The Liquidity Cost of Private Equity Investments: Evidence from Secondary Market Transactions

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Abstract

This paper uses proprietary data from a leading intermediary to understand the magnitude and determinants of transaction costs in the secondary market for private equity stakes. Most transactions occur at a discount to net asset value. Buyers average an annualized public market equivalent of 1.023 compared to 0.976 for sellers, implying that buyers outperform sellers by a market-adjusted five percentage points annually. Both the cross-sectional pattern of transaction costs and the identity of sellers and buyers suggest that the market is one in which relatively flexible buyers earn returns by supplying liquidity to investors wishing to exit.

1. Introduction

An important cost of investing in private equity funds at inception is that an investor must commit capital for a fund's entire life, typically ten to twelve years. During this period, a limited partner (LP) is committed to provide capital on demand to the general partner (GP) for the fund's investments and does not have access to the invested capital. Consequently, investments in private equity funds are less liquid than many alternative investments. Industry practitioners frequently cite the illiquidity of private equity investments among the most important risks that investors should consider when making these investments (see for example EVCA, 2013).

In recent years, a market has developed in which investors can buy and sell LP stakes in private equity funds. This market alleviates to some extent the illiquidity of private equity investments as it allows investors to exit their commitments. In a transaction in this market, the buyer pays the seller for the portion of his commitment that has already been drawn down and assumes the obligation to participate in all future investments and to pay all future management fees. In return, the buyer receives the right to all future distributions from exits of the fund's current investments.

Using privately obtained data on transactions in the secondary market for private equity funds from a leading intermediary in this market, we measure the average cost of transacting from both buyer and seller perspectives. These data cover all transactions intermediated by this broker during the 2006-2014 period and all of the bids they received on transactions subsequent to 2010.

We begin by examining the discounts or premiums relative to "Net Asset Value" (NAV) at which these transactions occur. A fund's NAV is the valuation that the fund reports to its investors, and deviations from NAV are generally used by practitioners to measure any discount or premium on a sale of a stake in a fund. In our sample, transactions occur on average at a discount to NAV for all types of funds that are transacted in the secondary market, including buyout funds, venture capital funds, real estate funds, and funds of funds. The average discount over the full sample is 13.8% of NAV, though this discount varies with fund age and overall market conditions. The 13.8% average for the full sample reflects, in part, deep discounts ("fire sales") that occurred with the sale of very young funds during the 2008-2009 financial

crisis, and some very old funds after the crisis. The most common type of transaction in our sample is for a fund between 4 and 9 years old, has an average discount to NAV of around 9%, and does not occur in the financial crisis.

Because the NAV of a private equity fund is not a market-based assessment of the fund's underlying value, and because NAVs are sometimes manipulated by GPs, we construct a second measure of the cost of secondary sales. Using data on the cash flow distributions of the funds, we calculate the annualized returns to investors who buy and sell the funds on the secondary market. Despite the discounts to NAV they accept, sellers potentially could outperform buyers by this measure if they are able to systematically sell funds at higher prices than justified by their future prospects. Sellers could conceivably be able to time the market in this way if they have a sufficiently large information gap over buyers.[1] However, the data suggest that the buyers in these transactions outperform sellers, again suggesting that transaction prices occur at a discount to the funds' underlying values. Buyers who purchase a fund through the secondary market and hold the fund to liquidation earn higher returns than sellers, on average. The most common type of transaction in our sample is associated with average (median) annualized buyer IRRs of 19.8% (15.6%). In comparison, average (median) annualized seller IRRs for the most common type of transaction are 2.8% (3.3%). Consistent with variation in NAV discounts, differences in buyer and seller IRRs vary substantially with the age of the fund at the time of transaction.

Larger IRRs for buyers relative to sellers could potentially reflect other factors, aside from liquidity costs. One possibility is the fact that in our sample, sellers tended to hold their positions during worse economic times (around the financial crisis), while buyers are more likely to have held their positions during the 2010-2014 period, when financial markets performed better. To adjust for such market wide factors, we compute annualized public market equivalents (PMEs) for buyers and sellers.[2] In the full sample, buyer

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[1] Potential buyers are provided "hard" information such as financial statements as part of the due diligence process. However, they do not have the "soft" information communicated privately by GPs about the business unless they are already LPs in this fund.

[2] The PME is equal to the ratio of the sum of discounted cash distributions from the fund to investors to the sum of discounted cash provided by investors to the fund, where the discount rate is the cumulative return on the public equity market from the inception of the fund to the cash flow in question. A ratio greater than one indicates outperformance

annualized PMEs average 1.023 compared to 0.976 for sellers. This pattern is consistent with the IRR results, and suggests that buyers do outperform sellers by about 5 percentage points per year. Annualized PMEs for funds between 4 and 9 years old, the most common transaction type, average 1.013 for buyers and 0.986 for sellers. These calculations imply that for the most common type of transaction in this market, sales of funds between 4 and 9 years old, buyers outperform sellers by a market-adjusted 2.7 percentage points per year that they are held. The fact that differences in annualized PMEs are so much smaller than differences in IRRs underscores the importance of adjusting returns for market conditions over the life of the fund.

Both the discounts to NAV and the difference in returns to buyers and sellers are measures of the cost of transacting in the secondary market. Across transactions, these costs appear to be associated with factors suggested by theories of market microstructure. NAV discounts tend to be larger for smaller funds, which is consistent with the idea that there are more information asymmetries with smaller funds than larger ones. Transaction discounts to NAV and the difference between buyer and seller returns also tend to be larger when the economy is doing poorly and there is less capital available to purchase the stakes. Finally, discounts are larger for smaller transactions, for which the costs of acquiring information per dollar invested are likely to be higher.

Institutional investors differ from one another in a number of ways, an important one of which is the extent to which their operations depend on the cash flows produced by their investments. For example, investors such as endowments and pension funds rely on their private equity investments to generate cash flow via distributions that is used by their organization and also are subject to periodic liquidity shocks. Most of the sellers in our sample are this type of investor, consistent with unexpected liquidity needs or changing portfolio strategies being the motivation for the sale. In contrast, most of the buyers in our sample

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relative to the public equity benchmark. Kaplan and Schoar (2005) are the first to use this market-adjusted performance measure in the empirical literature. Korteweg and Nagel (2016) and Sorensen and Jagannathan (2015) examine the theoretical validity of the PME. In this paper, we annualize PMEs to compare returns over different horizons because buyer and seller holding periods generally differ.

are funds of funds, which are often formed for the expressed purpose of acquiring stakes on the secondary market.

The secondary market for LP stakes in private equity appears to be one in which buyers receive returns for supplying liquidity. Sellers benefit because they are able to make strategic changes in their portfolios that, given the time horizon of private equity investments, would be impossible in the absence of a secondary market. Because of the cost of transacting in this market, the illiquidity of private equity should be a factor that investors take into account when investing in this sector, even though there is a market through which they can sell their stakes. To the extent that this market becomes more liquid over time, the illiquidity of private equity investments should become less important to institutional investors making portfolio decisions.

Although our analysis is the first to investigate transactions on the secondary market for private equity stakes, the results should be interpreted bearing in mind the selection issues associated with our sample of transactions. In particular, relative to the Preqin universe of funds, larger and worse-performing funds are more likely to be transacted on the secondary market. In our sample of transactions, larger funds are associated with higher transaction prices and poorly-performing funds with lower transaction prices. Consequently, the average transaction prices we document are potentially not representative of the price at which a randomly selected fund would transact. Further, it is possible that whether the transactions facilitated by our data provider are not representative of transactions by intermediated by other firms.

This paper is related to several strands of the existing literature. In its broadest goals, it adds to the theoretical and empirical literature that attempts to understand the risk and return of illiquid or thinly traded assets (see, for example Longstaff, (2014)). In private equity, the empirical literature on LP performance so far focuses exclusively on the returns earned by LPs who commit capital at a fund's inception and hold the fund for its entire life.[3] Our analysis extends this literature by documenting the returns to investors who

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[3] For estimates of hold-to-maturity private equity fund performance, see Kaplan and Schoar (2005), Ljungqvist, Richardson, and Wolfenzon (2007), Phallippou and Gottschalg (2009), Higson and Stucke (2012), Phalippou (2012), Robinson and Sensoy (2013, 2015), and Harris, Jenkinson, and Kaplan (2014). For estimates of differences in hold-

only hold their stakes for part of the fund's life. Bollen and Sensoy (2015) model the way in which the possibility of secondary sales at a discount affects the expected returns LPs require on their commitments to private equity funds. Their analysis suggests that, despite the secondary market discounts documented here, the returns initial LPs in private equity funds receive are often sufficient to compensate for the market and liquidity risks they face. Similarly, Sorensen, Wang, and Yang (2014) document that the returns earned by private equity funds are sufficiently high to compensate LPs for liquidity risks, in addition to management fees, carry and risk.

Previous work has documented the importance of liquidity in secondary markets other than private equity. Ramadorai (2012) and Ramadorai (2013) examine the secondary market for hedge funds and find that liquidity concerns, in additional to expectations of managerial performance, impact secondary market prices.

The results in our paper add to the growing literature on funds of funds and their performance. Brown, Goetzmann, and Liang (2004) and Fung, Hsieh, Naik, and Ramadorai (2008) both find that hedge funds of funds do not deliver abnormal performance, mostly because of the double fee structure in which investors pay fees on the fund of funds as well as the funds in which they are invested. However, recent work by Harris, Jenkinson, Kaplan, and Stucke (2015) argues that private equity funds of funds are an important exception and document that private equity funds of funds appear to generate excess returns, potentially because of their ability to provide cost-effective diversification, fund selection and monitoring, and access to otherwise unattainable investments. Our paper suggests that an additional reason why private equity funds of funds have had good performance is that a number these funds of funds specialize in acquiring private equity funds on the secondary market, and that these transactions have historically performed very well.

Prior work by Kleymenova, Talmor and Vasvari (2012) also examines aspects of the secondary market in private equity. Their work focuses on understanding prices bid for LP stakes, but does not analyze

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to-maturity fund returns across LPs, see Lerner, Schoar, and Wongsunwai (2007), Sensoy, Wang, and Weisbach (2014), and Cavagnaro, Sensoy, Wang and Weisbach (2017).

actual transactions, and consequently cannot determine the actual prices paid or the returns to buyers and sellers, which are the core of our analysis.

The remainder of this paper proceeds as follows. Section 2 discusses the institutional features of the secondary market for stakes in private equity funds. Section 3 presents statistics on our sample, especially regarding the pricing of the stakes relative to NAV. Section 4 presents statistics on the returns to buyers and sellers in this market. Section 5 examines the cross-sectional pattern of the discounts and the buyer and seller returns. Section 6 documents that the buyers and sellers tend to differ with respect to their reliance on cash flows from their investments, and consequently the flexibility they have regarding their investments. Section 7 discusses institutional features of the market that are relevant in interpreting our results. Section 8 summarizes the results and discusses their implications.

2. The Secondary Market for Stakes in Private Equity Funds

2.1. How Private Equity Funds are Structured

Private equity funds are limited partnerships in which general partners raise capital from limited partners and make investments in portfolio companies. These portfolio companies vary substantially from small startups, to large public corporations, to new housing developments, to the management of large infrastructure projects such as airports and toll roads. The element these companies have in common is that they could not have been financed through traditional sources of financing because they require the involvement of a highly-motivated investor who has substantial control rights to make them profitable. Private equity funds provide institutional investors a way to gain exposure to sectors of the economy that they could not invest in without these funds, and consequently add to the diversification of a broad portfolio.

Private equity funds return capital to investors when they exit their portfolio companies, since the funds they generate come from these sales. Private equity funds' managers' control over the timing of exits is limited, because the sale of a portfolio company depends on the availability and preferences of potential buyers. For this reason, most funds are set up in a closed-end structure, in which investors in the funds

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cannot sell their shares back to the fund, and must wait for the fund to liquidate its portfolio companies before receiving capital back from the fund.[4]

2.2. Why Investors Transact in the Secondary Market

Private equity funds generally have a ten-year stated life and are often extended beyond that point. During this time, investors have virtually no control over the cash flows generated by the private equity fund. Because it takes so long to receive capital back, investors in private equity funds generally do not invest in private equity funds unless they expect to be able to keep their capital in the fund for full life of the fund. However, unforeseen circumstances sometimes do occur, and can cause investors to desire to exit their investments early. Exiting early through the secondary market allows investors both to receive back some of the capital they have already invested, and also to be relieved of the obligation to provide capital for the fund's subsequent investments.

Industry professionals suggest that there are a number of reasons why LPs choose to sell their positions prior to the end of the fund's life. The most common motivations for investors to sell a position include a set of reasons best characterized as active portfolio management. These include the desire of investors to concentrate their investments into a smaller set of managers, resulting in the sale of positions deemed to be outside of the core set of fund managers. During our sample period the industry also went through important broad strategy shifts that brought many investors to sell their private equity holdings, including efforts to 'manage down' their private equity relationships. We also observe in our data cases in which LPs change the type of fund on which they focus, for example, from energy funds to mid-market buyout funds or funds that would accommodate direct coinvestment along with traditional private equity investments.

Investors sometimes choose to sell for other reasons outside of active portfolio management. Unexpected cash flow demands such as those occurring during the 2008-2009 financial crisis can lead

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[4] A few funds are open-end, and do allow investors to receive capital back from the fund at specified points in time. These are typically funds that invest in long-lived assets such as infrastructure, which require a very long commitment from the fund (usually 50 years or more).

investors to desire liquidity. In addition, some investors have restrictions on their portfolio composition and can become over-weighted in private equity following declines in the public markets, given that public market securities are marked to market in real time. Finally, regulatory changes such as Solvency II, Basel III, and the Volcker rule led some investors to reduce their private equity holdings.

While there is no way to know for sure why a particular LP wishes to sell his position, the age of the fund at the time of the sale provides some indication about the reason. In private conversations, industry practitioners generally claim that portfolio rebalancing-motivated sales occur most frequently when funds are between the ages of 4 and 9 years old. Transactions of funds in this age group represent the majority of the transactions in our sample.

The second most common type of transaction in our sample is what practitioners refer to as a "tail-end sale." These transactions occur when their positions in funds are near the end of their lifecycle and when the typical fund contains only a small number of unliquidated portfolio companies. Often the LP will have a target rate of return for his private equity investment and will sell his position if he finds that he can achieve this rate of return through a sale.

Finally, there are some transactions that occur early in a fund's life. These transactions tend to occur because of liquidity shocks, or because of regulatory requirements.

Buyers in the secondary market tend to be relatively sophisticated investors that have developed expertise in evaluating private equity portfolios, and hope to earn returns from providing liquidity in the secondary market. Some are institutional investors such as public retirement systems, but the most common buyers are funds of funds that are set up for the explicit purpose of investing in the secondary market.[5] An example of a large player in this market is the Blackstone Group, which has raised over $14b in a number of different secondary funds-of-funds. The returns to these secondary funds are generated both by the returns on the underlying private equity funds and also by the funds being acquired at a discount (or premium) to their fundamental value.

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[5] See *Guide to the Secondary Market*, published by Dow Jones in 2014, for a list of these funds, as well as the identity of other buyers in the secondary market.

2.3. How the Market is Structured

Because of the demand from potential sellers and buyers, around 2001, some intermediaries started assisting in the secondary sales of private equity funds stakes by marketing their stakes in private equity funds to potential buyers.[6] In a typical transaction, a potential seller engages an intermediary and pays them a fee, usually about 1% of the value of the stake. The intermediary locates potential buyers, gets approval from GPs for potential buyers to purchase the stake, distributes information about the fund's portfolio companies to these counterparties, accepts offers for the seller's stake in a private equity fund, and assists with the sale of the stake to the counterparty.[7] Deals typically fund on the last day of the quarter in which a price is agreed upon, with the median time between accepted offers and deal funding in our sample being 37 days.[8] The buyer pays the purchase price for the fund's existing investments to the seller (expressed as a percentage of NAV), takes on the seller's obligations for any committed future investments to the fund, and receives any distributions from the fund tied to that position. Individual funds are frequently sold as part of a larger portfolio transaction. In a portfolio transaction, the buyer submits an offer price for an entire portfolio of funds. Prices of the individual funds in the portfolio are then determined subject to the constraint that the size-weighted average of the individual prices equals the winning offer price.[9]

Figure 1 presents statistics on the size of the secondary market through time, based on an industry report provided by our data intermediary. This figure documents that the market has grown dramatically, from $2b in 2001 to $42b in 2014. There was an increase in volume around the time of the 2008-2009 financial crisis, presumably because endowments and pension funds worked to lower their exposure to

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[6] A few funds dedicated to seasoned private equity purchases, particularly at the tail end of funds' lives, existed as early as the 1990s but their direct investments were not brokered through an intermediary.

[7] Most partnership agreements do not allow limited partners to sell their stakes to whomever they want without having approval of the GP. For this reason, intermediaries must get approval from GPs before allowing potential new investors to bid. GPs will usually grant such approval for most potential new LPs, since having more liquid stakes makes their fund more desirable to future investors, though industry professionals have suggested to us that a small number of GPs can be quite selective about new LPs.

[8] It is possible that pricing discounts could be compensation for adverse changes in fund value before an agreed upon deal actually funds. We find no relationship between pricing discounts and time-to-deal-funding.

[9] In the empirical work below, we consider the extent to which the results are affected by the inclusion of portfolio transactions. In general, the results for the portfolio transactions in our sample are similar to the ones for individual deals.

private equity. Subsequent to the financial crisis, volume has continued to increase. Even the $42b volume in 2014 represents a small fraction of total private equity commitments, so it is likely that the secondary market volume will continue to grow in the future.

2.4. The Cost of Transacting

Stakes in private equity funds are long-term investments for which there are few potential buyers, and restrictions that further limit the possible buyers.[10] In addition, because the fund's portfolio companies are usually private, they do not have publicly available market values, and other publicly available information about these companies is limited. GPs do have considerable information about the portfolio companies, some of which they release to their own LPs, but not to the general public. Subject to non-disclosure agreements, intermediaries share the "hard" information that can be distributed to potential new LPs, and facilitate communication between potential buyers and GPs for the purposes of communicating additional "soft" information about funds. While potential buyers do their best to resolve information asymmetries, uncertainty about the quality of a fund's underlying investments takes time to resolve. Consequently, there can be substantial residual information asymmetry, which, combined with the limited number of potential buyers for a stake in any particular fund, leads the cost of transacting in any secondary market for stakes in private equity companies to be relatively high.[11]

How can one measure the transactions cost in the secondary market for private equity stakes? Part of the cost is a fee that is paid to the intermediary from the seller. However, the potentially more important part of the transaction cost in this market is the discount a seller must accept to compensate for the illiquidity in the market. Conceptually, this discount is the price that a buyer pays relative to the market assessment of the asset's fundamental value. Analogously, in an IPO or SEO, the transaction cost paid by the issuer

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[10] In 2003, when the University of Michigan provided performance data to a newspaper, Sequoia Capital announced that they would refuse to accept capital from the University of Michigan. More recently, in 2014 KKR threatened to cut off the Iowa Public Pension Fund from future investments if they complied with a public records request about the fees that they paid KKR. See *Wall Street Journal*, Nov. 4, 2014. These examples, however, are exceptions, and most GPs find fundraising so difficult that they are happy to take capital commitments from any potential LP.

[11] Kyle (1985) and Glosten and Milgrom (1985) present classic models in which the cost of transacting arises endogenously as a function of asymmetric information and other factors.

includes both the fees to the underwriter and the underpricing of the issue. Importantly, the secondary market for private equity stakes differs from the sale of public securities because there is not a clear market-based assessment of the stake's true value.

Practitioners typically use NAV to reflect the fund's fundamental value, since NAV is the measure of the fund's value that is reported to the fund's investors.[12] However, there is substantial discretion involved in computing NAV, and the extent to which NAVs fairly represent the present value of the fund's future cash flows is not clear. Recent empirical work suggests that because NAVs are based on historical cost, they do not adjust fully for value changes, so NAVs tend to understate the value of the portfolio companies. In addition, there is some evidence that some GPs tend to boost a fund's NAV when they are raising subsequent funds, and also near the end of the fund's life, when doing so can lead to higher fees. (See Jenkinson et al., 2014, Barber and Yasuda, 2015, and Brown et al., 2016).

It is important to remember that the purchase price of the stake, and consequently any discount to NAV, only applies to the drawn down portion of the commitment. The liability to participate in future drawdowns also changes hands when the stake is sold, and these future drawdowns are not affected by the purchase price of the secondary market transaction. Discounts to NAV can be misleading for this reason; if an LP has a stake in a fund and wishes to relieve himself of future liabilities, he could be willing to pay a seemingly high price to do so. For example, if a fund has only drawn down 5% of its commitments, an LP who sells a stake at a 50% discount to NAV is really only paying a discount of 2.5% of his total commitment to avoid future drawdowns (assuming the NAV of the invested assets is close to historical cost).

Interpreting discounts from NAV as a measure of liquidity costs in the secondary market is a common industry practice, and we present results using this measure. However, because discounts from NAV can be misleading, we also compute returns to buyers and sellers based on the price at which the

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[12] It is important to note that from the GP's perspective, the reported NAV is not intended to be the value for the limited partnership securities that the LP owns. LPs ultimately have no control, limited rights, and are subordinate to management fee payments. The NAV is not analogous to a mutual fund NAV, for example, but is used in practice by most LPs as their carrying value given the absence of other insights regarding fair value of their investment.

secondary sale takes place as well as data on the cash drawdowns and distributions a fund makes. To the extent that buyers earn higher returns than sellers actually received, or would have received if they held the fund to maturity, these differences in returns are additional measures of the liquidity costs borne by sellers who transact in the secondary market.

3. Sample of Secondary Market Transactions

3.1. Sample Selection

Our data on secondary market transactions are provided by a large intermediary in the private equity secondary market. This firm's market share in brokering LP liquidity has varied through time, and peaks in the later years of our sample. Our data on secondary market prices runs from 2006 to 2014. While the private equity secondary market has existed since 2001, only $23b in transactions occurred between 2001-2005, compared to $200b in the years 2006-2014 (See Figure 1). In our sample period of 2006-2014, about 90% of all secondary market transactions have occurred.

Our database contains information on both bids and transaction prices for stakes marketed by the broker, the total value of the transactions, as well as other information specific to each transaction. For some transactions, including all in the 2006-2009 period, we do not have bid data but do have transaction data.

We match the transaction data with data on cash flows and returns from *Preqin*. *Preqin* constructs two databases on which we rely heavily: the first contains returns (IRRs and multiples of invested capital) for a large sample of private equity funds, and the second contains quarterly cash flows on the drawdowns from limited partners and the distributions to the limited partners for a smaller sample.

To calculate returns to buyers and sellers in the secondary market, we merge the transaction database with one or both of the *Preqin* databases. The merge begins with 2,440 completed transactions. Implementing a screen within the transaction data for obvious outliers where the percent of NAV paid for a transaction seems implausible (less than 25% or greater than 400%, or other obvious data errors on transaction price) reduces the sample to 2,226 transactions. Our returns calculations require one transaction

value per fund quarter, so in circumstances in which a fund transacted multiple times in a quarter, we calculate the average percent of NAV paid for a fund in a given quarter. Merging observations in which funds transacted multiple times within particular quarters reduces the sample to 1,998 fund quarter transactions. When we restrict the sample to those funds for which cash flows are available from the *Preqin* cash flow database, it further declines to 1,054 fund quarter transactions.

One concern with computing returns to secondary market investments is the possibility that a secondary market buyer can purchase a fund at a discount to NAV in one quarter and then mark the value of the fund to NAV in the subsequent quarters, generating a mechanically large "paper" return. Because of this concern, we remove observations where a transaction took place within 4 quarters of the last reported NAV in the database.[13] This additional restriction reduces the sample to 811 fund quarter observations. We remove an additional 13 observations with reported annualized IRRs greater than 200% because they do not appear representative of the full sample and are likely driven by misreported cash flow data in *Preqin*. Finally, to be included in our final sample, we require that each transaction involves a fund that has sufficient data to calculate returns to both buyers and sellers. The resulting sample is 700 fund quarter transactions from 388 unique funds. Of the 388 unique funds represented in the final sample, 220 are buyout funds, 122 are venture capital funds, while the remaining 46 are real estate, funds of funds or "other" fund types.[14]

3.2. Sample Characteristics

Panel A of Table 1 reports the discounts to NAV for bid and transaction prices, with funds grouped into buyout, venture, fund of funds, and real estate, with all other funds combined together in a fifth category.[15] This table indicates that both the bid and transaction prices generally occur at a discount to

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[13] In a previous draft, we have presented the results without imposing this requirement on our sample. The pattern of returns reported is similar to that reported here except that buyers' average returns are even higher in the previous draft, since some observations are mechanically marked up shortly after the purchase.

[14] For calculations that do not require returns data, such as those presented in Tables 1 and 2, we include all funds in the transactions database, so these tables contain a substantially larger number of observations. Total transaction counts in Tables 1a and 1b differ from those in Table 1c because of missing data on fund size for some transactions.

[15] Funds in this "other" category include funds specializing distressed debt, energy, infrastructure, natural resources, restructuring, special situations, as well as an "other" category defined by the broker.

NAV. For the full sample, the average and median transaction prices are 86.2% and 85.6% of NAV respectively. Though not reported in Table 1, when weighted by fund size, average (median) transaction prices are 85.3% (90.0%) of NAV. The most commonly transacted type of fund is a buyout fund, with 2,303 bids and 1,132 transactions, and the next most common is venture with 603 bids and 704 transactions.[16] Panel B of Table 1 documents the number and price of bids and transactions in our sample by year. The number of transactions remains roughly constant over time (between 200 and 300 per year). Since the overall market has grown dramatically over our sample period, the additional transactions not in our sample reflect entry by new intermediaries. Our bid data begin in 2010 and for the years in which we have bid data, there are roughly 3 bids for each transaction.

After 2006, deals tended to occur at a discount to NAV, with an average and median bid and transaction price less than NAV. Prices relative to NAV declined precipitously during the 2009 financial crisis, during which the average transaction price was just 54% of NAV. During these years, the financial crisis created a demand for exits of private equity positions established during the prior boom years. The volume of transactions (213), however, was not particularly high relative to other years, suggesting that there was a shortage of potential buyers at this time, so that the only exits that did occur were at even deeper than usual discounts. Following 2009, NAV discounts steadily declined, with purchase prices averaging between 84% and 86% of NAV from 2010 through 2013 and increasing to 93.2% of NAV in 2014.

Because NAV discounts can serve as a rough measure of liquidity costs in the secondary market, Table 1 suggests liquidity costs in the secondary market for private equity funds average about 14%. NAV discounts in closed-end mutual funds can also be used as a rough proxy for market-wide liquidity costs. During our sample period, closed-end mutual fund discounts were between 6.5%-10%, with the exception of the financial crisis during which they increased to over 11%.[17] These comparisons suggest that liquidity

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[16] The number of transactions can exceed the number of bids in Table 1 (e.g. venture funds) because we are missing bid data for the 2006-2009 portion of the sample.

[17] Private equity NAVs are not comparable to mutual fund NAVs because private equity NAVs are based on GPs' estimates of value while mutual fund NAVs are based on market values. We only draw a comparison to closed-end mutual fund discounts because these discounts are frequently used as proxies for economy-wide liquidity costs.

costs in the secondary market for private equity investments were high relative to buy-and-hold private equity liquidity costs and market-wide measures of liquidity costs during our sample period, especially during the financial crisis.

Panel C of Table 1 documents the fund size and transaction size, both expressed in dollars and also as a fraction of fund size. The buyout funds that are transacted have a mean AUM of $3.7b (median $1.8b), the venture funds have a mean AUM of $459m (median $365m), and the remaining funds have a mean AUM of $1.3b (median $730m). Transaction sizes are also largest for buyout funds, with a mean size of $12.6m for buyout funds compared to $3.3m for venture funds.

To assess the representativeness of the funds that transacted on the secondary market, Panel A of Table 2 tabulates summary statistics for the *Preqin* universe while Panel B tabulates the same statistics for our main sample. Funds represented in the transaction data are larger on average than funds in the *Preqin* universe. The AUM for buyout funds in the merged sample average $3.2b, compared to $1.6b AUM for average buyout funds in *Preqin*. Venture and "other" fund types that transact on the secondary market also tend to be larger than average. For transactions to have a robust secondary market, there has to be sufficient demand and information available for the fund, which usually occurs for larger funds. Investments in large funds appear to be more liquid than investments in smaller ones: there are more transactions for the larger funds and they occur at a smaller discount to NAV.

Table 3 presents statistics on sales by the age of the fund at the time of the sale. In Panels A-C, we group the transactions into three age categories: 0-3 years, 4-9 years, and at least 10 years. Funds generally expect to exit their investments by year 10, although they often exercise an option to extend the fund's life by multiple years at the GP's discretion and with the permission of their LPs. Consequently, transactions in the "at least 10 years" category are tail end transactions of funds that have exited the majority of their investments but still have a few left on their books.

Transactions occurring between years 4 and 9 are the most common, with 704 transactions, which is 59% of the 1186 transactions for which we have cash flow data and can compute NAV. There is also a large number of tail end transactions, 354, which make up about 30% of the sample. Transactions that occur

early or late in a fund's life tend to be at lower prices than other transactions. Late in a fund's life, if the fund has already provided a return that clears the fund's hurdle rate but still has a few investments left, LPs will sometimes sell the fund in the secondary market to "clean up" their books. Early in a fund's life, the higher discounts could reflect greater uncertainty about GP quality as well as the value in relieving the LP of larger and longer-lasting future drawdown obligations.

The large discounts for transactions of buyout funds aged 0-3 years reported in Table 3 reflect the effects of the financial crisis on market prices. Of the 84 buyout transactions that occurred in the first 3 years of the funds life, 28 occurred in 2009 with another 18 in 2008. In contrast, very few stakes of venture funds were sold during the crisis; only 5 of the 21 total transactions were in 2009. The higher average prices for venture funds sold in the first 3 years likely occur because of this difference. If we exclude crisis transactions from both the buyout and venture summary statistics, each type has similar average prices in the sale of 0-3 year old funds.

In Panel D of Table 3, we report the average fund age at time of transaction for each year of our sample. Funds sold in 2009 had an average (median) age of 19.5 (14) quarters. In contrast, funds sold in the 2010-2014 period tended to be much older, with the mean (median) age peaking at 40.2 (35) quarters for transactions in 2013. These data suggest that LPs desiring liquidity in 2009 were more likely to sell younger funds, presumably to avoid larger future capital commitments. In contrast, older funds were more likely to be sold later in the sample period when liquidity demands were not likely to have been the primary reason for selling.

Table 4 presents estimates of equations that characterize the funds that are more likely to have transactions in the secondary market. The results suggest that both buyout and venture funds transact more frequently than "other" funds (the omitted category). Larger firms are much more likely to be transacted than smaller funds. Presumably, there is much more information available about larger funds and more potential buyers who already own a stake in the fund, so have acquired the necessary information on it. As suggested by the results in Table 3, young funds are less likely to transact than older funds. These results suggest that the secondary market is most liquid for larger funds that have been in existence for at least

three years. Finally, models (2) and (3), which include quarter fixed effects, indicate that higher performing

funds, as measured by their to-date PME, are less likely to transact.

4. The Returns of Sellers and Buyers

4.1. Internal Rates of Return

In Table 5 we present the annualized IRRs that buyers and sellers receive using the merged sample

of transaction data and *Preqin*. Using the cash flow data from *Preqin* and the purchase price in the

secondary market, we calculate the IRR that each buyer and seller receives on his investment. The first two

columns of Panel A of Table 5 document that the average return to sellers was 2.2% while the average

return to buyers was 22.3%. The difference between these average returns, reported in Column 3, is 20.1%,

which is statistically significantly different from zero.[18] We also report the median IRRs for sellers and

buyers; these values are 3.9% for sellers and 16.7% for buyers averaging across all funds. For the median

transaction, buyers outperform sellers but the differences are not as large as for the average IRR. In a

typical transaction sellers receive a positive return between 2.2% and 3.9% and buyers receive between

16.7% and 22.3%.[19]

The remaining columns of Table 5 break down the buyer and seller IRRs by the age of the fund at

the time of the transaction. The results presented document stark differences in seller returns for funds of

different ages. Sellers of young funds take substantial losses, with an average IRR of -26.2%. This very

low IRR could reflect that a large fraction (49 of 92) of the sales of young funds occurred at large discounts

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[18] Our statistical tests of the differences between buyer and seller returns cluster standard errors by quarter of transaction. One concern with clustering by quarter is that our transaction-based returns are calculated with overlapping horizons, an issue in the performance evaluation of venture capital funds first raised by Korteweg and Sorensen (2017). An approach to addressing the cross-correlation of funds with overlapping horizons is to cluster by vintage year. To allow for the possibility that cross-correlation spans multiple vintage years, we cluster by vintage year and neighboring vintage years. Finally, we also cluster standard errors by GP, allowing for correlation across all vintages within a given fund family. Our results are essentially unchanged when standard errors are clustered by any of these approaches. .

[19] Alternatively, one could weight the transactions by the value of the transaction. Using this approach gives similar results to those reported in Table 5. However, there are some extremely large transactions in our sample that make this calculation potentially unrepresentative; the maximum transaction is for a stake with a NAV of $325m, while the median transaction is for only $4.6m. However, when weighted by fund size, average (median) differences between buyer and seller average returns are as large as 28.3% (17.8%).

during the 2008-2009 financial crisis. In transactions of funds between 4 and 9 years old, which constitute the majority of our sample, sellers receive a small gain, with an IRR of 2.8%, and in tail end transactions, sellers average a 16.5% IRR. Buyers, on the other hand, do reasonably well in all transactions, with an average IRR of at least 20% for each age group.

In Panels B, C, and D we repeat this analysis for buyers and sellers of each type of fund separately. In each case, the average buyer IRR is substantially higher than the average seller IRR. For example, the results in Panel B document that for buyout funds, the average IRR for buying institutions was 23.7%, compared to roughly 1.7% for selling institutions. The differences between seller and buyer for venture (Panel C) and other funds (Panel D) are similar to those for buyouts. For each type of fund, buyers receive higher IRRs than sellers; sellers appear to be willing to take a haircut so that they can be relieved of their obligation for future commitments.

4.2. Public Market Equivalents

A potentially important consideration in interpreting the IRRs of buyers and sellers is the performance of the broader equity market during different portions of our sample period. In particular, the earlier part of our sample includes the 2008-2009 financial crisis, while the later part of our sample includes the 2010-2014 period in which the equity market performed very well. Since buyers held their positions later in time than sellers, it is possible that the observed differences in IRRs between buyers and sellers could reflect this timing rather than transactions costs in the secondary market.

To evaluate the extent to which the changing market conditions can explain the differential performance between buyers and sellers, we calculate the "Public Market Equivalent" (PME), which compares private equity performance relative to the benchmark of public equity markets, and is often considered to be the preferred way to evaluate private equity performance (see Sorensen and Jagannathan (2015) and Korteweg and Nagel (2016)). The PME is equal to the ratio of discounted distributions (from the fund to investors) to discounted capital calls (capital provided by investors to the fund), using the realized return on the public equity market as the discount rate. A PME greater than one means that a fund has outperformed the public equity market.

The standard PME does not adjust for the time a fund holds its assets, which is not an issue for prior studies such as Kaplan and Schoar (2005) that compare the performance of funds over their entire lives. However, the comparisons in our study are over very different time horizons. For example, we present returns for buyers and sellers of young funds, for which the buyer owns the fund for a much longer time than the seller and for tail end funds, for which the seller owns the fund for a much longer period than the buyer. For this reason, we focus our discussion on annualized PMEs, which are just PMEs taken to the power of one divided by the number of years a seller or buyer holds the asset. Appendix A outlines the calculation of annualized PMEs, and describes how buyer and seller PMEs relate to PMEs calculated over the full life of the fund.

Table 6 presents the annualized PMEs for buyers and sellers in our sample. Panel A of Table 6 documents that for the overall sample, sellers have an average annualized PME of 0.976 and buyers of 1.023. These average annualized PMEs imply that sellers underperform the public equity market by 2.4% per year while buyers outperform by 2.3% per year. Buyers, therefore, outperform sellers by about 5 percentage points per year. The difference between these returns is statistically significantly different from zero. Median annualized PMEs are closer to 1, 0.996 for sellers and 1.01 for buyers, indicating that the median performance is very close to that of the public equity market. When weighted by fund size, buyer-seller differences are larger; the average (median) is 7.6% (2.6%). We also note that our calculation of seller PMEs do not incorporate fees paid to the intermediary. Taking these fee into account would make the difference between buyer and seller PMEs slightly larger.

The remaining columns of Table 6 break down the annualized PMEs by the fund age at the time of transaction. As with the IRR results, the seller annualized PMEs for young funds is poor, suggesting that sellers earn 86.1% per year of what they would have earned in the public equity market. Sellers who sell between year 4 and year 9 of the fund's life earn 98.6% per year of the public equity market return while sellers who hold until year 10 earn 1.02% more each year than the public market. For each of these groups, the buyers earn more than the public equity market although in the tail end sales, their annualized return is lower (albeit not statistically significantly) than the sellers.

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Panels B, C, and D present the PME calculations for each type of fund separately. The numbers indicate that for each type, buyers have an annualized PME that is between 4 and 5 percentage points higher than sellers. Breaking down each type of fund by age of fund, the differences between buyer and seller annual returns are very large (between 20 and 25 percentage points per year) for the transactions of young funds, about 3 percentage points per year for the typical transaction in our sample that occurs for a fund between 4 and 9 years old, and close to zero for the tail end funds. These differences are generally statistically significant but smaller in magnitude than the differences in IRRs reported in Table 5. They suggest that part but not all of the spread differences in IRRs reported in Table 5 occur because of time series variation in market-wide returns.

One exception to our general pattern of results is that sellers of tail end portfolios earn higher returns than buyers. This pattern likely occurs because tail end portfolios have already realized the vast majority of distributions by the time they are sold. Purchasers of tail end funds are effectively speculating on the performance of one or two unliquidated portfolio companies rather than the entire fund. The large NAV discounts on tail end transactions reflect the uncertainty in the sale price and timing of liquidation for the remaining portfolio companies.

Nonetheless, except for sales of tail end portfolios, regardless of the type of fund or the approach used to measure returns, buyers in the secondary market outperform sellers. Moreover, these calculations do not include the fees paid to the intermediary, which are usually about 1% and are paid by the seller. Including these fees would make the differences in returns between buyers and sellers even larger. These differences in returns between buyers and sellers are consistent with the view that the transactions occur when sellers have a strong incentive to sell, so are willing to pay a cost to relieve themselves of some of their commitments to private equity.

4.3 Seller and Buyer Returns Relative to Buy-and-Hold Investors

In this paper, we have argued that differences between buyer and seller returns represent liquidity premiums earned by buyers. One potential interpretation of our results is that secondary market buyers are

simply earning the long-term buy-and-hold liquidity premium already documented in the literature rather than an extra premium for purchasing the funds on the secondary market.

To evaluate this issue, we compare long-term buy-and-hold returns of funds included in our transaction sample to secondary market buyer and seller returns. Panel B of Table 2 reports buy-and-hold IRRs for the funds included in our sample to be 10.2%. Panel A of Table 5 reports annualized IRRs of 22.3% and 2.2% for secondary buyers and sellers, respectively. In results presented in Appendix Table A1, we find that annualized buy-and-hold PMEs for our sample of funds average 1.00, compared to annualized PMEs of 1.023 and 0.976 for buyers and sellers, respectively. These results indicate that long-term buy-and-hold investors earn returns in excess of secondary sellers but lower than secondary buyers, suggesting that secondary market buyers earn liquidity premiums in excess of that received by buy-and-hold investors.

4.4. Impact of the Financial Crisis

During the 2009 financial crisis, there were large pricing discounts, and buyers who purchased stakes at these discounts earned high returns, while sellers generally lost money. To evaluate the extent to which these transactions are the primary driver of our result that buyers tend to outperform sellers, we recreate Tables 5 and 6 excluding transactions occurring between the third quarter of 2007 through the second quarter of 2009. We report these results in Tables A2 and A3 of the Appendix.

The results in these tables indicate that excluding crisis transactions does not substantially change the relative buyer and seller returns. The 17.0% larger annualized IRR for buyers than sellers in 4-9 year old transactions reported in Table 5 is virtually unchanged in the sample that excludes crisis observations (16.8% as reported in Table A2). Using annualized PMEs, buyer minus seller returns are 2.2% for 4-9 year old funds when crisis transactions are excluded, compared to a 2.7% difference when all transactions are included.

The largest change in the results when crisis transactions are excluded is for 0-3 year-old buyout funds, which were transacted at a disproportionately high rate during the crisis period. For these funds, the average difference between buyer and seller IRRs is 35.7% when crisis transactions are excluded, compared to differences of 53.9% when all transactions are included. Differences of a similar magnitude exist for

transactions in these funds when returns are measured as annualized PMEs. Despite this change in relative returns for this one set of funds, the pattern of buyers outperforming sellers does not appear to be driven by transactions occurring during the financial crisis, and is present throughout the sample.

It is important to note that the vast majority of our sample does *not* occur during the 2009 financial crisis. Most of the transactions have occurred during good economic times, which prevailed over most of our sample period. While the 2009 transactions are at a sufficiently large discount to reflect the "fire sale" mentality that prevailed during the financial crisis, these are very much the exception. Most transactions in our sample reflect the liquidity cost of transacting stakes of funds during normal times rather than fire sale prices that occurred during the financial crisis.

4.5   The Costs and Benefits of Selling Fund Commitments

Though we have documented the discounts associated with selling in the secondary market, we have not considered the magnitude of the potential benefit of relieving investors from future fund commitments. We calculate the present value of expected capital calls by discounting all realized capital calls using returns on the S&P 500 back to the time of an actual transaction, assuming that actual capital calls are a reasonable proxy for expected capital calls at the time of a transaction. The average (median) present value of unrealized capital calls for our sample is $1.27m ($637k). We note that over two-thirds of the transactions in our sample occur when a fund is older than five years, and most funds expect to call the full complement of capital within the first five years of a fund's life. For transactions where liquidity is more likely to be a motivating force, the sale of funds 3 years old or younger, the average present value of uncommitted capital is $3.55m. In dollar terms, the average (median) dollar discount from NAV associated with selling a stake is $1.62m ($718k). Pricing discounts for younger than 3-year old funds is larger, $1.98m, on average. In sum, for the average fund in our sample, an LP realizes a dollar discount to NAV of $1.62m in exchange for the liquidity gained from the sale and for relief from the obligation to fund an addition present value of $1.27m in future years. Younger funds (less than 3 years) realize an average dollar discount of $1.98m in exchange for relief from a present value obligation of $3.55m.

5. Cross-Sectional Variation in Transactions Costs

Funds-of-funds that are created to invest in secondary market transactions often state that they achieve returns by providing liquidity to private equity investors. The evidence that buyers outperform sellers is consistent with the observation that they are able to purchase their stakes at a discount to the stakes' underlying value. We can view this difference in returns as reflective of the transactions costs in this market, and the magnitude of this outperformance suggests that these transactions costs are meaningful.

Theories of market microstructure suggest that there are two main factors that determine the magnitude of transactions costs in any market: the overall demand for an asset (the "thinness" of the market) and the asymmetric information between buyers and sellers (see Glosten and Milgrom (1985) and Kyle (1985)). We next examine whether proxies for these factors appear to affect the transactions costs in the secondary market for private equity stakes.

We use two measures of transactions costs in our analysis. First, we consider the transaction price as a percentage of NAV that is paid in a given transaction. This measure has the advantage of being easy to measure and commonly used by practitioners. However, as discussed before, the NAV is an accounting measure that can deviate substantially from the market's assessment of the value of fund's invested assets. For this reason, as a second measure of transactions costs, we use the difference between each transaction's buyer and seller returns, measuring these returns by both IRRs and annualized PMEs. These differences reflect the returns that the buyer receives for providing liquidity to the seller.

Table 7 presents estimates of equations that characterize the factors affecting the magnitude of discounts from NAV, our first measure of transactions costs. Column 1 contains estimates of the extent to which transactions costs are related to fund type and age. Column 2 includes variables reflecting overall market conditions, as measured by the average price to earnings ratio in the equity market, as well as a number of transaction-specific controls. Column 3 replaces the macroeconomic controls with quarter-specific fixed effects. Column 4 includes a fund's PME as of the time of the transaction as an additional

variable.[20] Column 5 adds variables that proxy for the reputation of the General Partner, including the average PME of all funds in the GP family, GP age, and the log of GP assets across all funds. Finally, Columns 6-8 estimate the specification from Column 3 for each age group separately.

The main implications coming from these estimates are as follows. First, transactions costs appear to be countercyclical since they are higher when the market wide price to earnings ratio is low, which tends to be the case during recessions. During poor economic times, capital is more constrained, so there is less capital available to purchase stakes in private equity funds. Consequently, when the economy is doing poorly and P/E ratios are low, transaction prices in our sample tend to be lower relative to the stake's underlying value, so returns to buyers are therefore higher. In addition, there are likely to be more investors wishing to sell their stakes during poor economic times, which also leads to lower prices and higher buyer returns. Both of these effects likely contributed to the very low prices paid in 2009 during the financial crisis and the high returns to buyers of stakes at these low prices.

Second, transactions costs tend to be lower for larger transactions and for larger funds. There are likely to be fixed costs for an acquirer in acquiring information about a fund, so buyers are willing to pay a higher price if they are acquiring a larger stake in the fund. In addition, for smaller funds, there are fewer investors familiar with the deals that the fund has made, so asymmetric information is likely to be higher than for larger funds. Finally, there are likely to be more buyers interested in purchasing a stake in a large fund than a small one, which will tend to drive down transactions costs for large funds.

Third, younger funds are associated with larger transactions costs. The estimates reported in Column 1 suggest that funds that are younger than 3 years trade at a much larger discount than other funds. However, this discount disappears when we control for macroeconomic and other fund factors, suggesting that the large discount for young funds is driven by the fact that investors only are likely to sell young funds during poor financial conditions, which in our sample means during the financial crisis, especially 2009.[21]

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[20] We lose a substantial number of observations when estimating the model reported in column 4 because the model requires the calculation of fund PMEs, which requires the merge of our secondary market transaction data with Preqin.
[21] Another reason why there are large NAV discounts for young funds is the fact that young funds have substantial future capital commitments. If a fund has a substantial future capital commitment, then a large young-fund discount

Fourth, consistent with the unconditional tabulations presented in Table 3, the oldest funds in the sample, those sold when they are 10 years old or older, sell at a discount of about 10%. This result holds even when controlling for time fixed effects, indicating that the tail-end discount is a sample-wide phenomenon that persists independent of aggregate market conditions.

Fifth, funds that have performed better up to the time of the transaction sell at higher prices. Funds with one-standard deviation higher PMEs at the time of transaction (about 50 basis points) are associated with 2.5% higher prices as a percent of NAV. When we control for the average PME of all the funds in a GP fund family, we find that the GP fund family PME can explain variation in pricing.[22] This result indicates that the reputation of a GP, as measured by performance, impacts prices in the secondary market, even when controlling for performance of the specific fund being transacted. In fact, the transacting fund's PME is no longer statistically significant when GP performance is included. The reduction in statistical significance is likely due to collinearity between the individual fund's PME and the GP portfolio PME. Neither of the other measures of GP reputation, GP size and GP age, are statistically significantly different from zero.

Finally, the results indicate that transactions that occurred as part of a portfolio of transactions do not occur at significantly different prices when controlling for time fixed effects (models (3) and (4)). This result suggests that our main set of results is not being driven by cases in which LPs sell an entire portfolio of holdings at one time.

In Table 8 we present estimates of equations similar to those presented in Table 7 using the difference in returns between buyers and sellers as the dependent variable. In Columns 1-3, we measure the difference in returns using the difference in IRRs between buyers and sellers and in Columns 4-6 we use

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would be a much smaller fraction of the total commitment to the fund. A variable measuring the fraction of committed capital that is unfunded is highly correlated with fund age, so if we include it in the equation, both variables become statistically insignificant (unreported). When the percentage unfunded variable is included in place of fund age, we find an economically meaningful relationship between NAV discounts and percent unfunded. This equation implies that a 10% increase in percent unfunded is associated with almost a ten percentage point decline in the transaction price paid as a percent of NAV.

[22] The GP fund family PME is calculated as the average PME for all the individual funds of a GP over the life of the fund.

the difference in annualized PMEs between buyers and sellers. The cross-sectional patterns implied about transactions costs from the analysis of discounts to NAV in Table 7 continue to hold in the return differences presented in Table 8. Consistent with the idea that larger transactions sell at higher prices, the difference between buyer and seller returns is smaller for larger transactions. In addition, buyers earn larger returns relative to sellers on younger funds, presumably because they sell for lower prices. Interestingly, when differences between buyer and seller returns are measured using PMEs, the results indicate that for funds greater than ten years old, buyer minus seller returns are smaller.

Overall, there is a consistent cross-sectional pattern in the transaction prices (Table 7) and differences between buyer and seller returns (Table 8). Both sets of results suggest that transactions costs in the secondary market for private equity being affected by information asymmetries and the overall thinness in the market for stakes. Theories of market microstructure that have been tested extensively on public capital markets appear to apply to this market as well.

6. Who are the Sellers and Buyers?

The results presented to this point are consistent with the view that the secondary market is one in which buyers provide liquidity for sellers who wish to exit their investments and receive a return for doing so. Another question concerns the identities of the buyers and sellers. If cash flow considerations affect the desire to sell, then sellers should be institutions that rely on their investments for cash flows such as endowments or pension funds, while the buyers should be investors with sufficient flexibility to take advantage of market opportunities, such as funds of funds. We now examine whether this pattern characterizes the transactions in our sample.

Funds of funds are commonly created for purchasing funds in the secondary market and do not have cash flow requirements, so are a potential purchaser of unwanted stakes in private equity funds. Table 9 documents the frequency of funds-of-funds as buyers rather than sellers, relative to other types of investor. This table indicates that funds-of-funds are much more likely to be buyers than sellers. Funds-of-funds are buyers in 85.4% of the transactions in our sample, while other investors are buyers in only 14.6%. In

contrast, the majority of the sellers (66.6%) are LPs other than funds-of-funds. Table 10 also presents this comparison broken down by type of fund (buyout, venture capital, other). The pattern suggests that the market is one in which sellers tend to be institutional investors who rely on cash flows while buyers tend to be funds of funds.

In untabulated results, we note two interesting patterns in the timing of sales by certain seller types. First, almost 60% of all sales by financial institutions occurred during 2011 and 2012, when expectations of the impact of the Volcker rule were at their peak. Second, we note that almost 43% of all endowment sales occurred during the financial crisis, whereas pension funds had very few sales during the crisis. This market appears to be one in which sellers, for strategic reasons, liquidity needs, or regulatory pressure, seek to rebalance their portfolios. In contrast, buyers, primarily funds-of-funds, take advantage of their flexibility to provide liquidity to sellers and thereby earn higher returns.

Table 9 indicates that funds-of-funds are the largest providers of liquidity in the secondary market. In Table 10 we characterize the types of transactions where funds-of-funds are providing the most liquidity by tabulating the selling and purchasing patterns of funds-of-funds and other investors by the age of the fund. These patterns indicate that funds-of-funds provide liquidity to sellers across funds of all ages, but that they are the most frequent providers of liquidity for tail-end transactions. The ratio of fund-of-funds buyers to other buyers in funds 0-3 years old is 3-to-1, compared to similar ratios of 5-to-1 in middle aged funds, and greater than 10-to-1 for tail-end transactions.

7. Institutional Considerations

There are a number of institutional features of the market that should be considered when interpreting our results.

Portfolio vs. non-portfolio bids. As discussed in Section 2.3, many transactions in our sample are traded as part of a portfolio transaction. It is possible that portfolio transactions differ systematically from transactions of individual funds. We re-estimate the difference between buyer and seller returns (Table 5) for a set of funds that were not sold as part of a portfolio and compare them to results for portfolio

transactions. The results are qualitatively similar, though there is a slightly larger difference between buyer and seller returns for non-portfolio transactions. We also note that we control for portfolio transactions in the regression results presented in Table 7.

Pricing dates. Another institutional feature that could influence our results is the timing of the NAVs used to calculate purchase prices. Because NAVs are reported with a lag, when investors bid on funds they are often making bids based on 1 to 2 quarter old NAVs. Given that NAVs usually appreciate through time, the price as a percent of the stated NAV at the time of the bid represents a larger discount to a NAV that corresponds to the closing date of the transaction. NAVs are reported quarterly, so the "staleness" of the NAV relative to the transacted price depends on the timing of the transaction relative to the timing of the reporting of new NAVs. We re-calculate our main results using two-quarter leading NAVs (e.g. the NAV of a fund reported two quarters after the time of a transaction) and find qualitatively similar results. Buyer-seller differences average 13.2 percentage points when returns are measured with IRRs, while differences average 3.8 percentage points using annualized PMEs.

Closely related to the stale NAV issue is the introduction of FASB 157 in 2007-2008, which changed NAV valuation practices and had the effect of making quarter-to-quarter changes in NAV more volatile. The inter-quarter volatility of NAVs due to FASB 157 has the potential to exacerbate the stale NAV issue during the majority of our sample period. Unfortunately, the introduction of FASB 157 coincides with the onset of the financial crisis, making it difficult to disentangle the effect of the crisis on NAVs from the effects of FASB 157.

Vintage Effects. In unreported regressions, we control for vintage effects for the set of regression models presented in Table 7. We find that vintage effects do not meaningfully alter the results. Fund returns are often negatively correlated with fundraising because periods of aggressive fundraising result in large pools of capital chasing a relatively fixed set of opportunities. For this reason, fundraising could affect the secondary market inventory. For example, mega buyout funds raised massive amounts of capital in 2006 that was deployed at aggressive valuations over the next year. Not surprisingly, many of the funds placed on the secondary market between 2011 and 2014 were managers allocating their portfolios away from mega

buyout funds. Vintage fixed effects soak up this type of variation in market pricing in our regressions, but we wish to emphasize the economics leading us to include vintage fixed effects.

Closely related to vintage effects is the timing of our sample, 2006-2014. In this period the financial crisis of 2008-2009 represents a unique episode for all financial markets and the secondary market is no exception. Secondary market purchasers, in particular, cite 2009 as a period of unique opportunity where young funds, poised for strong growth through the heart of the J curve, were sold at deep discounts. We note that our core set of results are robust to the removal of crisis transactions (see section 4.5 and Tables A2-A3). More generally, we emphasize that all the results presented in our analysis represent those from a small and somewhat unique sample period.

Asymmetric information. In Section 5 we discussed the nature of asymmetric information in the secondary market. It is not obvious, however, which party has the superior information in secondary market transactions. One possibility is that investors in funds are likely to hold private information about their investments, so the sellers have better information. Alternatively, active participants in the secondary market sometimes argue that information asymmetries could go the other way, with purchasers having more information about funds than sellers. This information advantage can occur because the most common type of secondary market purchaser, a fund-of-funds specializing in secondaries, specializes in acquiring information about private equity funds, especially those funds in which they have decided to invest. In contrast, sellers could potentially know less about the portfolio firms of a particular fund since they are invested in many different assets and are responsible for all of them. Though the specialized-buyer-information-advantage argument is compelling, we note that we fail to find statistical evidence that specialized buyers, as proxied by fund-of-funds buyers, are associated with statistically different NAV discounts or differences in buyer vs. seller returns. In summary, with respect to the role of asymmetric information in the secondary market, we find statistical evidence in Section 5 that smaller funds and transaction sizes sell at a discount to larger funds, consistent with the view that the fixed costs of information acquisition are impounded in market prices.

8. Summary and Discussion

Private equity funds raise capital from limited partners, invest it in portfolio companies, and return capital to the limited partners only after the fund exits its investments in the portfolio companies. Because of this structure, investments in private equity funds are relatively illiquid, and this illiquidity can be a substantial cost of investing in private equity. The market response to this illiquidity of private equity investments was to form a secondary market in which investors can trade those stakes. Using data provided by a leading intermediary in this market, this paper evaluates the magnitude of transactions costs in this market and consequently the extent to which this secondary market alleviates the illiquidity of private equity investments.

Investors have a desire to exit their private equity positions for a variety of reasons: to reduce their liability for future draw downs, to manage down their exposure to a particular manager or investment strategy, or to comply with regulatory considerations such as Solvency II, Basel III, and the Volcker rule. For these reasons, sellers can pay a haircut to be relieved of the liabilities associated with a private equity fund and nonetheless be better off. Buyers, on the other hand appear to purchase assets when they are available at a sufficiently large discount to their underlying value. Consequently, the transactions costs in this market appear to be borne primarily by the sellers, not the buyers.

Our results suggest that transactions costs in the secondary market for private equity investments are reasonably large. The most common transactions in this market are for funds that have been in existence for between 4 and 9 years; for these funds the typical transaction is at a discount of 9 percent to NAV. In these transactions, buyers outperform sellers by an IRR average of 17.0%, but much of this difference comes from the timing of their investments; the difference in annual performance for buyers and sellers relative to the public equity market is about 3% per year. Nonetheless, the liquidity cost of investing in this market is substantial and one that investors should take account of when considering investing in private equity.

Transactions costs appear to be relatively high, most likely because of the limited number of participants and the asymmetric information about both funds and their portfolio firms. Cross-sectionally,

our results suggest that when markets are thinner, and when there is likely to be higher asymmetric information, our measures of transactions costs are higher. In particular, we find that transactions costs are higher during poor economic times, when the fund is smaller, when the stake of the fund being transacted is smaller, and when funds have lower PMEs as of the transaction date. We also note that our estimates are obtained from a selected sample of funds that are larger, on average, than the average fund in the universe of funds.

We also consider the characteristics of the buyers and sellers. Sellers tend to be investors such as pension funds, foundations and endowments, which rely on cash flows from their investments to fund their real activities. These types of investors sometimes wish to rebalance their positions and to relieve themselves of the liability for future drawdowns. In contrast, the buyers of these funds tend to be non-traditional investors without immediate cash flow requirements, who increase their returns by providing liquidity to these cash flow oriented investors. Often these investors are funds of funds that are established for the explicit purpose of taking advantage of opportunities in the secondary market.

There are a number of implications of this analysis. First, we provide insights into the workings of the secondary market for private equity investments. This market appears to be a seller initiated market in which sellers pay the transactions costs. Yet, the very existence of this market, and its increased volume through time, indicates that the ability to obtain liquidity via the secondary market is valuable to sellers.

Second, the results suggest that even though investors can now sell their stakes in private equity investments, the sale of these stakes is costly. Therefore, investors should take the expected transaction cost of selling the position into account when making portfolio decisions, and limit their investments in private equity to those that are unlikely to be reversed in the future.

Third, the results imply that purchasers of stakes in private equity have done well historically, typically outperforming other investors in private equity. This strong performance has likely contributed to the growth and performance of funds of funds specializing in acquisitions of stakes in funds through the secondary market.

Fourth, the analysis provides an approach to estimating transactions costs in markets for which it is not easy to measure the fundamentals of the asset being transacted. If the expected returns to buyers and sellers absent any transactions costs should be equal, then a comparison of the two provides a lower bound on the magnitude of these costs.

Overall, the secondary market for private equity investments has developed for the same reason as any market, because there are buyers and sellers who wish to transact. Sellers are usually private equity investors who are seeking to rebalance their portfolio. Buyers tend to be opportunistic investors who are able to acquire stakes in private equity funds at a discount. Transactions costs in this market are high for reasons suggested by market microstructure theory: it is a relatively thin market with few buyers and sellers in which asymmetric information is likely to be high. These costs tend to be inversely related to fund size, so this market is an exit option for only investments in the largest and most well known funds. Consequently, the liquidity cost of investing in private equity is high, and likely to remain an important consideration for investors when managing their private equity portfolios.

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Figure 1: Global secondary transaction volume ($ billion)
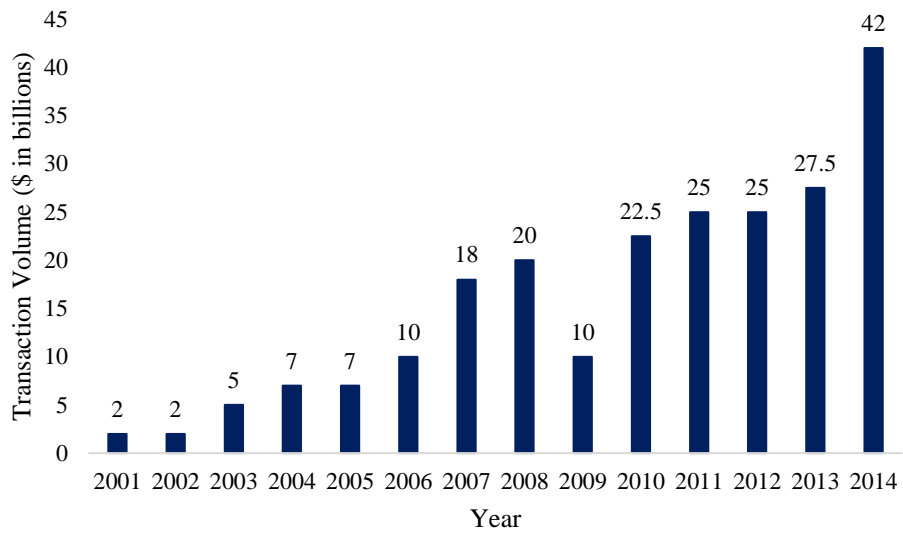
Table 1. Secondary Market Bid and Transaction Prices by Fund Type and by Year of Transaction

This table reports summary statistics on secondary market transactions by fund type (*Panel A)* and through time (*Panel B)*. We report the sample size, mean, median, and standard deviation of secondary market bids and of completed secondary market transaction prices. Bids and transaction prices are reported as a percent of the Net Asset Value (NAV) of the underlying funds being transacted. *Panel C* reports summary statistics on fund size, transaction size, and the transaction size as a fraction of fund size. Bid data, transaction prices, fund size, and transaction size data are all reported in the transaction database.

Panel A. Secondary Market Activity by Fund Type

| | Bid Data | | | | Transaction Data | | | |
| | Bid Price % NAV | | | | Purchase Price % NAV | | | |
	N	mean	median	SD	N	mean	median	SD
Buyout	2303	0.812	0.810	0.143	1132	0.851	0.865	0.305
Venture	603	0.691	0.704	0.121	704	0.900	0.856	0.385
Fund of Funds	25	0.740	0.740	0.111	56	0.784	0.788	0.192
Real Estate	195	0.807	0.825	0.083	77	0.946	0.937	0.228
Other	349	0.815	0.840	0.132	257	0.799	0.808	0.231
Total	3475	0.773	0.784	0.118	2226	0.862	0.856	0.323

Panel B. Secondary Market Activity through Time

| | Bid Data | | | | Transaction Data | | | |
| | Bid Price % NAV | | | | Purchase Price % NAV | | | |
	N	mean	median	SD	N	mean	median	SD
Pre-2006	--	--	--	--	9	0.733	0.737	0.178
2006	--	--	--	--	272	1.089	1.175	0.282
2007	--	--	--	--	217	0.993	0.950	0.434
2008	--	--	--	--	264	0.781	0.750	0.366
2009	--	--	--	--	213	0.544	0.526	0.187
2010	717	0.780	0.786	0.187	179	0.843	0.850	0.260
2011	778	0.766	0.780	0.137	259	0.822	0.803	0.218
2012	804	0.767	0.756	0.100	281	0.832	0.841	0.317
2013	602	0.787	0.785	0.118	222	0.866	0.833	0.236
2014	574	0.874	0.895	0.131	310	0.932	0.946	0.248
Total	3475	0.795	0.800	0.134	2226	0.862	0.856	0.323

Panel C. Average Fund and Transaction Size

| | | Fund Size ($ Million) | | | Transaction Size ($ Million) | | | Transaction Size as % of Fund Size | | |
	N	Mean	Med	SD	Mean	Med	SD	Mean	Med	SD
Buyout Funds	1052	$3,726.0	$1,800.0	$6,441.8	$12.6	$4.9	$25.2	0.016	0.003	0.122
Venture Funds	607	$458.9	$364.6	$389.3	$3.3	$1.8	$4.5	0.011	0.005	0.016
RE. FOF, Other	253	$1,308.2	$730.3	$1,584.3	$8.4	$3.8	$12.0	0.016	0.006	0.026

Table 2. Secondary Market Bid and Transaction Prices by Fund Size and Fund Experience

Panel A reports summary statistics on fund size and annualized IRRs for the universe of funds reported in the *Preqin* database. *Panel B* reports the same set of summary statistics for the intersection of funds in the *Preqin* and transaction sample.

Panel A. Summary Statistics on the Preqin Universe.

	Fund Size ($ M)				Annualized IRR			
	N	mean	median	SD	N	mean	median	SD
Buyout	787	1643.0	700.0	2658.3	787	0.107	0.110	0.170
Venture	710	386.2	247.5	447.4	710	0.075	0.061	0.203
Other	1043	1041.2	530.0	1491.3	1043	0.098	0.093	0.161
Total	2540	1044.6	460.5	1840.8	2540	0.094	0.090	0.177

Panel B. Summary Statistics on the Preqin – Transaction Sample Intersection

|	Fund Size ($ M)				Annualized IRR			
	N	mean	median	SD	N	mean	median	SD
Buyout	213	3253.2	1900.0	3877.5	213	0.124	0.116	0.110
Venture	132	546.3	424.4	488.3	132	0.068	0.036	0.211
Other	90	2076.4	1093.0	2485.0	90	0.101	0.105	0.116
Total	435	2188.3	875.0	3172.0	435	0.102	0.092	0.151

Table 3. Secondary Market Bid and Transaction Prices by Fund Age, Through Time

This table reports summary statistics on secondary market transactions by fund age at the time of a secondary market transaction. *Panel A* reports statistics for buyout funds while *Panels B* and *C* report prices and deal counts for venture and other funds, respectively. *Panel D* reports average fund age, in quarters, at the time of transaction, by year.

% of NAV for Completed Transactions			
	Fund Age at Time of Transaction		
	0-3 Years	4-9 Years	>=10 Years
Panel A. Buyout Funds			
Mean	0.718	0.909	0.822
Median	0.709	0.909	0.803
Std Dev.	0.320	0.238	0.421
N	84	462	175
Panel B. Venture Funds			
Mean	0.933	0.984	0.896
Median	0.934	0.948	0.835
Std Dev.	0.369	0.339	0.482
N	21	167	161
Panel C. Real Estate, Fund of Funds, Other			
Mean	0.789	0.895	0.753
Median	0.900	0.900	0.733
Std Dev.	0.320	0.149	0.297
N	23	75	18

Panel D. Fund Age at Time of Transaction

Average Fund Age at the Time of Transaction (# Quarters)				
Year	Count	Mean	Median	Std. Dev
2006	124	28.6	25	14.5
2007	108	32.1	31	13.0
2008	149	27.8	30	13.4
2009	100	19.5	14	13.0
2010	117	22.0	16	13.5
2011	158	26.7	22	11.8
2012	170	31.1	26	13.0
2013	127	40.2	35	16.4
2014	133	37.6	35	14.0

Table 4. Characterizing the Attributes of Funds that Sell.

This table presents estimates of equations in which the dependent variable is equal to one if a fund transacted in the secondary market. The equations are estimated by probit. The sample consists of a quarterly panel of funds in the *Preqin* universe. *Buyout* and *Venture* indicator variables are estimated relative to the "other" category of funds. *Log fund size* is the natural log of the fund size. The age indicator variables measure the age of funds, with funds 4-9 years old serving as the omitted category. *Fund PME* measures the performance of the fund up to the quarter in question (i.e., the to-date performance). We take the fund's NAV at that quarter as the liquidation value of the fund when calculating the fund's to-date PME. *Number of funds in fund family* measures the total number of funds reported in *Preqin* for a given General Partner. *Equity market price/earnings ratio* measures the aggregate equity market price/earnings ratio in a given quarter.

	Dependent Variable: Fund Sold in Secondary Market Indicator		
	(1)	(2)	(3)
Buyout Indicator	0.551***	0.537***	0.518***
	(9.489)	(8.678)	(8.054)
Venture Indicator	0.747***	0.722***	0.663***
	(9.815)	(9.602)	(8.571)
Log Fund Size	0.394***	0.438***	0.435***
	(14.838)	(18.562)	(18.811)
<= 3 Yr. Old Fund Indicator	-0.381***	-0.471***	-0.294**
	(-4.555)	(-5.003)	(-2.356)
4-9 Yr. Old Fund Indicator (omitted)			
>= 10 Yr. Old Fund Indicator	0.033	0.079	-0.063
	(0.434)	(1.067)	(-0.759)
Fund PME	-0.076	-0.137**	-0.151***
	(-1.386)	(-2.419)	(-2.668)
Number of Funds in Fund Family	-0.002	-0.004	-0.004
	(-0.532)	(-1.076)	(-1.242)
Equity Market Price/Earnings Ratio	-0.011		
	(-0.596)		
Quarter Fixed Effects	No	Yes	Yes
Vintage Fixed Effects	No	No	Yes
Std. Error Clustered by Quarter	Yes	Yes	Yes
Observations	53,975	53,975	53,975
Psuedo-R2	0.146	0.197	0.203

Table 5. Annualized IRRs to Buyers and Sellers in the Secondary Market.

This table reports average annualized IRRs to LPs over two different scenarios. *Secondary Market Seller Returns* are realized returns to LPs that invested in a fund at fund inception then sold their position in the fund through the secondary market. *Secondary Market Buyer Returns* are realized returns to LPs that bought into a fund through the secondary market then held the fund until the funds liquidation. In all return calculations, in circumstances where the fund has not liquidated we use the last available *Preqin* NAV as the assumed liquidation value. T-statistics are calculated with standard errors that are clustered by quarter of transaction. Reported returns are equally weighted. Unreported value weighted returns are qualitatively similar.

| | All Funds | | | | Fund Age at Time of Transaction | | | | | | | | | | | |
| | | | | | 0-3 Years | | | | 4-9 Years | | | | >= 10 Years | | | |
	Seller IRR	Buyer IRR	Buyer - Seller Diff.	T-stat	Seller IRR	Buyer IRR	Buyer - Seller Diff.	T-stat	Seller IRR	Buyer IRR	Buyer - Seller Diff.	T-stat	Seller IRR	Buyer IRR	Buyer - Seller Diff.	T-stat
Panel A. All Funds																
Mean	0.022	0.223	0.201	(3.59)	-0.262	0.248	0.510	(4.25)	0.028	0.198	0.170	(4.40)	0.165	0.274	0.110	(1.47)
Median	0.039	0.167			-0.250	0.214			0.033	0.156			0.106	0.195		
Std Dev.	0.264	0.320			0.375	0.212			0.191	0.257			0.237	0.481		
N	700	700			92	92			445	445			163	163		
Panel B. Buyout																
Mean	0.017	0.237	0.219	(4.56)	-0.283	0.256	0.539	(1.50)	0.040	0.224	0.184	(5.31)	0.143	0.266	0.123	(2.21)
Median	0.057	0.189			-0.277	0.219			0.047	0.18			0.135	0.181		
Std Dev.	0.246	0.302			0.352	0.191			0.194	0.243			0.128	0.486		
N	449	449			61	61			298	298			90	90		
Panel C. Venture																
Mean	0.045	0.201	0.156	(1.90)	-0.208	0.208	0.415	(1.50)	-0.008	0.135	0.144	(2.21)	0.193	0.309	0.116	(0.97)
Median	0.016	0.130			-0.057	0.133			0.003	0.097			0.051	0.214		
Std Dev.	0.299	0.368			0.481	0.29			0.186	0.279			0.334	0.479		
N	198	198			16	16			114	114			68	68		
Panel D. Other																
Mean	-0.024	0.187	0.211	(2.93)	-0.235	0.259	0.494	(3.30)	0.043	0.189	0.145	(2.33)	--	--	--	--
Median	0.023	0.166			-0.140	0.214			0.086	0.158			--	--		
Std Dev.	0.271	0.266			0.358	0.205			0.17	0.269			--	--		
N	53	53			15	15			33	33			--	--		

Table 6. Annualized PMEs for Buyers and Sellers in the Secondary Market

This table reports annualized PMEs to LPs over two different scenarios. *Seller annualized PMEs* are realized returns to LPs that invested in a fund at fund inception then sold their position in the fund through the secondary market. *Buyer annualized PMEs* are realized PMEs for LPs that bought into a fund through the secondary market then held the fund until the funds liquidation. We describe the details associated with the calculations in the Appendix   In all return calculations, in circumstances where the fund has not liquidated we use the last available *Preqin* NAV as the assumed liquidation value. T-statistics are calculated with standard errors that are clustered by quarter of transaction. Reported PMEs are equally weighted.

| | All Funds | | | | Fund Age at Time of Transaction | | | | | | | | | | | |
| | | | | | 0-3 Years | | | | 4-9 Years | | | | >= 10 Years | | | |
	Seller Annualized PME	Buyer Annualized PME	Buyer - Seller Diff.	T-stat	Seller Annualized PME	Buyer Annualized PME	Buyer - Seller Diff.	T-stat	Seller Annualized PME	Buyer Annualized PME	Buyer - Seller Diff.	T-stat	Seller Annualized PME	Buyer Annualized PME	Buyer - Seller Diff.	T-stat
Panel A. All Funds																
Mean	0.976	1.023	0.047	(2.36)	0.861	1.100	0.238	(3.02)	0.986	1.013	0.027	(2.74)	1.016	1.008	-0.008	(1.12)
Median	0.996	1.011			0.918	1.070			0.993	1.007			1.019	1.008		
Std Dev.	0.107	0.118			0.200	0.254			0.074	0.080			0.049	0.053		
N	700	700			92	92			445	445			163	163		
Panel B. Buyout																
Mean	0.982	1.027	0.045	(2.14)	0.856	1.102	0.246	(3.49)	0.995	1.019	0.024	(1.95)	1.023	1.001	-0.022	(4.20)
Median	1.006	1.012			0.917	1.077			1.002	1.008			1.030	1.008		
Std Dev.	0.106	0.105			0.187	0.195			0.075	0.080			0.035	0.058		
N	449	449			61	61			298	298			90	90		
Panel C. Venture																
Mean	0.973	1.012	0.038	(1.66)	0.882	1.089	0.207	(0.89)	0.966	0.997	0.031	(3.28)	1.007	1.018	0.012	(0.84)
Median	0.982	1.004			0.931	0.997			0.974	0.995			0.994	1.011		
Std Dev.	0.098	0.148			0.246	0.470			0.066	0.080			0.063	0.045		
N	198	198			16	16			114	114			68	68		
Panel D. Other																
Mean	0.946	1.036	0.091	(2.87)	0.862	1.100	0.239	(3.18)	0.973	1.015	0.041	(1.80)	--	--	--	--
Median	0.996	1.020			0.943	1.085			1.007	1.017			--	--		
Std Dev.	0.139	0.101			0.211	0.143			0.084	0.070			--	--		
N	53	53			15	15			33	33			--	--		

Table 7. The Association of Fund Attributes with %NAV Paid in Transactions.

This table reports the results of OLS regressions where the dependent variable in each model is the %NAV paid at the time of a transaction. *Venture Indicator* and *Buyout Indicator* are equal to one for venture and buyout funds, respectively. "Other" funds serve as the omitted group. *Equity market price/earnings ratio* measures the aggregate equity market price/earnings ratio in a given quarter. *Number of funds in fund family* measures the total number of funds in a GP family of funds. *Number of bids on fund* measures the number of bids on a given fund prior to the close of the transaction. *Log transaction size* is the log of the transaction size and *transaction size / fund size* measures the transaction size scaled by fund size. We construct a series of indicator variables for fund age. Funds between 4 and 9 years old are the omitted category for the fund age indicators. *Portfolio bid indicator* identifies transactions where an LP sold or bought multiple funds in a given transaction. Fund-of-funds *buy indicator* and fund-of-funds *sell indicator* identify the buy and sell transactions involving funds identified as funds-of-funds. *Fund PME* measures the performance of the fund at the time of a transaction, using the fund's NAV at that time as if it were a liquidating distribution. All standard errors are clustered at the transaction-quarter level.

	Dependent Var: % NAV Paid at Transaction							
	Full Sample					0-3 Yr Sample	4-9 Yr Sample	>10 Yr Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Venture Indicator	0.068	0.060	0.047	0.165***	0.162***	0.157	0.043	0.047
	(1.322)	(1.558)	(1.256)	(4.108)	(3.748)	(1.526)	(1.046)	(0.855)
Buyout Indicator	0.030	0.016	0.022	0.020	0.013	0.046	0.005	0.012
	(1.002)	(0.669)	(0.766)	(0.655)	(0.397)	(0.633)	(0.228)	(0.188)
<= 3 Yr. Old Fund Indicator	-0.125**	0.002	0.011	0.020	0.010			
	(-2.529)	(0.049)	(0.323)	(0.644)	(0.348)			
4-9 Yr. Old Fund Indicator (omitted)								
>= 10 Yr. Old Fund Indicator	-0.111***	-0.102***	-0.073***	-0.101***	-0.093***			
	(-3.076)	(-3.626)	(-3.798)	(-4.266)	(-3.519)			
Equity Market Price/Earnings Ratio		0.042***						
		(11.607)						
Number of Funds in Fund Family		-0.003	-0.003	-0.005**	-0.006**	-0.006	-0.000	-0.003
		(-1.338)	(-1.275)	(-2.519)	(-2.270)	(-1.094)	(-0.173)	(-0.552)
Log Fund Size		0.038***	0.037***	0.061***	0.066***	0.012	0.041***	0.048***
		(3.767)	(3.804)	(4.770)	(4.970)	(0.542)	(3.543)	(3.317)
Transaction Size / Fund Size		1.161**	1.215**	2.367***	2.509***	1.383	0.877**	4.376**
		(2.387)	(2.405)	(2.870)	(2.770)	(0.977)	(2.242)	(2.695)
Portfolio Bid Indicator		0.002	0.021	0.028	0.030	0.015	0.021	-0.007
		(0.091)	(1.111)	(1.427)	(1.522)	(0.183)	(1.222)	(-0.189)
Fund-of-funds Buy Indicator		0.023	-0.013	-0.031	-0.030	-0.002	-0.015	-0.011
		(1.330)	(-1.047)	(-1.518)	(-1.405)	(-0.065)	(-0.983)	(-0.374)
Fund-of-funds Sell Indicator		0.012	-0.025	-0.008	-0.008	-0.005	-0.013	-0.010
		(0.393)	(-1.196)	(-0.376)	(-0.336)	(-0.111)	(-0.462)	(-0.215)
Number of Bids on Fund				0.004	0.004			
				(1.406)	(1.291)			
PME at time of Transaction				0.052***	0.026			
				(3.254)	(1.483)			
Avg. G.P. PME					0.089**			
					(2.529)			
Avg. G.P. Log Size					-0.006			
					(-0.516)			
Avg. G.P. Age					-0.000			
					(-0.697)			
Transaction Quarter Fixed Effects	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Std. Err. Clustered by Transaction Quarter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,073	2,073	2,073	843	843	288	1,185	600
R-squared	0.034	0.214	0.321	0.418	0.421	0.478	0.344	0.191

Table 8. Difference between Buyer and Seller IRRs and PMEs

This table reports the results of OLS regressions where the dependent variable in models (1)-(3) is the difference in annualized IRRs of buyers and sellers in a given transaction. Models (4)-(6) report differences in buyer and seller returns for annualized PMEs. *Venture Indicator* and *Buyout Indicator* are equal to one for venture and buyout funds, respectively. "Other" funds serve as the omitted group. *Equity market price/earnings ratio* measures the aggregate equity market price/earnings ratio in a given quarter. *Number of funds in fund family* measures the total number of funds in a GP's family of funds. *Number of bids on fund* measures the number of bids on a given fund prior to the close of the transaction. *Log transaction size* is the log of the transaction size and *transaction size / fund size* measures the transaction size scaled by fund size. We construct a series of indicator variables for fund age. Funds between 4 and 9 years old are the omitted category for the fund age indicators. *Portfolio bid indicator* identifies transactions where an LP sold or bought multiple funds in a given transaction. Fund-of-funds *buy indicator* and fund-of-funds *sell indicator* identify the buy and sell transactions involving funds identified as funds-of-funds. *Fund PME* measures the performance of the fund at the time of a transaction, using the fund's NAV at that time as if it were a liquidating distribution. All standard errors are clustered at the transaction-quarter level.

	Buyer Annualized IRR Minus Seller Annualized IRR			Buyer Annualized PME minus Seller Annualized PME		
	(1)	(2)	(3)	(4)	(5)	(6)
Venture Indicator	0.010	0.061	0.073	0.003	0.006	0.023
	(0.141)	(0.933)	(1.136)	(0.077)	(0.154)	(0.597)
Buyout Indicator	0.038	-0.041	-0.035	-0.017	-0.033	-0.036
	(0.629)	(-0.869)	(-0.654)	(-0.554)	(-1.136)	(-1.208)
<= 3 Yr. Old Fund Indicator	0.291***	0.111*	0.125**	0.188**	0.132**	0.121**
	(3.382)	(1.879)	(2.211)	(2.736)	(2.539)	(2.306)
4-9 Yr. Old Fund Indicator (omitted)						
>= 10 Yr. Old Fund Indicator	-0.036	-0.039	-0.071	-0.034***	-0.024	-0.040**
	(-0.599)	(-0.708)	(-1.251)	(-3.138)	(-1.645)	(-2.726)
Equity Market Price/Earnings Ratio		-0.060***			0.003***	
		(-7.092)			(3.065)	
Number of Funds in Fund Family		-0.010**	-0.008*		-0.001	-0.001
		(-2.062)	(-1.733)		(-0.722)	(-0.497)
Log Fund Size		0.030*	0.016		0.014	0.004
		(1.761)	(0.915)		(1.361)	(0.345)
Transaction Size / Fund Size		-6.516***	-7.403***		-2.023**	-2.599***
		(-3.316)	(-4.268)		(-2.260)	(-3.193)
Portfolio Bid Indicator		-0.048	-0.000		-0.031	-0.009
		(-1.227)	(-0.004)		(-1.657)	(-0.436)
Fund-of-funds Buy Indicator		-0.030	-0.008		-0.022	-0.019
		(-0.857)	(-0.196)		(-0.897)	(-0.633)
Fund-of-funds Sell Indicator		0.067**	0.065		0.022	0.015
		(2.077)	(1.296)		(1.228)	(0.831)
Number of Bids on Fund		-0.005	-0.012**		-0.000	-0.002
		(-1.607)	(-2.526)		(-0.457)	(-1.494)
Transaction Quarter Fixed Effects	No	No	Yes	No	No	Yes
Std. Err. Clustered by Transaction Quarter	Yes	Yes	Yes	Yes	Yes	Yes
Observations	700	700	700	700	700	700
R-squared	0.059	0.311	0.368	0.127	0.244	0.297

Table 9. Frequency of Funds-of-Funds as Buyer and Seller

This table reports buyer and seller transaction counts by LP type, fund-of-funds and other LPs. Other LPs include pensions, endowments, trusts, foundations, financial institutions, sovereign funds, and state investment funds. *Panel's A, B, and C* tabulate counts for buyout, venture, and other funds, respectively.

Panel A. Transaction Counts - Buyout Funds

	Buy Transactions			Sell Transactions	
Year	Fund-of-funds	Other	Year	Fund-of-funds	Other
2006	39	5	2006	8	36
2007	41	6	2007	< 5	47
2008	91	4	2008	41	54
2009	43	13	2009	27	29
2010	66	24	2010	27	63
2011	112	20	2011	60	72
2012	115	8	2012	39	84
2013	52	11	2013	20	43
2014	48	23	2014	17	54
Total	607	114	Total	239	482

Panel B. Transaction Counts - Venture Funds

	Buy Transactions			Sell Transactions	
Year	Fund-of-funds	Other	Year	Fund-of-funds	Other
2006	68	7	2006	29	46
2007	51	< 5	2007	< 5	52
2008	43	< 5	2008	18	27
2009	35	< 5	2009	6	30
2010	14	< 5	2010	10	6
2011	14	< 5	2011	11	< 5
2012	29	< 5	2012	21	11
2013	40	< 5	2013	23	19
2014	30	< 5	2014	< 5	33
Total	324	25	Total	122	227

Panel C. Transaction Counts - Other Funds

	Buy Transactions			Sell Transactions	
Year	Fund-of-funds	Other	Year	Fund-of-funds	Other
2006	< 5	< 5	2006	< 5	< 5
2007	6	< 5	2007	< 5	6
2008	< 5	7	2008	6	< 5
2009	< 5	6	2009	5	< 5
2010	5	6	2010	< 5	8
2011	7	5	2011	< 5	8
2012	13	< 5	2012	7	8
2013	20	< 5	2013	5	17
2014	24	< 5	2014	< 5	25
Total	82	34	Total	34	82

Table 10. Buyers and Sellers by Type and Fund Age.

This table reports buyer and seller transaction counts by fund age at the time of transaction and by LP type, fund-of-funds and other LPs. Other LPs include pensions, endowments, trusts, foundations, financial institutions, sovereign funds, and state investment funds. *Panel's A, B, C, and D* tabulate counts for all fund types, buyout, venture, and other funds, respectively.

	Buy Transaction			Sell Transaction		
	0-3 Yr. Old Fund	4-9 Yr. Old Fund	>=10 Yr. Old Fund	0-3 Yr. Old Fund	4-9 Yr. Old Fund	>=10 Yr. Old Fund
Panel A. All Funds						
Other	31	112	30	75	511	205
Fund-of-funds	97	592	324	53	193	149
Panel B. Buyout						
Other	16	82	16	56	324	102
Fund-of-funds	68	380	159	28	138	73
Panel C. Venture						
Other	<5	13	11	7	128	92
Fund-of-funds	20	154	150	14	39	69
Panel D. Other						
Other	14	17	<5	12	59	11
Fund-of-funds	9	58	15	11	16	7

Appendix A

This appendix briefly outlines the calculation of annualized PMEs for buyers and sellers in the private equity/venture capital secondary market. In order to show precisely how the buyer, seller, and fund PME relate, consider the following expressions that demonstrate how each of the PME measures are calculated.

$$Ann.SellerPME = \left(\frac{\sum_{t=0}^{T}[\frac{Distribution_t}{(1+r_t)}] + \frac{(NAV\ at\ Trans.*\ \%NAV\ Paid\ in\ Trans.)_T}{(1+r_T)}}{\sum_{t=0}^{T}\frac{Call_t}{(1+r_t)}} \right) \wedge \frac{1}{(T/4)}$$

$$Ann.BuyerPME = \left(\frac{\sum_{t=T+1}^{N}[\frac{Distribution_t}{(1+r_t)}]}{\frac{(NAV\ at\ Trans.*\ \%NAV\ Paid\ in\ Trans.)_T}{(1+r_T)} + \sum_{t=T+1}^{N}\frac{Call_t}{(1+r_t)}} \right) \wedge \frac{1}{((N-T)/4)}$$

$$Ann.Full\ Fund\ PME = \left(\frac{\sum_{t=0}^{N}\frac{Distribution_t}{(1+r_t)}}{\sum_{t=0}^{N}\frac{Call_t}{(1+r_t)}} \right) \wedge \frac{1}{(N/4)}$$

In these expressions, date 0 is the quarter of the fund inception, date T represents the number of quarters from fund inception to the quarter of a secondary transaction, r_t is the return on the S&P 500 from date 0 to t, and N is number of quarters from date 0 to the fund's liquidation date. All cash flows are assumed to occur at the end of a quarter. In an effort to avoid double counting, calls and distributions prior to and including quarter T are assigned to the seller, and subsequent calls and distributions flow to the buyer. The buyer and seller PME equations defined above indicate that *all* cash flows are discounted back to date 0. In nearly all cases, the sum of the annualized seller and buyer PMEs will not equal the annualized full fund PME. Appendix Table A1 compares annualized and non-annualized buyer, seller, and full-fund PMEs. We also note that our seller PME calculation does not take into account fees paid by the seller to the intermediary that arranges the transaction. These fees, which vary in size based on the size of the deal and other market conditions, will lower the seller PME.

Appendix Table A1: Buyer, Seller, and Full Fund-Life PMEs

This table reports annualized and un-annualized PMEs to LPs over three different scenarios. *Seller PMEs* are realized returns to LPs that invested in a fund at fund inception then sold their position in the fund through the secondary market. *Buyer PMEs* are realized PMEs for LPs that bought into a fund through the secondary market then held the fund until the funds liquidation. In all return calculations, in circumstances where the fund has not liquidated we use the last available *Preqin* NAV as the assumed liquidation value. *Full Fund-Life PMEs* calculate PMEs for an investor that held the fund through the full life of the fund. Again, *Preqin* NAVs are assumed as the liquidation value for funds not yet liquidated at the end of our sample.

	Annualized PMEs			PMEs		
Panel A. All Funds	*Seller Annualized PME*	*Buyer Annualized PME*	*Full Fund-Life Annualized PME*	*Seller PME*	*Buyer PME*	*Full Fund-Life PME*
Mean	0.976	1.023	1.000	1.060	1.182	1.119
Median	0.996	1.011	1.004	0.974	1.064	1.030
Std Dev.	0.107	0.118	0.040	0.550	0.562	0.528
N	700	700	700	700	700	700
Panel B. Buyout						
Mean	0.982	1.027	1.006	1.077	1.180	1.153
Median	1.006	1.012	1.009	1.030	1.067	1.085
Std Dev.	0.106	0.105	0.036	0.423	0.521	0.374
N	449	449	449	449	449	449
Panel C. Venture						
Mean	0.973	1.012	0.990	1.048	1.193	1.064
Median	0.982	1.004	0.990	0.887	1.027	0.895
Std Dev.	0.098	0.148	0.045	0.787	0.670	0.797
N	198	198	198	198	198	198
Panel D. Other						
Mean	0.946	1.036	0.992	0.953	1.149	1.040
Median	0.996	1.020	1.011	0.975	1.107	1.085
Std Dev.	0.139	0.101	0.051	0.403	0.444	0.343
N	53	53	53	53	53	53

Appendix: Table A2. Average IRRs to Buyers and Sellers in the Secondary Market Excluding Crisis Transactions

This table reports average IRRs to LPs over two different scenarios. *Secondary Market Seller Returns* are realized returns to LPs that invested in a fund at fund inception then sold their position in the fund through the secondary market. *Secondary Market Buyer Returns* are realized returns to LPs that bought into a fund through the secondary market then held the fund until the funds liquidation. We exclude all transactions that occurred between 2007:Q3 and 2009:Q2. In all return calculations, in circumstances where the fund has not liquidated we use the last available *Preqin* NAV as the assumed liquidation value. T-statistics are calculated with standard errors that are clustered by quarter of transaction. Reported returns are equally weighted. Unreported value weighted returns are qualitatively similar.

| | All Funds | | | | Fund Age at Time of Transaction | | | | | | | | | | | |
| | | | | | 0-3 Years | | | | 4-9 Years | | | | >= 10 Years | | | |
Panel A. All Funds	Seller IRR	Buyer IRR	Buyer - Seller Diff.	T-stat	Seller IRR	Buyer IRR	Buyer - Seller Diff.	T-stat	Seller IRR	Buyer IRR	Buyer - Seller Diff.	T-stat	Seller IRR	Buyer IRR	Buyer - Seller Diff.	T-stat
Mean	0.043	0.219	0.176	(4.64)	-0.133	0.215	0.348	(2.97)	0.031	0.199	0.168	(5.54)	0.147	0.279	0.132	(1.83)
Median	0.044	0.177			-0.097	0.214			0.025	0.165			0.106	0.202		
Std Dev.	0.219	0.299			0.348	0.201			0.175	0.232			0.217	0.452		
N	477	477			44	44			319	319			114	114		
Panel B. Buyout																
Mean	0.047	0.233	0.187	(6.86)	-0.128	0.228	0.357	(3.13)	0.037	0.212	0.175	(6.82)	0.157	0.312	0.155	(3.54)
Median	0.059	0.186			-0.104	0.214			0.038	0.18			0.142	0.203		
Std Dev.	0.197	0.297			0.347	0.197			0.171	0.226			0.125	0.491		
N	331	331			28	28			238	238			65	65		
Panel C. Venture																
Mean	0.056	0.183	0.127	(1.66)	--	--	--	--	0.018	0.129	0.111	(1.94)	0.130	0.266	0.136	(1.06)
Median	0.012	0.133			--	--			0.011	0.097			0.015	0.214		
Std Dev.	0.266	0.312			--	--			0.199	0.232			0.313	0.394		
N	111	111			--	--			58	58			44	44		
Panel D. Other																
Mean	-0.025	0.202	0.226	(3.00)	--	--	--	--	-0.003	0.231	0.234	(4.20)	--	--	--	--
Median	0.023	0.214			--	--			0.018	0.214			--	--		
Std Dev.	0.247	0.276			--	--			0.152	0.272			--	--		
N	35	35			--	--			23	23			--	--		

Appendix: Table A3. Annualized PMEs for Buyers and Sellers in the Secondary Market Excluding Crisis Transactions

This table reports annualized PMEs to LPs over two different scenarios. *Seller annualized PMEs* are realized returns to LPs that invested in a fund at fund inception then sold their position in the fund through the secondary market. *Buyer annualized PMEs* are realized PMEs for LPs that bought into a fund through the secondary market then held the fund until the funds liquidation. We exclude all transactions that occurred between 2007:Q3 and 2009:Q2. In all return calculations, in circumstances where the fund has not liquidated we use the last available *Preqin* NAV as the assumed liquidation value. T-statistics are calculated with standard errors that are clustered by quarter of transaction. Reported PMEs are equally weighted.

| | All Funds | | | | Fund Age at Time of Transaction | | | | | | | | | | | |
| | | | | | 0-3 Years | | | | 4-9 Years | | | | >= 10 Years | | | |
Panel A. All Funds	Seller Annualized PME	Buyer Annualized PME	Buyer - Seller Diff.	T-stat	Seller Annualized PME	Buyer Annualized PME	Buyer - Seller Diff.	T-stat	Seller Annualized PME	Buyer Annualized PME	Buyer - Seller Diff.	T-stat	Seller Annualized PME	Buyer Annualized PME	Buyer - Seller Diff.	T-stat
Mean	0.980	1.010	0.029	(2.34)	0.868	1.047	0.179	(2.00)	0.984	1.006	0.022	(2.43)	1.013	1.005	-0.007	(1.22)
Median	0.994	1.007			0.918	1.039			0.991	1.004			1.018	1.008		
Std Dev.	0.094	0.092			0.195	0.238			0.072	0.066			0.047	0.037		
N	477	477			44	44			319	319			114	114		
Panel B. Buyout																
Mean	0.987	1.012	0.024	(1.83)	0.869	1.060	0.192	(2.20)	0.991	1.008	0.017	(1.58)	1.024	1.003	-0.021	(4.52)
Median	1.005	1.006			0.922	1.047			0.996	1.004			1.031	1.008		
Std Dev.	0.093	0.082			0.203	0.202			0.072	0.063			0.030	0.042		
N	331	331			28	28			238	238			65	65		
Panel C. Venture																
Mean	0.975	0.999	0.024	(1.07)	--	--	--	--	0.967	0.998	0.031	(2.35)	0.996	1.010	0.015	(2.16)
Median	0.974	1.007			--	--			0.971	1.005			0.982	1.009		
Std Dev.	0.072	0.117			--	--			0.063	0.076			0.061	0.030		
N	111	111			--	--			58	58			44	44		
Panel D. Other																
Mean	0.930	1.025	0.095	(2.43)	--	--	--	--	0.954	1.008	0.054	(1.97)	--	--	--	--
Median	0.977	1.012			--	--			0.977	1.004			--	--		
Std Dev.	0.140	0.090			--	--			0.089	0.070			--	--		
N	35	35			--	--			23	23			--	--		