Outside Insiders: Does Access to Information Prior to an IPO Generate a Trading Advantage After the IPO?

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Abstract

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KEYWORDS: Limited partners, information, investment returns, familiarity bias, venture backed IPOs, insider trading.

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Abstract

We investigate whether access to information prior to an IPO generates a trading advantage after the IPO. We find that limited partners (LPs) of venture capital funds obtain high returns when they invest in newly listed stocks backed by their funds. These returns are not explained by LPs' differing stock picking abilities, and are higher when LPs' information advantage over the public is higher. Further, LPs' access to information eliminates the familiarity bias that they display otherwise. Overall, access to information prior to the IPO results in a trading advantage. These findings contribute to the debate on insider trading regulations.

We investigate whether access to information prior to an initial public offering (IPO) generates a trading advantage after the IPO. We focus on information obtained through venture capital (VC) funds. VC backed startups have raised more than $160 billion in the last 30 years through initial public offerings (IPOs), accounting for more than half of all IPOs in recent years (Ritter (2013)). VC funds typically have had investments in these startups for several years prior to the IPO, particularly if they are the lead VC fund of the funding consortium. During this time, the Limited Partners (LPs) of the VC funds obtain information about these startups. This information may remain relevant to stock prices after the startups go public if stock prices do not fully incorporate the information at the time of the IPO.

Lead VC funds often are deeply involved with the companies in which they invest, offering them plenty of opportunity to obtain information.[1] LPs may have access to some of this information through the quarterly investment reports they typically receive from their VCs, official meetings of LPs and general partners, and through investment advisory review boards on which LPs often serve. VCs are also likely to share information about their investments with their LPs when they try to raise consecutive funds. As a result, LPs may obtain value-relevant information about these stocks, which we refer to as "connected stocks."[2]

However, access to information about a firm prior to its public listing does not necessarily imply a trading advantage after the listing. LPs' information about the connected startup could be revealed to the public around the time of the public offering. Moreover, LPs may also have access to information through other channels (Ivkovic and Weisbenner (2007); Cohen, Frazzini and Malloy (2008, 2010)) or simply may have better investment ability (Sensoy, Wang and Weisbach (2014)).

[1] Before the IPO, VC fund managers are often on the board of directors, and they help firms by providing strategic advice, professionalizing firm management and attracting better resources (Megginson and Weiss (1991); Hellmann and Puri (2000, 2002); Baum and Silverman (2004); Lindsey (2008); Ozmel, Robinson and Stuart (2013)). Lead VC funds in particular are very involved in their portfolio companies (Gorman and Sahlman (1989)) and could be more informed than non-lead VC funds that invest in later rounds (Admati and Pfleiderer (1994)).

[2] Analogously, we will also refer to "connected LPs" when the LP is connected to a stock, and to "connected investments" when the LP invests in a connected stock.

To explore our hypothesis and the alternative explanations, we construct a sample of LP investments in newly listed stocks which are backed by their VCs as the lead financier. The 13F filings allow us to observe these investments at the end of the first calendar-quarter after the IPO. We only consider new listings that have lockup periods longer than three months to ensure that any LP investments we observe are a result of an active investment decision by the LP and are not contaminated by shares distributed by the VC funds as they liquidate their holdings in the stock, i.e. make in-kind distributions. We focus on LPs' returns for the quarter after we observe their investments. In robustness tests we also consider alternative approaches and horizons.

We find that LPs' investments in connected stocks have an average raw return of 12.43% and an average Carhart 4-factor alpha of 18.64% in the next quarter. However, this does not necessarily mean that LPs have an information advantage; LPs may simply have superior investment skills. Therefore, we control for LP and VC fixed effects as well as a battery of other variables, and find that the difference between an LP's returns in connected investments versus an LP's returns in unconnected investments is still statistically significant and ranges between 14-20% in Carhart 4-factor quarterly alphas. These results are consistent with LPs having information about connected stocks, and cannot be explained by LPs' heterogeneous abilities to pick stocks, or by VC reputation effects.

We obtain similar results when using value-weighted returns, sign of returns, raw returns or after adjusting for risk using the Fama-French 3 factor model, industry/size matched portfolios or size/book-to-market-ratio matched portfolios. Comparing LPs' investments in connected stocks to all possible investments that LPs can make in all newly listed stocks, or restricting the sample to VC backed stocks, also yields similar results.

Consistent with an information advantage explaining our results, LPs' investments in connected stocks are relatively larger (average is $7.7 million) compared to their average original investments in

the IPO firm through their VC funds (about 4-8 times)[3]. However, these investments are small compared to LPs' stock portfolios and unlikely to contribute significantly to their overall returns. On the other hand, we are likely underestimating connected investments because we only observe positions that are held by LP firms that are required to report 13f documents and that are not liquidated before the end of the first quarter after the IPO.

Another way of investigating whether our results are driven by information is to check whether returns vary with the expected information advantage that connected LPs have over the public. For example, LPs may have more of an information advantage when investing in connected stocks for which public investors have relatively less information. Therefore, we partition our sample based on proxies for the level of public information produced about stocks. We find that the difference between an LP's returns in connected investments and an LP's returns in unconnected investments is higher among stocks that are not covered by any analysts in IBES, smaller stocks, and non-NYSE listings. Thus, when LPs presumably have a greater information advantage over the public, they obtain higher returns from their investments in connected stocks.

LPs may also have a higher information advantage if their connection to the stock implies better access to information. We consider two additional types of connections with varying access to information. First, we investigate connections thorough non-lead VC funds, which have relatively less access to information compared to lead VC funds due to less in-depth interactions with the entrepreneurs (Gorman and Sahlman (1989)). Second, we investigate connections through a prior business relationship between the LP and the VC firm that backs the stock.[4] Thus, the LP does not have access to formal information through their VC. We find some weak evidence of return predictability in non-lead fund connected investments, and we find no evidence of return predictability for investments

[3] We obtain mean size and mean number of LPs of both early and late stage VC funds from Lerner, Schoar and Wongsunwai (2007) and mean VC fund's investment in each startup that goes public from our sample.

[4] "Prior business relationship," means that the LP must have an investment in a different fund operated by the VC firm than the fund that backs the IPO. See Figure 1 or Section 2.2 for details on how this is defined.

in connections through prior relationships. We also find that controlling for the duration of the LP's investment in the startup does not explain the higher returns of connected investments. Overall, LPs obtain higher returns when their connection to the stock implies better access to information.

These results are consistent with LPs obtaining information from legal communication channels they have with their VC funds while fulfilling their fiduciary duty to monitor prior to the IPO. However, LPs may also obtain information about connected stocks through alternative channels. Although the channel of information dissemination is not crucial to our conclusion that LPs are informed about connected stocks, it may be important for policy purposes. To ensure that our results are not caused by local information sources (Loughran and Schultz (2005), Ivkovic and Weisbenner (2007)), we control for the geographic proximity of the LP to the startup in all specifications. Another information channel could be social ties (Cohen, Frazzini and Malloy (2008, 2010)) with the VC firms. Although we cannot entirely rule out this possibility, we do not find LPs performing better when they have a prior business relationship with the VC, which could possibly result in social ties. Overall, evidence is consistent with access to formal information channels prior to the IPO explaining our results.

We also verify that the number of connected investments in a particular stock positively and significantly predicts the stock's return in the next quarter. This leads to the possibility that outsiders may replicate connected LPs' investment strategies after observing their portfolios. Given that 13F reports are filed with a median delay of 43 days (Aragon and Martin (2012)), we check LPs' returns in the first month before the public observes their portfolios. LPs' returns from connected investments are statistically significant in the first month. However, in the second and third months, the returns slightly decline and their statistical significance varies across risk adjustment methods. The evidence is consistent with LPs' information advantage diminishing over time after their portfolios are observed.

A novel contribution of our study is to examine how access to information and familiarity bias interact to determine propensity to invest. We find that LPs display a higher propensity to invest, which

indicates a familiarity bias (Huberman (2001); Coval and Moskowitz (2001); Ivkovic and Weisbenner (2005); Massa and Simonov (2006); Cao, Han, Hirshleifer and Zhang (2011)), when they only have a prior business relationship with a VC firm that backs the IPO, i.e. when they do not have access to information. Conversely, we do not find a familiarity bias for an LP's investments in connected stocks. The finding that access to information can reduce or eliminate familiarity bias is intuitive, yet to the best of our knowledge, this is the first time it has been demonstrated.

More importantly, our contribution is to show for the first time that the information that non-insider institutions obtain through their connections prior to the IPO may still be valuable after the IPO. Public investors are disadvantaged in trading against these institutions that are not recognized as insiders by regulations. Our results are consistent with the large literature which documents that insiders' trades, including VC funds' in-kind distributions (Gompers and Lerner (1998)), predict future returns (see Seyhun (1986) and many others). We complement this literature by showing that outside investors, who have connections to a firm prior to its IPO, may still hold an information advantage compared to public investors.

This is also the first paper that analyzes LPs' investments in stocks backed by their VC firms. Our results indicate that institutional investors can obtain additional benefits from investing in private equity other than the returns on the private equity investment itself. However, this does not necessarily mean that VCs are leaving money on the table. VC backed IPOs are known to be underpriced for various reasons (Lee and Wahal (2004)), and stocks may also be underpriced after the IPO but prior to the first quarter because prices may not reflect all inside information. Our results show that LPs with information invest in these underpriced securities.

Our results have important policy implications as well. We find that LPs obtain information about companies in their VC funds' portfolios as a part of their fiduciary duty to monitor investments in private equity. Acquisition of such information is not illegal but at the same time the information may

not be fully accessible by the public even after the IPO. The legality of trading on non-public information is a crucial part of recent debates on proposed insider trading bills, which have focused on discussions about how to successfully prosecute illegal insider trading cases while avoiding unintended consequences of additional regulation.[5] Our results demonstrate a setting where a broad definition of illegal non-public information may have unintended spill-over effects in private equity investing.

2. Data, Variables and Empirical Strategy

2.1 Data Construction

We use the Private Equity module in Thomson One Banker to track VC investments in startups. SDC Platinum is used to track LP investments in VCs and CDA/Spectrum (Thomson Reuters Institutional Holdings) is used to track LP investments in startups' newly listed stocks.

CDA/Spectrum tracks 13F filings with the SEC. Any institutional investment manager who manages over $100 million is required to file a 13F form listing their assets on the last trading day of each quarter. They must report essentially all holdings of publicly traded equity securities of over $200,000 or 10,000 shares. Thomson One Banker's Private Equity module and CDA/Spectrum are comprehensive databases that capture the vast majority of transactions that we are interested in. However, we will be missing small institutional investors and very small investments. In addition, the SDC dataset may not capture all LP investments in VC funds. Therefore, we are likely to underestimate the prevalence of LP investments in connected stocks. Given that we miss some connected investments this may make it more difficult to detect any differences between connected investments and unconnected investments because some of the investments that the data show as unconnected may in fact be connected investments.

[5] New York Times by Peter Henning (3/17/2015), "Court Strikes on Insider Trading, and Congress Lobs Back," and Bloomberg View by Matt Levine (4/1/2015), "Another Politician Wants to Ban Insider Trading."

Unfortunately, these three datasets frequently use different names for the same institution. Thus, it is necessary to hand-match names to ensure accuracy for LPs and VCs. In this process, a firm might have one name in one dataset, and multiple names in another. For example, the insurance company Aetna appears as 6 separate entities in CDA/Spectrum.[6] We match all six to the SDC entry for "Aetna, Inc."

We define LP entries as one entity if they are under the same umbrella of corporate control. This implicitly assumes that buy-side investment managers in different divisions of the same institution share information. Since there is no legal impediment to sharing information across different investment divisions and there may be synergies from sharing information, this may be a reasonable assumption. Indeed, Massa and Rehman (2008) and Duan, Hotchkiss and Jiao (2014) find that organizations are able to share value-relevant information across divisions when making investments in the stock market. If managers within the same institution do not share information we are less likely to find that LPs possess an information advantage when investing in connected stocks. Regardless, in robustness tests, we also use a narrower definition of entities in which we count separate investment divisions as independent entities. We match LPs from SDC with investors in newly listed stocks from CDA/Spectrum. We find matches for 199 LP entities.

We hand-match VC funds from Thomson One Banker with VC funds from SDC. If a VC fund is labeled as "unspecified fund" we include it as an unspecified fund of the VC firm. These funds are not counted as distinct funds in our tests. Overall, we are able to match 416 VC firms and 722 VC funds to both databases.

[6] "AETNA LF + CASUALTY CO"'; "AETNA LIFE & CAS CO"; "AETNA LIFE & CASUALTY"; "AETNA LIFE & CASUALTY CO"; "AETNA LIFE INS & ANNUITY"; and "AETNA SERVICES INC" are the six names. Some of these are different divisions of Aetna, Inc, while others are different legal names for the same division used at different times.

For stocks, we only include IPOs that adhere to the criteria set forth in Loughran and Ritter (2004).[7] This covers "almost all IPOs of domestic operating companies that are large enough to be of interest to institutional investors." We obtain the list of 9,597 IPOs that have PERMNOs and meet these criteria from Jay Ritter's website. We merge this list with public firms with CUSIPs from CDA/Spectrum. The matching process is as follows: we use the CRSP-COMPUSTAT linking table to match PERMNOS from the list on Ritter's website with CUSIPS in CDA/Spectrum. We require that the IPO Date in Jay Ritter's dataset must be during the first quarter that the firm appears in CDA/Spectrum to ensure that we are capturing LP investments within the first three months the stock is available to the public. To obtain data on these stocks' IPOs, we match the CUSIPS to Thomson One Banker's Equity database of IPOs. To discover which VCs backed an IPO, we use Thomson One Banker's "Deal Number" category to match to startups in Thomson One Banker's PE Exits database whose "exit type" is listed as an IPO.

We only consider stocks that have a lockup period of at least 3 months. This guarantees that we are only capturing LPs' active investment decisions. After a lockup period expires, it is possible that LPs may obtain connected stocks in their portfolio from VC funds that make in-kind distributions,[8] i.e. distribute their shares to their LPs as they liquidate holdings in the stock. While it is technically possible for VCs to make in-kind distributions before the end of the IPO lockup period, this is not done in practice in order to mitigate litigation risk. We use lockup dates from Thomson One Banker, supplemented with hand-collected data from prospectuses in Free Edgar. Data availability for lock-up dates limits us to IPOs after 1988. However, we use data from 1970-2013 in Thomson One Banker and SDC in order to evaluate which LPs and VCs have relationships before the IPO date. After restricting the sample to IPOs

[7] Loughran and Ritter exclude best efforts offers; ADRs; closed-end funds; REITs; banks and savings and loans (S&Ls); partnerships; firms not covered by CRSP within six months of the offering; and IPOs with an offer price below $5.00 per share.

[8] In addition, Gompers and Lerner (1998) find that the timing of these distributions is not random; rather, VC funds tend to make in-kind distributions when a stock is overvalued.

from 1988-2013 that meet our lockup period requirement, the result is 4,169 IPOs, of which 1,536 are VC-backed.

2.2 Definitions and Examples of Connections

We denote a connection if the LP has an investment in a VC fund which is the lead VC fund in the financing consortium of the IPO firm. Gorman and Sahlman (1989) find that the lead venture capitalist visits the entrepreneur more often and stays longer for each visit than other VC funds that participate in the deal. Consequently, the lead VC fund could obtain a higher quantity and quality of information about the startup than other VC funds participating later in the deal (Admati and Pfleiderer (1994)), and in turn LPs can obtain more information about portfolio firms through their VC funds. Therefore, our primary variable of interest is connections through lead VC funds.

We create two additional variables to capture the varying degree of potential information advantage an LP may obtain through its connections with VC firms. We denote a non-lead connection if the VC fund of the LP has invested in the newly listed stock, but not as the lead VC fund. Presumably, non-lead VC funds would obtain less information about a startup than a lead VC fund would obtain.

Finally, if, prior to the IPO, the LP has invested in one of the funds of the VC firm other than the VC fund that backs the newly listed stock, we assume that there is a "relationship" between the LP and the VC firm, but not a "connection." As a result, the LP may be aware of the newly listed stock since it is backed by a VC firm with whom they have a relationship. However, the LP would not have received information about the newly listed stock from formal channels prior to the IPO because they are not an LP of one of the VC funds that backs the IPO firm.

These connections are illustrated in Figure 1. There are 3 VC firms: VC firm_A has two funds (A1 and A2), VC firm_B has three funds (B1, B2, and B3), and VC firm_C has 1 fund (C1). There are two LPs who invest in VC funds: LP1 invests in VC funds A2 and B1, and LP2 invests in VC fund B3. Dark solid lines indicate which VC fund is the lead VC fund for a startup, and light solid lines indicate VC funds that

are not lead VC funds. For example, VC fund A2 is the lead investor in stock 4, and is a non-lead investor in stock 3. Using our terminology, we would say LP1 has a connection to startups 4 and 5. LP1 has a non-lead connection to startups 3 and 6. LP1 has a relationship with startups 2, 7, and 8. Similarly, LP2 has a connection to startup 7, a non-lead connection to startup 8, and a relationship with startups 4, 5, and 6. When denoting connections, non-lead connections, and relationships, we require that both the LP's investment in the VC and the VC's investment in the startup must occur before the startup's IPO.

An actual example of an LP investment in a connected stock in our sample is CALPERS' (the California Public Employees' Retirement System) investment in the stock of Aegerion Pharmaceuticals, Inc. CALPERS invested in a VC fund called Alta BioPharma Partners III that closed in 2003. The VC fund invested in Aegerion on 12/29/2005 as the lead fund and participated in 6 total rounds of funding. Aegerion had its initial public offering on 10/22/2010 and we observe that CALPERS held a position in the stock on 12/31/2010. From 12/31/2010 to 3/31/2011, the share price of Aegerion rose by 16.9%.

2.3 Investment Time and Return Evaluation Horizon

We observe LPs' investments when they file 13F reports at the end of the calendar-quarter of the IPO date, i.e. the beginning of the first full calendar-quarter after the IPO date. We know that LPs' holdings must be the result of active investment decisions because we only consider IPOs with a lock up period of at least 3 months, ruling out stock distributions made by VC funds. In our main tests, we examine LPs' returns after we observe their portfolio holdings. Thus, we are treating the LPs' decision to remain a stockholder as a de facto indication of their desire to invest in the stock on the day that we observe the holding.

LPs could have chosen to invest in the startup before, at, or after the IPO prior to the end of the first calendar-quarter. For all lead-connected investments in our sample, we check whether LPs have invested prior to the IPO together with their lead-VC funds using S-1 filings in Free Edgar. We only find

two cases of pre-IPO investments (co-investment) by LPs together with lead VC funds. Our results are robust to excluding these observations.

Since we do not know the exact timing of investments and do not observe investments that the LPs sell before filing 13F reports, we do not attempt to evaluate returns prior to observing LPs' holdings in our main specification. Evaluating returns prior to observing LPs holdings is not only a noisy exercise but may also produce biased results because we expect LPs to invest in underpriced securities, such as stocks that have performed poorly after the IPO and become undervalued. Regardless, we examine these returns in robustness tests.

Our main return horizon is the 3 months after the end of the quarter of the IPO. Because LPs usually file 13F reports with a delay of more than 30 days (Aragon and Martin (2012)), we also check returns in the first month after we observe LPs' portfolios to allow us to evaluate their returns prior to when the public can observe their portfolios. We consider these relatively short horizon returns for a number of reasons. First, as time goes on, LPs' holdings and hence returns become contaminated by in-kind distributions. Second, the accuracy and relevance of information obtained prior to the IPO is likely to diminish over time. Finally, connected LPs' information advantage over the public will diminish as the public learns more about the newly listed firm, particularly after the public is able to observe connected LPs' holdings.

2.4 Variables

We create a number of dummy variables to capture the nature of the connection between an LP and a newly listed stock. *Connect* is equal to 1 if the LP is connected to the stock through a VC fund that acts as the lead financier. *NonLeadConnect* is equal to 1 if the LP is connected to the stock through a VC fund other than the lead VC fund. *Relationship* is equal to 1 if the LP is not connected to the stock through a VC fund that backed the IPO, but has previously invested in another fund of a VC firm which operates a VC fund backing the IPO (as described in section 2.2). We also create a dummy variable *Invest* that is

equal to 1 if the LP owns shares of the newly listed stock in the first 13F filing after the IPO date, i.e. at the end of the calendar-quarter of the IPO date.

Some institutional investors may prefer not to invest in newly listed stocks for extended periods of time for various reasons. To control for these institutions, we introduce the dummy variable *Active_LP* which is equal to 1 if the LP has invested in any IPO in the previous 365 days.

Because we are investigating returns to newly listed stocks shortly after their IPO, we borrow many control variables from the IPO literature. The information advantage possessed by the LP may depend on publicly available information about these firms, which in turn may depend on firm characteristics. Therefore we control for the log of the firm's Market to Book ratio (*MtoB*), the log of the size of the IPO (*Proceeds*), the log of the number of years the firm has been in business at the IPO date (*Age*), and a Nasdaq dummy (*Nasdaq*).

Certain types of firms act as gatekeepers in the IPO process. The reputations of the venture capitalists (Nahata (2008); Krishnan, Ivanov, Masulis and Singh (2011)) and underwriters (Nanda and Yun (1997)) that back newly listed stocks can affect their returns. We control for the reputation of the underwriter (*UW_Reputation*) as specified by Loughran and Ritter (2004) and updated on Jay Ritter's website.

Although we control for VC fixed effects, it is possible that a VC firm's reputation may change over time. Therefore we control for *VC_Reputation*, which is equal to the log of the number of successful IPOs completed in the prior 3 years by the VC firm backing the newly listed stock.[9] We also include a dummy to indicate whether an IPO is VC backed (*VC_Backed*) (Lee and Wahal (2004)).

We control for two accounting variables that Field and Lowry (2009) find are correlated with newly listed stock returns. These are working capital scaled by assets (*Working_Capital)*, and a dummy variable for a positive EBIT (*Positive_EBIT*).

[9] If there are multiple venture capitalist firms backing an IPO, we use the reputation of the most reputable VC.

It is possible that LPs have an information advantage about local stocks. They may be in the same social networks as local CEOs, or there may be information available from the local media that is more costly to obtain for out-of-town investors (Loughran and Schultz (2005), Ivkovic and Weisbenner (2007)). Therefore we control for *LocalDummy*, a dummy variable that equals 1 if the headquarters of the LP is within 100 miles of the headquarters of the newly listed firm.

Firms may attempt to time the IPO market, which may affect returns (Baker and Wurgler (2002); Edelen and Kadlec (2005); Pastor and Veronesi (2005); Cornelli, Goldreich and Ljungqvist (2006); Ljungqvist, Nanda and Singh (2006)). Therefore we control for several timing variables for each IPO. We control for sentiment (*Sentiment*), which is a monthly survey of consumer sentiment conducted by the University of Michigan. We control for the return of the Russell2000 in the 30 days prior to the IPO (*Russell2000*). We also introduce the average 1-day underpricing of all IPOs over the past 3 months (*AvgUP*) and the average 1-day underpricing of any IPOs in the same industry over the past year (*IndustryAvgUP*). Detailed descriptions of all variables are in Table 1.

2.5 Empirical Methodology

We want to explore whether LPs have an information advantage when investing in connected stocks. However, institutions that invest in both venture capital and newly listed stocks are sophisticated investors that may have superior skill at identifying undervalued newly listed stocks (Pukthuanthong-Le and Varaiya (2007); Field and Lowry (2009); Chemmanur, Hu and Huang (2010); Chiang, Qian and Sherman (2010)). Similarly, omitted heterogeneity among VC firms backing the deal may explain IPO firm returns. Therefore, in our main specification, we focus on comparing LPs' connected investments to their investments in unconnected newly listed stocks while controlling for LP and VC fixed effects. In this specification, observations are defined as stock-LP pairs where the LP invests in the stock.

$$Return_{i,k} = \beta_0 + \beta_1 * Connect_{i,j} + \boldsymbol{\beta_2} * \boldsymbol{X_{i,j}} + FE_v + FE_j + \varepsilon_{i,j,k} \qquad (1)$$

In Equation (1), $Return_{i,k}$ is the return of newly listed stock *i* for period *k*. $X_{i,j}$ is a matrix of control variables that controls for characteristics of firm *i*, LP *j*, and time series control variables at the IPO date of stock *i*. FE_v and FE_j, represent VC fixed effects and LP fixed effects, respectively. Thus, the coefficient β_1 compares returns from LPs' investments in connected stocks versus unconnected stocks after controlling for LPs' heterogeneous ability to pick newly listed stocks and any heterogeneous effects on returns of all VCs that back the newly listed stock. We double-cluster error terms by LP and stock.

We use a number of additional specifications for robustness tests. We compare LPs' returns from connected stocks to all other newly listed stock returns, while controlling for LPs' average returns from all investments. Observations are defined as all LP-stock pairs in the sample. We specify this using equation (2).

$$Return_{i,k} = \beta_0 + \beta_1 * Invest_{i,j} * Connect_{i,j} + \beta_2 * Invest_{i,j} + \beta_3 * Connect_{i,j} + \boldsymbol{\beta_4} * \boldsymbol{X_{i,j}} + FE_v + \varepsilon_{i,j,k} \quad (2)$$

For this equation we control for VC fixed effects and cluster error terms at the newly listed stock level. Note that since the sample is all LP-stock combinations and the dependent (left-hand) variable is the same for all LPs that could have invested in the same stock, clustering at the LP level or controlling for LP fixed effects would not be meaningful.

Further, we test whether investments by connected LPs predict returns of newly listed stocks using a sample where we have one observation for each newly listed stock. Although in all of our tests above we cluster error terms at the stock level, a regression where there is one observation for each stock is a conservative alternate way to eliminate concerns about correlated error terms. We use the specification in Equation (3).

$$Return_{i,k} = \beta_0 + \beta_1 * NumConnectInvestments_i + \boldsymbol{\beta_2} * \boldsymbol{X_i} + \varepsilon_{i,k} \quad (3)$$

NumConnectInvestments counts the number of LPs that are connected to the stock via a lead VC that invested in the stock. $\boldsymbol{X_i}$ includes all of our control variables that do not vary based on the identity of the LP.

It is possible that LPs may also be motivated to invest in the connected stock to provide support for the IPO of their VC fund, instead of being motivated purely by returns to the stock. If this is the first-order determinant of the connected investments we observe, we do not necessarily expect connected investments to have any return predictability. Perhaps another way to test this alternative motivation is to check whether LPs are more likely to hold connected stocks at the end of the first quarter. To test how propensity to invest is affected by a connection, we use all possible LP-stock pairs and employ the following logit regression. We double-cluster error terms by LP and stock:

$$Invest_{i,j} = \beta_0 + \beta_1 * Connect_{i,j} + \boldsymbol{\beta_2} * \boldsymbol{X_{i,j}} + FE_j + FE_v + \varepsilon_{i,j} \quad (4)$$

3. Returns from Connected Investments

3.1 Summary Statistics

First we report returns of various groups of IPO firms during the first full calendar-quarter after their IPO. The average return of all newly listed stocks in our sample is 4.77% for raw returns (with a standard deviation of 42.1%) and 3.78% for Carhart 4-factor adjusted alphas during the quarter. The same average for LP investments in newly listed stocks is 2.64% (standard deviation of 40.3%) for raw returns and 1.98% for risk adjusted returns. However, LPs' returns from connected investments are substantially higher, averaging 12.43% for raw returns (standard deviation of 39.2%) and 18.64% for risk adjusted returns. These returns are not simply higher because they are VC backed IPOs, which have an average of 2.28% for raw returns (standard deviation of 51.4%) and 1.53% for risk adjusted returns.

These returns to connected investments are comparable to returns obtained by *legal* insider traders (Bettis, Vickrey and Vickrey (1997); Lakonishok and Lee (2001); Jeng, Metrick and Zeckhauser (2003); Agrawal and Cooper (2015)) but significantly less than Ahern's (2014) finding of 35% over 21 days for *illegal* insider trading. Thus, illegal insider information earns much higher returns on an annualized basis than the returns we document. This makes sense for two reasons. First, information obtained before the IPO is not expected to be as valuable as illegal inside information obtained after the IPO. Second, LPs can also make investments in connected stocks without possessing any superior information.

Figure 2 shows the probability density function of connected investment returns (raw and risk adjusted) overlaid on the probability density function of all IPO stock returns. There is a striking difference between the two probability density functions. Connected investments' probability density function is not only positively skewed but also seems to have a second hump around 60% returns. The second hump indicates that the high mean return for connected investments at 12.43% is not caused by extreme outliers and is consistent with a group of the connected investments being informed investments.

In our sample, connected investments have a mean size of $7.7 million, which is estimated to be on average 4-8 times larger than LPs' average investments in individual startups within their VC fund's portfolio. To come up with this comparison we obtain mean size and mean number of LPs in both early and late stage VC funds from Lerner, Schoar and Wongsunwai (2007) [10] and mean VC fund's investment in each startup that goes public from our sample, which is about 5% of the VC firm's total reported investments. However, we do not investigate the contribution of these positions to LPs overall portfolio returns because these investments are small compared the mean stock portfolios of LPs in our sample.

[10] Metrick and Yasuda (2010) reports similar numbers using data from one large LP.

In addition, we only observe positions of LPs, who do not liquidate before the end of the first quarter after the IPO. Consequently, we are likely largely underestimating LPs' investments in connected stocks.

3.2 LP's Returns from Investing in Connected versus Unconnected Stocks

In Table 3 we compare LP investments in connected stocks versus unconnected stocks using Carhart 4 factors to adjust for risk, and after including various combinations of control variables, LP fixed effects, and VC fixed effects as in equation (1). The coefficient for *Connect* indicates the difference between an LP's investments in connected stocks versus investments in unconnected stocks. We find that an LP's investments in connected stocks do significantly better than the same LP's other investments in newly listed stocks in all specifications. An LP's connected investments have about 14% higher returns per quarter (*t*-stat = 1.83) than the same LP's unconnected investments when we only include LP and VC fixed effects as controls. Introducing all other control variables increases the return gap between an LP's connected investments and other investments to 20% per quarter (*t*-stat = 2.73). Control variables are generally insignificant with the exception of average underpricing of IPOs over the 90 days prior to the firm's IPO, which is negative and significant in some specifications.

Table 4 repeats the regression specification from column 6 of Table 3 using raw returns and alternative risk adjustment methods. Alternative risk adjustment methods include subtracting returns of matched portfolios by size quintiles and 49 industries (245 portfolios) and matched portfolios by size quintiles and book-to-market quintiles (25 portfolios), as well as running regressions using the Fama-French 3 factor method. Across these specifications, we find that an LP's returns from investing in connected stocks are 16% to 22% higher per quarter compared to its returns from unconnected investments, and the difference is always statistically significant.

We document that the return gap between an LP's connected and unconnected investments is large in both raw and risk adjusted returns after controlling for a battery of variables. The evidence so

far is consistent with LPs having information about connected stocks and cannot be explained by LPs' heterogeneous abilities to pick stocks or by VC reputation effects.

3.3 LPs' Returns from Connected Stocks Compared to All Newly Listed Stocks

The summary statistics show that LPs' returns from investing in unconnected newly listed stocks are slightly lower than the average returns of all newly listed stocks in our sample. Therefore it might make sense to compare LPs' returns from connected investments to all potential investments they could have made in newly listed stocks. Table 5 reports regression results based on equation (2).

LPs' connected investments have about 24% higher Carhart 4-factor alphas per quarter (*t*-stat = 3.30) compared to all other investments by LPs in newly listed stocks. The coefficient on "Invest" indicates that on average, LPs lose 1% (*t*-stat = 2.37) from their investments compared to their opportunity set. Therefore LPs' connected investments actually perform about 23% better than all other newly listed stocks in which they could have invested. We obtain similar results using raw returns and after adjusting for risk using Fama-French 3 factors, matched portfolios by size quintiles and 49 industries, and matched portfolios by size quintiles and book-to-market quintiles.

A number of control variables are significant across multiple specifications. While *Proceeds* and *Russell2000* are negatively correlated with future returns, *UW_Reputation* is positively correlated with future returns.

3.4 Stock Level Predictability

Next we test whether investments by connected LPs can predict returns of newly listed stocks. For this test, we use the specification in Equation (3), where each stock is a single observation, and the number of connected investments is an independent variable.[11]

[11] This could alternatively be tested with a rolling portfolio approach, where one can go long stocks that connected LPs invest in and short stocks that connected LPs do not invest in. However, the limited number of observations for each time period precludes such an approach.

Table 6 reports the results. As above we test raw and risk adjusted returns using various risk adjustment methods. The number of connected investments significantly predicts returns in all specifications, with the coefficient varying between 19% and 25%. In summary, active investment decisions of connected LPs seem to predict future stock returns. This is consistent with LPs' possession of information about connected stocks.

3.5 Return Predictability Horizon

Our results above imply that newly listed stock returns can be predicted by the investments of connected LPs. If this fact is known then outsiders can simply replicate LPs' portfolios after they are revealed to the public. LPs' portfolios are observed after they file 13F reports. While we do not witness the filing date, Aragon and Martin (2012) find that that on average, 88% of institutions file 13F reports more than 30 days after the end of the quarter. The median reporting lag time of 43 days implies that, on average, outsiders will only be able to replicate a connected LP investment strategy with about a month and a half lag. LPs' returns in the first month are less likely to be replicated by other investors and perhaps as a result LPs can earn higher returns before information about their holdings is released to the public.

In Table 7, we follow how returns to an LP's investments in connected stocks vary in the first, second and third months after the end of the calendar-quarter of the IPO, using equation (1). We find that the average coefficient on *Connect* across various risk adjustment methods in the first month is 5.9% and returns are always statistically significant at the 5% level. The average coefficients in the 2nd and 3rd months are 5.6% and 4.3%, respectively. These are slightly lower than the average for the first month, and their statistical significance is generally lower or insignificant. This is somewhat consistent with a decrease in the information advantage of connected LPs after outsiders are able to observe their portfolio holdings. Alternatively, as time passes markets participants may obtain more information about the newly listed stock, reducing the information advantage of connected LPs.

3.6 Returns Prior to Observing connected LP Investments

As discussed above, examining returns after we observe LPs' portfolios is the cleanest way to test whether LPs possess an information advantage. Thus, we may be underestimating LPs' returns by ignoring returns prior to observing LPs' portfolios. However, we are also concerned that LPs may be more likely to choose to invest in stocks that have not performed well and became undervalued, resulting in past returns having a downward bias. With these caveats in mind, we examine LPs' hypothetical returns from their connected investments assuming that they invest at time of IPO.

The average IPO first day return of LPs' connected investments is 31.5% compared to 19.6% for all IPOs in which they could have invested. Although the difference in returns is large in magnitude it is not statistically significant because of high volatility of first day returns. After the first day, LPs' investments in connected stocks have 5.0% average returns for the first month and 8.5% average returns for the first 90 days after their IPO. In comparison, all other stocks in which LPs could have invested generate 2.9% average return for the first month and 5.2% return for the first 90 days. The differences between these returns are not statistically significant. Therefore, we are likely underestimating LPs' returns from connected investments. However, we view these results with some circumspect given that we do not know exact timing of LPs' investments.

3.7 Additional Robustness Tests

We run a number of additional, unreported robustness tests of our main result using Carhart 4-factor adjusted alphas in equation (1). If the coefficient on the variable *Connect* is similar in magnitude and is statistically significant we report that our results are robust. These results are available upon request.

3.7.1 Potential VC Effects on Returns

All LP connected investments are by definition VC backed. Therefore, we include VC fixed effects, VC backed dummy and time varying VC reputation in all of our tests. Our results do not seem to be driven by VC backing or reputation effects. Indeed, the magnitude of returns differences between connected

investments versus others (around 20%) would be hard to reconcile with publicly observed information. Alternatively, we repeat our main tests in Table 3 and Table 5 using a sample that drops stocks that are not backed by any VC firm. We find that LPs' investments in connected stocks have 21% to 25% higher returns compared to returns of other VC backed stocks. Dropping VC fixed effects or other VC related controls also yields similar results.

We do not observe a random sample of VC and LP matching (Sorensen (2007); Marquez, Nanda and Yavuz (2015)). Given that the public knows the identity of VC funds and institutional investors of these funds at the time of IPO, we do not expect such sample selection bias (Heckman, 1979) to affect stock returns a quarter after the IPO. Regardless, we address this possibility using a geographical distance dummy which is equal to 1 if the distance between the LP and the VC is less than 200 miles, as an instrument for probability of matching. Our instrument is likely exogenous given that location of VCs and LPs are known and are not likely to affect returns a quarter after the IPO. The first stage regression shows that the geographical distance dummy is significant (*z*-stat = 5.25) and hence our instrument is relevant. The first stage (LR) Chi-square test statistic is 25.5, which makes it unlikely that we have a weak instrument (Stock and Yogo, 2005). In the second stage regression we find that the coefficient of the inverse-mills ratio is insignificant (*t*-stat = -0.43) and the coefficient on *Connect* is unaffected, indicating that sample selection is unlikely to play an important role.

3.7.2 Other Robustness Tests

In our main result we are forced to drop many observations because of missing control variables, especially for *MtoB*, *LocalDummy*, and *Working_Capital*. Our results are robust to dropping these variables and hence including missing observations.

In order to address the concern that our results may be driven by a few small investments we run value-weighted regressions yielding similar results.

Given the high volatility of returns of newly listed stocks, an appropriate robustness test could be testing whether LPs can predict the direction of returns (as opposed to direction and magnitude). We run a logit regression to test whether an LP's investments in connected stocks predict the direction of Carhart 4-factor quarterly alphas. Indeed, we obtain highly statistically significant results that *Connect* predicts the direction of future risk adjusted returns. The logit regressions imply that at average values for the other variables, an LP's investments in connected stocks are 23.5% more likely to have a positive Carhart 4-factor alpha compared to that same LP's other investments (*t*-stat = 4.39).

In defining connections, we define an entity as being under the same umbrella of corporate control. For instance we include investment divisions of large banks as the same entity (for details see section 2.1). For robustness we also use a narrower definition of entities in which we count separate investment divisions as independent entities. The narrower definition yields similar results.

4. Do Results Vary with Heterogeneity in LPs' Information Advantage?

Our finding in section 3 that LPs obtain higher returns from their connected investments is consistent with LPs having information about connected stocks. Another way of testing whether our results are driven by connected LPs' information advantage is to test whether our results vary with proxies for the level of the expected information advantage.

4.1 Alternative Information Channels

So far we have used LPs' connections to the stock's lead VC fund to determine whether LPs' investments in connected stocks do better. In this section we investigate other channels by which an LP can gain an information advantage. Although the channel of information dissemination is not crucial to our conclusion that LPs are informed about connected stocks, it may matter for policy purposes.

4.1.1 Heterogeneity in LP's Connection to the VC: Non-Lead Connections

First, we investigate non-lead VC fund level connections (*NonLeadConnect*), i.e. where the VC fund is not the lead fund that invested in the startup. LPs with non-lead connections may have access to less

information than LPs with lead connections. Our results in Table 8 indicate that an LP's risk-adjusted returns in non-lead connected investments are not statistically different from its returns in other newly listed stocks. In addition, the difference in returns between lead connections and non-lead connections is also statistically significant.

Although we expected non-lead connections to have less predictive power than lead connections, it is somewhat surprising that an LP's non-lead connected investments have no predictive power at all. We have repeated all of our previous tests using non-lead fund level connections. For brevity we do not report these results. In some of the specifications, LPs' investments in non-lead connected stocks do have predictive power. For example testing for raw returns in specification 2 shows that non-lead connected investments have about 10% higher returns (*t*-stat = 2.00) than LPs' other investments. However, this result is not robust across risk adjustment methods and specifications.

In order to understand whether the difference between returns to lead-VC fund connected investments and other types of investments can be explained by the duration that LPs have had the opportunity to analyze the startup, in column 5 of Table 8 we add a control variable (*Duration*) for the time difference between the IPO date and the VC fund's first investment in the IPO firm. The coefficient on *Connect* remains similar both in magnitude and significance.

Overall, LPs' investments in non-lead fund connected stocks have either no or significantly lower, and not as robust, predictive power compared to LPs' investments in lead-fund connected stocks.

4.1.2 Heterogeneity in LP's Connection to the VC: Relationship with VC firm

Second, we investigate VC firm level relationships (*Relationship*), i.e. where the LP has invested in one of the funds of the VC firm, but not in the VC fund that invested in the newly listed firm. In this case the LP won't be able to receive information through formal channels, such as reports about the company, prior to the IPO. However the LP may still obtain information through informal channels such as social

ties (Cohen, Frazzini and Malloy (2008, 2010)). When LPs have previous business relationships with VC firms, presumably they may also have personal connections with their VC firm's general partners.

The results in Table 8 indicate that the difference between an LP's risk-adjusted returns in relationship investments is not statistically different from its returns in other newly listed stocks. The difference in returns between lead connected investments and relationships investments is also statistically significant. Unlike non-lead fund connections (section 4.1.1), VC firm level relationships continue to be insignificant across all other specifications (not reported).

Although these results do not rule out the possibility that personal connections may play some role in the transfer of information, they emphasize that a connection through a lead VC fund that has invested in the newly listed stock, and hence a formal information channel, is more likely to explain our results. In other words LPs obtain information from formal reports of lead-VC funds as a part of their fiduciary duty to monitor their investments in private equity, and later they use this information to make informed investments in newly listed stocks.

4.1.3 Local Information Channels

LPs may obtain information about connected stocks through alternative channels such as local information sources (Loughran and Schultz (2005), Ivkovic and Weisbenner (2007)) or political connections (Faccio and Hsu (2013)). To control for this possibility, in all specifications we control for a local dummy variable (*LocalDummy*) that equals one if the headquarters of the LP is located less than 100 miles from the headquarters of the stock. This variable is never significant in any of our regressions that investigate LPs' returns to connected investments. However, as discussed in detail below, we do find that geographical proximity is positively correlated with the likelihood of investing in newly listed stocks.

4.2 Heterogeneity in Publicly Available Information

LPs may have a greater information advantage when public investors possess less information. Therefore, we examine whether our results vary with the magnitude of the expected information advantage held by insiders over public investors, as proxied by firm size, analyst coverage, and exchange listing requirements. For each proxy we divide the sample into two subsamples and evaluate the LPs' performance when investing in connected stocks in each subsample using equation (1). Results for this section are reported in Table 9.

4.2.1 Small versus Large Stocks

Market participants have an incentive to produce more information about larger stocks. Thus, investors who have private access to information on large stocks may have less of an advantage over the public than investors who have private access to information on small stocks (Chari, Jagannathan and Ofer (1988)). Therefore, columns 1 and 2 of Table 9 report results on two subsamples divided according to whether stock size is above or below the 30th percentile of all contemporaneous NYSE stocks.[12]

We find that in the subsample of relatively smaller newly listed stocks, an LP's investments in connected stocks perform significantly better than its other investments. An LP's connected investments have 20% higher Carhart 4-factor alphas per quarter than the same LP's unconnected investments in this subsample. In contrast, in the subsample of stocks with higher market value, an LP's connected investments have 5% higher alphas per quarter than the same LP's unconnected investments, and this number is not statistically significant. The difference between the coefficients in the two subsamples, 15%, is statistically significant with a *t*-stat of 1.99.

[12] We repeated this analysis using the median size of stocks in our sample to divide the sample, with similar results.

4.2.2 NYSE Versus Non-NYSE Stocks

NYSE listing requirements are historically more stringent than NASDAQ (Corwin and Harris (2001)).[13] Because these requirements could also be correlated with firm characteristics that are related to information generated about a firm by the market, we consider this to be another way to measure the information advantage that connected LPs may possess over other market participants. Presumably connected LPs may have more of an information advantage in non-NYSE listings. Columns 3 and 4 of Table 9 repeat our test in subsamples of NYSE and non-NYSE stocks. The non-NYSE category includes both AMEX and NASDAQ stocks.

We find that an LP's investments in connected non-NYSE stocks yield significantly higher returns than their other investments in non-NYSE stocks. An LP's connected investments in non-NYSE stocks have 22% higher Carhart 4-factor alphas per quarter than the same LP's unconnected investments in non-NYSE stocks. In contrast, connected investments do not result in higher returns in the NYSE subsample.[14] The difference between the coefficients on *Connect* in the two subsamples is statistically significant (*t*-stat = 2.88). To the extent that exchange listing is a proxy for publicly available information about a stock, this result is consistent with LPs possessing a greater information advantage about connected stocks when there is less publicly available information.

4.2.3 Analyst Coverage

Another proxy for information advantage of connected LPs could be whether or not a stock is covered by an analyst. In columns 5 and 6 of Table 9 we divide the sample according to whether or not the stock is covered by an analyst in IBES before we witness the LP's holding of the stock in its 13F filing.

[13] Corwin and Harris note that the NYSE has more stringent requirements than NASDAQ including higher net tangible assets, higher market values of publicly held shares, more shareholders, more publicly held shares, and higher pretax income. The NYSE also "weighs factors such as a company's position and stability in its industry, the composition of its board of directors and audit committee, and the voting rights associated with securities."

[14] The standard errors for the connection coefficient in the NYSE subsample do not converge. However, the point estimates for these specifications are sufficiently low that they can't possibly be statistically significant. For robustness we re-ran the test while omitting VC fixed effects, and obtained qualitatively similar results. We report this specification with VC fixed effects in the interest of consistency with the rest of the paper.

We find that results are stronger in the subsample of stocks that are not covered by an analyst. An LP's connected investments in stocks with no analyst coverage have 22% higher Carhart 4-factor alphas per quarter than the same LP's unconnected investments with no analyst coverage. In contrast, among stocks with coverage by an analyst, an LP's connected investments do not statistically significantly perform better than unconnected stocks. The difference between the coefficients in the subsamples, about 14%, is not statistically significant, but it is economically large and directionally consistent with the idea that connected LPs have a higher information advantage among stocks that have lower publicly available information.[15]

5. Access to Information and Propensity to Invest

Table 10 reports the results of equation (4) where we test whether LPs' propensity to invest varies with the nature of their connection to the stock. A caveat is that we do not observe LPs who have invested in the stock and liquidated their position prior to the end of the calendar-quarter of the IPO.

We consider connections through a lead VC fund, connections through a non-lead VC fund, and relationships with a VC firm backing the IPO. In all three types of connections, an LP is presumed to be aware of the newly listed stocks backed by the VC as in Merton (1987), although the degree of familiarity may vary with the strength of the connection, i.e. familiarity could be highest when the connection is through the lead VC fund. An LP's familiarity with a VC firm or a VC's portfolio may result in a familiarity bias towards investing in stocks backed by the VC. In addition, LPs may invest in stocks backed by their VC funds for the purpose of supporting the stock, making them even more likely to invest in connected and non-lead connected stocks. Regardless of the LP's motivations, our previous

[15] Clearly, analyst coverage is not random (Cliff and Denis (2004)), and can be correlated with stock characteristics that affect future returns. However, this is less of a concern in our study since we measure stock returns within the subsample with analyst following and within the subsample without analyst following. Regardless, this test adds to the circumstantial evidence that our results are likely driven by connected LPs' information advantage over the public.

results imply that the LP only has a robust information advantage over the public when a connection exists through the lead VC fund.

We find that LPs are not more likely to invest when they have a connection through a lead VC fund or a non-lead VC fund. This finding is not consistent with the argument that LPs invest in connected stocks to support IPOs backed by their VC funds. However, LPs are more likely to invest if their only connection is a previous business relationship with the VC firm. Interestingly, this higher likelihood to invest does not coincide with improved performance (as already shown in Section 4.1 and Table 8). In other words, LPs display a familiarity bias when they are weakly familiar with the stock and do not have direct access to information, but do not display a familiarity bias when they have a stronger familiarity but at the same time access to more information. Our results suggest that access to value-relevant information eliminates, or at the very least strongly reduces, familiarity bias.

In addition, we find that LPs are more likely to invest in newly listed stocks that are local, consistent with previous studies (Huberman (2001), Coval and Moskowitz (2001), Ivkovic and Weisbenner (2005), Massa and Simonov (2006)). We also find that LPs are more likely to invest in larger issues, VC-backed stocks, and stocks backed by more reputable underwriters. Positive performance of recent IPOs and whether the LP has invested in any other newly listed stocks in the past year are also important determinants of the propensity to invest in newly listed stocks.

Familiarity and access to information are often positively correlated, making it difficult to separately discern their effects on propensity to invest. However, we observe that the familiarity bias disappears, even when familiarity itself is presumably strongest, once an LP has formal access to information through a VC fund. This is a novel and intuitive finding and contributes to our understanding of familiarity bias in investing.

6. Conclusion

We investigate whether outsiders' access to information prior to an IPO, through indirect ties, generates a trading advantage after the IPO. The answer is not a priori clear because if the IPO market is perfectly efficient, the information would be incorporated into prices at the time of the IPO. We test this using venture capital (VC) backed initial public offerings (IPOs), where limited partners (LPs) of VC funds could become informed about the prospects of the IPO firm through their formal exchanges with the VC fund.

To the best of our knowledge, this is also the first study analyzing investment decisions of LPs in newly listed stocks backed by their VC funds. Although VC backed IPOs have accounted for more than half of all IPOs in recent years (Ritter (2013)), there has been little or no research analyzing connected LPs' investments in IPO firms and their returns.

We find that LPs obtain higher returns when they invest in connected stocks than when they invest in unconnected stocks after controlling for LP and VC fixed effects. In other words, controlling for LPs' heterogeneous investment skills, LPs still do better when they invest in connected stocks. These results are robust to various ways of measuring excess returns, controlling for a battery of variables that could affect newly listed firm returns, and alternative regression specifications. Further, connected LPs' returns are higher when their information advantage over the public is greater. LPs' returns are higher when investing in connected stocks with presumably less publicly available information, i.e. stocks that are smaller, have no IBES analyst coverage, and are not listed on NYSE. In addition, LPs' returns are highest and most robust when their VC's connection to the stock implies better access to information, i.e. when LPs are connected through the lead VC fund.

Another novel contribution is that LPs' familiarity bias disappears when investing in connected stocks. A growing literature analyzes local (familiarity) bias in investing (Huberman (2001), Coval and Moskowitz (2001), Ivkovic and Weisbenner (2005), Massa and Simonov (2006)). Familiarity and access to information are often positively correlated, making it difficult to separately discern their effects on

propensity to invest. Our unique setup allows us to vary both information and familiarity, and we observe that familiarity bias disappears, even when familiarity itself is presumably strongest, once an LP has formal access to information through a VC fund. Our results suggest that access to value-relevant information eliminates, or at the very least strongly reduces, familiarity bias.

Perhaps most importantly, we show that outside investors, who do not have direct access to information after the IPO and hence are not considered insiders by regulatory agencies, may still hold an information advantage compared to public investors.

Our results also contribute to the debate on possible unintended consequences of recently proposed insider trading bills.[16] In an attempt to make insider trading violations easier to prosecute, some members of Congress have proposed bills that can potentially impose a broad ban on trades that use information that is not publicly available. Our findings indicate that this may have unintended consequences that might spill over to private equity investing, where information is legally acquired as a part of an LP's fiduciary duty to monitor its investments. Such a wide definition of insider trading could very well disincentivize these institutional investors from investing in either private equity or newly listed connected stocks.

[16] See the discussion in the New York Times by Peter Henning (3/17/2015), "Court Strikes on Insider Trading, and Congress Lobs Back," and Bloomberg View by Matt Levine (4/1/2015), "Another Politician Wants to Ban Insider Trading."

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Table 1 - Variable Definitions

Invest	A dummy variable = 1 if the LP has an investment in the IPO firm at the date of the first 13F filing after the IPO date, and = 0 otherwise. Source: CDA/Spectrum
Connect	A dummy variable = 1 if the LP has invested in a lead VC fund that backs the IPO, and = 0 otherwise. The investment must have occurred before the date of the IPO.
NonLeadConnect	A dummy variable = 1 if the LP has invested in a non-lead VC fund that backs the IPO, and = 0 otherwise. The investment must have occurred before the IPO date.
Relationship	A dummy variable = 1 if the LP has invested in a VC firm that backs the IPO, but not in a VC fund that backs the IPO, and = 0 otherwise.
LocalDummy	A dummy variable = 1 if the headquarters of the stock is within 100 miles of the headquarters of the LP, and = 0 otherwise.
Active_LP	A dummy variable = 1 if the LP has invested in any IPO in the dataset in the 365 days preceding the IPO of the stock being evaluated, and equal to zero otherwise. The sample used to create this variable includes stocks without a lockup period.
VC_Backed	A dummy variable = 1 if the IPO is backed by a VC firm, and = 0 otherwise.Source: Thomson One Banker
VC_Reputation	Over the past 1095 days, the natural log of 1 plus the number of IPOs that have gone public that previously have had investments from the VC firm. The sample used to create this variable includes stocks without a lockup period. If an IPO has not had any investments by VCs, then this variable is equal to zero. If the startup has received investments from multiple VC firms, this variable is the maximum among those firms.
MtoB	The log of the stock's market-to-book ratio at the time of the IPO. Source: Thomson One Banker and Compustat
Proceeds	The log of the proceeds that the startup receives from the IPO. Source: Thomson One Banker
Age	The log of 1 plus the number of years that the startup has existed at the time of the IPO. Source: Jay Ritter's website
UW_Reputation	The reputation of the underwriter on a scale from 1 through 9 (9 is highest reputation Reputation data is from Jay Ritter's website.
Positive_EBIT	A dummy variable = 1 if the startup's EBIT is greater than 0 in the last annual statement before the IPO, and = 0 otherwise. EBIT is defined as revenue - operating expenses. Source: Compustat
Working_Capital	The working capital of the startup in the final annual accounting statement released before the IPO, divided by the total assets. Source: Compustat
Nasdaq	A dummy variable = 1 if the IPO is on the Nasdaq exchange, and = 0 otherwise. Source: Thomson One Banker
Sentiment	The level of the University of Michigan Consumer Sentiment Index in the month of the IPO. Source: University of Michigan
Russell2000	The cumulative returns to the Russell2000 (small cap) index in the 30 days leading up to the IPO.
IndustryAvgUP	The average underpricing of every IPO in the same Fama-French 49 industry as the startup firm over the 365 days prior to the firm's IPO. The sample used to create this variable includes stocks without a lockup period.
AvgUP	The average underpricing of every IPO over the 90 days prior to the firm's IPO. The sample used to create this variable includes stocks without a lockup period.
Underpricing	The return of the IPO on the 1st day. Opening prices are taken from Thomson One Banker, and closing prices are taken from CRSP. Calculated by authors from CRSP and Thomson One Banker
NumConnect-Investments	The number of LPs that have invested in the IPO that have connections to the IPO.
Duration	The natural log of the number of months that the LP's VC fund has had an investment in the startup prior to the IPO.

Table 2 – Correlations

This table reports pairwise correlations in the sample of all LP-stock pairs. Row 20 indicates the variable AvgUP. Numbers in bold indicate 10% significance.

	Carhart Alpha	Invest	Connect	NonLeadConnect	Relationship	Local Dummy	Active_LP	VC_ Backed	VC_Reputation	MtoB	Proceeds	Age	UW_Reputation	Positive_EBIT	Working_Capital	Nasdaq	Sentiment	Russell 2000	IndustryAvgUP
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2	**-0.011**	**1**																	
3	-0.001	**0.003**	**1**																
4	**-0.005**	**0.007**	**0.672**	**1**															
5	**-0.008**	**0.015**	-0.002	-0.002	**1**														
6	0.001	**0.034**	0.002	**0.004**	**0.004**	**1**													
7	0.003	**0.172**	0.002	0.002	**0.005**	**0.031**	**1**												
8	**0.014**	**0.004**	**0.038**	**0.042**	**0.094**	**0.007**	**-0.006**	**1**											
9	**-0.003**	**0.013**	**0.041**	**0.051**	**0.135**	**0.008**	**-0.008**	**0.596**	**1**										
10	**0.005**	**-0.014**	**-0.005**	**-0.006**	**-0.005**	**-0.004**	**0.024**	**0.099**	**0.043**	**1**									
11	**-0.033**	**0.154**	**0.009**	**0.012**	**0.015**	**0.041**	**-0.054**	**-0.091**	**-0.014**	**-0.127**	**1**								
12	-0.001	**0.036**	**-0.009**	**-0.006**	**-0.013**	**-0.013**	**0.003**	**-0.188**	**-0.130**	**-0.089**	**0.145**	**1**							
13	**0.015**	**0.097**	**0.013**	**0.016**	**0.031**	**0.025**	**-0.034**	**0.133**	**0.154**	**-0.072**	**0.602**	**0.107**	**1**						
14	**-0.004**	-0.001	**-0.019**	**-0.028**	**-0.052**	**-0.024**	**0.004**	**-0.399**	**-0.336**	**-0.092**	**0.089**	**0.318**	**0.017**	**1**					
15	**0.025**	**0.008**	**0.007**	**0.012**	**0.021**	**-0.011**	0.000	**0.154**	**0.143**	**-0.039**	**0.021**	**0.044**	**0.125**	**0.043**	**1**				
16	**0.016**	**-0.046**	**0.011**	**0.007**	**0.028**	**-0.027**	**0.030**	**0.277**	**0.197**	**0.128**	**-0.322**	**-0.115**	**-0.061**	**-0.232**	**0.082**	**1**			
17	**0.015**	**0.009**	**-0.019**	**-0.013**	**-0.010**	**0.010**	**0.061**	**0.038**	**0.080**	**0.102**	**-0.079**	**-0.043**	**-0.052**	**-0.184**	**0.010**	**0.177**	**1**		
18	**-0.057**	**0.020**	-0.001	-0.001	0.000	**0.012**	**-0.009**	-0.001	**0.010**	**0.004**	**0.087**	**0.012**	**0.033**	**-0.026**	**-0.029**	**-0.0157**	**0.025**	**1**	
19	**-0.003**	**0.033**	0.000	**0.004**	**0.025**	**0.013**	**0.007**	**0.193**	**0.210**	**0.160**	**0.045**	**-0.093**	**0.068**	**-0.268**	**0.022**	**0.201**	**0.417**	**0.033**	**1**
20	**-0.049**	**0.045**	**-0.004**	-0.001	**0.014**	**0.022**	**0.008**	**0.135**	**0.159**	**0.094**	**0.096**	**-0.092**	**0.078**	**-0.292**	**-0.021**	**0.159**	**0.516**	**0.132**	**0.681**

Table 3 – Returns to LP Investments in Connected versus Unconnected Stocks

The sample is all LP-stock pairs where the LP invests in the newly listed stock at the time of the first 13F filing after the stock is publicly listed. The dependent (left-hand) variable is the stock return after controlling for Carhart-4 factors. The time period of the return begins on the date that ownership is observed in CDA/Spectrum, and ends after 3 months. All variables are defined in Table 1. Standard errors are double clustered by stock and LP. Numbers in parenthesis indicate *t*-stats. *, **, and *** indicate 10%, 5%, and 1% levels of significance, respectively.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Connect	**0.167****	**0.135***	**0.159****	**0.154****	**0.154***	**0.202*****	**0.278*****	**0.211*****	**0.274*****
	(2.02)	(1.83)	(2.30)	(2.28)	(1.86)	(2.73)	(2.71)	(2.78)	(2.72)
LocalDummy			-0.001			0.001	-0.008	-0.001	-0.007
			(-0.10)			(0.04)	(-0.47)	(-0.05)	(-0.41)
Active_LP			-0.008			-0.002	0.023	0.007	0.011
			(-0.37)			(-0.07)	(0.88)	(0.26)	(0.40)
VC_Backed				-0.005		-0.013	-0.003	-0.013	-0.002
				(-0.15)		(-0.38)	(-0.11)	(-0.39)	(-0.07)
VC_Reputation				-0.007		-0.007	-0.004	-0.007	-0.003
				(-0.32)		(-0.33)	(-0.22)	(-0.33)	(-0.19)
MtoB				-0.003		-0.005	-0.007	-0.005	-0.007
				(-0.37)		(-0.55)	(-0.83)	(-0.55)	(-0.86)
Proceeds				-0.010		-0.009	-0.015	-0.010	-0.012
				(-1.03)		(-0.82)	(-1.40)	(-0.97)	(-1.15)
Age				-0.000		0.004	0.005	0.004	0.005
				(-0.03)		(0.38)	(0.48)	(0.39)	(0.47)
UW_Reputation				0.004		0.004	0.005	0.003	0.005
				(0.61)		(0.47)	(0.63)	(0.38)	(0.70)
Positive_EBIT				0.025		-0.010	-0.010	-0.009	-0.011
				(0.85)		(-0.34)	(-0.41)	(-0.32)	(-0.42)
Working_Capital				0.015		0.012	0.016	0.012	0.016
				(0.84)		(0.61)	(0.97)	(0.62)	(0.94)
Nasdaq				-0.004		-0.001	0.001	-0.002	0.003
				(-0.25)		(-0.04)	(0.06)	(-0.09)	(0.17)
Sentiment					0.001	0.001	0.001	0.001	0.001
					(1.08)	(0.87)	(1.20)	(1.02)	(0.97)
Russell2000					-0.200	-0.293	-0.292	-0.285	-0.300
					(-0.99)	(-1.10)	(-1.12)	(-1.07)	(-1.15)
IndustryAvgUP					0.062	0.069	0.086	0.066	0.091
					(0.97)	(0.92)	(1.22)	(0.87)	(1.29)
AvgUP					**-0.185****	-0.162	**-0.230****	-0.170	**-0.221****
					(-2.02)	(-1.46)	(-2.23)	(-1.54)	(-2.15)
Constant	**0.020****	0.230	0.166	0.077	0.133	-0.277	-0.023	-0.012	**0.288*****
	(2.56)	(1.05)	(1.08)	(0.69)	(0.61)	(-1.14)	(-0.19)	(-0.09)	(2.59)
VC Fixed Effects?	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No
LP Fixed Effects?	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes
N	24,991	24,991	20,284	20,900	23,305	15,871	15,871	15,871	15,871
Adjusted-R^2	0.00	0.088	0.090	0.093	0.094	0.098	0.013	0.100	0.011

Table 4 – Alternative Risk Adjustment Methods

The sample is all LP-stock pairs where the LP invests in the newly listed stock at the time of the first 13F filing after the stock is publicly listed. The dependent (left-hand) variable is the measure of the stock return as specified in each regression. The time period of the return begins on the date that ownership is observed in CDA/Spectrum, and ends after 3 months. All variables are defined in Table 1. Standard errors are double clustered by stock and LP. Column 6 includes only VC backed IPOs. Numbers in parenthesis indicate *t*-stats. *, **, and *** indicate 10%, 5%, and 1% levels of significance, respectively.

	Raw Return	Carhart 4-Factor Alpha	FF 3-Factor Alpha	Industry-Size Matching Portfolios	FF25 Matching Portfolios
Variables	(1)	(2)	(3)	(4)	(5)
Connect	**0.219*** **	**0.202*** **	**0.161*** **	**0.201*** **	**0.191*** **
	(3.30)	(2.73)	(3.10)	(3.69)	(3.27)
LocalDummy	-0.004	0.001	-0.001	0.000	0.003
	(-0.23)	(0.04)	(-0.05)	(0.02)	(0.18)
Active_LP	-0.030	-0.002	0.006	-0.012	-0.022
	(-1.01)	(-0.07)	(0.23)	(-0.54)	(-0.85)
VC_Backed	-0.036	-0.013	-0.015	-0.034	-0.029
	(-1.14)	(-0.38)	(-0.49)	(-1.14)	(-0.94)
VC_Reputation	-0.032	-0.007	-0.002	-0.021	-0.024
	(-1.41)	(-0.33)	(-0.09)	(-1.02)	(-1.16)
MtoB	0.008	-0.005	-0.004	-0.003	0.003
	(0.96)	(-0.55)	(-0.46)	(-0.45)	(0.34)
Proceeds	-0.016	-0.009	-0.007	0.010	-0.013
	(-1.28)	(-0.82)	(-0.66)	(0.89)	(-1.09)
Age	-0.001	0.004	0.003	-0.005	-0.003
	(-0.09)	(0.38)	(0.33)	(-0.51)	(-0.25)
UW_Reputation	0.003	0.004	0.006	0.000	-0.001
	(0.34)	(0.47)	(0.80)	(0.07)	(-0.17)
Positive_EBIT	-0.001	-0.010	-0.011	0.001	0.006
	(-0.03)	(-0.34)	(-0.38)	(0.04)	(0.22)
Working_Capital	0.012	0.012	0.011	0.013	0.015
	(0.66)	(0.61)	(0.57)	(0.71)	(0.89)
Nasdaq	-0.015	-0.001	0.006	-0.008	-0.008
	(-0.72)	(-0.04)	(0.32)	(-0.41)	(-0.44)
Sentiment	-0.001	0.001	0.001	0.000	0.000
	(-1.06)	(0.87)	(1.16)	(0.46)	(0.19)
Russell2000	**-1.050*** **	-0.293	-0.363	**-0.428***	**-0.697*** **
	(-4.23)	(-1.10)	(-1.44)	(-1.89)	(-2.99)
IndustryAvgUP	-0.049	0.069	0.016	-0.086	-0.069
	(-0.78)	(0.92)	(0.25)	(-1.44)	(-1.22)
AvgUP	0.065	-0.162	-0.143	-0.147*	-0.058
	(0.75)	(-1.46)	(-1.47)	(-1.74)	(-0.69)
Constant	-0.014	-0.277	-0.299	-0.343	-0.051
	(-0.07)	(-1.14)	(-1.41)	(-1.53)	(-0.26)
VC Fixed Effects?	Yes	Yes	Yes	Yes	Yes
LP Fixed Effects?	Yes	Yes	Yes	Yes	Yes
N	15,871	15,871	15,871	15,499	15,871
Adjusted-R^2	0.134	0.098	0.102	0.151	0.136

Table 5 – LPs' Returns from Investing in Connected Stocks: Full Sample of LP-Stock Pairs

The sample is all potential LP-stock pairs. The dependent (left-hand) variable is the measure of the stock return as specified in each regression. The time period of the return begins on the date that ownership is observed in CDA/Spectrum, and ends after 3 months. All variables are defined in Table 1. Standard errors are clustered by stock. Numbers in parenthesis indicate *t*-stats. *, **, and *** indicate 10%, 5%, and 1% levels of significance, respectively.

	Raw Return	Carhart 4-Factor Alpha	FF 3-Factor Alpha	Industry-Size Matching Portfolios	FF25 Matching Portfolios
Variables	(1)	(2)	(3)	(4)	(5)
Connect*Invest	**0.205****	**0.238*****	**0.215*****	**0.174****	**0.175****
	(2.47)	(3.30)	(3.23)	(2.36)	(2.30)
Connect	0.003	-0.005	-0.014	0.020	0.035
	(0.09)	(-0.15)	(-0.46)	(0.64)	(1.21)
Invest	**-0.013****	**-0.013****	**-0.009***	**-0.015*****	**-0.020*****
	(-2.43)	(-2.37)	(-1.89)	(-2.95)	(-4.05)
LocalDummy	0.007	0.006	0.008	0.006	0.008
	(0.63)	(0.61)	(0.77)	(0.58)	(0.77)
Active_LP	0.002	0.000	0.000	0.002	0.000
	(0.92)	(0.12)	(0.27)	(1.06)	(0.27)
VC_Backed	-0.020	-0.006	-0.012	-0.016	-0.028
	(-0.79)	(-0.23)	(-0.48)	(-0.68)	(-1.19)
VC_Reputation	**-0.034***	-0.029	-0.022	-0.027	-0.020
	(-1.69)	(-1.51)	(-1.16)	(-1.45)	(-1.13)
MtoB	0.009	-0.002	-0.000	0.009	0.003
	(1.40)	(-0.34)	(-0.01)	(1.58)	(0.49)
Proceeds	**-0.030*****	**-0.020****	**-0.020****	**-0.027*****	-0.000
	(-3.06)	(-2.26)	(-2.33)	(-2.88)	(-0.01)
Age	-0.008	-0.000	-0.001	-0.007	-0.008
	(-0.89)	(-0.03)	(-0.12)	(-0.78)	(-0.92)
UW_Reputation	**0.014****	**0.011****	**0.012****	**0.010***	0.008
	(2.29)	(1.99)	(2.32)	(1.79)	(1.35)
Positive_EBIT	-0.007	-0.026	-0.020	-0.008	-0.013
	(-0.28)	(-1.07)	(-0.87)	(-0.35)	(-0.53)
Working_Capital	0.012	0.021	0.015	0.015	0.021
	(0.59)	(1.29)	(0.99)	(0.82)	(1.14)
Nasdaq	-0.010	-0.008	-0.002	-0.007	-0.016
	(-0.60)	(-0.50)	(-0.15)	(-0.44)	(-1.01)
Sentiment	-0.000	0.001	**0.001***	0.001	0.001
	(-0.14)	(1.54)	(1.73)	(0.82)	(1.37)
Russell2000	**-1.141*****	**-0.544****	**-0.568****	**-0.823*****	**-0.719*****
	(-4.94)	(-2.24)	(-2.52)	(-3.78)	(-3.38)
IndustryAvgUP	-0.050	0.076	0.026	-0.053	-0.088
	(-0.83)	(0.93)	(0.39)	(-0.96)	(-1.49)
AvgUP	0.042	-0.171	-0.161	-0.088	-0.126
	(0.44)	(-1.37)	(-1.49)	(-0.96)	(-1.33)
Constant	0.110	-0.020	-0.046	0.057	-0.091
	(1.25)	(-0.22)	(-0.52)	(0.70)	(-1.12)
VC Fixed Effects?	Yes	Yes	Yes	Yes	Yes
N	272,080	272,080	272,080	272,080	266,620
Adjusted-R^2	0.141	0.102	0.101	0.139	0.133

Table 6 – Stock Level Regressions

Each observation is one newly listed stock. The dependent (left-hand) variable is the stock return that is specified for each regression. *NumConnectInvestments* is the total number of LPs that make connected investments in the stock. The time period of the return begins on the date that ownership is observed in CDA/Spectrum, and ends after 3 months. All variables are defined in Table 1. Robust standard errors are reported. Numbers in parenthesis indicate *t*-stats. *, **, and *** indicate 10%, 5%, and 1% levels of significance, respectively.

	Raw Return	Carhart 4-Factor Alpha	Industry-Size Matching Portfolios	FF25 Matching Portfolios
Variables	(1)	(2)	(3)	(4)
NumConnectInvestments	**0.202****	**0.252*****	**0.207*****	**0.189****
	(2.23)	(2.99)	(2.60)	(2.35)
VC_Backed	-0.017	-0.009	-0.025	-0.013
	(-0.69)	(-0.36)	(-1.10)	(-0.55)
MtoB	**0.018****	0.003	0.010	**0.018****
	(2.22)	(0.41)	(1.49)	(2.38)
Proceeds	**-0.029*****	**-0.021****	0.001	**-0.025*****
	(-3.05)	(-2.45)	(0.12)	(-2.85)
Age	-0.007	0.001	-0.008	-0.006
	(-0.82)	(0.18)	(-1.05)	(-0.78)
UW_Reputation	**0.015****	**0.011****	0.008	**0.011***
	(2.45)	(2.02)	(1.50)	(1.90)
Positive_EBIT	0.002	-0.013	-0.006	-0.001
	(0.07)	(-0.55)	(-0.27)	(-0.05)
Working_Capital	0.006	0.016	0.020	0.011
	(0.28)	(0.94)	(1.11)	(0.58)
Nasdaq	-0.022	-0.015	**-0.031***	-0.021
	(-1.25)	(-0.95)	(-1.91)	(-1.27)
Sentiment	0.000	**0.002****	**0.001****	0.001
	(0.30)	(2.18)	(2.01)	(1.45)
Russell2000	**-1.013*****	**-0.516****	**-0.647*****	**-0.723*****
	(-4.61)	(-2.25)	(-3.20)	(-3.49)
IndustryAvgUP	-0.022	0.081	-0.065	-0.022
	(-0.36)	(1.04)	(-1.14)	(-0.40)
AvgUP	0.005	-0.174	-0.145	-0.116
	(0.06)	(-1.50)	(-1.63)	(-1.33)
Constant	0.049	-0.079	**-0.145***	-0.005
	(0.57)	(-0.91)	(-1.86)	(-0.06)
VC Fixed Effects?	Yes	Yes	Yes	Yes
N	3,214	3,214	3,154	3,214
Adjusted-R^2	0.057	0.024	0.052	0.057

Table 7 – Returns to LP Investments in Connected vs. Unconnected Stocks: Monthly Returns

The sample is all LP-stock pairs where the LP invests in the newly listed stock at the time of the first 13F filing after the stock is publicly listed. The dependent (left-hand) variable is the measure of the stock return as specified in each regression. The time period of the return is specified for each panel as the period encompassing the first, second, or third month after the date that ownership is witnessed in CDA/Spectrum (to be clear, this is the date of record in the 13F report, not the date that the 13F report is filed with the SEC). Panel A reports returns for the 1st month, Panel B reports returns for the 2nd month, and Panel C reports returns for the 3rd month. The dependent (left-hand) variable is the measure of the stock return as specified in each regression. All control variables in Table 3 are included but not reported. All variables are defined in Table 1. Standard errors are double clustered by stock and LP. Numbers in parenthesis indicate *t*-stats. *, **, and *** indicate 10%, 5%, and 1% levels of significance, respectively.

	Raw Return	Carhart 4-Factor Alpha	FF 3-Factor Alpha	Industry-Size Matching Portfolios	FF25 Matching Portfolios
	(1)	(2)	(3)	(4)	(5)
Panel A: Returns for 1st Month					
Connect	**0.061****	**0.061****	**0.049****	**0.056****	**0.066****
	(2.25)	(2.42)	(2.09)	(2.20)	(2.30)
VC Fixed Effects?	Yes	Yes	Yes	Yes	Yes
LP Fixed Effects?	Yes	Yes	Yes	Yes	Yes
N	15,874	15,874	15,874	15,874	15,434
Adjusted-R^2	0.167	0.163	0.156	0.164	0.164
Panel B: Returns for 2nd Month					
Connect	**0.076****	**0.051***	0.042	**0.064****	**0.046***
	(2.53)	(1.65)	(1.37)	(2.34)	(1.66)
VC Fixed Effects?	Yes	Yes	Yes	Yes	Yes
LP Fixed Effects?	Yes	Yes	Yes	Yes	Yes
N	15,876	15,876	15,876	15,876	15,434
Adjusted-R^2	0.146	0.135	0.138	0.150	0.137
Panel C: Returns for 3rd Month					
Connect	0.049	**0.057***	**0.053***	0.036	**0.049***
	(1.56)	(1.84)	(1.81)	(1.41)	(1.71)
VC Fixed Effects?	Yes	Yes	Yes	Yes	Yes
LP Fixed Effects?	Yes	Yes	Yes	Yes	Yes
N	15,873	15,873	15,873	15,873	15,432
Adjusted-R^2	0.142	0.093	0.100	0.134	0.138

Table 8 – Heterogeneity in LP's Connection to VC

The sample is all LP-stock pairs where the LP invests in the newly listed stock at the time of the first 13F filing after the stock is publicly listed. The dependent (left-hand) variable is Carhart 4-factor alpha. The time period of the return begins on the date that ownership is observed in CDA/Spectrum, and ends after 3 months. Standard errors are double clustered on stock and LP. Numbers in parenthesis indicate t-stats. A constant is included but not reported. *, **, and *** indicate 10%, 5%, and 1% levels of significance, respectively.

	(1)	(2)	(3)	(4)	(5)
Connect	**0.202*****			**0.200*****	**0.250*****
	(2.73)			(2.72)	(2.89)
NonLeadConnect		-0.039		-0.037	
		(-1.33)		(-1.28)	
Relationship			-0.008	-0.006	
			(-0.56)	(-0.41)	
LocalDummy	0.001	0.001	0.001	0.001	0.001
	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)
Active_LP	-0.002	-0.002	-0.002	-0.002	-0.002
	(-0.07)	(-0.07)	(-0.06)	(-0.08)	(-0.07)
VC_Backed	-0.013	-0.012	-0.012	-0.013	-0.013
	(-0.38)	(-0.37)	(-0.37)	(-0.38)	(-0.38)
VC_Reputation	-0.007	-0.007	-0.007	-0.007	-0.008
	(-0.33)	(-0.33)	(-0.32)	(-0.32)	(-0.33)
MtoB	-0.005	-0.005	-0.005	-0.005	-0.005
	(-0.55)	(-0.56)	(-0.56)	(-0.55)	(-0.55)
Proceeds	-0.009	-0.009	-0.009	-0.009	-0.009
	(-0.82)	(-0.81)	(-0.82)	(-0.82)	(-0.82)
Age	0.004	0.004	0.004	0.004	0.004
	(0.38)	(0.38)	(0.38)	(0.38)	(0.39)
UW_Reputation	0.004	0.004	0.004	0.004	0.004
	(0.47)	(0.48)	(0.48)	(0.47)	(0.47)
Positive_EBIT	-0.010	-0.010	-0.010	-0.010	-0.010
	(-0.34)	(-0.35)	(-0.35)	(-0.35)	(-0.35)
Working_Capital	0.012	0.011	0.011	0.012	0.012
	(0.61)	(0.60)	(0.60)	(0.61)	(0.61)
Nasdaq	-0.001	-0.000	-0.000	-0.001	-0.001
	(-0.04)	(-0.02)	(-0.02)	(-0.03)	(-0.04)
Sentiment	0.001	0.001	0.001	0.001	0.001
	(0.87)	(0.85)	(0.86)	(0.87)	(0.87)
Russell2000	-0.293	-0.292	-0.293	-0.293	-0.293
	(-1.10)	(-1.10)	(-1.10)	(-1.10)	(-1.10)
IndustryAvgUP	0.069	0.069	0.069	0.069	0.069
	(0.92)	(0.92)	(0.92)	(0.92)	(0.92)
AvgUP	-0.162	-0.162	-0.162	-0.162	-0.162
	(-1.46)	(-1.46)	(-1.46)	(-1.46)	(-1.46)
Duration					-0.013
					(-1.66)
LP & VC Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	15,871	15,871	15,871	15,871	15,871
Adjusted-R^2	0.098	0.097	0.097	0.098	0.097

Table 9 – Heterogeneity in Information Advantage of LPs

The sample is all LP-stock pairs where the LP invests in the newly listed stock at the time of the first 13F filing after the stock is publicly listed. Each column represents regression results within the indicated sub-sample. "Small MV" is the sample of IPO firms that have market values below the 30th percentile of contemporaneous NYSE-listed stocks. "NYSE" is the sample of IPOs that are listed at NYSE. "No Analyst Cover" is the sample of IPO firms that are not covered by an analyst in IBES at the end of the quarter of the IPO date. "Large MV," "Non-NYSE," and "Yes Analyst Cover" are the converse of "Small MV," "NYSE," and "No Analyst Cover," respectively. The dependent (left-hand) variable is Carhart 4-factor alpha. The time period of the return begins on the date that ownership is observed in CDA/Spectrum, and ends after 3 months. Standard errors are double clustered on stock and LP. Numbers in parenthesis indicate t-stats. *, **, and *** indicate 10%, 5%, and 1% levels of significance, respectively. Standard errors for *Connect* in Regression 4 do not converge.

Sample:	Small MV	Large MV	Non-NYSE	NYSE	No Analyst Coverage	Yes Analyst Coverage
	(1)	(2)	(3)	(4)	(5)	(6)
Connect	**0.203****	0.046	**0.220*****	0.005	**0.217*****	0.079
	(2.56)	(0.65)	(2.88)	.	(2.65)	(0.98)
LocalDummy	0.018	-0.027	-0.013	0.029	-0.003	-0.001
	(0.80)	(-1.08)	(-0.66)	(1.03)	(-0.11)	(-0.03)
Active_LP	-0.057	**0.086*****	0.009	-0.016	-0.018	-0.030
	(-1.39)	(2.94)	(0.28)	(-0.31)	(-0.57)	(-0.68)
VC_Backed	0.033	**-0.163****	-0.008	-0.025	0.053	-0.064
	(0.85)	(-2.33)	(-0.21)	(-0.43)	(0.89)	(-1.48)
VC_Reputation	-0.002	-0.068	-0.012	0.073	-0.005	-0.016
	(-0.08)	(-0.90)	(-0.48)	(1.31)	(-0.13)	(-0.56)
MtoB	-0.010	0.002	-0.003	-0.012	-0.016	0.003
	(-0.82)	(0.12)	(-0.28)	(-1.34)	(-1.06)	(0.30)
Proceeds			-0.022	-0.008	0.002	-0.022
			(-1.24)	(-0.50)	(0.15)	(-1.50)
Age	-0.010	0.011	-0.002	0.008	-0.011	**0.022***
	(-0.75)	(0.81)	(-0.15)	(0.86)	(-0.90)	(1.71)
UW_Reputation	0.001	0.057	0.007	0.007	-0.005	0.014
	(0.18)	(1.49)	(0.78)	(0.27)	(-0.59)	(0.97)
Positive_EBIT	-0.002	-0.042	0.011	-0.118	-0.028	0.013
	(-0.05)	(-0.63)	(0.33)	(-1.29)	(-0.63)	(0.32)
Working_Capital	0.012	**0.101***	0.016	-0.039	0.030	0.027
	(0.53)	(1.93)	(0.76)	(-0.45)	(0.99)	(0.77)
Nasdaq	0.000	0.003			0.002	0.006
	(0.01)	(0.07)			(0.08)	(0.18)
Sentiment	0.001	-0.001	0.002	-0.000	0.002	0.001
	(0.78)	(-0.43)	(1.19)	(-0.22)	(0.98)	(0.53)
Russell2000	-0.131	**-0.380****	-0.298	-0.379	-0.228	-0.421
	(-0.33)	(-1.24)	(-0.81)	(-1.44)	(-0.55)	(-1.55)
IndustryAvgUP	-0.006	0.149	0.066	0.145	0.189	-0.017
	(-0.05)	(1.20)	(0.71)	(-1.30)	(1.16)	(-0.26)
AvgUP	-0.051	-0.180	-0.168	-0.121	-0.126	-0.119
	(-0.21)	(-1.59)	(-1.16)	(-1.38)	(-0.45)	(-1.55)
Constant	-0.242	-0.500	-0.049	0.168	-0.030	-0.300
	(-0.97)	(-1.41)	(-0.29)	(0.75)	(-0.11)	(-1.09)
VC Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
LP Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	10,023	5,848	11,228	4,643	7,747	8,124
Adjusted-R^2	0.092	0.348	0.099	0.124	0.126	0.238

Table 10 – Propensity to Invest

The sample is all potential LP-stock pairs. These are all logit regressions. The dependent (left-hand) variable is *Invest*, which is a dummy variable equal to one if the LP holds the stock at the end of the first quarter after the IPO, and zero otherwise. Other variables are defined in Table 1. Numbers in parenthesis indicate *Z*-stats. All standard errors are double-clustered by LP and stock. *, **, and *** indicate 10%, 5%, and 1% levels of significance, respectively.

Variables	(1)	(2)	(3)	(4)
Connect	-0.345			-0.309
	(-0.91)			(-0.79)
NonLeadConnect		-0.007		0.018
		(-0.03)		(0.08)
Relationship			**0.341*****	**0.336*****
			(3.69)	(3.52)
LocalDummy	**0.209*****	**0.209*****	**0.209*****	**0.209*****
	(4.02)	(4.02)	(4.01)	(4.02)
Active_LP	**2.410*****	**2.410*****	**2.410*****	**2.410*****
	(12.02)	(12.02)	(12.02)	(12.02)
VC_Backed	**0.209*****	**0.209*****	**0.208*****	**0.208*****
	(4.31)	(4.31)	(4.30)	(4.30)
VC_Reputation	-0.001	-0.002	-0.005	-0.004
	(-0.05)	(-0.05)	(-0.15)	(-0.14)
MtoB	**0.028****	**0.028****	**0.028****	**0.028****
	(1.96)	(1.96)	(1.97)	(1.97)
Proceeds	**0.645*****	**0.645*****	**0.644*****	**0.644*****
	(13.64)	(13.64)	(13.64)	(13.63)
Age	0.026	0.026	0.026	0.026
	(1.24)	(1.24)	(1.23)	(1.23)
UW_Reputation	**0.148*****	**0.148*****	**0.148*****	**0.148*****
	(6.85)	(6.85)	(6.86)	(6.86)
Positive_EBIT	-0.011	-0.010	-0.011	-0.011
	(-0.23)	(-0.22)	(-0.23)	(-0.24)
Working_Capital	0.019	0.019	0.020	0.020
	(0.47)	(0.47)	(0.48)	(0.48)
Nasdaq	0.042	0.041	0.041	0.041
	(0.80)	(0.80)	(0.78)	(0.79)
Sentiment	-0.003	-0.003	-0.003	-0.003
	(-0.66)	(-0.66)	(-0.66)	(-0.66)
Russell2000	0.352	0.353	0.352	0.351
	(0.92)	(0.92)	(0.92)	(0.92)
IndustryAvgUP	0.083	0.083	0.083	0.082
	(0.82)	(0.83)	(0.82)	(0.82)
AvgUP	**0.519*****	**0.519*****	**0.519*****	**0.520*****
	(3.02)	(3.02)	(3.02)	(3.02)
Constant	**-11.254*****	**-11.254*****	**-11.250*****	**-11.249*****
	(-24.96)	(-24.96)	(-24.94)	(-24.94)
VC Fixed Effects	Yes	Yes	Yes	Yes
LP Fixed Effects	Yes	Yes	Yes	Yes
N	272,460	272,460	272,460	272,460

Figure 1 – Example of Relationships among VC firms

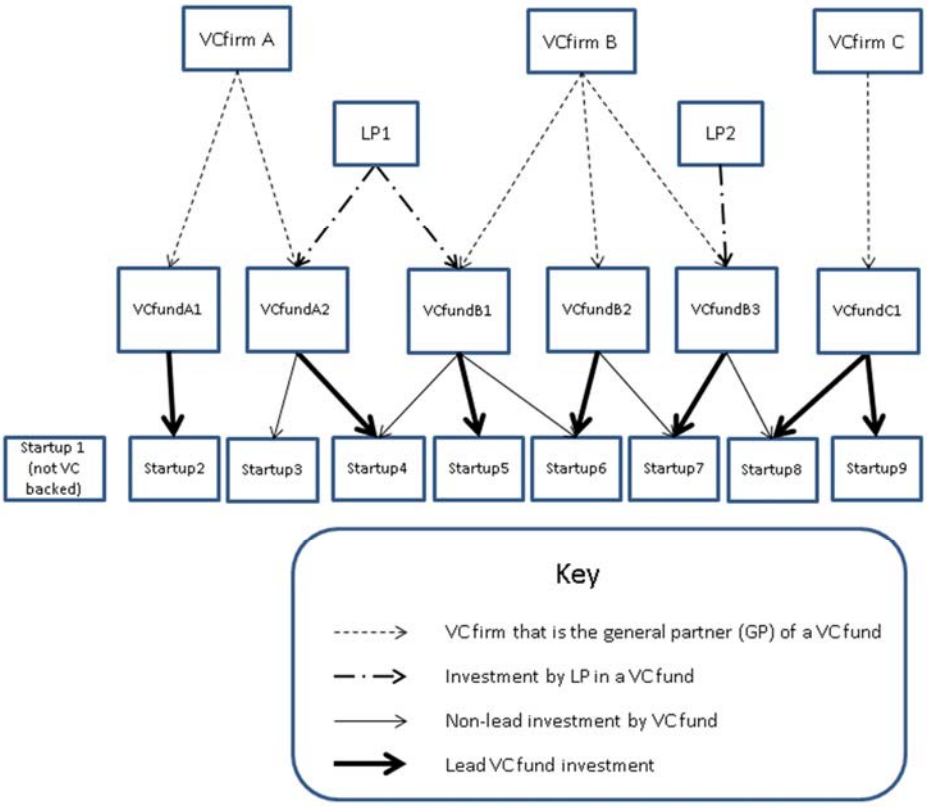
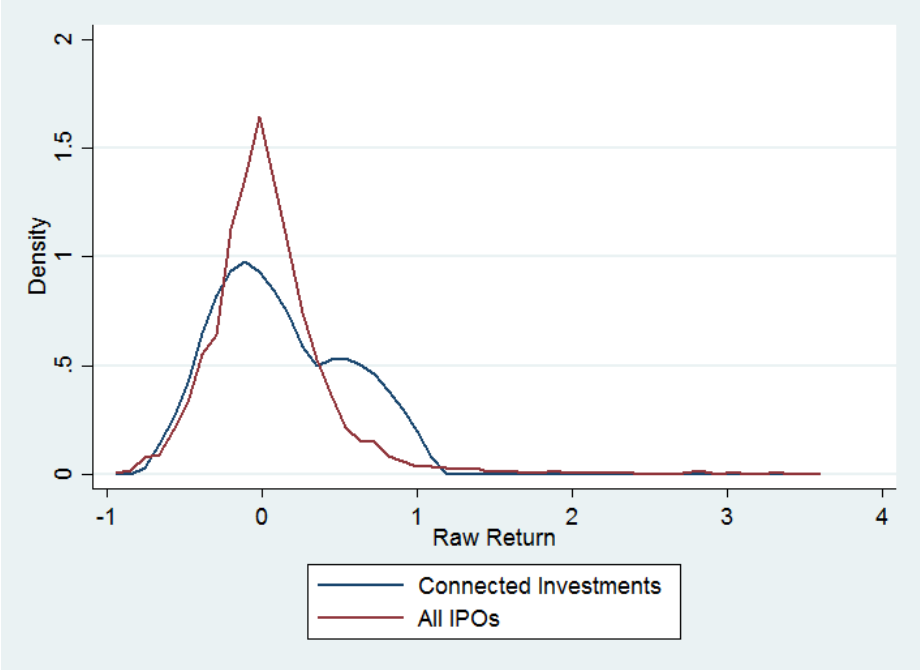


Figure 1: The figure demonstrates definitions of LP-startup connections. LP1 has a connection to startups 4 and 5, a non-lead connection to startups 3 and 6, and may have a relationship with startups 2, 7, and 8. LP2 has a connection to startup 7, a non-lead connection to startup 8, and may have a relationship with startups 4, 5, and 6.

Figure 2 – Probability Density Function of Returns to LPs' Connected Investments



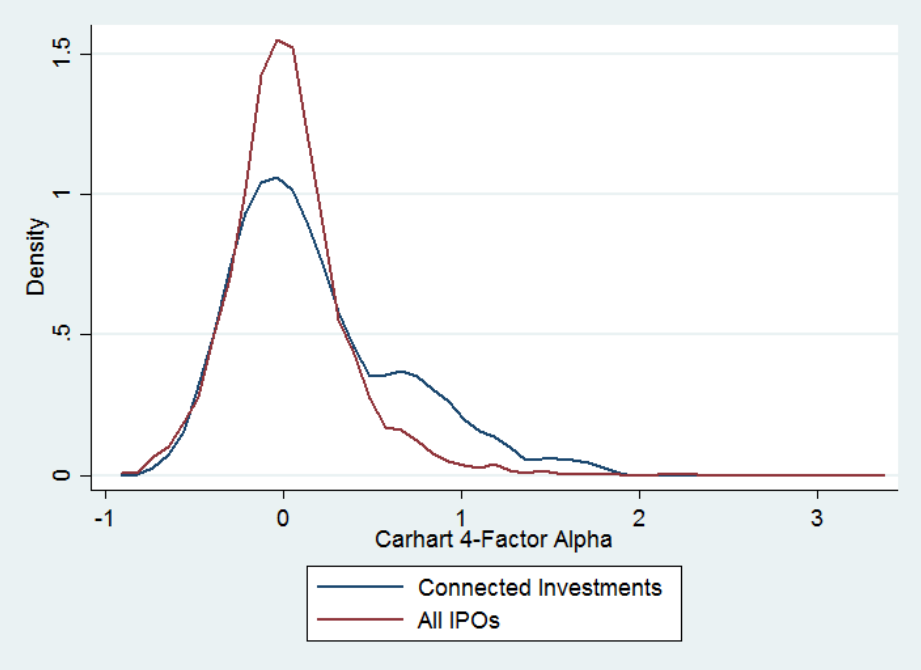


Figure 2: The figure demonstrates probability density functions of quarterly raw returns and Carhart 4-Factor alpha of all IPO stocks and LPs' connected investments. The graphs are truncated at 400% returns for readability.