Do Hedge Funds Possess Private Information in IPO Stocks?

Evidence from Post-IPO Holdings*

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Abstract

Using hedge funds' holdings of IPO stocks, we find that stocks with hedge fund holdings beyond what can be explained by publicly available information yield abnormal returns, suggesting that hedge funds possess private information in IPO stocks. Moreover, compared to other investors, hedge funds have more predictive ability for future stock returns in post-IPO trading and are able to sell IPO stocks before underperforming periods start. Finally, hedge funds earn higher abnormal returns in "connected" stocks when their prime brokers serve as the IPO underwriters, indicating that such connection is an important source of private information for hedge funds.

JEL classification: G11, G14, G23, G24, G30, G32

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1. Introduction

A lot of media attention has been focused on the initial public offering (IPO) of Facebook on May 18, 2012. There were 421 million shares sold to investors at $38 per share, amassing over $16 billion in new capital. However, Facebook's shares were down by more than 50% just three months after the offer date, hitting an all-time low of $17.73 on September 4, 2012—before rebounding for a one-day return of 19% to $23.23 on October 24, 2012. This kind of roller-coaster ride in price is not atypical for IPO stocks. Large information asymmetry lies between investors and these stocks, which are usually issued by young firms with growth potential but no current earnings. Therefore, the "correct" value of an IPO stock is particularly difficult to determine. An extensive literature has been devoted to the understanding of the pricing and initial allocation of IPO stocks (e.g., Rock 1986; Benveniste and Spindt 1989; Welch 1992; Chemmanur 1993; Sherman and Titman 2002; Ljungqvist, Nanda, and Singh 2006). Compared to the closely scrutinized allocation process and initial returns, a less examined issue of IPO stocks is the substantial price swings in post-IPO trading as manifested by the case of Facebook. Therefore, IPO stocks, characterized by severe information asymmetry and large variations in post-IPO returns, provide ideal opportunities for informed investors to exploit their information advantages.

Who is likely to benefit from the opportunities presented by IPO stocks? Anecdotal evidence has pointed to some large institutional investors, such as hedge funds, as being the recipients of proprietary information about IPO stocks from the underwriters.[1] In addition to the information exchange during the IPO process, underwriters may continue to share sensitive information with their favorite clients after the IPO. Underwriters are likely to continue to have

[1] See "Some Big Firms Got Facebook Warning" by Gina Chon, Jenny Strasburg and Anupreeta Das on May 24, 2012 in *The Wall Street Journal* and "Facebook IPO Highlights Unfair Game" by Francesco Guerrera on May 29, 2012 in *The Wall Street Journal.*

access to more information about the issuers than the general public because they typically maintain a long-term relationship with the IPO firms for reasons such as subsequent equity offerings or analyst coverage (Dunbar 2000; Krigman, Shaw, and Womack 2000; Ljungqvist, Marston, and Wilhelm 2006). Moreover, it is no longer a secret that some of the world's largest investment banks regularly host private meetings for their favorite clients and possibly tip off valuable information at these special occasions.[2] This kind of questionable relations in the financial industry is coming under fresh scrutiny by the regulators, as illustrated by the increasing number of insider trading cases against some high-profile hedge fund managers by the U.S. Securities and Exchange Commission (SEC).[3]

Why underwriters may favor hedge funds over other investors? The hedge fund industry has experienced remarkable growth in the past two decades [see survey article by Stulz (2007)]. In the meantime, hedge funds become the most prized customers for large investment banks and constitute a major source of revenue for underwriting institutions that also provide prime brokerage service. Besides the traditional execution and custody services, prime brokers also provide clients with the ability to borrow money for purchases (margin financing) and borrow securities for short-selling (securities lending), services that are frequently used by hedge funds and generate large profits for prime brokers. According to a recent industry report, prime brokerage is estimated to account for 30% of $40 billion equity trading revenues per year at the top investment banks (Finadium, 2013). If hedge funds do receive private information regarding IPO stocks, it should be reflected in the superior performance of the IPO stocks they pick. Moreover, if hedge funds are considered more important customers than other institutions to

[2] See "Banks Woo Funds With Private Peeks" by David Enrich and Dana Cimilluca on May 16, 2011 in *The Wall Street Journal.*

[3] See "U.S. in Vast Insider Trading Probe" by Susan Pulliam, Michael Rothfeld, Jenny Strasburg, and Gregory Zuckerman on November 20, 2010 in *The Wall Street Journal.*

their source of information, hedge funds should have information advantages over other institutions in trading IPO stocks.

Using hedge funds' holdings of IPO stocks reported in SEC Form 13F filings, this study provides the first comprehensive analysis of hedge funds' investments in IPO stocks.[4] We address the following research questions. Do IPO stocks chosen by hedge funds yield higher returns? If so, is it because of hedge funds' private information, or other reasons such as their ability to interpret public information, favorable allocations they receive, or hedge fund activism? How do hedge funds perform compared to other institutional investors in post-IPO trading? If hedge funds do possess private information in IPO stocks, what is the source of their information?

Our sample consists of the holdings of 4,165 newly public stocks between 1994 and 2010 by a sample of 1,003 hedge fund management companies. We find that hedge funds tend to invest in IPO stocks immediately following the offer date. About 79% of IPO stocks are held by at least one hedge fund at the first report date (the first quarter-end after the IPO offer date). On average, hedge funds hold 5.48% of total shares outstanding of each stock, and each IPO stock has 5.93 funds investing in it at the first report date. The comparison of IPO stocks with and without hedge fund investments reveals that hedge funds make calculated choices with regard to deal and firm characteristics. They are inclined to invest in IPO stocks of larger offer size, those of greater upward price revision, or those that are backed by either venture capitalists or more reputable investment banks. They also favor more profitable issuers and firms with longer operating histories. According to prior studies such as Ritter (1991), Brav and Gompers (1997), and Carter, Dark, and Singh (1998), these characteristics are typically associated with better post-IPO performance. Do the IPO stocks chosen by hedge funds indeed yield higher returns?

[4] Most of the holding-based studies use the Daniel, Grinblatt, Titman, and Wermers (1997) method, which requires that a stock must have at least one year of pricing data and thus excludes IPO stocks in the analysis.

Using a calendar-time portfolio regression approach, we find that stocks with hedge fund ownership at the first report date do outperform those without hedge fund ownership in the subsequent quarter. Specifically, a zero-investment portfolio with a long position in IPO stocks held by hedge funds and a short position in those not held by hedge funds yields a 2.2% abnormal return on a monthly basis, which is much higher than the abnormal return earned in a similarly constructed zero-investment portfolio of non-IPO stocks.

We explore a number of alternative explanations for the relation between hedge fund ownership and IPO stock performance. First, as in the case of Facebook, hedge funds may possess private information about IPO stocks. Alternatively, hedge funds may utilize public knowledge to generate abnormal returns in the same way as other institutional investors (Field and Lowry 2009). To examine if the abnormal return is attributable to private information or public knowledge, we compare stocks with hedge fund ownership unexplained by IPO deal and firm characteristics with those stocks not held by hedge funds. Stocks with unexplained hedge fund ownership are defined as stocks with positive residuals from a Tobit (negative binomial) regression of the percentage of shares held by hedge funds (the number of hedge funds investing in each stock) on deal and firm characteristics. We find that the IPO stocks with hedge fund holdings beyond what can be explained by publicly available attributes yield abnormal returns of 0.9–1.2% per month. Moreover, they beat those IPO stocks not held by hedge funds by as much as 2.6–2.7% per month. To the extent that the hedge fund ownership unexplained by deal and firm characteristics captures the private information of hedge funds, our results imply that hedge funds do possess proprietary information when selecting IPO stocks.

Second, prior research shows that investment banks may allocate "hot" IPOs to institutional investors (e.g., Aggarwal 2003; Boehmer, Boehmer, and Fishe 2006; Chemmanur,

Hu, and Huang 2010). Hedge funds could simply receive the favorable allocation, without receiving additional private information. To test the private information explanation against this alternative hypothesis, we need to remove all allocated shares from the analysis. However, because IPO allocation data are not publicly available, it is impossible to separate allocated shares from shares bought by hedge funds in the secondary market using data at the first report date. To address this issue, we conduct the calendar-time portfolio analysis using hedge fund holdings at the second report date (second quarter-end after the IPO offer date) and exclude the holdings of each given stock by those hedge funds that already have shares at the first report date. This process effectively ensures that all shares in the analysis are purchased in the secondary market and not from the allocation. We show that stocks with positive residuals of hedge fund ownership at the second report date still significantly outperform those not owned by hedge funds, although by a smaller margin, indicating that private information is an important reason for hedge funds' superiority in selecting IPO stocks.

Third, it has been shown that some hedge funds can play an active role and influence corporate behavior, which causes better firm performance (Brav, Jiang, Partnoy, and Thomas 2008). To test the private information explanation against the hedge fund activism hypothesis, we classify potential hedge fund activists as either those holding more than 5% of a stock or those holding more than 1% of a stock for four consecutive quarters within two years of the IPO. We then remove their holdings from the calendar-time portfolio analysis. The alphas of the long-short portfolios using the positive residuals of hedge fund ownership are still significantly positive and are comparable to those of the whole sample. These results suggest that hedge funds achieve better performance in IPO stocks primarily because of private information instead of shareholder activism.

While the evidence so far indicates that hedge funds make "smart" decisions picking stocks immediately after the IPO, it remains to be seen if they continue to do well in the post-IPO trading of newly public stocks and if they display information advantages over other institutional investors. To answer these questions, we directly compare the explanatory power of hedge fund ownership with that of other institutional ownership in predicting one-quarter-ahead returns of IPO stocks within two years of the IPO. We follow a number of well-established methods used in the prior literature on institutional trading (e.g., Chen, Jegadeesh, and Wermers 2000; Gompers and Metrick 2001; Sias, Starks, and Titman 2006). First, we examine the *change* and *level* of the hedge fund ownership and compare them with those of other institutional investors. Second, in addition to the *percentage holding*, we study the *number* of hedge funds investing in each IPO stock and compare it with the number of other institutional investors. Third, we examine if there is any difference in the information content of the *purchases* versus *sales* made by hedge funds and then compare them with those made by other institutional investors. Overall, we find a consistent picture of a strong relation between hedge fund ownership and IPO stock returns, which overshadows the relation between other institutional ownership and IPO stock returns. The results are obtained by using the Fama-MacBeth (1973) regression approach and including both hedge fund and non-hedge fund ownerships as explanatory variables. For example, we find that both the change and level of hedge fund ownership are significantly related to the one-quarter-ahead returns of IPO stocks, and we obtain the same findings using either the percentage holding or the number of hedge funds investing in each IPO stock. In addition, the purchases (sales) made by hedge funds are positively (negatively) related to future returns, suggesting that hedge funds' decisions are based on correct and timely information about

stock price increases or decreases. By contrast, the results for other institutions are much weaker across all specifications.

IPO long-run underperformance is well-documented in the literature [see a survey article by Ritter and Welch (2002)], which offers an another opportunity to analyze the information advantages possessed by hedge funds as compared to other institutions. It is interesting to see whether hedge funds can avoid the underperforming period of IPO stocks. To do so, we first show that the typical price movement of an IPO stock has an initial increase in price followed by an underperforming period. We then use the notion of price peak [as defined in Brunnermeier and Nagel (2004)] to identify the beginning of the underperforming period for each IPO stock. Next, we calculate the change in the percentage holding of hedge funds (or other institutional investors) around the price peak and see if they can effectively time the sales of their shares to avoid the underperformance trap. The results show that hedge funds are able to sell IPO stocks right before the underperforming period starts, while other institutional investors are at least one quarter behind in unloading the underperforming IPO stocks. The sharp contrast between the behavior of hedge funds and that of other institutions around the price peak highlights a distinct information advantage of hedge funds over other institutions.

Finally, we address the question of where hedge funds obtain their information. As discussed in the Facebook example, because hedge funds are a major source of revenue for underwriting institutions that also serve as prime brokers, hedge funds could possibly receive private information in IPO stocks that is not released to the public. If this is the case, hedge funds should earn higher profits in those IPO stocks when their prime brokers are also the lead underwriters of the IPOs. Matching the names of prime brokers of hedge funds with the names of lead underwriters for IPO deals, we are able to separate each hedge fund's long positions into

two portfolios: connected holdings and nonconnected holdings. A hedge fund's holding in a particular IPO stock is defined as "connected" if at least one of the hedge fund's prime brokers is among the lead underwriters for the IPO. We then calculate the abnormal returns for the connected and nonconnected holdings using a similar method as in Cohen, Frazzini, and Malloy (2008). We find that hedge funds produce significantly higher abnormal returns in their connected holdings than in their nonconnected holdings, suggesting that the linkage between prime brokers and IPO underwriters does serve as a channel of valuable information for hedge funds.

We further explore the effectiveness of the primer broker and underwriter connection along two dimensions. First, we investigate the interaction between hedge funds' prime broker connections and hedge fund characteristics. The linkage is more valuable for large funds and for funds with equity-hedge or event-driven strategies, which is consistent with prime brokers favoring clients who are a major source of their revenues. Second, we examine the time-series patterns. While the result is more pronounced during the Internet bubble period, the abnormal return of the long-short portfolio (connected minus nonconnected) is still at 8.7% per year in the post-bubble period, highlighting an economically significant advantage gained by hedge funds through the broker-underwriter connection.

We make contributions to the literature in a number of ways. First, our paper sheds light on the debate over whether some institutional investors, especially hedge funds, possess information advantages in the equity market. Prior research has provided mixed evidence using hedge funds' equity holdings from 13F filings (e.g., Brunnermeier and Nagel 2004; Griffin and Xu 2009; and Bae, Baik, and Kim 2011). We document a strong relation between hedge fund ownership and the performance of IPO stocks, which exhibit large information asymmetry. We

further explore alternative explanations for this relation, such as public information (Field and Lowry, 2009), favorable allocation (Chemmanur, Hu, and Huang, 2010), or hedge fund activism (Brav, Jiang, Partnoy, and Thomas 2008). Our results are most consistent with the private information explanation, i.e., hedge funds use private information to select IPO stocks with better performance.

Second, different from prior studies on hedge fund performance, the unique setting of IPO stocks allows us to investigate the source of private information for hedge funds through the linkage between their prime brokers and IPO underwriters. We find that hedge funds produce significantly higher abnormal returns in connected holdings than in nonconnected holdings, indicating that the prime broker and IPO underwriter connection is an important source of private information for hedge funds.

Third, our paper is also related to the prior studies on underwriters and affiliated funds. Ritter and Zhang (2007) find some evidence that investment banks allocate hot IPOs to affiliated funds to boost their fund performance, while Hao and Yan (2012) show that investment banks use affiliated funds as a "dumping ground" of worse-performing IPO stocks to support their underwriting business at the expense of fund shareholders. We show that underwriters may have tipped off their valued clients that are not affiliated with them, but are major sources of their revenues.

Fourth, our study also complements the literature on venture capitalists and IPO stocks. Venture capitalists are involved in financing and monitoring start-ups before the IPO (Gompers 1995). But they typically liquidate their positions when the lock-up period ends (e.g., Gompers and Lerner 1999; Field and Hanka 2001). In contrast, we show that hedge funds actively engage in buying and selling IPO stocks in the secondary market and exploit their information

advantages to earn profits.

Finally, besides contributing to the academic literature, our study also offers some important policy implications. We show that one potential source of private information used by hedge funds lies in the connection between hedge funds' prime brokers and IPO underwriters. Our findings, therefore, suggest that the questionable relation between hedge funds and their prime brokers should be considered in the regulators' on-going investigation of the insider trading practices in the financial industry.

The remainder of the paper proceeds as follows. The next section describes the data collection process and presents the summary statistics of hedge fund holdings of IPO stocks. Section 3 examines the decision of investing in IPO stocks by hedge funds. Section 4 examines the performance of IPO stocks selected by hedge funds. Section 5 compares the predictive power of hedge fund ownership versus other institutional ownership for future stock returns. Section 6 investigates whether hedge funds can avoid IPO long-run underperformance. Section 7 explores the source of hedge funds' private information. Finally, we conclude in Section 8.

2. Data and Summary Statistics

2.1. Data Description

We obtain a list of hedge fund management companies from two different sources. First, from the Bloomberg hedge fund database, we collect a list of 849 hedge fund management companies that filed Form 13F in September or December 2010.[5] Bloomberg classifies all investment companies filing Form 13F into different categories, such as hedge funds, mutual funds, and so forth. Because most institutional investors are Bloomberg customers themselves, Bloomberg has the advantage of better classifying their types and collecting a more

[5] All investment companies with more than $100 million in assets are required to file Form 13F, a quarterly report of all equity holdings greater than 10,000 shares or $200,000 in market value.

comprehensive sample of hedge funds. However, one disadvantage of Bloomberg is that it only includes "live" funds. Therefore, we also collect the names of 4,163 hedge fund management companies from the 2009 Hedge Fund Research (HFR) database. The advantage of HFR is that it includes both the live and dead hedge fund management companies starting from 1994. By combining these two data sources, this study presents a broad cross-section of the live hedge funds while still including a rich history of funds that have existed in the past, which allows us to mitigate survivorship bias.

Next, we match the names of hedge fund companies from Bloomberg and HFR to a list of all Form 13F filers in Thomson Reuters CDA/Spectrum. Because two different institutions may sometimes have the same name, we double check the validity of matched names by verifying the companies' addresses in Bloomberg or HFR against the 13F filers' addresses from SEC's Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system. Finally, we use all available online resources to reconcile any remaining discrepancies. After the name and address matching, we have 1,318 candidate hedge fund management companies. To ensure that the main business of these companies is hedge fund management, we apply the filtering process of Brunnermeier and Nagel (2004). If a candidate hedge fund company is not registered as an investment advisor with the SEC, the company is included in the final sample of hedge funds. If it is registered, we check SEC Form ADV filed by the company and require the following two criteria for it to be considered as a hedge fund in our final sample: (1) at least 50% of its clients are "other pooled investment vehicles" (such as private equity or hedge funds) or "high net worth individuals", and (2) it charges performance-based fees. The final hedge fund sample consists of 1,003 hedge fund management companies, of which 690 are from Bloomberg and 537 are from HFR, with 224 contained in both databases. Finally, we obtain the stock holdings of these

management companies from Thomson Reuters CDA/Spectrum for the period of 1994 to 2010.[6]

Our IPO data consists of U.S. firms going public between January 1994 and December 2010 from the Thomson Reuters Securities Data Company (SDC). Following the general practice in the IPO literature, we exclude closed-end funds, American depositary receipts (ADRs), unit offerings, and IPOs with offer prices below $1. We further require that data from the Center for Research in Security Prices (CRSP) be available. Our final IPO sample consists of 4,165 IPOs. We collect IPO deal characteristics from SDC at the time of the offering. We also obtain pricing data from CRSP and financial information from Standard and Poor's Compustat database. Finally, we obtain the data on IPO firm age and underwriter rank from Professor Jay Ritter's website.

2.2 Summary Statistics of the Hedge Fund and IPO Samples

Table 1 reports the summary statistics of the hedge fund and IPO samples used in our study. We first present the year-by-year number of hedge funds as well as the number of IPOs from 1994 to 2010 in columns (1)–(4). The number of hedge funds increases from 113 in 1994 (58 from Bloomberg and 90 from HFR, with 35 from both databases) to 770 in 2010 (669 from Bloomberg and 318 from HFR, with 217 from both databases). Next, we examine several measures of hedge fund holdings in stocks at the first report date after the IPO. As shown in column (5), about 79% of IPO stocks are held by at least one hedge fund at the first report date over the whole sample period. Before the Internet bubble, about 70% of newly public stocks are held by hedge funds. There is a surge during the bubble period. After that, the hedge fund industry maintains a strong interest in IPO stocks until the financial crisis of 2008, when the IPO market dried up. To address the concern that our results are affected by the growth in the hedge

[6] One advantage of using stock holding data is to avoid the various biases of hedge funds' self-reported returns as documented by prior literature (e.g., Fung and Hsieh 2000, 2009; Liang 2000).

fund industry, we also calculate the percentage of IPO stocks held by the 113 funds that are included in the database from the beginning of the sample period (year 1994). As shown in column (6), patterns for these 113 funds are similar to those of the whole sample.

We further investigate hedge fund ownership in terms of the percentage of shares held by hedge funds (*HFP*) and the number of hedge funds investing in each stock (*HFN*). For each quarter *t* and each stock *i*, *HFP* and *HFN* are calculated by aggregating across hedge fund *j*:

$$HFP_{t,i} = \frac{\sum_{j=1}^{N} Number\ of\ shares\ held_{t,i,j}}{Total\ shares\ outstanding_{t,i}}, \quad (1)$$

$$HFN_{t,i} = \sum_{j=1}^{N} HFD_{t,i,j}, \quad (2)$$

where $Number\ of\ shares\ held_{t,i,j}$ is the number of shares for stock *i* held by hedge fund *j* at time *t*, $Total\ shares\ outstanding_{t,i}$ is the total number of shares outstanding for stock *i* at time *t*, and $HFD_{t,i,j} = 1$ if $Number\ of\ shares\ held_{t,i,j} > 0$, and 0 otherwise.

Columns (7) and (8) in Table 1 present the statistics of *HFP* and *HFN* for each year. At the end of each quarter, cross-sectional averages of hedge fund ownership for IPO stocks are calculated. Then, yearly averages are taken over the four quarters within a year. The percentage of shares held by hedge funds at the first report date after the IPO averages 5.48% of total shares outstanding, and each IPO stock has an average of 5.93 hedge funds investing in it over the sample period from 1994 to 2010. The percentage holding starts from below 3% in the 1990s and peaks at 10% in 2007. The number of hedge funds investing in each stock also increases substantially and steadily over the sample period, with the exception of a drop in 2010 in the aftermath of the recent financial crisis. Overall, we find an increased presence of hedge funds in IPO stocks over time.

In addition to hedge funds' holdings at the first report date, we also investigate hedge funds' investment patterns within eight reporting quarters after the IPO, such as when they

initiate their positions and how long they hold on to their positions (holding duration). These statistics are not tabulated for the purpose of brevity. We find that about 25% of the holdings are initiated in the first quarter, while about 10–11% of the holdings are initiated in each of the subsequent quarters. Among all holdings, 48% have a holding duration equal to one quarter and the average holding duration is 3.04 quarters. Overall, the turnover rate is very high among hedge funds that invest in newly public stocks.

3. Hedge Funds' Decision to Invest in IPO Stocks

3.1 Characteristics of IPO Stocks with versus without Hedge Funds at the First Report Date

In this section, we investigate hedge funds' decision to invest in IPO stocks using their holdings recorded at the first report date. Previous studies have identified certain deal and firm characteristics that signal good quality and are typically associated with better post-IPO performance. Offerings with larger proceeds are considered to be of higher quality. IPOs with upward price revisions indicate higher market demand. Brav and Gompers (1997), Nahata (2008), and Krishnan, Ivanov, Masulis, and Singh (2011) provide evidence that IPOs backed by venture capitalists do not suffer long-run underperformance. Carter, Dark, and Singh (1998) show that IPOs underwritten by prestigious investment banks also subsequently perform better. Moreover, Ritter (1991) finds that IPO firms with longer operating histories post higher long-run returns. Field and Lowry (2009) show that firms with more liquid assets and positive earnings before interest and tax (EBIT) at the time of the offering do better after the IPO. Besides these return-related variables, we consider other variables that can potentially influence hedge fund holdings, such as asset turnover and leverage ratio. We also include research and development (R&D) spending and an indicator variable for high-tech companies, as hedge funds may have an

advantage in evaluating companies with more information asymmetry.

Table 2 presents the summary statistics of IPO stocks held by hedge funds and those not held by hedge funds. We collect deal characteristics at the time of the offering and accounting variables from the last fiscal quarter before the IPO offer date. In terms of deal characteristics, the two groups of IPO stocks differ substantially, and the differences are all statistically significant using either *t*-tests or Wilcoxon tests. Specifically, hedge funds exhibit a strong preference for larger offerings and offerings with larger upward price revisions. IPO stocks held by hedge funds are more likely to be underwritten by prestigious investment banks and backed by venture capitalists. In terms of firm characteristics, the two groups are also significantly different from each other, with the exception of asset turnover. Hedge funds favor IPO firms with a longer operating history and those in high-tech industries. They also desire firms with more liquid assets, higher profitability, and lower leverage. The Z-statistic of the Wilcoxon test indicates that hedge funds invest in firms with larger R&D spending, although the *t*-test result is insignificant due to the skewness of the variable. Overall, the results indicate that hedge funds are drawn to IPO stocks with better deal and firm characteristics.

3.2 Determinants of Hedge Fund Ownership of IPO Stocks at the First Report Date

We explore the determinants of hedge fund ownership of IPO stocks at the first report date in the regression analyses. Specifically, we examine three aspects of hedge fund ownership: (1) the probability of a stock being held by hedge funds, (2) the percentage of shares held by hedge funds (*HFP*), and (3) the number of hedge funds investing in each stock (*HFN*). The explanatory variables include the deal and firm characteristics described in the preceding section. We add year dummies to control for the effect of time variations in the IPO market and the hedge fund industry.

First, we run probit regressions to investigate the probability of an IPO stock being held by hedge funds. The Results of the probit regressions are reported in columns (1)–(3) of Table 3. The coefficient estimates on the deal characteristics, *Offer Size*, *Offer Price Revision*, *Underwriter Rank Dummy*, and *VC-Backed Dummy*, are all positive and statistically significant, confirming the univariate results. In addition, the coefficient estimates on the firm characteristics, *Profitability* and *High-Tech Dummy,* are significantly positive. Lastly, the goodness-of-fit statistic (pseudo R^2) indicates that deal characteristics matter more than firm characteristics in explaining the likelihood of IPO stocks being held by hedge funds.

Second, we model the percentage of shares held by hedge funds based on deal and firm characteristics. Following Falkenstein (1996) and Griffin and Xu (2009), we choose Tobit regressions to examine the percentage of shares held by hedge funds (*HFP*) because this variable is a non-negative variable that is censored at zero. The results of the Tobit regressions in columns (4)–(6) of Table 3 show that many of the deal and firm characteristics are important determinants of the percentage of shares held by hedge funds, confirming that hedge funds do use public information in their decisions to invest in IPO stocks. Specifically, the level of hedge fund holdings is higher for issuers with larger offerings, for firms underwritten by more prestigious investment banks, and for firms backed by venture capitalists. In addition, the coefficient estimates on *Firm Age* and *Profitability* are significantly positive, indicating that firms with a longer operating history, as well as those with higher profits, have higher levels of hedge fund holdings.

Lastly, we conduct negative binomial model regressions of the number of hedge funds investing in each IPO stock (*HFN*) because this variable is constrained to be a positive integer or zero. The results in columns (7)–(9) of Table 3 indicate that all deal characteristics have

statistically significant effects on the number of hedge funds investing in each IPO stock. Controlling for deal characteristics, the number of hedge funds is also positively related to *High-Tech Dummy* and *R&D Intensity*. Overall, these results indicate that deal and firm characteristics are also important determinants of the number of hedge funds investing in each IPO stock.

4. IPO Stock Performance Based on Hedge Fund Holdings

4.1 Risk-Adjusted Performance of Stocks with versus without Hedge Funds

The above analysis indicates that hedge funds are able to select IPO stocks with good qualities that signal better post-IPO performance. We now check if IPO stocks held by hedge funds indeed subsequently yield higher returns than those not held by hedge funds using calendar-time portfolio regressions. For each month from April 1994 to December 2010, IPO stocks that went public in the previous quarter are grouped into two portfolios: *With-HF* contains those held by hedge funds and *Without-HF* contains those not held by hedge funds based on the hedge fund holdings at the first report date after the IPO. The portfolios are rebalanced every quarter so that only stocks that went public in the previous quarter are included in the portfolios at each point in time. Over the sample period, 3,292 IPO stocks are classified in the group of *With-HF*, and 873 IPO stocks are classified in the group of *Without-HF*. We also construct a zero-investment portfolio (*With−Without*) consisting of a long position in stocks held by hedge funds and a short position in stocks not held by hedge funds. The equal-weighted portfolio returns are then regressed on the Fama-French-Carhart four factors (Fama and French 1993; Carhart 1997). The regression is specified as

$$R_t - Rf_t = \alpha + \beta_1(Rm_t - Rf_t) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 MOM_t + \varepsilon_t \,, \qquad (3)$$

where R_t is the portfolio return, Rf_t is the three-month Treasury-bill rate, Rm_t is the market return, SMB_t is the difference between the small-firms stock return and the big-firms stock return, HML_t

is the difference between high book-to-market stock return and low book-to-market stock return, and MOM_t is the difference between the high-momentum stock return and the low-momentum stock return. We use the weighted least squares method to correct for heteroscedasticity, with the weight being the number of stocks in the portfolio for each quarter.

Table 4 presents the results of calendar-time portfolio regressions. Panel A contains the analysis of IPO stocks. Looking at the loadings on the four factors, we see that relative to the portfolio of stocks not held by hedge funds, the portfolio of stocks held by hedge funds has higher loadings on the market factor and momentum factor, but lower loadings on the size factor and value factor. The intercepts (alphas) reflect whether or not the portfolios have abnormal returns. In particular, the alpha of the *With−Without* portfolio is positive and statistically significant at the 1% level, implying that IPO stocks held by hedge funds perform significantly better than those not held by hedge funds. The outperformance is also economically significant, as the *With-HF* portfolio beats the *Without-HF* portfolio by approximately 2.2% per month. Overall, the first-report-date hedge fund ownership appears to be valuable in predicting returns for the next quarter. We repeat our analysis using value-weighted portfolio returns and find that our results are qualitatively the same. For brevity, we report only the results of the equal-weighted analysis here and in the ensuing sections.

Because most prior research finds that hedge fund holdings generally do not significantly predict returns, which is in sharp contrast to our finding of IPO stocks, we conduct additional analysis to examine hedge funds' investments in non-IPO stocks. Panel B contains the results of non-IPO stocks using the same calendar-time regression method as in Panel A. We define non-IPO stocks as all stocks in the CRSP database, excluding the 4,165 IPO stocks in our sample.[7] For each month from April 1994 to December 2010, we separate the non-IPO stocks into two

[7] The same data filters for IPO stocks are also applied to non-IPO stocks to ensure comparability.

portfolios: those held by hedge funds and those not held by hedge funds based on hedge fund holdings at the previous quarter end. The portfolios are rebalanced every quarter to reflect the changes in hedge fund holdings. Over the sample period, 11,301 non-IPO stocks are classified into the group of *With-HF*, and 10,203 non-IPO stocks are classified into the group of *Without-HF*. We find that the economic significance of the alpha for the non-IPO stocks is quite small: the *With-HF* portfolio has an alpha of 0.13% per month, while the long-short portfolio has an alpha of 0.04% per month. These estimates are consistent with prior studies using the entire equity holdings of hedge funds and are much smaller than the results we obtain using hedge funds' holdings in IPO stocks.

4.2 Public Information versus Private Information

Is the documented stock-picking ability of hedge funds attributable to the known IPO deal and firm characteristics or to the private information possessed by hedge funds? To answer this question, we develop a method to capture the private information contained in hedge fund ownership that is not explainable by publicly available information. We first calculate the predicted percentage holding/count of hedge fund ownership from the Tobit/negative binomial regressions and then use the residuals as proxies for hedge funds' private information that is not explained by IPO deal and firm characteristics. This method is based on the assumption that the determinants used in the Tobit or negative binomial models fully specify all public information, leaving only private information content in the residual.

We construct two portfolios using the proxies of private information: *Positive Unexplained HF Holding* contains 1,259 IPO stocks with positive residuals from the Tobit regressions, and *Positive Unexplained HF Count* includes 1,464 IPO stocks with positive residuals from the negative binomial regressions. We also construct two zero-investment

portfolios consisting of a long position in one of the two above-mentioned portfolios and a short position in the 873 IPO stocks without hedge fund ownership. The portfolios are rebalanced every quarter so that only stocks that went public in the previous quarter are included in the portfolios at each point in time. Looking at the results in Table 5, we see that the alphas of *Positive Unexplained HF Holding* and *Positive Unexplained HF Count* are both significantly positive. Moreover, the zero-investment portfolio with long positions in *Positive-Unexplained-HF-Holding* stocks generates a return of 2.7% per month. The zero-investment portfolio with long positions in *Positive Unexplained HF Count* stocks earns a return of 2.6% per month. These findings indicate that hedge fund ownership purged of publicly available information is useful for picking IPO stocks.

4.3 IPO Allocation

To see if our results are driven by the favorably allocated shares or by the private information possessed by hedge funds, we use two methods to eliminate the effects of IPO allocations. First, it has been documented that some institutional investors "flip" their allocated shares of some hot IPOs with large initial returns on the first day of trading (e.g., Cornelli and Goldreich 2001; Ljungqvist and Wilhelm 2002; Ritter and Welch 2002). If these allocated shares are not flipped immediately, they will appear as part of the holdings at the first report date after the IPO. To address this alternative explanation, we exclude IPOs that take place in the last month of each quarter. This specification is based on the previous finding that heavy selling activities by institutional investors mostly happen during the first month following the IPO (Aggarwal 2003). Column (1) of Table 6 shows that the positive abnormal returns of the zero-investment portfolios are still strongly significant. The abnormal returns of the portfolios with positive residuals (purged of public information) are around 2.3% per month, suggesting that

private information is still the major reason for hedge funds' success in selecting IPO stocks.

Second, prior studies have shown that some institutions may receive allocations in IPOs with better long-term performance (e.g., Boehmer, Boehmer, and Fishe 2006; Chemmanur, Hu, and Huang 2010). Therefore, our finding may be due to some hedge funds holding on to their favorable allocations of IPOs with better post-IPO performance. Since IPO allocation data are not publicly available, there is no systematic way to distinguish allocated shares from shares bought by hedge funds in the open market using only data from the first report date. Therefore, we design a methodology using information from both the first and second report dates to remove allocated shares. Specifically, for any given stock, we exclude all holdings of those hedge funds that already have shares at the first report date. Therefore, the remaining holdings, if any, at the second report date consist of only shares purchased by some "new" hedge funds (funds that do not have shares at the first report date) from the secondary market between the first and second report dates. We then rerun the calendar regressions based on these "allocation-free" holdings at the second-report date.

Using these allocation-free holdings, we separate the IPOs that went public two quarters ago (thus with data on both the first and second report dates) into the following portfolios: the *With* portfolio consists of 2,305 IPO stocks whose shares are purchased by some "new" hedge funds (funds that do not have shares at the first report date) from the secondary market between the first and second report dates, and the *Without* portfolio consists of 1,825 IPO stocks whose shares are not purchased by any "new" hedge funds from the secondary market between the first and second report dates. The portfolios are rebalanced every quarter, and the portfolios only include the IPOs that satisfy the above criteria at each point in time. Similarly, the portfolios of positive residuals are defined based on the allocation-free holdings at the second report date.

Over the sample period, 1,310 IPOs have positive residuals from the Tobit model and 1,201 IPOs have positive residuals from the negative binomial model.

The results in Column (2) of Table 6 show that the zero-investment portfolios formed at the second report date with allocation-free holdings still produce significant and positive abnormal returns. For example, the abnormal returns of the zero-investment portfolios based on positive residuals (purged of public information) are around 1.2-1.3% per month.[8] Overall, our findings indicate that the superior performance of IPO stocks held by hedge funds does not merely stem from favorable allocations, and our results are consistent with hedge funds having private information.

4.4 Hedge Fund Activism

Recent studies have shown that hedge funds can play an active role and influence corporate decisions in the target companies, which can lead to better firm performance and create value for shareholders (e.g., Brav, Jiang, Partnoy, and Thomas 2008). Therefore, it is possible that our results are due to hedge fund activists being involved in newly public companies.

To test the hedge fund activism explanation against the private information explanation, we remove potential hedge fund activists from the analysis. Potential hedge fund activists are identified in two ways using the hedge fund holdings within eight quarters after the IPO: (1) if a hedge fund holds more than 5% of a stock at least once, or (2) if a hedge fund holds more than 1% of a stock for four consecutive quarters. We remove the holdings by these potential hedge fund activists and repeat the calendar-time portfolio analysis. Columns (3) and (4) of Table 6 present the results. The alphas of the long-short portfolios are significantly positive and are comparable to the whole sample analysis. Therefore, we believe that hedge funds achieve better performance

[8] Given that the information advantage of hedge funds is likely to be more pronounced immediately after the IPO, it is expected that the abnormal returns based on the second report date will be smaller than those based on the first report date.

in IPO stocks mainly because of the information effect of stock picking instead of shareholder activism.

5. The Return Predictability of Hedge Fund Ownership versus Other Institutional Ownership

In this section, we directly test the explanatory power of hedge fund ownership versus that of other institutional ownership in predicting the returns of IPO stocks within two years of the IPO. In particular, we first collect stock holdings by all intuitional investors that file Form 13F from Thomson Reuters CDA/Spectrum and define those managers that are not included in our hedge fund sample as "non-hedge funds". We then calculate two sets of ownership variables, one for hedge funds and the other for non-hedge funds, following a number of well-established methods used in the prior literature on institutional trading (e.g., Chen, Jegadeesh, and Wermers 2000; Gompers and Metrick 2001; Sias, Starks, and Titman 2006). Last, we include both hedge fund ownership and non-hedge fund ownership in the Fama-MacBeth (1973) regression to examine their explanatory power for future returns.

5.1. The Percentage Holding and the Number of Investors in Each IPO Stock

We first look at the change and level of the percentage holding following Gompers and Metrick (2001). According to Gompers and Metrick, the information explanation suggests that the change in ownership should be relatively more important than the level of ownership in explaining future returns, while the demand shock explanation will show that the level of ownership is more important. For each calendar quarter, stocks that were taken public within the previous eight quarters are included in the cross-sectional regression. One-quarter-ahead stock returns (RET_{t+1}) are regressed on the change in the percentage of shares held by hedge funds in the current quarter (ΔHFP_t), the percentage of shares held by hedge funds from the last quarter

(HFP_{t-1}), and the corresponding variables based on the holdings of non-hedge funds, $\Delta NonHFP_t$ and $NonHFP_{t-1}$. The regression model is specified as follows:

$$RET_{t+1,i} = \alpha_t + \beta_{1t}\,\Delta HFP_{t,i} + \beta_{2t}\,HFP_{t-1,i} + \beta_{3t}\,\Delta NonHFP_{t,i} + \beta_{4t}\,NonHFP_{t-1,i} + \boldsymbol{\gamma' X_{t,i}} + \varepsilon_{t,i}\,, \quad (4)$$

where $\boldsymbol{X}$ is a vector of control variables including deal characteristics and the following stock characteristics that prior literature has shown to be potentially related to future returns. First, we use stock price and turnover rate to gauge liquidity. Second, we include measures of "prudence", such as firm age, return volatility, dividend yield, and S&P 500 membership, as in Gompers and Metrick (2001). Third, information asymmetry is proxied by R&D intensity. Lastly, we control for three variables that are associated with future stock returns: market value (size), market-to-book ratio, and past stock returns. IPO deal characteristics are measured at the time of the offering. Other firm and stock characteristics are measured at each quarter-end. To the extent that these variables capture the publicly available information, the remaining explanatory power of hedge fund and non-hedge fund ownership measures will result from their private information.

Table 7 reports the time-series average of coefficients estimated from the 66 quarterly regressions between the second quarter of 1994 and the third quarter of 2010. We use Newey-West (1987) standard errors to adjust for heteroscedasticity and autocorrelation up to four lags. Column (1) shows that both the change and level of percentage hedge fund holding (ΔHFP_t and HFP_{t-1}) have significant explanatory power for futures returns. Specifically, the coefficient of ΔHFP_t is 0.307, which is statistically significant at the 1% level, and the coefficient of HFP_{t-1} is 0.108, which is also statistically significant at the 1% level. In sharp contrast, neither the change nor the level of non-hedge fund holdings has a significant coefficient. Among control variables, IPO stocks underwritten by prestigious investment banks or backed by venture capitalists are associated with higher future returns. These results suggest that, even after controlling for public

information, hedge funds have information advantages in post-IPO trading over other institutions.

Sias, Starks, and Titman (2006) predict that, if stock price changes arise from investors' information, the change in the number of institutional investors investing in each stock should also be related to stock returns. Therefore, we also study the change in the number of hedge funds investing in each stock in the current quarter (ΔHFN_t) and the number of hedge funds from the last quarter (HFN_{t-1}), and we compare them with the corresponding variables for non-hedge funds, $\Delta NonHFN_t$ and $NonHFN_{t-1}$.

We rerun the Fama-MacBeth regression in Equation (4) by replacing the percentage holding variables with the variables based on the number of investors. Results are reported in column (3) of Table 7. We find similar results using the number of hedge funds (ΔHFN_t and HFN_{t-1}) as those using hedge fund percentage holding (ΔHFP_t and HFP_{t-1}). Namely, ΔHFN_t and HFN_{t-1} are both positive and statistically significant. In contrast, only $\Delta NonHFN_t$ is statistically significant while $NonHFN_{t-1}$ is not significant. Furthermore, the coefficients of hedge fund variables are larger than those of non-hedge fund variables.

5.2. The Information Content of Purchases and Sales

Prior studies have documented that the stocks purchased by institutional investors have higher returns than the stocks they sell (e.g., Chen, Jegadeesh, and Wermers 2000; Puckett and Yan 2011). To examine any difference in the information content of *purchases* versus *sales* made by hedge funds (or non-hedge funds), we further decompose the change in the percentage of shares held by hedge funds (ΔHFP_t) into buy-trade and sell-trade. At any given quarter *t*, buy-trade (HFP_BUY_t) is calculated by aggregating across hedge funds with positive changes of shares, while sell-trade (HFP_SELL_t) is calculated by aggregating across hedge funds with negative changes of shares. Specifically,

$$HFP\_BUY_{t,i} = \frac{\sum_{j=1}^{N} Max[(Number\ of\ shares\ held_{t,i,j} - Number\ of\ shares\ held_{t-1,i,j}),0]}{Total\ shares\ outstanding_{t,i}}, \text{ and} \quad (5)$$

$$HFP\_SELL_{t,i} = \frac{\sum_{j=1}^{N} |Min[(Number\ of\ shares\ held_{t,i,j} - Number\ of\ shares\ held_{t-1,i,j}),0]|}{Total\ shares\ outstanding_{t,i}}, \quad (6)$$

where $Number\ of\ shares\ held_{t,i,j}$ is the number of shares for stock *i* held by hedge fund *j* at time *t* and $Total\ shares\ outstanding_{t,i}$ is the total number of shares outstanding for stock *i* at time *t*. Non-hedge fund buy-trade ($NonHFP\_BUY_t$) and sell-trade ($NonHFP\_SELL_t$) are constructed in the same fashion. The regression model is specified as follows:

$$RET_{t+1,i} = \alpha_t + \beta_{1t} HFP\_BUY_{t,i} + \beta_{2t} HFP\_SELL_{t,i} + \beta_{3t} HFP_{t-1,i} + \beta_{4t} NonHFP\_BUY_{t,i} + \beta_{5t} NonHFP\_SELL_{t,i} + \beta_{6t} NonHFP_{t-1,i} + \boldsymbol{\gamma' X_{t,i}} + \varepsilon_{t,i} . \quad (7)$$

If hedge funds (or non-hedge funds) have any predictive power for future stock returns, their purchases should be positively correlated to future stock returns and their sales should be negatively correlated to future stock returns.[9] Column (2) of Table 7 shows the results based on the purchase and sales of hedge funds and non-hedge funds. We find that the coefficients of all hedge fund ownership variables have correct signs as predicted: HFP_{t-1} is positive; HFP_BUY_t is positive; and HFP_SELL_t is negative. Moreover, HFP_t and HFP_Sell_t are statistically significant at the 1% and 5% levels, respectively. In contrast, only one of the three non-hedge fund variables, $NonHFP\_BUY_t$, has a significant coefficient with the predicted sign.

It is worth noting that our measures in Equations (5) and (6) allow cross-sectional difference among managers, as we calculate buy-trade and sell-trade separately and simultaneously for each quarter. In a related paper, Chen, Jegadeesh, and Wermers (2000) study the portfolio choices of mutual fund managers and use the aggregate action of all managers to define the change in holding as either a buy-trade or sell-trade for each quarter. To confirm the

[9] Note that both *HFP_SELL* and *Non_HFP_SELL* are defined in absolute terms. Therefore, the expected signs of the coefficients for these two variables in the regression are negative, provided that hedge funds and non-hedge funds correctly predict the future decline in stock price.

robustness of our results, we follow the idea of a representative manager (for hedge funds and non-hedge funds, respectively) and define purchases and sales in the same way as Chen, Jegadeesh, and Wermers (2000).[10] The results are qualitatively the same and are not reported here.

We also decompose the change in the number of hedge funds investing in each stock (ΔHFN_t) into the number of hedge funds initiating positions (HFN_BUY_t) and the number of hedge funds liquidating positions (HFN_SELL_t):

$$HFN\_BUY_{t,i} = \sum_{j=1}^{N} Max\left[\left(HFD_{t,i,j} - HFD_{t-1,i,j}\right), 0\right], \quad (8)$$

$$HFN\_SELL_{t,i} = \sum_{j=1}^{N} \left|Min\left[\left(HFD_{t,i,j} - HFD_{t-1,i,j}\right), 0\right]\right|, \quad (9)$$

where $HFD_{t,i,j}$ = 1 if $Number\ of\ shares\ held_{t,i,j}$ > 0, and 0 otherwise, and $Number\ of\ shares\ held_{t,i,j}$ is the number of shares for stock i held by hedge fund j at time t. The change in the number of non-hedge funds initiating positions ($NonHFN\_BUY_t$) and the number of non-hedge funds ($NonHFN\_SELL_t$) liquidating positions are constructed correspondingly. We then rerun the Fama-MacBeth regression in Equation (7) by replacing the percentage holding variables with the variables based on the number of investors.

Looking at the results in column (4) of Table 7, we find that all hedge fund variables have statistically significant coefficients with the predicted signs: HFN_{t-1} is significantly positive; HFN_BUY_t is significantly positive; and HFN_SELL_t is significantly negative. Again, only one of the three non-hedge fund variables, $NonHFN\_BUY_t$, is statistically significant. These results suggest that hedge funds have more ability to correctly predict the price increases and decrease of IPO stocks than other institutions do.

[10] $HFP\_BUY_{t,i}$ equals $\Delta HFP_{t,i}$ if $\Delta HFP_{t,i}>0$ and 0 otherwise; $HFP\_SELL_{t,i}$ equals $|\Delta HFP_{t,i}|$ if $\Delta HFP_{t,i}<0$ and 0 otherwise. Corresponding variables for non-hedge funds are defined in the same fashion.

5.3. Alternative Explanations

Prior literature has shown that only institutional investors who have participated in the IPO allocation show superior performance in post-IPO trading (Chemmanur, Hu, and Huang 2010). We design two ways to address the effects of allocations on our results. First, to remove all allocated shares from the analysis, we delete all holdings that are initiated at the first report date.[11] As a result, the remaining holdings consist of only shares that are purchased in the secondary market after the first report date, thus are considered "allocation-free". Second, we remove all holding by those investors that have participated in the allocation process, i.e., even shares purchased in the secondary markets by these investors will be removed. To do so, for any given stock, we remove all subsequent holdings of an investor if the investor has shares of this stock at the first report date after the IPO, regardless of whether the holdings are initiated at the first report date.

The results are reported in Panel A of Table 8. Using allocation-free holdings, we continue to find that hedge funds have significant predictive power for future returns of IPO stocks. Similarly, our results are largely unchanged if we remove investors that have participated in the IPO allocation and only focus on those that are not involved in the allocation process. Moreover, the predictive power of hedge funds continues to dominate that of non-hedge funds, suggesting that the information advantages of hedge funds over other institutional investors are not due to IPO allocations. For brevity, the coefficients of non-hedge funds are suppressed in the table.

Next, we explore the alternative explanation that the relation between hedge fund ownership and future returns may stem from hedge fund activism. We exclude potential activists

[11] Holdings, including those in the subsequent quarters, are considered initiated at the first report date as long as the hedge fund holds the stock continuously starting from the first report date.

using two methods as described in Section 4.4. The results are reported in Panel B of Table 8. Using either method of removing hedge fund activists, we find that hedge funds continue to show significant predictive power for future returns and their predictive power continues to dominate that of non-hedge funds. Therefore, we conclude that hedge funds outperform other institutional investors in predicting the returns of IPO stocks primarily because of information advantage rather than receiving allocated shares or hedge fund activism.

6. Can Hedge Funds Avoid IPO Long-Run Underperformance?

It is well documented in the literature that IPO stocks typically experience long-run underperformance. Can hedge funds or other institutions successfully sell IPO stocks before the underperforming periods start? The answer to this question may reveal an information advantage of hedge funds from a new angle that differs from prior studies.

We adopt a similar methodology from Brunnermeier and Nagel (2004). Instead of examining the price movements of technology stocks during the Internet bubble, we examine the price patterns of IPO stocks after the offer date. Specifically, for each IPO stock, we construct a total return index based on its monthly raw returns within two years of the IPO. Motivated by the prior finding that IPO firms typically underperform relative to their matching firms (Ritter 1991; Loughran and Ritter 1995), we also construct a match-adjusted return index based on 25 size/book-to-market portfolios. We include firms with IPO dates from 1994-2008 to allow for a two-year post-IPO period in our data, and we further require that each firm has more than two quarters of return data. This results in a sample of 4,018 IPO stocks.

To illustrate the typical price movement of IPO stocks after the offer date, we use a "representative" IPO stock as an example. The representative stock is defined as a hypothetical stock whose return equals the average return of all IPO stocks in the sample. Panel A of Figure 1

shows the two return indexes from the time of the IPO to two years (24 months) after the IPO for the representative stock. The total return increases initially after the IPO, then stabilizes, and even starts to drift downward. The index constructed using match-adjusted returns shows a clearer picture: the match-adjusted return index reaches the highest point at the fourth month after the IPO, after which the representative stock starts to severely underperform the matched sample.

From the illustration, we see that the typical price movement of an IPO stock has an initial increase in price followed by an underperforming period. Therefore, we expect that informed investors, such as hedge funds, should initially hold shares of an IPO stock and sell their positions before the underperforming period starts. To identify the beginning of the underperforming period for each stock, we use the notion of price peak in Brunnermeier and Nagel (2004), which is defined as the quarter at which the return index reaches its maximum value. Panel B of Figure 1 presents the distribution of the price peak quarters. 598 (648) stocks have the total return index (match-adjusted return index) reach the highest point at the same quarter as the IPO date. The quarter after the IPO date has the largest number of stocks attaining their price peaks: 953 (1,057) based on raw (match-adjusted) returns. However, we also see a large cross-sectional variation with a substantial number of stocks having price peaks in quarters two to eight.

To examine if hedge funds or other institutions can successfully time the sales of their shares in IPO stocks to avoid the underperformance trap, we align our sample firms according to their price peak event quarters. Specifically, we assign event quarter zero to the quarter when the return index of an IPO stock reaches its highest point. We then compute the changes in hedge fund holdings and non-hedge fund holdings around the price peak quarter. Panel A of Figure 2

shows the results using the total return index. The first point to note is that the change in hedge fund holdings is consistently positive before the price peak quarter, suggesting that hedge funds are not afraid to invest in IPO stocks. However, hedge funds begin to sell their positions in IPO stocks starting from the exact quarter when the prices of IPO stocks reach the peak, and there is an even further selloff by hedge funds in the first quarter after the price peak quarter. On the other hand, non-hedge funds clearly fall behind hedge funds in unloading IPO stocks by at least one quarter. We find similar results using the match-adjusted return index in Panel B of Figure 2. Overall, our findings indicate that hedge funds are able to sell IPO stocks before other institutional investors do to avoid the IPO underperformance trap, highlighting another distinct information advantage of hedge funds over other institutions around the pivotal point of IPO stock returns.

7. The Source of Private Information, Prime Brokers, and Hedge Fund Characteristics

Hedge funds are important customers of their prime brokers, many of whom also conduct investment banking business such as underwriting IPOs. This connection creates a potential channel for information to pass from prime brokers, if they are also the underwriters of IPOs, to their hedge fund customers. In this section, we explore whether the prime broker-underwriter link could give hedge funds an information edge and boost the returns of their investments in the "connected" IPO stocks.

7.1. Connected versus Nonconnected Stocks

To identify the prime broker-underwriter link, we first collect data on the prime broker information of hedge funds from the HFR database and lead underwriter information of IPOs from the SDC database. Among 537 HFR managers in our sample, 437 have prime broker information available, and 4,149 out of 4,165 IPOs have underwriter information available in

SDC. We then match the names of prime brokers of hedge funds with the names of underwriters for IPO deals. A hedge fund's holding in a particular IPO stock is defined as "connected" if at least one of the hedge fund's prime brokers is among the lead underwriters for the IPO. Overall, we find a total of 4,983 pairs of connected hedge funds and IPOs in our sample. We adopt a similar methodology as Cohen, Frazzini, and Malloy (2008) to construct the calendar-time portfolios of connected and nonconnected holdings. For each calendar quarter, we separate each hedge fund's 13F holdings of stocks that were taken public within the last eight quarters into two groups: connected and nonconnected holdings. Within each group, we first calculate each hedge fund's monthly return in the following quarter weighted by the fund's dollar holdings in each stock, assuming that the fund does not change its holdings between 13F reports. We then compute the average monthly returns for the connected (nonconnected) portfolio across all funds weighted by each hedge fund's dollar holdings in the connected (nonconnected) group. The portfolios are rebalanced every quarter. To measure the difference in returns between these two portfolios, we also construct a long-short portfolio that consists of a long position in the connected portfolio and a short position in the nonconnected portfolio. We control for risk by running the Fama-French-Carhart four-factor model to obtain alpha. We use the weighted least squares method to correct for heteroscedasticity, with the weight being the sum of holdings in each portfolio at each quarter.

Panel A of Table 9 illustrates our main result. The connected holdings include 301 hedge funds' investments in 1,163 IPOs over the sample period, while the nonconnected holdings consist of 428 hedge funds' investments in 3,696 IPOs.[12] Connected holdings yield an abnormal return of 1.14% per month, while nonconnected holdings do not have an abnormal return

[12] The numbers of hedge funds (or IPOs) in the connected and nonconnected portfolios are not necessarily exclusive. A hedge fund can simultaneously invest in both connected and nonconnected IPOs. Similarly, an IPO can be held by both connected and nonconnected hedge funds at the same time.

significantly different from zero. The long-short portfolio also has a large and significantly positive alpha, suggesting that connected holdings outperform nonconnected holdings in an economically and statistically significant way. Therefore, our evidence is consistent with prime brokers being an important source of valuable information for hedge funds about IPO stocks.

7.2. Hedge Fund Characteristics

Hedge fund characteristics are another interesting element that may affect hedge funds' performance in IPO stocks. First, certain fund characteristics (such as fund size) may be a proxy for the talent or skills of the managers and thus could have an impact on performance. Alternatively, hedge fund characteristics may influence the way information is passed from hedge funds' prime brokers to their favorite clients. For example, if large funds are more important sources of revenue to their prime brokers, they are more likely to receive favorable information from their prime brokers. Therefore, we also investigate the interaction between hedge funds' prime broker connections and fund characteristics. Specifically, we look at three characteristics: fund size, fund age, and fund strategy. Fund size is measured using the total value of hedge fund holdings from 13F filings at a given quarter. Fund age is a proxy for experience and is measured by the time since the hedge fund filed its first 13F filing. Finally, we divide funds into two groups based on their self-reported strategy: if a hedge fund management company has a hedge fund using equity-hedge or event-driven as its main strategy, then the hedge fund management company is labeled as "IPO-Related". All other hedge funds are labeled as "Others".

Panel B of Table 9 shows the subsample results. We divide the sample along two dimensions, based on their fund characteristics and based on connected and nonconnected portfolios. Looking at the connected portfolios and nonconnected portfolios separately, we

observe two notable patterns. On the one hand, we find that there are no significant abnormal returns for nonconnected holdings in any of the subsamples regardless of fund characteristics. This result implies that hedge funds cannot produce abnormal returns based on their talents or strategies alone when there is no connection through their prime brokers. On the other hand, we find that many funds with different characteristics are able to deliver significant abnormal returns in the connected portfolios, suggesting the existence of interaction effects between fund characteristics and the way in which hedge funds are connected through their prime brokers.

A closer look at connected holdings versus nonconnected holdings within each subgroup of fund characteristics reveals some interesting results. Regarding fund size, we find that large funds' investments in connected IPO stocks significantly outperform their investments in nonconnected IPO stocks. In contrast, for small funds, there is no significant difference between the connected and nonconnected portfolios. This result suggests that only large funds (but not small funds) are getting valuable information from their prime brokers. Similarly, funds with equity-hedge or event-driven strategies extract significantly higher returns in connected stocks than in non-connected stocks, while funds in other types of strategies do not. This finding is consistent with prime brokers only favoring customers that are likely to be repeat customers. As to fund age, the connected portfolios have significantly higher positive abnormal returns regardless of the hedge fund's age. Experience, therefore, does not seem to matter as long as there is a connection through their prime brokers. Overall, we find that the linkage between prime brokers and IPO underwriters serves as a channel of valuable information for hedge funds. In addition, there is evidence of certain fund characteristics affecting this particular channel of information acquisition, which is consistent with prime brokers favoring clients who are a major source of their revenues.

7.3. Time-Series Patterns

We are also interested in the time-series patterns of the abnormal returns. The reasons are twofold. First, IPOs from the Internet Bubble period tend to behave differently from IPOs from the pre-bubble and post-bubble periods. Second, the prime broker service only took off as an important branch of the investment banking business in the late 1990s following the exponential growth of the hedge fund industry. Therefore, to examine the time-series patterns of the abnormal returns, we divide the sample into three sub-periods, 1994-1998 (pre-Bubble), 1999-2001 (Internet Bubble), and 2002-2010 (post-Bubble). We repeat the same analysis of connected versus nonconnected stocks for each subperiod in Panel C of Table 9.

Overall, we find significant results for both the Internet bubble period and the post-bubble period, while alpha is insignificant in the pre-bubble period. Other than the loss of statistical power due to a smaller number of observations, one possible explanation for the insignificant result in the pre-bubble period is that hedge funds were not yet considered major clients for investment banks in the early 1990s, as the overall size of the hedge fund industry was still relatively small. Therefore, their source of information was not likely the broker-underwriter connection. After the tremendous growth in the hedge fund industry in the late 1990s and through 2000s, the broker-underwriter connection apparently has become more valuable for hedge funds. Investment banks have strong incentive to tip off information about IPO stocks to their important hedge fund clients, as evidenced by the significant abnormal returns earned by hedge funds in both the Internet bubble period and the post-bubble period. We do see, however, alpha decreases from the bubble period to the post-bubble period. This is not surprising as the unusually high abnormal returns in the bubble period may be partly caused by the irrational exuberance in the stock market. Additionally, the increasingly heated competition and

exponential growth in the size of assets under management could have also brought down profits (Berk and Green 2004). Nonetheless, the abnormal return of the long-short portfolio (connected minus nonconnected) is still at 0.726% per month in the post-bubble period, which is translated to about 8.7% per year, highlighting an economically significant advantage gained by hedge funds through the broker-underwriter connection.

8. Conclusion

In this paper, we examine hedge funds' investments in newly public stocks using quarterly data from Form 13F filings from 1994 to 2010. We first document that hedge funds deliberately choose stocks with better deal characteristics, such as higher offer price revisions, more reputable underwriters, and venture-capital backing. IPO stocks owned by hedge funds at the first report date yield significantly higher returns than those not owned by hedge funds. Using residual holdings purged of publicly known characteristics to proxy for private information, we find that such private information is instrumental for hedge funds in selecting IPO stocks with abnormal returns. Moreover, these results remain after alternative explanations, such as favorable allocation and hedge fund activism, are taken into account.

Looking beyond the first report date, we show that hedge funds have distinct information advantages in post-IPO trading as compared to other institutional investors. The information advantage of hedge funds over other institutional investors is further highlighted in the analysis of their trading behaviors around the price peaks of IPO stocks. Hedge funds correctly predict the start of underperforming periods and begin to unload their positions in a more timely fashion than other institutional investors do.

Finally, we investigate the source of private information for hedge funds and find that hedge funds' investments in connected IPO stocks yield significantly higher returns than those in

nonconnected IPO stocks. Moreover, this connection is more valuable for large funds and for funds with equity-hedge or event-driven strategies, supporting the conjecture that hedge funds obtain private information from the underwriters as they are a major source of revenues to the underwriters' prime brokerage services.

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Table 1 Summary Statistics

This table presents the summary statistics of the hedge fund and IPO samples from 1994 to 2010. The hedge fund sample consists of 1,003 hedge fund management companies with Form 13F filings, of which 690 are obtained from Bloomberg and 537 from Hedge Fund Research (HFR), with 224 contained in both databases. The IPO sample consists of 4,165 stocks. Columns (1)–(3) present the year-by-year number of hedge funds. Column (4) reports the year-by-year number of IPOs. Column (5) reports the percentage of IPO stocks held by all hedge funds at the first report date. Column (6) reports the percentage of IPO stocks held by the 113 funds that are included in the database from the beginning of the sample period (year 1994). Columns (7)–(8) present the percentage of shares held by hedge funds (*HFP*) and the number of hedge funds investing in each stock (*HFN*). For each quarter *t* and each stock *i*, *HFP* and *HFN* are calculated by aggregating across hedge fund *j*:

$HFP_{t,i} = \frac{\sum_{j=1}^{N} Number\ of\ shares\ held_{t,i,j}}{Total\ shares\ outstanding_{t,i}}$ and $HFN_{t,i} = \sum_{j=1}^{N} HFD_{t,i,j}$, where $HFD_{t,i,j} = 1$ if $Number\ of\ shares\ held_{t,i,j} > 0$, and 0 otherwise.

At the end of each quarter, cross-sectional averages of *HFP* and *HFN* for IPO stocks are calculated. Then, yearly averages are taken over the four quarters within a year.

Year	(1) No. of Hedge Funds in Bloomberg	(2) No. of Hedge Funds in HFR	(3) Total No. of Hedge Funds	(4) Total No. of IPOs	(5) % IPO Stocks held by Hedge Funds	(6) % IPO Stocks held by the 113 Hedge Funds that Filed Form 13F in 1994	(7) *HFP*	(8) *HFN*
1994	58	90	113	407	65.60	65.60	2.41	1.52
1995	72	108	137	456	73.90	72.15	2.56	2.26
1996	77	113	146	681	72.25	69.46	2.37	1.94
1997	107	140	187	465	71.40	67.31	2.96	2.32
1998	122	159	215	287	69.34	64.11	2.67	2.52
1999	139	179	245	457	87.31	80.53	2.70	4.14
2000	164	196	278	342	91.23	85.38	3.36	4.78
2001	167	200	283	72	94.44	83.33	5.01	7.02
2002	219	223	342	66	89.39	83.33	8.21	7.97
2003	268	248	398	67	92.54	82.09	6.87	6.92
2004	326	287	473	169	95.27	84.62	7.47	7.37
2005	404	320	561	162	89.51	73.46	9.38	8.50
2006	487	357	657	161	90.68	82.61	6.66	8.21
2007	562	384	746	198	87.37	69.70	10.11	9.11
2008	575	387	760	29	79.31	65.52	7.99	10.72
2009	605	350	747	45	66.67	55.56	4.77	8.08
2010	669	318	770	101	86.14	64.36	7.70	7.51
1994-2010	690	537	1,003	4,165	79.06	72.94	5.48	5.93

Table 2 Characteristics of IPO Stocks with versus without Hedge Funds at the First Report Date

This table compares the deal and firm characteristics of IPO stocks held by hedge funds at the first report date with those of the stocks not held by hedge funds. The sample consists of 4,165 IPOs. Deal characteristics include *Offer Size* as the total amount of capital raised by the issuer, *Offer Price Revision* as the percentage difference between the offer price and the midpoint of the initial filing range, *Underwriter Rank* as a number ranging from zero to nine, with higher ranks representing higher quality, and *VC-Backed Dummy* as an indicator variable that equals one if the IPO firm is backed by venture capitalists. Firm characteristics consist of *Firm Age* as the number of years from the founding date of the firm to the IPO offer date, *Asset Liquidity* as the ratio of working capital over total assets, *Profitability Dummy* as an indicator variable that equals one if EBIT is larger than zero, *Asset Turnover* as the ratio of sales over total assets, *Leverage* as the ratio of total liabilities over total assets, *High-Tech Dummy* as an indicator variable that equals one if the IPO firm comes from a high-tech industry as defined in SDC, and *R&D Intensity* as the ratio of R&D expenses over sales (if R&D is missing, we set it to zero). We collect deal characteristics at the time of the offering and accounting variables from the last fiscal quarter before the IPO offer date. Two-sided *t*-tests and Wilcoxon tests are conducted to compare the difference between the two groups. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	With Hedge Funds				Without Hedge Funds				Test of Difference	
	N	Mean	Median	StdDev	N	Mean	Median	StdDev	t-stat	z-stat
Deal Characteristics										
Offer Size (million $)	3,292	132.92	55.55	528.57	873	35.79	14.70	86.88	10.04***	30.18***
Offer Price Revision (%)	3,278	3.85	0.00	26.31	866	-5.25	0.00	21.30	10.61***	11.68***
Underwriter Rank (0-9)	3,246	7.86	8.00	1.56	864	5.04	5.00	2.72	29.19***	27.34***
VC-Backed Dummy	3,291	0.46	0.00	0.50	873	0.23	0.00	0.42	13.69***	12.20***
Firm Characteristics										
Firm Age	3,217	15.32	8.00	21.88	817	11.92	6.00	16.79	4.84***	5.48***
Asset Liquidity	2,948	0.14	0.18	0.56	752	-0.17	0.05	1.39	5.97***	10.20***
Profitability Dummy	3,234	0.54	1.00	0.50	823	0.47	0.00	0.50	3.62***	3.62***
Asset Turnover	3,193	0.38	0.30	0.46	799	0.59	0.31	4.79	-1.26	-0.10
Leverage	3,214	0.66	0.60	0.60	821	0.93	0.71	1.51	-5.17***	-7.64***
High-Tech Dummy	3,292	0.57	1.00	0.49	873	0.41	0.00	0.49	8.68***	8.58***
R&D Intensity	3,066	1.02	0.00	7.33	726	0.70	0.00	5.71	1.28	6.09***

Table 3 Determinants of Hedge Fund Ownership at the First Report Date

This table presents the results of probit, Tobit, and negative binomial regressions of hedge fund ownership at the first report date after the IPO. Models (1)–(3) are probit regressions of an indicator variable that equals one if the IPO stock is held by hedge funds. Models (4)–(6) are Tobit regressions of the percentage of shares held by hedge funds (*HFP*). Models (7)–(9) are negative binomial regressions of the number of hedge funds investing in each IPO stock *(HFN*). The explanatory variables consist of deal characteristics and firm characteristics variables defined in Table 2 and *Underwriter Rank Dummy*, which is an indicator variable that equals one if underwriter rank is greater than or equal to eight. Year dummies are also included in the analyses, but the coefficient estimates are not reported for brevity. The sample consists of 3,381 IPOs with all variables available. Heteroscedasticity-adjusted standard errors are provided in parentheses. For the negative binomial model, we also report the p-value of the likelihood ratio test for overdispersion in the dependent variable (null being no overdispersion). ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Probit Regressions			Tobit Regressions			Negative Binomial Regressions		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	-4.954***	0.089***	-4.765***	-6.321***	-0.936**	-6.399***	-1.454***	0.142*	-1.505***
	(0.593)	(0.017)	(0.595)	(0.508)	(0.482)	(0.603)	(0.073)	(0.081)	(0.082)
Log(Offer Size)	2.001***		1.939***	2.385***		2.256***	0.513***		0.511***
	(0.242)		(0.236)	(0.161)		(0.164)	(0.016)		(0.017)
Offer Price Revision (%)	0.012***		0.012***	-0.004		-0.003	0.007***		0.007***
	(0.003)		(0.003)	(0.005)		(0.005)	(0.001)		(0.001)
Underwriter Rank Dummy	0.361**		0.310*	0.624**		0.615**	0.232***		0.219***
	(0.168)		(0.166)	(0.276)		(0.277)	(0.035)		(0.035)
VC-Backed Dummy	0.580***		0.456***	0.620***		0.714***	0.179***		0.150***
	(0.139)		(0.146)	(0.224)		(0.242)	(0.027)		(0.029)
Log(1+Firm Age)		0.001	-0.077		0.542***	0.230*		0.110***	0.016
		(0.003)	(0.071)		(0.127)	(0.123)		(0.019)	(0.014)
Asset Liquidity		0.021**	0.132		0.794**	0.071		0.127**	0.038
		(0.009)	(0.174)		(0.329)	(0.321)		(0.061)	(0.052)
Profitability Dummy		-0.011*	0.239*		0.936***	0.419*		0.185***	0.046
		(0.007)	(0.140)		(0.248)	(0.239)		(0.038)	(0.029)
Asset Turnover		-0.002	-0.027		-0.661***	-0.296		-0.128***	-0.013
		(0.002)	(0.051)		(0.248)	(0.217)		(0.042)	(0.010)
Leverage		-0.001	-0.161		-0.172	-0.237		-0.089**	-0.044
		(0.007)	(0.144)		(0.273)	(0.269)		(0.041)	(0.034)
High-Tech Dummy		0.021***	0.307**		0.495**	-0.083		0.112***	0.090***
		(0.007)	(0.138)		(0.241)	(0.241)		(0.036)	(0.029)
R&D Intensity		0.001	0.009		-0.008	-0.002		-0.004**	0.002*
		(0.001)	(0.008)		(0.014)	(0.013)		(0.002)	(0.001)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3,381	3,381	3,381	3,381	3,381	3,381	3,381	3,381	3,381
Diagnostics									
LR test of overdispersion (*p*-value)							<0.001	<0.001	<0.001
Pseudo R^2	0.3216	0.2129	0.3278	0.0578	0.0380	0.0585	0.1864	0.0832	0.1878

Table 4 Risk-Adjusted Performance of Stocks with versus without Hedge Funds

This table presents the risk-adjusted performance of stocks with and without hedge funds. Panel A presents the results for IPO stocks. For each month from April 1994 to December 2010, IPO stocks that went public in the last quarter are grouped into two portfolios: *With-HF* contains IPO stocks held by hedge funds at the first report date after the IPO, and *Without-HF* contains IPO stocks not held by hedge funds at the first report date after the IPO. In addition, we construct a zero-investment portfolio (*With − Without*) consisting of a long position in IPO stocks held by hedge funds and a short position in those not held by hedge funds. The portfolios are rebalanced every quarter. Over the sample period, 3,292 IPO stocks are classified in the group of *With-HF* and 873 IPO stocks are classified in the group of *Without-HF*. Panel B presents the results for non-IPO stocks. We define non-IPO stocks as all stocks in CRSP database other than the 4,165 stocks in our IPO sample. For each month from April 1994 to December 2010, we separate the non-IPO stocks into two portfolios: *With-HF* contains non-IPO stocks that are held by hedge funds at the end of previous quarter and *With-HF* contains non-IPO stocks that are not held by hedge funds at the end of previous quarter. In addition, we construct a zero-investment portfolio (*With − Without*) consisting of a long position in non-IPO stocks held by hedge funds and a short position in those not held by hedge funds. Portfolios are rebalanced every quarter. Over the sample period, 11,301 non-IPO stocks are classified into the group of *With-HF* and 10,203 non-IPO stocks are classified into the group of *Without-HF*. The portfolio returns are regressed on the Fama-French-Carhart four factors. There are 201 monthly portfolio returns in each regression. Weighted least squares method is employed to correct for heteroscedasticity, with the weight being the number of stocks in the portfolio for each quarter. Parameter estimates are shown in the table with the corresponding standard errors in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: IPO Stocks						
	Alpha	RMRF	SMB	HML	MOM	Adj. R^2
Without-HF	-1.120**	1.133***	0.858***	-0.004	-0.193	0.5289
	(0.452)	(0.115)	(0.139)	(0.183)	(0.126)	
With-HF	0.695	1.348***	0.701***	-0.960***	0.213**	0.7720
	(0.440)	(0.114)	(0.118)	(0.157)	(0.098)	
With – Without	2.205***	0.151	0.022	-0.848***	0.483***	0.2635
	(0.620)	(0.160)	(0.170)	(0.227)	(0.143)	
Panel B: Non-IPO Stocks						
	Alpha	RMRF	SMB	HML	MOM	Adj. R^2
Without-HF	0.106	0.582***	0.539***	0.077	-0.101***	0.7583
	(0.151)	(0.037)	(0.042)	(0.049)	(0.029)	
With-HF	0.133*	0.905***	0.533***	0.233***	-0.135***	0.9548
	(0.080)	(0.018)	(0.023)	(0.025)	(0.015)	
With − Without	0.035	0.319***	0.023	0.177***	-0.045**	0.5284
	(0.105)	(0.024)	(0.030)	(0.033)	(0.020)	

Table 5 Risk-Adjusted Performance of IPO Stocks with Unexplained Hedge Fund Ownership

This table presents the risk-adjusted performance of stocks with unexplained hedge fund ownership. We first calculate the predicted percentage holding/count of hedge fund ownership at the first report date after the IPO from the Tobit/negative binomial regressions and then use the residuals as proxies for hedge funds' private information that is not explained by IPO deal and firm characteristics. For each month from April 1994 to December 2010, we construct three portfolios with those IPO stocks that went public in the last quarter: (1) *Without-HF* consists of 873 IPO stocks not held by hedge funds at the first report date after the IPO, (2) *Positive Unexplained HF Holding* consists of 1,259 IPO stocks with positive residuals from the Tobit regression in Model 6 of Table 3, and (3) *Positive Unexplained HF Count* consists of 1,464 IPO stocks with positive residuals from the negative binomial regression in Model 9 of Table 3. The portfolios are rebalanced every quarter so that only IPOs in the previous quarter are included in the portfolios at each point in time. In addition, we construct two zero-investment portfolios consisting of a long position in Portfolio (2) or (3) and a short position in Portfolio (1). The portfolio returns are then regressed on the Fama-French-Carhart four factors. There are 201 monthly portfolio returns in each regression. Weighted least squares method is employed to correct for heteroscedasticity, with the weight being the number of stocks in the portfolio for each quarter. Parameter estimates are shown in the table with the corresponding standard errors in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Alpha	Rm - Rf	SMB	HML	MOM	Adj. R^2
(1) Without-HF	-1.120**	1.133***	0.858***	-0.004	-0.193	0.5289
	(0.452)	(0.115)	(0.139)	(0.183)	(0.126)	
(2) Positive Unexplained HF Holding	1.188**	1.248***	0.553***	-1.220***	0.219*	0.7066
	(0.564)	(0.149)	(0.151)	(0.209)	(0.134)	
(3) Positive Unexplained HF Count	0.946*	1.308***	0.561***	-1.210***	0.335***	0.7153
	(0.561)	(0.144)	(0.144)	(0.199)	(0.130)	
(2) − (1)	2.675***	0.051	-0.060	-1.093***	0.489***	0.2635
	(0.665)	(0.173)	(0.185)	(0.254)	(0.166)	
(3) − (1)	2.588***	0.130	-0.050	-1.120***	0.549***	0.2897
	(0.687)	(0.176)	(0.186)	(0.254)	(0.169)	

Table 6 Alternative Explanations of the Risk-Adjusted Performance of IPO Stocks with Hedge Fund Ownership

We address two alternative explanations with the calendar-time portfolio regressions of the zero-investment portfolio returns as in Tables 4 and 5. Panel A reports the impact of favorable IPO allocations on abnormal returns. (1) To alleviate the effects of allocated shares, we exclude IPOs that take place in the last month of each quarter. (2) To remove all allocated shares from our analysis, we exclude all holdings by those hedge funds that already have shares at the first report date to ensure that all shares at the second report date are newly purchased on the secondary market between the first and second report dates. We then construct the portfolios based on the "allocation-free" holdings at the *second* report date after the IPO. Panel B reports the impact of hedge fund activism on abnormal returns. (3) We remove all shares by hedge funds holding more than 5% of a stock at least once within eight quarters after the IPO. (4) We remove all shares by hedge funds holding more than 1% of a stock for four consecutive quarters within eight quarters after the IPO. For brevity purpose, we only report the coefficient estimates of the intercepts (alphas) with the corresponding standard errors in the parentheses. The number of IPOs in each zero-investment portfolio is included in the brackets. ***,**,* represent the significance level of 1%, 5%, and 10% respectively.

Panel A: Allocation		
	(1) Exclude IPOs in the Last Month of Each Quarter	(2) Second Report Date and Exclude Allocated Shares
With − Without	1.882***	1.162**
	(0.700)	(0.481)
	[2,269 − 544]	[2,305 − 1,825]
Positive Unexplained HF Holding − Without	2.274***	1.316***
	(0.771)	(0.488)
	[924 − 544]	[1,310 − 1,825]
Positive Unexplained HF Count − Without	2.321***	1.194**
	-0.767	(0.528)
	[978 − 544]	[1,201 − 1,825]
Panel B: Activism		
	(3) Exclude >5% Holdings	(4) Exclude >1% Holdings for 4 Quarters
With − Without	1.793***	1.602**
	(0.603)	(0.625)
	[3,211 − 954]	[3,194 − 971]
Positive Unexplained HF Holding − Without	2.378***	1.682**
	(0.640)	(0.654)
	[1,392 − 954]	[1,289 − 971]
Positive Unexplained HF Count − Without	2.328***	2.173***
	(0.667)	(0.692)
	[1,439 − 954]	[1,444 − 971]

Table 7 The Return Predictability of Hedge Fund Ownership versus Non-Hedge Fund Ownership

This table reports the estimates from the Fama-MacBeth (1973) regressions of one-quarter-ahead returns of IPO stocks on hedge fund ownership and non-hedge fund ownership. For each calendar quarter from 1994:Q2 to 2010:Q3, stocks that were taken public within the last eight quarters are included in the cross-sectional regressions. The coefficient estimates are the time-series average of coefficients from the quarterly cross-sectional regressions. The hedge fund ownership variables include the change in the percentage of shares held by hedge funds (ΔHFP_t), the percentage of shares held by hedge funds from the last quarter (HFP_{t-1}), the change in the number of hedge funds investing in each stock (ΔHFN_t), and the number of hedge funds from the last quarter (HFN_{t-1}). We further decompose ΔHFP_t into buy-trade ($HFP\_BUY_{t,}$) and sell-trade (HFP_SELL_t), and ΔHFN_t into the number of funds initiating positions (HFN_BUY_t) and the number of funds liquidating positions (HFN_SELL_t). The corresponding non-hedge fund ownership variables are defined in the same fashion. We control for variables that are associated with hedge fund ownership and future returns: *Offer Size* is the total amount of capital raised by the issuer; *Offer Price Revision* is the percentage difference between the offer price and the midpoint of the initial filing range; *Underwriter Rank Dummy* is an indicator variable that equals one if underwriter rank is greater than or equal to eight; *VC-Backed Dummy* is an indicator variable that equals one if the IPO firm is backed by venture capitalists; *Price* is stock price; *Turnover* is the average ratio of monthly volumes over shares outstanding during the three months in the previous quarter; *Firm Age* is the number of years from the founding date of the firm to the IPO offer date; *Volatility* is the standard deviation of daily returns during the three months in the previous quarter; *Dividend Yield* is the ratio of cash dividend over share price (if cash dividend is missing, we set it to zero); *S&P500 Dummy* is an indicator variable that equals one if the IPO firm is included in the S&P500 index; *R&D Intensity* is the ratio of R&D expenses over sales (if R&D is missing, we set it to zero); *Size* is the market value of equity as measured by price times shares outstanding; *Market-to-Book* is the ratio of market value over book value of common stocks; *Past Return* is the preceding three-month cumulative market-adjusted return. IPO deal characteristics are measured at the time of the offering. Other firm and stock characteristics are measured at each quarter-end. Newey-West (1987) standard errors adjusted for heteroscedasticity and autocorrelation up to four lags are presented in the parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 7 - Continued

	(1)	(2)	(3)	(4)
Hedge Fund Ownership				
ΔHFP_t (%)	0.307***			
	(0.083)			
HFP_{t-1} (%)	0.108***	0.156***		
	(0.040)	(0.045)		
HFP_BUY_t (%)		0.036		
		(0.235)		
HFP_SELL_t (%)		-0.409**		
		(0.172)		
ΔHFN_t			0.350***	
			(0.132)	
HFN_{t-1}			0.353**	0.434***
			(0.145)	(0.151)
HFN_BUY_t				0.263*
				(0.143)
HFN_SELL_t				-0.540**
				(0.257)
Non-Hedge Fund Ownership				
$\Delta NonHFP_t$ (%)	0.033			
	(0.033)			
$NonHFP_{t-1}$ (%)	0.004	-0.015		
	(0.021)	(0.026)		
$NonHFP\_BUY_t$ (%)		0.132***		
		(0.046)		
$NonHFP\_SELL_t$ (%)		-0.002		
		(0.104)		
$\Delta NonHFN_t$			0.174***	
			(0.037)	
$NonHFN_{t-1}$			0.014	-0.014
			(0.025)	(0.026)
$NonHFN\_BUY_t$				0.203***
				(0.049)
$NonHFN\_SELL_t$				-0.091
				(0.081)
Log(Offer Size)	-0.822	-0.952	-0.585	-0.733
	(0.898)	(0.965)	(0.807)	(0.845)
Offer Price Revision (%)	-0.009	-0.011	-0.010	-0.009
	(0.019)	(0.018)	(0.020)	(0.018)
Underwriter Rank Dummy	1.500*	1.891*	1.878*	1.922*
	(0.838)	(1.034)	(1.000)	(1.025)
VC-Backed Dummy	2.448**	2.644**	2.401**	2.186**
	(1.096)	(1.199)	(1.042)	(1.006)
Log(Price)	0.148	-0.122	0.265	0.326
	(1.112)	(1.238)	(1.202)	(1.184)
Turnover	-0.145	-0.034	-0.279	-0.275
	(0.204)	(0.268)	(0.245)	(0.249)
Log(1+Firm Age)	0.366	0.188	0.317	0.329
	(0.435)	(0.457)	(0.437)	(0.445)
Volatility (%)	-0.281	-0.428	-0.235	-0.260
	(0.333)	(0.471)	(0.297)	(0.338)
Dividend Yield (%)	4.101	6.005***	4.666*	4.494*
	(2.656)	(2.303)	(2.610)	(2.636)
S&P500 Dummy	0.440	2.946	-4.432	-3.323
	(1.503)	(3.147)	(4.698)	(4.827)
R&D Intensity	-1.414*	-1.926	-2.013	-1.712
	(0.814)	(1.224)	(1.342)	(1.077)
Log(Size)	-0.036	-0.039	-0.037	-0.041
	(0.031)	(0.035)	(0.028)	(0.033)
Market-to-Book	0.314	0.235	-1.015	-0.800
	(0.747)	(0.780)	(0.888)	(0.918)
Past Return (%)	-0.019	-0.015	-0.020	-0.024
	(0.018)	(0.018)	(0.018)	(0.018)
Intercept	0.327	2.404	4.312	3.986
	(3.991)	(5.332)	(4.732)	(5.089)
No. of Cross-sectional Regressions	66	66	66	66
Average Adj. R^2	0.0651	0.0753	0.0711	0.0672

Table 8 Alternative Explanations of the Return Predictability of Hedge Fund Ownership

We address alternative explanations with Fama-MacBeth regressions as in Table 7. Panel A reports the impact of IPO allocations on return predictability. (1) To remove allocated shares, we exclude all first-time holdings by those investors that have shares on the first report date. (2) To remove investors that have participated in the allocation process, we delete all holdings by those investors that have shares on the first report date. Panel B reports the impact of hedge fund activism on return predictability. (3) We remove all shares by investors holding more than 5% of a stock at least once within eight quarters after the IPO. (4) We remove all shares by investors holding more than 1% of a stock for four consecutive quarters within eight quarters after the IPO. For brevity purpose, we only report the coefficient estimates of the hedge fund ownership variables. Newey-West (1987) standard errors adjusted for heteroscedasticity and autocorrelation up to four lags are presented in the parentheses. ***,**,* represent the significance level of 1%, 5%, and 10% respectively.

Panel A: Allocation

	(1) Exclude Allocated Shares				(2) Exclude Participating Funds			
ΔHFP_t (%)	0.435***				0.439***			
	(0.162)				(0.173)			
HFP_{t-1} (%)	0.043	0.077			0.053	0.074		
	(0.086)	(0.100)			(0.090)	(0.104)		
HFP_BUY_t (%)		0.323*				0.339*		
		(0.181)				(0.201)		
HFP_SELL_t (%)		-0.534**				-0.544**		
		(0.242)				(0.263)		
ΔHFN_t			0.460**				0.433**	
			(0.177)				(0.185)	
HFN_{t-1}			0.350**	0.680***			0.364**	0.625***
			(0.141)	(0.241)			(0.148)	(0.228)
HFN_BUY_t				0.318**				0.274
				(0.158)				(0.175)
HFN_SELL_t				-0.981***				-0.839**
				(0.369)				(0.375)
Non-Hedge Fund Ownership	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of cross-sectional regressions	66	66	66	66	66	66	66	66
Average Adj. R^2	0.0658	0.0628	0.0683	0.0719	0.0656	0.0640	0.0689	0.0697

Panel B: Activism

	(3) Exclude >5% Holdings				(4) Exclude >1% Holdings for 4 Consecutive Quarters			
ΔHFP_t (%)	0.542***				0.341***			
	(0.141)				(0.114)			
HFP_{t-1} (%)	0.184	0.188			0.042	0.084		
	(0.134)	(0.130)			(0.108)	(0.111)		
HFP_BUY_t (%)		0.590***				0.291*		
		(0.228)				(0.170)		
HFP_SELL_t (%)		-0.549**				-0.273		
		(0.254)				(0.263)		
ΔHFN_t			0.339***				0.298**	
			(0.123)				(0.123)	
HFN_{t-1}			0.336**	0.399***			0.302**	0.356***
			(0.135)	(0.133)			(0.122)	(0.138)
HFN_BUY_t				0.291**				0.246*
				(0.145)				(0.139)
HFN_SELL_t				-0.468*				-0.403
				(0.249)				(0.278)
Non-Hedge Fund Ownership	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of cross-sectional regressions	66	66	66	66	66	66	66	66
Average Adj. R^2	0.0666	0.0642	0.0710	0.0669	0.0710	0.0750	0.0705	0.0671

Table 9 Hedge Funds' Connected Holdings versus Nonconnected Holdings in IPO Stocks

This table reports the risk-adjusted returns of hedge funds' connected and nonconnected holdings in IPO stocks. For each calendar quarter from 1994:Q1 to 2010:Q3, we separate each hedge fund's 13F holdings of stocks that were taken public within the last eight quarters into two groups: connected holdings and nonconnected holdings. A hedge fund's holding in a particular IPO stock is defined as "connected" if at least one of the hedge fund's prime brokers is among the lead underwriters for the IPO. Otherwise, the holding is classified as "nonconnected". For the connected (nonconnected) portfolio, we first calculate each hedge fund's monthly return in the following quarter across stocks weighted by the dollar holdings in each stock and then we compute the average monthly returns across funds weighted by the dollar holdings of each hedge fund. Portfolios are rebalanced every quarter. "Connected − Nonconnected" is the difference between the connected portfolio and the nonconnected portfolio. The portfolio returns are then regressed on the Fama-French-Carhart four factors. There are a total of 201 monthly portfolio returns. The weighted least squares method is employed to correct for heteroscedasticity, with the weight being the sum of holdings in each portfolio at each quarter. Parameter estimates are shown in the table with the corresponding standard errors in parentheses. Panel A presents the whole sample analysis. In Panel B, we divide the sample based on three hedge fund characteristics: size, age, and strategy. First, size is measured using the total value of hedge fund holdings from 13F filings at a given quarter. Large funds have value greater than the median and small funds have value smaller than the median at a given quarter. Second, age is the time since the hedge fund first filed its 13F. Old funds have age longer than the median and young funds have age shorter than the median at a given quarter. Third, we divide funds into two groups based on their self-reported investment strategy: if a hedge fund management company has a hedge fund using equity-hedge or event-driven as its main strategy, the hedge fund management company is labeled as "IPO-Related". All other hedge funds are labeled as "Others". In Panel C, we divide the sample into three sub-periods, 1994-1998 (pre-Bubble), 1999-2001 (Internet Bubble), and 2002-2010 (post-Bubble). Only alphas from the regressions are reported in Panels B and C. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Connected vs. Nonconnected

	Alpha	RMRF	SMB	HML	MOM	Adj. R^2
Connected IPO Holdings	1.143***	1.544***	0.523***	-1.110***	0.424***	0.8441
	(0.433)	(0.094)	(0.100)	(0.119)	(0.071)	
Nonconnected IPO Holdings	-0.249	1.436***	0.513***	-0.878***	0.282***	0.9035
	(0.266)	(0.062)	(0.065)	(0.079)	(0.044)	
Connected − Nonconnected	1.001***	0.075	0.082	-0.183*	0.117**	0.1176
	(0.320)	(0.074)	(0.077)	(0.093)	(0.053)	

Panel B: Alphas of Sub-Samples

	Fund Size		Fund Age		Fund Strategy	
	Large	Small	Old	Young	IPO-Related	Others
Connected IPO Holdings	1.425***	0.068	0.863**	1.717***	1.183***	0.202
	(0.480)	(0.389)	(0.412)	(0.535)	(0.441)	(0.529)
Nonconnected IPO Holdings	-0.248	-0.226	-0.327	-0.100	-0.251	-0.245
	(0.267)	(0.305)	(0.254)	(0.342)	(0.265)	(0.445)
Connected − Nonconnected	1.062***	0.348	0.862**	1.271***	0.988***	0.537
	(0.381)	(0.346)	(0.341)	(0.409)	(0.322)	(0.721)

Table 9 - Continued

Panel C: Alphas of Sub-Periods			
	Pre-Internet Bubble (1994-1998)	Internet Bubble (1999-2001)	Post-Internet Bubble (2002-2010)
Connected IPO Holdings	0.341	2.539*	0.670*
	(0.705)	(1.364)	(0.376)
Nonconnected IPO Holdings	0.243	-0.555	-0.087
	(0.385)	(0.816)	(0.242)
Connected − Nonconnected	0.156	2.439**	0.726**
	(0.617)	(1.019)	(0.283)

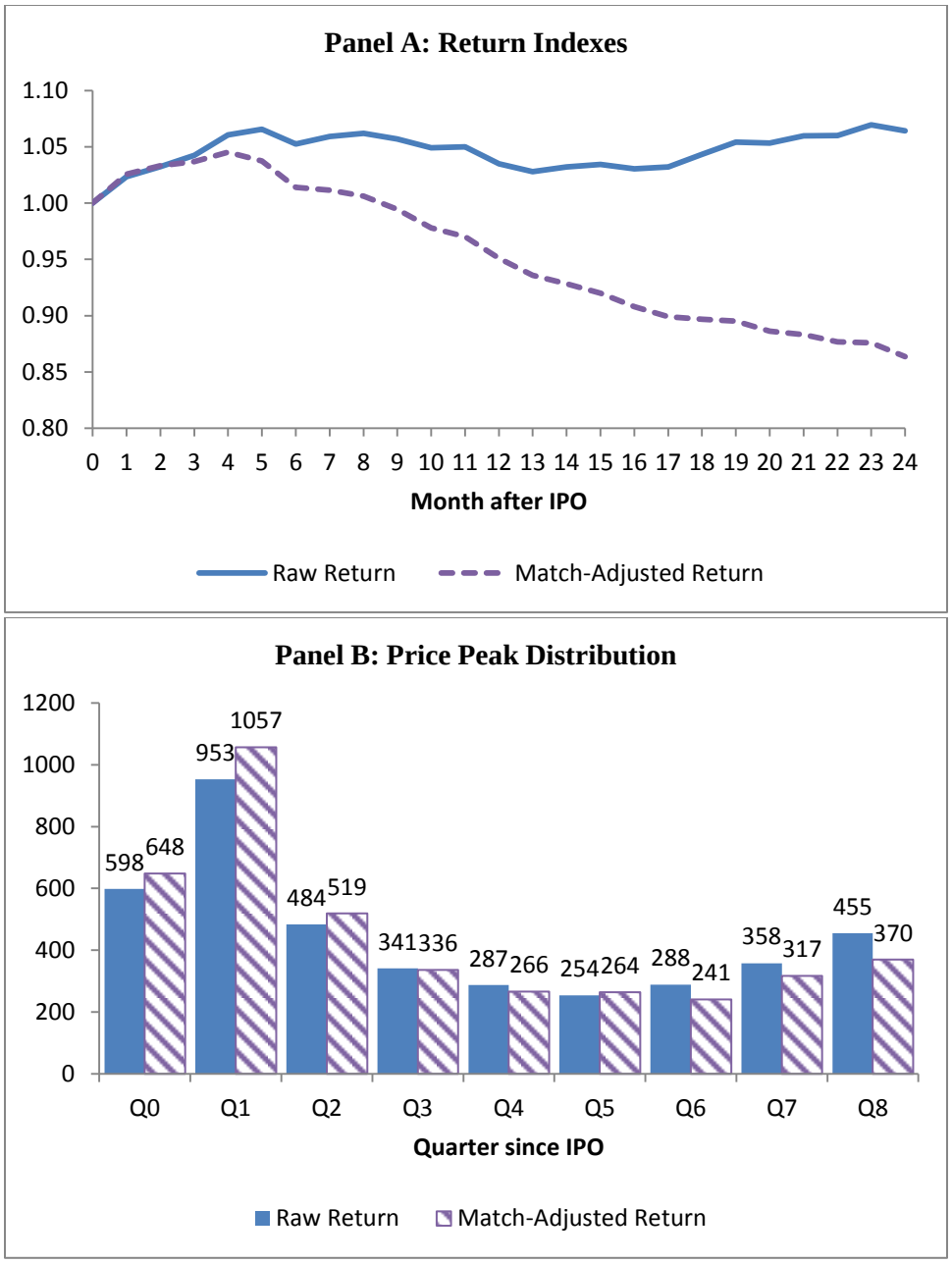

Figure 1 IPO Long-Run Underperformance and the Distribution of Price Peaks for IPO Stocks
For each IPO stock, we construct a total return index (match-adjusted return index) based on its monthly raw returns (match-adjusted returns) within two years of the IPO. In Panel A, we use a "representative" stock to illustrate the typical price movement of IPO stocks after the offer date. The representative stock is defined as a hypothetical stock whose return equals the average return of all IPO stocks in the sample. The total return indexes (match-adjusted return indexes) of the representative stock are then plotted from the time of the IPO to two years (24 months) after the IPO. Panel B shows the distribution of the price peak of individual IPO stocks, where the price peak for each stock is defined as the quarter in which its return index reaches the highest point within the two-year window after the offer date.

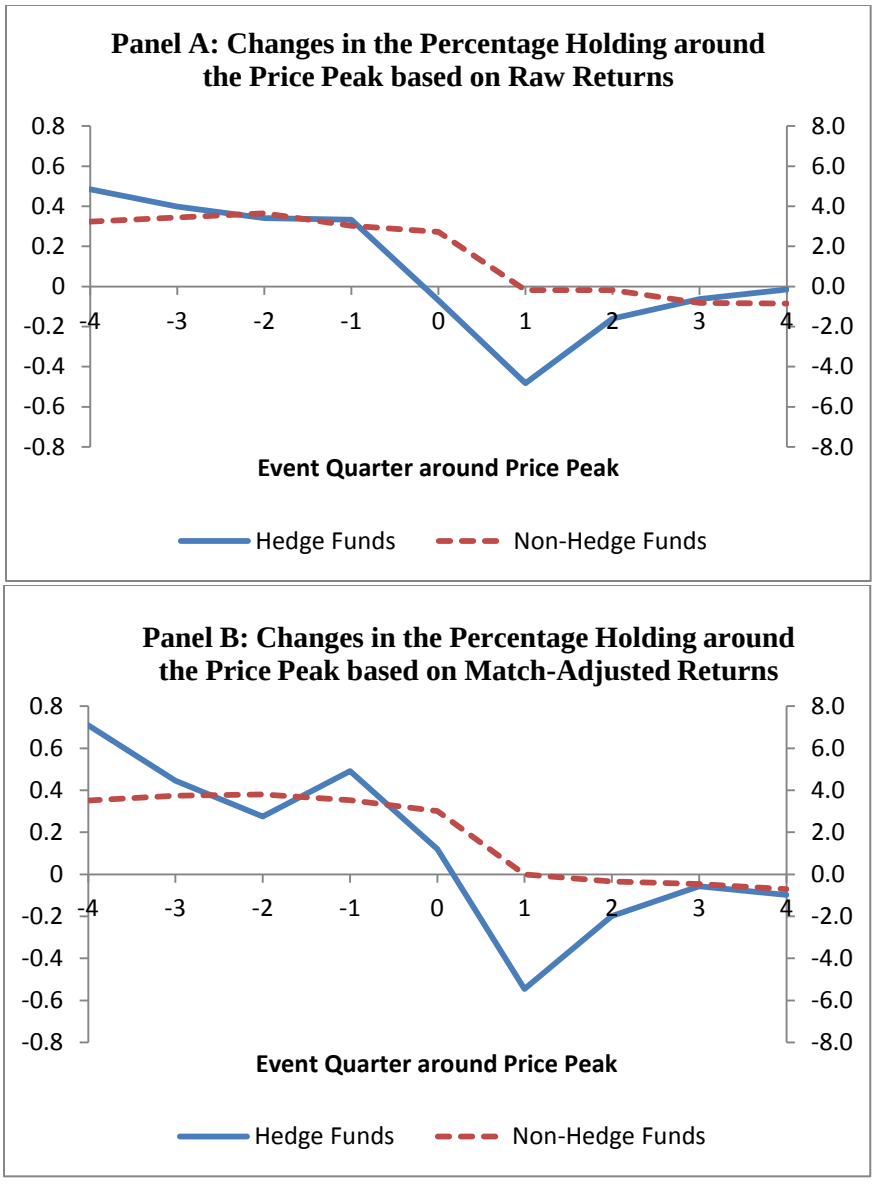

Figure 2 Changes in the Percentage Holding around the Price Peak of IPO Stocks

We first align all our sample firms according to their price peak event quarters, i.e., we assign event quarter zero to the quarter when the return index of an IPO stock reaches its highest point. We then examine the change in the percentage holding of hedge funds (*ΔHFP*) and the change in the percentage holding of non-hedge funds (*ΔNonHFP*) from four quarters before to four quarters after the price peak quarter. The change in the percentage holding of hedge funds is displayed on the left vertical axis and the change in the percentage holding of non-hedge funds is displayed on the right vertical axis. Horizontal axis is the number of quarters relative to the price peak quarter.