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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 explain 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 with 0.976 for sellers, implying that buyers outperform sellers by a market-adjusted 5 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.

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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 10–12 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.

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 2007–2009 financial crisis and some very old funds after the crisis. The most common type of transaction in our sample is for a fund between four and nine 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 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 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 internal rate of returns (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, differ-

ences 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 reflect other factors, aside from liquidity costs. One possibility is that, in our sample, sellers tend to hold their positions during worse economic times (around the financial crisis) and buyers are more likely to hold 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 annualized PME averages 1.023 compared with 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 PME for funds between four and nine 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 four and nine 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 PME 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 more information asymmetries exist 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 less capital is 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 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. Most of the buyers in our sample are funds of

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. 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 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 PME to compare returns over different horizons because buyer and seller holding periods generally differ.

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. 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 show are potentially not representative of the price at which a randomly selected fund would transact. Further, it is possible that the transactions facilitated by our data provider are not representative of transactions 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, e.g., 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 examining the returns to investors who hold their stakes for only 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 shown here, the returns that initial LPs in private equity funds receive are often sufficient to compensate for the market and liquidity risks they face. Similarly, Sorensen et al. (2014) find 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 shown the importance of liquidity in secondary markets other than private equity. Ramadorai (2012, 2013) examine the secondary market for hedge

funds and find that liquidity concerns, in addition 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 et al. (2004) and Fung et al. (2008) 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 et al. (2014) argues that private equity funds of funds are an important exception and show 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 that private equity funds of funds have had good performance is that a number these funds specialize in acquiring private equity funds on the secondary market and that these transactions have historically performed very well.

Prior work by Kleymenova et al. (2012) examines aspects of the secondary market in private equity. Their work focuses on understanding prices bid for LP stakes, but it does not analyze 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 shows 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

In this section we discuss the institutional features of the private equity secondary market.

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

³ For estimates of hold-to-maturity private equity fund performance, see Kaplan and Schoar (2005), Ljungqvist et al. (2007), Phalippou and Gottschalg (2009), Higson and Stucke (2012), Phalippou (2012), Robinson and Sensoy (2013, 2016), and Harris et al. (2014). For estimates of differences in hold-to-maturity fund returns across LPs, see Lerner et al. (2007), Sensoy et al. (2014), and Cavagnaro et al. (2017).

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, because 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 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 the full life of the fund. 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 to be relieved of the obligation to provide capital for the fund's subsequent investments.

Industry professionals suggest that LPs choose to sell their positions prior to the end of the fund's life for a number of reasons. The most common motivations for investors to sell a position include a set of reasons best characterized as active portfolio management, such as 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 went through important broad strategy shifts that brought many investors to sell their private equity holdings, including efforts to manage down their private equity relations. 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 buy-out funds or funds that would accommodate direct co-investment along with traditional private equity investments.

Investors sometimes choose to sell for reasons outside of active portfolio management. Unexpected cash flow demands such as those occurring during the 2007–2009 financial crisis can lead investors to desire liquidity. In addition, some investors have restrictions on their portfolio composition and can become overweighted in private equity following declines in the public markets, given that

⁴ A few funds are open-end and do allow investors to receive capital back from the fund at specified times. 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).

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 no way exists 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 four and nine 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 life-cycle 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, some transactions 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 more than \$14 billion in a number of different secondary funds of funds. The returns to these secondary funds are generated by the returns on the underlying private equity funds and by the funds being acquired at a discount (or premium) to their fundamental value.

2.3. How the market is structured

Because of the demand from potential sellers and buyers, some intermediaries around 2001 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 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

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.

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.

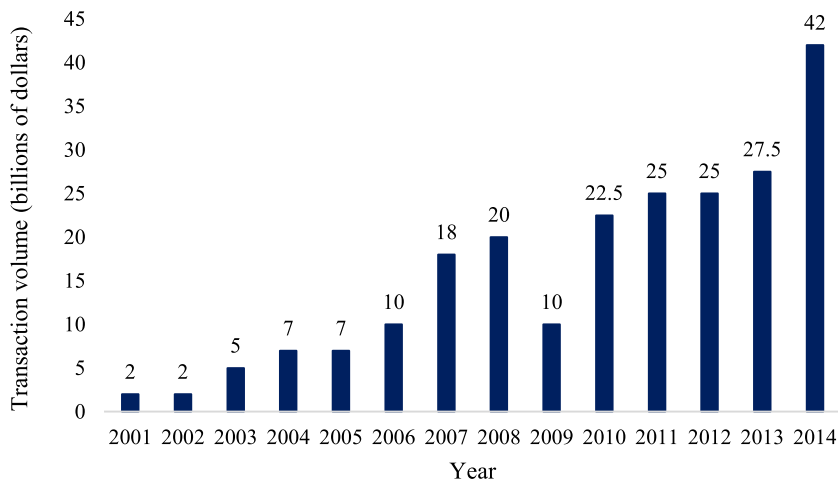


Fig. 1. Global secondary transaction volume (billions of dollars).

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

Fig. 1 presents statistics on the size of the secondary market through time, based on an industry report provided by our data intermediary. This figure shows that the market has grown dramatically, from \$2 billion in 2001 to \$42 billion in 2014. An increase in volume is evident around the time of the 2007–2009 financial crisis, presumably because endowments and pension funds worked to lower their exposure to private equity. Subsequent to the financial crisis, volume has continued to increase. Even the \$42 billion volume in 2014 represents a small fraction of total private equity commitments, so the secondary market volume likely will continue to grow in the future.

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, because 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 selective about new LPs.

⁸ Pricing discounts could be compensation for adverse changes in fund value before an agreed upon deal funds. We find no relation 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.

2.4. The cost of transacting

Stakes in private equity funds are long-term investments with 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 nondisclosure 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. Substantial residual information asymmetry results, 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

¹⁰ In 2003, when the University of Michigan provided performance data to a newspaper, Sequoia Capital announced that it would refuse to accept capital from the university. More recently, in 2014, KKR threatened to cut off the Iowa Public Pension Fund from future investments if it complied with a public records request about the fees that it paid KKR. See Wall Street Journal (2014). These examples, however, are exceptions, and most GPs find fund-raising 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.

market assessment of the asset's fundamental value. Analogously, in an initial public offering or seasoned equity offering, the transaction cost paid by the issuer 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 no clear market-based assessment of the stake's true value exists.

Practitioners typically use NAV to reflect the fund's fundamental value, as NAV is the measure of the fund's value that is reported to the fund's investors.¹² However, substantial discretion is 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, some evidence shows 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., 2016](#); [Barber and Yasuda, 2017](#); [Brown et al., 2016](#)).

The purchase price of the stake and, consequently, any discount to NAV applies only 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 drawn down only 5% of its commitments, an LP who sells a stake at a 50% discount to NAV is 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. Because discounts from NAV can be misleading, we also compute returns to buyers and sellers based on the price at which the 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 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

This section describes the data we use to evaluate the private equity secondary market.

¹² 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, have 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.

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 run from 2006 to 2014. While the private equity secondary market has existed since 2001, only \$23 billion in transactions occurred between 2001 and 2005, compared with \$200 billion in the years 2006–2014 (see [Fig. 1](#)). In our sample period of 2006–2014, about 90% of all secondary market transactions have occurred.

Our database contains information on bids and transaction prices for stakes marketed by the broker, the total value of the transactions, and 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 2440 completed transactions. Implementing a screen within the transaction data for outliers for which the percent of NAV paid for a transaction seems implausible (less than 25% or greater than 400%, or other data errors on transaction price) reduces the sample to 2226 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 1998 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 1054 fund quarter transactions.

One concern with computing returns to secondary market investments is the possibility that a secondary market buyer purchases a fund at a discount to NAV in one quarter and then marks the value of the fund to NAV in the subsequent quarters, generating a mechanically large paper return. Because of this concern, we remove observations in which a transaction took place within four 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

¹³ In a previous draft, we present 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, because some observations are mechanically marked up shortly after the purchase.

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 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

Fund type	Bid data: bid price as percent of NAV				Transaction data: purchase price as percent of NAV			
	N	Mean	Median	Standard deviation	N	Mean	Median	Standard deviation
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

Year	Bid data: bid price as percent of NAV				Transaction data: purchase price as percent of NAV			
	N	Mean	Median	Standard deviation	N	Mean	Median	Standard deviation
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

Funds	N	Fund size (millions of dollars)			Transaction size (millions of dollars)			Transaction size as percent of fund size		
		Mean	Median	Standard deviation	Mean	Median	Standard deviation	Mean	Median	Standard deviation
Buyout funds	1052	\$3726.0	\$1800.0	\$6441.8	\$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
Real estate, funds of funds, other	253	\$1308.2	\$730.3	\$1584.3	\$8.4	\$3.8	\$12.0	0.016	0.006	0.026

not appear representative of the full sample and are likely driven by misreported cash flow data in Preqin. Finally, we require that each transaction involves a fund that has sufficient data to calculate returns to both buyers and sellers. The resulting sample is seven hundred 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, and the remaining 46 are real estate, funds of funds, or 'other' fund types.¹⁴

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 Panels A and B of Table 1 differ from those in Panel C because of missing data on fund size for some transactions.

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 and all other funds combined together in a fifth category.¹⁵ This table indicates that the bid and transaction prices generally occur at a discount to 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 2303 bids and 1132 transactions,

¹⁵ Funds in this 'other' category include funds specializing in distressed debt, energy, infrastructure, natural resources, restructuring, special situations, and an 'other' category defined by the broker.

Table 2

Secondary market bid and transaction prices by fund size and fund experience.

Panel A reports summary statistics on fund size and annualized internal rate of returns (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.

Funds	Fund size (millions of dollars)				Annualized IRR			
	N	Mean	Median	Standard deviation	N	Mean	Median	Standard deviation
<i>Panel A: Summary statistics on the Preqin universe</i>								
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	1,491.3	1043	0.098	0.093	0.161
Total	2540	1044.6	460.5	1840.8	2540	0.094	0.090	0.177
<i>Panel B: Summary statistics on the Preqin universe and transaction sample intersection</i>								
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

and the next most common is venture with 603 bids and 704 transactions.¹⁶ Panel B of Table 1 reports the number and price of bids and transactions in our sample by year. The number of transactions remains roughly constant over time (between two hundred and three hundred per year). Because 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, each transaction has roughly three bids.

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 2007–2009 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) was not particularly high relative to other years, suggesting a shortage of potential buyers at this time. 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 reports that 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% and 10%, with the exception of the financial crisis during which they increased to over 11%.¹⁷ These comparisons suggest that liquidity 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 shows the fund size and transaction size, expressed in dollars and as a fraction of fund size. The buyout funds that are transacted have a mean assets under management (AUM) of \$3.7 billion (median \$1.8 billion), the venture funds have a mean AUM of \$459 million (median \$365 million), and the remaining funds have a mean AUM of \$1.3 billion (median \$730 million). Transaction sizes are also largest for buyout funds, with a mean size of \$12.6 million for buyout funds compared with \$3.3 million 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 and 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 \$3.2 billion, compared with \$1.6 billion 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, sufficient demand and information must be available for the fund, which usually occurs for larger funds. Investments in large funds appear to be more liquid than investments in smaller ones. The larger funds have more transactions 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: zero to three years, four to nine years, and at least ten years. Funds generally expect to exit their investments by year ten, 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 “ten or more

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 and mutual fund NAVs are based on market values. We draw a comparison only to closed-

end mutual fund discounts because these discounts are frequently used as proxies for economy-wide liquidity costs.

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 and 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. NAV = net asset value.

	N	Mean	Median	Standard deviation
Fund age at time of transaction (percent of NAV for completed transactions)				
<i>Panel A: Buyout funds</i>				
Zero to three years	84	0.718	0.709	0.320
Four to nine years	462	0.909	0.909	0.238
Ten or more years	175	0.822	0.803	0.421
<i>Panel B: Venture funds</i>				
Zero to three years	21	0.933	0.934	0.369
Four to nine years	167	0.984	0.948	0.339
Ten or more years	161	0.896	0.835	0.482
<i>Panel C: Real Estate, fund of funds, other</i>				
Zero to three years	23	0.789	0.900	0.320
Four to nine years	75	0.895	0.900	0.149
Ten or more years	18	0.753	0.733	0.297
Average fund age at time of transaction (number of quarters)				
<i>Panel D: Time of transaction</i>				
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

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 four and nine 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. A large number of tail-end transactions, 354, 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 zero to three 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 three years of the fund's life, 28 occurred in 2009 with another 18 in 2008. In contrast, very few stakes of venture funds were sold during the crisis. Only five of the 21 total transactions were in 2009. The higher average prices for venture funds

sold in the first three years likely occur because of this difference. If we exclude crisis transactions from both the buyout and the venture summary statistics, each type has similar average prices in the sale of zero to three 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. 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. 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, much more information is available about larger funds, and more potential buyers, who already own a stake in the fund, have acquired the necessary information on them. As

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 indicator* 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 four to nine 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 net asset value at that quarter as the liquidation value of the fund when calculating the fund's to-date private market equivalent (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-to-earnings ratio in a given quarter. (** $p < 0.05$, *** $p < 0.01$).

Variable	Dependent variable: <i>Fund sold in secondary market indicator</i>		
	Model 1	Model 2	Model 3
<i>Buyout indicator</i>	0.551*** (9.489)	0.537*** (8.678)	0.518*** (8.054)
<i>Venture indicator</i>	0.747*** (9.815)	0.722*** (9.602)	0.663*** (8.571)
<i>Log fund size</i>	0.394*** (14.838)	0.438*** (18.562)	0.435*** (18.811)
≤ 3 -year-old fund indicator	-0.381*** (-4.555)	-0.471*** (-5.003)	-0.294** (-2.356)
≥ 10 -year-old fund indicator	0.033 (0.434)	0.079 (1.067)	-0.063 (-0.759)
<i>Fund PME</i>	-0.076 (-1.386)	-0.137** (-2.419)	-0.151*** (-2.668)
<i>Number of funds in fund family</i>	-0.002 (-0.532)	-0.004 (-1.076)	-0.004 (-1.242)
<i>Equity market price/earnings ratio</i>	-0.011 (-0.596)		
<i>4-9-year-old fund indicator (omitted)</i>			
Quarter fixed effects	No	Yes	Yes
Vintage fixed effects	No	No	Yes
Standard error clustered by quarter	Yes	Yes	Yes
Number of observations	53,975	53,975	53,975
Pseudo R^2	0.146	0.197	0.203

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

This section provides estimates of returns to buyers and sellers in private equity secondary markets.

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 report that the average return to sellers was 2.2% and 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 show stark differences in seller returns for funds of different ages.

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 weigh the transactions by the value of the transaction. Using this approach gives similar results to those reported in Table 5. However, some extremely large transactions in our sample make this calculation potentially unrepresentative. The maximum transaction is for a stake with a NAV of \$325 million, and the median transaction is for only \$4.6 million. When weighted by fund size, average (median) differences between buyer and seller average returns are as large as 28.3% (17.8%).

¹⁸ Our statistical tests of the differences between buyer and seller returns cluster standard errors by quarter of transaction. One concern with

Table 5

Annualized internal rate of returns (IRRs) to buyers and sellers in the secondary market.

This table reports average annualized IRRs to limited partners (LPs) over two different scenarios. Secondary market seller returns are realized returns to LPs that invested in a fund at fund inception and 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 and then held the fund until the funds liquidation. In all return calculations, in circumstances in which the fund has not liquidated, we use the last available Preqin net asset value as the assumed liquidation value. *t*-statistics, reported in parentheses, are calculated with standard errors that are clustered by quarter of transaction. Reported returns are equally weighted. Unreported value weighted returns are qualitatively similar.

Statistic	Fund age at time of transaction															
	All funds				Zero to three years				Four to nine years				Ten or more years			
	Seller IRR	Buyer IRR	Buyer–seller difference	<i>t</i> -statistic	Seller IRR	Buyer IRR	Buyer–seller difference	<i>t</i> -statistic	Seller IRR	Buyer IRR	Buyer–seller difference	<i>t</i> -statistic	Seller IRR	Buyer IRR	Buyer–seller difference	<i>t</i> -statistic
<i>Panel A: All funds</i>																
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		
Standard deviation	0.264	0.320			0.375	0.212			0.191	0.257			0.237	0.481		
<i>N</i>	700	700			92	92			445	445			163	163		
<i>Panel B: Buyout</i>																
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	0.180			0.135	0.181		
Standard deviation	0.246	0.302			0.352	0.191			0.194	0.243			0.128	0.486		
<i>N</i>	449	449			61	61			298	298			90	90		
<i>Panel C: Venture</i>																
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		
Standard deviation	0.299	0.368			0.481	0.290			0.186	0.279			0.334	0.479		
<i>N</i>	198	198			16	16			114	114			68	68		
<i>Panel D: Other</i>																
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			−	−		
Standard deviation	0.271	0.266			0.358	0.205			0.170	0.269			−	−		
<i>N</i>	53	53			15	15			33	33			−	−		

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 during the 2007–2009 financial crisis. In transactions of funds between four and nine 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 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 show that, for buyout funds, the average IRR for buying institutions was 23.7% , compared with 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. The earlier part of our sample includes the 2007–2009 financial crisis, and the later part of our sample includes the 2010–2014 period in which the equity market performed very well. Because buyers held their positions later in time than sellers, the observed differences in IRRs between buyers and sellers could reflect this timing instead of 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, which compares private equity performance relative to the benchmark of public equity markets, and is often the preferred way to evaluate private equity performance (see Sorensen and Jagannathan, 2015; 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. 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 an-

nualized 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 reports that, for the overall sample, sellers have an average annualized PME of 0.976 ; buyers, 1.023 . These average annualized PMEs show that sellers under-perform the public equity market by 2.4% per year; 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 one, 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%). Also, our calculation of seller PMEs do not incorporate fees paid to the intermediary. Taking these fees 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, with sellers earning 86.1% per year of what they would have earned in the public equity market. Sellers who sell between year four and year nine of the fund's life earn 98.6% per year of the public equity market return, and sellers who hold until year ten 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.

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 four and nine 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 occurs 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, not 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

Table 6

Annualized public market equivalents (PMEs) for buyers and sellers in the secondary market.

This table reports annualized PME to limited partners (LPs) over two different scenarios. *Seller annualized PMEs* are realized returns to LPs that invested in a fund at fund inception and 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 and 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 in which the fund has not liquidated, we use the last available Preqin net asset value as the assumed liquidation value. *t*-statistics, reported in parentheses, are calculated with standard errors that are clustered by quarter of transaction. Reported PMEs are equally weighted.

Statistic	Fund age at time of transaction															
	All funds				Zero to three years				Four to nine years				Ten or more years			
	Seller annualized PME	Buyer annualized PME	Buyer-seller difference	<i>t</i> -statistic	Seller annualized PME	Buyer annualized PME	Buyer-seller difference	<i>t</i> -statistic	Seller annualized PME	Buyer annualized PME	Buyer-seller difference	<i>t</i> -statistic	Seller annualized PME	Buyer annualized PME	Buyer-seller difference	<i>t</i> -statistic
<i>Panel A: All funds</i>																
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		
Standard deviation	0.107	0.118			0.200	0.254			0.074	0.080			0.049	0.053		
<i>N</i>	700	700			92	92			445	445			163	163		
<i>Panel B: Buyout</i>																
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		
Standard deviation	0.106	0.105			0.187	0.195			0.075	0.080			0.035	0.058		
<i>N</i>	449	449			61	61			298	298			90	90		
<i>Panel C: Venture</i>																
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		
Standard deviation	0.098	0.148			0.246	0.470			0.066	0.080			0.063	0.045		
<i>N</i>	198	198			16	16			114	114			68	68		
<i>Panel D: Other</i>																
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			-	-	-	-
Standard deviation	0.139	0.101			0.211	0.143			0.084	0.070			-	-	-	-
<i>N</i>	53	53			15	15			33	33			-	-	-	-

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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

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 shown in the literature instead of 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 with 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 PME for our sample of funds average 1.00, compared with 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 2007–2009 financial crisis, there were large pricing discounts, and buyers who purchased stakes at these discounts earned high returns and 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 four- to nine-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 four- to nine-year-old funds when crisis transactions are excluded, compared with a 2.7% difference when all transactions are included.

The largest change in the results when crisis transactions are excluded is for zero- to three-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 with 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.

The vast majority of our sample does not occur during the 2007–2009 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, not fire sale prices that occurred during the financial crisis.

4.5. The costs and benefits of selling fund commitments

Though we have shown 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 Standard & Poor's (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 \$1.27 million (\$637,000). 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 in which liquidity is more likely to be a motivating force, that is, the sale of funds three years old or younger, the average present value of uncommitted capital is \$3.55 million. In dollar terms, the average (median) dollar discount from NAV associated with selling a stake is \$1.62 million (\$718,000). Pricing discounts for younger than three-year-old funds is larger, \$1.98 million, on average. In sum, for the average fund in our sample, an LP realizes a dollar discount to NAV of \$1.62 million in exchange for the liquidity gained from the sale and for relief from the obligation to fund an addition present value of \$1.27 million in future years. Younger funds (less than three years) realize an average dollar discount of \$1.98 million in exchange for relief from a present value obligation of \$3.55 million.

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 two main factors 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](#); [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, the NAV is an accounting measure that can deviate substantially from the market's assessment of the value of a fund's invested assets. For this reason, we use, as a second measure of transactions costs, 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.

Six main implications emanate from these estimates. First, transactions costs appear to be countercyclical because 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 less capital is available to purchase stakes in private equity funds. Consequently, when the economy is doing poorly and price-to-earnings ratios are low, transaction prices in our sample tend to be lower relative to the stake's underlying value. Returns to buyers are therefore higher. In addition, more investors likely wish 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. An acquirer likely will in-

cur fixed costs in gaining 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, fewer investors are familiar with the deals that the fund has made, so asymmetric information is likely to be higher than for larger funds. Finally, more buyers likely are 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 three years trade at a much larger discount than other funds. 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 are likely to sell young funds only during poor financial conditions, which in our sample means during the financial crisis, especially 2009.²¹

Fourth, consistent with the unconditional tabulations presented in [Table 3](#), the oldest funds in the sample, those sold when they are ten 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, is statistically significantly different from zero.

Sixthly, 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

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 merging of our secondary market transaction data with Preqin.

²¹ Another reason the young funds have large NAV discounts is that young funds have substantial future capital commitments. If a fund has a substantial future capital commitment, then a large young fund discount 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 relation between NAV discounts and percent unfunded. This equation implies that a 10% increase in percent unfunded is associated with an almost 10 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.

Table 7

The association of fund attributes with % NAV paid at transactions.

This table reports the results of ordinary least squares regressions in which the dependent variable in each model is % NAV paid at 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-to-earnings ratio in a given quarter. *Number of funds in fund family* measures the total number of funds in a general partner (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 four and nine years old are the omitted category for the fund age indicators. *Portfolio bid indicator* identifies transactions in which a limited partner 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. *PME at time of transaction* measures the performance of the fund at the time of a transaction, using the fund's net asset value at that time as if it were a liquidating distribution. *t*-statistics, reported in parentheses, are calculated with standard errors that are clustered by quarter of transaction. (** $p < 0.05$, *** $p < 0.01$).

Variable	Dependent variable: % NAV paid at transaction							
	Full sample					Zero- to three-year sample	Four- to nine-year sample	Ten or more year sample
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
<i>Venture indicator</i>	0.068 (1.322)	0.060 (1.558)	0.047 (1.256)	0.165*** (4.108)	0.162*** (3.748)	0.157 (1.526)	0.043 (1.046)	0.047 (0.855)
<i>Buyout indicator</i>	0.030 (1.002)	0.016 (0.669)	0.022 (0.766)	0.020 (0.655)	0.013 (0.397)	0.046 (0.633)	0.005 (0.228)	0.012 (0.188)
≤ 3 -year-old fund indicator	-0.125** (-2.529)	0.002 (0.049)	0.011 (0.323)	0.020 (0.644)	0.010 (0.348)			
≥ 10 -year-old fund indicator	-0.111*** (-3.076)	-0.102*** (-3.626)	-0.073*** (-3.798)	-0.101*** (-4.266)	-0.093*** (-3.519)			
<i>Equity market price/earnings ratio</i>		0.042*** (11.607)						
<i>Number of funds in fund family</i>		-0.003 (-1.338)	-0.003 (-1.275)	-0.005** (-2.519)	-0.006** (-2.270)	-0.006 (-1.094)	-0.000 (-0.173)	-0.003 (-0.552)
<i>Log fund size</i>		0.038*** (3.767)	0.037*** (3.804)	0.061*** (4.770)	0.066*** (4.970)	0.012 (0.542)	0.041*** (3.543)	0.048*** (3.317)
<i>Transaction size / Fund size</i>		1.161** (2.387)	1.215** (2.405)	2.367*** (2.870)	2.509*** (2.770)	1.383 (0.977)	0.877** (2.242)	4.376** (2.695)
<i>Portfolio bid indicator</i>		0.002 (0.091)	0.021 (1.111)	0.028 (1.427)	0.030 (1.522)	0.015 (0.183)	0.021 (1.222)	-0.007 (-0.189)
<i>Fund of funds buy indicator</i>		0.023 (1.330)	-0.013 (-1.047)	-0.031 (-1.518)	-0.030 (-1.405)	-0.002 (-0.065)	-0.015 (-0.983)	-0.011 (-0.374)
<i>Fund of funds sell indicator</i>		0.012 (0.393)	-0.025 (-1.196)	-0.008 (-0.376)	-0.008 (-0.336)	-0.005 (-0.111)	-0.013 (-0.462)	-0.010 (-0.215)
<i>Number of bids on fund</i>				0.004 (1.406)	0.004 (1.291)			
<i>PME at time of transaction</i>				0.052*** (3.254)	0.026 (1.483)			
<i>Average GP PME</i>					0.089** (2.529)			
<i>Average GP log size</i>					-0.006 (-0.516)			
<i>Average GP age</i>					-0.000 (-0.697)			
<i>4-9-year-old fund indicator (omitted)</i>								
Transaction quarter fixed effects	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Standard error clustered by transaction quarter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of 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

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. In Columns 4-6 we use 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. 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, a consistent cross-sectional pattern emerges 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

Table 8

Difference between buyer and seller internal rate of return (IRRs) and public market equivalents (PMEs).

This table reports the results of ordinary least squares regressions in which 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-to-earnings ratio in a given quarter. *Number of funds in fund family* measures the total number of funds in a general partner'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 four and nine years old are the omitted category for the fund age indicators. *Portfolio bid indicator* identifies transactions in which a limited partner 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. *t*-statistics, reported in parentheses, are calculated with standard errors that are clustered by quarter of transaction. (** $p < 0.05$, *** $p < 0.01$).

Variable	Buyer annualized IRR minus Seller annualized IRR			Buyer annualized PME minus Seller annualized PME		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>Venture indicator</i>	0.010 (0.141)	0.061 (0.933)	0.073 (1.136)	0.003 (0.077)	0.006 (0.154)	0.023 (0.597)
<i>Buyout indicator</i>	0.038 (0.629)	-0.041 (-0.869)	-0.035 (-0.654)	-0.017 (-0.554)	-0.033 (-1.136)	-0.036 (-1.208)
≤ 3 -year-old fund indicator	0.291*** (3.382)	0.111* (1.879)	0.125** (2.211)	0.188** (2.736)	0.132** (2.539)	0.121** (2.306)
≥ 10 -year-old fund indicator	-0.036 (-0.599)	-0.039 (-0.708)	-0.071 (-1.251)	-0.034*** (-3.138)	-0.024 (-1.645)	-0.040** (-2.726)
<i>Equity market price/earnings ratio</i>		-0.060*** (-7.092)			0.003*** (3.065)	
<i>Number of funds in fund family</i>		-0.010** (-2.062)	-0.008* (-1.733)		-0.001 (-0.722)	-0.001 (-0.497)
<i>Log fund size</i>		0.030* (1.761)	0.016 (0.915)		0.014 (1.361)	0.004 (0.345)
<i>Transaction size/fund size</i>		-6.516*** (-3.316)	-7.403*** (-4.268)		-2.023** (-2.260)	-2.599*** (-3.193)
<i>Portfolio bid indicator</i>		-0.048 (-1.227)	-0.000 (-0.004)		-0.031 (-1.657)	-0.009 (-0.436)
<i>Fund of funds buy indicator</i>		-0.030 (-0.857)	-0.008 (-0.196)		-0.022 (-0.897)	-0.019 (-0.633)
<i>Fund of funds sell indicator</i>		0.067** (2.077)	0.065 (1.296)		0.022 (1.228)	0.015 (0.831)
<i>Number of bids on fund</i>		-0.005 (-1.607)	-0.012** (-2.526)		-0.000 (-0.457)	-0.002 (-1.494)
<i>4–9-year-old fund indicator (omitted)</i>						
Transaction quarter fixed effects	No	No	Yes	No	No	Yes
Standard error clustered by transaction quarter	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	700	700	700	700	700	700
R-squared	0.059	0.311	0.368	0.127	0.244	0.297

private equity are 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 thus far 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. Regarding 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 and buyers should be investors with sufficient flexibility to take advantage of market opportunities, such as funds of funds.

Funds of funds are commonly created for purchasing funds in the secondary market and do not have cash flow requirements. As a result, they are a potential purchaser of unwanted stakes in private equity funds. Table 9 shows the frequency of funds of funds as buyers instead of 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, and other investors are buyers in only 14.6%. The majority of the sellers (66.6%) are LPs other than funds of funds. Table 10 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

Table 9

Frequency of funds of funds as buyer and seller.

This table reports buyer and seller transaction counts by limited partner (LP) type, fund of funds and other LPs. Other LPs are pensions, endowments, trusts, foundations, financial institutions, sovereign funds, and state investment funds. Panels A, B, and C tabulate counts for buyout, venture, and other funds, respectively.

Year	Buy transactions		Sell transactions	
	Fund of funds	Other	Fund of funds	Other
<i>Panel A: transaction counts, buyout funds</i>				
2006	39	5	8	36
2007	41	6	< 5	47
2008	91	4	41	54
2009	43	13	27	29
2010	66	24	27	63
2011	112	20	60	72
2012	115	8	39	84
2013	52	11	20	43
2014	48	23	17	54
Total	607	114	239	482
<i>Panel B: Transaction counts, venture funds</i>				
2006	68	7	29	46
2007	51	< 5	< 5	52
2008	43	< 5	18	27
2009	35	< 5	6	30
2010	14	< 5	10	6
2011	14	< 5	11	< 5
2012	29	< 5	21	11
2013	40	< 5	23	19
2014	30	< 5	< 5	33
Total	324	25	122	227
<i>Panel C: Transaction counts, other funds</i>				
2006	< 5	< 5	< 5	< 5
2007	6	< 5	< 5	6
2008	< 5	7	6	< 5
2009	< 5	6	5	< 5
2010	5	6	< 5	8
2011	7	5	< 5	8
2012	13	< 5	7	8
2013	20	< 5	5	17
2014	24	< 5	< 5	25
Total	82	34	34	82

Volcker rule were at their peak. Second, almost 43% of all endowment sales occurred during the financial crisis, and 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. 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 in which 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 zero to three years old is three-to-one, compared with similar ratios of five-to-one in middle-age funds and greater than ten-to-one for tail-end transactions.

7. Institutional considerations

A number of institutional features of the market should be considered when interpreting our results.

7.1. Portfolio versus non-portfolio bids

Many transactions in our sample are traded as part of a portfolio transaction (See Section 2.3). Portfolio transactions could differ systematically from transactions of individual funds. We reestimate 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 with results for portfolio transactions. The results are qualitatively similar, though a slightly larger difference exists between buyer and seller returns for non-portfolio transactions. Also, we control for portfolio transactions in the regression results presented in Table 7.

7.2. 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 one- to two-quarter-old NAVs. Given that NAVs usually appreciate, 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 recalculate 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, and differences average 3.8 percentage points using annualized PMEs.

Closely related to the stale NAV issue is the introduction of Financial Accounting Standards Board (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.

7.3. 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

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 limited partners (LP) type, fund of funds, and other LPs. Other LPs are pensions, endowments, trusts, foundations, financial institutions, sovereign funds, and state investment funds. Panels A, B, C, and D tabulate counts for all fund types, buyout, venture, and other funds, respectively.

Fund type	Buy transaction			Sell transaction		
	Zero- to three-year-old fund	Four- to nine-year-old fund	Ten or more year-old fund	Zero- to three-year-old fund	Four- to nine-year-old fund	Ten or more year-old fund
<i>Panel A: All funds</i>						
Other	31	112	30	75	511	205
Fund of funds	97	592	324	53	193	149
<i>Panel B: Buyout</i>						
Other	16	82	16	56	324	102
Fund of funds	68	380	159	28	138	73
<i>Panel C: Venture</i>						
Other	< 5	13	11	7	128	92
Fund of funds	20	154	150	14	39	69
<i>Panel D: Other</i>						
Other	14	17	< 5	12	59	11
Fund of funds	9	58	15	11	16	7

results. Fund returns are often negatively correlated with fund-raising because periods of aggressive fund-raising result in large pools of capital chasing a relatively fixed set of opportunities. For this reason, fund-raising could affect the secondary market inventory. For example, mega buyout funds raised massive amounts of capital in 2006 that were 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 2007–2009 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 in which young funds, poised for strong growth through the heart of the J curve, were sold at deep discounts. 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.

7.4. Asymmetric information

In Section 5, we discuss the nature of asymmetric information in the secondary market. Which party has the superior information in secondary market transactions is not obvious. One possibility is that investors in funds are likely to hold private information about their investments, so the sellers have better information. 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 in-

formation advantage can occur because the most common type of secondary market purchaser, that is 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. Sellers could know less about the portfolio firms of a particular fund because they are invested in many different assets and are responsible for all of them. Though the specialized buyer information advantage argument is compelling, 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 versus seller returns. In summary, with respect to the role of asymmetric information in the secondary market, we find statistical evidence that smaller funds and transaction sizes sell at a discount to larger funds (see Section 5), 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 the 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 the secondary market and consequently the extent to which this market alleviates the illiquidity of private equity investments.

Investors have a desire to exit their private equity positions for a variety of reasons, for example, to reduce their

liability for future drawdowns, 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 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 four and nine years. For these funds, the typical transaction is at a discount of 9% 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 asymmetric information is likely to be higher, our measures of transactions costs are higher. 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 PME as of the transaction date. 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. 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.

This analysis has a number of implications. 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 buyers and sellers 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: that is, 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 investments only 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.

Appendix A

This Appendix briefly outlines the calculation of annualized PMEs for buyers and sellers in the private equity and 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: (*Add A1, A2, A3 labels for equations*)

$$\begin{aligned} \text{Annual Seller PME} &= \left(\frac{\sum_{t=0}^T \left[\frac{\text{Distribution}_t}{(1+r_t)} \right] + \frac{(\text{NAV at Transaction} \times \text{NAV Paid in Transaction})_T}{(1+r_T)}}{\sum_{t=0}^T \frac{\text{Call}_t}{(1+r_t)}} \right) \wedge \frac{1}{(T/4)}, \end{aligned} \quad (\text{A1})$$

$$\begin{aligned} \text{Annual Buyer PME} &= \left(\frac{\sum_{t=T+1}^N \left[\frac{\text{Distribution}_t}{(1+r_t)} \right]}{(\text{NAV at Transaction} \times \text{NAV Paid in Transaction})_T + \sum_{t=T+1}^N \frac{\text{Call}_t}{(1+r_t)}} \right) \wedge \frac{1}{((N-T)/4)}, \end{aligned} \quad (\text{A2})$$

and

$$\begin{aligned} \text{Annual Full Fund PME} &= \left(\frac{\sum_{t=0}^N \frac{\text{Distribution}_t}{(1+r_t)}}{\sum_{t=0}^N \frac{\text{Call}_t}{(1+r_t)}} \right) \wedge \frac{1}{(N/4)}. \end{aligned} \quad (\text{A3})$$

In these expressions, date 0 is the quarter of the fund inception, date T represents the number of quarters from

Table A1

Buyer, seller, and full fund life public market equivalents (PMEs).

This table reports annualized and un-annualized PMEs to limited partners (LPs) over three different scenarios. *Seller PMEs* are realized returns to LPs that invested in a fund at fund inception and 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 and then held the fund until the funds liquidation. In all return calculations, in circumstances in which the fund has not liquidated we use the last available Prequin net asset value (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, Prequin NAVs are assumed as the liquidation value for funds not yet liquidated at the end of our sample.

Statistic	<i>Seller annualized PMEs</i>	<i>Buyer annualized PMEs</i>	<i>Full fund life annualized PMEs</i>	<i>Seller PMEs</i>	<i>Buyer PMEs</i>	<i>Full fund life PMEs</i>
<i>Panel A: All funds</i>						
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
Standard deviation	0.107	0.118	0.040	0.550	0.562	0.528
N	700	700	700	700	700	700
<i>Panel B: Buyout</i>						
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
Standard deviation	0.106	0.105	0.036	0.423	0.521	0.374
N	449	449	449	449	449	449
<i>Panel C: Venture</i>						
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
Standard deviation	0.098	0.148	0.045	0.787	0.670	0.797
N	198	198	198	198	198	198
<i>Panel D: Other</i>						
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
Standard deviation	0.139	0.101	0.051	0.403	0.444	0.343
N	53	53	53	53	53	53

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 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. 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.

Table A2

Average internal rate of returns (IRRs) to buyers and sellers in the secondary market excluding crisis transactions.

This table reports average IRRs to limited partners (LPs) over two different scenarios. *Secondary market seller returns* are realized returns to LPs that invested in a fund at fund inception and 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 and 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 in which the fund has not liquidated we use the last available Prequin net asset value as the assumed liquidation value. *t*-statistics, reported in parentheses, are calculated with standard errors that are clustered by quarter of transaction. Reported returns are equally weighted. Unreported value-weighted returns are qualitatively similar.

Statistic	Fund age at time of transaction															
	All funds				Zero to three years				Four to nine years				Ten or more years			
	Seller IRR	Buyer IRR	Buyer-seller difference	<i>t</i> -statistic	Seller IRR	Buyer IRR	Buyer-seller difference	<i>t</i> -statistic	Seller IRR	Buyer IRR	Buyer-seller difference	<i>t</i> -statistic	Seller IRR	Buyer IRR	Buyer-seller difference	<i>t</i> -statistic
<i>Panel A: All funds</i>																
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		
Standard deviation	0.219	0.299			0.348	0.201			0.175	0.232			0.217	0.452		
<i>N</i>	477	477			44	44			319	319			114	114		
<i>Panel B: Buyout</i>																
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	0.180			0.142	0.203		
Standard deviation	0.197	0.297			0.347	0.197			0.171	0.226			0.125	0.491		
<i>N</i>	331	331			28	28			238	238			65	65		
<i>Panel C: Venture</i>																
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		
Standard deviation	0.266	0.312			-	-			0.199	0.232			0.313	0.394		
<i>N</i>	111	111			-	-			58	58			44	44		
<i>Panel D: Other</i>																
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			-	-		
Standard deviation	0.247	0.276			-	-			0.152	0.272			-	-		
<i>N</i>	35	35			-	-			23	23			-	-		

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Table A3

Annualized public market equivalents (PMEs) for buyers and sellers in the secondary market excluding crisis transactions.

This table reports annualized PMEs to limited partners (LPs) over two different scenarios. *Seller annualized PMEs* are realized returns to LPs that invested in a fund at fund inception and 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 and 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 in which the fund has not liquidated we use the last available Prequin net asset value as the assumed liquidation value. *t*-statistics, reported in parentheses, are calculated with standard errors that are clustered by quarter of transaction. Reported PMEs are equally weighted.

Statistic	Fund age at time of transaction															
	All funds				Zero to three years				Four to nine years				Ten or more years			
	<i>Seller</i> annualized PMEs	<i>Buyer</i> annualized PMEs	<i>Buyer-seller</i> difference	<i>t</i> -statistic	<i>Seller</i> annualized PMEs	<i>Buyer</i> annualized PMEs	<i>Buyer-seller</i> difference	<i>t</i> -statistic	<i>Seller</i> annualized PMEs	<i>Buyer</i> annualized PMEs	<i>Buyer-seller</i> difference	<i>t</i> -statistic	<i>Seller</i> annualized PMEs	<i>Buyer</i> annualized PMEs	<i>Buyer-seller</i> difference	<i>t</i> -statistic
<i>Panel A: All funds</i>																
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		
Standard deviation	0.094	0.092			0.195	0.238			0.072	0.066			0.047	0.037		
<i>N</i>	477	477			44	44			319	319			114	114		
<i>Panel B: Buyout</i>																
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		
Standard deviation	0.093	0.082			0.203	0.202			0.072	0.063			0.030	0.042		
<i>N</i>	331	331			28	28			238	238			65	65		
<i>Panel C: Venture</i>																
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		
Standard deviation	0.072	0.117			-	-			0.063	0.076			0.061	0.030		
<i>N</i>	111	111			-	-			58	58			44	44		
<i>Panel D: Other</i>																
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			-	-		
Standard deviation	0.140	0.090			-	-			0.089	0.070			-	-		
<i>N</i>	35	35			-	-			23	23			-	-		

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