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

Umit Ozmel*	Timothy E. Trombley**	M. Deniz Yavuz***
Purdue University	San Diego State University	Purdue University

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 lead 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. LPs are more likely to invest if they have an information advantage, and access to information eliminates the familiarity bias that they display otherwise.

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

JEL CODES: G11, G14, G23, G24.

We are grateful for comments from an anonymous referee, Lauren Cohen, Jennifer Conrad, Michael Ewens, Mara Faccio, Oleg Gredil, Jarrad Harford (the Editor), Jiekun Huang, Byoung-Hyoun Hwang, Huseyin Gulen, Zoran Ivkovic, Laura Lindsey, John McConnell, Raj Nahata, Manju Puri, Moon Song, Rene Stulz, Sunil Wahal and seminar participants at the Western Finance Association Meetings (2016), York University CFA-FRL-JIFMIM Financial Markets Conference (2016), Financial Management Association Annual Meeting (2016), Michigan State University Federal Credit Union Conference (2015), Miami University, Purdue University, San Diego State University, and the University of Cincinnati.

*E-mail: uozmelya@purdue.edu, phone: (765) 49-62286

** E-mail: ttrombley@mail.sdsu.edu, phone: (619) 594-1914

***E-mail: myavuz@purdue.edu, phone: (765) 494-1337

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

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 lead 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. LPs are more likely to invest if they have an information advantage, and access to information eliminates the familiarity bias that they display otherwise.

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. Anecdotal evidence from VCs also suggests that observing firms through time provides intangible information, such as managerial style, that is not readily available to a typical IPO investor. 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

[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.

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)).

To explore our hypothesis and the alternative explanations, we construct a sample of LP investments in newly listed stocks that are backed by their VCs as the lead financier. We observe these investments at the end of the first calendar-quarter after the IPO using 13F filings. We only consider 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 and are not contaminated by shares distributed by the VC funds as they liquidate their holdings in the stock, that is, 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 19-26% depending on the risk adjustment method used. At the IPO firm level, we find that investments by connected LPs predict future returns. The first connected investment predicts 19-33% higher quarterly returns, which increase to 36%-54% when two or more connected LPs invest in the stock. 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. Further, we find that return predictability declines after 1 month, that is, after the public is typically able to witness LPs' holdings through 13f reports (Aragon and Martin (2012)).

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. Therefore, we test whether proxies for the level of public information produced about stocks modulate LPs' returns from connected stocks. We find that an LP's returns from connected investments is even higher among stocks that are not covered by any analysts in IBES (13.9%), smaller stocks (15.6%), and non-NYSE listings (21.4%).[3] 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 through non-lead VC funds, which have less access to information than lead VC funds (Gorman and Sahlman (1989),

[3] The difference between analyst-covered and non-analyst-covered connected stocks is not statistically significant.

Adamati and Pfleiderer (1994)). Second, we investigate connections through a prior business relationship between the LP and the VC firm that backs the stock.[4] Thus, the LP may have social ties with the VC but does not have access to formal information. We find some weak evidence of return predictability in non-lead fund connected investments, and we find no evidence of return predictability in investments with connections through prior relationships. Overall, LPs obtain higher returns when their connection to the stock implies better access to information. These results also allow us to narrow down the channel of information dissemination. Although the specific channel is not crucial to our conclusion that connected LPs are informed, it may be important for policy purposes. Overall, our results are consistent with LPs obtaining information from their VC funds while fulfilling their fiduciary duty to monitor prior to the IPO and are less likely to be explained by their social ties (Cohen, Frazzini, and Malloy (2008, 2010)) or access to local information channels (Loughran and Schultz (2005), Ivkovic and Weisbenner (2007)).

Another novel contribution of our study is to examine how access to information and familiarity interact to determine propensity to invest. Familiarity and access to information are often positively correlated, making it difficult to discern their individual effects on propensity to invest. Our unique framework allows us to address this question by varying familiarity and formal access to information. We find that the familiarity bias disappears, even when familiarity itself is presumably strongest, once an LP has formal access to information through a VC fund. On the other hand, a familiarity bias exists when the LP has a previous business relationship with the VC fund but has no access to information.

[4] "Prior business relationship," means that the LP must have a prior 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.

We provide further evidence that access to information enables connected LPs to tilt their investments in the direction of return predictability while avoiding familiarity bias. LPs are more likely to invest in connected stocks when they have a higher information advantage relative to public investors, proxied by stocks not covered by any analysts in IBES, smaller stocks, and non-NYSE listings. In addition, an LP's likelihood of investing in connected stocks varies with VC and underwriter reputation in the direction of return predictability implied by these factors.[5] On the other hand, when investing in relationship stocks, in which LPs have no information advantage, LPs' propensity to invest does not vary with proxies of public access to information. Also, LPs are less likely to invest in relationship stocks backed by both reputable VCs and underwriters, that is, regardless of the direction of return predictability. This is consistent with intermediary reputation and familiarity acting as substitutes in determining propensity to invest, perhaps because both act through non-information channels to affect investment behavior.

This is the first paper that analyzes LPs' investments in stocks backed by their VC firms. 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. 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.[6] Other investors are disadvantaged in trading against these institutions that are not recognized as insiders by regulators. Our results are consistent with the large literature which documents that

[5] In our sample, returns are negatively correlated with VC reputation and positively correlated with underwriter reputation. Thus, LPs would be less likely to invest in connected stocks backed by more reputable VCs.

[6] 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.

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.

We contribute to the general literature on propensity to invest, in particular, to the ongoing debate as to whether or not the observed familiarity (or home) bias in investor portfolios is driven by information.[7] First, we show evidence that access to information eliminates familiarity bias. This is an intuitive finding, yet to the best of our knowledge, this is the first time it has been demonstrated. Second, we suggest that the interaction of access to information with contexts in which such access is more valuable can be used to disentangle information advantage from familiarity bias. We illustrate this by showing that LPs with access to information tilt their portfolios in the direction of both higher information advantage and returns.

Our results have important policy implications as well. We find evidence consistent with the notion 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 known 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 prosecute genuine illegal insider trading cases while avoiding unintended consequences of

[7] See Huberman (2001); Coval and Moskowitz (2001); Ivkovic and Weisbenner (2005); Massa and Simonov (2006); Seasholes and Zhu (2010); Cao, Han Hirshleifer, and Zhang (2011); and Pool, Stoffman and Yonker (2012).

additional regulation.[8] Our results demonstrate a setting in which a broad definition of illegal non-public information may have unintended spill-over effects in private equity investing.

Section II discusses the data and methodology. Section III presents our initial results and robustness tests. Section IV shows how our results vary with the level of information advantage the investor has over the general public. Section V investigates the implication of our findings on investors' propensity to invest. Section VI concludes and summarizes the paper's findings.

II. Data, Variables and Empirical Strategy

II.A 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

[8] 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."

detect any differences between connected investments and unconnected investments because some investments that the data show as unconnected may in fact be connected investments.

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.[9] 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.

[9] "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.

We hand match VC funds from Thomson One Banker with VC funds from SDC. Hand matching is necessary for two reasons. First, many VC funds have very similar names. Second, both datasets include observations where the VC firm is known but the name of the specific VC fund is unknown, and neither dataset uses a universal naming convention for identifying these funds. These "unspecified funds" are about 19% of the observations in Thomson One and 1% of the observations in SDC, and we do not count them as distinct funds in our tests. Overall, we are able to match 416 VC firms and 722 VC funds to both databases.

For stocks, we only include IPOs that adhere to the criteria set forth in Loughran and Ritter (2004).[10] According to Loughran and Ritter, 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 that have 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 with startups in Thomson One Banker's PE Exits database whose "exit type" is listed as an IPO.

[10] 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.

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

II.B Definitions and Examples of Connections

We define the relationship between a firm and an LP as 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.

[11] 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.

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 because it is backed by a VC firm with whom the LP has a relationship. However, the LP would not have received information about the newly listed stock prior to its IPO because the LP did not invest in a VC fund 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.

<<<<FIGURE 1 ABOUT HERE>>>>

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 was established 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%.

II.C 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, that is, 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 LP's 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 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.

II.D 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. NONLEAD_CONNECT 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, that is, 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 incorporate 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 (M_TO_B), 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); Ozmel, Reuer, and Gulati (2013)) 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.[12] We also

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

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).

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 (2017)). 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. Therefore we control for LOCAL_DUMMY, 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 (INDUSTRY_AVGUP).

We have a number of variables that are used in regressions at the newly listed stock level. #CON_INV=1 is a dummy that equals 1 if the number of connected LPs invested in the

stock is 1 and #CON_INV>=2 is a dummy that equals 1 if the number of connected LPs invested in the stock is greater than or equal to 2. #CON_NOT_INV counts the number of connected LPs that did not invest in the stock and #INV_BY_NONCONNECT_LPS counts the number of all nonconnected LPs in our sample that invest in the stock.

Detailed descriptions of all variables are provided in Table 1.

<<<<TABLE 1 HERE>>>>

II.E 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 in which the LP invests in the stock.

$$(1) \quad \mathrm{RETURN}_{i,k} = \beta_0 + \beta_1 * \mathrm{CONNECT}_{i,j} + \boldsymbol{\beta_2} * \boldsymbol{X_{i,j}} + FE_v + FE_j + \varepsilon_{i,j,k}$$

In Equation (1), $\mathrm{RETURN}_{i,k}$ 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. These tests control for each LP's investment opportunity set. Observations are defined as all LP-stock pairs in the sample. We specify this using Equation (2).

$$(2) \quad \mathrm{RETURN}_{i,k} = \beta_0 + \beta_1 * \mathrm{INVEST}_{i,j} * \mathrm{CONNECT}_{i,j} + \beta_2 * \mathrm{INVEST}_{i,j} + \boldsymbol{\beta_4} * \boldsymbol{X_{i,j}} + FE_v + \varepsilon_{i,j,k}$$

For this equation we control for VC fixed effects and cluster error terms at the newly listed stock level. 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 in which 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 in which 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).

$$(3)\quad \mathrm{RETURN}_{i,k} = \beta_0 + \beta_1 * \#\mathrm{CON\_INV} = 1_i + \beta_2 * \#\mathrm{CON\_INV} >= 2_i + \boldsymbol{\beta_3} * \boldsymbol{X_i} + FE_v + \varepsilon_{i,k}$$

#CON_INV=1 and #CON_INV>=2 are dummy variables that equal to 1 if the number of connected investments is equal to 1, and equal to or larger than 2, respectively. These tests are useful not only as a robustness tests of earlier results but also to better understand how returns vary with the number of connected investments. $\boldsymbol{X_i}$ includes all of our control variables that do not vary based on the identity of the LP.

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 in Equation (4):

$$(4)\quad \mathrm{INVEST}_{i,j} = \beta_0 + \beta_1 * \mathrm{CONNECT}_{i,j} + \boldsymbol{\beta_2} * \boldsymbol{X_{i,j}} + FE_j + FE_v + \varepsilon_{i,j}$$

III. Returns from Connected Investments

III.A Summary Statistics

Table 2 reports summary statistics of key variables and returns to 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.

<<<<<<TABLE 2 ABOUT HERE>>>>>>>>>>>>

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 (2017) 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.

<<<<<<<<<FIGURE 2 ABOUT HERE>>>>>>>>>>>

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 the mean size and the mean number of LPs in both early and late stage VC funds from Lerner, Schoar, and Wongsunwai (2007)[13] and use the mean VC fund investment in each startup that goes public from our sample, which is about 5% of the VC fund'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.

At the newly listed stock the level the average number of connected investments, or frequency of observing connected investments, is 0.007. Conditional on having a connected investment, the average number of connected investments is 1.2. In summary, connected investments are rare events in our sample. However, our sample is limited by the LP investments in venture capital that are reported in SDC Platinum. In addition, we only observe positions of LPs who did not liquidate before the end of the first quarter after the IPO. Consequently, we are likely largely underestimating the number of LPs' investments in connected stocks.

III.B LP's Returns from Investing in Connected versus Unconnected Stocks

In Table 3 we compare LP investments in connected stocks versus unconnected stocks using raw returns and various method of adjusting for risk, and after including a battery of control variables, LP fixed effects, and VC fixed effects as in Equation (1). Alternative risk adjustment methods include subtracting returns of matched portfolios by size quintiles and 49 industries

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

(245 portfolios) and matched portfolios by size quintiles and book-to-market quintiles (25 portfolios), as well as using the Fama-French 3 factor and Carhart 4 factor models. The coefficient for CONNECT indicates the difference between an LP's investments in connected stocks versus its 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 19% to 26% statistically significantly higher returns per quarter than the same LP's unconnected investments.[14]

<<<<<<<<<<TABLE 3 ABOUT HERE>>>>>>>>>>>

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.

III.C 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 4 reports results from such regressions based on Equation (2).

[14] Control variables are generally insignificant with the exceptions of average underpricing of IPOs over the 90 days prior to the firm's IPO, duration that LP's VC has had investments in the firm prior to the IPO, and past 30 days Russell-2000 index returns, which are all negative and significant in some specifications.

<<<<<<<TABLE 4 ABOUT HERE>>>>>>>>>>

The coefficient on INVEST indicates that on average, LPs lose 1% (*t*-stat = 2.37) from their investments compared to their opportunity set. However, LPs who are connected and choose to invest fare better than those who are connected and choose not to invest by a margin of 24% Carhart 4-factor alpha per quarter (*t*-stat = 3.32). This gives a noisy measure of the tremendous value of being connected. Connected LPs who obtain information that a stock is undervalued can invest and obtain very high returns.

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.

III.D Stock Level Predictability

We examine the relation between returns and the number of investments by connected LPs in Table 5. For this test, we use the specification in Equation (3), in which each stock is a single observation, and all control variables are at the stock level. The coefficient on the first connected investment translates into 20% to 33% statistically significantly higher quarterly returns compared to the base group of stocks with no investments by connected LPs.

<<<<<<<<<<TABLE 5 ABOUT HERE>>>>>>>>>>>>>

The coefficient on two or more connected investments ranges between 36% to 54% and is always statistically significant. Although never statistically significant, the difference between returns when there are two or more connected investments and returns when there is one connected investment ranges between 3% and 27%. In other words, a significant portion of the return predictability comes from the first connected investment. However, the increasing magnitude of the coefficients with the number of connected LP investments is consistent with more connected LPs investing in newly listed stocks that are more underpriced.[15]

The coefficient of total connections that are not invested is never significant, implying that it is not possible to infer overvalued stocks from the inaction of connected LPs. The coefficient may not be significant because there are many reasons that LPs may choose not to invest in a given stock. On the other hand, the coefficient of the total number of investments made by non-connected LPs is always negative and significant. Thus, the popularity of the newly listed stock among LPs without a connection predicts small negative returns, consistent with average LP investments doing worse compared to all newly listed stocks (Table 4).

In summary, the first connected investment explains most of the return predictability and there is a slight but not statistically significant increase in returns as the number of connected LPs investing in the stock increases. However, as mentioned earlier we are likely missing many observations of LPs investing in connected stocks and as a result the average number of connected investments is only 1.2 conditional of having a connected investment.

[15] We have also tested whether the total number of investments by connected LPs can predict returns of newly listed stocks in unreported tests. The number of connected investments significantly predicts returns in all specifications, with the coefficient varying between 19% and 25% per connected investment.

Unfortunately, this prevents us from analyzing the relation between the number of connected investments and returns in further detail.

III.E 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 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.

<<<<<<<<<<TABLE 6 ABOUT HERE>>>>>>>>>>>>

In Table 6, 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.

III.F 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 the 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. 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.

Overall, our inability to include returns from the first day of LPs' investments in connected stocks likely to cause us to underestimate LPs' returns from connected investments in our main tests in Table 3, 4 and 5. However, we view these results with some circumspect given that we do not know exact timing of LPs' investments.

III.G 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 in the Internet Appendix (www.timtrombley.com).

III.G.1 Controlling for VC Effects

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, although our results also hold if we do not include these. 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 4 using a sample that drops stocks that are not backed by any VC firm. We find that LPs' investments in connected stocks have 18% 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 the funds in our sample 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 the locations 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) in explaining the likelihood of a match between an LP and a VC. Thus, 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 = -0.44) and the coefficient on CONNECT is unaffected, indicating that sample selection is unlikely to play an important role.

III.G.2 Other Robustness Tests

In our main result, we are forced to drop many observations because of missing control variables, especially for M_TO_B, LOCAL_DUMMY, and WORKING_CAPITAL. Our results are robust to dropping these variables (or all control 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. The logit regressions imply that at average values for the other variables, an LP's investments in connected stocks are 19.1% more likely to have a positive Carhart 4-factor alpha compared to that same LP's other investments (*z*-stat = 2.25).

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.

IV. 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.

IV.A Heterogeneity in 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 might 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.

First, we investigate non-lead VC fund level connections (NONLEAD_CONNECT), in other words, connections in which 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 7 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.[16] In addition, the difference in returns between lead connections and non-lead connections is also statistically significant.

Second, we investigate VC firm level relationships (RELATIONSHIP), in other words, connections in which 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 7 indicate that the difference between an LP's risk-adjusted returns from investing in relationship stocks is not statistically different from its returns in other newly listed stocks. The difference in returns between lead connected investments and relationship investments is also statistically significant.

Overall, LP investments in nonlead fund connected stocks and relationship connected stocks have either no or significantly lower predictive power compared to LPs' investments in lead fund connected stocks. Although these results do not rule out the possibility that personal connections or informal channels may play some role in the transfer of information, they

[16] In some of the specifications, LPs' investments in non-lead connected stocks do have predictive power. For example, testing for raw returns in Equation (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.

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.

<<<<<<<TABLE 7 ABOUT HERE>>>>

IV.B 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.[17]

Market participants have an incentive to discover 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, column 2 of Table 7 reports results of interacting CONNECT with the SMALL dummy variable, which takes the value of 1 if the stock size is above the 30th percentile of all contemporaneous NYSE stocks.[18] We find that an LP's

[17] These three proxies are all significantly correlated with each other. The correlation coefficients between Small and Non-NYSE (39.1%), NonNYSE and No-Analyst (6.6%), and Small and No-Analyst (4.2%) are all statistically significant at the 10% level.

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

investments in small connected stocks perform significantly better (16%) compared to its connected investments in large stocks.

NYSE listing requirements are historically more stringent than NASDAQ (Corwin and Harris (2001)).[19] 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. Hence, connected LPs may have more of an information advantage in non-NYSE listings. Column 3 of Table 7 reports results after interacting CONNECT with NON-NYSE. We find that an LP's investments in connected non-NYSE stocks yield significantly higher returns (21% higher Carhart 4-factor alpha per quarter) than its connected investments in NYSE stocks.

Another proxy for the information advantage of connected LPs could be whether or not a stock is covered by an analyst. Column 4 of Table 7 reports results after interacting CONNECT with NO-ANALYST, which indicates that the stock is not covered by an analyst in IBES before we witness the LP's holding of the stock in its 13F filing. An LP's connected investments in stocks with no analyst coverage have 14% higher Carhart 4-factor alphas per quarter than the same LP's connected investments with analyst coverage. The difference 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.[20]

[19] 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."

[20] Clearly, analyst coverage is not random (Cliff and Denis (2004)), and can be correlated with stock characteristics that affect future returns. Regardless, this test adds to the circumstantial evidence that our results are likely driven by connected LPs' information advantage over the public.

Overall, the empirical evidence is consistent with LPs possessing a greater information advantage about connected stocks when there is less publicly available information.

V. LPs' Propensity to Invest in Connected Stocks

In this section, we try to understand whether LPs' investment behavior in connected stock is driven by information obtained through its VC fund or by other factors such as familiarity bias and intermediary reputation.

V.A Heterogeneity in Information Channels and Propensity to Invest

As we discussed above, we consider three channels with varying access to information: connections through a lead VC fund, connections through a nonlead VC fund, and relationships with a VC firm backing the IPO. In all three channels 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, making it possible that 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. Finally, the information that LPs have access to through lead connected VCs could be positive or negative and may affect their likelihood of investing accordingly.

Table 8 presents results using Equation (4). Column 1 of Table 8 shows that LPs are more likely to invest only if their connection is a previous business relationship with the VC firm. This higher likelihood to invest does not coincide with improved performance (as evinced by the negative, statistically insignificant coefficient associated with Relationship in Table 7, Column 1). In other words, LPs display a familiarity bias when they are weakly familiar with the stock and do not have direct access to information.

On the other hand, 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 is consistent with the connection itself not being significant predictor of future returns (Table 4). LPs with information are likely to invest only in underpriced securities while avoiding fairly priced or overpriced securities. As a result, LPs do not display a familiarity bias when they have a stronger familiarity but at the same time access to more information. Access to value relevant information eliminates, or at the very least strongly reduces, familiarity bias.[21]

Familiarity and access to information are often positively correlated, making it difficult to discern their individual effects on propensity to invest. However, we observe that the familiarity bias disappears, even when familiarity itself is presumably at its 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.

<<<<<<<<<<TABLE 8 ABOUT HERE>>>>>>>>>>

V.B Publicly Available Information and Propensity to Invest

There are several reasons why it is hard to predict ex-ante how a connection with access to information affects LPs' propensity to invest. First, the information that LPs have access to could be either positive or negative. Second, the investment behavior of LPs in unconnected

[21] A number of control variables are significant determinants of propensity to invest. 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 and VCs (after dropping VC fixed effects). Also, positive performance of recent IPOs and whether the LP has invested in any other newly listed stocks in the past year are positively correlated with propensity to invest.

stocks matters. Third, access to information may not translate into an information advantage compared to publicly available information. However, we can learn more about the investment behavior of connected LPs by analyzing how the public's access to information modulates connected LPs' investment decisions. In this case, the ex-ante predicted sign of interaction effects are relatively clear. Among connected stocks, when connected LPs have no information advantage compared to the public they would not be more likely to invest because they can invest in stocks in which they have a comparative advantage. However, when they have an information advantage compared to the public, at least in some cases the information would be positive and connected LPs should invest. As a result, regardless of the main effect of a connection on propensity to invest, we expect a higher likelihood of investing among connected stocks in which the LP has an information advantage relative to the public.

Next, we analyze whether an LP's propensity to invest varies with the interaction of connection type and proxies for the public's access to information. We use SMALL, NON-NYSE and NO-ANALYST dummies as proxies for the amount of information that market participants have about the stock. Table 8 Columns 2-4 present results. Overall, LPs are less likely to invest in IPO stocks that are in the small, non-NYSE and no-analyst categories. However, LPs are more likely to invest in connected stocks that are in the non-NYSE and no-analyst categories (but not in small stocks).

On the other hand, we do not find that LPs' likelihood of investing in relationship or nonlead connected stocks significantly varies with SMALL, NON-NYSE, and NO-ANALYST dummies. This is consistent with these types of connections not yielding significant information

for LPs, and therefore proxies for the information possessed by the public do not modulate the relation between these types of connections and propensity to invest.

Overall, the higher likelihood of investment among sub-categories (non-NYSE, no-analyst) of connected stocks in which connected LPs have higher returns is consistent with connected LPs' investment behavior being driven by information.

V.C Financial Intermediary Reputation and Propensity to Invest

We find that both the VC's and the underwriter's reputations are both significantly and positively correlated with LPs' propensity to invest in newly listed stocks. The reputation of a financial intermediary may affect investment behavior through return predictability or for other non-information related reasons. Therefore, we analyze how the interaction of an LP's type of connection and the reputation of financial intermediaries affects the likelihood of investing.

In our sample, we generally find that returns following the first quarter after the IPO are negatively correlated with VC reputation and positively correlated with underwriter reputation (Table 4), though these coefficients are not significant in all specifications. If investment behavior is determined by return predictability, the opposite signs for return predictability implies opposite effects of VC and underwriter reputation on the likelihood of investment.

Columns 5 and 6 of Table 8 show interactions of connection types with VC reputation and underwriter reputation, respectively.[22] Overall, LPs are more likely to invest in IPOs backed by more reputable VCs and underwriters. Among connected stocks, LPs are significantly less likely to invest when the IPO is backed by more reputable VCs, and are more likely (but not

[22] The intermediary reputation variables UW_REPUTATION and VC_REPUTATION are significantly positively correlated with each other indicating that more reputable VCs match with more reputable underwriters. Therefore, in this exercise, we include intermediary reputation variables one at a time and also drop VC dummies.

significantly) to invest when the underwriter is more reputable. In both cases, LPs are more likely to invest in the direction of return predictability.

On the other hand, we find that the interaction of a relationship with either the VC or the underwriter reputation is always negative and significant regardless of the direction of return predictability. In other words, when determining propensity to invest there is a substitution effect between intermediary reputation and familiarity with the VC backing the stock. Perhaps this is not surprising because both a prior relationship with the VC and intermediary reputation may affect propensity to invest through non-information channels.

VI. Conclusion

We investigate whether outsiders' access to information prior to an IPO 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), in which limited partners (LPs) of VC funds could become informed about the prospects of the IPO firm through their formal exchanges with the VC fund. Although VC backed IPOs have accounted for more than half of all IPOs in recent years (Ritter (2013)), 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.

We find that LPs obtain higher returns when they invest in connected stocks in comparison to 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, LPs' returns are highest and most robust when their VC's connection to the stock implies better access to information, that is, when LPs are connected through the lead VC fund. In addition, connected LPs' returns are higher when their information advantage over the public is greater, that is, when they invest in stocks that are smaller, have no IBES analyst coverage, and are not listed on NYSE.

Another novel contribution is to show 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 discern their individual effects on propensity to invest (Pool, Stoffman, and Yonker (2012)). We contribute to this debate by showing that familiarity bias disappears, even when familiarity itself is presumably strongest, once an LP has formal access to information through a VC fund. Further, we use the interaction of access to information with proxies of publicly available information and intermediary reputation to show that LPs tilt their investment decisions towards higher return predictability when their VC connection implies information, but that there is a substitution effect between familiarity and intermediary reputation when their VC connection to the stock implies no information. Our results suggest that access to value relevant information eliminates, or at the very least strongly reduces, biases in investment behavior.

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.[23] 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.

[23] 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."

References

Agrawal, Anup, and Tommy Cooper. "Insider trading before accounting scandals." *Journal of Corporate Finance* 34 (2015): 169-190.

Admati, Anat R., and Paul Pfleiderer. "Robust financial contracting and the role of venture capitalists." *Journal of Finance* 49, no. 2 (1994): 371-402.

Ahern, Kenneth R. "Information networks: Evidence from illegal insider trading tips." *Journal of Financial Economics* 125, no. 1 (2017): 26-47.

Aragon, George O., and J. Spencer Martin. "A unique view of hedge fund derivatives usage: Safeguard or speculation?" *Journal of Financial Economics* 105, no. 2 (2012): 436-456.

Baker, Malcolm, and Jeffrey Wurgler. "Market timing and capital structure." *Journal of Finance* 57, no. 1 (2002): 1-32.

Baum, Joel AC, and Brian S. Silverman. "Picking winners or building them? Alliance, intellectual, and human capital as selection criteria in venture financing and performance of biotechnology startups." *Journal Of Business Venturing* 19.3 (2004): 411-436.

Bettis, Carr, Don Vickrey, and Donn W. Vickrey. "Mimickers of corporate insiders who make large-volume trades." *Financial Analysts Journal* 53, no. 5 (1997): 57-66.

Cao, H. Henry, Bing Han, David Hirshleifer, and Harold H. Zhang. "Fear of the Unknown: Familiarity and Economic Decisions." *Review of Finance* 15 (2011): 173-206.

Carhart, Mark M. "On persistence in mutual fund performance." *Journal of Finance* 52, no. 1 (1997): 57-82.

Carter, Richard, and Steven Manaster. "Initial public offerings and underwriter reputation." *Journal of Finance* 45, no. 4 (1990): 1045-1067.

Chari, Varadarajan V., Ravi Jagannathan, and Aharon R. Ofer. "Seasonalities in security returns: The case of earnings announcements." *Journal of Financial Economics* 21, no. 1 (1988): 101-121.

Chemmanur, Thomas J., Gang Hu, and Jiekun Huang. "The role of institutional investors in initial public offerings." *Review of Financial Studies* 23.12 (2010): 4496-4540.

Chiang, Yao-Min, Yiming Qian, and Ann E. Sherman. "Endogenous Entry and Partial Adjustment in IPO Auctions: Are Institutional Investors Better Informed?" *Review of Financial Studies* 23, no. 3 (2010): 1200-1230.

Cliff, Michael T., and David J. Denis. "Do initial public offering firms purchase analyst coverage with underpricing?" *Journal of Finance* 59, no. 6 (2004): 2871-2901.

Cohen, Lauren, Andrea Frazzini, and Christopher Malloy. "Sell-Side School Ties." *Journal of Finance* 65, no. 4 (2010): 1409-1437.

Cohen, Lauren, Andrea Frazzini, and Christopher Malloy. "The Small World of Investing: Board Connections and Mutual Fund Returns." *Journal of Political Economy* 116, no. 5 (2008): 951-979.

Cornelli, Francesca, David Goldreich, and Alexander Ljungqvist. "Investor sentiment and pre-IPO markets." *Journal of Finance* 61, no. 3 (2006): 1187-1216.

Corwin, Shane A., and Jeffrey H. Harris. "The initial listing decisions of firms that go public." *Financial Management* (2001): 35-55.

Coval, Joshua D., and Tobias J. Moskowitz. "The Geography of Investment: Informed Trading and Asset Prices." *Journal of Political Economy* 109, no. 4 (2001): 811-841.

Duan, Ying, Edith S. Hotchkiss, and Yawen Jiao. "Business Ties and Information Advantage: Evidence from Mutual Fund Trading." (2014). *SSRN Working Paper.*

Edelen, Roger M., and Gregory B. Kadlec. "Issuer surplus and the partial adjustment of IPO prices to public information." *Journal of Financial Economics* 77, no. 2 (2005): 347-373.

Faccio, Mara, and Scott HC Hsu. "Politically connected private equity and employment." *Journal of Finance* 72, no. 2 (2017): 539-574.

Fama, Eugene F., and Kenneth R. French. "The cross-section of expected stock returns." Journal *of Finance* 47, no. 2 (1992): 427-465.

Field, Laura Casares, and Michelle Lowry. "Institutional versus individual investment in IPOs: The importance of firm fundamentals." *Journal of Financial and Quantitative Analysis* 44.03 (2009): 489-516.

Gompers, Paul, and Josh Lerner. "Venture Capital Distributions: Short-Run and Long-Run Reactions." *Journal of Finance* 53.6 (1998): 2161-2183.

Gorman, Michael, and William A. Sahlman. "What do venture capitalists do?." *Journal of Business Venturing* 4.4 (1989): 231-248.

Heckman, James J. "Sample selection bias as a specification error." *Econometrica* (1979): 153-161.

Hellmann, Thomas, and Manju Puri. "The interaction between product market and financing strategy: The role of venture capital." *Review of Financial Studies* 13.4 (2000): 959-984.

Hellmann, Thomas, and Manju Puri. "Venture capital and the professionalization of start-up firms: Empirical evidence." *Journal of Finance* 57.1 (2002): 169-197.

Henning, Peter J. "Court Strikes on Insider Trading, and Congress Lobs Back." *New York Times*, March 17, 2015.

Huberman, Gur. "Familiarity breeds investment." *Review of Financial Studies* 14, no. 3 (2001): 659-680.

Ivković, Zoran, and Scott Weisbenner. "Information diffusion effects in individual investors' common stock purchases: Covet thy neighbors' investment choices." *Review of Financial Studies* 20.4 (2007): 1327-1357.

Ivković, Zoran, and Scott Weisbenner. "Local does as local is: Information content of the geography of individual investors' common stock investments." *Journal of Finance* 60, no. 1 (2005): 267-306.

Jeng, Leslie A., Andrew Metrick, and Richard Zeckhauser. "Estimating the returns to insider trading: A performance-evaluation perspective." *Review of Economics and Statistics* 85, no. 2 (2003): 453-471.

Krishnan, C. N. V., Vladimir I. Ivanov, Ronald W. Masulis, and Ajai K. Singh. "Venture capital reputation, post-IPO performance, and corporate governance." *Journal of Financial and Quantitative Analysis* 46, no. 05 (2011): 1295-1333.

Lakonishok, Josef, and Immoo Lee. "Are insider trades informative?." *Review of Financial Studies* 14, no. 1 (2001): 79-11.

Lee, Peggy M., and Sunil Wahal. "Grandstanding, certification and the underpricing of venture capital backed IPOs." *Journal of Financial Economics* 73.2 (2004): 375-407.

Lerner, Josh, Antoinette Schoar, and Wan Wongsunwai. "Smart institutions, foolish choices: The limited partner performance puzzle." *The Journal of Finance* 62, no. 2 (2007): 731-764.

Levine, Matt. "Another Politician Wants to Ban Insider Trading." *Bloomberg View*, April 1, 2014.

Lindsey, Laura. "Blurring firm boundaries: The role of venture capital in strategic alliances." *Journal of Finance* 63.3 (2008): 1137-1168.

Ljungqvist, Alexander, Vikram Nanda, and Rajdeep Singh. "Hot Markets, Investor Sentiment, and IPO Pricing." *Journal of Business* 79, no. 4 (2006): 1667-1702.

Loughran, Tim, and Jay Ritter. "Why has IPO underpricing changed over time?." *Financial Management* (2004): 5-37.

Loughran, Tim, and Paul Schultz. "Liquidity: Urban versus rural firms." *Journal of Financial Economics* 78.2 (2005): 341-374.

Marquez, Robert, Vikram Nanda, and M. Deniz Yavuz. "Private Equity Fund Returns and Performance Persistence." *Review of Finance* 19, no. 5 (2015): 1783-1823.

Massa, Massimo, and Andrei Simonov. "Hedging, familiarity and portfolio choice." *Review of Financial Studies* 19.2 (2006): 633-685.

Massa, Massimo, and Zahid Rehman. "Information flows within financial conglomerates: Evidence from the banks–mutual funds relation." *Journal of Financial Economics* 89, no. 2 (2008): 288-306.

Megginson, William L., and Kathleen A. Weiss. "Venture capitalist certification in initial public offerings." *Journal of Finance* 46.3 (1991): 879-903.

Merton, Robert C. "A simple model of capital market equilibrium with incomplete information." *Journal of Finance* 42, no. 3 (1987): 483-510.

Metrick, Andrew, and Ayako Yasuda. "The Economics of Private Equity Funds." *Review of Financial Studies* 23, no. 6 (2010): 2303-2341.

Nahata, Rajarishi. "Venture capital reputation and investment performance." *Journal of Financial Economics* 90, no. 2 (2008): 127-151.

Nanda, Vikram, and Youngkeol Yun. "Reputation and financial intermediation: An empirical investigation of the impact of IPO mispricing on underwriter market value." *Journal of Financial Intermediation* 6, no. 1 (1997): 39-63.

Ozmel, Umit, Jeffrey J Reuer. and Ranjay Gulati. “Signals across multiple networks: how venture capital and alliance networks affect interorganizational collaboration”. Academy of Management Journal **56**(3) (2013): 852–866.

Ozmel, Umit, David T. Robinson, and Toby E. Stuart. "Strategic alliances, venture capital, and exit decisions in early stage high-tech firms." Journal of Financial Economics 107.3 (2013): 655-670.

Pástor, Ľuboš, and Pietro Veronesi. "Rational IPO waves." Journal of Finance 60, no. 4 (2005): 1713-1757.

Pool, Veronika K., Noah Stoffman, and Scott E. Yonker. "No place like home: Familiarity in mutual fund manager portfolio choice." Review of Financial Studies 25, no. 8 (2012): 2563-2599.

Pukthuanthong-Le, Kuntara, and Nikhil Varaiya. "IPO Pricing, Block Sales, and Long-Term Performance." Financial Review 42, no. 3 (2007): 319-348.

Ritter, Jay R. "Initial Public Offerings: VC-backed IPO Statistics Through 2012." (2013). University of Florida Working Paper.

Seasholes, Mark S., and Ning Zhu. "Individual investors and local bias." Journal of Finance 65, no. 5 (2010): 1987-2010.

Sensoy, Berk A., Yingdi Wang, and Michael S. Weisbach. "Limited partner performance and the maturing of the private equity industry." *Journal of Financial Economics* 112, no. 3 (2014): 320-343.

Seyhun, H. Nejat. “Insiders' profits, costs of trading, and market efficiency.” *Journal of Financial Economics*, 16(2) (1986):189-212.

Sørensen, Morten. How smart is smart money? A two-sided matching model of Venture Capital. The *Journal of Finance* (2007), 62(6), 2725-2762.

Stock, James H., and Motohiro Yogo (2005). Testing for weak instruments in linear IV regression. Identification and inference for econometric models: Essays in honor of Thomas Rothenberg (2005).

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.
NONLEAD_CONNECT	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.
#CON_INV=1	A dummy variable = 1 if the number of connected LPs invested in the stock is equal to 1, and =0 otherwise.
#CON_INV>=2	A dummy variable = 1 if the number of connected LPs invested in the stock is greater than or equal to 2, and =0 otherwise.
#CON_NOT_INV	The variable is equal to number of connected LPs that did not invest in the newly listed stock at the end of first quarter after the IPO date.
#INV_BY_NONCONNECT_LPS	The variable is equal to number of all non-connected LPs who invested in the newly listed stock at the end of first quarter after the IPO.
LOCAL_DUMMY	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. 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.
M_TO_B	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. 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.
RUSSELL2000	The cumulative returns to the Russell2000 (small cap) index in the 30 days leading up to the IPO.
INDUSTRY_AVGUP	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.
AVGUP	The average underpricing of every IPO over the 90 days prior to the firm's IPO.
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
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 – Summary Statistics

Panel A provides summary statistics of the key variables. All variables are defined in Table 1. Panel B provides summary statistics of raw returns of quarterly returns from the first full calendar-quarter after the IPO date, that is, beginning at the end of the calendar-quarter of the IPO date. "All stocks" includes all stocks from 1988-2013 that meet the criteria to be included in our sample. "All LP Investments" includes every investment by LPs in newly listed stocks whether they are connected investments or not. "Connected Investments" includes LP investments in IPOs that they are connected to through a lead VC fund.

	1	2	3	4
	Mean	Standard Deviation	Min	Max
Panel A: Summary Statistics of Variables				
INVEST	0.0591	0.2359	0.000	1.000
CONNECT	0.0009	0.0295	0.000	1.000
NONLEAD_CONNECT	0.0011	0.0324	0.000	1.000
RELATIONSHIP	0.0052	0.0721	0.000	1.000
#CON_INV=1	0.0053	0.0725	0.000	1.000
#CON_INV>=2	0.0010	0.0310	0.000	1.000
VC_REPUTATION	0.3692	0.8051	0.000	3.219
PROCEEDS	4.0649	1.1324	-0.968	9.886
UW_REPUTATION	7.7714	1.7959	1.001	9.001
NASDAQ	0.7000	0.4583	0.000	1.000
SENTIMENT	90.7063	11.8728	55.300	112.000
RUSSELL2000	0.0155	0.0474	-0.271	0.257
INDUSTRY_AVGUP	0.2101	0.2512	-0.208	2.860
AVGUP	0.2090	0.2022	-0.047	1.143
DURATION	0.0069	0.1616	0.000	5.547
Panel B: Summary Statistics of Returns				
All IPO Stocks	4.77%	42.1%	-91.94%	605.88%
All LP Investments in IPOs	2.64%	40.3%	-91.94%	605.88%
Connected Investments	12.43%	39.2%	-42.37%	80.63%

Table 3 – Returns to Connected Investments

The sample in Table 3 is all LP-stock pairs in which 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	**0.258*** **	**0.250*** **	**0.192*** **	**0.263*** **	**0.248*** **
	(3.259)	(2.854)	(2.784)	(3.919)	(3.365)
LOCAL_DUMMY	-0.004	0.001	-0.001	0.000	0.003
	(-0.224)	(0.042)	(-0.050)	(0.028)	(0.186)
ACTIVE_LP	-0.031	-0.002	0.006	-0.013	-0.022
	(-1.015)	(-0.074)	(0.225)	(-0.548)	(-0.860)
VC_BACKED	-0.036	-0.013	-0.015	-0.034	-0.028
	(-1.134)	(-0.376)	(-0.487)	(-1.133)	(-0.941)
VC_REPUTATION	-0.032	-0.008	-0.002	-0.021	-0.024
	(-1.414)	(-0.330)	(-0.093)	(-1.022)	(-1.162)
M_TO_B	0.008	-0.005	-0.004	-0.003	0.003
	(0.958)	(-0.551)	(-0.463)	(-0.453)	(0.336)
PROCEEDS	-0.016	-0.009	-0.007	0.010	-0.013
	(-1.275)	(-0.817)	(-0.655)	(0.894)	(-1.089)
AGE	-0.001	0.004	0.003	-0.005	-0.003
	(-0.089)	(0.385)	(0.330)	(-0.512)	(-0.249)
UW_REPUTATION	0.003	0.004	0.006	0.001	-0.001
	(0.338)	(0.472)	(0.800)	(0.067)	(-0.166)
POSITIVE_EBIT	-0.001	-0.010	-0.011	0.001	0.006
	(-0.031)	(-0.347)	(-0.385)	(0.036)	(0.214)
WORKING_CAPITAL	0.012	0.012	0.011	0.013	0.015
	(0.661)	(0.613)	(0.567)	(0.711)	(0.887)
NASDAQ	-0.015	-0.001	0.006	-0.008	-0.009
	(-0.724)	(-0.036)	(0.316)	(-0.417)	(-0.443)
SENTIMENT	-0.001	0.001	0.001	0.000	0.000
	(-1.065)	(0.870)	(1.160)	(0.449)	(0.182)
RUSSELL2000	**-1.050*** **	-0.293	-0.363	**-0.429***	**-0.698*** **
	(-4.226)	(-1.098)	(-1.443)	(-1.888)	(-2.995)
INDUSTRY_AVGUP	-0.049	0.069	0.015	-0.086	-0.069
	(-0.781)	(0.918)	(0.244)	(-1.443)	(-1.222)
AVGUP	0.065	-0.162	-0.142	**-0.147***	-0.058
	(0.749)	(-1.463)	(-1.474)	(-1.739)	(-0.691)
DURATION	-0.011	**-0.013***	-0.009	**-0.017** **	-0.016
	(-0.908)	(-1.662)	(-1.127)	(-2.047)	(-1.606)
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 4 – LPs' Returns from Investing in Connected Stocks: Full Sample of LP-Stock Pairs

The sample in Table 4 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	**0.204****	**0.238*****	**0.214*****	**0.175****	**0.173****
	(2.481)	(3.319)	(3.250)	(2.310)	(2.364)
INVEST	**-0.013****	**-0.013****	**-0.009***	**-0.020*****	**-0.015*****
	(-2.427)	(-2.365)	(-1.888)	(-4.046)	(-2.944)
CONNECT	0.053	0.031	0.021	**0.072****	**0.070***
	(1.276)	(0.772)	(0.535)	(2.002)	(1.765)
LOCAL_DUMMY	0.007	0.006	0.008	0.008	0.006
	(0.631)	(0.607)	(0.768)	(0.768)	(0.584)
ACTIVE_LP	0.002	0.000	0.000	0.000	0.002
	(0.923)	(0.129)	(0.275)	(0.275)	(1.071)
VC_BACKED	-0.020	-0.006	-0.012	-0.028	-0.016
	(-0.786)	(-0.228)	(-0.476)	(-1.189)	(-0.683)
VC_REPUTATION	**-0.034***	-0.029	-0.022	-0.020	-0.027
	(-1.692)	(-1.508)	(-1.158)	(-1.135)	(-1.451)
M_TO_B	0.009	-0.002	-0.000	0.003	0.009
	(1.402)	(-0.340)	(-0.009)	(0.490)	(1.578)
PROCEEDS	**-0.030*****	**-0.020****	**-0.020****	-0.000	**-0.027*****
	(-3.052)	(-2.259)	(-2.330)	(-0.009)	(-2.873)
AGE	-0.008	-0.000	-0.001	-0.008	-0.007
	(-0.893)	(-0.030)	(-0.121)	(-0.921)	(-0.780)
UW_REPUTATION	**0.014****	**0.011****	**0.012****	0.008	**0.010***
	(2.287)	(1.992)	(2.323)	(1.348)	(1.785)
POSITIVE_EBIT	-0.007	-0.026	-0.020	-0.013	-0.008
	(-0.280)	(-1.075)	(-0.871)	(-0.534)	(-0.348)
WORKING_CAPITAL	0.012	0.021	0.015	0.021	0.015
	(0.588)	(1.290)	(0.993)	(1.138)	(0.817)
NASDAQ	-0.010	-0.008	-0.002	-0.016	-0.007
	(-0.597)	(-0.499)	(-0.153)	(-1.009)	(-0.442)
SENTIMENT	-0.000	0.001	**0.001***	0.001	0.001
	(-0.141)	(1.538)	(1.725)	(1.373)	(0.815)
RUSSELL2000	**-1.141*****	**-0.544****	**-0.568****	**-0.719*****	**-0.823*****
	(-4.941)	(-2.236)	(-2.522)	(-3.377)	(-3.778)
INDUSTRY_AVGUP	-0.050	0.076	0.026	-0.088	-0.053
	(-0.827)	(0.932)	(0.389)	(-1.494)	(-0.959)
AVGUP	0.042	-0.171	-0.161	-0.126	-0.088
	(0.441)	(-1.370)	(-1.489)	(-1.335)	(-0.958)
DURATION	**-0.013***	-0.010	-0.009	-0.010	**-0.013****
	(-1.822)	(-1.606)	(-1.568)	(-1.619)	(-2.042)
VC Fixed Effects?	Yes	Yes	Yes	Yes	Yes
N	272,080	272,080	272,080	266,620	272,080
Adjusted-R^2	0.141	0.102	0.101	0.133	0.139

Table 5 – Stock Level Regressions

Each observation in Table 5 is one newly listed stock. The dependent (left-hand) variable is the stock return that is specified for 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. 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	FF 3-Factor Alpha	Industry-Size Matching Portfolios	FF25 Matching Portfolios
Variables	(1)	(2)	(3)	(4)	(5)
#CON_INV=1	**0.200***	**0.331*****	**0.267*****	**0.207****	**0.198***
	(1.667)	(2.837)	(2.688)	(1.963)	(1.811)
#CON_INV>=2	**0.539****	**0.359***	**0.390****	**0.476****	**0.425****
	(2.509)	(1.691)	(2.006)	(2.093)	(2.120)
#CON_NOT_INV	-0.007	-0.011	-0.013	0.006	0.000
	(-0.531)	(-0.809)	(-1.016)	(0.472)	(0.008)
#INV_BY_NONCONNECT_LPS	**-0.006*****	**-0.005*****	**-0.004****	**-0.008*****	**-0.006*****
	(-3.137)	(-2.755)	(-2.323)	(-4.494)	(-3.487)
VC_BACKED	-0.004	0.002	-0.002	-0.015	-0.002
	(-0.179)	(0.069)	(-0.091)	(-0.642)	(-0.082)
VC_REPUTATION	-0.030	-0.027	-0.019	-0.017	-0.024
	(-1.530)	(-1.429)	(-1.041)	(-0.984)	(-1.345)
M_TO_B	**0.018****	0.003	0.005	0.011	**0.018****
	(2.276)	(0.461)	(0.788)	(1.586)	(2.451)
PROCEEDS	-0.009	-0.004	-0.007	**0.028*****	-0.004
	(-0.782)	(-0.405)	(-0.690)	(2.692)	(-0.397)
AGE	-0.005	0.003	0.002	-0.005	-0.004
	(-0.581)	(0.400)	(0.336)	(-0.685)	(-0.510)
UW_REPUTATION	**0.014****	**0.011****	**0.012****	0.008	**0.011***
	(2.446)	(2.002)	(2.208)	(1.447)	(1.886)
POSITIVE_EBIT	-0.003	-0.017	-0.011	-0.010	-0.005
	(-0.100)	(-0.714)	(-0.467)	(-0.419)	(-0.207)
WORKING_CAPITAL	0.007	0.018	0.012	0.022	0.013
	(0.370)	(1.057)	(0.732)	(1.230)	(0.688)
NASDAQ	-0.024	-0.017	-0.012	**-0.034****	-0.023
	(-1.367)	(-1.071)	(-0.764)	(-2.087)	(-1.424)
SENTIMENT	0.000	**0.002****	**0.002****	**0.001****	0.001
	(0.344)	(2.177)	(2.332)	(1.991)	(1.481)
RUSSELL2000	**-1.022*****	**-0.518****	**-0.523****	**-0.659*****	**-0.728*****
	(-4.657)	(-2.266)	(-2.465)	(-3.272)	(-3.525)
INDUSTRY_AVGUP	-0.015	0.085	0.043	-0.058	-0.016
	(-0.250)	(1.095)	(0.667)	(-1.034)	(-0.294)
AVGUP	0.030	-0.152	-0.152	-0.111	-0.090
	(0.333)	(-1.305)	(-1.489)	(-1.232)	(-1.019)
VC Fixed Effects?	Yes	Yes	Yes	Yes	Yes
N	3,214	3,214	3,214	3,154	3,214
Adjusted-R^2	0.060	0.026	0.023	0.057	0.060

Table 6 – Returns to LP Investments in Connected vs. Unconnected Stocks: Monthly Returns

The sample in Table 6 is all LP-stock pairs in which 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. 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	**0.098*** **	**0.096*** **	**0.089*** **	**0.095*** **	**0.105*** **
	(3.342)	(3.286)	(3.257)	(3.440)	(3.547)
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	**0.062***	**0.074** **	0.025	**0.057***	0.044
	(1.749)	(2.221)	(0.579)	(1.774)	(1.172)
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	0.149	0.137
Panel C: Returns for 3rd Month					
CONNECT	0.045	0.042	**0.060** **	**0.040***	**0.051***
	(1.617)	(1.007)	(2.037)	(1.731)	(1.893)
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 7 – Heterogeneity in LP's Information Advantage

The sample in Table 7 is all LP-stock pairs in which 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. Coefficients of all control variables are allowed to vary across samples. Standard errors are double clustered on stock and LP. Numbers in parenthesis indicate t-stats. Some of the standard errors in Column 3 do not converge. *, **, and *** indicate 10%, 5%, and 1% levels of significance, respectively.

	Heterogeneity in LP's Access to Information	Heterogeneity in Public's Access to Information		
	(1)	(2)	(3)	(4)
CONNECT	**0.430***	(0.661)	0.004	0.079
	(1.825)	(-0.027)	.	(0.989)
NONLEAD_CONNECT	0.186			
	(0.851)			
RELATIONSHIP	-0.006			
	(-0.396)			
SMALL		0.463		
		(1.249)		
SMALL X CONNECT		**0.156****		
		(1.972)		
NON-NYSE			-0.311	
			.	
NON-NYSE X CONNECT			**0.214*****	
			(2.873)	
NO-ANALYST				0.075
				(0.295)
NO-ANALYST X CONNECT				0.139
				(1.478)
Control Variables	All	All except PROCEEDS & NASDAQ	All except PROCEEDS & NASDAQ	All except PROCEEDS & NASDAQ
LP & VC Fixed Effects	Yes	Yes	Yes	Yes
N	15,871	15,871	15,871	15,871
Adjusted-R^2	0.098	0.170	0.100	0.170

Table 8 – Propensity to Invest

The sample in Table 8 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. In column 3 we allow the coefficient of control variables to vary across Non-NYSE and NYSE samples otherwise standard errors of coefficient of interest do not converge. *, **, and *** indicate 10%, 5%, and 1% levels of significance, respectively.

Interaction Variable		SMALL	NON-NYSE	NO-ANALYST	UW_REPUTATION	VC_REPUTATION
	(1)	(2)	(3)	(4)	(5)	(6)
CONNECT	-0.31 (-0.79)	-0.57 (-0.88)	**-10.21***** (-3.52)	-1.07 (-1.64)	-2.12 (-0.70)	0.22 ((0.34)
NONLEAD_CONNECT	0.02 (0.08)	-0.54 (-0.94)	**-7.16***** (-3.26)	-0.57 (-1.01)	-3.29 (-1.19)	0.42 (0.68)
RELATIONSHIP	**0.34***** (3.52)	0.22 (1.41)	0.15 (0.58)	**0.35***** (3.42)	**2.20**** (2.01)	**1.14***** (4.04)
Interaction Variable x CONNECT		-0.33 (-0.45)	**10.08***** (2.60)	**0.64**** (2.22)	0.14 (0.41)	**-0.63**** (-2.43)
Interaction Variable x NONLEAD_CONNECT		0.28 (0.96)	**7.34***** (3.62)	0.70 (1.20)	0.33 (1.03)	-0.38 (-1.41)
Interaction Variable x RELATIONSHIP		0.20 (1.04)	0.27 (1.14)	0.06 (0.53)	**-0.22*** (-1.73)	**-0.43***** (-3.45)
Interaction Variable		**0.65***** (11.50)	-0.84 (-1.01)	**-0.42***** (-7.35)	**0.14***** (6.62)	**0.08***** (3.62)
Control Variables	All	All except PROCEEDS & NASDAQ	All except PROCEEDS & NASDAQ	All except PROCEEDS & NASDAQ	All except VC_REPUTATION	All except UW_REPUTATION & VC_BACKED
VC Fixed Effects	Yes	Yes	Yes	Yes	No	No
LP Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	272,080	272,080	272,080	272,080	272,080	272,080
Pseudo R^2	0.25	0.24	0.23	0.23	0.25	0.25

Figure 1 – Examples of LP-Startup Connections

Figure 1 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.

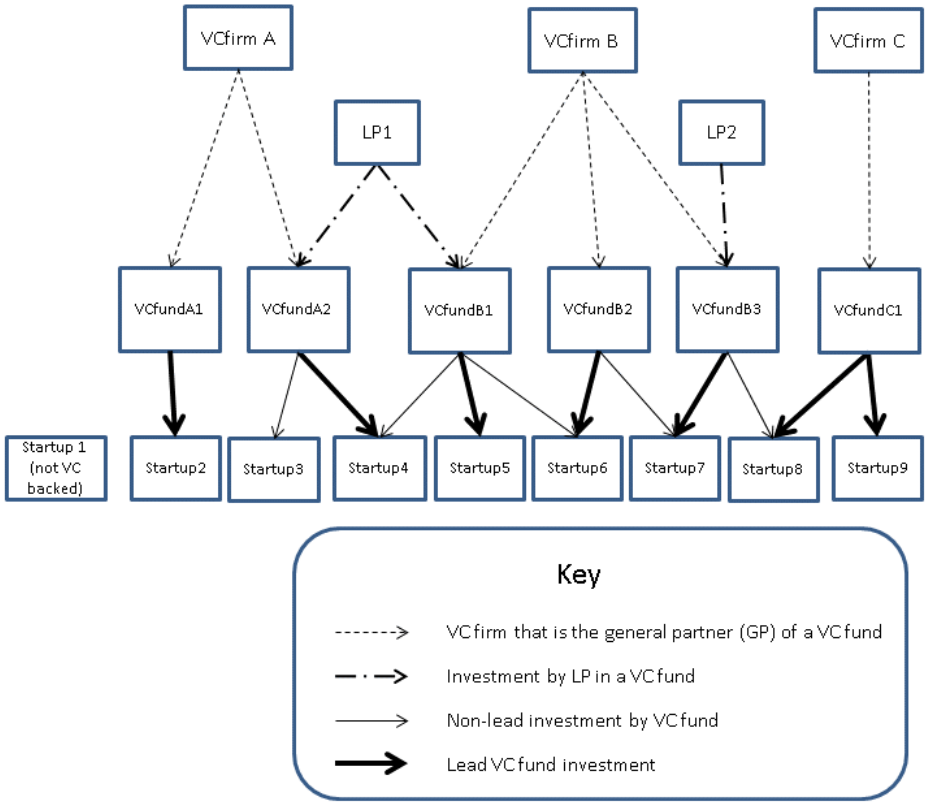

Figure 2 – Probability Density Function of Returns to LPs' Connected Investments

Figure 2 figure demonstrates probability density functions of quarterly raw returns and Carhart 4-Factor alpha of all IPO stocks and LPs' connected investments.