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The illiquidity puzzle: theory and evidence from private equity⋆

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Abstract

This paper presents the theory that managers can use the liquidity of securities as a choice variable to screen for deep-pocket investors, those that have a low likelihood of facing a liquidity shock. We assume an information asymmetry about the quality of the manager between the existing investors and the market. The manager then faces a lemons problem when he has to raise funds for a subsequent fund from outside investors, because the outsiders cannot determine whether the manager is of poor quality or the existing investors were hit by a liquidity shock. Thus, liquid investors can reduce the manager's cost of capital in future fundraising. We test the assumptions and predictions of our model in the context of the private equity industry. Consistent with the theory, we find that transfer restrictions on investors are less common in later funds organized by the same private equity firm, where information problems are presumably less severe. Also, partnerships whose investment focus is in industries with longer investment cycles display more transfer constraints. Finally, we present evidence consistent with the assumptions of our model, including the high degree of continuity in the investors of successive funds and the ability of sophisticated investors to anticipate funds that will have poor subsequent performance.

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1. Introduction

Economists have long argued that liquidity is a mixed blessing. On the one hand, liquidity provides a number of benefits for investors. For example, more liquid assets can provide positive incentive effects through improved performance measurement and more informativeness of stock prices (see, for example, Holmström and Tirole, 1993, Faure-Grimaud and Gromb, 1999, and Scharfstein and Stein, 2000). Greater liquidity also allows investors to easily redirect funds toward more efficient uses (as highlighted in the literature on liquidity shocks in the tradition of Diamond and Dybvig, 1983, and Shleifer and Vishny, 1997). On the other hand, the literature has identified costs of investor liquidity. Most of these papers rely on the intuition that increased liquidity reduces the incentives for large shareholders to fulfill their monitoring role (as in Bhide, 1993, and Aghion, Bolton, and Tirole, 2000).

This paper examines a rationale for liquidity that is distinct from the governance-based stories that have dominated the earlier literature. We present a model in which a manager of a private equity firm explicitly chooses the degree of illiquidity of shares to screen for investors with long horizons. Investors who expect to face many liquidity shocks in the future would find these restrictions especially onerous and therefore would avoid investing. The benefits of having liquid investors become apparent once the firm has to go back to the market to raise new capital. If the original investors do not reinvest because of a liquidity shock, the outside investors cannot distinguish whether the initial investors truly faced a liquidity shock or whether they have learned that the fund is a lemon. Transfer constraints de facto allow the manager to trade off increased cost of capital in early fundraising against lower cost in future fundraising by minimizing the lemons problem with respect to the outside market.

The novel contribution of our model is that we analyze illiquidity as a choice variable, which can be influenced by the manager of the fund and allows him to screen for deep-pocket investors. Thus, illiquidity here is not the symptom of an underlying asymmetric information problem as it

is in most of the asset pricing literature on liquidity. Instead, we model illiquidity as an outcome of the optimization problem that the general partners (GPs) have. The intuition of our model is driven by the information asymmetry between inside and outside investors and not by the fact that a private equity fund could face large transaction costs if it was forced to liquidate prematurely. The transfer of equity stakes is independent of the capital commitment to the fund.

We motivate the analysis by considering a setting where the monitoring role of large investors is much less important, but severe restrictions on liquidity are commonplace: private equity limited partnerships. Three observations inspire our analysis. First, limited partners (LPs) in U.S. private equity funds typically have very limited rights and incentives to influence or direct the funds' activities.[1] Even though in some cases investors can, for example, vote to dissolve the fund, this hardly ever occurs.

Second, private equity investors require wide-ranging information rights that allow them to monitor the performance of the fund. Usually, investors meet with their general partners on a regular basis to discuss the progress of the portfolio firms. In dealing with unsatisfactory funds, the response of institutional investors typically is to not invest in the subsequent funds raised by the private equity organization. All the limited partners we talked to confirmed that they choose exit over voice when they are dissatisfied with the performance of a fund. The investors' effort to monitor the fund is largely driven by the desire to get better information that informs the reinvestment decision.

Third, serious limitations on the transferability of partnership interests (far beyond what is required by securities law) are commonplace. The presence of these curbs is particularly puzzling given that partnership interests are very illiquid to start with, because of the large stakes held by each limited partner.[2]

[1] At least in part, this reluctance is rooted in the Uniform Limited Partnership Act, which links the shielding of the limited partners from liability for the partnership's activities to their non-involvement in the day-to-day management of the fund.

[2] A number of recent attempts have been made in the investment banking community to issue debtlike securities that are backed by private equity returns to circumvent these constraints.

We believe that the choice of liquidity as a screening device is a more general phenomenon, which applies to a number of situations involving security design. Examples include other private partnerships, such as real estate investment funds and private placements raised by public companies. One illustration are the so-called PIPE transactions (Private Investments in Public Entities), which involve a public company raising capital from a private investor, often a hedge fund. Similarly, Warren Buffett of Berkshire-Hathaway allegedly resists splitting the stock of his fund (an individual share is trading in May 2003 at a value above $2000) because he wants to make his fund only accessible to wealthy individuals who presumably have long horizons.

This intuition also has relevance in many other settings in corporate finance. Consider, for example, a biotechnology start-up that has the choice of either undertaking an initial public offering (IPO) or raising capital in a strategic alliance with a large pharmaceutical company. The former solution often provides a lower cost of capital in the short run, particularly if the IPO market is hot. One of the reasons that we observe the heavy dependence on strategic alliances in biotechnology could be that start-ups want to secure very liquid investors with long horizons, who will be more likely to provide follow-on financing.

We then turn to an empirical examination of the testable predictions of our theory based on a sample of about 250 private equity partnership agreements. We show that, consistent with our model, the restrictions on limited partners' ability to transfer funds are less common in later funds organized by the same private equity group, where information problems are presumably less severe. Also, private equity partnerships whose investment focus is in industries with longer investment cycles display more transfer constraints. Funds that invest in businesses that take a long time before they produce observable results are prone to increased information asymmetry. In congruence with our theory, these funds are more concerned about preventing transfers of equity stakes. For example, we find that funds specializing in the biotechnology investments have more transfer constraints, while those focused on software and the Internet have fewer constraints. We argue that these

findings are consistent with the idea that, in situations where asymmetric information problems are more severe for future fundraising, more emphasis will be placed on selecting long-horizon investors. Another finding is that contracts by California venture capital partnerships are much less likely to employ many restrictive provisions. One interpretation of this result is that in the close-knit California venture community information on the relative performance of funds could be more readily ascertained.

We also empirically examine two crucial assumptions of our model: (1) that limited partners can learn about the quality of the funds in which they invest and thus have inside information, and (2) that a substantial persistence exists in the composition of limited partners between different funds of a private equity organization. We find support for the first assumption using data on the private equity investments of two large and sophisticated limited partners. We focus on their decisions to reinvest or discontinue commitments to partnerships. We show that these LPs on average discontinue funds that have lower returns, while those that were reinvested experience higher returns subsequently. These findings indicate that private equity investors are able to acquire inside information about the funds they are involved in through the investment process. Furthermore, in line with our theoretical assumptions, we find that funds that were discontinued subsequently raise smaller funds, which could reflect the fact that the departure of an inside investor signals negative information to the outside market. Second, we show that a considerable degree of continuity is evident in the limited partners in the successive funds of private equity organizations.

Finally, we examine a possible alternative explanation for the patterns seen here. The use of transferability constraints could be a mechanism through which general partners prohibit loose-cannon troublemakers from investing in their funds. Established GPs could have less to fear from such LPs and thus make less use of these mechanisms. We present both anecdotal and large-sample evidence that is inconsistent with this alternative explanation.

The plan of the paper is as follows. Section 2 considers the institutional setting of private equity

and discusses an illustrative case. We present the model in Section 3. Section 4 discusses the data and the analysis of private equity contracts. Section 5 discusses the supplemental analyses. The final section concludes the paper.

2. Institutional setting

Private equity is an environment to examine the costs and benefits of liquidity as a screening mechanism, as it presents a setting where the traditional rationale for illiquidity, the need for governance, is not present. This section discusses this setting at greater length.

Private equity funds typically are raised in the form of limited partnerships. Unlike corporations, these partnerships have finite lives, typically ten years (though extensions of a few years are possible). The general partners (the private equity fund's managers) invest the capital raised from limited partners, typically large institutional and individual investors, in entrepreneurial or restructuring funds. After the firms go public or are sold, the proceeds (whether in the form of equity or cash) are divided between the limited and general partners, leading to a close alignment of the incentives of the two parties. For a more detailed discussion of private equity funds, see Gompers and Lerner (1999b).

Conversations with limited and general partners of private equity funds suggest that the restrictions on the transferability of limited partnership interests are motivated in large part by the adverse effects that such transfers can have on the operations of the funds. The recurring theme that we heard when talking to practitioners is that GPs want to avoid partnership stakes ending up in the hands of unsophisticated investors without a long-term commitment to the asset class, which is in line with the argument of this paper. A number of the seasoned practitioners pointed to the experience of the early private equity funds, i.e., most funds were freely tradable between the 1940s and 1960s.[3]

[3]These early funds were typically structured as closed-end funds or corporations, instead of limited partnerships. This structure was based not on choice but on necessity, because these pioneering funds found it very difficult to

A review of historical materials regarding the pioneering venture capital fund American Research and Development (ARD) suggests that the liquidity of the fund had a number of adverse effects.[4] For instance, raising additional capital proved to be highly dilutive for existing shareholders. When ARD sought to raise additional capital in 1958 to finance its investment in Digital Equipment Corporation (which ultimately accounted for the majority of its portfolio gains), it was required to sell shares at a price that was nearly 40% below the fund's net asset value (and even further below the fund's true value).

By way of contrast, we did not hear any support for a story in which transfer constraints exist to create greater involvement of LPs. Usually this does not constitute an important consideration for two reasons. First, investments by private equity funds are typically highly illiquid and difficult to salvage for an attractive price. Thus, even if the limited partners were to step in and force a liquidation of a fund, they would be unlikely to get much of a return for their effort. This lack of active involvement in the fund's day-to-day activities, however, does not preclude the limited partners from gathering important information about the quality and performance of the general partners running the fund. This interaction allows the LPs to develop an informed opinion about the quality of the partnership and its general partners. If the partnership turns out to be of low quality, LPs will avoid investing in any further funds organized by the problematic organization.

Second, the Uniform Limited Partnership Act (ULPA), which has been enacted in its original or revised form in 48 of the 50 states (Harroch, 1998), restricts the ability of limited partners to become involved with the day-to-day operations of the fund. Under this act, a limited partner's liability extends only to the amount of capital contributed to the partnership, as long as that partner does not "participate in the control of the business."[5] As a result, limited partners who exercise supervisory authority or other management control over the partnerships in which they

access capital from institutional sources. Instead, they often turned to investment banks to raise the needed funds from retail investors through public offerings.

[4]This discussion is based on Capital Publishing Company (various years), Liles (1977), and the Georges Doriot collections in the archives of the Baker Library and the French Library and Cultural Center of Boston.

[5]Revised Uniform Limited Partnership Act 303(a). The ULPA. uses the phrase "take part."

invest could endanger their limited liability status, a grave concern for any investor.[6]

Finally, securities and tax regulations certainly play a role in the decision to restrict the transferability of limited partnership interests. Funds try to avoid coming under the provisions of the Investment Company Act of 1940, which imposes costly disclosure requirements on the GPs. Similarly, if the stakes of a limited partnership were freely traded, the fund would be taxed at the partnership as well as the LP level, which would be especially detrimental because many investors of private equity funds are tax-exempt entities. Most practitioners and legal scholars agree, however, that the level of control over transfer constraints imposed in most partnership agreements are far in excess of what would be required to comply with securities and tax law. The Appendix contains a detailed discussion of the tax implications and legal constraints affecting limited partnerships.

3. A model of transferability restrictions in private equity

Why would a venture capitalist (VC) place restrictions on the transferability of partnership stakes? At face value, such restrictions reduce the liquidity of partnership stakes and should therefore diminish their value, because limited partners, even very liquid ones, want to be compensated for the lack of liquidity. In this section, we propose a simple model that explains why a venture capitalist can benefit from such restrictions in the long run, even though they could in the short run reduce value by requiring the GPs to pay a liquidity premium to investors.

The basic idea is that transfer restrictions are used to screen for limited partners with long horizons. Imagine that LPs differ in their likelihood to face liquidity shocks and thus in their likelihood of being forced to sell their partnership stakes. LPs with a higher propensity of liquidity shocks would find these restrictions especially onerous and, therefore, would be less inclined to invest in these funds than those with a lower likelihood of liquidity shocks, everything else equal.

[6]For a discussion of these issues, see Burr (1982) and Feld (1969). These strictures may be relaxed by the creation of limited liability corporations (LLCs), hybrid structures that were first introduced in 1977. Given the novelty of these structures and the size of the potential downside, limited partners have been reluctant to assume a more active governance role, even in funds organized as LLCs.

We assume that ex ante GPs do not know which investors are liquid and which ones are not, but the LPs know about their own commitment to the asset class. By imposing these restrictions in the first place, the GP is guaranteed a pool of LPs that are especially liquid.

Liquid limited partners are beneficial for the GP because of the repeated game nature of the fundraising process. GPs normally raise new funds every few years. If the GP has investors with deep pockets, he will not need to go back to the capital market for future fundraising. Therefore, the GP trades off the current cost of equity against the benefits from ensuring future access to the capital market. As we will show, the higher the benefits from raising a follow-on fund, the more this trade-off tilts in the direction of imposing transfer constraints, everything else equal.

We assume that incumbent investors obtain inside information about the quality of the GP during their time of involvement with the first fund. Given that GPs do not need to disclose any information about their performance to the general public, the best way to find out about the quality and returns of a fund is by being invested in it. Therefore, insiders are natural candidates to invest in the GP's next fund, if the GP turns out to be a high type. Consequently, the GP faces an adverse selection problem in the outside market. If an incumbent limited partner has a liquidity shock, the GP is forced to go to outside investors. These outsiders will wonder why incumbent investors passed on the new fund. They cannot differentiate whether the incumbent investors passed because of liquidity reasons or because the fund is a lemon. Therefore, outside investors will charge a higher cost of capital than an insider who knows the quality of the GP. This assumption, which we believe accurately describes the private equity fundraising process, provides the central source of asymmetric information in our model.[7]

[7] An extension of the model that has been suggested could be to introduce heterogeneity in the level of sophistication of the limited partners. If deep pocket investors are also better at differentiating high-quality venture capitalists from low-quality ones, more liquid LPs might select better funds. This approach would only undo the logic of our model, however, if the correlation between deep pockets and better information was perfectly correlated. In this extreme case, liquid LPs select the best funds and lower-quality funds are left with less sophisticated (and, according to this assumption, more illiquid) investors. Thus, in equilibrium no need for screening would exist by the private equity funds. Because we do not feel that this is a realistic description of the private equity investment process, we abstract from this extension.

We also rule out strategic behavior of the general partner in the first period by assuming that his quality is unknown to the investors as well as to the GP himself. This assumption is supported by many observers of the venture capital fundraising cycle. Even GPs that have long and successful track records as entrepreneurs or managers in established companies prior to joining (or raising) a fund often struggle to succeed in private equity. Moreover, a recent paper by Gompers and Lerner (1999a) explicitly tests whether venture capitalists have private information about their quality or not. The paper finds evidence that is consistent with a model in which venture capitalists do not possess private information about their own type ex ante.

3.1. Setup

Our model has two players: a general partner and a limited partner. While for simplicity we model only a single LP, we will be implicitly assuming that there are many LPs and, therefore, that the GP has all the bargaining power.[8]

The GP wants to raise a fixed amount of capital I to finance a first fund. Because we are interested in how screening for investors affects future costs of capital, we will assume that he plans to raise a second fund in the future. There are two types of GPs in the population, a good type (with probability p) and a bad type (with probability $1-p$). A good GP's fund will be worth $V_G > 0$, whereas a bad venture capitalist's fund will be worth 0. Both types receive a private benefit, B, from running the fund. This guarantees that, even if the venture capitalist knew that he was a bad type, he would choose to raise a new fund. We assume that at the time of raising the first fund neither LP nor GP know whether the GP is of high or low type.

Given that I dollars need to be raised, the GP and the LP must agree on what fraction of the

[8]Formally including all these partners produces equivalent results but severely complicates the notation. The key difference is that, in a scenario with several LPs, the existing LPs could step in to buy the share of an LP that faces a liquidity shock. The logic of our model would be unchanged, however, because the GP in the first period still has the incentive to ensure that at least a sufficient subset of the LPs are very liquid to avoid having to raise funds from the outside market. In practice, LPs, especially pension funds, often have tight restrictions on how much they can invest in each individual private equity fund and therefore cannot have too much exposure in a single fund.

firm, π, the LP will receive in return for his I dollars of investment.[9] LPs also come in two types. Illiquid LPs (who occur with probability q) face a liquidity shock with probability λ_1 and liquid ones (probability $1-q$) face it with probability $\lambda_2 < \lambda_1$. We assume that em ex ante GPs do not know the type of the LP, but LPs know their likelihood of having a liquidity shock. A liquidity shock means the investor must sell his shares (and cannot invest in new shares); he will incur a cost c. One can view this either as the utility cost of being unable to liquidate the shares right away or the dollar cost of having to sell the stakes at a much lower value. For simplicity, we normalize the interest rate in the market to be zero.

The model takes place over four periods (see Figure 1).

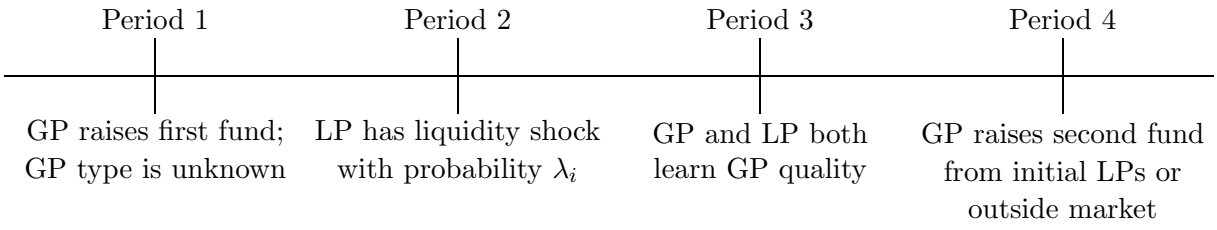

Figure 1: Timeline of the model. The graphic summarizes the interactions between the general partner (GP) and the limited partner (LP) in the model.

a. In the first period, the GP raises money for the first fund. The GP and the LP agree on the share $\pi_1$that the LP will receive in exchange for his investment. The type of the GP is unknown to both parties, but only the LP knows whether he is a liquid or illiquid type.

b. In the second period, the investor could face a liquidity shock. Because he does not know yet

[9] In actuality, the GP and the investors will bargain over the carried interest and management fee that the GP will receive. Here, we model this as bargaining over the fraction of the value received by the investors for expositional simplicity.

whether the fund he has invested in is a good fund or a bad fund, he faces no lemons problem when trying to sell the stake.

c. In the third period, both parties learn the type of the GP. With probability p, the general partner is a good type. Because the actual returns of the fund are realized only after the second fund has been raised, outside investors do not receive information about the quality of the GP.

d. Subsequently, in the last period, a new fund is raised. The GP could either go to the outside market to raise funds or could rely on incumbent investors, depending on their liquidity and his type. The cost of capital in this period will be called π_2^Mif he goes to the market and π_2^Iif incumbent investors finance the next fund.[10]

3.2. Solving the model

The GP's optimization problem is to maximize his profits from both funds. He has to choose whether he will impose a liquidity constraint in the first period or not. Therefore, we solve the model by computing profits with and without restrictions and then comparing the two scenarios. In both cases, we will use backward induction to solve the model.

3.2.1. No restriction

If the GP places no restriction, he will raise funds from both types of LPs, liquid and illiquid.[11] In the fourth period, the GP's cost of capital will depend on whether he is a good type or a bad type. Only if the GP turns out to be a good type is the incumbent investor willing to invest at the cost of capital:

[10]For simplicity, we do not consider whether future liquidity shocks affect the new set of investors and how that impacts the next round of fundraising and so on. The intuition is merely a replay of the current model.

[11]For simplicity, we assume that the GP has no other nonprice instrument to screen between investors.

$$\pi_2^I = \frac{I}{V_G}. \tag{1}$$

The GP must go to the outside market if either the incumbent investor receives a liquidity shock or if the GP turns out to be a bad type, because then the inside investors will not be willing to reinvest. The market cannot differentiate between these two cases and will charge a lemons premium in both cases.[12]

The cost of capital for the GP now is

$$\pi_2^{MN} = \frac{I[(q\lambda_1 + (1-q)\lambda_2)p + (1-p)]}{(q\lambda_1 + (1-q)\lambda_2)pV_G}. \tag{2}$$

In the first period, the GP faces a cost of capital independent of his type because it is unknown:

$$\pi_1^N = \frac{I}{V_G p}. \tag{3}$$

Therefore, the GP's overall profits are

$$\begin{aligned} & V_G p - I + B \\ + \quad & p[(1-\lambda_1)q + (1-\lambda_2)(1-q)](B + (V_G - I)) \\ + \quad & p[\lambda_1 q + \lambda_2(1-q)](B + V_G - \frac{I[(q\lambda_1 + (1-q)\lambda_2)p + (1-p)]}{(q\lambda_1 + (1-q)\lambda_2)p}) \\ + \quad & (1-p)B. \end{aligned} \tag{4}$$

Each of these terms is easy to interpret. The first term is the expected profit plus private benefits in the first period. The second term is the profit plus private benefits if the GP turns out to be good (probability p) and the incumbent investor does not have a liquidity shock [probability $(1-\lambda_1)q + (1-\lambda_2)(1-q)$]. The third line describes the profits if the GP is good but the incumbent

[12] If the pool of bad types in the population is very large, the lemons problem could preclude GPs from obtaining financing in the outside market. In this case, the importance of transfer constraints would be even more pronounced, because the market now becomes inaccessible to the venture capitalist after the incumbent LP has a liquidity shock.

investor gets a liquidity shock [probability $\lambda_1 q + \lambda_2(1-q)$], forcing the GP to go to the market. The final term is the payoff if the GP turns out to be bad and has to go to the market. He will receive the private benefits only because the project will be worth nothing.

3.2.2. With restriction

We model when the GP imposes transfer restrictions in the first period as inflicting a cost c whenever the LP wants to sell.[13] Then LPs with low probability of a liquidity shock will be more inclined to invest in the fund. Again, the cost of capital in the second period will depend on the GP's type. If he is a good type and the LP did not face a liquidity shock, the cost of capital is

$$\pi_2^I = \frac{I}{V_G}. \tag{5}$$

This is parallel to the case with no restriction, but the probability of obtaining financing from insiders is now higher, because the GP has screened out the illiquid LPs.

Again, there are two cases when the GP needs to raise funds from the outside market: either he is a bad type or the inside investor has a liquidity shock. In this case, his cost of capital is

$$\pi_2^{MR} = \frac{I[\lambda_2 p + (1-p)]}{\lambda_2 p V_G}. \tag{6}$$

The cost of capital in the outside market is now much higher than in the case with no restrictions. The market knows that the LP has a low probability of a liquidity shock and thus puts more weight on the possibility that the GP is a bad type.[14]

[13] We can think of this as the transaction costs involved when the limited partner wants to sell his stake. Alternatively, these costs can be interpreted as the utility cost to an LP who is forced to hold the private equity stake when his outside need for capital is very high.

[14] Alternatively, we could imagine that the outside market has no way of knowing the composition of the limited partners that invested in the first period. In this case, the venture capitalist who imposed transfer constraints in the first fund faces the same cost of capital when he has to go to the market as a fund that did not screen for liquid investors, because the market cannot differentiate between them. This simplifies the trade-off for the GP. He only trades off a liquidity premium in the first period with reduced likelihood of having to go to the market in the second, when he imposes constraints. The results are qualitatively unchanged, but imposing transfer constraints is more attractive.

If the liquid LP has a very low likelihood of facing a liquidity shock ($\lambda_2 < \frac{I(1-p)}{(V_G-I)p}$), now it becomes impossible for the GP to raise any follow-on financing from the outside market. The market will think that almost surely the GP must be a bad type, if the inside investor passes on the next fund. We analyze the case in which the GP is unable to obtain financing from the outside market. In the first period, the GP's cost of capital is equal to the case with no restrictions:

$$\pi_1^N = \frac{I}{V_G p}. \tag{7}$$

Now the GP's overall profits are

$$\begin{aligned} & V_G p - I + B - \lambda_2 c \\ + \quad & p(1-\lambda_2)(B + (V_G - I)) \\ + \quad & p\lambda_2(0) \\ + \quad & 0. \end{aligned} \tag{8}$$

Each of these terms is parallel to the case with no restrictions. The first term is the expected profit plus private benefits in the first period, minus the liquidity premium that the GP has to pay the limited partners for incurring the transfer restrictions. The second term is the profit plus the private benefits if the GP turns out to be good (probability p) and the incumbent investor does not have a liquidity shock [probability $(1-\lambda_2)$]. Because the transfer restrictions screen out investors with high frequency of liquidity shocks, the probability of achieving insider financing in the second period is much higher than in the case with no restrictions. In contrast, the third and fourth lines show the costs of transferability constraints. The GP's profits are zero if he is a good type but the incumbent investor gets a liquidity shock (probability $\lambda_2 p$), because he cannot get any financing from the outside market. The GP also foregoes his private benefits because he cannot obtain financing for a follow-on fund.

3.3. When is it profitable to impose transfer restrictions?

The difference in profits when there is a restriction relative to when there is none is

$$(1-p)[I-B]-\lambda_2 c-p\lambda_2(B+V_G-I). \tag{9}$$

Each of these terms is intuitive. The first term reflects the benefits of having liquid investors. If the GP turns out to be good, then he benefits from having a reduced probability of a liquidity shock. The second term is the liquidity premium. The liquid investor still faces a shock with probability λ_2, so he will need to have his initial investment cover this shock. The third term reflects the worsening of the lemons problem in the outside market caused by the restriction.

There are several things to note here. First, the above result depends only on λ_2, the likelihood that the liquid investor receives a liquidity shock, but not on λ_1, the likelihood that the illiquid investor receives a liquidity shock. λ_1 does not enter the result, because the benefits of imposing transfer restrictions (and thus only having liquid investors, λ_2) are calculated relative to the benchmark case when both types of LPs invest. Second, consider the following comparative statics. Suppose that the private benefits of control are small (B$\rightarrow$ 0) and that the liquid investor rarely receives liquidity shocks ($\lambda_2 \rightarrow 0$). This makes the costs of placing a transfer restriction small and also increases the benefit of the restriction. Thus, in this case the GP will want to impose a restriction. Alternatively, imagine that the pool of LPs is composed mainly of liquid investors ($q \rightarrow 0$). Then it will be unprofitable to place a restriction. There are few illiquid investors to screen out, but the GP would still have to pay the liquidity premium ($\lambda_2 c$). Similarly, if all GPs were high types ($p \rightarrow 1$), placing a restriction would be unprofitable. These comparative statics underscore the rationale for restrictions. By screening for liquid investors, transfer constraints reduce the adverse selection that the GP will face when raising funds in the second period.[15]

[15] When the GP can return to the outside market in the next fundraising round even if the existing LP does not reinvest, the benefits from transfer constraints are reduced. The GP would optimally impose transfer constraints only if the reduction in the cost of capital in the second fundraising round offsets the liquidity premium that the LP will require in the first round.

3.4. Extension: intensity of information asymmetry

In this section we present a simple extension of the model to capture the notion that differences exist in the severity of asymmetric information between the outside investors and the inside investors.[16] For this purpose, we assume that with probability *(1-x)* outside investors will know the type of the GP in period four (when the new fund is being raised); i.e., there will be no information asymmetry between the insiders and the market. With probability x, outside investors do not learn the type of the GP, and therefore the above described information asymmetry holds.

The GP's overall profits are parallel to section 3.2, but in the second period we now have to take into account that the GP will face information asymmetry in the outside market only with probability x, while with probability *(1-x)* the GP will face a situation in which the outside market is fully informed about his type. In this case, the GP will be able to raise capital from the market (inside or outside investors) at the low cost of capital π_2^I if he is a good type. If he turns out to be a low type, however, he will now not be able to go to the market at all. In the case with no information asymmetry, the bad types lose the ability to hide their type by pooling with the high-type GPs that are hit by a liquidity shock of their investors.

Finally, the difference in profits between the case with and without restrictions is now

$$-\lambda_2 c - x[p\lambda_2(B + V_G - I) - (1-p)(I - B] \tag{10}$$

Imposing a transfer restriction becomes more beneficial the higher the likelihood that the outside investors will not be informed; i.e., the more likely is the existence of asymmetric information problems between inside and outside investors. If x equals one, outside investors are always uninformed and the solution is equal to the results of section 3.3. As x approaches zero the difference in profits between the case with restrictions and the case without becomes unambiguously negative ($-\lambda 2c$). Intuitively, if there are no asymmetric information problems, it is never beneficial to

[16] We thank an anonymous referee for suggesting this extension of the model.

impose transfer constraints, because no benefits accrue from imposing them, but the LP still has to be compensated for the liquidity premium. This extension of the model provides an interesting testable implication. In situations in which GPs are less prone to asymmetric information (e.g., because they have a longer track record) we should expect to see fewer transfer constraints.

4. Analysis of partnership agreements

The model we developed in Section 3 generates a number of testable predictions. In this section we test these predictions.

4.1. Estimation strategy

A central argument is that limited partnerships should be most concerned about restricting the liquidity of their stakes when the asymmetric information problem between the market and inside investors is greatest. We argue that this information gap is affected by a number of characteristics, including the sequence number of the fund, the type of assets that the fund manages, and the geographic location of the fund. These characteristics should in turn affect the tightness of transfer restrictions.

According to our model, contracts should be most restrictive for the initial funds that a private equity firm raises, because at this point the asymmetric information is most severe. We expect that transfer restrictions become less stringent with each additional fund.[17]

Another factor that could impact the amount of asymmetric information private equity firms face is the ease with which the underlying assets of the fund can be valued. Holding everything else constant, our model would predict that funds whose assets are more difficult to value by an outsider should have tighter transfer restrictions. Funds that invest in sectors that take a long time

[17]One consideration that could make it harder for us to find any effects is the tendency for many private equity groups to simply recycle their partnership agreements from fund to fund, instead of carefully examining the appropriateness of the features. For examples of such contractual rigidity in other settings, see Pittmann (1991).

to produce observable results could be prone to increased information asymmetries. Therefore, we classify funds into four industry categories: pharmaceutical, business services, telecommunications, and software/Internet. We posit that start-ups in the pharmaceutical industries take a much longer time before they have observable products than start-ups in software and Internet-related businesses.

Our model also implies that in environments in which information is transferred more easily, we should observe fewer restrictions on liquidity. Measuring differences in information diffusion is very difficult, and any proxy for these must be coarse and incomplete. One potential dimension along which the informational environment of private equity funds varies is local culture. A well-known study on this topic by Saxenian (1994) analyzes the social and informational networks between the Silicon Valley venture capital community and that of Massachusetts's Route 128. Her findings suggest that information is shared much more extensively and diffuses more rapidly in the close-knit Silicon Valley community than in Massachusetts. Similarly, Stuart and Sorenson (2002) show that geographic proximity is an important source of knowledge spillovers in the venture capital community. In particular, states with low enforceability of employee noncompetition clauses, such as California, have high labor turnover, which leads to the easier diffusion of information. In the context of our model, we expect fewer transfer restrictions for funds based in California.[18]

An important caveat for our cross-sectional tests is that the type of assets in which funds invest is a choice variable. Imagine that private partnerships have different, unobserved abilities to alleviate asymmetric information problems with respect to the broader market. If the funds optimally choose the type of investments that are most suited to their type, in equilibrium we perhaps could not observe any difference in the liquidity of partnership stakes between the funds. We believe, however, that the self-selection problem is less severe than it first appears, because

[18] Many East Coast-based venture capital groups also have offices in California. But in general, venture organizations tend to make the bulk of their investments near their primary offices. A number of other explanations could exists as to why contracts have developed differently between California and the East Coast, but note that partnership law is uniform nationwide, because of the widespread promulgation of the ULPA.

private equity organizations' existing networks largely prevent general partners from freely moving between locations and industries. Given these limitations, however, the cross-sectional results should be treated only as suggestive evidence for our theory.

4.2. Data

The sample consists of 243 private equity funds whose partnership agreements we were able to access and analyze. Given that these documents are not publicly accessible, we rely on the collections of a number of institutional and individual investors. Because we wish to avoid undesirable heterogeneity (e.g., the impact of other nations' securities laws), we eliminated funds that were not U.S.-based private equity partnerships. Gompers and Lerner (1996) employ a subset of these partnership contracts to analyze how the use of covenants restricts the behavior of general partners.

We collect a variety of supplemental information from other sources. We determined the age of the private equity organization, the location of its primary office, and the number of previous funds from Asset Alternatives (2001), Venture Economics (1995, 2001), and private placement memoranda used to raise funds. The partnership agreements we collected from LPs are diverse. Some were very established private equity investors, who have access to some of the most prestigious funds in the industry. Other limited partners are less established and, consequently, tend to invest in younger and less prestigious private equity organizations.

As Table 1 reports, our sample contains 243 funds that were formed between 1974 and 2001, with the mean being 1992. While the emphasis on later partnerships in part is a consequence of the greater ease of collecting documentation on more recent funds, it also reflects the rapid growth of the private equity industry in recent years. Considerable heterogeneity also exists in the size of the funds raised and their focus (approximately 20% of the funds are devoted to buyout investing, and another 20% exclusively to early-stage venture investing). Moreover, 35% of the funds are based in California, while 40% are in the two East Coast states with the greatest private equity

concentrations (Massachusetts and New York). Lastly, we see that funds have different industry foci. We classify a number of main industries: pharmaceutical industry (which largely consists of biotechnology investments), telecommunications, business services, and software/Internet. This heterogeneity allows us to analyze how fund-specific characteristics relate to the transferability of partnership interests.

4.3. Descriptive statistics

Table 2 provides an overview of the many different contract provisions that private equity firms use to restrict potential transfers of partnership stakes or the nature of the transferee. Almost 90% of the funds in our sample require that the "general partner must approve of the transfer," which effectively allows the general partners to prevent any transfer that conflicts with their interests. However, specific exemptions allow LPs to transfer stakes that override the GP's need for approval.

Most provisions fall into one of three broad classes. First, most partnership contracts include several provisions that explicitly allow the transfer of stakes to certain kinds of investors or in specific, well-defined circumstances. For example, 36% of the contracts stipulate that transfers are allowed to sophisticated investors, 43% of the funds allow the transfer to family members, and 28% permit the transfer of stakes to other limited partners. Other, more customized provisions include the permission to sell partnership shares after bankruptcy (in 3% of the funds) or to a spouse after a divorce (in 13%).[19]

Second, many partnership contracts contain detailed provisions controlling the process by which shares can get sold. For example, about 10% of our funds have restrictions on the number of potential investors that can buy a partnership stake in the secondary market. We also find that about 30% of the funds require that the limited partner's entire share be sold in any transaction or that stakes be sold to at most one person.

[19]The latter provision is mainly found in California-based partnerships.

Finally, the third set of restrictions reflects the private equity firms' regulatory environment. Table 2 shows that in the majority of partnership agreements, transfers cannot add regulatory and tax requirements or lead to a termination of the partnership. While only 64% of the agreements have a general clause that the transfers cannot violate the law, the same protective function can be achieved through more specific clauses. These curbs stem from concerns with the Investment Company Act of 1940 and other securities legislation.[20]

4.4. Constructing composite measures

The descriptive statistics document the complexity of the contract terms. It would be misleading to analyze each of these contract provisions separately, because no one single term governs the transferability of limited partnership interests by itself. Thus, to assess the extent to which the agreements either facilitate or hinder the transfer of limited partnership interests, we focus on a number of different composite measures that aggregate the information in the partnership agreements. The composite measures we employ take several forms.

Table 2 shows which provisions are included in these composite measures. First, we add all relevant terms, giving a $+1$ score for terms that enhance the transferability of limited partnership interests or otherwise protect the interests of the limited partners, -1 for terms that limit transfers, and 0 if such a term is not included. The second measure simply sums up the most direct provisions: the number of different types of investors to whom the limited partners are allowed to transfer their interests. The next measure is the sum of the three contract provisions that most explicitly give the general partners the ability to control the liquidity of partnership interests. Specifically, these are the requirements that the general partner approve the transfer, that the general partner approve of the limited partner status of the transferee, and that any transfer cannot conflict with

[20] We want to point out one potential source of measurement error in our data. In some cases, very powerful limited partners obtain side letters from their private equity funds that grant them certain exemptions. Unfortunately, collecting information on these side deals is virtually impossible. Our intuition, however, is that this should not affect our data too much. These limited partners are normally the ones that do not need to be screened for liquidity.

the general partner's interests. The final measure, which we call complexity, summarizes all the contract provisions regarding transferability, no matter whether they enhance the LP's or the GP's prerogatives. This measure is intended to capture the level of detail and intricacy with which general partners and limited partners address this issue.

Table 2 summarizes the four variables analyzed in the remainder of this section. The frequency of each contractual term is reported in the first column of the table. The second through fifth columns indicate whether a term is employed in each of the four independent variables constructed here, and if it is regarded as a positive or negative contribution to the total.[21]

4.5. Results

Table 3 provides a first look at general patterns in the use of transferability provisions in limited partnership agreements. The cross-tabulations suggest that later funds raised by private equity groups tend to have more provisions that enhance the transfer of partnerships by LPs. But they also have more provisions that allow GPs to control the transfers. Limited partner-friendly terms also appear to be associated with early-stage venture funds, older groups, those based in California, and those established in the later years of the sample. Our interpretation of these patterns, however, must be cautious because of the univariate nature of these comparisons.

To test the hypotheses of our model we estimate the following baseline regression:

$$\begin{aligned} composite_{ijt} &= \alpha * sequ_{ijt} + \beta * log(size)_{ijt} \\ &+ \lambda * buyout + \delta * early + \gamma_t + \omega_j + \epsilon_{ijt}. \end{aligned} \tag{11}$$

The different composite measures of transferability that were discussed in Section 4 are regressed on the sequence number of the fund, dummy variables indicating whether a partnership raises a

[21] We also repeated the analysis that follows for individual, very prominent provisions, such as the GP's right to approve the LP status of the transferee. We find that the same patterns that are reported for the composite measures hold at the level of a single provision.

buyout or early-stage venture capital fund, and controls for the size of the fund, as measured by the logarithm of committed capital. We also include year fixed effects (the year the fund had its final closing) and in some regressions fixed effects for each private equity organization. All standard errors are corrected for heteroskedasticity and clustered at the private equity group level.

Table 4 presents the results using the composite measure of transferability as the dependent variable. The coefficient on the sequence variable is large and statistically significant, with a point estimate of 0.09 and a standard error of 0.04 in the first column. At the mean of the independent variables, a 1.0 standard deviation increase in fund sequence translates into a 15% increase in the composite measure of transferability. As the second column suggests, the relationship between the ease of transferability and the sequence number of the fund remains robust when other independent variables are added. One exception is when the year in which the private equity organization was established (the age of the private equity group) is added as an independent variable. This measure is strongly negatively correlated with the fund sequence variable. When added to the regression it leads to a decline in the magnitude and significance of the sequence variable. Column 3 shows that the coefficient goes down to 0.06 with a standard error of 0.05. If we include the age of the private equity partnership by itself without controlling for the sequence number of the fund, we find a negative coefficient, which is economically and statistically very significant (not reported in the paper). This suggests that younger private equity firms have more transfer constraints, which is consistent with our hypothesis that firms with a shorter track record must be more concerned about asymmetric information problems. We think, however, that the sequence number of the fund is a more accurate proxy of information asymmetry, because it reflects the amount of prior information that is available for each fund.

We isolate the longitudinal variation in the third and fourth columns, where we employ fixed effects for each private equity group. The within-firm specification allows us to control for unobserved differences across private equity firms. Thus, we can estimate the longitudinal effect on

transfer constraints when a private equity firm raises its second, third, and later funds. Because private equity firms rarely change between different subclasses (for example, moving from buyout to early-stage investing is challenging), the coefficients on the buyout and early-stage dummies are not meaningful in this specification. We repeat the estimation in the fifth column, leaving out these variables. Again, the sign of the sequence variable is positive and statistically significant and the magnitude of the coefficient is basically unchanged from the fourth column.

Unfortunately, we cannot apply this within-firm estimation to the cross-sectional tests of whether the location (California versus Massachusetts) or the industry focus of the partnership matter for the transferability of stakes. Virtually no funds change the location of their headquarters during the time period. (This pattern is not unique to the funds in our sample, but a common feature of the industry.) Therefore, it is impossible to measure the effect of changes in these characteristics on the transferability of partnership stakes.

Instead, we use simple cross-sectional tests to estimate the correlation between the liquidity of partnership shares and the observable characteristics of interest, such as the location of the fund. In all these estimations, we also include year fixed effects. To assess the potential impact of fund-specific heterogeneity on the coefficients of these dummy variables, we reestimate the results while subsequently including a number of fund-specific variables and analyze how they affect these coefficients. If the size of the coefficients on the variables of interest does not change much after including additional control variables, we can feel more comfortable that these results are not purely driven by unobserved, fund-specific heterogeneity.

Column 5 of Table 4 shows that the coefficient on the California dummy is positive and significant, while the other regional dummies are insignificant. California private equity funds are less concerned about transfers of their partnership stakes than the average private equity firm. In the sixth column, we include control variables for the logarithm of fund size and dummies for buyout versus venture funds. Even after including these covariates, the size of the coefficient on the Cal-

ifornia dummy does not change significantly. It is statistically significant in all specifications, and the point estimate of the coefficient goes down by only 15%, from 2.86 to 2.45. If the coefficient on the California dummy was purely driven by unobservable heterogeneity between funds, we would expect the size of this coefficient to be smaller and statistically less significant once we include the other cross-sectional controls. The idea is that if the main source of variation between California and East Coast firms is the unobservable heterogeneity, including additional firm-specific controls should capture some of this underlying heterogeneity and, therefore, the significance of the initial variable would be reduced.

The interpretation of the difference between buyout and venture funds in the transferability of partnership interests is less clear-cut. Table 4 shows that the coefficients on the dummies for early-stage venture funds are significantly positive, and those for buyout funds negative and sometimes significant. As above, we also analyzed how the coefficient changes with the addition of other control variables in unreported regressions. In general, and different from the effects on the location dummies, we find that the significance and the size of the coefficient of the buyout and venture dummies are reduced with each additional control variable.

We also include dummies for the different industry foci of the private equity funds. Column 7 shows that funds with a focus on the pharmaceutical industry have significantly more transfer constraints than the average. Similarly, funds that specialize in software and Internet ventures have many fewer constraints than the average fund. Practitioners assert that investment cycles in the pharmaceutical industries are particularly long. Therefore, GPs in this sector will be subject to information asymmetries for a prolonged time period. Consistent with our theory, these funds are more concerned about preventing transfers of equity stakes.

Finally, we look at the time series-variation in transferability provisions to analyze whether funds that are raised in boom times show a different reliance on these provisions than funds that are raised in busts. We do not find a clear empirical pattern in the data (not reported). This

does not seem surprising given the institutional features of the venture capital industry. On the one hand, during boom times, considerable amounts of money flow into the industry and capital is much easier to come by. This would suggest a reduced need for transferability constraints. On the other hand, boom times lead to a change in the composition of private equity investors. Specifically, in these times we see a large inflow of less liquid investors who are not committed to the asset class in the long run; e.g., individuals and modest-size pension funds. Therefore, GPs will have an increased need to screen LPs to avoid the negative stigma associated with short-term investors who will drop out of the market when the industry goes through a downturn (i.e., when liquidity is most precious). Given these countervailing effects, it is not obvious ex ante that there should be a clear-cut prediction about the correlation between transfer constraints and market liquidity.

4.6. Robustness checks

One could be concerned that our proposed composite measures weigh all provisions equally (restrictive, facilitating, and regulatory constraints), which could over- or understate the importance of one of these categories relative to the other. For instance, on average our sample has more facilitating provisions than restrictive ones. If, however, restrictive provisions had more bite, a simple sum of the number of restrictions would overstate the ease of transferability of the partnership interests.

Therefore, in Table 5, we separate the contract provisions into those that facilitate and those that restrict transfers. Again we find evidence that supports our main hypothesis. The first and second columns report that the number of provisions that enhance fund transfers increases for later funds. These results indicate that our findings are not simply driven by the dynamics of netting out the different types of provisions. We also rerun these two specifications excluding any provision that could be motivated by compliance with regulatory considerations; e.g., provisions that affect the tax status or partnership status of the fund. The results (not reported) are qualitatively unchanged relative to results reported in Table 5.

We also want to make sure that the changes in contract provisions are not purely driven by mere editorial changes in these contracts, but that they reflect substantive factors in the transferability of stakes. Ideally, we would like to obtain data of actual trades that happened or even attempted sales that were blocked. The data were impossible to collect. As the second-best alternative, we talked to lawyers specializing in private equity and consulted the related legal literature to determine which provisions are generally considered most important and restrictive. Provisions that give the general partners the right to approve of transfers and to prevent any transfer that conflicts with their interests are generally believed to be the most critical restrictions. The results using these restrictions only are reported in the third and fourth columns of Table 5. Parallel to the prior results, we find that the coefficient on the sequence variable is negative and significant when firm fixed effects are used.[22]

5. Testing the assumptions of the model

Two central assumptions of our model are that (1) LPs learn about the GP's quality when investing in his fund and thus face lower information asymmetries, and (2) considerable persistence exists in the composition of limited partners across the different funds raised by a given private equity organization. In this section, we present two tests that support the assumptions of our model.

5.1. LPs learn about GP quality

One of the important assumptions of our model is that investors can gain insider knowledge about the underlying quality of the funds they invest in. To test this idea, we collect information on the private equity investments of two large and sophisticated LPs that provided us with some of the

[22]In Table 5, we also report for the sake of completeness regression analyses using the measure of contractual complexity as the independent variable. We also separately estimate for each of the contract provisions a probability model (not reported here) of the likelihood of being included in later funds. Consistent with the findings of the composite measures, we observe that for restrictive provisions the probability of being included in the contract declines over time, and vice versa for facilitating provisions.

original contract information. Collecting this type of information is virtually impossible for a large set of LPs.[23] The LPs who provided us with the data are very large and long horizon investors. Their decision to reinvest in a partnership is primarily based on the expectations of a fund's future returns and is not driven by temporary liquidity shocks.

The idea is to analyze whether partnerships in which the LPs did not choose to participate (which we will term discontinued funds) subsequently performed worse than those in which they did choose to reinvest (continued funds). In a second step, we then investigate if the future fund-raising ability of a partnership is correlated with an LP's decision to discontinue investment into that partnership.

For that purpose, we separate funds into two groups: the ones that are discontinued and those that are reinvested. We match these two different subsets of funds anonymously to individual fund performance data from Venture Economics.[24] Our initial sample contained 111 decisions whether or not to invest in a follow-on fund prior to the end of 1997. (We use this cutoff date because we wished to ensure that there is a sufficient period over which the fund's performance can be measured.) Twelve observations were duplicate funds, which we dropped from the sample, and seven could not be matched to Venture Economics data. This left us with the 92 funds, 70 that are continued and 22 that are not.

The measure of returns that we use in this sample is the total value of distributions to investors divided by paid-in-capital, net of management fee and carried interest at the end of a fund's life (or at the time that Venture Economics provided the data). This is a standard performance measure used in the VC industry and is provided by Venture Economics. The measure is easy to interpret and simple to benchmark with the market average. The drawback is that it does not take into account the exact timing of cash flows. Therefore, we also replicate our tests using internal rate

[23]We thank the anonymous LPs for the access to their data and their support of this study.

[24]We thank Jesse Reyes from Venture Economics for generously providing us with the performance data. Because the data were provided to us without identifying the fund names, we can rely only on fund characteristics that are contained in the Venture Economics data set.

of return (IRR) as an alternative performance measure (not reported here) and the results are qualitatively unchanged. We do not use any measures of interim fund performance, because these largely reflect differences in reporting practices by different funds and do not represent actual economic outcomes.[25]

Panel A of Table 6 reports the descriptive statistics of the reinvested funds versus those that were discontinued. In the table, we report raw results without market adjustment. The average realized returns of funds that were discontinued is slightly lower than that of reinvested funds, 170% versus 213%. These are total returns over the lifetime of the funds, on average about eight to ten years. We note that on average the funds in our LP sample have significantly higher returns than the industry average.[26] This result supports the assertion that the limited partners that provided us with the investment data are sophisticated. We then present the adjusted return: the return less the mean return of all private equity funds formed in that same year. (Because venture capital investments have very long horizons and are rarely marked to market, finding the right benchmark for returns is difficult.) We find that market-adjusted returns for the funds that were subsequently dropped by our LPs are significantly lower than for those that were continued. Continued funds outperformed the VC industry by 21% on average, while discontinued funds had excess returns of negative 36%. The difference is now much more significant because more funds were discontinued during years when venture returns were attractive.

We also find that funds that were discontinued on average are somewhat larger than those that were reinvested. This finding could reflect the fact that many sophisticated LPs refuse to invest in funds that grow too quickly (see, for instance, Lerner, 2000). Once we examine the follow-on funds of these partnerships (the funds raised after the one in which the LPs made their decision to invest or not), we see that the discontinued funds seem to grow less. This result suggests that these discontinued funds encountered difficulties, or that the decision of the sophisticated LPs not

[25] A more detailed discussion of the construction of performance measures is provided in Kaplan and Schoar (2003).
[26] See, for example, ventureeconomics.com and Kaplan and Schoar (2003).

to invest served as a negative signal to other LPs.

While the univariate statistics are in line with the assumptions of our model, it is more informative to look at the results of multivariate analysis. In Panel B of Table 6, we regress the realized IRR of the fund on a dummy for whether the fund was continued or reinvested and controls for the type of fund (VC versus buyout) and year fixed effects. We find that VC funds have better performance than buyout funds, consistent with the overall Venture Economics (2002) data. Column 1 of Table 6 shows that funds that the LPs decided to reinvest in, on average, have significantly higher performance than those that were discontinued. The coefficient on the continuation dummy is 16.02 (a 16% greater annualized rate of return), with a standard error of 6.75. These results suggest that investors can anticipate when the returns of the subsequent funds of the private equity organizations in which they invested will not be satisfactory.

In Column 2 of Panel B, we repeat the above estimation using the returns of the subsequent fund that the GP raised as the dependent variable. We seek to test whether LPs can predict the subsequent performance of the partnership's future funds. There are 16 cases for which we do not have information on the returns of the follow-on fund. We believe that some of the missing observations are the result of the failure of the partnership to raise a subsequent fund, which is the strongest response to expected poor performance. (Given that the data were given to us in anonymous fashion, we cannot check independently whether these funds did not raise a follow-on fund or whether the information is just missing in the data.) A smaller fraction of funds was missing from the set of continued funds than from the discontinued funds. If were we able to adequately adjust for groups that failed to raise a subsequent fund, we anticipate that this correction would make our results stronger. But because of data limitations, we simply drop the funds for which we do not have subsequent performance measures. We regress the realized returns of a partnership's next fund on the same right-hand side variables as in Column 1 of Panel B. We find that partnerships that are discontinued by these LPs subsequently performed worse in their next fund than those

that were reinvested.

Finally, in Columns 3 and 4 of Panel B, we investigate the relationship between the size of the subsequent fund a partnership raises and the decision of an LP to discontinue investment. In Column 3 we regress the logarithm of the size of the next fund on a dummy for whether the LP decided to reinvest and the usual control variables. We also include the size of the current fund as a control for underlying differences in partnership sizes. We find that funds that are continued by the LPs subsequently raise larger funds than those that are discontinued. The results hold if we use the percentage change in fund size from the current to the future fund, as we show in Column 4 of Panel B.

However, we find that, on average, funds raised immediately after the LPs decide to discontinue the investment into a partnership are larger than the ones that are continued. This seems to run counter to our theory, which would predict that the fund directly after the decision to drop is made should also suffer from the lemons problem. Two countervailing effects could explain this finding. First, we cannot observe if these funds might have been even larger had the LP not dropped the given fund from their portfolio. Second, from conversations with practitioners we understand that many sophisticated LPs tend to drop funds once they become extremely large. However, the decision to drop a fund is often made after the other LPs have already committed to the fund. Therefore the negative information about an LP discontinuing investments could be incorporated only in the follow-on fund of the partnership.

5.2. LP continuity across partnerships

Another critical assumption is that a considerable degree of continuity exists across the limited partners between different funds of a private equity partnership. To address this question, we obtained information on the actual composition of limited partners for a subset of the private equity organizations in our sample. Unfortunately we were able to get this information only for

a very small subset of private equity organizations (in total 11 organizations with at least two funds each), because many limited partners are bound by confidentiality agreements with GPs. We hand-collected the information on LP names from the individual signature sheets at the back of the agreements.

One feature of the signature sheets that complicates our analysis greatly is that many of the larger partnerships use collective titles for large subsets of investors in the follow-on funds; e.g. "XX Partnership investors." Moreover, many wealthy individuals seem to change their investment intermediary between funds. For example, in the original fund a person invests directly in the fund, in which case the person's own name would appear in the signature sheet. The next time around an intermediary, e.g., a bank, invests on his or her behalf, in which case we would see only an entry that says "Citibank as Investment Manager for account Y." Even though the LP continued to invest in the partnership, we would not be able to track the LP in this case. These factors lead to a strong downward bias in the amount of continuity we can hope to see. But even with these limitations of the data we find strong persistence in the set of limited partners that invest in a fund. On average, more than 55% of the LPs in our sample reinvest in a partnership if they are invested in the current fund. If we look at the subset of partnerships for which we can trace all LPs unambiguously across funds (six private equity organizations) the fraction of repeat investors goes up to 84% . This large amount of persistence in the composition of LPs seems to be in line with the general view in the industry.[27]

5.3. Examining an alternative hypothesis

One alternative explanation for the fact that funds with longer track records have less onerous restrictions is that well-established funds have much more powerful and entrenched GPs. Such an established private equity investor could not be as easily pushed around by trouble-making

[27] Given the very small sample size, it is not a meaningful exercise to relate the fraction of repeat investors in these funds with our measures of tightness of transfer constraints.

investors. While less established GPs could use transferability constraints to deter troublesome LPs, established GPs perhaps do not need to worry as much about keeping such investors out and thus rely less on transferability constraints.

This alternative story, however, that harassment of general partners is confined to those LPs who are deterred by liquidity constraints seems to run counter to a considerable degree of anecdotal evidence. When we look at the recent history of the private equity industry, much of the public activism has been driven by California Public Employees' Retirement Fund, which, with over $150 billion in assets, has deep pockets. A number of major university endowments also have very knowledgeable private equity professionals, who have not been reserved about pointing out behavior that they find troublesome (e.g., see the discussions in Swensen, 2000). Thus, if a GP seeks to deter troublesome LPs, it seems unlikely that the adoption of transferability constraints will be effective.

Second, the claim that established GPs pay less attention to provisions in partnership agreements contradicts the evidence presented in Gompers and Lerner (1996). They examine provisions that constrain the activities of general partners in venture capital funds. Under the alternative hypothesis, established funds could have as many restrictions as their less established counterparts. Because they would not need to worry about being harassed by limited partners, established GPs should then not go through the time-consuming process of seeking to have restrictions removed and instead simply use their older partnership agreements as a template.[28] In actuality, Gompers and Lerner find that funds raised by more established venture organizations have significantly fewer restrictions. For instance, a fund raised by a group one decade older than the average had 25% fewer restrictions on the general partners' activities than one raised by a group at the mean of the independent variables.

Finally, when we look at actual concessions made to LPs, we find that established GPs are more accommodating than their less established peers. We examine the venture capital funds

[28]If limited partners desired to have such restrictions added, perhaps to impress the investment committees that oversee them with the toughness of their bargaining, the GPs could acquiesce.

raised during the technology bubble period of 1999-2000, when LPs had an enormous appetite for venture capital investments. In many cases, funds were raised on terms that were subsequently perceived as unfair to the limited partners; e.g., with extraordinary levels of management fees. During the course of late 2001 and 2002, a number of venture capital organizations announced their intention to restructure these funds in ways that were more attractive to the limited partners, for instance, by cutting the percentage of capital charged as management fees or reducing the size of the fund.

In the following, we examine which funds made concessions to their LPs during this period. We expect that these decisions will be associated with larger funds, as well as those partnerships that raised significantly more capital than in the previous fund and the original target. But we are particularly interested in examining if more established groups are less willing to make concessions, as the alternative hypothesis would suggest.

To undertake this analysis, we first identified all venture capital funds that had a final closing in 1999 and 2000. We eliminate buyout funds, funds-of-funds, and funds based outside the United States. To identify these funds, we used the annual "Fundraising Round-Up" section of the January edition of the *Private Equity Analyst*, from which we recorded the fund's name, the year of final close, location, original target, and final size.[29]

We then identify the size of venture capital organizations' previous fund and the year that the private equity organization was founded from various sources, including *Galante's Venture Capital and Private Equity Directory, Pratt's Guide to Venture Capital Sources, The Fitzroy Dearborn International Directory of Venture Capital Funds*, the venture organizations' websites, and press accounts in Lexis-Nexis. In a half-dozen cases, we were unable to determine the size of the previous fund. (In many more cases, the fund raised in 1999 or 2000 was a first-time fund, so there was no

[29]In four cases, the targeted fund size was not available. In these instances, we assumed the target fund size bore the same relationship to the actual fund size as that of the median fund. (In the median case, the actual fund raised was approximately 5% larger than the original target.) The results did not change materially if we assumed instead that the target fund size was the actual fund size or simply eliminated these observations.

earlier fund.)[30]

We identified venture capital concessions (through end of December 2002) from a variety of press accounts as well as discussions with experienced limited partners and venture capitalists. It is difficult to assess how complete our listing is, but given the intense press scrutiny of these moves, we believe that our coverage is good.

Table 7 presents the basic patterns. Panel A reports the results of univariate tests of the several key measures, divided between those associated with funds that did and did not make concessions. Funds that make concessions are disproportionately larger and raised by more established venture organizations. No significant patterns emerge, however, when we examine the percentage difference between the fund's size and either the original target or the previous fund size.

Panel B reports the results of logit regression analyses, when the dependent variable is a dummy indicating that the fund made a concession to its limited partners. The independent variables include the size of the fund (in millions of current dollars), the percentage change from the original target to the amount raised, the age of the fund, and controls denoting funds raised in 2000 and based in California and Massachusetts. Our rationale for including a dummy variable for 2000 is that these funds largely closed after the initial decline in technology equities (fundraising is concentrated in the final months of the calendar year). The inclusion of dummies for these two states is motivated by the fact that they account for nearly 60% of the venture funds during this period. The first regression uses all observations and denotes first-time funds with a dummy.

[30]We denoted as first funds those in which partners from existing funds rearranged themselves; e.g., Redpoint, where partners from two established venture group joined together; or some partners from an established group left to establish a fund of their own. If, however, the group was simply renamed, we did not consider it a new fund. A complication was introduced by groups that raised funds out of sequence; e.g., if a generalist Fund III was followed by a smaller Genomics Fund dedicated solely to biotechnology investments. The fund previous to the Genomics Fund would be Fund III. When Fund IV was raised, though, we used Fund III as the previous fund, not the Genomics Fund, because it is more directly comparable. Another complication was introduced by venture funds that were raised by private equity groups making buyout investments. Our algorithm was to regard this as a follow-on fund as long as it operated under the same name. If the fund was raised under a different name (e.g., Bain Capital's Brookside Capital), it was considered a first fund. If the firm raised two funds with the same investment focus that closed simultaneously (typically one geared toward domestic investors and one geared toward overseas investors), we consolidated the amount and treated it as if it were a single fund.

The second regression only employs follow-on funds, and includes as an independent variable the percentage change in the size of the previous and the current fund.

The coefficient on the age variable, 0.06, suggests that more established funds are more willing to make concessions to their limited partners. This result holds even when we control for the size of the fund, the amount raised relative to the original target, and the amount raised relative to the earlier fund. Nor is the result insignificant in magnitude. At the mean of the independent variables, a 1.0 standard deviation increase in fund age increases the predicted probability of a concession by 76% (from 2.5% to 4.4%). This result runs directly counter to the alternative hypothesis, which argues that more established funds are particularly effective at resisting demands from limited partners.

We explore the robustness of these results in several ways in unreported regressions. We alter the assumptions in regard to the treatment of missing observations. Because there is a very large dispersion in fund size (from $7 million to $2.2 billion), we employ the logarithm of this measure instead. We also employ dummy variables for additional states where these funds were raised. These changes have little impact on the results.[31]

5.4. Interpreting the results

We are cautious to emphasize that our empirical results should be viewed as suggestive evidence for the theoretical framework that we have developed in the paper. We cannot control for a number of potential omitted variables in the cross-sectional estimations, partly because they are truly unobservable and partly because of the serious restrictions in the disclosure of information in the

[31] A more complex alternative hypothesis can explain the empirical facts seen above. Small, less liquid LPs could engage in a variety of unproductive activities that annoy GPs. GPs could thus seek to eliminate such potential investors through the use of transferability constraints. Screening out such investors could be a major concern of less established GPs. More established general partners, who may draw upon a higher caliber of limited partners, thus perhaps need not to worry about such behaviors and, as a result, do not bother to impose transferability constraints. While such a hypothesis could fit the observed empirical patterns regarding the use of transferability restrictions, it runs against other observed patterns in the private equity industry, such as the way in which major LPs have played the dominant role in pushing for reforms of the industry.

private equity industry. Despite these potential data shortcomings, the results provide new insights into the interaction between private equity funds and their investors, an area that has been very difficult to analyze previously.

We think that the positive relationship between the ease of transferability and the sequence number of the private equity fund (estimated based on within-group changes) is the strongest evidence in support of our theory. Most alternative stories for transfer restrictions would imply either a negative coefficient on the sequence variable or no effect. An alternative theory that has been mentioned is that general partners want to reduce the liquidity of their stakes to avoid the transaction costs of raising capital in future rounds. Even though this theory could explain why there could be transfer restrictions in the first place, it cannot easily predict the dynamic effects that we show. In fact, if we assume that the value of the general partners' time increases over time, because they have more outside opportunities, we would predict the opposite sign. It is particularly striking that transfer constraints are less stringent for follow-on funds, if we consider that the bargaining power between limited partners and funds shifts toward the general partners once they have been able to establish a track record. Moreover, it is important to keep in mind that any industry-wide changes in bargaining power (which could result from shifts in the supply and demand of capital) will not affect our estimates, because we are controlling for year fixed effects in all our specifications.

In the supplemental analysis, we show that LPs are able to acquire inside information about the quality of a partnership during the investment process and that the subsequent fundraising ability of a partnership is lower when an inside investor decides not to reinvest. We also show that typically a considerable degree of continuity exists among the LPs who invest in different funds of the same partnership. These results support the assumptions made in our model. More generally, we think that they provide interesting evidence on the importance of asymmetric information in the interaction between private equity fund managers and their investors.

Finally, we examine the alternative hypothesis that the transferability restrictions could be used to deter troublesome LPs. Established GPs perhaps are not as concerned about these LPs and thus eschew these provisions. We present a variety of anecdotal and statistical evidence that is inconsistent with this alternative suggestion.

6. Conclusion

This paper examines the rationales for restrictions on liquidity. It suggests an alternative to the governance-based rationale traditionally offered for such curbs, focusing on the private equity industry. The model suggests that imposing restrictions on the liquidity of investor ownership stakes could enable managers, in our case GPs of private equity groups, to influence the composition of investors. We explicitly model liquidity constraints as a choice variable that allows the GP to alleviate the adverse selection problem in follow-on fundraising by screening for deep pocket investors.

We test these predictions in the context of the private equity industry. We find that, consistent with our theory, funds that are less prone to asymmetric information have fewer transfer constraints. For example, later funds of the same private equity firm have fewer transfer constraints, consistent with the idea that these funds are less affected by information asymmetries, because the firm has established a track record. Moreover, funds that operate in industries with longer investment cycles have more constraints. Also, funds in the close-knit California private equity environment have fewer constraints than East Coast funds, where information could travel more slowly. We also present evidence consistent with the assumptions of the model. In particular, we show that the existing investors of a fund are able to obtain inside information about the quality of the partnership.

The applications of these ideas are much broader and more general than the private equity setting. Many corporate finance transactions impose restrictions that are in excess of what are

required by securities law. Exploring the extent to which some of these same rationales could be at work is a natural extension of this analysis. An understanding of these issues, however, is particularly urgent in the private equity industry. In the past few years, a surge of interest has been evident on the part of limited partners in liquidating their holdings. In some cases, these groups have sought to reduce their overall exposure to private equity; in other instances, they have sought to garner dry powder for further private equity investments (for a discussion, see Toll, 2000). As the theoretical analysis above suggests, such moves have the potential for very positive features, but also for substantial costs. Thus, gaining a better understanding of the trade-offs associated with liquidity is important to academics and practitioners alike.

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Appendix

A major concern of private equity funds is to avoid coming under the provisions of the Investment Company Act of 1940, which has been characterized as "one of the most complex and extensive of all the federal securities statutes."[32] One of the four major securities acts enacted during the period of New Deal reforms initiated by President Franklin D. Roosevelt, it sought to regulate mutual funds and other instruments for pooled investments in securities. The act imposes detailed regulations governing almost every aspect of investment companies' operations, including reporting requirements, governance provisions, and demands for detailed record keeping.

Anticipating that investment companies could seek to avoid these requirements, the drafters of the act developed two central tests as to what constituted an investment company. A company would be regarded as an investment firm if it satisfied one of two tests. These were if it "is or holds itself out as being engaged primarily, or proposes to engage primarily, in the business of investing, reinvesting or trading in securities" or "owns or proposes to acquire investment securities having a value exceeding 40 per centum of the issuer's total assets (exclusive of Government securities and cash items)."[33]

Almost every private equity group would fall under these rules, which would essentially make the type of investing practiced by most groups impossible, were it not for an exception established by the drafters of the act (and its subsequent amendments). The act exempts funds whose securities are owned by less than one hundred "accredited investors" (those with $200,000 in annual net income for the past two years and expected in the current year or $1 million in net worth) and intend to remain privately held. (This exemption is often referred as the "Rule of 99" in private equity circles.) In 1996, this requirement was amended to allow these partnerships to accept funds from an unlimited number of "super qualified" investors (those with more than $5 million of investable assets). The need to avoid coming under the provisions of the act have provided a powerful spur to private equity organizations to control transfers of partnership interests. Nonetheless, the level of control over transferability in these agreements is far in excess of what would be required to comply with securities law.

Tax considerations also play a role. Section 708(b)(1)(B) of the Internal Revenue Code, first enacted in 1954, limits such exchanges. Motivated by the desire to avoid sales of partnership interests for tax purposes, this statute states that a partnership terminates if "within a 12-month period there is a sale and exchange of 50 percent or more of the total interest in partnership capital and profits." This has been interpreted as limiting the annual sum of all transfers, whether between limited partners or with third parties, to less than 50%. (Exceptions are made for, among other cases, gifts, bequests, and transfers between divorcing spouses.)

A second set of tax regulations is even more binding. Since 1987, partnerships that are "traded in an established securities market" or "readily tradable on a secondary market or the substantial

[32] Gilberg (1986, p. 1632). For a more general discussion of this act, see Loss and Seligman (1995).
[33] 15 United States Code @80a-3(a)(1)(A) and United States Code @80a-3(a)(1)(C).

equivalent thereto" may be designated publicly traded partnerships (also known as master limited partnerships).[34] The central test is whether the trading volume in these partnership interests on such exchanges exceeds 2% of the pool's capital or profit share. Publicly traded partnerships are generally treated as corporations for income tax purposes; i.e., earnings are taxed at the entity as well as the partner level, instead of just at the partner level, which is highly disadvantageous to the partners.

[34]Reg. 1.7704-1(a)(1). The definition of these markets is intricate. For example, trading of partnership interests through qualified matching services does not trigger a characterization of a fund as a publicly traded partnership, as long as the total annual volume of shares traded on all exchanges is less than 10% (McKee, Nelson and Whitmire, 1997).

Table 1

Characteristics of the private equity funds in the sample. The sample consists of 243 U.S. private equity partnerships. The table indicates the key characteristics of the funds and the private equity organizations in the sample. Dummy variables are denoted with question marks. The industry dummies do not add up to 100 percent, because private equity funds can report activities in several different industries.

Variable	Mean	Standard deviation	Minimum	Maximum
Sequence of fund	5.4	4.9	1	36
Early-stage venture fund?	0.30		0	1
Buyout fund?	0.19		0	1
Size of fund (in millions of dollars)	451.8	778.4	10.5	6,100.0
Year of private equity group establishment	1981	9.1	1946	2000
Year of fund final closing	1992	6.6	1974	2001
California-based fund?	0.35		0	1
Massachusetts-based fund?	0.26		0	1
New York-based fund?	0.15		0	1
California-based fund?	0.35		0	1
Pharmaceutical industry?	0.47		0	1
Computer/Internet industry?	0.42		0	1
Business services?	0.28		0	1
Telecommunications industry?	0.39		0	1

Table 2

Summary of the provisions used to construct the dependent variables in the analyses. The first column indicates how often the contractual term regarding transferability is found in the 243 partnership agreements in the sample. The second through fifth columns indicates whether the measure is included in the construction of the four composite measures used in the analysis below. A "+" sign indicates that the presence of the provision was regarded as a favorable indication in constructing the variable; a "-" sign, its presence was regarded as a negative indication. LP = limited partner; GP = general partner.

	Frequency of term in contracts	Is this measure included in dependent variable?			
Contractual feature	(in percent)	Composite of LP "friendliness"	Count of LP transferees	Key pro-GP restrictions	Contract complexity
Other LPs have right of first refusal	33	+			+
Transfers allowed to					
Other LPs	30	+	+		+
Partners of LP	17	+	+		+
Family members/trusts	46	+	+		+
Former spouse after divorce	13	+	+		+
Successor entity after merger/dissolution	40	+	+		+
Trustee/creditor after bankruptcy	4	+	+		+
Wholly owned subsidiary	33	+	+		+
80% owned subsidiary	16	+	+		+
Majority-owned corporation	8	+	+		+
Successor trustee/trust fiduciary	69	+	+		+
Sophisticated investors	34	+	+		+
Heir has rights to stop payments	2	+			+
Transfer cannot					
Add regulatory requirements for other LPs	82	-			+
Result in partnership termination	57	-			+
Lead to transferee not having LP status	24	-			+
Violate laws	64	-			+
Add taxes	44	-			+
Be to entity whose business conflicts with other LPs	2	-			+
Be to entity whose business conflicts with GPs	3	-		+	+
GP must approve transfer	89	-		+	+
Transfer must be to only one person	9	-			+
Transfer can only be to one nonexisting LP	3	-			+
Transfer must be of no more than 50% of LP interest	14	-			+
Transfer must be of no less than 100% of LP interest	10	-			+
GP will manage process of finding appropriate LP	9	-			+
Agent handling transfer may represent multiple sellers	25	-			+
LP bears cost of transfer	63	-			+
GP must approve LP's status as appropriate LP	73	-		+	+
Transferee must agree to partnership agreement	42	-			+

Table 3

Appearance of key transferability provisions in different types of partnership agreements. The sample consists of 243 U.S. private equity partnerships. The table indicates the mean of the various measures of transferability restrictions for funds with different characteristics. Test statistics from t=tests of the differences are also presented. LP = limited partner; GP = general partner.

	Variable			
Fund characteristic	Composite of LP "friendliness"	Count of LP transferees	Key pro-GP restrictions	Contract complexity
Sequence of fund				
Above median	3.69	3.53	1.78	10.80
Below median	2.97	2.63	1.50	9.49
Test statistic of difference	1.91***	2.99*	3.65*	2.94*
Early-stage venture fund				
Yes	4.62	3.90	1.64	11.33
No	2.67	2.74	1.65	9.46
Test statistic of difference	5.11*	3.72*	0.11	4.03*
Buyout fund				
Yes	1.64	2.04	1.62	8.96
No	3.62	3.33	1.66	10.26
Test statistic of difference	4.34*	3.46*	0.35	2.34**
Fund size:				
Above median	3.10	2.82	1.73	10.17
Below median	3.53	3.30	1.53	10.09
Test statistic of difference	1.13	1.58	2.57**	0.19
Year of private equity group formation				
More recent than median	2.60	2.37	1.67	9.80
Less recent than median	3.99	3.71	1.60	10.41
Test statistic of difference	3.73*	4.55*	0.87	1.34
California fund				
Yes	5.03	4.57	1.63	12.05
No	2.28	2.28	1.66	8.91
Test statistic of difference	8.08*	8.45*	0.44	7.60*
Massachusetts fund				
Yes	2.28	1.89	1.51	8.62
No	3.59	3.51	1.70	10.51
Test statistic of difference	3.19*	5.07*	2.26**	3.89*
New York fund				
Yes	2.47	2.58	1.81	9.69
No	3.39	3.18	1.62	10.08
Test statistic of difference	1.79***	1.44	1.73***	0.62
Year of fund formation				
More recent than median	2.88	2.68	1.77	10.25
Less recent than median	3.72	3.41	1.50	10.02
Test statistic of difference	2.20**	2.43**	3.54*	0.52

*Significant at 1% confidence level.
**Significant at 5% confidence level.
***Significant at 10% confidence level.

Table 4

Regression analysis, using composite measure of limited partner-friendly transferability restrictions. The sample consists of 243 U.S. private equity partnerships. The dependent variable, defined in Table 2, takes on values between –3 and +11. The independent variables include the sequence of the fund, dummy variables for funds specializing in early–stage venture and buyout investing and those based in California, Massachusetts, and New York, the year the private equity group was established, the logarithm of fund size (in millions of dollars), as well as dummies for the industry focus of the fund. Fixed effects for the year of the fund closing are included in all regressions; those for the private equity organization in some regressions. Standard errors are in brackets.

Independent variable	Dependent variable: composite measure of limited partner-friendly transferability restrictions						
Sequence of fund	0.09 [0.04]**	0.06 [0.05]	0.06 [0.05]	0.14 [0.05]*	0.07 [0.04]***	0.08 [0.04]***	0.08 [0.04]***
Early-stage venture fund	1.66 [0.43]*	1.62 [0.43]*	1.62 [0.43]*	-0.02 [0.48]		0.92 [0.42]**	0.90 [0.43]**
Buyout fund	-1.49 [0.56]*	-1.34 [0.57]**	-1.34 [0.57]**	0.01 [0.58]		-0.69 [0.52]	-0.59 [0.54]
Logarithm of fund size	0.32 [0.22]	0.26 [0.22]	0.26 [0.22]	-0.33 [0.21]			
Year private equity group formed		-0.03 [0.02]	-0.03 [0.02]				
California fund					2.86 [0.52]*	2.45 [0.53]*	2.34 [0.55]*
Massachusetts fund					0.25 [0.55]	0.39 [0.54]	0.32 [0.56]
New York fund					0.51 [0.60]	0.80 [0.61]	0.78 [0.69]
Pharmaceutical Industry							-1.34 [0.65]**
Software/Internet Industry							1.90 [0.65]*
Business Services							-1.30 [0.67]
Telecommunications Industry							-0.27 [0.69]
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Private equity group fixed effects	No	No	No	Yes	No	No	No
Number of observations	243	243	243	243	243	243	233
F-statistic	2.72	2.70	2.70	2.47	3.52	3.68	4.31
p-value	0.000	0.000	0.000	0.001	0.000	0.000	0.000
Adjusted R^2	0.17	0.17	0.17	0.84	0.23	0.25	0.42

*Significant at 1% confidence level.
**Significant at 5% confidence level.
***Significant at 10% confidence level.

Table 5

Regression analysis, using alternative measures of transferability restrictions. The sample consists of 243 U.S. private equity partnerships. The dependent variables, defined in Table 2, are the count of the number of parties that the limited partners are allowed to transfer partnership interests to (taking on values between 0 and 8), the count of the number of key pro-general partner terms are included in the agreement (taking on values between 0 and 3), and the overall measure of the complexity of the agreement (taking on values between 0 and 18). The independent variables include the sequence of the fund, dummy variables for funds specializing in early–stage venture and buyout investing, and the logarithm of fund size (in millions of dollars). Fixed effects for the year of the fund closing are included in all regressions; those for the private equity organization in some regressions. Standard errors are in brackets. LP = limited partner; GP = general partner. LP = limited partner; GP = general partner.

	Dependent variable					
Independent variable	Count of LP transferees		Key pro-GP terms		Contractual complexity	
Sequence of fund	0.06 [0.03]***	0.05 [0.03]***	0.002 [0.01]	-0.03 [0.01]**	0.08 [0.05]	0.14 [0.05]*
Early-stage venture fund	1.20 [0.36]*	0.08 [0.25]	-0.09 [0.09]	0.04 [0.13]	1.62 [0.52]*	-0.13 [0.46]
Buyout fund	-0.76 [0.46]	0.06 [0.31]	-0.23 [0.12]**	-0.24 [0.15]	-1.20 [0.68]***	-0.47 [0.56]
Logarithm of fund size	0.18 [0.18]	-0.36 [0.11]*	-0.0005 [0.04]	0.01 [0.05]	0.20 [0.26]	-0.15 [0.20]
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Private equity group fixed effects?	No	Yes	No	Yes	No	Yes
Number of observations	243	243	243	243	243	243
F-statistic	2.13	3.67	2.39	4.20	2.19	8.00
p-value	0.002	0.000	0.000	0.000	0.001	0.000
Adjusted R^2	0.12	0.93	0.14	0.75	0.12	0.90

*Significant at 1% confidence level.
**Significant at 5% confidence level.
***Significant at 10% confidence level.

Table 6

Limited partners' decision to invest into a partnership's follow-on fund or to discontinue investment. The sample consists of venture capital (VC) investments by two large limited partners and their decisions to allocate investments into the follow-on fund of a particular partnership or not. In total, we observe 92 investments. In Panel A we report the characteristics of funds that were reinvested versus those that were dropped, as well as p-value from t- and Wilcoxon tests of the significance of these differences. Cash-on-cash returns measure the ratio of the value of all distributions of the fund to the amount raised. Returns in excess of private equity (PE) market reports cash-on-cash returns after taking out the average returns of all private equity funds started during the same vintage year. Panel B presents regression analyses, in which the dependent variable in the first column is $Return_t$ measured as the annualized returns at the end of the fund's lifetime or as of mid-2002, and $Return_{t+1}$ in the second column is annualized return of the next fund that the partnership raises. $Log(size)_{t+1}$ in the third panel is the logarithm of the capital under management of the next fund and %Δ(Size) is the change in fund size from the current fund to the next. The independent variables include a dummy equal to one if the limited partner decided to continue investment into the partnership. VC Dummy is a dummy equal to one if the fund is a VC fund and zero for buyout funds. $Log(size)_t$ is the amount of capital under management in the current fund (in millions of current dollars). Standard errors in brackets.

Measure	Comparison of…	Those that were reinvested	Those that were not	Test p-value
Panel A Univariate comparisons				
Cash-on-cash returns	Mean	213%	170%	0.334
	Median	196%	91%	0.075
Returns in excess of PE market	Mean	21%	-36%	0.000
	Median	17%	-40%	0.000
Size of current fund (in millions of dollars)	Mean	202.4	382.5	0.000
	Median	109.6	241.4	0.000
Percent change, current to next fund size	Mean	+44.1%	21.9%	0.000
	Median	+39.9%	9.0%	0.000

	Dependent variable			
Independent variable	$Return_t$	$Return_{t+1}$	$Log(Size)_{t+1}$	%Δ(Size)
Panel B Regression analyses				
Is partnership continued?	0.65	0.45	0.42	0.46
	[0.27]*	[0.22]**	[0.30]***	[0.27]**
VC Dummy	1.04	2.08	-1.31	0.43
	[0.47]*	[0.41]*	[0.34]*	[0.21]*
$Log(size)_t$			0.34	
			[0.13]*	
Year fixed effects	Yes	Yes	Yes	Yes
Number of observations	92	76	76	76
Adjusted R^2	0.21	0.35	0.61	0.04

* Significant at the 1% confidence level.
** Significant at the 5% confidence level.
*** Significant at the 10% confidence level.

Table 7

The prevalence of concessions by venture capital funds raised in the bubble years. The sample consists of 274 venture capital funds raised in 1999 and 2000. In Panel A, the characteristics of funds that did and did not make concessions to their limited partners before the end of 2002 are reported, as well as p-value from t- and Wilcoxon tests of the significance of these differences. Panel B presents a logit regression analysis, in which the dependent variable is a dummy denoting whether the fund made concessions before the end of 2002. The independent variables include the size of the fund (in millions of current dollars), the percentage change from the original target to the amount raised, the age of the fund, and dummy variables denoting funds raised in 2000 and based in California and Massachusetts. The first regression uses all observations and denotes first-time funds with a dummy. The second regression employs only follow-on funds and includes as an independent variable the percentage change in size from the previous to the current fund. Standard errors in brackets.

Measure	Comparison of…	Those who made concessions	Those who did not	Test p-value
Panel A Univariate comparisons				
Size of fund (in millions of dollars)	Mean	771.4	297.0	0.000
	Median	616.5	172.5	0.000
Age of venture organization	Mean	19.9	8.2	0.000
	Median	16.5	4.0	0.005
Percent change, target to fund size	Mean	+15.9	+15.7	0.985
	Median	+5.2	+5.2	0.606
Percent change, previous to current fund size	Mean	+145.5	+227.8	0.505
	Median	+118.2	+133.3	0.575

Independent variable	Dependent variable: were any concessions to LPs made?			
Panel B Logit regression analyses				
Size of fund (in millions of dollars)	0.002	[0.001]*	0.002	[0.001]*
Percent change, target to fund size	0.06	[1.12]	0.20	[1.19]
Age of venture organization	0.06	[0.02]**	0.05	[0.02]**
Fund raised in 2000	-0.99	[0.62]	-0.70	[0.63]
California based organization	1.46	[0.86]***	1.18	[0.87]
Massachusetts based organization	2.20	[0.93]**	2.03	[0.93]**
First-time fund	-0.70	[1.13]		
Percent change, previous to current fund size			-0.14	[0.19]
Constant	-5.21	[1.04]*	-4.70	[1.03]*
Number of observations	274		188	
Log likelihood	-51.33		-47.45	
χ^2-statistic	40.54		28.21	
p-value	0.000		0.000	
Pseudo R^2	0.28		0.23	

* Significant at the 1% confidence level.
** Significant at the 5% confidence level.
*** Significant at the 10% confidence level.