications.

4.2.1 Relation to Additional Fund Characteristics

A fund can be characterized based on its trading behavior following IPO allocations and also its portfolio's general characteristics. Table 4.76 analyzes a number of fund traits based on terciles of funds' reputations for information production as measured by $AvgInformed$. Funds that have a strong reputation for informed trading tend to have less systematic selling in the past and hold IPOs longer on average. In addition, they tend to hold the most diversified portfolios, reflected both

Table 4.70: Probit Estimation of IPO Allocations Using IPO-Year Clustered Standard Errors. "Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are available in the appendix. Standard errors, clustered at the IPO and year level, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1062***	0.0912***	0.0781***
	(0.0090)	(0.0053)	(0.0072)
Log($FundAge$)	-0.0082***	-0.0019***	-0.0020***
	(0.0007)	(0.0003)	(0.0003)
$Churn$	0.1721***	0.1689***	0.1065*
	(0.0255)	(0.0425)	(0.0546)
$OneTime$	0.6684***	0.5162***	0.4910***
	(0.0378)	(0.0184)	(0.0218)
$MultipleTimes$	1.2378***	0.8974***	0.8472***
	(0.0592)	(0.0257)	(0.0291)
$NumPrevIPOs$	0.0067*	0.0026***	0.0023***
	(0.0039)	(0.0002)	(0.0002)
$AvgSystematicSell$		0.5047***	0.5678***
		(0.0422)	(0.0471)
$AvgFlipped$		-0.4272***	-0.5354***
		(0.0368)	(0.0653)
$AvgIPOHoldTime$		0.0075**	0.0138***
		(0.0035)	(0.0029)
$AvgInformed$		0.5421***	0.4305***
		(0.0588)	(0.0682)
$HighUP$			-0.4119***
			(0.1174)
$HighUP\times$ Log($FundValue$)			0.0242***
			(0.0055)
$HighUP\times$ Log($FundAge$)			0.0001
			(0.0004)
$HighUP \times Churn$			0.1104***
			(0.0397)
$HighUP \times OneTime$			0.0350**
			(0.0137)
$HighUP \times MultipleTimes$			0.0690***
			(0.0248)
$HighUP \times NumPrevIPO$			0.0007***
			(0.0001)
$HighUP \times AvgSystematicSell$			-0.1033**

			(0.0469)
$HighUP \times AvgFlipped$			0.1801***
			(0.0699)
$HighUP \times AvgIPOHoldTime$			-0.0111***
			(0.0021)
$HighUP \times AvgInformed$			0.1995***
			(0.0450)
Constant	-4.2123***	-3.9860***	-3.8606***
	(0.1732)	(0.1468)	(0.1756)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	9.84%	19.04%	19.60%
Observations	2,940,445	1,777,725	1,777,725

Table 4.71: Probit Estimation of Future Informed Trading Using IPO-Year Clustered Standard Errors. "Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Standard errors, clustered at the IPO and year level, are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0174	-0.0115*
	(0.0113)	(0.0061)
$UWInfoProd$	0.0061	0.0178***
	(0.0038)	(0.0027)
$OneTime$	-0.0324	-0.0019
	(0.0289)	(0.0154)
$MultipleTimes$	0.0664	0.0429***
	(0.0485)	(0.0155)
$FirstNumAnalysts$	0.0041	0.0223***
	(0.0485)	(0.0155)
$OneYearNumAnalysts$	-0.0174	-0.0115*
	(0.0113)	(0.0061)
$VCBacked$	0.0750***	0.0406***
	(0.0184)	(0.0146)
$90DayReturn$	0.1522***	0.2831***
	(0.0241)	(0.0136)
$Spread$	-4.2088**	-6.0518***
	(1.7486)	(1.1621)
$AvgVolume$	0.0000***	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	0.2960	0.4380
	(1.1621)	(0.4956)
$IndustryOverweight$	0.0440***	0.0536***
	(0.0127)	(0.0097)
$IndWeightStdDev$	-0.1107***	-0.0630**
	(0.0369)	(0.0321)
$NumPrevIPOs$	0.0022	0.0002**
	(0.0095)	(0.0001)
$AllocationPct$	-0.8691*	-0.8819***
	(0.4578)	(0.2867)
$Shares$	-0.0232***	-0.0384***
	(0.0071)	(0.0054)
$Churn$	-1.4245***	-1.3338***
	(0.1232)	(0.0716)
Log($FundValue$)	0.0664***	0.0058

	(0.0178)	(0.0079)
Log($FundAge$)	-0.0024***	-0.0004
	(0.0007)	(0.0004)
$AvgFlipped$		-0.9307***
		(0.1484)
$AvgSystematicSell$		0.6393***
		(0.1484)
$AvgIPOHoldTime$		0.0209***
		(0.0050)
$AvgInformed$		1.5408***
		(0.1180)
$MoneyLeft$	0.0199**	0.1018***
	(0.0088)	(0.0105)
$AvgInformed \times MoneyLeft$		-0.1804***
		(0.0266)
Constant	-1.7113***	-0.9996***
	(0.3457)	(0.1730)
Year Dummy Variables	Yes	Yes
Pseudo R^2	4.01%	9.15%
Observations	22,936	106,453

Table 4.72: Probit Estimation of IPO Allocations Using Bootstrapped Standard Errors. "Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are available in the appendix. Bootstrapped standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	RecAllocation		
	New Funds	Established Funds	Established Funds
Log($FundValue$)	0.1062***	0.0912***	0.0781***
	(0.0018)	(0.0013)	(0.0022)
Log($FundAge$)	-0.0082***	-0.0019***	-0.0020***
	(0.0002)	(0.0001)	(0.0001)
$Churn$	0.1721***	0.1689***	0.1065***
	(0.0126)	(0.0106)	(0.0165)
$OneTime$	0.6684***	0.5162***	0.4910***
	(0.0080)	(0.0047)	(0.0067)
$MultipleTimes$	1.2378***	0.8974***	0.8472***
	(0.0114)	(0.0047)	(0.0062)
$NumPrevIPOs$	0.0067***	0.0026***	0.0023***
	(0.0014)	(0.0000)	(0.0000)
$AvgSystematicSell$		0.5047***	0.5678***
		(0.0182)	(0.0269)
$AvgFlipped$		-0.4272***	-0.5354***
		(0.0196)	(0.0288)
$AvgIPOHoldTime$		0.0075***	0.0138***
		(0.0006)	(0.0011)
$AvgInformed$		0.5421***	0.4305***
		(0.0179)	(0.0227)
$HighUP$			-0.4119***
			(0.0604)
$HighUP\times$ Log($FundValue$)			0.0242***
			(0.0030)
$HighUP\times$ Log($FundAge$)			0.0001
			(0.0002)
$HighUP \times Churn$			0.1104***
			(0.0224)
$HighUP \times OneTime$			0.0350***
			(0.0087)
$HighUP \times MultipleTimes$			0.0690***
			(0.0084)
$HighUP \times NumPrevIPO$			0.0007***
			(0.0001)
$HighUP \times AvgSystematicSell$			-0.1033***

			(0.0344)
$HighUP \times AvgFlipped$			0.1801***
			(0.0353)
$HighUP \times AvgIPOHoldTime$			-0.0111***
			(0.0013)
$HighUP \times AvgInformed$			0.1995***
			(0.0308)
Constant	-4.2123***	-3.9860***	-3.8606***
	(0.0404)	(0.0335)	(0.0483)
Year Dummy Variables	Yes	Yes	Yes
Pseudo R^2	9.84%	19.04%	19.60%
Observations	2,940,445	1,777,725	1,777,725

Table 4.73: Probit Estimation of Future Informed Trading Using Bootstrapped Standard Errors. "Established Funds" observations have a value for $AvgInformed$ while "New Funds" observations do not due to an insufficient data history. Variable definitions are provided in the appendix. Bootstrapped standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$Informed$	
	New Funds	Established Funds
$UnderwriterRank$	-0.0174**	-0.0115***
	(0.0086)	(0.0042)
$UWInfoProd$	0.0061	0.0178***
	(0.0042)	(0.0019)
$OneTime$	-0.0324	-0.0019
	(0.0267)	(0.0124)
$MultipleTimes$	0.0664**	0.0429***
	(0.0327)	(0.0121)
$FirstNumAnalysts$	0.0041	0.0223***
	(0.0327)	(0.0121)
$OneYearNumAnalysts$	-0.0174**	-0.0115***
	(0.0086)	(0.0042)
$VCBacked$	0.0750***	0.0406***
	(0.0220)	(0.0099)
$90DayReturn$	0.1522***	0.2831***
	(0.0243)	(0.0105)
$Spread$	-4.2088***	-6.0518***
	(1.5709)	(0.7609)
$AvgVolume$	0.0000***	0.0000***
	(0.0000)	(0.0000)
$6MonthReturnStdDev$	0.2960	0.4380
	(1.0006)	(0.4676)
$IndustryOverweight$	0.0440***	0.0536***
	(0.0088)	(0.0070)
$IndWeightStdDev$	-0.1107***	-0.0630***
	(0.0289)	(0.0183)
$NumPrevIPOs$	0.0022	0.0002***
	(0.0045)	(0.0000)
$AllocationPct$	-0.8691**	-0.8819***
	(0.3849)	(0.1649)
$Shares$	-0.0232***	-0.0384***
	(0.0053)	(0.0023)
$Churn$	-1.4245***	-1.3338***
	(0.0696)	(0.0356)
Log($FundValue$)	0.0664***	0.0058

	(0.0070)	(0.0047)
Log($FundAge$)	-0.0024***	-0.0004*
	(0.0005)	(0.0002)
$AvgFlipped$		-0.9307***
		(0.0575)
$AvgSystematicSell$		0.6393***
		(0.0485)
$AvgIPOHoldTime$		0.0209***
		(0.0014)
$AvgInformed$		1.5408***
		(0.0441)
$MoneyLeft$	0.0199**	0.1018***
	(0.0096)	(0.0066)
$AvgInformed \times MoneyLeft$		-0.1804***
		(0.0207)
Constant	-1.7113***	-0.9996***
	(0.1729)	(0.1099)
Year Dummy Variables	Yes	Yes
Pseudo R^2	4.01%	9.15%
Observations	22,936	106,453

Table 4.74: OLS Estimation of Total Future Informed Trading Using Bootstrapped Standard Errors. Variable definitions are available in the appendix. Bootstrapped standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	$TotalInformed$			
	(1)	(2)	(3)	(4)
$LogFirmAge$	0.0146	0.0263	0.0183	0.0159
	(0.0437)	(0.0420)	(0.0436)	(0.0449)
$LogProceeds$	-1.2344***	-1.1365***	-1.2067***	-0.9343***
	(0.0996)	(0.1035)	(0.0952)	(0.0831)
$UnderwriterRank$	-0.1191***	-0.1323***	-0.1224***	-0.1091***
	(0.0351)	(0.0350)	(0.0326)	(0.0288)
$VCBacked$	0.1296	0.1224	0.1277	0.0115
	(0.1063)	(0.0981)	(0.1046)	(0.0879)
$NumConcurrentIPO$	0.0014	0.0019	0.0012	0.0002
	(0.0035)	(0.0035)	(0.0039)	(0.0031)
$AvgUPConcurrentIPO$	-0.0207***	-0.0255***	-0.0229***	-0.0167***
	(0.0050)	(0.0050)	(0.0045)	(0.0045)
$TechFirm$	0.0545	0.0536	0.0614	0.0313
	(0.1025)	(0.1128)	(0.1082)	(0.0900)
$OfferPriceRevision$	-0.2646	-0.9246***	-0.4801	-0.4026
	(0.3361)	(0.3543)	(0.3334)	(0.2802)
$PercentSold$	-1.2181***	-1.1168***	-1.1765***	-0.7957***
	(0.2644)	(0.2543)	(0.2533)	(0.2512)
$PercentInst$	-0.5028**	-0.5272**	-0.4328**	-0.3369*
	(0.2008)	(0.2293)	(0.2146)	(0.1983)
$UWAvgUP$	-0.9375**	-1.5384***	-1.1130***	-0.8093*
	(0.4328)	(0.4543)	(0.4138)	(0.4360)
$UWInfoProd$	0.1381***	0.1457***	0.1418***	0.0721***
	(0.0238)	(0.0240)	(0.0210)	(0.0235)
$NumInstInv$	0.3260***	0.3218***	0.3212***	0.3084***
	(0.0066)	(0.0065)	(0.0073)	(0.0061)
$AvgIndOverweight$	0.0149	-0.0166	0.0092	-0.0853
	(0.0974)	(0.0933)	(0.1011)	(0.0988)
$Spread$	-19.5562***	-18.6359***	-19.5546***	1.8968
	(4.6145)	(4.6044)	(4.4970)	(4.2383)
$AvgVolume$	2.9516***	2.7295***	2.6373***	2.6255***
	(0.5436)	(0.5055)	(0.5485)	(0.5222)
$ReturnStdDev$	-7.6958*	-9.8565**	-7.7620*	-7.4830**
	(4.5018)	(4.2288)	(4.3643)	(3.7753)
$FirstNumAnalysts$	-0.2914***	-0.2733***	-0.2840***	-0.2234***
	(0.0734)	(0.0731)	(0.0801)	(0.0643)
$OneYearNumAnalysts$	0.3332***	0.3234***	0.3276***	0.2434***

	(0.0378)	(0.0405)	(0.0460)	(0.0417)
$Underpricing$		1.0552***		
		(0.2981)		
$TotalMoneyLeft$			0.0050*	
			(0.0026)	
$AvgProbability$				22.8774***
				(0.7663)
Constant	7.4369***	7.2856***	7.5080***	-0.7761
	(0.6127)	(0.6161)	(0.6774)	(0.7767)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	80.95%	81.06%	80.98%	83.54%
Observations	5,216	5,216	5,216	5,216

Table 4.75: OLS Estimation of Underpricing Using Bootstrapped Standard Errors. Variable definitions are available in the appendix. Bootstrapped standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Underpricing			
	(1)	(2)	(3)	(4)
LogFirmAge	-0.0099***	-0.0110***	-0.0111***	-0.0110***
	(0.0026)	(0.0026)	(0.0028)	(0.0027)
LogProceeds	-0.0612***	-0.0921***	-0.0855***	-0.0880***
	(0.0066)	(0.0077)	(0.0073)	(0.0073)
UnderwriterRank	0.0078***	0.0125***	0.0131***	0.0127***
	(0.0026)	(0.0027)	(0.0023)	(0.0028)
VCBacked	0.0014	0.0068	0.0061	0.0052
	(0.0080)	(0.0070)	(0.0068)	(0.0069)
NumConcurrentIPO	-0.0006*	-0.0004	-0.0005	-0.0005
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
AvgUPConcurrentIPO	0.0045***	0.0043***	0.0045***	0.0044***
	(0.0006)	(0.0006)	(0.0005)	(0.0005)
MktReturn	5.8031***	5.6935***	5.6653**	5.5940***
	(2.1481)	(1.9132)	(2.2057)	(1.8870)
MktStdDeviation	1.3487	1.6339	1.1885	1.3962
	(1.5086)	(1.3295)	(1.4175)	(1.3843)
TechFirm	0.0012	0.0005	0.0001	0.0001
	(0.0088)	(0.0084)	(0.0081)	(0.0077)
OfferPriceRevision	0.6960***	0.6256***	0.6265***	0.6235***
	(0.0284)	(0.0299)	(0.0287)	(0.0291)
PercentSold	-0.0869***	-0.0952***	-0.0887***	-0.0895***
	(0.0166)	(0.0165)	(0.0164)	(0.0158)
PercentInst	0.1110***	0.0222	0.0251	0.0246
	(0.0148)	(0.0165)	(0.0184)	(0.0166)
UWAvgUP	0.5708***	0.5706***	0.5754***	0.5722***
	(0.0439)	(0.0439)	(0.0390)	(0.0413)
UWInfoProd	-0.0049***	-0.0072***	-0.0079***	-0.0081***
	(0.0017)	(0.0019)	(0.0017)	(0.0019)
AvgIndOverweight	0.0223**	0.0297***	0.0297***	0.0284***
	(0.0088)	(0.0083)	(0.0080)	(0.0082)
Spread	-0.7984*	-0.8629**	-0.7600**	-0.5728
	(0.4112)	(0.3697)	(0.3589)	(0.3678)
AvgVolume	0.2956***	0.2070***	0.1915***	0.2028***
	(0.0393)	(0.0431)	(0.0409)	(0.0394)
ReturnStdDev	1.9203***	2.1005***	2.1415***	2.1026***
	(0.3534)	(0.3475)	(0.3591)	(0.3494)
FirstNumAnalysts	-0.0186***	-0.0173***	-0.0158***	-0.0164***

	(0.0047)	(0.0045)	(0.0044)	(0.0043)
$OneYearNumAnalysts$	0.0111***	0.0094***	0.0077***	0.0082***
	(0.0029)	(0.0025)	(0.0029)	(0.0027)
$NumInstInv$		0.0040***	0.0022***	0.0037***
		(0.0005)	(0.0006)	(0.0004)
$TotalInformed$			0.0053***	
			(0.0013)	
$AvgProbability$				0.3101***
				(0.0607)
Constant	0.0912*	0.1233**	0.0884*	0.0145
	(0.0477)	(0.0494)	(0.0513)	(0.0539)
Year Dummy Variables	Yes	Yes	Yes	Yes
R^2	58.85%	59.91%	60.14%	60.11%
Observations	5,216	5,216	5,216	5,216

through the highest number of portfolio positions and the lowest level of industry concentration. Furthermore, these funds are generally older, and on average are the largest funds. While their post-IPO trading activity is highest, overall, they churn their portfolios the least. Finally, these funds tend to be rewarded in future quarters, with more IPO allocations for more total money left on the table. Notably, funds with the best historical information production tend to be least concentrated in the IPO firm's industry prior to receiving an allocation. This suggests that funds without established reputations may be targeted for specific IPOs.

4.2.2 Relation to Bushee (1998) Measures

To study the influence of institutional investors on the myopic behavior of managers, Bushee [1998] classifies institutional investors as either transient, dedicated or quasi-indexers. Bushee [1998] concludes that higher ownership by transient investors (those with high portfolio turnover, diversification, and momentum trading) is associated with managerial myopia (reducing R&D to boost earnings). I therefore examine the relation between $AvgInformed$ and this established classification of institutional investors.

Table 4.77 shows that while dedicated investors and quasi-indexers appear similar regarding information production, transient investors lag substantially behind in their average measure of $AvgInformed$. Transient investors also tend to systematically sell their allocations more often, and to hold IPOs for nearly half as long as dedicated investors or quasi-indexers. In addition, transient investors have very high portfolio turnover relative to other types, as measured by $Churn$ (consistent with Bushee [1998]).

Dedicated investors tend to receive more allocations and more money left on the table than quasi-indexers or transient investors. In addition, dedicated investors are over-represented, receiving over 8% of allocations while making up only 6% of funds overall. Quasi-indexers are generally under-represented, as they receive 35% of allocations but make up 55% of funds. Transient investors, while not appearing to be information producers, do receive slightly more allocations than is proportional, receiving 34% of allocations while making up 30% of funds.

Table 4.76: Summary Statistics by $AvgInformed$ Terciles. The number of observations in each tercile varies slightly as quarterly terciles can be uneven due to repeat observations being placed in the same tercile.

	Low $Informed$	Middle $Informed$	High $Informed$
$AvgInformed$	7.7%	20.3%	37.9%
$AvgSystematicSell$	63.1%	50.6%	36.1%
$AvgInformed_NoSysSell$	15.4%	28.9%	45.1%
$AvgIPOHoldTime$	3.98	4.74	6.56
$IndustryConc$	69.5%	58.4%	55.0%
$PositionIndustryConc$	0.35	0.29	0.28
Fund Age	10.5	12.2	12.5
Fund Value	$4.74	$11.40	$27.10
Number Port. Positions	396	604	1051
$Churn$	19%	16%	13%
Num Allocations Next Quarter	1.9	3.3	4.2
Mean Allocation Percent	3.47%	2.93%	3.19%
Median Allocation Percent	1.30%	1.78%	1.74%
Average $MoneyLeft$ Per Fund-Quarter	$871,500	$1,840,429	$2,341,795
Observations (Fund-Quarters)	11,548	11,932	11,723

Table 4.77: Summary Statistics Based on Bushee (1998) Classifications.

	DED	QIX	TRA	Missing
$AvgInformed$	22.8%	23.4%	19.5%	23.7%
$AvgSysSell$	43.8%	43.8%	58.7%	47.0%
$AvgInformed\_NoSysSell$	30.1%	30.7%	27.6%	32.1%
$AvgHoldTime$	6.22	6.47	3.47	5.21
$IndustryConc$	95.3%	53.3%	64.3%	59.0%
$PositionIndustryConc$	0.55	0.18	0.40	0.25
Fund Age	10.5	12.7	10.5	12.6
Fund Value	$24.50	$18.80	$6.77	$17.10
Number Port. Positions	550	891	481	714
$Churn$	11%	10%	23%	17%
Num Allocations Next Quarter	4.7	3.1	3.0	3.1
Mean Allocation Percent	7.41%	2.74%	2.95%	3.05%
Median Allocation Percent	3.64%	1.29%	1.82%	1.52%
Average $MoneyLeft$ Per Fund-Quarter	$3,174,614	$1,447,023	$1,839,732	$1,488,100
Observations (Fund-Quarters)	1,942	12,531	12,459	8,189

4.2.3 Relation to Fund Type

Institutional investors can also be characterized by their type, and the 13F data and Brian Bushee's website[6] classify funds as one of the following: bank trust, insurance company, investment company, independent investment advisor, corporate pension fund, public pension fund, university and foundation endowment and miscellaneous. Table 4.78 provides summary statistics for each of the preceding classifications.

Banks, investment companies and public pensions tend to produce high levels of information for IPOs (and do not tend to systematically sell IPO allocations), while corporate pensions and university endowments tend to be poor information producers. Corporate pensions, independent investment advisors, and investment companies tend to receive IPO allocations in industies in which their portfolios are heavily weighted, while banks and public pensions are not overweight industries in which they receive IPO allocations. Investment companies receive the most allocations relative to their proportion, receiving 14% of allocations while only making up 4% of funds.[7] Banks and insurance companies also receive proportionally more allocations, with banks receiving 18% of allocations while making up 13% of funds, and insurance companies receiving 7% of allocations while making up 4% of funds. Independent investment advisors receive less than a proportional amount of allocations, receiving 48% of allocations while making up 68% of funds.

[6] Classification data is available at http://acct3.wharton.upenn.edu/faculty/bushee.

[7] Percentages are calculated based on the number of funds and is not weighted by those funds' assets under management.

Table 4.78: Summary Statistics Based on Fund Type Classifications. Variable definitions are available in the appendix.

	Banks	Corp Pensions	Indepentent Inv. Advisors	Insurance Companies	Investment Companies	Misc.	Public Pensions	Univ Endowments
$AvgInformed$	23.9%	19.4%	21.2%	20.6%	22.8%	23.4%	32.0%	17.0%
$AvgSysSell$	45.1%	47.8%	52.1%	48.0%	46.2%	51.6%	43.2%	51.9%
$AvgInformed\_NoSysSell$	32.5%	26.3%	29.1%	27.7%	29.7%	31.6%	36.3%	24.2%
$AvgHoldTime$	6.37	4.90	4.60	6.18	5.50	4.99	6.99	5.21
$IndWeightStdDev$	50.7%	58.9%	67.3%	46.4%	50.0%	60.1%	17.1%	51.6%
$IndOverweight$	-0.03	0.33	0.41	0.08	0.23	0.41	-0.02	0.20
Fund Age	13.7	11.6	10.4	15.3	12.8	12.3	14.1	12.4
Fund Value	$30.60	$5.83	$7.87	$15.10	$33.20	$20.90	$29.00	$2.57
Number of Portfolio Positions	1387	489	474	962	669	808	2018	605
$Churn$	10%	13%	18%	12%	14%	19%	8%	14%
Number of Allocations Next Quarter	4.6	1.7	2.9	3.4	6.0	4.0	4.1	1.7
Mean Allocation Percent	2.32%	4.35%	3.48%	2.70%	3.19%	3.22%	0.75%	7.97%
Median Allocation Percent	0.91%	1.31%	2.00%	1.18%	2.19%	1.20%	0.42%	3.73%
Average $MoneyLeft$ Per Fund-Quarter	$1,526,685	$1,468,152	$1,635,021	$1,141,690	$4,048,695	$3,084,497	$722,380	$467,247
Observations (Fund-Quarters)	4,332	532	18,391	2,254	2,588	2,753	555	147

4.3 Computation of Trading Profits

This section details my methodology for estimating the trading profits of a single informed trading in an environment where a firm adapts its investment decision to the firm's stock price.

4.3.1 Numerical Estimation of Microstructure

I consider a single security trading in a one-period batch auction market as in Kyle [1985]. In expectation, the market maker breaks even and the liquidity traders' costs are opposite the informed trader's profits. The market microstructure deviates from the Kyle [1985] model for two reasons. First, the informed trader has a potentially less than perfectly correlated signal of the true productivity of the firm. This requires slight adjustments to the informed trader's order strategy, the market maker's pricing strategies and the resulting expected trading profits, which are detailed at the end of this section. Second, the feedback of prices to firm actions eliminates the standard linear-normal relationships that give the Kyle [1985] model its elegance. Specifically, when an informative signal is made public, the firm's price reflects an expansion when the expected productivity shock is above some threshold, creating a "kink" in the price of the firm as a function of the normally distributed productivity shock.

I start by assuming that the private signal of the informed trader will be revealed at the end of trading. In a one period model, this assumption serves to simplify the strategies of the informed trader and market maker. Knowing that the signal will be fully revealed, neither the informed trader nor the market maker are concerned with the possibility that the firm will inaccurately infer the informed trader's signal from the price. Without a fully revealed signal this could be the case, for example, when a positive signal leads to informed buying but is accompanied by a greater volume of uninformed selling. Uninformed selling in sufficient size would result in a negative price change that would indicate to the firm that a negative signal likely resulted. Alleviating this concern allows the informed trader to maximize his trading profits from his information without concern for the firm's inference problem.

I place several restrictions on the strategy space of the informed trader, for both computational and economic reasons. The order submission strategy, which maps observed private signals to order size, is taken to be a step function. Each step takes a constant value over a continuous region of measure $\frac{\sqrt{\Sigma}}{x}$ where x indicates the step size. This simplification is used to maintain computational tractability. Each step is computationally optimized later in the process, so increasing the number of steps greatly increases the required processing time. Economically, I isolate attention to order strategies that are monotonically increasing in the private signal. Doing so prevents the market maker from assigning a potential informed order flow to multiple private signals. I do not attempt to show, but do suspect, that equilibria violating this criteria do not exist.

To numerically compute expectations I discretize the normally distributed signal by using N evenly spaced evaluation points over $+/-6$ standard deviations of the mean. As an example, for $N = 101$, evaluation points are spaced every 0.12 standard deviations.[8] The discrete distribution is generated by calculating the value of the normal probability density function at each evaluation point, and then scaling all points to ensure the discrete distribution's density is one. When needed, the same procedure is applied to the distribution of noise trading order flow.

In the first step of the numerical process, I take the order strategy of the informed trader as given. Initially, I guess that the order strategy is the Kyle [1985] linear order strategy. Given this order strategy, I calculate the expected value of the firm's produced cash flows conditional on the total order flow. This is the pricing function of the market maker. For a given total order flow, the expected value of the firm's produced cash flows is calculated as follows.[9] The market maker knows that each total order flow can originate from each private signal, provided it is paired with the appropriate noise trading order flow. Furthermore, each signal can be mapped to an expected level of the firm's produced cash flows. The expected price, given the total order flow, is

[8] In the results presented herein, the number of evaluation points and steps were chosen to create a 1-to-1 relationship. This prevents the loss of any accuracy in estimation due to averaging optimal responses across multiple signals within one step.

[9] The market maker prices all potential realizations of order flow. This range is calculated by taking the lowest and highest possible order flows of the noise traders and adding it to the order flow generated by the informed trader when he observes his lowest and highest possible signals. I evaluate the order flows between these end points at intervals of 0.001.

equal to the sum of the possible values of the firm's produced cash flows weighted by their relative probabilities where the relative probabilities are given by multiplying the probability of the signal with that of the paired noise trading order flow divided by the sum of these products for all such pairs. The signal probability is given by the discrete distribution, while the noise trading order flow is calculated using the normal probability density function. Repeating this process for all possible total order flows results in a mapping from order flows to prices.

I next take the market maker's mapping (pricing strategy) as given and optimize the informed trader's order strategy. The informed trader wishes to maximize his expected trading profits. To calculate the expected trading profits, I use the discrete distributions of signals and noise trading order flows to generate the net order flows that the market maker may observe. For each net order flow, the informed trader knows the price that will result (from the mapping) and the true expected value of the firm's produced cash flows (given his signal). The expected profit for each possible signal can then be calculated, where the expectation is due to the randomness of the noise trading order flow. Using a pattern search algorithm, the levels of each step in the order strategy function are varied until more profitable strategies cannot be found. The algorithm finishes when changing the existing iteration values by less than a threshold, e.g. 0.000001, does not improve the expected profits.[10] The value function that is optimized can be written as

$$\sum_{i=1}^{N}\left(\psi(s_i)prob(s_i)\left[E[P|s_i]-\sum_{j=1}^{N}\lambda(\psi(s_i)+u_j)prob(u_j)\right]\right) \tag{4.4}$$

where ψ is the step function mapping signals to orders (which is optimized), λ is the pricing function mapping total order flows to prices, P is the firm's cash flow and u is noise trader order flow.

To find an order strategy and pricing function that are best responses to one another, I iterate this process by recalculating the pricing function given the optimized order strategy. The order strategy is then optimized given the updated pricing function. This iterative process continues until the maximum percentage deviation of the optimized order strategy's step coefficients from their previous values is lower than a specified threshold, e.g. 0.0001. At this point, the order strategy

[10] The pattern search algorithm used in MATLAB minimizes the negative of the expected trading profits by altering the order strategy that is used to map signals to informed order sizes.

that generated the pricing function is nearly identical to the optimal order strategy given the new pricing function, and the two are best responses. This provides an equilibrium to the microstructure setting with price feedback, but I do not claim that this is a unique equilibrium.

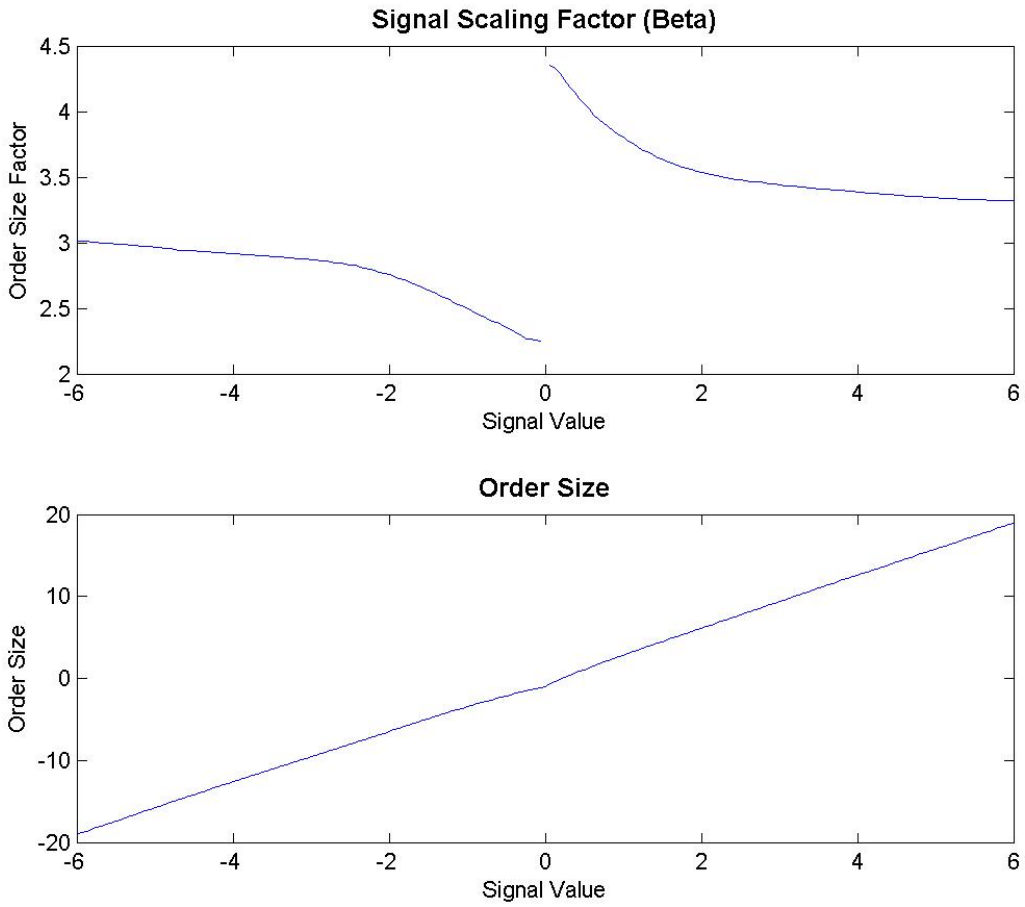
An example of the optimal order strategy of the informed trader is presented in Figure 4.1 and the corresponding pricing strategy is presented in Figure 4.2. I present results for a firm whose expansion project size (I) is equal to the size of assets-in-place (A), which is set to 10. The variance of the productivity shock (Σ), the correlation of the signal (ρ), and the standard deviation of noise trading from the firm's shareholders (σ_w) are all set equal to 1. The cost of information (c) does not impact the market microstructure directly.

In Figure 4.1, the top panel shows the multiplicative scaling factors (Kyle's β) for each level of the observed signal, while the bottom panel translates the signals to the informed trader's order size.[11] It appears that the informed trader decreases his trading intensity for negative signal realizations, while increasing the trading intensity for positive signal realizations. I conjecture that the reduced intensity serves to mask the more intense trading for positive signals, where the price variance and trading profitability is higher. The bottom panel shows that the order strategy is monotonically increasing in the signal. The fixed portion of the order flow and with the variable scaling combine to result in the nearly linear character of the order size with respect to the signal. As in the Kyle [1985] model, the informed trader adapts his order strategy to the level of noise trading in the market.

In Figure 4.2, the top panel shows the price for a given level of order flow, and the bottom panel shows the price sensitivity that gives rise to that mapping. From the top panel, we can see that the slope of the pricing function in the right tail is approximately twice the slope of the pricing function in the left tail, reflecting the increased variance of prices due to the firm investing in its expansion project. This is further demonstrated in the bottom panel, where the price mapping has

[11] The order strategy of the informed trader includes a fixed amount to account for when the signal is equal to the mean productivity shock. I estimate the remaining scaling factors including the fixed portion of the order size. The top panel would change were I to back out the fixed portion first, but the remainder of my results would be unchanged.

Figure 4.1: Informed Order Strategy With Price Feedback. Parameters for the estimation are $I = 10$, $A = 10$, $\sigma_w = 10$ and $\Sigma = \rho = 1$.



been translated into a sensitivity to order flow, which is similar to Kyle's λ. Comparing the left edge to the right edge, we can see that the sensitivity approximately doubles in comparing large negative order flows to large positive order flows. When the order flow is in the tails, the estimated λ is very close to Kyle's λ adjusted for the degree of price volatility (which is double in the right tail).

To further demonstrate the similarity with the Kyle [1985] model, Figure 4.3 shows the market maker's posterior beliefs regarding the distribution of the private signal and the value of the firm's cash flows (when net order flow is zero). The top panel highlights that the posterior distribution of the private signal is approximately normal and its variance is half that of the variance of the *ex-ante* distribution. The fitted probabilities shown are restricted to be normal. The R^2 of the fit in the top panel is over 99.9%. This is also consistent with the one-period results from Kyle [1985], where half of the informed trader's information is incorporated into prices after one round of trading. The bottom panel highlights that this does not imply that the posterior distribution of the firm's price is normally distributed. The distribution is much fatter to the right of the mean, consistent with the firm's investment in the expansion project increasing the expected cash flows when the signal is positive.

Figure 4.4 shows how trading profits scale with the size of the firm's expansion project. Defining ξ as the ratio of numerically estimated trading profits to analytically calculated trading profits without price feedback, I examine the sensitivity of trading profits to ξ by repeating the process of finding the best response functions for multiple levels of I given $A = 10$. Figure 4.4 shows that the trading profits of the informed trader appear to be linear in ratio of the expansion project size to the assets-in-place of the firm. Fitting the expected profits by

$$f(\rho, \sigma_w, \Sigma, I, A) = \frac{\rho \sigma_w \sqrt{\Sigma}}{2} \times \left(1 + \frac{I}{2A}\right) \tag{4.5}$$

I observe an R^2 of 99.96%. This suggests that informed trading profits are very nearly linear in the firm's growth options.

I repeat the estimation of optimal order and pricing strategies for the case of no price feedback,

Figure 4.2: Market Maker's Price Strategy With Price Feedback. Parameters for the estimation are $I = 10$, $A = 10$, $\sigma_w = 10$ and $\Sigma = \rho = 1$.

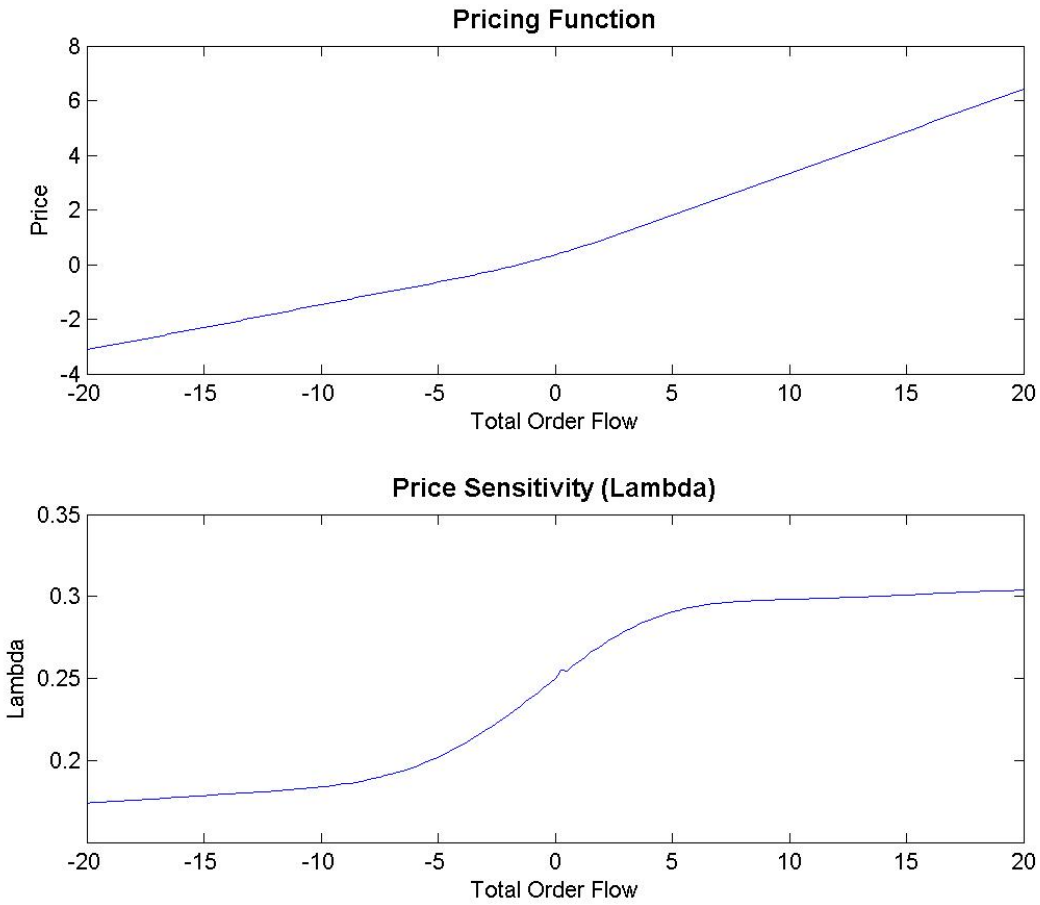


Figure 4.3: Market Maker's Posteriors With Price Feedback. Parameters for the estimation are $I = 10$, $A = 10$, $\sigma_w = 10$ and $\Sigma = \rho = 1$.

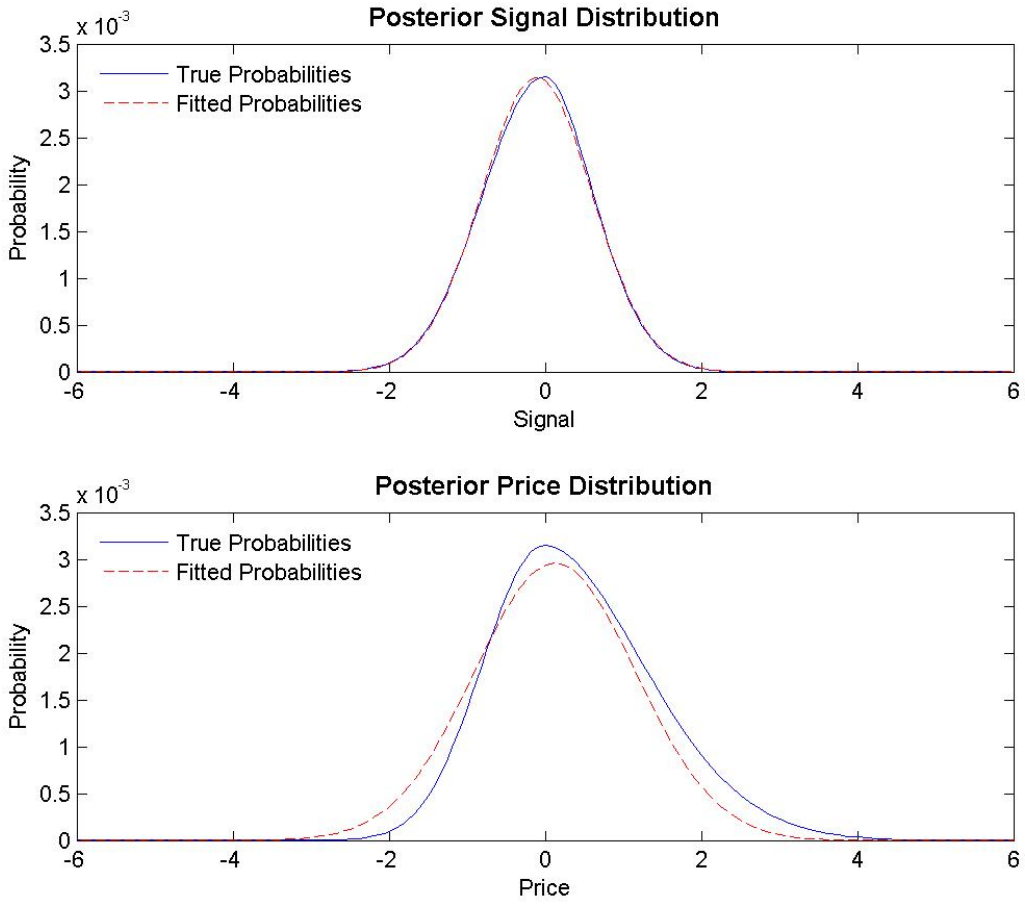
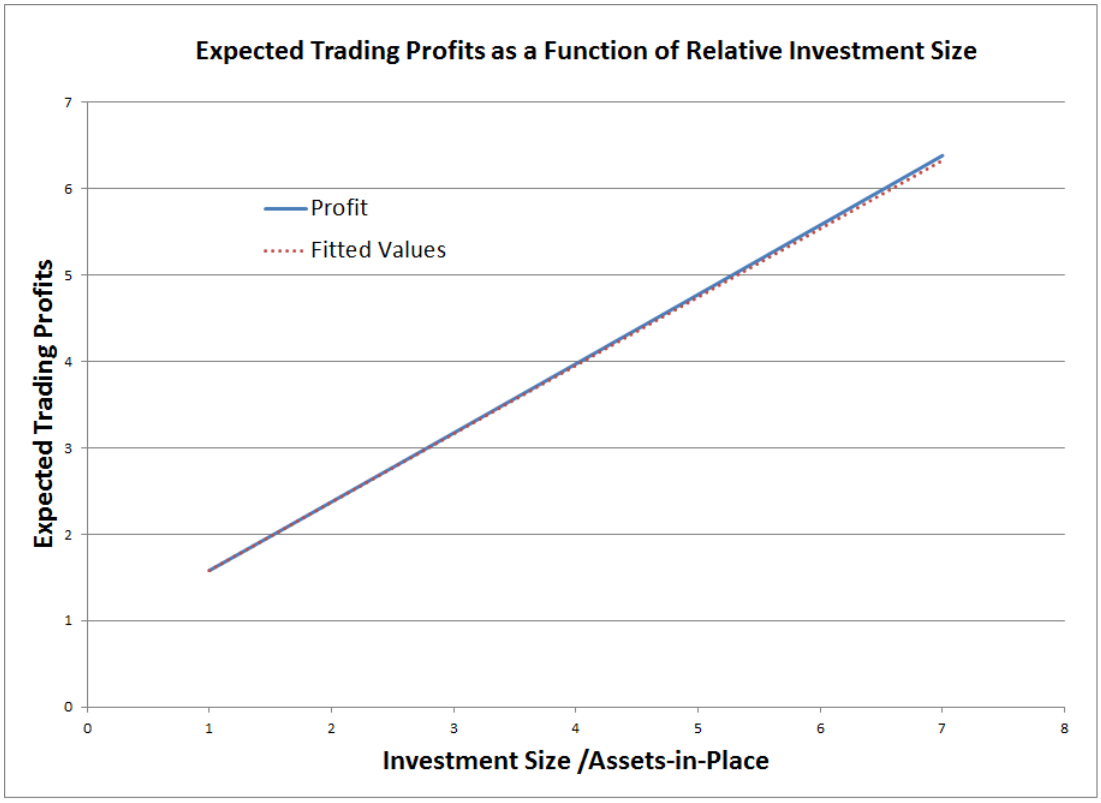


Figure 4.4: Expected Trading Profits and Expansion Project Size. Parameters for the estimation are $A = 10$, $\sigma_w = 10$, $\Sigma = \rho = 1$ and I is allowed to vary.



i.e. the Kyle [1985] model, to provide confidence in the numerical estimation process. Setting $I = 0$ prevents opportunity for price feedback. However, rather than seeding the model's initial guess with the analytic result of the Kyle [1985] model, I use an equilibrium strategy with price feedback as the initial guess. This provides a robust test of the numerical methods, as the iterative process of finding best-responses should converge to the analytic results regardless of the initial guess. Figures 4.5, 4.6 and 4.7 show that the method produces numerical estimates that closely approximate (deviations of less than 0.002%) the analytic results of the Kyle [1985] model for the order strategy, pricing strategy, and posterior distribution of prices conditional on order flow.

While computational solutions often result in a loss of analytic tractability, I show that in the presence of price feedback the expected trading profits of the informed trader maintain an approximately linear relationship with the exogenous variables of the Kyle [1985] model. While the fit of the model is not perfect, the portion of the variance in the trading profits explained by the correlation of the signal, the standard deviation of productivity and the standard deviation of noise trading order flow is almost 100%. More precisely, the residual variance is fifty-five orders of magnitude smaller than the total variance. I demonstrate this in Figure 4.8 by comparing numerically computed and analytically calculated expected profits.

The left set of graphs in Figure 4.8 show two lines, the higher of which plots the numerically computed expected trading profits ("computed value"). The lower of the two lines plots the analytically calculated expected trading profits ("theoretic value") using

$$\frac{\rho\sigma_w\sqrt{\Sigma}}{2}. \tag{4.6}$$

When analytically calculated trading profits are low, the corresponding numerically computed profits are also low, and they can be seen to grow together as correlation, productivity standard deviation and noise trading standard deviation increase. The right set of graphs in Figure 4.8 show the same numerically computed profits together with the analytically calculated profits multiplied by a scaling factor ("scaled theoretic value"). Specifically, the scaled, analytically calculated profits

Figure 4.5: Informed Order Strategy Without Price Feedback. Parameters for the estimation are $I = 10$, $A = 10$, $\sigma_w = 10$ and $\Sigma = \rho = 1$. The analytic calculation gives $\beta = \rho\sigma_w\sqrt{\Sigma} = 3.16228$. The numerical estimation gives an average slope estimate of $\bar{\beta} = 3.16234$, which is a deviation of 0.0019% from the analytic result.

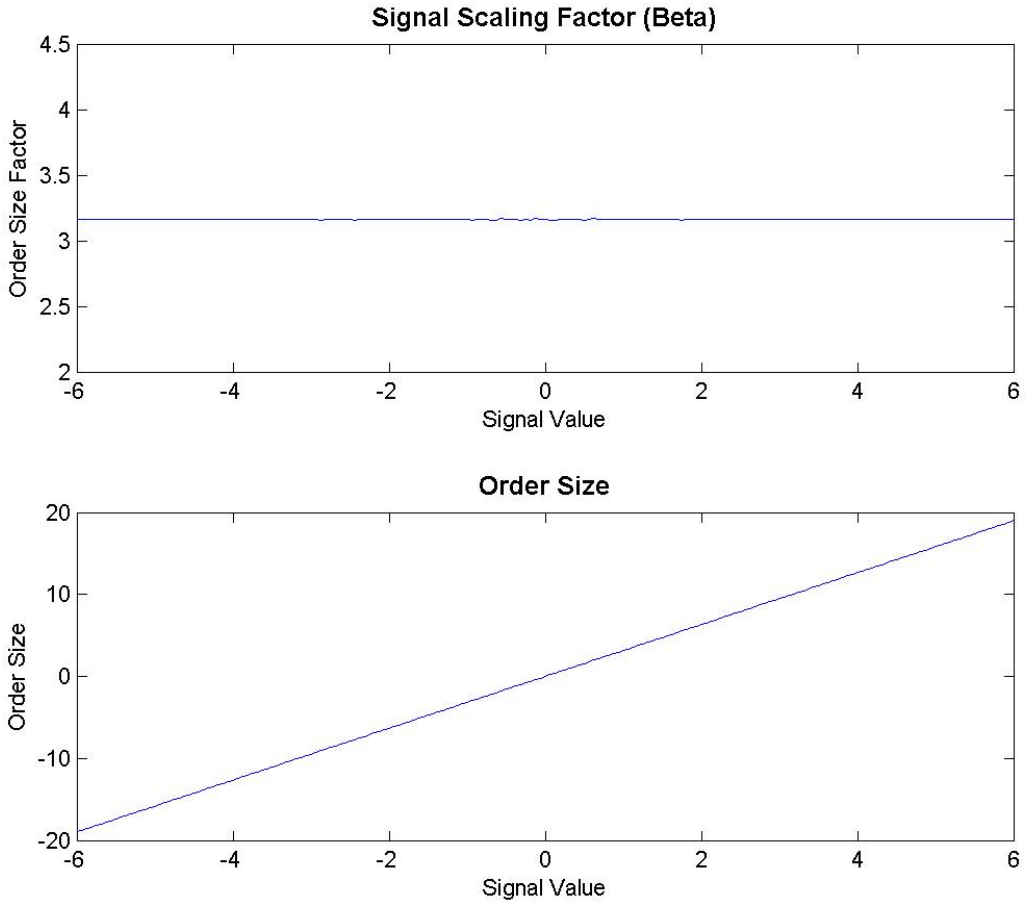


Figure 4.6: Market Maker's Price Strategy Without Price Feedback. Parameters for the estimation are $I = 10$, $A = 10$, $\sigma_w = 10$ and $\Sigma = \rho = 1$. The analytic calculation gives $\lambda = \frac{1}{2\rho\sigma_w\sqrt{\Sigma}} = \frac{1}{2\beta} = 0.158114$. The numerical estimation gives an average sensitivity estimate of $\bar{\lambda} = 0.158115$, which is a deviation of 0.0007% from the analytic result.

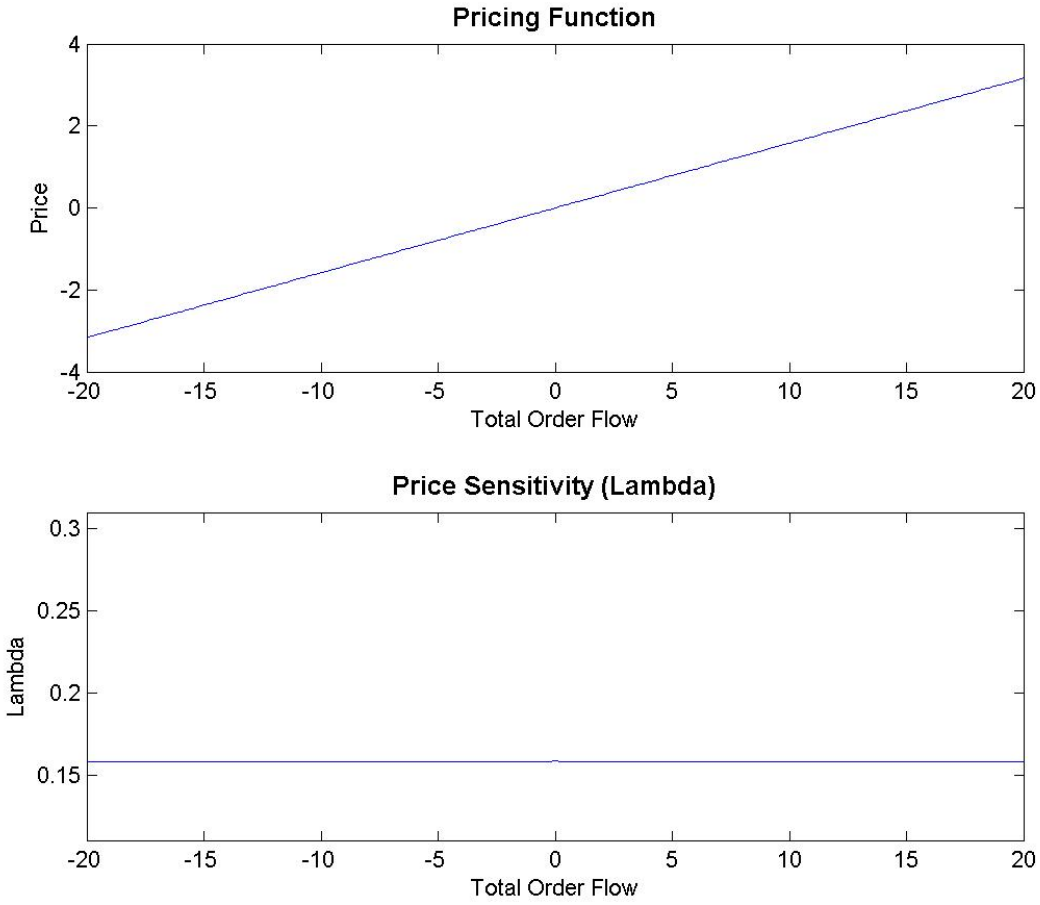


Figure 4.7: Market Maker's Posteriors Without Price Feedback. Parameters for the estimation are $I = 0$, $A = 10$, $\sigma_w = 10$, $\Sigma = \rho = 1$. Posteriors are shown for the case of zero observed total order flow. The expected posterior mean and standard deviation is 0 and 0.707107. The posterior price distribution's best fit using a normal distribution has a mean of -0.0001 and standard deviation of 0.707072 (deviation of 0.0001% from the analytic result). The fitted distribution explains the numerically estimated probabilities with an R^2 of greater than 99.9999.%

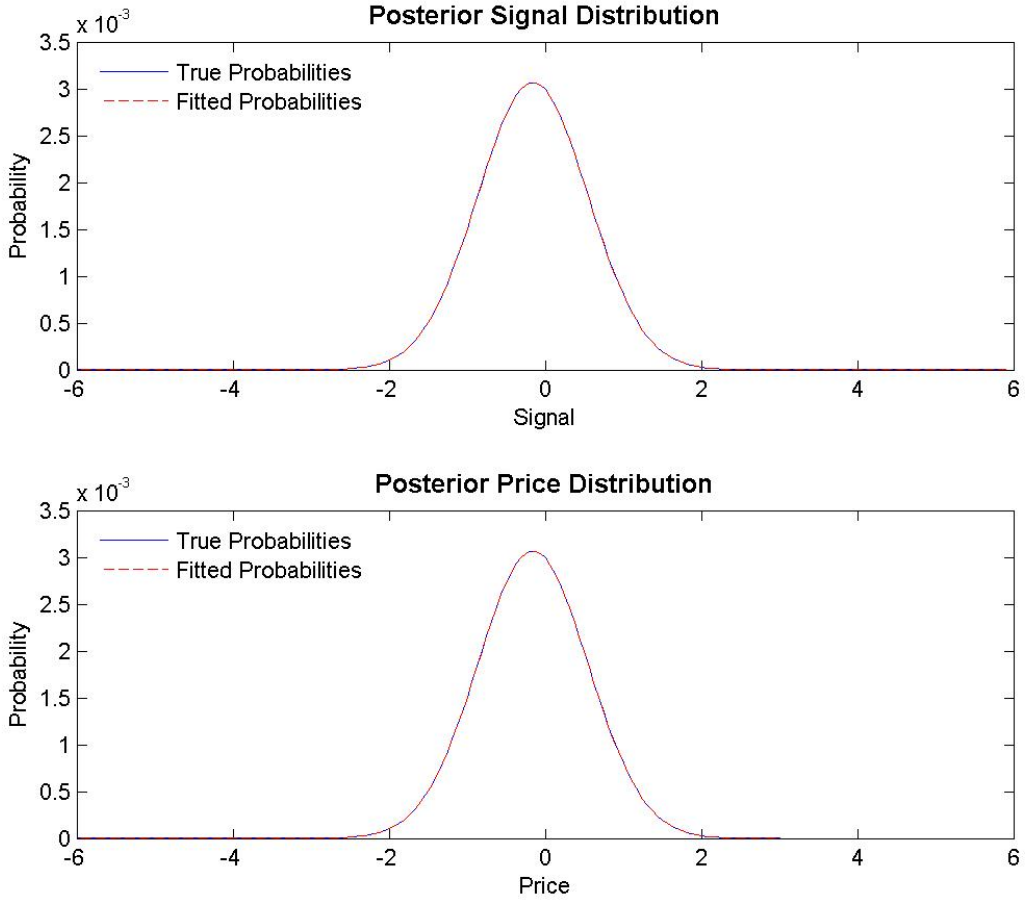
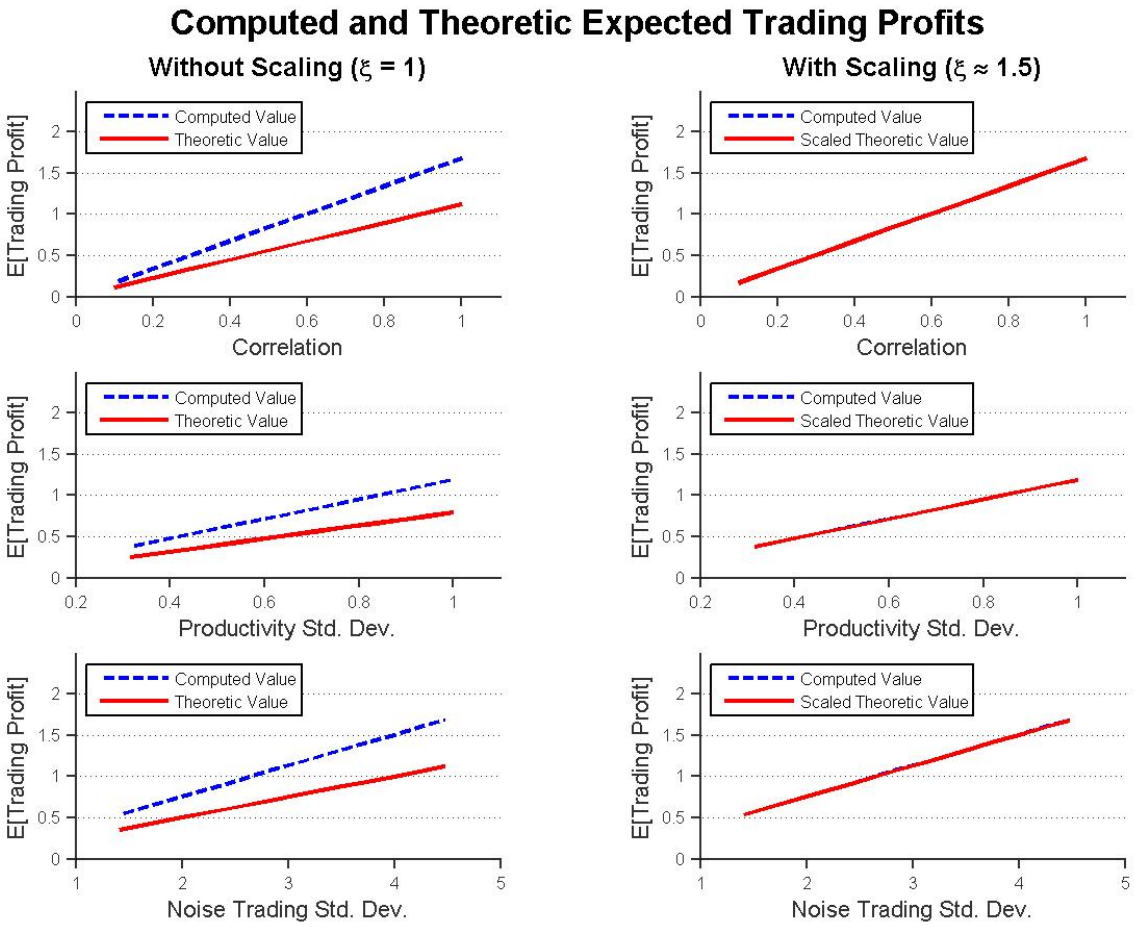


Figure 4.8: Microstructure Informed Trading Profits. The asset mix used in the numerical estimation is $A = I = 10$. When varying ρ, $\Sigma = 0.5$ and $\sigma_w = 10$. When varying Σ, $\rho = 0.5$ and $\sigma_w = 10$. When varying σ_w, $\rho = 0.5$ and $\Sigma = 1$. The resulting ξ, which depends on I and A, is 1.50195.



are calculated using

$$\xi\left(\frac{\rho\sigma_w\sqrt{\Sigma}}{2}\right) \tag{4.7}$$

where ξ is the average ratio, across all evaluation points, between the numerically computed profit and the analytically calculated profit. The right set of graphs show that the computed values and scaled theoretic values are nearly indistinguishable, as the near 100% fit suggests. This high level of precision provides confidence that informed trading profits, in the presence of price feedback, are linear in the signal correlation, standard deviation of productivity and standard deviation of noise trading order flow as in the standard Kyle [1985] model. Before proceeding, I note that ξ depends on the firm's asset mix which is set at $I = A = 10$ in Figure 4.8.

If the generic trading profit function is assumed to be the numerically-approximated linear form (Equation (4.7)), I can represent the expected trading profits as a function of traditional microstructure variables and price feedback's linear scaling effect. The standard deviation of the post-trading price, $\rho\sqrt{\Sigma}$, depends on the level of information produced and the productivity variance. The standard deviation of noise trading order flow is σ_w. Letting $\delta = \frac{\xi}{2}$, the informed trader's expected trading profits are approximated by

$$\delta\rho\sigma_w\sqrt{\Sigma}. \tag{4.8}$$

which is a linear function of ρ.

4.3.2 Kyle (1985) Model With a Correlated Signal

I follow section 2 of Kyle [1985] to derive the trading profits of an informed trader possessing a signal potentially less than fully correlated with the true firm value. Given a signal s with $corr(\tilde{s}, \tilde{v}) = \rho$ the informed trader selects solves

$$\underset{x}{\text{Max}} \quad E\left[(\tilde{v} - \lambda(x(s) + u))x(s)|s\right]. \tag{4.9}$$

The first-order condition of the informed trader's profit optimization problem can be written as

$$x(s) = \frac{\rho(s - \bar{s})}{2\lambda}. \tag{4.10}$$

Conjecturing that the strategy is linear gives

$$x(s) = \beta s + a \tag{4.11}$$

where $\beta = \frac{\rho}{2\lambda}$ and $a = -\frac{\rho\bar{s}}{2\lambda}$. The market maker takes the strategy of the informed trader as given and sets the price equal to the expected value of the security conditional on the order flow. Application of the linear projection theorem yields

$$E[v] = \frac{cov[v,y]}{var[v]}(y - E[y]) = \frac{\rho\beta\Sigma}{\sigma_u^2 + \beta^2\Sigma}(y - E[y]) = \lambda(y - E[y]). \tag{4.12}$$

Solving for λ gives

$$\lambda^* = \frac{\rho\sqrt{\Sigma}}{2\sigma_w} \tag{4.13}$$

and the expected profit of the informed trader is

$$\frac{\rho\sigma_w\sqrt{\Sigma}}{2} \tag{4.14}$$

which is a linear function of ρ.

Chapter 5

Conclusion

I model a firm's decision to go public, its IPO process and its future investment decisions to demonstrate that underpriced IPO allocations can increase firm value. Underpriced IPO allocations align the firm's and outsiders' incentives, allowing the firm influence on information production. As a result, the firm induces a more informative post-IPO price, leading to more informed investment decisions. Increased price informativeness makes growth options more valuable *ex-ante*.

Intermediation by an underwriter facilitates the alignment of incentives for future information production when information is dispersed. While dispersed information introduces a free-rider problem and reduces the incentive power of allocations, an underwriter can provide additional incentives by inducing a stationary repeated game. Through monitoring and the threat of exclusion from future IPOs, the underwriter can enforce future information production provided that firms additionally underprice IPO shares, making IPO participation profitable. The underwriter provides a coordination mechanism, between one-time issuing firms and institutional investors who repeatedly participate in IPOs, which allows the firm to incentivize more information production than would otherwise be possible.

I develop a new measure of funds' informed trading to study links among underpricing, institutional allocations and post-IPO information production. Using significant quarterly changes in institutional holdings to proxy for informed trading, I show that aggregating informed trading over funds that receive allocations provides predictability of returns over the following quarter. This suggests that the measure does identify funds' trading on long-lived information. Furthermore,

the data indicate strong relations among underpricing, the number of institutional allocations and the measure of post-IPO informed trading. Economically, the number of institutional allocations receiving allocations and producing information are together a first-order determinant of underpricing. The data also indicate that investors' histories of informed trading are important determinants of allocations and future trading behavior, consistent with a repeated game existing between underwriters and investors. Finally, firms' future investment decisions are more sensitive to their post-IPO returns when they incentivize more information production through the IPO.

I extend the literatures on IPO underpricing, price feedback, institutional investors and underwriters by demonstrating how the IPO process can provide a significant opportunity for firms to influence their information environments. Institutional investors may contribute substantial value to economic activities by trading to credibly communicate dispersed information. Underwriters allow for high-value, high-information-production equilibria when information is dispersed. I demonstrate a channel through which primary and secondary financial markets interact to provide real economic benefits.

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Appendix A

Proofs of Propositions

Proof of Proposition 1:

Using Equation (2.15) in Equation (2.14) allows the participation constraint to be written as

$$\kappa(E[P_4] - P_1) - \frac{\kappa^2 \Sigma (2/\pi) I^2}{16c} + g(\sigma_w, \Sigma, A, I)\left(\hat{\rho}(\kappa) - \hat{\rho}(0)\right) - \frac{\kappa I \sqrt{\Sigma}\sqrt{2/\pi} g(\sigma_w, \Sigma, A, I)}{4c} \geq 0 \quad \text{(A.1)}$$

which simplifies to

$$\kappa(E[P_4] - P_1) - \frac{\kappa^2 \Sigma (2/\pi) I^2}{16c} \geq 0. \quad \text{(A.2)}$$

Before taking first-order conditions, I establish the following lemma to simplify the firm's problem.

Lemma 1. *For $\kappa > 0$, the outsider's participation constraint binds when Equation (2.17) is at a maximum.*

Proof of Lemma 1:

Suppose the opposite, that the outsider's participation constraint did not bind at the optimum. In that case, there exists an $\epsilon > 0$ such that the firm could increase the offer price P_1 to $P_1 + \epsilon$ without violating the inequality. The manager's objective function would then increase by $\kappa\epsilon > 0$. However, this would imply that Equation (2.17) was not at a maximum, providing a contradiction to the original supposition and proving that the participation constraint must bind at the optimum. □

Using Lemma 1 to re-write the participation constraint as an equality, substituting it into

Equation (2.17), and writing $\hat{\rho}$ as Equation (2.15) gives

$$\begin{aligned}\underset{\kappa}{\text{Max}} \quad & (1-\kappa)\left(A+\frac{I\sqrt{\Sigma}\sqrt{2/\pi}\left(g(\sigma_w,\Sigma,A,I)+\frac{1}{2}\kappa I\sqrt{\Sigma}\sqrt{2/\pi}\right)}{4c}\right) \\ & +\kappa\left(A+\frac{I\sqrt{\Sigma}\sqrt{2/\pi}\left(g(\sigma_w,\Sigma,A,I)+\frac{1}{2}\kappa I\sqrt{\Sigma}\sqrt{2/\pi}\right)}{4c}-\frac{\kappa\Sigma(2/\pi)I^2}{16c}\right) \\ & -g(\sigma_w,\Sigma,A,I)\frac{\left(g(\sigma_w,\Sigma,A,I)+\frac{1}{2}\kappa I\sqrt{\Sigma}\sqrt{2/\pi}\right)}{2c}\end{aligned} \tag{A.3}$$

Consolidating terms and simplifying gives

$$\underset{\kappa}{\text{Max}} \quad A+\kappa\frac{I^2\Sigma(2/\pi)}{8c}-\kappa^2\frac{I^2\Sigma(2/\pi)}{16c}-\kappa\frac{g(\sigma_w,\Sigma,A,I)I\sqrt{\Sigma}\sqrt{2/\pi}}{8c}-\frac{g(\sigma_w,\Sigma,A,I)^2}{2c} \tag{A.4}$$

Taking the derivative with respect to κ gives a first-order condition that can be expressed as

$$\kappa^* = 1-\frac{2g(\sigma_w,\Sigma,A,I)}{I\sqrt{\Sigma}\sqrt{2/\pi}}. \tag{A.5}$$

Substituting Equation (2.18) into Equation (2.15) gives the outsider's information production:

$$\begin{aligned}\rho^* &= \frac{g(\sigma_w,\Sigma,A,I)+\left(1-\frac{2g(\sigma_w,\Sigma,A,I)}{I\sqrt{\Sigma}\sqrt{2/\pi}}\right)\frac{1}{2}I\sqrt{\Sigma}\sqrt{2/\pi}}{2c} \\ &= \frac{I\sqrt{\Sigma}\sqrt{2/\pi}}{4c}.\end{aligned} \tag{A.6}$$

If the manager were able to possess the information production technology, he would solve

$$\underset{\rho}{\text{Max}} \quad A+\frac{1}{2}I\rho\sqrt{\Sigma}\sqrt{2/\pi}-c\rho^2. \tag{A.7}$$

The first-order condition sets the marginal benefit of information equal to its marginal cost giving the first-best information production as

$$\rho^{FB} = \frac{I\sqrt{\Sigma}\sqrt{2/\pi}}{4c} \tag{A.8}$$

which is equal to ρ^*.

Using Lemma 1, the profits of the outsider, conditional on κ^*, must be equal to the profits of the outsider when he owns no shares in the firm, so Equation (A.2) must hold with equality. This

implies that the dollar value of underpricing is

$$E[P_4^*] - P_1^* = \kappa^* \frac{I^2\Sigma(2/\pi)}{16c} \tag{A.9}$$

$$= \frac{I^2\Sigma(2/\pi)}{16c} - \frac{2g(\sigma_w, \Sigma, A, I)I\sqrt{\Sigma}\sqrt{2/\pi}}{16c}. \tag{A.10}$$

where

$$P_1^* = A + \frac{I^2\Sigma(2/\pi) + 2I\sqrt{\Sigma}\sqrt{2/\pi}g(\sigma_w, \Sigma, A, I)}{16c}. \tag{A.11}$$

and

$$P_4^* = A + \frac{I^2\Sigma(2/\pi)}{8c} \tag{A.12}$$

Underpricing as a percentage of the offer price is

$$\frac{E[P_4^*] - P_1^*}{P_1^*} = \frac{I^2\Sigma(2/\pi) - 2g(\sigma_w, \Sigma, A, I)I\sqrt{\Sigma}\sqrt{2/\pi}}{I^2\Sigma(2/\pi) + 2g(\sigma_w, \Sigma, A, I)I\sqrt{\Sigma}\sqrt{2/\pi} + 16cA}. \tag{A.13}$$

Finally, note that firm elects to go public if the maximized value of Equation (2.17) is greater than A which is satisfied if

$$\frac{\Sigma I^2(2/\pi)}{16c} - \frac{g(\sigma_w, \Sigma, A, I)^2}{4c} \geq 0 \tag{A.14}$$

Because no information is created and I assume zero trading costs when the firm remains private, the expansion project has net present value zero and the private firm's value is A. Equation (A.14) will then be greater than A, and the firm will go public, when the value created through price feedback exceeds the trading profits to the information-producing outsider, i.e.

$$\frac{\Sigma I^2(2/\pi)}{16c} \geq \frac{g(\sigma_w, \Sigma, A, I)^2}{4c} \tag{A.15}$$

which simplifies to

$$I\sqrt{\Sigma}\sqrt{2/\pi} \geq 2g(\sigma_w, \Sigma, A, I). \tag{A.16}$$

□

Proof of Proposition 2:

To show the proposed equilibrium is a sub-game perfect Nash equilibrium, I analyze each possible defection and show that the defector's resulting utility, assuming sub-game perfect play going forward, is weakly worse than the utility provided by equilibrium play.

The firm has several opportunities to deviate. If the firm chooses not to use the underwriter (when the equilibrium is to do so given the firm's parameters) and the underwriter's reputation is intact, then additional information production cannot be incentivized and firm value is reduced. On the other hand, if the underwriter's reputation is not intact and the firm chooses to use the underwriter, then the firm's action is sub-optimal as no information production will occur given the investors' strategy (only produce information if it weakly profitable to do so, and the underwriter's reputation is intact). If the firm sets an offer price too high or makes allocations too small, such that the underwriter will not monitor information production, then investors will not produce information after receiving allocations, and firm value is reduced. If the firm sets the offer price too low or makes allocations too large, the firm could increase the offer price or decrease allocations without altering information production, and thereby recapture some of the value lost to the information producers. If the firm sets an uneven allocation schedule, then the unequal allocation vector provides either excess or insufficient information production incentives to some investors. Because investors are homogeneous, they require the same level of allocation in order to produce information. If an excessive allocation is provided to an investor, the allocation could be reduced without altering the investor's information production decision, allowing more investors to have proper incentives, increasing information production. If insufficient allocations are provided for information production, then the insufficient allocations could be reduced to zero. This does not alter the amount of total information production, but it does reduce the value lost by the firm as it sells fewer shares at a discount. In either case, unequal allocations can be realigned to provide more wealth to the firms' initial investors. These deviations do not rely on future sub-game perfection as firms are one-time participants in the repeated game.

Investors have several opportunities to deviate, and in each case the off-equilibrium path is to earn zero future profits as a result of being excluded from future offerings. The threat of

exclusion is credible given the competitive fringe of information producers. Purchasing an allocation is weakly profitable in the equilibrium strategy, so defecting to earn zero cannot be profitable. After receiving an allocation when the underwriter's reputation is intact (implying that they are monitoring information production in the sub-game), producing information is weakly profitable in the equilibrium, so deviating to earn zero cannot be profitable. If the underwriter's reputation is not intact, after receiving an allocation it cannot be profitable to deviate and produce information, as doing so has no effect on future offerings (so it cannot provide additional profits) because the off-equilibrium path does not connect sub-games in any way.

The underwriter won't deviate from monitoring and enforcing information production as doing so results in a loss of a presumably discounted, infinitely lived stream of positive utility. The loss occurs because firms will only use the underwriter if its reputation is intact, and investors will only produce information if the underwriter's reputation is intact. This is a sub-game perfect threat, as neither firms nor investors can profitably deviate from this off-equilibrium path as doing so will not result in any information production or future profitable allocations. Furthermore, in the off-equilibrium path, the underwriter monitoring is not needed by firms or investors, as allocations provide sufficient internal incentives for information production that don't rely on future sub-games' profits.

As there are always an infinite number of future sub-games, these arguments apply at each sub-game, and the equilibrium is stationary across time. □

Proof of Proposition 3:

Given the two constraints governing the firm's optimization problem, begin by recognizing that there are three relevant cases: (i) only the individual rationality constraint binds (Equation (2.27)); (ii) both the individual rationality and incentive compatibility constraints bind (Equation (2.27) and Equation (2.29)); (iii) only the incentive compatibility constraint binds (Equation (2.29)). I consider the cases sequentially.

Case (i): Only individual rationality constraint binds

The individual rationality (participation) constraint can be written as

$$\hat{\kappa}P_1 \leq \frac{\sqrt{n}h(\sigma_w, \Sigma, I, A, N)}{\sqrt{N}} + \hat{\kappa}E[P_4] - \frac{cn}{N} \tag{A.17}$$

Appealing to a similar argument as in Lemma 1, the participation constraint will bind and after substitution the firm's problem becomes:

$$\underset{n}{\text{Max}} \qquad \left(A + \frac{1}{2}\sqrt{\frac{n}{N}}I\sqrt{\Sigma}\sqrt{2/\pi}\right) - \frac{cn}{N} \tag{A.18}$$

which is the same as the firm's problem were it to directly own the individual production technologies. The first-order condition of the firm's problem can be written as:

$$\sqrt{\frac{n^*}{N}} = \frac{I\sqrt{2/\pi}\sqrt{\Sigma}}{4c} \tag{A.19}$$

The offer price can then be calculated using the binding participation constraint:

$$P_1 = E[P_4] - \frac{n}{\hat{\kappa}}\left(\frac{c}{N} - \frac{h(\sigma_w, \Sigma, I, A, N)}{\sqrt{n}\sqrt{N}}\right) \tag{A.20}$$

and the underpricing percentage is:

$$\frac{E[P_4] - P_1}{P_1} = \frac{\frac{1}{\hat{\kappa}}\left(\frac{I^2\Sigma(2/\pi)}{16c} - \frac{h(\sigma_w,\Sigma,I,A,N)I\Sigma\sqrt{2/\pi}}{4c}\right)}{\frac{I^2\Sigma(2/\pi)}{8c} - \frac{1}{\hat{\kappa}}\left(\frac{I^2\Sigma(2/\pi)}{16c} - \frac{h(\sigma_w,\Sigma,I,A,N)I\Sigma\sqrt{2/\pi}}{4c}\right)} \tag{A.21}$$

Finally, note that this equilibrium is only applicable when the incentive compatibility constraint is slack, implying that

$$\hat{\kappa} > \frac{I\sqrt{\Sigma}\sqrt{2/\pi}\left(I\sqrt{\Sigma}\sqrt{2/\pi} - 4h(\sigma_w, \Sigma, I, A, N)\right)}{16c^2} \tag{A.22}$$

and the firm chooses to go public, which occurs if

$$I\sqrt{\Sigma}\sqrt{2/\pi} \geq 4h(\sigma_w, \Sigma, I, A, N). \tag{A.23}$$

Case (ii) Individual rationality and incentive compatibility constraints bind

In the case of two binding constraints, the individual rationality constraint can be substituted into the optimization while the incentive compatibility constraint can be re-written to incorporate the binding individual rationality constraint as

$$\frac{h(\sigma_w, \Sigma, I, A, N)}{\sqrt{n}\sqrt{N}} + \frac{\hat{\kappa}}{n}\frac{I\sqrt{2/\pi}\sqrt{\Sigma}}{4\sqrt{n}\sqrt{N}} \geq \frac{c}{N} \tag{A.24}$$

which can be substituted into the firm's problem, with the constraint's shadow price λ, giving:

$$\underset{n,\lambda}{\text{Max}} \quad \left(A + \frac{1}{2}\sqrt{\frac{n}{N}}I\sqrt{\Sigma}\sqrt{2/\pi}\right) - \frac{cn}{N} + \lambda\left(\frac{h(\sigma_w,\Sigma,I,A,N)}{\sqrt{n}\sqrt{N}} + \frac{\hat{\kappa}}{n}\frac{I\sqrt{2/\pi}\sqrt{\Sigma}}{4\sqrt{n}\sqrt{N}} - \frac{c}{N}\right) \tag{A.25}$$

Given that both constraints bind in this case, it must be that

$$n^{3/2}\frac{c}{N} - n\frac{h(\sigma_w,\Sigma,I,A,N)}{\sqrt{N}} - \frac{\hat{\kappa}I\sqrt{\Sigma}\sqrt{2/\pi}}{4\sqrt{N}} = 0 \tag{A.26}$$

Letting $x \equiv \sqrt{n}$, Equation (A.26) can be written as $x^3 + bx^2 + d = 0$, where

$$b = \frac{-h(\sigma_w,\Sigma,I,A,N)\sqrt{N}}{c} \tag{A.27}$$

$$d = -\frac{\hat{\kappa}I\sqrt{\Sigma}\sqrt{2/\pi}\sqrt{N}}{4c} \tag{A.28}$$

Following Nickalls [1993], there is one real solution to this equation which gives

$$\sqrt{n^*} = \frac{-b}{3} + \sqrt[3]{\frac{1}{2}\left(-d - \frac{2b^3}{27} + \sqrt{d^2 + \frac{4db^3}{27}}\right)} - \sqrt[3]{\frac{1}{2}\left(-d - \frac{2b^3}{27} - \sqrt{d^2 + \frac{4db^3}{27}}\right)} \tag{A.29}$$

This solution can be used to solve for P_4^*, P_1^* and the resulting underpricing given the other parameters of the model. Due to the complexity of n^*, I do not present the closed-form to these values and instead graphically represent the relationships in Figures (2.4) through (2.7). The parameter conditions under which this equilibrium results are discussed under case (iii).

Case (iii): Only incentive compatibility constraint binds

Substituting the binding incentive compatibility constraint into the firm's problem through P_1 gives:

$$\begin{aligned}\underset{n}{\text{Max}} \quad & (1-\hat{\kappa})\left(A + \frac{1}{2}\sqrt{\frac{n}{N}}I\sqrt{\Sigma}\sqrt{2/\pi}\right) + \hat{\kappa}E[P_4] + \frac{r\hat{\kappa}I\sqrt{\Sigma}\sqrt{2/\pi}}{4\sqrt{n}\sqrt{N}} \\ & + \frac{(1+r)h(\sigma_w,\Sigma,I,A,N)\sqrt{n}}{\sqrt{N}} - \frac{(1+r)cn}{N} - n\left(\frac{h(\sigma_w,\Sigma,I,A,N)}{\sqrt{n}\sqrt{N}}\right)\end{aligned} \tag{A.30}$$

Consolidating terms and taking the derivative with respect to n gives a first-order condition that can be written as:

$$\frac{I\sqrt{\Sigma}\sqrt{2/\pi}}{4\sqrt{n}\sqrt{N}} - \frac{r\hat{\kappa}I\sqrt{\Sigma}\sqrt{2/\pi}}{8n^{3/2}\sqrt{N}} + \frac{rh(\sigma_w,\Sigma,I,A,N)}{2\sqrt{n}\sqrt{N}} - \frac{(1+r)c}{N} = 0 \tag{A.31}$$

Letting $y \equiv \frac{1}{\sqrt{n}}$, Equation (A.31) can be written as a depressed cubic of the form $y^3 + Ay - B = 0$ where

$$A = \frac{-2(I\sqrt{2/\pi} + 2rh(\sigma_w, \Sigma, I, A, N))}{r\hat{\kappa}I\sqrt{2/\pi}} \tag{A.32}$$

$$B = \frac{-8c(1+r)}{r\hat{\kappa}I\sqrt{2/\pi}\sqrt{\Sigma}\sqrt{N}} \tag{A.33}$$

Following Nickalls [1993] there are three real solutions to this equation. Evaluating the objective function for each solution reveals that n^* is given by:

$$\frac{1}{\sqrt{n^*}} = 2\sqrt{\frac{-A}{3}}cos\left(\frac{2\pi}{3} - \frac{arccos\left(\frac{B}{-2(\frac{-A}{3})^{3/2}}\right)}{3}\right) \tag{A.34}$$

This solution can be used to solve for P_4^*, P_1^* and the resulting underpricing given the other parameters of the model. Due to the complexity of n^*, I do not present the closed-form to these values and instead graphically represent the relationships in Figures (2.4) through (2.7).

Case (iii) occurs when the firm elects to use the coordination ability of the underwriter to enforce future information production by using additional underpricing to provide incentives for the information producers by means of future IPOs. This equilibrium will result when the optimal number of investors exceeds that of case (ii), while otherwise other equilibria result. Due to the complexity of the optimal number of investors in cases (ii) and (iii), the distinction between the equilibria is shown graphically in Figures (2.4) through (2.7). □

Appendix B

Variable Definitions

AllocationPct: The shares reported by a fund in the 13F filings for the quarter following the IPO divided by the number of shares sold in the IPO.

AvgFlipped: Average value of *Flipped* for a fund's IPO holdings over the past five years.

AvgInformed: Average value of $Informed$ for a fund's IPO holdings over the past five years.

AvgInformed_25: Average value of $Informed\_25$ for a fund's IPO holdings over the past five years.

AvgInformed_100: Average value of $Informed\_100$ for a fund's IPO holdings over the past five years.

AvgInformed_BuyOrSell: Average value of $Informed\_BuyOrSell$ for a fund's IPO holdings over the past five years.

AvgInformed_MinBuySell: The minimum of $AvgInformed$ and $AvgInformed\_Sell$.

AvgInformed_Min4IPOs: Average value of $Informed$ for a fund's IPO holdings over the past five years, but requiring only 4 past IPOs rather than 8.

AvgInformed_NoSysSell: Average value of $Informed\_NoSysSell$ for a fund's IPO holdings over the past five years.

AvgInformed_Q3Q4: Average value of $Informed\_Q3Q4$ for a fund's IPO holdings over the past five years.

AvgInformed_Sell: Average value of $Informed\_Sell$ for a fund's IPO holdings over the past five years.

AvgIPOHoldTime: Average number of quarters the fund has maintained a position in the IPO firm's

stock for a fund's IPO holdings over the past five years.

AvgLongHolder: Average value of *LongHolder* for a fund's IPO holdings over the past five years.

AvgMaxPctChange: Average value of *MaxPctChange* for a fund's other IPO holdings over the past five years.

AvgMoneyLeft: Average value of *TotalMoneyLeft* for funds that receive allocations in an IPO.

AvgProbability: The average probability (over those institutional investors receiving allocations in an IPO) of institutional investors producing information in the future conditional on their specific allocation and characteristics.

AvgSystematicSell: Average value of *SystematicSell* for a fund's other IPO holdings over the past five years.

AvgUPConcurrentIPO: Average underpricing of IPOs issued in the same month as the IPO, as used in Ibbotson et al. [1975].

AvgVolume: Average daily volume, in millions of shares, in CRSP over the first six months of trading after a firm's IPO.

Churn: Measure of trading activity calculated following Yan and Zhang (2009).

FirmAge: Natural logarithm of the firm's age at the time of the IPO based on founding dates from the Field-Ritter dataset used in Field and Karpoff [2002] and Loughran and Ritter [2004].

FirstNumAnalysts: Number of analysts issuing reports in the first month after the end of the quiet period.

Flipped: Indicator variable equal to one if a fund has sold its initial holdings by the end of the second quarter.

FundAge: Number of years a fund has reported in the 13F filings data, starting in 1980.

FundValue: Total dollar value of a fund's positions reported in the 13F filings data.

IndustryOverweight: Excess weighting of the IPO firm's industry in a fund's portfolio, normalized by the standard deviation of all funds' weightings in that industry.

IndWeightStdDev: Fund's standard deviation of excess weightings in its portfolio for all industries. Higher values indicate less diversified, more industry-concentrated portfolios.

Informed: Indicator variable equal to one if a fund increased its position by at least 50% in any of the first three quarters following an IPO, and zero otherwise.

Informed_25: Indicator variable equal to one if a fund increased its position by at least 25% in any of the first three quarters following an IPO, and zero otherwise.

Informed_100: Indicator variable equal to one if a fund increased its position by at least 100% in any of the first three quarters following an IPO, and zero otherwise.

Informed_LinearAdj: Indicator variable equal to one if a fund's maximum adjusted position increase was in the top 26.25 percentile of adjusted increases after removing the expected increase conditional on the number of shares reported at the end of the first quarter after the IPO.

Informed_Q3Q4: Indicator variable equal to one if a fund increased its position by at least 50% in the third quarter or fourth quarter following an IPO, and zero otherwise.

Informed_NoSysSell: Indicator variable equal to one if a fund increased its position by at least 50% in any of the first three quarters following an IPO and $SystematicSell = 0$, and zero otherwise.

Informed_BuyOrSell: Indicator variable equal to one if a fund increased or decreased its position by at least 50% in any of the first three quarters following an IPO, and zero otherwise.

Informed_Sell: Indicator variable equal to one if a fund decreased its position by at least 50% in any of the first three quarters following an IPO, and zero otherwise.

Informed_SizeAdj: Indicator variable equal to one if a fund increased its position by more than a threshold level in any of the first three quarters following an IPO and $SystematicSell = 0$, and zero otherwise. The threshold level is based on the shares reported by the fund at the end of the quarter of the IPO, and thresholds are given in Table 4.9.

LongHolder: Indicator variable equal to one if a fund holds the IPO firm's stock at the end of the fourth quarter following the IPO.

MaxPctChange: A fund's maximum increase in position, as a percentage, for the three quarters following an IPO (capped at 250%).

MktReturn: Market return (CRSP value-weighted return) over the 15 trading days prior to the issue date.

MktStdDeviation: Standard deviation of market returns (CRSP value-weighted returns) over the 15 trading days prior to the issue date.

MoneyLeft: Economic value of underpricing to a fund. Calculated as the offering price times *Underpricing* times the number of shares owned by the fund.

MultipleTimes: Indicator variable equal to one if the fund has participated in more than one recent IPO by the underwriter of the current IPO.

NumConcurrentIPO: Number of IPOs issued in the same month as the IPO, as used in Ibbotson et al. [1975].

NumPrevIPOs: Number of IPOs a fund has received allocations in (i.e., reported holdings in as of the end of the quarter of the IPO) within the last five years.

NumInstInv: The number of institutional investors reporting holdings of the firm in the first quarterly report following the IPO.

OfferPriceRevision: Percentage change from the midpoint of the first offer price range to the final offering price. The positive relationship between underpricing and offer price revisions was first documented by Hanley [1993].

OneTime: Indicator variable equal to one if the fund has participated in one recent IPO by the underwriter of the current IPO.

OneYearNumAnalysts: Number of analysts issuing reports in the month one year after an IPO's issuance.

PercentSold: Total shares in the firm issued divided by the number of shares outstanding after the IPO. Bradley and Jordan [2002] uses a measure of overhang that captures the percent retained by the pre-IPO owners.

PercentInst: Total holdings of institutions in the first reporting quarter divided by the number of shares issued. A similar measure (using more precise allocations data) is used in Ljungqvist and Wilhelm [2002].

Proceeds: Natural logarithm of the total IPO proceeds adjusted to year 2000 dollars.

Shares: The number of shares reported by a fund in the 13F filings in the quarter following the IPO

(proxy for allocations).

Spread: Bid-ask spread estimator from Corwin and Schultz [2012].

SystematicSell: Indicator variable equal to one if a fund does not hold any shares of the IPO firm's stock at the end of the fourth quarter following the IPO, and did not increase its position in the stock in the second or third quarter following the IPO, and zero otherwise.

$TechFirm$: Indicator variable equal to one if the firm's SIC code is in a technology sector as defined by Cliff and Denis [2004].

$TotalInformed$: The total number of institutions making a large buy over the three quarters following the IPO (using $Informed$). Definitions for variations of $TotalInformed$ are constructed using the corresponding variations of $Informed$.

$TotalMoneyLeft$: Economic value of underpricing to all funds receiving allocations. Calculated by summing the offering price times $Underpricing$ times the number of shares owned by each fund over the number of funds receiving allocations.

$Underpricing$: Measured from the offer price to the price at the end of the first-day of trading.

$UnderwriterRank$: Carter Manaster rank originated in Carter and Manaster [1990], and further updated in Carter et al. [1998] and Loughran and Ritter [2004]. The data is taken from Jay Ritter's website.

$UWAvgUP$: Average abnormal underpricing for an underwriter over the five years preceding an IPO. This measure was first used by Hoberg [2007] as *UnderwriterPersistence*.

$UWInfoProd$: The underwriter's average level of abnormal $TotalInformed$ in its IPOs over the previous five years.

$VCBacked$: Indicator variable equal to one if the firm is backed by a venture capital firm, and zero otherwise.

$6MonthReturnStdDev$: Standard deviation of daily CRSP returns over the first six months following a firm's IPO.

$90DayReturn$: Return from the closing price on the firm's first day of trading (thereby excluding the underpricing in the return) to the closing price 90 days after the IPO.