Equity ownership in IPO issuers by brokerage firms and analyst research coverage

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1. Introduction

This study examines whether brokerage firm venture investment in an IPO issuer affects the firm's research coverage.[1] Since the early 1990s, brokerage firms have made substantial venture capital (VC) investments in young, privately held companies, often suggesting they can help bring these companies public. In fact, brokerage firms have reaped billions of dollars in profits bringing companies public.[2] Brokerage firm analysts actively participate in the VC investment decisions, the going-public underwriting process, and analyst coverage decisions relating to these IPO firms. In addition, analysts frequently make personal investments in these private companies as well [Maremont (2000), SEC (2005) and Unger (2001)].

Following the meltdown of internet and technology stocks in early 2000s, investors, regulators, and lawmakers raised serious concerns that combining venture investing and analyst research under one roof could create a serious conflict of interest between brokerage firms and public investors.[3] This is similar to their concerns about combining underwriting services and analyst research under one roof [e.g., Lin and McNichols (1998) and Michaely and Womack (1999)] or about combining auditing and consulting services under one roof [e.g., Zhang (2007)]. Specifically, the concerns have focused on whether analysts of brokerage firms with VC ownership ("affiliated analysts and firms") make more overly optimistic IPO recommendations than unaffiliated analysts, especially for weaker issuers and during the periods in which affiliated brokerage firms are likely to unload their share ownership.[4] These concerns are similar to the arguments that led to the passage of the Glass-Steagall Act, which separated

[1] According to the SEC (2005), sell-side analysts typically work for full-service broker-dealers, whereas buy-side analysts work for institutional money managers. Independent analysts work for firms without investment banking business. We use "analysts" and "firms" to refer to sell-side analysts and brokerage firms, respectively. We use "issuers" or "companies" to refer to the entities that analysts cover.

[2] These profits were a considerable portion of the overall profits of brokerage firms. For example, about 15% of the net income of Goldman Sachs in 1999 is from these profits. The figure is similar in many other firms.

[3] The SEC refers to this phenomenon as "venture investing," which is among four areas of conflict that "stand out" [Unger (2001) and SEC (2005)]. See also a front-page story in the Wall Street Journal about this phenomenon [Maremont (2000)]. An *Institutional Investor* article argues that it is one of "the most fundamental conflict of interest of all Wall Street Analysts" [Schack (2001)].

[4] For example, Chase H&Q took Infospace public in December 1998. Right after the expiration of the lockup period, Chase' venture capital subsidiary sold all the shareholdings from a venture investment made six months before IPO, pocketing a 7,000% profit. At the same time, Chase's analyst was reiterating a "must-own holding" on Infospace [Maremont (2000)].

commercial and investment banking for almost seven decades, or the passage of the SOX provision that force a separation of auditing and consulting services at accounting firms. These arguments also predict that stock recommendations by affiliated analysts are less informative and thus lead to smaller abnormal announcement returns. We term these concerns about brokerage firm incentives as the *conflict of interest hypothesis*. Supporters of this hypothesis have strenuously argued for prohibiting brokerage firm analysts from covering a company whenever the brokerage firm also is an investor in the company.

In light of the systemic problems in the banking industry highlighted by the Global Financial Crisis of 2008, there is renewed skepticism of the universal banking model and renewed interest in re-imposing major elements of the Glass-Steagall Act, which prohibited the integration of major investment banking and commercial banking activities for half a century after its passage. However, a blanket application of this Act's prohibitions may be unjustified and inefficient. As a counterpoint to the prior hypothesis, supporters of brokerage firm VC (BVC) ownership argue that combining VC and analyst functions under one roof can benefit both issuers and public investors. The argument is that these investments enhance the information advantage of affiliated analysts, which can benefit public investors through more accurate analyst reports. Since VCs generally obtain board representation or observation rights, frequent financial reports, and easy access to management, it follows that brokerage firm VC ownership can provide an information advantage to affiliated analysts over unaffiliated analysts and this information could be shared with public investors. Brokerage ownership can also give affiliated analysts stronger incentives to investigate these companies. Since IPO issuers and public firm issuers are required to disclose brokerage firm ownership in their prospectuses, affiliated analysts can have incentives to truthfully communicate to public investors in a timely manner their superior issuer information. This is due to 1) greater vulnerability of affiliated brokerage firms to litigation risks and regulatory liabilities, due to their information advantage and 2) the repeated nature of the IPO underwriting business, i.e., institutional investors are unlikely to be receptive to buying IPOs from brokerage firms with affiliated analysts who are more often misleading. In addition, Ljungqvist, Marston, Wilhelm (2006) show that analyst optimism does not help firms gain underwriting business from issuers. As a result, the

recommendations of affiliated analysts can be more informative and possibly less optimistic than those of unaffiliated analysts.[5] The fact that brokerage firms put their own capital at risk in their post-IPO shareholdings, which generally have lengthy lockup periods, can give affiliated analysts even more credibility.[6] We term this the *enhanced credibility hypothesis*.

Given the risky nature of IPOs, confounded by the limited information about company operations and financial conditions, IPO issuers generally face much greater stock price uncertainty and information asymmetry than seasoned public firms. This makes analyst reports especially important since they can improve the credibility of private companies going public. Since *Institutional Investor* (*II*) star analysts have higher visibility with investors, staking their reputation on the performance of the companies they cover, coverage by them can provide valuable added certification of an issuer. Thus, certification by *II* star analysts is likely to be especially valuable to IPO firms.[7] When brokerage firms are VC investors, they have stronger incentives to provide coverage by an affiliated *Institutional Investor* (*II*) star analyst to an IPO issuer, reflecting their improved alignment of interests with the IPO issuers. This enhances the value to a private company of having a brokerage firm as a VC investor. We term this the *issuer alignment of interest hypothesis*.

The debate as to whether and on what basis analysts and brokerage firm VCs should be allowed to invest in pre-IPO companies culminated in the SEC approval in 2002 of a new NASD Rule 2711 and amendments to NYSE Rules 351 and 472, of which a significant portion addresses the equity ownership and trading activities of analysts and their brokerage firms. Despite a public furor in 2002 over biased analyst research, regulators primarily adopted a market based approach to requiring public disclosure of significant brokerage ownership positions, instead of prohibiting all types of ownership. Specifically, the

[5] Stock recommendations are known to be overly optimistic, especially those pertaining to IPO issuers [e.g., Lin and McNichols (1998), Michaely and Womack (1999), Bradley, Jordan, Ritter (2003), James and Karceski (2006), and Ljungqvist, et al. (2006)]. For our IPO sample, 85.5% of the recommendations are strong buys or buys, while sell recommendations are less than one percent of all recommendations.

[6] Lockup agreements act to prohibit insider sales before a prespecified date, usually 180 calendar days after the IPO. Brokerage firms, like any investor, have to disclose equity ownership above 5%. If they are also an underwriter, they have to disclose any equity ownership or warrant based underwriting compensation.

rules only prohibit analysts from owning securities in issuers prior to an IPO or trading in them when they are taking positions against their own recommendations about the firm. Otherwise analysts can invest in companies they cover provided that they disclose in research reports and public appearance any personal ownership in listed companies as well as brokerage firm ownership when it exceeds 1% of outstanding shares in IPO firms or public companies.[8]

Using a sample of venture-backed IPOs over the 1994-2000 period, we examine the impact of brokerage firm VC ownership on analyst research before the passage of the new exchange rules in order to investigate whether these rules changes concerning to brokerage firm ownership are necessary. Since all the hypotheses predict that the impact of brokerage ownership increases with the investment's size, we focus on percentage shareholdings by brokerage firm VCs.

We first focus on the impact of brokerage shareholdings on the recommendations made by affiliated analysts in the first year after the IPO. We find that the likelihood of firms assigning *II* stars to cover these firms, especially higher ranked stars, increases with the size of brokerage shareholdings, which is consistent with the *issuer alignment of interest hypothesis*. Brokerage ownership appears to benefit public investors in two dimensions. First, the size of brokerage ownership reduces the likelihood of overly optimistic recommendations by affiliated analysts and it increases the likelihood of negative recommendations when compared to unaffiliated analysts. Second, the magnitude of the market reactions to recommendation announcements increases with the size of brokerage ownership, while the magnitude of the stock's abnormal returns in the year after the initial recommendations are unrelated to brokerage ownership. These results are consistent with the *enhanced credibility hypothesis* and are inconsistent with the *conflict of interest hypothesis*.

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[7] Consistent with star coverage being valuable to the issuers, prior research shows that star coverage has a strong influence on the market shares of investment banks [e.g., Dunbar (2000), Krigman, Shaw, Womack (2001), Cliff and Denis (2004), Rau, Patel, Khorana, Clarke (2007)].

[8] See Appendix for details about the rules concerning equity ownership. The NYSE and NASD had rules that required disclosure in research reports. However, the language in those rules used to be particularly vague – requiring only a boilerplate statement that a firm, the analyst or another employee "may" have an interest in the shares.

The *conflict of interest hypothesis* predicts that affiliated analysts would provide booster shots, especially for weaker and riskier issuers that the brokerage firm owns. In contrast, the *enhanced credibility hypothesis* predicts that affiliated analysts would be more objective and informative about these same issuers (1) to avoid legal liabilities and tainted reputations and (2) because they have better information access. When we examine the subsamples of issuers classified by information asymmetry and uncertainty, the enhanced credibility predictions are more strongly supported for riskier issuers with shorter histories and fewer tangible assets, which further validates the enhanced credibility hypothesis.

In the second and third years after the IPO, which is beyond the lockup period and generally after VCs' shareholding distribution to their investors, there is no significant difference in cumulative abnormal returns between issuers with and without brokerage ownership. This evidence is consistent with a direct relation between brokerage firm VC ownership and the benefits to issuers and investors.

We also find that affiliated analysts are never more optimistic than unaffiliated analysts during lockup expiration periods and other periods when VCs are likely to distribute their shareholdings to fund investors, even though the differences are mostly insignificant. Moreover, we do not find any concentration of initial or reaffirmed positive stock recommendations by affiliated analysts during these periods compared to unaffiliated analysts. Overall, our results suggest that allowing brokerage firms to have VC ownership, when combined with detailed analyst disclosure and restrictions on sales, benefits both IPO issuers and public investors and does not create a serious conflict of interest between brokerage firms and public investors. Our results support the market-based approach favored by regulators, while providing some suggestions on improving the existing rules in several dimensions.

Our study makes at least four contributions to the extant literature. First, to our knowledge, our study is the first to examine the impact of VC ownership by brokerage firms on their research coverage of newly listed firms, a phenomenon that has attracted extensive media coverage as well as heightened attention by various market participants. Second, our study provides evidence on an unexamined aspect of universal banking and complements several strands of this literature on other aspects of universal banking. Third, our study supports the usefulness of the NASD and NYSE rules on brokerage firm VC

ownership, and provides indirect evidence on the effects of the new rules on brokerage ownership in seasoned public companies and analyst ownership in general. Fourth, to our knowledge, this is the first study to examine the determinants of star analyst coverage of IPO firms and whether analysts provide booster shots to IPO issuers' stock prices at lockup expirations or other periods when distributions of VC shareholdings are likely.

Section 2 discusses the relation of our study to the existing literature and especially with respect to the effects of analyst share ownership. Section 3 describes sample data. Section 4 reports the results of brokerage firm VC ownership. The last section summarizes our conclusions.

2. Relation with the Existing Literature and with the Questions about Analyst Ownership

Our study complements several strands of the universal banking literature. A growing body of research on the impact of underwriting relationship on analyst research finds that stock recommendations and earnings forecasts of *underwriter affiliated* analysts are more biased than those of other analysts [e.g., Lin and McNichols (1998), Michaely and Womack (1999), O'Brien, McNichols, Lin (2005), and James and Karceski (2006)].[9] We examine the impact of brokerage ownership of issuer stock on affiliated analyst recommendations, while also controlling for the IPO underwriter status of these brokerage firms in our analysis. We also provide evidence on research coverage by underwriters over a longer horizon than prior research.

Our study is also related to the literature that examines the impact of VC equity ownership of financial institutions (FIs) on the IPO process. For example, using the equity ownership positions of major classes of FIs, including commercial banks, investment banks, and insurance companies, as well as the size of bank loans, Li and Masulis (2006) show that debt and equity ownership by various FIs reduces the IPO underpricing demanded by rational investors.[10] Despite the beneficial impact of FI ownership, little is known as to why IPO underpricing is reduced. Given that IPO underwriters increasingly offer

[9] Some recent studies question the robustness of this evidence with different samples [e.g., Bradley et al. (2006) and McNichols, O'Brien, and Pamukcu (2006)]

other post-IPO services such as research coverage [e.g., Krigman, Shaw, and Womack (2001) and Cliff and Denis (2004)] and market making [e.g., Aggarwal (2000) and Ellis, Michaely, and O'Hara (2000)], rational investors are likely to demand smaller IPO underpricing if they expect analyst coverage from affiliated brokerage firms to be less biased, as well as more informative and influential. Thus, our study provides evidence on one specific channel through which brokerage VC ownership can reduce IPO underpricing.[11]

Our investigation of analyst research during the period when VCs are likely to make share distributions complements the work of Bradley, Jordan, Ritter (2003) who investigate analyst coverage in the period immediately after the quiet period which ends after the 25th calendar day following the offering. Our examination of star analyst coverage complements the existing literature on affiliated and unaffiliated analyst coverage.[12] Recent work shows that star analyst coverage has a stronger influence on issuer decisions to award underwriting assignments to investment banks than regular analyst coverage [e.g., Dunbar (2000), Krigman, Shaw, Womack (2001), Cliff and Denis (2004), Rau, Patel, Khorana, Clarke (2007)]. Star analysts also appear quite influential with retail investors, an important brokerage firm customer base [e.g., Malmendier and Shanthikumar (2007)]. At the same time star analysts are in limited supply and are much more costly for brokerage firms to employ, given their higher salaries.[13] Our findings suggest that brokerage firm VC (BVC) ownership aligns the incentives of issuers and brokerage firms.

Our study indirectly addresses the wide-spread concern that analyst equity ownership in IPO issuers and seasoned public companies create incentives for analysts to frequently tout these companies in

[10] Our paper is also related to the extensive literature that examines the effects of bank lending on underwriting process. See Drucker and Puri (2006) for an excellent review.
[11] Another study by Gompers and Lerner (1999) finds no significant relation between underpricing and an indicator variable for underwriter share ownership in venture-backed IPOs.
[12] For example, Michaely and Womack (1999) and Bradley, et al. (2003) find that lead underwriters are more likely to provide IPO coverage and Cliff and Denis (2004) find that issuers purchase regular analyst coverage with underpricing, whereas Bradley et al. (2006) show that for the 1999-2000 period these results are limited to the coverage initiated at the end of quiet period.
[13] For evidence that star analysts can earn millions of dollars in extra compensation, see Laderman (1998) and Kessler (2001).

research reports and in talks with the news media.[14] Furthermore, analyst ownership can create information benefits and conflicts of interest similar to brokerage firm VC ownership and has attracted at least as much critical attention [e.g., Gasparino and Opdyke (2001), Opdyke (2001a), Schack (2001), and Unger (2001)]. A division of opinion on whether analyst should be able to own stocks that they cover has led brokerage firms and regulators to adopt alternative approaches [e.g., Schack (2001), Boni and Womack (2002a), Boni and Womack (2002b), Craig (2001), Delpit (2001)].[15] Since 2001 brokerage firms have started disclosing in their research reports the stock ownership positions they and their analysts hold. In widely reported moves, several large brokerage firms actually banned any analyst ownership.[16] Further, the NASD and NYSE enacted rules mandating the disclosure of analyst ownership in publicly held stocks and prohibiting pre-IPO ownership by analysts.[17]

One reason for the differences of opinion and the alternative approaches is the lack of empirical evidence about the impact of analyst ownership [Opdyke (2001a)]. This dearth of research is partly due to data limitations concerning analyst ownership. Before the recent NASD and NYSE rules, analysts did not have to disclose their personal ownership. The spotty data that exists in this period makes it difficult to clearly identify analyst with and without stock ownership in all circumstances. After the implementation of the recent exchange rules, analysts are only allowed to invest in seasoned public companies if they disclose the existence, though not the size, of their ownership positions. The new exchange rules changes make it nearly impossible to study the impact of pre-IPO analyst ownership on their IPO coverage. Also, post-regulation data on analyst ownership in seasoned companies is limited because several large firms

[14] For example, about 120 of 600 Merrill Lynch analysts world-wide own stocks they cover [Gasparino and Opdyke (2001)]. CSFB and Edward Jones both report that one-third of their analysts own stocks they cover. In a survey conducted by the Securities and Exchange Commission (SEC), nearly 30% of surveyed analysts bought cheap stock in private companies that they later covered after the companies finish their IPOs. The survey also shows that some analysts pocketed millions of dollars in profits by executing trades contrary to their buy recommendations, and some even sold short stocks on which they had issued buy recommendations [Opdyke (2001b)].

[15] For example, among industry practitioners, Schack (2001) reports that most sell-side professionals do not see analyst ownership as problematic, whereas Boni and Womack (2002b) find that buy-side professionals are evenly divided about analyst ownership of listed stocks, but only 8% of their survey respondents agreed that analysts should be allowed to have pre-IPO ownership.

[16] For example, Morgan Stanley and Goldman Sachs require analysts to disclose their ownership and Goldman also requires disclosure of ownership by members of their households. Prudential requires disclosure if analysts own more than $10,000 of stocks. Edward Jones, Merrill Lynch, and Credit Suisse First Boston banned analysts from owning shares of companies under coverage [Gasparino and Opdyke (2001) and Opdyke (2001a)].

now prohibit such ownership and analysts do not have to disclose the size of their ownership. Further, even if analyst ownership is available, it is usually tiny in percentage and dollar terms. Moreover, its impact is difficult to assess unless we can compare it to an analyst's personal wealth. Given these data constraints, the controversies revolving around analyst ownership are likely to remain unresolved. [18]

Even if we do not have actual analyst ownership, our evidence adds to the understanding of how analyst ownership affects research coverage for the following reasons. First, the disclosure restrictions on analyst ownership after the new exchange rules are similar to those on BVC ownership before these rules are implemented (which is effectively our sample period). Second, the sale restrictions on analyst ownership after the new exchange rules are similar to those on BVC ownership that existed before these new rules. The equity ownership in IPOs by analysts and their brokerage firms has always been subject to sale restrictions, and both analysts and their firms have to comply with lockup restrictions and have to file Form 144 disclosures of trades in shares acquired through venture investing. In comparison, analyst ownership in seasoned public companies is subject to sale restrictions after the passage of the new exchange rules. Third, since analyst compensation is likely to depend on the returns realized on brokerage firm VC ownership, analyst incentives are likely to be similar to the incentives created by personal ownership in these firms. In addition to analyst ownership, our evidence has implications for the impact on research coverage of brokerage ownership in seasoned public companies, following similar logic.[19]

3. Data Sources and Descriptive Statistics [Do we include Financials & Utilities?]

Our sample begins with the population of 1,286 venture-backed IPOs completed over the 1994-2000 period taken from Thomson Financial's Securities Data Corporation's (SDC) Corporate New Issue

[17] See Appendix for two recent enforcement cases by the SEC and NASD related to analyst ownership.
[18] Our paper complements a contemporaneous study by Johnston (2006) who investigates the impact of analyst ownership on IPO research coverage on the basis of small samples. His examination is hampered by the above data constraints. He finds an insignificant impact of analyst stock ownership on research coverage, except that the ownership reduces recommendation bias. Given the much larger size of BVC ownership, the economic significance of BVC ownership is likely to dominate that of analyst ownership. Studying BVC ownership also allows us to obtain a much bigger sample.
[19] The differences for seasoned companies are that analysts need to disclose the presence of more than 1% brokerage ownership and any ownership by themselves and that there are no sale restrictions for brokerage firms.

Database. The sample excludes unit offers, closed-end funds (including REITs), ADRs, foreign issues, reverse LBOs, limited partnerships, equity carve-outs, and IPOs with offer prices below $5, which are likely to have different accounting treatment and different incentives for going public.[20] After obtaining prospectuses for all 1,286 IPOs, we verify that they are venture-backed by reading the "Principal Shareholder" and "Underwriting" sections of each prospectus. Excluding 17 IPOs that are not really venture backed and 34 IPOs without analyst coverage leaves us a final sample of 1,235 IPOs.

Stock recommendations are taken from the Institutional Brokers Estimate System (I/B/E/S) U.S. Detail Recommendation History File that we obtain in 2002. The database starts in October 1993, and includes both brokerage firm-specific recommendations and standardized I/B/E/S recommendations. The standardized I/B/E/S recommendations are integer ratings from 1 through 5, corresponding to "strong buy," "buy," "hold," "underperform," and "sell." We merge underperforms and sells into one "sell" category and assign it an integer rating of 4 in our analysis given the scarcity of negative recommendations. Following the prior literature, we focus on the recommendations made in the first year after IPO, though we also examine those made in the second and third years [e.g., Bradley, Jordan, and Ritter (2006), Cliff and Denis (2004), James and Karceski (2006), and Michaely and Womack (1999)]. This leads to a sample of 8,551 recommendations made by 181 firms and 1,756 analysts in the first year after the IPOs.

Data on IPO characteristics are taken from many sources. Our primary focus is on brokerage firm shareholdings in issuers immediately after the IPOs because this is the most recent ownership figure when analysts initiate coverage following the quiet period.[21, 22] We hand collect from IPO prospectuses detailed information on brokerage VC ownership, the complete list of syndicate members, percentage of

[20] We focus on this period because it is associated with a large number of venture backed IPOs. We start our sample in 1994 also because our recommendation data starts in October 1993. Our sample ends in 2000 because (1) our analysis requires four years of post-IPO data, (2) Ljungqvist, Malloy, and Marston (2006) find that I/B/E/S analyst recommendation data are subject to manipulation after 2000, and (3) it furthers our understanding of the impacts of BVC ownership before the recent exchange rules changes and thus yields implications about the necessity of these rules, e.g., whether brokerage VC ownership should be prohibited.

[21] Quiet period ends 25 days after IPOs during our sample period. During the quiet period, the SEC generally prohibits issuers and their underwriters from publishing opinions about valuation and from making forward-looking statements about different cash flow measures.

secondary shares offered, as well as pre-IPO information on shares outstanding and total assets. Firms who are not underwriters have to report equity ownership above 5% in the "Principal Shareholder" section of the prospectus. Underwriters have to disclose their pre-IPO equity ownership of all sizes in the "Underwriting" section of the prospectus, though we also find additional ownership in the "Principal Shareholder" section. Brokerage VC ownership includes shares held by firms' subsidiaries such as captive venture capital funds. We collect the number of shares corresponding to brokerage warrant holdings and include it in the post-IPO BVC ownership. Information on VC fund affiliations with brokerage firms comes from the Pratt's Guide to Venture Capital Sources, VentureXpert and individual VC websites. During our sample period, brokerage firms experience a substantial number of mergers and acquisitions. If one firm acquires another, we assume that the surviving firm acquires the entire VC investment portfolio and analyst coverage by both firms after the acquisition completion date. We obtain the timing of the mergers from the appendix of Corwin and Schultz (2005).

We obtain additional IPO issue characteristics from an array of other sources. The Sand Hill Aggregate VC Portfolio Holdings Index is taken from Sand Hill Econometrics. This index measures the total value of VC portfolios companies each month, and its change measures aggregate returns to VCs. Stock capitalization, closing prices, shares outstanding, share trades, and stock returns are from the University of Chicago's Center for Research in Securities Prices (CRSP) database. SIC and GICS codes are from the Compustat annual database. The indicator for simultaneous global offerings is from SDC. The data on underwriter reputation and incorporation dates are from Jay Ritter's website.[23] The VentureXpert database is the main source for the number of VC funding rounds prior to the IPO.

We construct a variety of variables that capture the characteristics of recommendations, analysts, and issuers. Table 1 reports variable definitions and Table 2 presents the summary statistics. The sample is classified by whether brokerage firms have equity ownership. Given 8,551 recommendations on 1,235 IPOs, analysts make about seven recommendations on an IPO in the first year. Overly optimistic

[22] The results are similar for pre-IPO shareholdings and are available upon request

[23] We thank Jay Ritter for making the data available at his website (http://bear.cba.ufl.edu/ritter/ipodata.htm).

recommendations dominate IPO coverage; more than 85% of the recommendations are either buys or strong buys.

Comparing columns 2 and 3 of Table 2, IPOs with brokerage VC ownership have fewer strong buys, but more buy recommendations. They are also more likely to receive analyst coverage from underwriters. Affiliated analysts cover fewer stocks and issue fewer reports. Turning to issuer characteristics, issuers with brokerage VC ownership are significantly larger. They have greater pre-IPO total assets and post-IPO market capitalization, raise more gross proceeds, and conduct more global offerings. These IPOs experience smaller underpricing and first month returns, have less CEO ownership and other VC ownership, and sell fewer secondary offering shares. These IPOs are more frequently offered during the 1999-2000 period and when venture returns are greater, based on the Sand Hill VC Index. The last row of the table shows that about 30% of IPO issuers have one or more brokerage firms with VC ownership making analyst recommendations.

Since a firm can issue several recommendations a year on an issuer, Table 3 reports summary statistics on research coverage of IPO issuers by brokerage firms, which is composed of 5,815 unique combinations of issuers and brokerage firm analysts. We use IPO issuer-brokerage firm data to investigate whether a brokerage firm with VC ownership in an IPO issuer is more likely to provide star analyst coverage. From Table 2 we can infer that within the first year of the IPO, each brokerage firm makes an average of 1.47 analyst recommendations on the stock (= 8,551 / 5,815), and there are an average of 4.71 analysts from brokerage firms covering each IPO (= 5,815 / 1,235). About 11.20% of the coverage is by *II* star analysts (= 651 / 5,815). About 8% of brokerage firms covering IPOs have VC ownership (= 465 / 5,815), and on average a brokerage firm holds 4.45% of IPO issuers' equity.

Underwriters are more active in covering IPO issuers; 3,214 of the total unique combinations of issuers and brokerage firms covering them are associated with underwriters (= 1,538 + 1,676). Underwriters, especially lead underwriters, are also more likely to provide star analyst coverage and have VC share ownership. About 21% of lead underwriters provide star analyst coverage, which is the highest among all brokerage firm groups (= 324 / 1538). About 17% of lead underwriters that provide coverage

also have VC ownership, which is again higher than any other group of brokerage firms (= 263 / 1538). The average ownership among these lead underwriters is 4.71%. These facts suggest that it is important to control for underwriter status in our analysis.[24]

Table 4 presents summary statistics on analyst recommendations categorized by level and direction of stock recommendations. We use brokerage firm data to analyze the optimism and abnormal returns of analyst recommendations. We present the number of recommendations in each category, as well as average industry-adjusted abnormal returns over the five day (-2, +2) event window. We define the industry-adjusted abnormal return as the buy-and-hold return on IPO issuer *i* minus the buy and hold return on an equally weighted industry portfolio for the same GICS industry:[25]

$$Abnormal\ Return_{a\ to\ b} = [\prod_{t=a\ to\ b}(1 + r_t^i) - \prod_{t=a\ to\ b}(1 + r_t^{industry})], \quad (1)$$

where r_t^i is the raw return on issuer *i* on day *t*, and $r_t^{industry}$ is the return on the matched industry index.

To examine the direction of stock recommendations, we include initiations of analyst coverage with initial investment recommendations, which represents 68% of the total sample (= 5,815 / 8,551), along with a large number of subsequent revisions in recommendations (both upgrades and downgrades). Investors seem to recognize that IPO coverage is overly optimistic. Initiations of hold recommendations are associated with significantly negative abnormal returns. The abnormal returns on the release of negative hold and sell recommendations, as well as all downgrades, are associated with much larger abnormal returns in magnitude than other recommendations, and these abnormal returns are all significantly negative. The largest abnormal returns of -16% are associated with the release of recommendation downgrades to hold or sell. For other recommendations, the release of initial recommendations and upgrades to buy and strong buy are associated with significant positive abnormal returns, with upgrades having a relatively larger effect. Reiterations of buy and strong buy

[24] We find brokerage VC ownership by non-underwriters in only 21 IPOs. This is likely to be due to the fact that firms who are not in the syndicate do not have to report ownership less than 5%, as evident in the higher level of ownership when it is reported (8.31%). This small sample is also likely to affect the significance level for coefficient estimates related to non-underwriter ownership.

[25] The S&P/MSCI Global Industry Classification System (GICS) assigns each company to one of the 10 sections, 24 industry groups, 62 industries, and 122 sub-industries. Following Boni and Womack (2006), we match IPO issuers with industry indexes based on the 62 GICS industries.

recommendations have insignificant abnormal returns, suggesting that investors perceive these reiterations as providing little new information on average.

4. Empirical Analysis

4.1. Brokerage Firm VC Ownership and the Likelihood of Star Analyst Coverage

We begin the analysis by examining whether brokerage firm VC ownership affects the probability that an IPO issuer is covered by an *II* star analyst. Each year *II* publishes a list of first, second, third, and runners-up All-American analyst teams in each industry based on a survey of money managers. Star analysts have significant positive influence on an investment bank's market share. For example, Dunbar (2000) and Rau et al. (2007) report that the market share of an equity underwriter significantly increases if it has a star analyst covering the industry. Krigman, et al. (2001) show that star coverage is the most important element in issuer management's decision to switch underwriters between an issuer's IPO and its subsequent seasoned equity offering. Using issuer level data, Cliff and Denis (2004) find that issuers use greater underpricing to pay lead underwriters for regular analyst coverage over the 1993-2000 period, whereas Bradley et al. (2006) show that this phenomenon does not exist in the 1999-2000 period. If VC ownership aligns the interests of brokerage firms and IPO issuers, then we should expect the likelihood of star analyst coverage, especially highly ranked star analysts, to increase with brokerage VC (BVC) ownership.

To examine whether a firm assigns an *II* star analyst to cover an issuer, we rely on IPO issuer-brokerage level data. We study star analyst coverage using two models specified as follows:

$$\textit{Existence of Star}_{i,j} \text{ or } \textit{Rank of Star Analyst}_{i,j}$$
$$= f\left(a_0 + a_1 \bullet \textit{BVC Ownership}_{i,j} + a_2 \bullet \textit{Control Variables}_{i,j}\right). \quad (2)$$

We examine the probability of firms providing star analyst coverage using a probit model. The dependent variable, $\textit{Existence of Star}_{i,j}$, is an indicator variable that is one if brokerage firm *j* assigns an *II* star analyst to cover issuer *i* and zero otherwise. Analyst rank is based on *II* rankings in the year prior to the IPO. We analyze the probability of brokerage firms providing higher ranked star analyst coverage

using an ordered probit model. The dependent variable, *Rank of Star*$_{i,j}$, equals one through four if firm *j* assigns to issuer *i* an analyst who belongs to the first through the runners-up teams, respectively. The dependent variable is five if a non-star analyst is assigned. If the likelihood of firms assigning star analysts, especially the higher ranked stars, increases with the size of BVC ownership, the coefficient estimate of BVC ownership should be positive in the probit model and negative in the ordered probit model.

The release dates of analyst recommendations clusters in calendar time [Welch (2000)]. For example, Bradley et al. (2003) show that many recommendations are issued right after the end of the quiet period. Thus, we adjust coefficient estimate standard errors for cross-sectional correlation at the IPO issuer level throughout our analysis and employ a broad set of control variables. To avoid look-ahead bias, we exclude variables that are not publicly known by the end of quiet period. The control variables for star analyst coverage include IPO issuer and brokerage firm characteristics that could influence the star analyst coverage decision. We include the underwriter status of brokerage firms because they have more reputation and financial capital at stake as their underwriting syndicate responsibilities increase, which should increase the likelihood of star analyst coverage in the same way that VC ownership does, as evident in Table 3. We include brokerage firm size and investment bank reputation because they are important determinants of whether analysts become *II* stars [Emory and Li (2007)]. As a result, larger brokerage firms and especially brokerage firms with more underwriting business are likely to have more star analysts available. We also include a direct measure of star analyst availability. This is an indicator variable that is one if in the IPO year a brokerage firm has an *II* star analyst in the same industry as the issuer, and zero otherwise. We include IPO underpricing because Cliff and Denis (2004) show that issuers use part of the underpricing to compensate underwriters for providing regular analyst coverage. Greater underwriter compensation should increase the likelihood that issuers obtain star analyst coverage.

We include a few measures of IPO issuer size and prominence: the logarithm of total assets and an indicator for NYSE listing. Since larger and more prominent companies are likely to generate greater

future investment banking business, they are more likely to obtain star analyst coverage. Finally, we include a bubble period indicator to control for any time period variation during the 1999-2000 period.

Column (1) of Table 5 reports the coefficient estimates of the probit model on the existence of star analyst coverage. The coefficient estimate of BVC ownership is positive and significant at the 1% level. In untabulated results, we find that the marginal effect of BVC ownership, measured by the increase in the probability of star analyst coverage for a one-standard deviation increase in BVC ownership, is 0.93%. Since Table 3 shows that 11.20% (= 651 / 5815) of the IPO issuer-brokerage firm sample has *II* star analyst coverage, the marginal effect of BVC ownership results in a non-trivial increase in the unconditional probability of star analyst coverage of 8.30% (= 0.93 / 11.20).

Column (2) of Table 5 reports the coefficient estimates of the ordered probit model used to examine whether brokerage firms are more likely to assign higher ranked analysts (with stars being the highest rank) to provide issuer coverage as their VC percentage ownership increases. Brokerage firms could primarily assign runners-up to *II* star analysts to cover the issuers, instead of higher ranked star analysts who are more influential and more highly compensated. The coefficient estimate of BVC ownership in column (2) is negative and significant at the 1% level. To understand the economic significance of the results, we examine the marginal effects of brokerage firm VC ownership. In untabulated results, we find that the marginal effect of BVC ownership is 0.24%, 0.18%, 0.13%, and 0.24%, respectively, for the probability of brokerage firms assigning an analyst in the first through the three runners-up categories of *II* star analysts. Given the probabilities of being covered by analysts ranked in the first three runners-up *II* categories as well as top ranked *II* star analysts are 2.41%, 2.53%, 2.03%, and 4.23% respectively, the marginal effect of BVC ownership on the unconditional probabilities of brokerage firms assigning an analyst from the top ranked through the three runners-up teams of *II* star analysts are 9.96%, 6.92%, 6.16%, and 5.67% (= 0.24 / 4.23), respectively. Thus, brokerage firms with larger VC ownership are particularly likely to assign higher ranked star analysts to cover these issuers. In comparison, the marginal effect of VC ownership is -0.79% for the probability of brokerage firms

assigning non-star analysts. Given that non-star analysts are 88.80% of our sample, the marginal effect of VC ownership by brokerage firms reduces this unconditional probability by 0.89% (= -0.79 / 88.80).

In the ordered probit model shown in column (3), we differentiate VC ownership of brokerage firms by IPO underwriting status, using interaction terms. Coefficient estimates on VC ownership by lead underwriters and co-managers are negative and significant at the 5% and 10% level, respectively, whereas the coefficient estimate on VC ownership of other brokerage firms is insignificant. Thus, our results suggest that when brokerage firms have greater reputation and financial capital at stake, VC ownership increases their propensity to provide star analyst coverage, and especially higher ranked analysts.[26]

We also split the IPO sample by issuers with high and low information asymmetry. If VC ownership aligns the interests of affiliated brokerage firms with those of IPO issuers, then the impact of VC ownership on star analyst coverage should be stronger for IPOs with greater information asymmetry, because these IPOs would benefit more from the stronger certification of a star analyst. In columns (4) and (5), we report ordered probit estimates when the sample is split based on median company age, which is our primary measure of information asymmetry. For relatively younger and older IPOs, VC ownership has a significant negative effect at the 1% and 10% levels respectively, on the rank of the analyst that the brokerage firm provides. We find similar results when using other common measures of information asymmetry and uncertainty such as company size, aftermarket stock return variance, and the proportion of tangible assets. The fact that VC ownership creates a stronger alignment of interest between brokerage firms and weaker and riskier IPO issuers provides further support for the *issuer alignment of interest hypothesis*.

Examining the control variables, they are all statistically significant and have coefficient signs consistent with prior work. The pseudo R-squares are 44% and 37% for the probit and ordered probit models respectively, indicating that our models explain a sizable portion of the cross-sectional variability in star analyst coverage. Overall, the results in this section are consistent with the *issuer alignment of interest hypothesis*.

4.2. VC Ownership by Brokerage Firms and Analyst Recommendation Optimism

This section examines the impact of BVC ownership on recommendation optimism. Consistent with the prior literature, IPO coverage is particularly tainted with overly optimistic recommendations. Table 2 shows that more than 85% of the sample recommendations are either strong buys or buys. The *enhanced credibility hypothesis* predicts that the recommendations of affiliated analysts should be relatively more objective than those of unaffiliated analysts, especially for weaker and riskier issuers, whereas the *conflict of interest hypothesis* predicts the opposite.

We use analyst recommendations in this and the next sections to examine how the size of brokerage firm's VC ownership affects the likelihood that an individual analyst's recommendation is more optimistic or informative. We examine recommendation optimism using variants of the following model.

$$Strong\ Buy_{i,j,k} \text{ or } Level\ of\ Recommendations_{i,j,k}$$
$$= f\,(a_0 + a_1 \bullet BVC\ Ownership_{i,j,k} + a_2 \bullet Control\ Variables_{i,j,k}). \qquad (3)$$

We use a probit model to analyze the probability that a recommendation is a strong buy. The dependent variable, $Strong\ Buy_{i,j,k}$, is an indicator variable that is one if a recommendation made by analyst k from firm j on issuer i is a strong buy and zero otherwise. We use an ordered probit model to analyze whether percentage BVC ownership reduces the probability of positive recommendations, as well as increasing the probability of negative recommendations. The dependent variable, $Level\ of\ Recommendations_{i,j,k}$, equals one through four if a recommendation made by analyst k from firm j on issuer i is a strong buy, buy, hold, and sell, respectively. If VC ownership by a brokerage firm enhances the credibility of its analysts by reducing the likelihood of overly optimistic recommendations and increasing the likelihood of negative recommendations, the coefficient estimate of VC ownership should be negative in the probit model and positive in the ordered probit model. If VC ownership mainly creates

[26] The insignificant estimate for the BVC ownership of other brokerage firms here and throughout the paper could be due to the very small number of other brokerage firms with BVC ownership.

conflicts of interest between brokerage firms and public investors, we expect these two coefficients to have opposite signs to those predicted by the *enhanced credibility hypothesis*.

We employ a broad set of control variables that capture potentially important firm, issuer and analyst characteristics. We control for underwriter status because lead underwriters seem to be particularly biased in their IPO coverage [e.g., Lin and McNichols (1998), and Michaely and Womack (1999)]. Brokerage firm prestige is measured by its size and investment banking reputation. More prestigious firms are less likely to mislead investors by making overly optimistic recommendations because they have more reputation capital at stake [e.g., Ljungqvist, Marston, Wilhelm (2006)]. We include gross proceeds and issuer market capitalization to control for the size and prominence of an IPO. To capture differences in analyst activity levels, the analysis includes the number of reports made by an analyst and the number stocks an analyst covers [Clement (1999) and Jacob, Lys, and Neale (1999)]. To assess whether star analysts are more overly optimistic than other analysts, we include an indicator for *II* star analysts. If star analysts are less likely to issue overly optimistic recommendations because they personally have more reputation capital at stake, we need to control for star analyst status, especially given our prior finding that star coverage increases with the size of a brokerage firm's VC ownership. We include an indicator for recommendations made within the first month of IPOs because Bradley et al. (2006) find that relatively more optimistic recommendations by underwriters occur in the period right after the quiet period, at least during the 1999-2000 bubble period. Finally, we include a bubble period indicator to control for any time period variation during the last two years of our sample period.

Column (1) of Table 6 reports the coefficient estimates in our probit model for the probability of strong buy recommendations. The coefficient estimate of BVC ownership is negative and significant at the 1% level. In untabulated results, we find that the marginal effect of BVC ownership on the probability of that affiliated analysts make strong buy recommendations is -7.18%. Since Table 2 shows that 39.12% of all recommendations are strong buys, the marginal effect of VC ownership results in a reduction in the unconditional probability of strong buy recommendations of 18.35% (= -7.18 / 39.12).

We use an ordered probit model to examine the impact of brokerage firm VC ownership at each recommendation level. If the ordered probit model estimates indicate that brokerage firm VC ownership not only reduces the number of overly optimistic strong buy recommendations, as shown in Table 2, but also raises the number of negative recommendations of holds and sells, the results will be even stronger.

Column (2) of Table 6 reports that the coefficient estimate of brokerage firm VC ownership is positive and significant at the 1% level in this model. To understand the economic significance of the results, we examine the marginal effects of BVC ownership. In untabulated results, we find that the marginal effect of BVC ownership is -5.21%, 2.12%, 2.82%, and 0.28%, respectively, on the probability of a strong buy, buy, hold, and sell. Table 2 reports that the unconditional probabilities of these four levels of recommendations are 39.12%, 46.38%, 13.74%, and 0.76% respectively. Thus, the marginal effect of brokerage firm VC ownership reduces the unconditional probability of strong buys by 13.32% (= -5.21 / 39.12), and increases the unconditional probability of buys, holds, and sells by 4.57%, 20.52%, and 36.84%, respectively. The fact that brokerage firm VC ownership significantly reduces the probability of strong buys is consistent with the probit model estimates. The ordered probit model further shows that brokerage firm VC ownership substantially increases the probability of negative recommendations of holds and sells. Interestingly, the marginal effect of brokerage firm VC ownership is much stronger when it comes to negative recommendations.

In column (3), we differentiate VC ownership by the underwriter status of brokerage firms. The coefficient estimate on the VC ownership of lead underwriters is positive and significant at the 1% level, whereas VC ownership of co-managers and other brokerage firms are insignificant. To the extent that the recommendations of lead underwriters are usually the most biased, our results suggest that VC ownership induces brokerage firm analysts to provide overly optimistic recommendations less frequently, especially when these firms face greater conflicts of interest with IPO investors due to their lead underwriter role.

We again split the IPO sample by information asymmetry levels. If VC ownership intensifies brokerage firm conflicts of interest with IPO investors or undermines the credibility of its affiliated analysts, this effect should be stronger for IPOs with greater information asymmetry. For example, the

conflict of interest hypothesis predicts that affiliated analysts are more likely to provide booster shots to weaker and riskier issuers. In columns (4) and (5), we measure information asymmetry by issuer age and split the IPO sample at the median issuer age. Ordered probit estimates show that for younger IPO issuers, brokerage firm VC ownership has a positive coefficient that is significant at the 1% level, which indicates that VC ownership reduces analyst recommendations on these IPOs. In contrast, for older IPO firms, brokerage firm VC ownership has an insignificant effect. We find similar results when using other common measures of information asymmetry such as company size, aftermarket stock return variance and the proportion of tangible assets. The results provide further support for the *enhanced credibility hypothesis*.

The coefficient estimates of almost all the control variables are highly significant with expected signs. One interesting finding is that recommendations made by II star analysts or in bubble period are more overly optimistic. We find several other interesting findings concerning the relative optimism of underwriters. First, indicators for underwriters and quiet period are both insignificant for the probit model in column (1), although in untabulated results, we find that the coefficient estimates of the underwriter indicator are significantly positive when the quiet period indicator is excluded. Second, lead underwriters are more overly optimistic, even after adjusting for the quiet period indicator in columns (2) and (3). However, compared to the untabulated results without quiet period indicator, the tabulated results suggest that the impact of underwriter status is weaker. Overall, our results suggest that the quiet period indicator weakens the perceived positive optimism of underwriters, but does not completely eliminate it for our sample. Our results based on a longer sample period complement Bradley et al. (2006). We also find that the pseudo R-squares are about 4% for all the models, consistent with the results in similar studies [e.g., James and Karceski (2006)]. Overall, our results in this section are consistent with the *enhanced credibility hypothesis* and inconsistent with the *conflict of interest hypothesis*.

4.3. VC Ownership by Brokerage Firms and the Informativeness of Analyst Recommendations

In this section, we examine whether VC ownership by brokerage firms benefits investors by providing them with more informative analyst recommendations. The *enhanced credibility hypothesis* predicts that the recommendations of affiliated analysts are likely to be more informative than those of unaffiliated analysts, especially for weaker and riskier issuers, whereas the *conflict of interest hypothesis* predicts the opposite. This analysis provides an independent test of the two hypotheses analyzed in Section 4.2. Although affiliated analysts are less overly optimistic, their recommendations may not be more informative, because informativeness is affected by many factors including optimism.

We use the following regression model to analyze the impact of brokerage firm VC ownership on the informativeness of analyst recommendations.

$$Informativeness_{i,j,k} = a_0 + a_1 \bullet BVC\ Ownership_{i,j,k} + a_2 \bullet Control\ Variables_{i,j,k} + u_{i,j,k,} \quad (4)$$

where we measure the informativeness of a recommendation by analyst *k* from brokerage firm *j* on issuer *i* using the abnormal stock return over the event day window (-2, +2) around the recommendation release date. We adjust abnormal returns of negative recommendations by multiplying them by a minus one. Negative recommendations include holds, sells, as well as buy recommendations that are downgrades of strong buys. Thus, the abnormal returns of a total of 1,701 recommendations have reversed signs according to Table 4 (= 1,175 + 65 + 461). Analysts are implicitly advising investors to sell off or short sell stocks with these negative recommendations, and investors recognize that these recommendations are negative signals as evident by the associated negative event period abnormal returns. The abnormal returns of the analyst's other positive recommendations are not adjusted.

We calculate the abnormal returns based on a buy-and-hold strategy using benchmarks such as the value- and equal-weighted CRSP indexes, the value- and equal-weighted indexes of the stock exchanges on which the IPOs list, the S&P 500 index, size decile indexes, and industry indexes. While the results are similar for all the indexes, we believe that the industry index is the most appropriate

because analysts are usually industry experts [Boni and Womack (2006)]. We therefore focus our discussion on the industry-adjusted excess returns.[27]

We employ a broad set of control variables in the above regression analysis. We include an indicator for underwriter status, since lead underwriter recommendations are reported to be more biased, and thus, less informative. We include indicators for the levels and directions of recommendations because the estimates in Table 4 show that recommendations of different levels and directions have abnormal returns of very different magnitudes. We control for brokerage firm size since (1) larger brokers can provide analysts with more resources, enabling them to produce more informative recommendations and (2) larger brokerage firms have larger sales forces and more customers, which could mean their recommendations have stronger impacts on event period returns [Stickel (1995)]. Larger brokerage firms are also found to be less overly optimistic in Section 4.2. We also control for the IPO return starting at the offer price and percentage share turnover, both measured at the end of the quiet period. Divergence in opinions creates trading volume, and is also likely to increase the demand for analyst research and its impact on stock prices. We control for the number of analyst reports issued and the number of stocks covered since issuing frequent reports may reduce the informativeness of each recommendation, while covering more stocks could enable analysts to have a better understanding of industry trends or leave them with less time to carefully analyze individual firms. We also have an indicator for *II* star analysts since the informativeness of star analyst recommendations could be greater than that of non-star analysts. We include an indicator for recommendations made within the first month of IPOs because Bradley et al. (2006) show that during the bubble period analysts affiliated with underwriters had relatively more optimistic recommendations, especially immediately after the quiet period. Finally, we include a bubble period indicator to control for a weakening of market conditions during the last two years of our sample period.

[27] Boni and Womack (2006) show that industry groups constructed with 62 GICS industries are very good proxies for Wall Street industry groupings. They also find that the value of analyst recommendations lies in analysts' ability to pick stocks within industries. Following Boni and Womack (2006), we present results using industry indexes based on the 62 GICS industries. Using industry indexes based on two-digit SIC codes or Fama-French 48 industries yields similar conclusions.

Column (1) of Table 7 examines how brokerage firm VC ownership affects the adjusted event period abnormal returns of analyst recommendations. The coefficient estimate of brokerage VC ownership is positive and significant at the 1% level. To interpret the economic significance, the results suggest that a one percent increase in its VC ownership increases adjusted abnormal returns by 0.26%. Given an average adjusted abnormal return of 3.99% during the event period and an average BVC ownership of 4.45%, average brokerage firm VC ownership increases the average abnormal returns of their analyst recommendations by about 29% (= 0.26 * 4.45 / 3.99).

In column (2), we distinguish across brokerage firm VC ownership by underwriter status. The VC ownership of lead underwriters and co-managers has a coefficient estimate that is positive and significant at the 1% and 10% level, respectively. To the extent that lead underwriters are more biased as suggested by Table 6, our results are also consistent with VC ownership enabling brokerage firms to have more informative recommendations, especially when other brokerage firms are found to be strongly biased. The results are consistent with the *enhanced credibility hypothesis*.

We also split the IPO sample into high and low asymmetric information issuers. If VC ownership enhances the credibility of broker affiliated analysts, their credibility should have a stronger impact on the recommendations concerning IPOs with greater information asymmetry. The *conflict of interest hypothesis* has the opposite predictions. In columns (3) and (4), we report the results when the sample is split based on median issuer age, as one proxy for asymmetric information. Brokerage firm VC ownership has a positive effect that is significant at the 1% and 10% levels, respectively, on the informativeness of recommendations for younger and older IPO issuers, respectively. We find similar results when using other common measures of information asymmetry such as company size, aftermarket stock return variance and the proportion of tangible assets. The results provide further support for the *enhanced credibility hypothesis*.

As a robustness check, we use the absolute value of the event period abnormal returns to measure informativeness. The results in column (5) of Table 7 show that brokerage firm VC ownership has a positive coefficient, which is significant at the 1% level, consistent with the results in columns (1)-(4).

The coefficient estimates of control variables are also similar across the two measures of recommendation informativeness.

The coefficient estimates of the control variables in Table 7 are all highly significant and have their expected signs with two exceptions. First, consistent with Bradley et al. (2006), recommendations of underwriters do not seem to be more or less informative than other brokerage firms after controlling for the timing of recommendations. Second, the recommendations of II star analysts do not seem to be more or less informative than non-star analysts. The adjusted R-squares are about 9%-14% for all the models, which indicates that the models explain a sizable portion of the cross-sectional variability in recommendation informativeness.

We further investigate the impact of brokerage firm VC ownership on the adjusted post-event abnormal returns over the three months, six months, and one year after an analyst recommendation announcement using equation (4). We adjust post-event abnormal returns the same way we adjust event-period abnormal returns. It is important to determine whether investors are underreacting or overreacting to analyst recommendations of brokerage firms with VC ownership. The event period impact of analysts from brokerage firms with VC ownership could be due to investors erroneously believing that these affiliated analysts have enhanced credibility, which may be a result of the marketing efforts of the sales forces of these brokerage firms [Stickel (1995)]. This overreaction argument predicts a negative and significant impact of brokerage VC ownership on adjusted post-event abnormal returns as investors realize that affiliated analyst recommendations are not more informative. Alternatively, investors may not fully recognize the enhanced credibility of affiliated analysts during the event period. This underreaction argument predicts a positive and significant relation between brokerage VC ownership and the adjusted post-event abnormal returns, similar to the positive relation between brokerage VC ownership and the adjusted event-period abnormal returns.

In untabulated results, we find that the coefficient estimates of BVC ownership are insignificant when we use the adjusted post-event abnormal returns as dependent variables in equation (4), which suggests that investors rationally attribute greater credibility to affiliated analysts during the event period.

These results also suggest that larger reactions to recommendations by analysts of brokerage firm with VC ownership are not a result of brokerage firm marketing power misleading IPO investors.

4.4. Post-Lockup VC Share Distributions

News media and regulators have accused affiliated analysts of providing booster shots to issuer stock prices by reiterating overly optimistic recommendations around lockup expiration periods, enabling affiliated brokerage firms to unload their shares and leave public investors stranded, as predicted by the *conflict of interest hypothesis* [see, e.g., SEC (2005)]. If this is the case, the recommendations of affiliated analysts in brokerage firms with VC ownership should be more overly optimistic and less informative than those of unaffiliated analysts during these periods, and their reiterations of strong buy and buy recommendations during these periods should be a larger portion of all their positive reiterations.

In untabulated results, we examine the recommendations issued during the periods of 10 to 120 days around lockup expiration dates using two approaches to investigate whether affiliated analysts provide booster shots to issuer stock prices. First, we use equations (3) and (4) and find that affiliated analysts issue less overly optimistic and more informative recommendations during these periods than unaffiliated analysts, even though the differences are insignificant in a majority of cases. Second, we do not find a statistically significant concentration of positive recommendation reiterations by affiliated analysts during these periods when compared to unaffiliated analysts.

To further investigate whether issuer stock prices receive booster shots, we also examine other periods where VCs are likely to make share distributions of portfolio company stock. Gompers and Lerner (2004) report VC funds do not usually sell their portfolio company shareholdings, but instead distribute their shares to the fund's limited partners. Furthermore, the typical VC fund distributes its shares about a year after the IPO. In untabulated results, we do not find a concentration of positive reiterations from affiliated analysts between the lockup expirations and eighteenth month after IPOs. Affiliated analysts also issue less optimistic recommendations during these periods, though the differences are statistically insignificant in most cases. Thus, brokerage firm VC ownership does not seem

to induce booster shots during lockup expiration periods or share distribution periods, and the allegations of booster shots used to argue for more stringent regulation of brokerage firm VC ownership seem to be unfounded. The results are inconsistent with the *conflict of interest hypothesis* and weakly support the *enhanced credibility hypothesis*. [28]

At the distribution of VC shareholdings, the issuer experiences the loss of a large blockholder. VCs usually leave the board at about the same time [Gompers and Lerner (2004)]. If our findings which support the *issuer alignment of interest hypothesis* and the *enhanced credibility hypothesis* are really due to VC ownership, then after the fund share distributions affiliated brokerage firms are likely to lose their information advantage and their enhanced incentives to provide star analyst coverage and to avoid legal and regulatory liabilities and tainted reputation due to poor analyst recommendations. In untabulated results, we do not find any significant differences in research coverage or analyst recommendations between brokerage firms with and without VC ownership in the period after the typical VC fund makes its share distribution, i.e., the second and third year after IPOs. These results further support issuer and IPO investor benefits associated with brokerage firm VC ownership.

4.5. The Presence and Size of Brokerage Firm VC Ownership and the "One Percent" Rule

We can measure brokerage firm VC ownership in an IPO issuer either qualitatively by an indicator or quantitatively by the VC's percentage shareholder ownership. The indicator for brokerage firm VC ownership captures its presence as a shareholder, whereas the BVC ownership percentage measures its size. We investigate whether brokerage firms should be required to disclose the size of their VC ownership positions, in addition to the presence of this ownership, by examining whether the actual size of BVC ownership provides additional information beyond the existence of share ownership. If the presence and size of brokerage firm VC ownership both have an impact on analyst research coverage, or if only the size of BVC ownership affects coverage, then we can conclude that the size of VC ownership

[28] The insignificant results related to lockup expirations and share distributions could be due to the small samples.

is likely to provide more information to investors, and regulators should consider requiring the disclosure of the size of brokerage firm VC ownership.

We focus on the significance of an indicator variable for the existence of underwriter VC ownership on IPO coverage. Note that non-underwriters must generally report brokerage firm VC ownership over 5%, whereas underwriters have to report any ownership level regardless of size. In untabulated results, we replace percentage BVC ownership with this indicator in equations (2)-(4) and find that this indicator has a significantly negative effect on recommendation optimism (at the 5% level), a positive and weakly significant effect (at the 10% level) on star analyst coverage, and an insignificant effect on the informativeness of recommendations. Thus, this indicator has weaker effects than the brokerage firm's VC ownership percentage. This indicator is generally insignificant when we simultaneously include VC ownership percentage in equations (2)-(4), indicating that the information associated with the presence of VC ownership is subsumed by the size of this ownership position. The results suggest that investors can infer more information by knowing the size of brokerage firm VC ownership.

The new NASD and NYSE rules require brokerage firms to disclose in their analyst research reports when their equity ownership is above one percent in any listed companies. The "one percent" threshold is arbitrary, and the NASD solicited public comments about its appropriateness when issuing the proposed rules [Unger (2001)]. We compare the impact of this threshold to that of requiring disclosure of any equity ownership. If disclosing ownership at this threshold gives investors valuable information, then having a threshold may actually enable brokerage firms to avoid disclosing potential conflicts of interest when they are below the 1% ownership level. In untabulated results, we find that an indicator for share ownership above one percent has qualitatively the same effects on various aspects of analyst research coverage explored in equations (2)-(4) as an indicator for any underwriter VC ownership as discussed previously. Thus, a "zero percent" threshold is not less informative than a "one percent" threshold. However, our evidence suggests that regulators should consider requiring the disclosure of

brokerage firm and analyst percentage ownership positions because this information is valuable to investors trying to assess the reliability of analyst recommendations.

4.6. Sensitivity Analysis

4.6.1. Controlling for Endogeneity

In the earlier analysis, we treat brokerage firm VC ownership as exogenous, but there are plausible reasons to believe otherwise. For example, VC ownership may be an endogenous consequence of brokerage firm investment criteria, both at the initiation of VC funding and as long as equity ownership in the company is maintained [e.g., Lee and Wahal (2004)]. As companies receive further rounds of venture financing, brokerage firms have to decide whether to continue investing, accept certain level of dilution, or exit from their investments. At the IPO date, brokerage firms also have to decide whether to sell some or all of their shareholdings, as well as how many new shares the IPO issuer should offer [Delaney (2005)].

Endogeneity may generate selection biases and result in inconsistent model estimates. To address the potential endogeneity problem, we estimate a two-equation treatment model [Maddala (1983)]. The endogenous decision is modeled through a treatment equation. Suppose there is an unobservable underlying variable, *BVC Ownership**, that determines the size of brokerage firm equity ownership (post-IPO) in an issuer, the treatment rule for *BVC Ownership** is

$$BVC\,Ownership^{*} = M'b + \varepsilon \tag{5a}$$

$$BVC\,Ownership = \begin{cases} 100 & when \;\; 100 \le BVC\,Ownership^{*} \quad (5b) \\ BVC\,Ownership^{*} & when \;\; 0 < BVC\,Ownership^{*} \le 100 \quad (5c) \\ 0 & when \;\; BVC\,Ownership^{*} \le 0 \quad (5d) \end{cases}$$

where the indexes are omitted for simplicity. *BVC Ownership** is a latent variable observed only when a brokerage firm has post-IPO equity ownership in an issuer; *M* represents a vector of determinants of the firm's equity ownership; *b* is a vector of coefficients multiplying the elements of *M*; and ε is a disturbance term assumed to have a standard normal distribution. If *BVC Ownership** exceeds 100, the brokerage firm's observed percentage ownership in the issuer, *BVC Ownership*, equals to 100; if *BVC Ownership**

drops below 0, *BVC Ownership* equals to 0; otherwise *BVC Ownership** is equal to *BVC Ownership*. Thus, *BVC Ownership* is a two-boundary Tobit variable, constrained between 0 and 100.

The second equation of the treatment model analyzes the effects of brokerage firm VC ownership on different aspects of research coverage by controlling for brokerage firm, issuer, and analyst characteristics. Depending on the question analyzed, the second equation is a probit model, an ordered probit model, or an ordinary least squares model as specified in equations (2)-(4). For example, focusing on recommendation informativeness, the second equation of the treatment model will be equation (4), where the disturbance term u is assumed to be normally distributed with mean zero, variance σ^2_u, and a correlation of ρ with ε.

Since we measure brokerage firm VC ownership immediately after the IPO, we limit the Tobit model's explanatory variables to issuer and brokerage characteristics known as of the IPO date to avoid any look-ahead bias. To take into account investor demand at the IPOs, we include offer price revision. To control for an offer's credibility with investors, we include lead underwriter reputation measured by its investment banking ranking. To control for underwriter status, we include separate indicators for firms that are lead managers or co-managers. We measure issuer size and issue complexity with pre-IPO total assets and an indicator for global offerings. We include company age to capture the information asymmetry between issuers and public investors. We use the percentage of secondary shares in the IPO to control for the impact of insider selling. We include the number of financing rounds and other VC ownership to control for size and intensity of VC investment. We include changes in aggregate VC investment level (Sand Hill Index) over the prior quarter to proxy for VC expected returns. All the significant repressors in the Tobit model that do not appear in the second equation of the treatment model are actually insignificant in the second equation and thus serve as valid instrumental variables.

To understand the expected impact of the explanatory variables, we need to understand the incentives of VCs. VC investments are usually structured as limited partnerships designed to immediately return to their partners any cash inflows realized by the funds as they exit their portfolio companies. Exits through IPOs are the most attractive option because IPOs tend to generate the highest profits, which are

essential for VCs to raise more capital in the future. An important determinant of the market reception to the IPOs is the size of the equity ownership that the VCs retain after IPOs. Prior research shows that given information asymmetry, public investors demand greater underpricing of IPO shares if VCs retain less shares after the IPOs [e.g., Leland and Pyle (1977), Ritter (1984), and Downes and Heinkel (1982)]. Thus, the perceived information asymmetry is positively related to the size of ownership position that VCs retain. Sensitive to the extremely high level of perceived information asymmetry associated with IPO issuers, VCs typically accept lockup restrictions to enhance investor demand, thereby reducing IPO underpricing. VCs also frequently hold their shares long after lockup expirations [Gompers and Lerner (2004)], so as to allow the information asymmetry and uncertainty about the stock to dissipate more before making share distributions to their limited partners.

Since brokerage firm VCs have incentives similar to traditional VCs, we expect company age, underwriter reputation, prior venture returns, offer price revisions, and secondary shares proportion of the IPO to have negative effect on post-IPO brokerage ownership, because these variables are likely to be negatively correlated with the level of information asymmetry between issuers and public investors. Older issuers generally have more financial and operating information available. Underwriter reputation serves as a certification of issuer quality that can alleviate information asymmetry. Higher venture returns measured by the changes in Sand Hill Index raise investor perceptions about issuer quality. Larger upward price revisions also indicate investor optimism about issuer quality. Optimistic expectations of investors can reduce investor concern about information asymmetry and cause them to accept less underpricing. Secondary share offerings are likely to rise when underwriters assess information asymmetry to be relatively low and do not object to insider sales at the IPO date. Brokerage firm VC arms are likely to retain fewer issuer shares if other investors are allowed to sell shares in secondary offerings.

We expect the other explanatory variables to have positive effects on brokerage firm VC ownership. Global offerings are more complicated than purely domestic IPOs. They also face myriad of disparate securities regulations across various countries where they are selling the IPO and can intensify the information asymmetry that foreign investors face. BVC shareholders who are also underwriters are

likely to have greater information advantages relative to other BVC shareholders, and thus are likely to retain more shares to avoid the appearance of conflicts of interest with public investors. Brokerage firms with VC shareholdings may keep a larger ownership position in larger IPO issuers because these issuers are less risky or because these issuers are more complex. Further, investments by traditional VCs that compete to meet issuer funding needs may crowd out venture investments by brokerage firm VCs.

We simultaneously estimate the two-equation treatment model using maximum likelihood methods. After adjusting for selectivity, our estimates of the effects of brokerage firm VC ownership are similar to those reported in Tables 5 - 7. In untabulated results, the coefficient estimate of brokerage firm VC ownership is 0.03 for the existence of star coverage and -0.03 for analyst ranking, with t-statistic of 2.42 and -2.47, respectively. The coefficient estimate of brokerage firm VC ownership is -0.19 for the existence of strong buys and is 0.14 for the analyst recommendation level, with t-statistic of -3.39 and 2.87, respectively. Further, the coefficient estimate of brokerage firm VC ownership is 0.33 for the adjusted event period abnormal returns, with a t-statistic of 2.73. Thus, our conclusions are not affected by adjustments for endogeneity.[29]

In Table 8, we present single equation Tobit model estimates (equation (5)) using both the recommendation-level sample and the firm-issuer level sample. These results are similar to those obtained from the joint maximum likelihood estimation of equation (5) along with one of the equations (2) through (4). For brevity, we do not present the five sets of coefficient estimates of the Tobit model corresponding to the five models in equations (2) through (4). As evident in Table 8, all the coefficient estimates have the expected signs and are statistically significant at conventional significance levels. The pseudo R-squares are 29% for the recommendation-level sample and 13% for the firm-issuer level sample, which indicates that our model explains a sizable portion of the cross-sectional variability in brokerage firm VC ownership. The significant coefficient estimates and sizable pseudo R-squares are clear evidence that

[29] One explanation for the more overly optimistic recommendations of underwriters is mutual selection of issuers and brokerage firms based on common optimism: issuers are likely to select brokerage firms with more optimistic views about their prospects and brokerage firms are more likely to underwrite issuers in which they have positive assessments. However, this hypothesis cannot consistently explain our findings. Although more optimistic brokerage

brokerage firm VCs actively determine their on-going investment levels based on issuer characteristics, even though this endogeneity does not seem to affect our conclusions.

4.6.2. Additional Control Variables

We also control for many other variables that could affect a firm's post-IPO equity ownership decision. We include some control variables for all the research coverage dimensions that we examine, whereas we include other controls solely for a specific research coverage dimension. Given that these control variables are largely insignificant and do not affect our conclusions, the results are not tabulated, but are available upon request.

We begin with control variables potentially relevant to all the research coverage dimensions. To reflect individual VC specialization in a few promising industries or technologies, we control for industry fixed effect using indicators for 62 GICS industries, or alternatively indicators for two-digit SIC codes, indicators for Fama-French 48 industries, or indicators for financial, utility, Internet, and technology companies respectively. To control for time variations in IPO market conditions and overall VC investment activity, we include yearly fixed effects [e.g., Lee and Wahal (2004)]. We include indicators for an issuer's state of incorporation to capture the strong preferences of VCs to invest in firms geographically nearby. We include measures of VC reputation such as VC age and the number of IPOs backed by the VCs, since more reputable VCs are likely to bring in more investment banking business. As a result, brokerage firms may provide star analyst coverage and issue more optimistic recommendations to please these VCs, and this increased optimism could reduce the informativeness of their recommendations. We include the equity ownership of other VCs to capture the nurturing activities of other non-brokerage firm VCs.

We include gross spread to control for an important element of underwriter compensation. Greater compensation to underwriters can increase the likelihood of receiving both star analyst coverage and more optimistic recommendations. We include the number of IPOs, the average underpricing of

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firms are more likely to have larger shareholdings in these issuers and to provide star analyst coverage, it is not clear

recent IPOs, and the matched market index returns in the past three months to control for recent market conditions. We include CEO ownership and the proportion of secondary shares because firms may issue overly optimistic recommendations and provide star analyst coverage to boost up stock prices when insiders are selling more shares and when CEOs own more shares.[30] We control for issuer size with its equity valued at the offer prices and an NYSE listing indicator. We control for issue size with gross proceeds and the percentage of new shares offered. We include an indicator for the largest six auditors to control for auditor reputation. We measure information asymmetry with tangible assets as a percentage of fixed assets, indicators for the Internet bubble period and for the existence of lockup agreements. We also include pre-IPO issuer characteristics such as company age, the number of business segments, the number of two-digit SIC industries that an issuer has a significant presence in, and the prior-year number of companies in the same two-digit SIC code.

With respect to star analyst coverage and recommendation informativeness, we also control for issue size with the logarithm of gross proceeds. With respect to the recommendation optimism of star analysts, we include percentage share turnover and the IPO return from offer price to the end of the quiet period. Since higher share turnover and return momentum tend to induce further trading interest, firms are more likely to provide star analyst coverage to attract this future trading volume. Higher return momentum also indicates investor optimism, which can be related to more optimistic recommendations.

With respect to optimism and informativeness of other analyst recommendations, we control for a brokerage firm's industry specialization by including the proportion of its analysts in the same industry as the issuer. We also include underpricing because companies that compensate underwriters through greater underpricing could receive more optimistic recommendations. We include an indicator for global offers to control for the prominence and complexity of these issues. We include pre-IPO issuer characteristics such as listing exchange and total assets. We also include analyst characteristics such as the number of analysts

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why these firms would simultaneously issue less optimistic recommendations.

[30] News media reports that CEOs were crucial in the decision of awarding investment banking deals. For example, in the recent controversies about "spinning," issuer CEOs awarded the investment banking business of their own companies to underwriters in exchange for share allocations in hot IPOs [e.g., Chaffin, Michaels, and Silverman (2002), and Smith (2002)].

that cover the same issuer and experience measured as the number of years that an analyst appears in the I/B/E/S earnings forecast database as well as the number of other recommendations issued during the recommendation announcement period.

4.6.3. Other Sensitivity Tests

We segment the IPO sample period in several ways. Bradley et. al. (2003) report that I/B/E/S analyst coverage is less complete in the early portion of our sample period. Although we do not see any reason why this could affect our results, we nevertheless split our sample in two and find that it does not affect our results. Breaking the sample period at the bubble period of 1999-2000 does not affect our results either. Bradley et al. (2003) also show that intensive analyst coverage, especially overly optimistic recommendations, occurs immediately after the quiet period and Bradley et al. (2006) find that recommendations made immediately after the quiet period are different from those made in the next 11 months. Thus, we examine whether brokerage firms with VC ownership have a different impact on the recommendations made immediately after the quiet period's expiration. We find that affiliated analysts are not significantly different from the other analysts in terms of recommendation optimism, possibly due to sample size, yet the recommendations of affiliated analysts continue to be more informative.

Because Cliff and Denis (2004) report that Merrill Lynch is not covered in the I/B/E/S database until 1998, we exclude IPOs in which Merrill Lynch is a syndicate member. We also substitute dollar ownership of brokerage firms in place of percentage ownership. To ensure that our results are not driven by outliers, we estimate quantile regressions and alternatively winsorize our sample at the 1% and 5% levels. Since other VC ownership and brokerage firm VC ownership are likely to be negatively correlated, we eliminate other VC ownership in Table 8 to avoid a potential simultaneity problem. We also eliminate star analyst availability in Table 5, or define star analyst availability by whether the brokerage firm has a star analyst in the industry. We find very similar results for all these additional tests.

5. Conclusions

Using a comprehensive sample of VC-backed IPOs over the 1994-2000 period, we examine the impact of venture investments in IPO issuers by brokerage firms on their analysts' IPO research coverage. We find that this ownership raises the likelihood that a brokerage firm will provide *Institutional Investor* star analyst coverage, especially by higher ranked star analysts. Their equity ownership also enhances both the accuracy and credibility of "affiliated" brokerage firm analysts, which benefits public investors. We find affiliated analysts produce more informative and less overly optimistic recommendations than unaffiliated analysts, especially for weaker and riskier issuers and especially when brokerage firms face potentially more acute conflicts of interest due to their lead underwriter roles. Our evidence demonstrates that combining venture investing and analyst research under one roof benefits IPO issuers and public investors, instead of creating conflicts of interest between these brokerage firms and public investors.

Although our sample is based on brokerage shareholdings in IPO issuers, our results are likely to have implications for the new NASD and NYSE rules pertaining to the equity ownership by brokerage firms and their analysts in both IPOs and seasoned public companies. First and most importantly, our results suggest that regulators are correct in adopting a market-based approach to requiring more detailed disclosure, which should significantly benefit issuing companies and public investors. Simply prohibiting brokerage and analyst ownership does not appear beneficial to either issuers or investors. Second, our results indicate that disclosing the size of brokerage and analyst ownership positions would provide more valuable information to public investors than simply disclosing the presence of such ownership. Regulators should require this disclosure if the costs to brokerage firms are not prohibitively high. Third, since the pre-IPO ownership of analysts is subject to the same restrictions on sales as brokerage ownership, requiring detailed disclosure of pre-IPO analyst ownership should be more beneficial than simply prohibiting this ownership as required by the new exchange rules. Similarly, several large brokerage firms should reconsider their prohibition on analyst ownership, given that the new rules require detailed disclosure.

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Appendix:
Provisions of the NASD and NYSE rules on the stock ownership of analysts and their firms

On May 10, 2002, the SEC approved the new NASD Rule 2711 and amendments to the NYSE Rule 351 and 472. The rules intend to increase analyst independence and to provide more extensive disclosure of conflicts of interest in research reports and public appearance. In particular, the rules require disclosure of financial interests in covered companies by analysts and firms and restrict personal trading by analysts. The rules are implemented by the end of 2002. Here is a summary of the provisions of the rules that are related to the ownership and trading of analysts and their brokerage firms.

1. Analyst accounts are prohibited from obtaining any securities before an issuer's IPO if the issuer is in the same industries that the analyst follows. If already owned, analysts cannot provide research coverage until divesting all pre-IPO shares.

2. Trading for a period between 30 calendar days before and five calendar days after the publication of a research report are generally prohibited. Analysts also cannot trade in a manner inconsistent with their recommendations.

3. Analysts need to disclose in research reports and public appearances if their brokerage firms own more than one percent of any class of common equity. Financial interests by analysts or their household members need to be disclosed. Analysts cannot publish reports or conduct interviews with news media if they are not sure about the ownership of their firms.

Two recent enforcement cases

1. In 2003 the SEC sued Paul Johnson, a former Robertson Stephens analyst, alleging that he failed to inform investors about his ownership in two public companies in which he issued bullish research reports about proposed mergers and that he would reap substantial profits upon completion of each merger [Solomon (2005)].

2. The NASD has fined Sanford C. Bernstein, a subsidiary of Alliance Capital Management LP, and one of its star analysts a combined $550,000. The NASD says analyst Brad Hintz sold shares of Morgan Stanley and Lehman Brothers in January 2005, even as he had favorable ratings on the companies. Mr. Hintz also traded in a personal account in six securities he covered, with many other transactions contrary to his ratings. This type of sale is in violation of NASD rules against trading contrary to an analyst's recommendation. Sanford C. Bernstein was fined $350,000 and Mr. Hintz was fined $200,000. This is the largest fines the regulator has ever levied for this type of behavior. [Craig (2006)]

Table 1. Definitions of Variables used in the Analysis

BVC Ownership (%)	Post-IPO percentage equity ownership of brokerage firms in venture backed IPOs
Strong Buy, Buy, Hold, and Sell	Indicator variable that is one if a recommendation is a strong buy, buy, hold, or if a recommendation is a underperform or sell, respectively, and zero otherwise
Lead, Co-Manager	Indicator variable that is one if a brokerage firm is a lead underwriter or a co-manager, respectively, and zero otherwise
II Star	Indicator variable that is one if an analyst is in the *Institutional Investor* All-American teams in the prior year, and zero otherwise
Number of Reports	Logarithm of the average number of recommendations that an analyst issues on the stocks under coverage
Number of Stocks	Logarithm of the number of stocks that an analyst covers
Broker Size	Logarithm of the number of analysts employed by the analyst's firm. For analysts who switch firms within a given year, we use the time-weighted average of the two firms
Total Assets	Logarithm of issuer total assets in the fiscal year-end prior to IPO in $millions
Company Size	Logarithm of the market capitalization of the issuers that the analyst covered at the end of the quiet period in $millions
Gross Proceeds	Logarithm of offer price x shares offered in $millions
Global Offering	Indicator that is one if an IPO is a simultaneous global offering and zero otherwise
Underwriter Reputation	Investment banking reputation of lead underwriters
Star Availability	Indicator variable that is one if a brokerage firm has an *II* star in the same industry as the IPO issuer prior to the IPO year, and zero otherwise
Offer Price Revisions (%)	(Offer price / midpoint of initial filing range) – 1
Underpricing (%)	(Closing price on trading day 0 / offer price) – 1
First Month Return (%)	(Stock price at the end of quiet period – offer price) / offer price * 100
Share Turnover (%)	Share turnover (shares traded / shares outstanding) by the end of quiet period
Other VC Ownership (%)	Percentage of post-IPO share held by traditional and corporate venture funds
Secondary Shares (%)	Number of shares sold by pre-IPO investors / pre-IPO shares outstanding
NYSE	Indicator variable that is one if an IPO is listed on the NYSE, and zero otherwise
Number of Rounds	Number of venture financing rounds up to the IPO
Sand Hill Index	A index for the total value of the portfolio holdings of all the VCs
Aggregate Venture Returns (%)	Percentage change in the Sand Hill Index in the quarter before IPOs
Company Age	Logarithm of (1 + age of an issuer at IPO)
Quiet Period	Indicator variable that is one if a recommendation is made in the first 30 days after IPO, and zero otherwise
Bubble Period	Indicator variable that is one if an IPO is offered in 1999 or 2000, and zero otherwise

Table 2. Average Characteristics of Venture Backed IPOs

Descriptive statistics are reported for our sample of venture-backed IPOs completed between January 1994 and December 2000 by U.S. issuers. Variable definitions are given in Table 1. BVC Ownership represents IPOs in which a brokerage firm has equity ownership right after IPOs, whereas No BVC Ownership represents the remaining IPOs. We also conduct *t*-tests on the differences of IPO characteristics between IPOs with brokerage equity ownership and IPOs without it. ***, **, and * indicate that *t*-statistics are significant at the 1%, 5%, and 10% levels, respectively.

	All	No BVC Ownership	BVC Ownership	
Recommendation Characteristics				
Strong Buy (%)	39.12	39.50	34.77	***
Buy (%)	46.38	45.84	52.44	***
Hold (%)	13.74	13.90	12.08	
Sell (%)	0.76	0.76	0.71	
Lead Underwriter (%)	28.14	25.55	57.33	***
Co-managers (%)	30.05	29.27	38.94	***
Analyst and Brokerage Firm Characteristics				
Number of Reports	11.94	12.03	9.89	**
Number of Stocks	8.38	8.43	7.16	**
Broker Size	47.70	47.67	48.44	
Issuer Characteristics:				
Total Assets ($Millions)	84.58	40.47	125.45	**
Company Size ($Millions)	329.48	291.36	364.80	**
Gross Proceeds ($Million)	61.00	55.35	66.25	***
Global Offering (%)	29.15	26.94	31.20	**
Underwriter Reputation	8.01	8.11	7.92	
Offer Price ($)	13.42	13.36	13.46	
Offer Price Revision (%)	8.93	10.40	7.57	
Underpricing (%)	44.67	48.89	40.76	**
First Month Return (%)	59.86	65.16	54.95	*
Share Turnover (%)	134.28	127.95	140.14	
Other VC Ownership (%)	48.71	54.15	43.66	***
Secondary Shares (%)	7.38	9.10	5.79	***
NYSE (%)	2.75	2.02	3.43	
Number of Rounds	4.29	4.19	4.39	
Aggregate Venture Returns (%)	47.94	48.54	47.38	
Company Age	8.92	9.22	8.64	
Bubble Period (%)	39.76	36.20	43.06	***
Number of Recommendations	8551	7855	696	
Number of IPOs	1235	872	363	

Table 3. Summary Statistics of the Firm-Issuer Level Data

Table 3 reports the summary statistics of the firm-issuer level data about research coverage for venture-backed IPOs completed between January 1994 and December 2000 by U.S. issuers. It reports for the whole sample, as well as the subsamples classified by underwriter status. For each sample, it reports the total number of firm covering issuers, the number of coverage by *II* stars, the number of coverage in which firms have equity ownership, and the average percentage of equity ownership of firms that have ownership. Variable definitions are given in Table 1.

Total	(No.)	5815
Total with *II* Star Availability	(No.)	1443
Total with *II* Star Coverage	(No.)	651
First Team *II* Star Coverage	(No.)	140
Second Team *II* Star Coverage	(No.)	147
Third Team *II* Star Coverage	(No.)	118
Runners-Up Team *II* Star Coverage	(No.)	246
Total with BVC Ownership	(No.)	465
	Mean Share (%)	4.45
Lead Underwriters	(No.)	1538
Lead Underwriters with *II* Star Availability	(No.)	593
Lead Underwriters with II Star Coverage	(No.)	324
Lead Underwriters with BVC Ownership	(No.)	263
	Mean Share (%)	4.71
Co-Managers	(No.)	1676
Co-Managers with *II* Star Availability	(No.)	434
Co-Managers with II Star Coverage	(No.)	195
Co-Managers with BVC Ownership	(No.)	181
	Mean Share (%)	3.62
Other Brokerage Firms	(No.)	2601
Other Brokerage Firms with *II* Star Availability	(No.)	416
Other Brokerage Firms with II Star Coverage	(No.)	132
Other Brokerage Firms with BVC Ownership	(No.)	21
	Mean Share (%)	8.31

Table 4. Distribution of Recommendation Level Data

Table 4 reports the distribution of recommendations for venture-backed IPOs completed between January 1994 and December 2000 by U.S. issuers and the related average industry adjusted abnormal returns by the levels and directions of recommendations. We define the industry-adjusted abnormal return as the buy-and-hold return on issuer *i* minus the compounded return on the corresponding industry portfolio:

$$Abnormal\ Return_{a\ to\ b} = [\prod_{t=a\ to\ b}(1 + r_t^i) - \prod_{t=a\ to\ b}(1 + r_t^{industry})]$$

where r_t^i is the raw return on issuer *i* on day t, and $r_t^{industry}$ is the return on the matched industry index. For each category of recommendations, we report the number of recommendations, the average event period abnormal return over the (-2, +2) event day window, and the t-statistic for the returns. For example, the intersection of "Strong Buy" and Upgrades has 685 recommendations. This number means that 685 strong buy recommendations are a result of upgrades. We merge the recommendations with I/B/E/S ratings of 4 and 5 into the sell category, because there are very few recommendations for these levels. Given that there is no upgrade from sells to underperforms, this merge does not affect our results. The data are from January 1994 through December 2001.

		Strong Buy	Buy	Hold	Sell
Initiation					
Number of Recommendations	5815	2430	2919	440	26
Average Abnormal Return (%)		3.19	1.52	-1.83	-6.50
t-statistic		(9.49)	(4.46)	(-2.38)	(-2.55)
Reiteration					
Number of Recommendations	682	230	407	43	2
Average Abnormal Return (%)		-0.68	0.90	-6.07	-6.45
t-statistic		(-0.66)	(1.06)	(-2.91)	(-1.27)
Downgrade					
Number of Recommendations	1184	N/A	461	686	37
Average Abnormal Return (%)			-9.02	-15.82	-14.75
t-statistic			(-9.47)	(-17.64)	(-3.94)
Upgrade					
Number of Recommendations	870	685	179	6	N/A
Average Abnormal Return (%)		6.19	3.35	-6.91	
t-statistic		(8.13)	(2.72)	(-0.96)	
Number of Recommendations		3345	3966	1175	65

Table 5. Brokerage Equity Ownership and Star Coverage

Table 5 reports the determinants of *Institutional Investor* (*II*) star coverage for venture-backed IPOs completed between January 1994 and December 2000 by U.S. issuers. In column (1), we report the estimates of a probit model regression where the dependent variables is one if a brokerage firm assigns an *II* star to cover an issuer, and zero otherwise. In columns (2)-(5), we report the estimates of an ordered probit model. The dependent variable of this model equals one through four if a recommendation is made by an analyst who belongs to the first through the runners-up teams of *II*, respectively. The dependent variable equals five if a recommendation is made by a non-star analyst. Variable definitions are given in Table 1. ***, **, and * indicate that *t*-statistics are significant at the 1%, 5%, and 10% levels, respectively. The t-statistics are heteroscedasticity consistent and are adjusted for cross-sectional correlation among observations for the same issuer. We use the firm-issuer level data about research coverage from January 1994 through December 2001.

	Probit Model		Ordered Probit		Ordered Probit		Ordered Probit Firm Age <= Median		Ordered Probit Firm Age > Median	
	(1)		(2)		(3)		(4)		(5)	
	Est.	t-stat.	Est.	t-stat.	Est.	t-stat.	Est.	t-stat.	Est.	t-stat.
BVC Ownership	0.02 **	2.74	-0.02 ***	-2.94			-0.02 ***	-2.60	-0.01 *	-1.71
BVC Ownership*Lead					-0.02 **	-2.28				
BVC Ownership*Co-manager					-0.02 *	-1.89				
BVC Ownership*Other					-0.01	-0.29				
Lead	0.49 ***	7.52	-0.49 ***	-7.85	-0.49 ***	-7.84	-0.47 ***	-5.33	-0.45 ***	-4.11
Co-manager	0.19 ***	2.82	-0.18 ***	-2.83	-0.17 ***	-2.76	-0.21 ***	-2.34	-0.03	-0.21
Broker Size	0.41 ***	8.61	-0.43 ***	-9.34	-0.43 ***	-9.34	-0.41 ***	-5.50	-0.31 ***	-3.84
Underwriter Reputation	0.21 ***	5.30	-0.21 ***	-5.55	-0.21 ***	-5.53	-0.23 ***	-3.70	-0.26 ***	-4.03
Star Availability	1.14 ***	20.01	-1.10 ***	-20.26	-1.10 ***	-20.25	-1.38 ***	-16.62	-1.23 ***	-12.35
Underpricing	0.01 ***	2.93	-0.01 ***	-2.94	-0.01 ***	-2.95	0.00 **	-2.23	0.00	-0.14
Log (Total Assets)	0.12 ***	5.37	-0.11 ***	-5.22	-0.11 ***	-5.23	-0.07 ***	-2.41	-0.17 ***	-4.10
NYSE	0.29 **	2.11	-0.39 ***	-3.14	-0.39 ***	-3.15	-0.52 ***	-2.79	-0.15	-0.72
Bubble Period	-0.42 ***	-6.73	0.43 ***	7.35	0.43 ***	7.34	0.39 ***	4.69	0.45 ***	4.18
Intercept	-5.48 ***	-15.41	6.63 ***	19.24	6.63 ***	19.23	6.85 ***	12.05	6.91 ***	11.91
Pseudo R^2	0.44		0.37		0.37		0.41		0.37	
N	5815		5815		5815		3370		2445	

Table 6. Brokerage Equity Ownership and Recommendation Optimism

Table 6 reports the determinants of recommendation optimism for venture-backed IPOs completed between January 1994 and December 2000 by U.S. issuers. In column (1), we report the estimates of a probit model regression where the dependent variables is one if a recommendation is a strong buy, and zero otherwise. In columns (2)-(5), we report the estimates of an ordered probit model. The dependent variable equals one through four if a recommendation is a strong buy, buy, hold, and sell, respectively. Variable definitions are given in Table 1. ***, **, and * indicate that *t*-statistics are significant at the 1%, 5%, and 10% levels, respectively. The t-statistics are heteroscedasticity consistent and are adjusted for cross-sectional correlation among observations for the same issuer. We use the recommendation level data from January 1994 through December 2001.

	Probit Model		Ordered Probit		Ordered Probit		Ordered Probit Firm Age <= Median		Ordered Probit Firm Age > Median	
	(1)		(2)		(3)		(4)		(5)	
	Est.	t-stat.	Est.	t-stat.	Est.	t-stat.	Est.	t-stat.	Est.	t-stat.
BVC Ownership	-0.18 ***	-3.29	0.14 ***	2.93			0.17 ***	2.51	0.06 *	0.76
BVC Ownership*Lead					0.20 ***	3.18				
BVC Ownership*Co-manager					0.06	0.77				
BVC Ownership*Other					0.09	0.39				
Lead	0.06	1.40	-0.08 **	-2.04	-0.09 **	-2.27	-0.07	-1.16	-0.08	-1.38
Co-manager	-0.01	-0.36	0.00	-0.13	0.00	0.11	0.00	-0.01	-0.02	-0.37
Broker Size	-0.08 ***	-3.80	0.07 ***	4.00	0.07 ***	4.02	0.08 ***	3.24	0.07 ***	2.77
Underwriter Reputation	-0.06 ***	-3.30	0.05 ***	2.91	0.05 ***	2.99	0.05 **	2.11	0.04	1.62
Log (Gross Proceeds)	0.27 ***	5.66	-0.21 ***	-5.01	-0.20 ***	-4.98	-0.20 ***	-3.12	-0.22 ***	-3.89
Company Size	-0.24 ***	-6.18	0.20 ***	6.02	0.20 ***	5.98	0.16 ***	3.08	0.23 ***	5.06
Number of Reports	-0.43 ***	-6.08	0.45 ***	7.41	0.45 ***	7.42	0.44 ***	4.98	0.45 ***	5.17
Number of Stocks	0.38 ***	4.62	-0.42 ***	-5.86	-0.42 ***	-5.87	-0.43 ***	-4.18	-0.41 ***	-4.01
II Stars	0.05 ***	2.50	-0.03 *	-1.89	-0.03 *	-1.87	0.00	-0.08	-0.06 ***	-2.51
Quiet Period	0.06	1.36	-0.25 ***	-6.92	-0.25 ***	-6.93	-0.23 ***	-4.54	-0.27 ***	-4.95
Bubble Period	0.03	0.94	-0.08 ***	-2.41	-0.08 ***	-2.41	-0.04	-0.76	-0.10 ***	-2.06
Intercept	0.74 ***	3.67	-0.64 ***	-3.57	-0.65 ***	-3.62	-0.64 ***	-2.41	-0.53 **	-2.04
Pseudo R^2	0.04		0.05		0.05		0.04		0.05	
N	8551		8551		8551		4983		3568	

Table 7. Brokerage Equity Ownership and Recommendation Informativeness

Table 7 reports the coefficient estimates of the following model used to analyze the determinants of the informativeness of stock recommendations for venture-backed IPOs completed between January 1994 and December 2000 by U.S. issuers:

$$Informativeness_{i,j,k} = a_0 + a_1 Percentage\ BVC\ Ownership_{i,j,k} + a_2 Control\ Variables_{i,j,k} + u_{i,j,k,}$$

In columns (1)-(4), we use the transformed event period abnormal returns of recommendations to measure the informativeness of the recommendation made by analyst *k* from firm *j* on issuer *i*. The event period abnormal return of a recommendation is defined as the industry-adjusted abnormal returns over the (-2, +2) event day window. The industry-adjusted abnormal return is the buy-and-hold return on issuer *i* minus the compounded return on the corresponding industry portfolio based on 62 GICS industries:

$$Abnormal\ Return_{a\ to\ b} = [\prod_{t=a\ to\ b}(1 + r_t^i) - \prod_{t=a\ to\ b}(1 + r_t^{industry})],$$

where r_t^i is the raw return on issuer *i* on day *t*, and $r_t^{industry}$ is the return on the matched industry index. We transform the abnormal returns of hold and sell recommendations, as well as buy recommendations that are results of downgrades, by reversing the sign of the abnormal returns of these recommendations. Analysts essentially ask investors to unload or short sell the stocks involved in these recommendations and investors recognize that these recommendations are negative signals. Thus, the abnormal returns of a total of 1,701 recommendations have reversed sign. We do not transform the abnormal returns of the other recommendations. In column (1), we report for the whole sample. In column (2), we interact BVC ownership with the underwriter status of firms. In columns (3) and (4), we report for the two subsamples split according to the median firm age of IPO companies. In column (5), we report the estimates of the same model where we use the absolute value of the event period abnormal returns to measure the informativeness of recommendations. Variable definitions are given in Table 1. ***, **, and * indicate that *t*-statistics are significant at the 1%, 5%, and 10% levels, respectively. The t-statistics are heteroscedasticity consistent and are adjusted for cross-sectional correlation among observations for the same issuer. We use the recommendation level data from January 1994 through December 2001.

	Transformed Abnormal Returns								Absolute Abnormal Returns	
	Overall Sample		Overall Sample		Firm Age <= Median		Firm Age > Median		Overall Sample	
	(1)		(2)		(3)		(4)		(5)	
	Est.	t-stat.	Est.	t-stat.	Est.	t-stat.	Est.	t-stat.	Est.	t-stat.
BVC Ownership	0.26 ***	3.48			0.34 ***	3.12	0.17 *	1.71	0.20 ***	3.55
BVC Ownership*Lead			0.26 ***	2.79						
BVC Ownership*Co-manager			0.26 *	1.80						
BVC Ownership*Other			0.36	1.09						
Lead	0.90	1.48	0.91	1.50	1.05	1.19	0.62	0.77	0.50	1.13
Co-manager	0.14	0.24	0.14	0.25	0.11	0.13	-0.15	-0.18	0.57	1.36
Strong Buy	-1.88 ***	-2.35	-1.88 ***	-2.35	-1.40	-1.25	-2.56 **	-2.28	-1.97 ***	-3.35
Buy	-3.68 ***	-5.02	-3.68 ***	-5.02	-3.76 ***	-3.68	-3.66 ***	-3.59	-2.57 ***	-4.78
Sell	0.72	0.29	0.73	0.29	0.94	0.25	-0.09	-0.03	-0.16	-0.09
Upgrade	3.52 ***	4.72	3.52 ***	4.71	3.97 ***	3.78	2.71 ***	2.64	3.16 ***	5.79
Downgrade	10.17 ***	13.17	10.17 ***	13.16	9.39 ***	8.47	11.07 ***	10.64	7.71 ***	13.63
Reiteration	-0.82	-1.03	-0.82	-1.03	-1.61	-1.45	0.34	0.30	1.12 *	1.91
Broker Size	1.22 ***	4.07	1.22 ***	4.07	0.95 **	2.25	1.57 ***	3.76	0.84 ***	3.83
First Month Return	0.01 ***	5.17	0.01 ***	5.17	0.01 ***	4.43	0.01 ***	2.70	0.00 ***	3.16
Share Turnover	0.94 ***	15.04	0.94 ***	15.04	1.06 ***	13.32	0.63 ***	5.99	0.80 ***	17.33
Number of Reports	-3.24 ***	-3.18	-3.24 ***	-3.18	-3.97 ***	-2.76	-2.15	-1.53	-1.86 ***	-2.50
Number of Stocks	3.21 ***	2.72	3.21 ***	2.71	4.29 ***	2.58	1.59	0.97	1.77 **	2.04
II Star	-0.07	-0.11	-0.07	-0.10	-0.57	-0.59	0.47	0.48	-0.33	-0.65
Quiet Period	1.84 ***	2.90	1.84 ***	2.90	3.23 ***	3.67	-0.34	-0.39	1.72 ***	3.70
Bubble Period	-1.13 **	-2.27	-1.13 **	-2.28	-1.58 **	-2.31	-0.50	-0.69	4.59 ***	12.66
Intercept	-1.05	-0.67	-1.05	-0.67	-0.85	-0.39	-0.69	-0.31	6.57 ***	5.71
Adjusted R^2	0.09		0.09		0.09		0.10		0.14	
N	8551		8551		4983		3568		8551	

Table 8. Determinants of Brokerage Equity Ownership

Table 8 reports estimates of a Tobit model. The dependent variable is BVC ownership, which is constraint between zero and 100. We present the results using the recommendation-level sample of 8,551 observations in column (1), whereas we present the results using the firm-issuer level data of 5,815 observations in column (2). Variable definitions are given in Table 1. ***, **, and * indicate that *t*-statistics are significant at the 1%, 5%, and 10% levels, respectively. The t-statistics are heteroscedasticity consistent and are adjusted for cross-sectional correlation among observations for the same issuer. The data are from January 1994 through December 2001.

	Recommendation-Level Sample (1)		Firm-Issuer Level Sample (2)	
	Est.	t-stat.	Est.	t-stat.
Lead	18.07 ***	16.39	17.83 ***	13.93
Co-Manager	14.13 ***	13.40	13.77 ***	11.30
Log (Total Assets)	0.64 ***	2.70	0.58 **	2.01
Global Offering	1.74 ***	2.42	2.17 **	2.48
Number of Rounds	0.43 ***	4.01	0.35 ***	2.75
Company Age	-1.19 ***	-2.89	-0.92 *	-1.84
Underwriter Reputation	-1.46 ***	-5.07	-1.29 ***	-3.71
Secondary Shares	-0.09 ***	-3.40	-0.09 ***	-2.95
Aggregate Venture Returns	-0.01 *	-1.93	-0.01 *	-1.71
Offer Price Revision	-0.02 ***	-2.55	-0.02 *	-1.75
Other VC Ownership	-0.10 ***	-8.50	-0.10 ***	-6.43
Intercept	-17.88 ***	-6.31	-18.24 ***	-5.40
Pseudo R^2	0.29		0.13	
N	8551		5815	