Private Equity Real Estate Funds: Returns, Risk Exposures, and Persistence

by

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Abstract

Using performance data through 2017Q4 on 467 funds that came to market between 2000 and 2013, we first examine the unconditional performance of closed-end, Private Equity Real Estate (PERE) returns over time and across various fund characteristics. The performance metrics include the internal rate of return (IRR), the multiple on invested capital (MOIC), and a proxy for the public market equivalent (PME). Using conditional sorts, as well as regression procedures with asset pricing specifications, we estimate the exposure of PERE performance to fund-level characteristics and macroeconomic environment risk factors and find that both fund characteristics and macroeconomic risk factors significantly affect PERE performance. More specifically, we find that PERE performance is positively related to fund size, GDP growth changes, private market real estate returns, interest rate changes, and default spread changes and negatively related to vintage volume. International funds dramatically underperformed relative to domestic funds during our sample period. We also find that fund performance is positively associated with the performance of prior funds raised by the same PERE firm.

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Introduction

Commercial real estate (CRE) investments require significant equity capital, entail long lead times to structure and close transactions, and benefit from economies of scale in financing, third-party fees and costs, and operational efficiency. As a result, private equity real estate (PERE) funds have become an increasingly important source of CRE funding and growth. According to Prequin, the aggregate PERE fund capitalization exceeded $900 billion as of 2Q 2018. Advantages of investing in a non-listed real estate funds include the ability to gain portfolio exposure to (CRE) with less commitment of equity capital, easier implementation of investment strategies compared with direct investment in CRE, diversification benefits, and access to expert management. In addition, many investors are attracted to non-listed funds because of their expected high correlation with the underlying CRE market, although PERE funds, especially closed-end funds, do suffer from the same lack of liquidly as direct investments in CRE.[1]

Much research exists on the exposure of listed real estate returns to firm-specific risk and macroeconomic risk factors (Ling and Naranjo, 1997; Pavlov et al., 2015). However, despite PERE's increasing significance in real estate capital markets, the return performance and risk profile of PERE funds are not well understood. Kaplan and Sensoy (2015) provide a comprehensive survey of the literature on non-real estate private equity performance and conclude that "There is clearly more work to be done to fully understand the sources and magnitudes of the risks facing PE investors." "Attempting to do so is a fertile area for future research." The aim of this paper is to contribute to our understanding of the returns and risk exposures of PERE funds.

We first document the time varying and cross-sectional performance of a large sample of closed-end PERE funds. We then estimate the exposure of fund-level returns and other performance metrics to fund-level characteristics, market risk, and macroeconomic variables. For the fund characteristics, we estimate the influence of fund size, vintage year, and investment strategy, among other variables. For market risks, we estimate PERE's exposure to the National Council of Real Estate Investment Fiduciaries (NCREIF) Open End Diversified Core Equity (ODCE) Index and to the aggregate annual volume of capital raised

[1] See Arnold, Ling, and Naranjo (2017) for an expanded discussion of the typical life cycle and risks of a closed-end PERE fund.

for PERE funds.[2] For the macroeconomic environment, we examine the influence of the business cycle and other risks of the economic environment by estimating the exposure of PERE fund performance to GDP growth, interest rate changes, and changes in risk premiums in the bond market. We also examine the extent to which PERE fund performance can be explained by the performance of prior funds sponsored by a PERE fund manager (fund persistence).

With the above unique analyses and tests, we contribute to market participants' strategic understanding of the factors driving PERE performance as well as to the academic and practitioner literatures that examines the extent to which the business environment and fund-specific factors drive PERE performance, as well as the role of prior fund performance. A few related papers have examined dimensions of PERE performance (e.g., Hahn et. al, 2005; Tomperi, 2010; Bond and Mitchell, 2010; Fisher and Hartzell, 2016, and Delfim and Hoesli, 2016). However, none have comprehensively examined in a U.S. context the drivers of PERE performance, including the incremental and contextual roles of PERE fund persistence.

The rest of this paper is structured as follows. In the next section, we provide some background on the universe of PERE funds and the data limitations that challenge researchers in this area. In section three, we describe our empirical strategy and in section four we provide information describing the composition of our PERE fund database as well as summary statistics characterizing our performance measures. In section five, we discuss the summary statistics for our regression variables as well as our regression results, including the extent to which the performance of prior funds brought to market by a fund manager explains the performance of its subsequent fund. Section six concludes.

Background and Motivation

Ideally, actual, rather than the manager's estimates of returns (income and capital appreciation) for each PERE fund would be available on a quarterly basis. This would allow each fund's quarterly return to be regressed on contemporaneous or lagged fund-specific and

[2] The NCREIF Fund Index Open End Diversified Core Equity (NFI- ODCE) is a capitalization-weighted and time-weighted index of the investment returns of 25 open-end commingled funds with a core investment focus reflecting lower risk, utilizing lower leverage, comprised of equity ownership of stabilized operating properties diversified across the United States and across property sectors. NFI-ODCE is considered a reasonable proxy for core real estate investments purchased through commingled ownership.

macroeconomic risk factors.[3] If estimated in a panel regression framework, such regressions would allow the researcher to make inferences about the typical fund's exposure to common risk factors and allow the comparison of these exposures to other competing asset classes (public stocks, bonds, etc.). Such analyses can also produce the average "alpha" for the funds in the sample, allowing the researcher to make inferences about the "abnormal" return performance of the sample. The availability of quarterly total return data would also allow the researcher to examine the cross sectional-determinants of fund returns by including fund characteristics in the performance regressions, such as fund size, leverage, geographical focus, property type focus, and investment style (e.g., core, value-added, or opportunistic investment strategies). Examples of time-series analyses of private equity real estate returns using periodic fund–level cash flow data and returns include Alcock, et al. (2013), Fuerst and Matysiak (2013), Delfim and Hoesli (2016), Pagliari (2017), and Farrelly and Simon Stevenson (2017).

Unfortunately, in practice, the total returns of non-listed assets, such as direct real estate and PERE funds, which are measured on a quarter-to-quarter basis, suffer from potentially severe measurement problems. In particular, even if periodic cash investments and cash flow distributions to investors are available, periodic changes in the value of the fund's assets are estimated by the manager or, occasionally, by an independent fee appraiser at intermittent intervals (e.g., one-to-three years). The reliance on estimated valuations rather than transaction prices is well known to produce lagging and smoothing in the reported period-by-period capital appreciation reported by the manager; therefore, estimated total returns suffer from serial correlation over time.[4] This measurement problem means that inferences made about systematic risk, idiosyncratic risk, excess returns, and the sensitivity of fund returns to various fund characteristics using quarterly, or even annual, data are highly suspect.

To avoid the problems associated with the use of lagged and smoothed quarterly return data, we follow the approach of Kaplan and Schoar (2005), Robinson and Sensoy (2013), Harris, Jenkinson, and Kaplan (2014), Peng (2016), and others and use "holding period" performance metrics. These metrics include the internal rate of return (IRR) earned by the fund's limited partners and the multiple on invested capital (MOIC). From data supplied by Cambridge Associates, we are also able to estimate a proxy for each fund's public market

[3] For a discussion of risk/macroeconomic factors that are typically employed in real estate return studies, see, for example, Ling and Naranjo (2015).

[4] For a discussion of the lagging and smoothing inherent in appraisal-based property valuations, see Fisher and Geltner (2000) and references therein.

equivalent (PME), a performance metric developed by Kaplan and Schoar (2005) that has gained increased usage in the private equity industry in recent years. The net IRR to investors, which is a dollar-weighted performance metric and thus sensitive to the timing of fund inflows and outflows, is the most commonly quoted performance metric. Fund managers may be able to boost reported IRRs by selling assets that are performing well and distributing the proceeds prematurely to investors.[5] That is, although potentially inconsistent with the objective of maximizing the fund investors' terminal wealth, managers may be able to boost realized IRRs by delaying the pace of investment and/or by shortening the duration of the investment horizon.[6]

The MOIC of a fund investment is calculated as the sum of all cash flow distributions to the limited partners (LPs) divided by the sum of all capital contributions and fees paid by the LPs. The MOIC captures the magnitude of net cash distributions relative to the sum of total capital called plus any fees and expenses paid/incurred by the investors. The MOIC is not affected by the timing of cash inflows and outflows; therefore, it is less susceptible to timing manipulation by managers engaging in strategies that delay the pace of investment and/or shorten investment horizons. However, because the investment horizon (time) is ignored, the maximization of MOIC without regard to the investment time horizon may be suboptimal for the investor and not provide the investor adequate compensation for the length of time the capital is put to work.

The PME compares the return LP investors earned net of fees in a private fund to what that same investor would have earned in an equivalently timed investment in a benchmark stock market index. The cash flow stream received from the public equity market investment is assumed to mimic the cash outflows and cash inflows of the private fund. Cash distributions and capital calls are discounted at the realized return on the selected equity market index. The public market index selected for discounting may range from the S&P 500, Nasdaq, or (small cap) Russell 2000 for private equity, to the MSCI US REIT Index (domestic) or FTSE/NAREIT Global Real Estate Index (international) for real estate funds. IRRs,

[5] See Case (2018) for a discussion in a commercial real estate context of how the IRR can be manipulated by managers.

[6] As an alternative to delaying investment activity, some investment managers use credit facilities (known as a subscription line) rather than investor cash to facilitate early investment activity, which delays capital calls from investors. Since the net IRR computation begins only as capital is drawn from investors, the use of this subscription line effectively shortens the investment horizon from the perspective of the investor, which may artificially inflate IRRs.

MOICs, and PMEs are reported net of management fees and any carried interest paid to the fund sponsor.[7]

Prior to any capital calls or net cash distributions, the IRR and MOIC metrics are estimated by the manager using projected cash inflows and outflows. These metrics are then updated (typically quarterly) by the manager throughout the life of a fund using a combination of realized and projected cash flows prior to the final liquidation of the fund's assets. As the fund matures, an increasing percentage of the cash flows used to calculate performance metrics are based on realized cash flows. Fully-realized cash inflows and outflows are used to calculate these performance metrics for fully-liquidated funds.

Empirical Strategy

We first examine the unconditional performance of PERE holding period returns over time and across various fund characteristics. More specifically, we examine how fund performance varies across vintage years and across various investment strategies. The investment strategies (styles) we consider include domestic versus international portfolio holdings and risk/return profiles; more specifically, core and value added strategies versus opportunistic, distressed debt, and development strategies.[8] We also examine the extent to which the performance of funds managed by private entities differs from the performance of funds managed by an affiliate of a public company. We then use conditional sorts as well as regression procedures with asset pricing specifications to estimate the risk exposures of PERE returns to fund-level characteristics, market risk, and macroeconomic environment risk factors. We also examine whether fund performance is positively related to the performance of prior funds raised by the same PERE firm.

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[7] Since we do not have access to all the underlying periodic cash flows for each of our sample observations, we approximate PME as the MOIC of the private fund investment divided by a synthetic MOIC based on a hypothetical investment in the S&P 500 over the same investment period. The investment period is assumed to start in the quarter in which the fund reached 50% deployment. The length of the investment horizon is calculated as the mathematical equivalency of the log of the MOIC divided by the log of (1+IRR), where IRR is the net IRR earned by investors in the fund. This methodology is less precise than discounting verifiable cash flows at the discount rate provided by the relevant public market index. Nevertheless, each fund will have a unique investment horizon which will relate its net MOIC to its net IRR.

8 The general expectation is that core investments are concentrated in stabilized properties with low leverage and a focus on income generation from existing rent rolls. Value-added investments involve additional management expertise to re-lease, reposition, or redevelop exiting assets, often with the use of more leverage than core investments. Opportunistic investment strategies generally involve greater investment in land and development projects or distressed properties with even more use of leverage.

The general empirical specification for our cross-sectional regression analysis of fund performance and risk factor loadings is as follows:

$$Metric_i = \alpha + \beta_i \sum_{i=1}^{R}(Risk_j) + \lambda_i \sum_{i=1}^{F}(Fund_i) + \delta(Sequence_i) + \varepsilon_i,$$

where $Metric_i$ is the realized performance metric (IRR, MOIC, or PME) for fund i, $Risk_j$ is a vector of macroeconomic risk factors that match the timing of each fund, $Fund_i$ is a vector of corresponding time-invariant fund characteristics, $Sequence_i$ is the logarithm of the sequence number of the fund (prior funds sponsored by the same private equity firm), and ε_i is a standard error term. The macroeconomic risk factors we examine include the annualized change in nominal GDP from the quarter in which each fund's committed capital was 50% deployed (defined as Deployment Quarter) to the end of its investment horizon, the total return on NCREIF's ODCE (core fund) index[9] from the fund's Deployment Quarter to the end of its investment horizon, the change in the yield on 10-year Treasury securities, and the change in the spread between BBB bond yields and 10-year U.S. Treasury yields over this same period of analysis.[10]

Fund characteristics employed in the regression analysis include fund size, the geographic concentration of the fund (domestic versus international), the risk category of the fund, and whether or not the fund manager is a private entity or an affiliate of a publicly-traded entity. Vintage year fixed effects are included in a set of regression specifications to control for inter-year variation in performance. Standard errors are adjusted for heteroscedasticity and clustered at the GP level.

[9] Established in 1982, NCREIF is a not-for-profit institutional real estate industry association that collects, processes, validates, and disseminates information on the risk/return characteristics of commercial real estate assets owned by institutional (primarily pension and endowment fund) investors. The NCREIF Fund Index - Open End Diversified Core Equity (NFI-ODCE), is an index of total investment returns reporting on both a historical and current basis the results of 25 open-end commingled funds pursuing a core investment strategy. The NFI-ODCE is a capitalization-weighted, gross of fee, time-weighted return index on real estate open-end funds with an inception date of December 31, 1977. The term Diversified Core Equity style typically reflects lower risk investment strategies utilizing low leverage and generally represented by equity ownership positions in stable U.S. operating properties diversified across regions and property types.

[10] As noted by Peng (2016), the cross-sectional approach to estimating risk factor loadings has emerged in the recent literature on private equity and venture capital (see, e.g., Cochrane 2005, Korteweg and Sorensen 2010, Driessen, Lin and Phalippou 2012). This approach relates holing period returns (IRRs) to risk factors over the same periods. Each asset or fund-level return is treated as a separate realization of returns on the asset class/sector; cross-sectional variation in returns is used to estimate the risk factor loadings of the asset. See Peng (2016) for an extended discussion.

Data

Disclosure by PERE sponsors is neither required by federal nor state regulations and much of the provided information on fund style, fund size, and performance are obtained from data voluntarily provided by the sponsor/manager. This creates a potential reporting bias. For example, in their analysis of venture capital reporting to the ThompsonOne data base, Phalippou and Gottschalg (2009) find that managers often report inflated interim performance results. Moreover, some managers report only gross returns and gross equity multiples to their limited partner (LP) investors and some managers average the performance of multiple funds when reporting, without time-weighting or (fund) size weighting.

The source of our PERE data is Cambridge Associates (CA). From our analysis, CA's PERE dataset provides the most complete and reliable data containing individual fund vintage year, geographic focus, fund size, investment style (risk), manager affiliation (public or private), IRRs, and MOICs, In addition, the proprietary data CA provided contains sufficient information to calculate the dollar-weighted duration of each fund's actual investment horizon.[11]

CA receives fund performance data directly from managers, and validates much of this reporting with fund investors to ensure high quality data and a deep time series. Since CA also provides back-office and reporting services for numerous managers, most managers voluntarily provide CA with their operating performance. CA does not make individual fund information publicly available unless a manager is in the market raising a new fund or provides CA permission to "unlock" their fund data to an identified data subscriber. The confidentiality provided to managers mitigates reporting bias, and there appears to be no selection bias in that CA requests information from any PERE fund of which it is aware. Importantly, once a manager's performance data has been obtained it remains in the database even if the sponsor of the fund suspends reporting.

Our data cover the 2006Q1-2017Q4 time-period and includes PERE fund information and quarterly performance metrics. The performance metrics include net IRR, DPI, and TVPI for the lessor of 48 quarters or the number of quarters reported by the manager based on the

[11] Burgiss is a competing provider of private equity fund data. The benefits of the Burgiss data are explained in Harris et al. (2014). A primary advantage of the Burgiss data is that it includes all investor level cash inflows and outflows, as well as estimated changes in the net asset value of the fund, although this information is not typically made available for individual funds but rather batched. These estimated NAVs, however, are also provided by managers and are therefore susceptible to return smoothing and manipulation.

life of the fund. DPI represents a "distributed to paid-in" capital multiple; that is, it is a metric of realized and distributed capital and cash flows. In contrast, TVPI represents a "total value to paid-in" capital multiple and is equal to the DPI plus all undiscounted cash flows forecasted by the manager to be distributed in the future. TVPI therefore represents the manager's estimate of the total multiple on invested capital (MOIC). The more mature the fund and the greater is the percentage of realizations relative to forecasted distributions, the more accurate the estimate of TVPI. When a fund's cash flows are fully realized, TVPI equals MOIC.

To mitigate right censoring of the performance data, we exclude funds that came to market after 2013. This produces an initial sample of 658 funds, sponsored by 224 managers, with $489.8 billion in total assets under management (AUM). CA identifies the quarter in which each fund has deployed at least 25%, 50%, and when applicable, 75% of its committed capital, but not the exact percentage funded.[12] We delete 22 funds that were less than 50% deployed to insure the reported performance metrics (i.e., projected TVPI and IRR) are based on an identified and largely acquired portfolio of properties.

To obtain a clean sample of closed-end, equity real estate funds, we exclude real estate debt funds, funds providing financing to home builders for lot acquisitions and development, funds of funds, and funds targeting the infrastructure, and health care sectors as they are less representative of general commercial and multifamily real estate exposures. This removes 44 funds from the sample. The removal of nine funds with various data inadequacies further reduces the sample to 584 funds. We also delete 51 funds with 1999 or earlier vintages as well as 62 funds whose reported IRR or TVPI or calculated PME was a sample outlier.[13] Finally, we deleted three funds with an investment date that ends after September of 2018.

The impact of these sample construction decisions is summarized in Table 1. Our final sample consists of 467 funds, sponsored by 197 distinct managers, with a total AUM of $373.2 billion. Of the 467 funds, 147 were the first PERE fund sponsored by the manager, 107 funds were the second in a series, 69 funds were the third in a sequence sponsored by the manager, and 144 funds are the fourth fund or later in a series. Fund information and quarterly performance metrics are available from CA through the third quarter of 2018, although all

[12] Certain funds begin returning capital from early property dispositions before all capital is called from investors so there are instances where, due to netting, many funds never reach 75% deployment of their investors' capital commitment.

[13] For example, we calculate the relationship of the logarithm of the MOIC to the logarithm of the 1+ IRR to determine the investment horizon. If 1+IRR is close to one, the logarithm of one is zero and cannot be used in the denominator of a quotient.

regressions are based on performance metrics ending 20174Q. Performance information is included for the lessor of 48 quarters or the number of quarters reported by the manager based on the life of the fund.

Figure 1 displays the vintage year variation of PERE activity by fund count and by mean fund size, unadjusted for inflation. The number of new real estate funds increased from an average of 11 in 2000-2002 to a peak of 86 in 2007. After declining to 47 in 2008 and to 13 in 2009, an average of 33 funds was raised from 2010 to 2013. The increase in the number of new funds raised from 2001 to 2007 and the sharp decline that followed is reflective of the boom and bust in CRE prices and transaction activity that occurred during this period.[14] The mean fund size in our sample is $653 million with a standard deviation of $1.037 billion. The average fund size increased from $285 billion in 2001 to $865 million in 2007. By 2010 the average fund size had declined by approximately half but rebounded to $820 million in 2013.

Performance Metrics

In private real estate investment, performance benchmarks are typically peer universe based. In this context, a peer universe would consist of all the competing funds of a given style and specialization. An ideal peer universe benchmark for fund investors most reflective of manager performance ideally should be constructed by aggregating the periodic (quarterly) cash inflows and outflows produced by the set of funds that constitute the peer universe and calculating the IRR of these aggregate cash flows (Arnold et al., 2017). Because the underlying fund level cash flows for the funds in the peer universe are not available, we follow the industry convention of benchmarking performance by averaging reported IRRs, MOICs, and PMEs across funds, per the methodology discussed below.

Prior research has shown that using equal weights to average IRRs across comparable funds is theoretically invalid and upward biased (e.g., Phalippou, 2008, and Phalippou and Gottschalg, 2009). Weighting by fund size partially mitigates the bias. However, the literature concludes that the best approximation of the true benchmark IRR is an average that weights IRRs by both the duration (investment horizon) and the (dollar) size of each

[14] According to CoStar COMPS, nominal "constant-quality" CRE prices across all U.S. property types and markets increased 103 percent from 2000Q1 to a peak in 2007Q2. Nominal CRE prices then declined 35 percent on average from their peak in 2007Q2 to 2011Q2. This sharp decline in market values was associated with a notable decline in the number and dollar volume of sale transactions. According to CoStar COMPS, CRE transaction volume plunged from $576 billion in 2007 to $128 billion in 2009, a 78 percent decline (http://costargroup.com/costar-news/ccrsi).

fund. The weight of each fund in the duration dollar-weighted IRR calculation is determined by its (duration x size) divided by the sum of (duration x size) for all funds in the sample.

Summary Statistics

Table 2 provides descriptive statistics for our IRR, TVPI, and PME performance measures using our sample of 467 funds. The mean, median, and standard deviation for each performance metric are provided on an equally-weighted, dollar weighted, and duration-dollar-weighted basis. For dollar-weighted IRRs, we use a weighting factor provided by CA based on the relative capital deployed by each fund in relation to the aggregate capital deployed across the entire 467 sample of funds.[15] For duration-dollar weighted IRRs, we use the product of each fund's duration (investment horizon) and the CA weighting factor described above.[16]

The mean IRR of the 467-fund sample is 7.62% using a simple average, and rises to 8.28% when weighting by the dollar size of the fund. The increase associated with dollar weighting indicates that larger funds tended to perform better over the sample period. The median IRR exceeds the mean, which confirms the outperformance of larger funds and indicate it is not substantially affected by outliers. Duration-dollar weighting the IRR has a dramatic effect, lowering the mean IRR of the full sample to 5.11% and the median IRR to 6.19%. These results document that the durations of the various IRR-ranked cohorts have a significant downward effect on performance, with the lowest IRRs having the longest durations. Another striking feature of the reported IRRs is the large variation across funds. In all three cases, the annualized standard deviation exceeds the mean return; when duration-dollar weighting fund performance, the standard deviation is approximately twice the mean return. Understanding the determinants of this cross-sectional variation in performance is a primary purpose of the current research.

As expected, the average TVPI is largely unaffected by the weighting scheme. The mean TVPI of the total sample is 1.29 using a simple average, 1.31 using dollar-weighting, and 1.22 using duration-dollar-weighting. The median TVPIs are slightly larger than the means, confirming the relative outperformance of larger funds. Our calculated PMEs suggest that most funds in our sample substantially underperformed relative to the chosen public market

[15] We believe weighting funds by relative capital deployed is considerably more accurate than weighting by relative manager reported AUM given the disparity of percentage of AUM actually deployed across funds.

[16] The average IRRs include the effects of management fees and carried interest paid to fund sponsors but not the opportunity cost investor incur waiting for their capital to be called (Arnold et al., 2017).

benchmark. As with the IRRs, the measured underperformance of our sample funds is magnified when the means and medians are duration-dollar weighted. This again indicates that funds with the lowest PMEs have the longest durations. Our three fund-level performance measures are highly correlated (see table 4). For example, the correlation between the CA-reported IRR and TVPI is 0.886; the correlation between the CA-reported IRR and our calculated PME is 0.715.

Univariate Sorts on Key Fund Characteristics

The large variation in reported IRRs discussed above may be driven by variation in fund characteristics such as size, risk profile, and geographic focus. The observed variation may also be driven by economic cycles. Figure 2 plots mean IRRs by vintage year using equal-weighting, dollar weighting, and duration-dollar-weighting. As expected, differences in reported IRRs are observed across the three weighting schemes within a given year. However, this within vintage year variation is small relative to the variation in IRRs across vintage years. For example, dollar-weighted mean IRRs exceeded 16 percent in 2000 and 2001, fell to 9.86 percent in 2002, and to 6.48 percent among funds brought to market in 2003. This decline continued until 2006 when the dollar-weighted mean IRR was -2.95 percent. This deterioration in performance was likely caused by capital being deployed by fund managers during the boom in CRE prices that occurred just prior to the significant pricing downturn that began in most parts of the U.S. in late 2007 or 2008.

The dollar-weighted mean IRR, however, jumped to 8.05 percent in 2007, to 11.34 percent in 2008 and to 22.52 percent in 2009. This sharp rise in reported performance reflects the timing of capital raising and investment by funds with 2007, 2008, and 2009 vintage years; these funds had the discretionary capital needed to deploy funds at a time when both property prices, liquidity, and investor appetite for CRE had fallen dramatically. After purchasing properties in distressed (or at least "stressed") markets, these fund managers were than able to ride the eventual recovery in CRE markets. Dollar-weighted mean IRRs ranged from 13.08 percent to 16.69 percent for funds with vintage years of 2010-2013. The large variation in reported IRRs across vintage years displayed in Figure 2 suggests that economic cycles and the macroeconomic variables that drive these cycles better explain fund performance than fund characteristics.

Table 3 provides equally-weighted descriptive statistics for IRRs and TVPIs disaggregated by geography, manager type, and risk profile. The corresponding results for

the total sample (Table 2) are reproduced in the first column for comparative purposes. The equally-weighted mean IRR for the domestic funds in our sample is 9.41%, but just 5.13% for the international sample. This 428 basis point (unconditional) outperformance of domestic funds does not appear to be driven by greater idiosyncratic risk; in fact, the standard deviation of the mean return is slightly lower for domestic funds. The mean TVPI for the domestic funds in our sample is 1.37, which exceeds the average TVPI of 1.19 produced by international funds.

The manager of 410 funds (88%) in our sample are private entities; 57 funds are managed by affiliates of publicly-traded entities. The mean (median) IRR for private managers is 7.68% (8.79%); the mean (median) IRR for funds managed by publicly-traded entities is 7.17% (8.50%). However, the idiosyncratic volatility of LP returns with private managers is slightly higher. The mean (median) TVPI produced by private managers is five (six) basis points lower than public managers.

Finally, we classify core, core-plus, and value-added funds as "low risk" investment vehicles; "high-risk" funds include funds self-described by mangers as pursuing an opportunistic, development, or distressed property investment strategy. The theoretical expectation is that funds pursuing riskier investment strategies will, on average, produce higher returns with greater idiosyncratic volatility. However, the mean IRR for high risk funds is 6.87%; the corresponding mean IRR for low risk funds is 8.72%. This finding is consistent with the conclusions of Pagliari (2017) and Fisher and Hartzell (2016). However, the median IRR for low risk funds exceeds that of high risk funds by just 29 basis points. This indicates that the 185 basis point outperformance of low risk funds based on differences in means is driven by large positive outliers. The mean (median) TVPI produced by high risk funds is eight (nine) basis points lower than the TVPI produced by low risk funds.[17]

PERE Fund Performance, Fund Characteristics, and Macroeconomic Risk Exposures

Evidence on PERE Performance, Fund Characteristics, and Macroeconomic Risks

Table 4 provides a correlation matrix of our performance measures along with corresponding fund characteristics and macroeconomic risks. Looking at column (1), we see that IRR is highly correlated with TVPI (89%) and with our PME metric (72%). Kaplan and Schoar (2005) find somewhat similar correlations in their private equity (PE) fund

[17] The amount of leverage used by the fund is unavailable to us the Cambridge Associates data. As emphasized by Pagliari (2017), leverage is directly related to the fund's risk-adjusted performance and is only imperfectly controlled for by the inclusion of the fund's risk/style.

performance metrics; the correlation of IRR and TVPI is 75% and the correlation of IRR and PME is 88%. Columns 1 also reveals that the correlation of TVPI and PME is 69% for our PERE funds, whereas Kaplan and Schoar (2005) find a correlation of 65% in their sample of PE funds.

Looking further down column (1), we find several interesting correlations between IRR and both fund characteristics and macroeconomic risks. More specifically, we find that reported IRRs are negatively associated with vintage volume (*VintageVolume*). Similarly, international PERE funds over our sample period tend to be correlated with negative performance as do high risk (*High_Risk*) funds (i.e., funds pursuing an opportunistic, development, or distressed property investment strategy).[18] This negative correlation is consistent with our earlier reported average performance results by risk/return profile. The lack of significant correlation between fund size and IRRs (as well as TVPIs) is inconsistent with economies of scale in investment management. However, the negative correlation between vintage volume and our performance measures is consistent with anecdotal industry evidence that large vintage volumes are associated with overinvestment, perhaps an insufficient opportunity set, and poor subsequent performance.

Turning to macroeconomic risks, we find positive correlations between IRR and TVPI performance and our macroeconomic risk factors. In particular, we find positive and significant correlations between IRRs and US GDP growth (*US_GDP*), between global GDP growth (*Global_GDP*) and *Global_IPD*, which is the total return on the All Sector Global IPD Property Fund Index from the Deployment Quarter to the end of the fund's investment horizon.[19] Reported IRRs and TVPIs are also strongly positively correlated with changes in the yield on 10-years Treasury securities (*Treasury_10*) and to changes in the BBB bond spread relative to 10-year Treasuries (*BBB_Spread*) over the fund's investment horizon. These positive correlations are consistent with investors demanding higher risk premiums, and consequently higher expected returns (IRRs), as compensation for exposure to these various macroeconomic risks. The correlations using our other performance metrics, TVPI

[18] Using property level data, Gang, Peng, and Thibodeau (2017) find that core properties have lower systematic risk but higher returns than noncore properties before and after adjusting for both systematic and nonsystematic risk.

[19] The Global IPD Property Fund Index is produced by MSCI (www.msci.com/real-estate). MSCI Real Estate's country, regional and global indexes are constructed to represent the financial and operating performance of private real estate markets across direct property and property funds structured as listed and unlisted vehicles, joint ventures and single client accounts. Based on 2017 year-end figures, MSCI's index covers $2 trillion of private real estate assets across more than 30 countries and includes data on more than 240 cities worldwide.

and PME, are similar to those using IRR. This is not surprising given the high correlations among our performance metrics.

Fund Characteristics and PERE Performance

The unconditional means and correlations provide some preliminary evidence on the relations between PERE performance and fund characteristics and macroeconomic risks, but those findings do not control for confounding factors that could influence the unconditional correlations. Table 5 reports the cross-sectional relations between IRR performance and fund characteristics for all funds, domestic funds, and international funds. We report results excluding and including vintage year fixed effects because we want to unmask the explanatory power of important fund characteristics that vintage year dummies might potentially absorb. However, given the time-series trends observed in PERE returns (see Figure 2), it is also important to examine results controlling for vintage year effects. For each regression, we cluster the errors by fund and adjust the errors for heteroscedasticity.

Looking at the first row of Table 5, we find that there is a positive and statistically significant relation between PERE fund size and realized performance. However, this positive relation appears to be driven by international funds. In particular, we find that, excluding or including vintage year fixed effects, the relation between international PERE fund size and performance is positive and statistically significant, while the relation for domestic (US) PERE funds is not statistically significant. PE investors are often concerned with how performance varies with fund size because of the scalability of investment allocations, among other reasons. Fund size has been found to be predictive of reduced performance in several studies (Chen et al., 2004). Moreover, the negative relation between fund size and performance is more pronounced for funds that hold less liquid portfolios (Yan, 2008). Conversely, larger funds enjoy several potential advantages, including shared fixed costs, lower expenses, and more resources for investment research (e.g., Fuerst and Matysiak, 2013). Our finding that larger international PERE funds tend to perform better is also consistent with Kaplan and Schoar (2005) and Harris, Jenkinson, and Kaplan (2014) who find a positive relation between venture capital fund size and performance, but no relation between the performance of buyout funds and size. A positive relation between size and performance is also found in several studies of PERE funds (e.g., Tomperi, 2010, and Fuerst and Matysiak, 2013).

The aggregate amount of capital committed to a private equity sector varies substantially from peak to trough of a cycle and periods of elevated fundraising activity tend to be followed

by periods of low performance (Brown et al., 2018; Robinson and Sensoy, 2016). The second row of Table 5 reports a negative and highly significant relation between *VintageVolume* and PERE performance when vintage year fixed effects are excluded. This negative relation is consistent with larger fund flows chasing a limited number of investment opportunities (Harris, Jenkinson, and Kaplan, 2014). Our finding is also consistent with Lopez-de-Silanes, Phalippou, and Gottschalg (2015) who find that investments held by private equity firms in periods with a high number of simultaneous investments underperform substantially. The authors argue that their findings are consistent with the theoretical literature on organizational diseconomies linked to firm structure. Brown et al. (2018) also provide a discussion of potential frictions that may arise in the organizational structure of LP firms and investors. Unsurprisingly, the results reported in Columns (3) and (6) that include vintage year fixed effects largely absorb the vintage volume effect, except for PERE international funds in column (6) where vintage volume remains negative and statistically significant.

Turning to the other fund characteristics, we find in columns (1) and (3) that international PERE funds are associated with significantly lower performance over our sample period. These findings are consistent with our unconditional results reported in Table 3 where international PERE funds displayed lower mean and median performance relative to domestic funds over our sample. The estimated coefficients on *High Risk* and *Public Manager* cannot be distinguished from zero in any of the regressions specifications reported in Table 5. Fisher and Hartzell (2016) also find that the risk/return designations of funds are not predictive of realized fund performance. Overall, the results reported in Table 5 suggest that market timing (vintage year) dominates fund characteristics when explaining realized performance.

Macroeconomic Risks and PERE Performance

A great deal of research has focused on the links between stock, bond, and real estate market returns and macroeconomic events such as fluctuations in GDP, interest rates, and default spreads (e.g., Chen, et al., 1986; Ling and Naranjo, 1997). However, little research has examined the role of these risk factors in PE performance more broadly and no research of which we are aware has done so for the performance of U.S. PERE funds.[20] Table 6 reports

[20] Delfim and Hoesli (2016) examine the exposure of a sample of European PERE funds to macroeconomic risk factors.

results on the cross-sectional relation between PERE fund performance and various macroeconomic risk factors. Similar to Table 5, we report results for all funds, domestic funds, and international funds, as well as results excluding and including vintage year fixed effects. For each regression, we again cluster the errors by fund and adjust the errors for heteroscedasticity.

The results displayed in Table 6 show that PERE performance is strongly influenced by various macroeconomic risk factors. We first examine the exposure of PERE funds to the annualized change in nominal GDP growth from the first quarter in which each fund was at least 50% deployed (Deployment Quarter) to the end of its investment horizon. We consistently find a positive and highly significant relation between *US GDP* and PERE performance. This significantly positive relation is in contrast to studies that find mixed to negative evidence on the relation between GDP growth and equity returns (Ritter, 2012). For the international funds, we use a similarly defined Global GDP proxy in place of US GDP growth. However, in contrast to the US domestic PERE fund results, we do not find a significant relation between Global GDP growth and international PERE performance. This is consistent with the mixed evidence between equity returns and GDP growth reported in the literature, but may also be due to a looser link between Global GDP growth and local economic conditions across countries, although GDP growth is positively correlated across developed countries.[21]

Table 6 also provides results on the estimated relation between real estate market related risks and PERE performance. As a commercial real estate market proxy, we use the total return on NCREIF's ODCE (core fund) index from the quarter in which each fund's committed capital was 50% deployed to the end of its investment horizon. For our international PERE regressions, we replace the NCREIF ODCE with MSCI's Global IPD index. We find a significantly positive relation between PERE performance and the broad-based performance of the global private real estate market. This significant positive relation holds for both all funds and domestic PERE funds, both including and excluding vintage year fixed effects. However, similar to our reported GDP findings, we do not find a statistically significant relation between the international PERE performance and our proxy for global private real estate performance.

[21] Additionally, international funds, as reported by CA, are based on the geographic concentration reported to CA by each manager. An international designation may have been the original intent of a global manager or may represent a majority but not exclusivity of the geographic concentration.

In rows five and six of Table 6 we report results on the influence of interest rates changes (*Treasury_10*) and credit risk changes (*BBB_Spread*) on PERE performance. Similar to our other macroeconomic variables, we measure our corresponding interest rate variables as the annualized change from the quarter in which each fund was 50% deployed to the end of its investment horizon. Across all, domestic, and international PERE fund groups, we find a positive and statistically significant relation between PERE performance and both *Treasury_10* and *BBB_Spread*. The estimated positive exposure of PERE to *Treasury_10* is consistent with PERE investments serving as a partial inflation hedge, with real asset investments appreciating with inflation. Similarly, the positive relation between changes in default risk and PERE fund performance is consistent with Chava and Purnanandam (2010), who find a positive cross-sectional relationship between expected stock returns and default risk. They argue that investors should expect a positive risk premium for exposure to systematic default risk. In contrast, several studies find a negative relationship between default risk and realized returns due to realized returns being, at times, a poor proxy for ex ante expected returns. Using the same logic, we expect a positive exposure, as we document, with the interest rate changes on PERE IRRs.

PERE Performance Exposures: Fund Characteristics and Macroeconomic Risks

We have separately examined the influence of fund characteristics and macroeconomic risks on PERE performance as reported in Tables 5 and 6, respectively. However, the results reported in Table 5 could suffer from omitted macroeconomic variables and the results reported in Table 6 could suffer from omitted fund characteristics. Table 7 reports the combined effects of fund characteristics and macroeconomic risks on PERE fund performance. In Table 8 we report further evidence on the robustness of our findings using TVPI as an alternative PERE fund performance metric.

The combined results reported in Table 7 are similar to our earlier discussed results for fund characteristic effects in Table 5 and macroeconomic risk effects in Table 6. In our combined specifications, we find that fund size continues to have a positive relation with fund performance, although this positive association is driven by international funds. In the absence of year fixed effects, vintage volume continues to have a negative effect on the performance of domestic funds, although the effect is muted with the inclusion of the macroeconomic variables, which are also correlated with the fund's vintage year. International funds continue to conditionally underperform. Similarly, GDP growth, real estate market returns, interest rate changes, and default spread changes continue to be

positively associated with PERE IRR performance. The adjusted R-squares from the various combined specifications are all high, ranging from 38.7% to 51.5% for domestic funds without and with vintage year fixed effects, respectively. The adjusted R-squares range from 30.1% to 37.2% for international funds without and with vintage year fixed effects, respectively. The estimated coefficients on *Treasury_10* and *BBB_Spread* remain positive and highly significant, especially when vintage year fixed effects are excluded.

As an additional robustness check, we report in Table 8 results using TVPI as our PERE performance metric in place of IRR. Similar to our IRR performance findings, we find that fund size has a positive relation with fund performance (though more muted for domestic funds), vintage volume generally has a negative effect on PERE performance with the inclusion of vintage year fixed effects, and international funds conditionally underperform. Similarly, GDP growth, real estate market returns, interest rate changes, and default spread changes are positively associated with PERE TVPI performance. Overall, the effects using TVPI are somewhat muted relative to our IRR results, which is displayed by the lower adjusted R-squares. The adjusted R-squares from the various combined specifications are all still reasonably high, ranging from 18.6 to 27.9% for domestic funds, without and with vintage year fixed effects, respectively. For international funds, the adjusted R-squares range from 21.1% to 27.2% excluding and including vintage year fixed effects.

Persistence in PERE Performance

Table 9 reports results that show the influence of fund persistence on PERE performance. In particular, we include the performance of a fund family's previous fund (*IRR_Lag*), if available, as an additional explanatory variable in our performance regressions. This reduces our sample size from 467 to 266 funds. We also include our full set of fund characteristics and macroeconomic risk factors. Similar to our previous tables, we separately report results for all funds, domestic funds, and international funds, excluding and including vintage year fixed effects. For each regression, we again cluster the errors by fund and adjust estimation errors for heteroscedasticity.

In the first row of Table 9, we report evidence consistent with PERE performance persistence. More specifically, the estimated coefficient on *IRR_Lag* is positive and significant at the 10% level or higher across all funds, domestic funds, and international funds when time fixed effects are excluded. For domestic PERE funds, the estimated coefficient on *IRR_Lag* is not significant when we include vintage year fixed effects. The estimated coefficient on *IRR_Lag* of 0.165 without vintage year fixed effects (t-statistic of 3.4) for all

funds suggests that a 1% increase in the performance of a prior fund is associated with a 16.5 basis point increase in the performance of the current fund. The effects of *IRR_Lag* on subsequent fund performance are more pronounced for international funds. Our findings on the persistence of PERE performance are consistent with the findings in Kaplan and Schoar (2005) who find strong performance persistence in private equity funds. Importantly, our findings are in contrast to the results for mutual funds and hedge funds where there is little to mixed evidence on performance persistence (e.g., Carhart, 1997; Brown, et al. 1999; Kat and Menexe, 2003; among others). This suggests that there is unique transferability of investment knowledge and skills across subsequent funds within the PERE and PE structure.

Summary and Conclusion

In this paper, we investigate the factors driving the performance of closed-end, private equity real estate (PERE) funds. We focus on the explanatory power of fund characteristics and macroeconomic risk exposures. We first document the time-varying and cross-sectional performance of a large sample of PERE funds obtained from Cambridge Associates, disaggregated by geographic focus, manager type, and risk profile. We then estimate the exposure of fund returns and other performance metrics to fund-level characteristics, market risks, and macroeconomic variables.

For the fund characteristics, we estimate the influence of fund size, vintage year, and investment strategy, among other fund characteristics. For market risks, we estimate PERE's exposure to the returns on a size-weighted index of total returns earned by a sample of open-end real estate funds (the NCREIF ODCE index) and to the aggregate volume of capital raised for PERE funds during the fund's vintage year. For the macroeconomic environment, we examine the influence GDP growth and changes in long-term interest rates and credit (default) risk spreads relative to Treasury yields. We also examine the extent to which the (IRR) performance of a prior fund from the same family (if available) predicts the performance of our sample funds.

Using performance data through 2017Q4 on 467 PERE funds that came to market in 2000-2013, we find that fund characteristics, market risks, and macroeconomic risk factors significantly affect PERE performance. In particular, we find that PERE performance is positively related to fund size, GDP growth changes, returns in the private real estate market, long-term interest rate changes, and changes in credit (default) risk spreads. PERE

performance is negatively related to the dollar volume of PERE funds that came to market in the same year as the fund. These vintage year effects are especially strong when fundamental macroeconomic variables, which are correlated with vintage year, are excluded from the analysis. Funds with an exposure to international real estate markets dramatically underperformed funds identified as "domestic" by Cambridge Associates during our sample period. We also find that fund performance is positively associated with the performance of prior funds raised by the same PERE firm (family).

More broadly, our unique findings on the role of fund characteristics, market risks, and macroeconomic factors contributes to a gap in the PE literature whereby the sources and magnitudes of the risks facing PE investors are not well understood. Our findings have important implications for PE investment and allocation strategies. While this paper provides novel results on the fund characteristics, market risks, and macroeconomic factors driving final PERE returns, an important open question is the economic and behavioral factors driving the dynamics between interim performance reporting by GP's and final performance outcomes.

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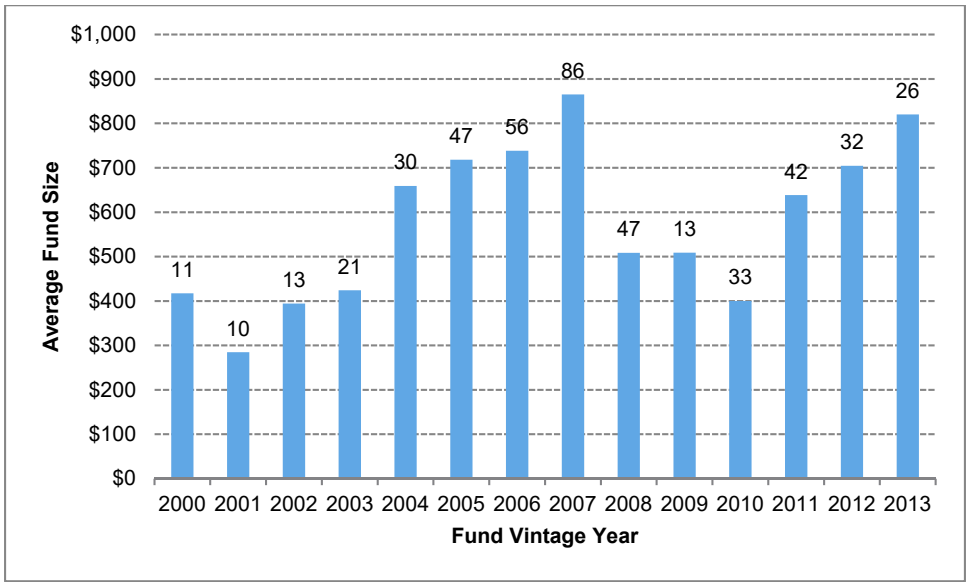
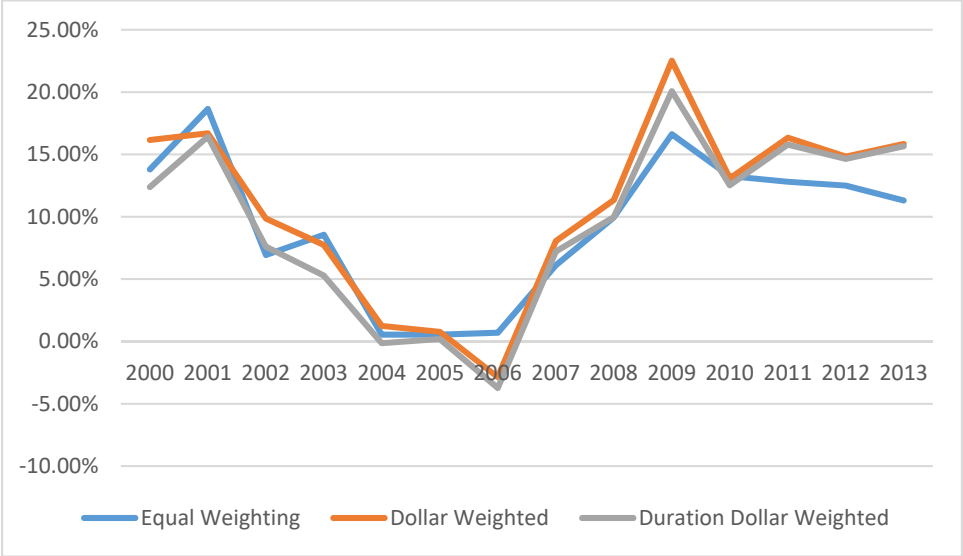
Figure 1: Mean Fund Size in $Millions and Fund Count by Vintage Year



This Figure displays the vintage year variation of PERE activity by fund count and by mean fund size, unadjusted for inflation. Total committed capital is used as our proxy for fund size. The source of our data is Cambridge Associates.

Figure 2: Average Realized IRRs by Vintage Year



This figure plots mean IRRs for our sample of 467 PERE funds from Cambridge Associates, by vintage year, using equal-weighting, dollar weighting, and duration-dollar-weighting. For dollar-weighted performance metrics, we use a weighting factor provided by CA based on the relative capital deployed by each fund in relation to the aggregate capital deployed across the entire 467 sample of funds. For duration-dollar weighted IRRs, we use the product of each fund's duration (or investment horizon) and the CA weighting factor.

Table 1: Number of Funds and Assets under Management by Vintage Year

	Fund Count	Manager Count	Total AUM ($Bil)
CA Initial Sample	658	224	$489.8
Filters			
Unrealized Funds (2014 & Later)	22	21	$24.6
Non-CRE Equity	44	27	$24.9
Data Errors	9	8	$3.8
1999 and Earlier	51	30	$26.0
Filtered Sample	**532**	**204**	**$410.4**
Outlier - IRR	27	24	$17.1
Outlier - TVPI	14	11	$12.2
Outlier - PME	21	18	$7.9
InvestmentDate >= Sep 30 2018	3	3	$2.8
Final Sample	**467**	**197**	**$373.2**

This table displays the filters used to arrive at our final sample of 467 PERE funds. The source of our data is Cambridge Associates. Dollar values are unadjusted for inflation. IRR is the internal rate of return; TVPI represents a "total value to paid-in" capital multiple. The PME compares the return LP investors earned net of fees in a private fund to what that same investor would have earned in an equivalently timed investment in a benchmark stock market index.

Table 2: Descriptive Statistics for Various Performance Measures and Weighting Techniques

		Equally weighted			Dollar weighted			Duration dollar weighted		
	Count	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
IRR	467	7.62%	8.78%	9.66%	8.28%	10.73%	9.94%	5.11%	6.19%	10.04%
TVPI	467	1.29	1.34	0.39	1.31	1.38	0.42	1.22	1.31	0.47
PME	467	0.65	0.70	1.67	0.64	0.87	1.62	0.21	0.59	1.70

This table provides descriptive statistics for our IRR, TVPI, and PME performance measures using our sample of 467 funds. IRR is the internal rate of return; TVPI represents a "total value to paid-in" capital multiple. The PME compares the return LP investors earned net of fees in a private fund to what that same investor would have earned in an equivalently timed investment in a benchmark stock market index. For dollar-weighted performance metrics, we use a weighting factor provided by CA based on the relative capital deployed by each fund in relation to the aggregate capital deployed across the entire 467 sample of funds. For duration-dollar weighted IRRs, we use the product of each fund's duration (or investment horizon) and the CA weighting factor.

Table 3: IRR and TVPI by Geography, Manager Type, and Risk Profile

		By geography		By manager type		By risk profile	
IRR	All funds	Domestic	International	Private	Public	High	Low
Count	467	272	195	410	57	277	190
Mean	7.62%	9.41%	5.13%	7.68%	7.17%	6.87%	8.72%
Median	8.78%	10.05%	5.83%	8.79%	8.50%	8.55%	8.84%
SD	9.66%	9.33%	9.58%	9.72%	9.30%	9.70%	9.53%
TVPI							
Mean	1.29	1.37	1.19	1.29	1.34	1.26	1.34
Median	1.34	1.42	1.22	1.34	1.40	1.31	1.40
SD	0.39	0.37	0.40	0.39	0.43	0.40	0.37

This table provides equally-weighted descriptive statistics for IRRs and TVPIs disaggregated by geography, manager type, and risk profile. The corresponding results for the total sample (Table 2) are reproduced in the first column. IRR is the internal rate of return; TVPI represents a "total value to paid-in" capital multiple and includes projected, as well as realized, cash distributions.

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Table 4: Variable Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) IRR	1.000													
(2) TVPI	0.886	1.000												
(3) PME	0.715	0.692	1.000											
(4) *FundSize*	0.017	0.000	-0.015	1.000										
(5) *VintageVolume*	-0.234	-0.132	-0.255	0.130	1.000									
(6) *International*	-0.219	-0.233	-0.149	0.250	0.086	1.000								
(7) *Public_Manager*	-0.017	0.040	0.042	0.335	0.108	0.095	1.000							
(8) *High_Risk*	-0.094	-0.102	-0.055	0.183	0.035	0.365	0.056	1.000						
(9) *US_GDP*	0.447	0.354	0.121	-0.096	-0.175	-0.071	-0.048	-0.026	1.000					
(10) *ODCE*	0.031	0.043	0.035	0.004	0.086	-0.109	-0.020	-0.131	-0.004	1.000				
(11) *Global_GDP*	0.460	0.334	0.128	-0.072	-0.211	-0.027	-0.099	-0.006	0.869	-0.032	1.000			
(12) *Global_IPD*	0.453	0.367	0.084	-0.051	-0.018	-0.050	-0.079	-0.042	0.807	0.140	0.907	1.000		
(13) *Treasury_10*	0.473	0.336	0.252	-0.101	-0.211	0.050	-0.051	0.021	0.563	-0.179	0.656	0.560	1.000	
(14) *BBB_Spread*	0.185	0.148	0.290	-0.000	-0.252	-0.052	0.043	-0.070	0.094	0.049	0.059	0.109	-0.164	1.000

IRR is the internal rate of return; TVPI represents a "total value to paid-in" capital multiple. The PME compares the return LP investors earned net of fees in a private fund to what that same investor would have earned in an equivalently timed investment in a benchmark stock market index. All other variable definitions are provided in the Appendix.

Table 5: Regressions of Realized IRR on Fund Variables

	IRR			IRR		
	No Vintage Year Fixed Effects			With Vintage Year Fixed Effects		
	All	Domestic	International	All	Domestic	International
FundSize	0.010**	0.006	0.009*	0.011***	0.013	0.010**
	(2.208)	(0.461)	(1.837)	(2.845)	(1.129)	(2.283)
VintageVolume	-0.001***	-0.001***	-0.001***	-0.001	0.001	-0.010**
	(-5.103)	(-3.781)	(-3.383)	(-0.728)	(0.568)	(-2.544)
Public Manager	-0.002	-0.006	0.003	0.004	-0.002	-0.001
	(-0.142)	(-0.340)	(0.133)	(0.348)	(-0.105)	(-0.057)
High Risk	-0.005	-0.012	0.010	-0.005	-0.015	-0.013
	(-0.560)	(-1.047)	(0.606)	(-0.597)	(-1.576)	(0.840)
International	-0.042***	---	---	-0.045***	---	---
	(-4.453)	---	---	(-5.556)	---	---
Constant	0.172***	0.146***	0.055	0.196***	0.134***	0.239***
	(7.715)	(5.309)	(1.417)	(5.425)	(3.481)	(2.834)
Vintage Years FE	No	No	No	Yes	Yes	Yes
Observations	467	272	195	467	272	195
Adjusted R^2	0.095	0.041	0.054	0.339	0.391	0.290

This table reports the cross-sectional relations between IRR performance and fund characteristics for all funds, domestic funds, and international funds. We report results excluding (columns (1)-(3)) and including vintage year fixed effects (columns (4)-(6)). All variable definitions are provided in the Appendix. Regression errors are clustered by fund and adjusted for heteroscedasticity.

Table 6: Regressions of IRR on Macroeconomic Variables

	IRR			IRR		
	No Vintage Year Fixed Effects			With Vintage Year Fixed Effects		
	All	Domestic	International	All	Domestic	International
US_GDP	1.968***	2.707***	---	2.105***	4.462***	---
	(3.956)	(4.172)	---	(3.758)	(6.316)	---
ODCE	0.039**	0.053**	---	0.044***	0.060**	---
	(2.462)	(2.207)	---	(2.617)	(2.428)	---
Global_GDP	---	---	0.104	---	---	-2.256
	---	---	(0.041)	---	---	(-0.726)
Global_IPD	---	---	0.061	---	---	0.248
	---	---	(0.149)	---	---	(0.482)
Treasury_10	3.757***	3.541***	4.111***	2.056***	0.392	3.627***
	(8.634)	(6.695)	(5.558)	(3.922)	(0.639)	(4.265)
BBB_10_Spread	1.682***	1.262***	2.165***	1.257***	0.665*	1.899***
	(5.859)	(3.533)	(4.804)	(3.813)	(1.731)	(3.509)
Constant	0.034*	0.021	0.078***	0.023	-0.118***	0.237***
	(1.663)	(0.763)	(3.290)	(0.592)	(-2.691)	(3.431)
Vintage Years FE	No	No	No	Yes	Yes	Yes
Observations	467	272	195	467	272	195
Adjusted R^2	0.324	0.379	0.283	0.368	0.515	0.343

This table reports the cross-sectional relations between IRR performance and macroeconomic risk factors for all funds, domestic funds, and international funds. We report results excluding (columns (1)-(3)) and including (columns (4)-(6)) vintage year fixed effects. All variable definitions are provided in the Appendix. Regression errors are clustered by fund and adjusted for heteroscedasticity.

Table 7: Regressions of IRR on Fund and Macroeconomic Variables

	IRR			IRR		
	No Vintage Year Fixed Effects			With Vintage Year Fixed Effects		
	All	Domestic	International	All	Domestic	International
FundSize	0.014***	0.019*	0.014***	0.013***	0.013	0.014***
	(3.759)	(1.692)	(3.117)	(3.525)	(1.281)	(3.219)
VintageVolume	-0.000	-0.000**	0.000	0.000	0.005***	-0.010***
	(-1.591)	(-2.201)	(0.207)	(0.234)	(2.943)	(-2.703)
Public Manager	-0.004	-0.009	-0.012	0.003	-0.005	-0.016
	(-0.385)	(-0.571)	(-0.649)	(0.261)	(-0.356)	(-0.875)
High Risk	-0.002	-0.008	-0.002	-0.004	-0.011	0.000
	(-0.321)	(-0.829)	(-0.107)	(-0.458)	(-1.338)	(0.028)
International	0.046***	---	---	-0.046***	---	---
	(-5.839)	---	---	(-6.026)	---	---
US_GDP	1.727***	2.734***	---	1.890***	4.479***	---
	(3.611)	(4.217)	---	(3.514)	(6.334)	---
ODCE	0.032**	0.054**	---	0.029*	0.056**	---
	(2.055)	(2.243)	---	(1.791)	(2.230)	---
Global_GDP	---	---	0.385	---	---	-1.979
	---	---	(0.141)	---	---	(-0.641)
Global_IPD	---	---	-0.020	---	---	0.158
	---	---	(-0.045)	---	---	(0.310)
Treasury_10	3.929***	3.414***	4.449***	2.472***	0.413	3.999***
	(9.192)	(6.371)	(5.856)	(4.888)	(0.668)	(4.653)
BBB_Spread	1.522***	0.985***	2.280***	1.254***	0.587	2.008***
	(5.286)	(2.651)	(4.665)	(3.971)	(1.517)	(3.721)
Constant	0.119***	0.046	0.084*	0.088*	-0.124**	0.292***
	(4.288)	(1.372)	(1.869)	(1.826)	(-2.336)	(3.164)
Vintage Years FE	No	No	No	Yes	Yes	Yes
Observations	467	272	195	467	272	195
Adjusted R^2	0.382	0.387	0.307	0.423	0.515	0.372

This table reports the cross-sectional relations between IRR performance and both fund characteristics and macroeconomic risk factors for all funds, domestic funds, and international funds. We report results excluding (columns (1)-(3)) and including (columns (4)-(6)) vintage year fixed effects. All variable definitions are provided in the Appendix. Regression errors are clustered by fund and adjusted for heteroscedasticity.

Table 8: Regressions of TVPI on Fund and Macroeconomic Variables

	TVPI			TVPI		
	No Vintage Year Fixed Effects			With Vintage Year Fixed Effects		
	All	Domestic	International	All	Domestic	International
FundSize	0.036**	0.024	0.038*	0.038**	0.015	0.040**
	(2.088)	(0.464)	(1.898)	(2.306)	(0.308)	(2.079)
VintageVolume	0.000	-0.000	0.000	-0.018**	-0.003	-0.035**
	(0.029)	(-0.266)	(0.244)	(-2.270)	(-0.309)	(-2.169)
Public Manager	0.060	0.022	0.050	0.075	0.025	0.041
	(1.159)	(0.309)	(0.614)	(1.469)	(0.379)	(0.501)
High Risk	-0.012	-0.039	0.016	-0.025	-0.052	0.020
	(-0.344)	(-0.921)	(0.248)	(-0.719)	(-1.282)	(0.297)
International	-0.195***	---	---	-0.207**	---	---
	(-5.421)	---	---	(-5.918)	---	---
US_GDP	6.766***	10.669***	---	5.007***	12.146***	---
	(3.110)	(3.565)	---	(2.053)	(3.518)	---
ODCE	0.106	0.296***	---	0.016	0.184	---
	(1.508)	(2.685)	---	(0.211)	(1.517)	---
Global_GDP	---	---	-8.299	---	---	-8.405
	---	---	(-0.686)	---	---	(-0.610)
Global_IPD	---	---	1.607	---	---	0.660
	---	---	(0.801)	---	---	(0.289)
Treasury_10	11.241***	7.516***	16.412***	6.913***	-1.030	13.900***
	(5.784)	(3.039)	(4.882)	(3.013)	(-0.342)	(3.623)
BBB_Spread	4.871***	2.259	7.498***	3.785***	1.078	6.440***
	(3.721)	(1.316)	(3.467)	(2.642)	(0.571)	(2.673)
Constant	1.341***	1.052***	1.199***	1.638***	1.017***	1.824***
	(10.661)	(6.851)	(6.053)	(7.513)	(3.915)	(4.419)
Vintage Years FE	No	No	No	Yes	Yes	Yes
Observations	467	272	195	467	272	195
Adjusted R^2	0.233	0.186	0.211	0.287	0.279	0.272

This table reports the cross-sectional relations between IRR performance and both fund characteristics and macroeconomic risk factors for all funds, domestic funds, and international funds. We report results excluding (columns (1)-(3)) and including (columns (4)-(6)) vintage year fixed effects. All variable definitions are provided in the Appendix. Regression errors are clustered by fund and adjusted for heteroscedasticity.

Table 9: PERE Fund Performance Persistence

	IRR			IRR		
	No Vintage Year Fixed Effects			With Vintage Year Fixed Effects		
	All	Domestic	International	All	Domestic	International
IRR_Lag	0.165***	0.118*	0.229***	0.138***	0.092	0.178**
	(3.396)	(1.817)	(2.979)	(2.811)	(1.481)	(2.142)
FundSize	0.016***	0.034**	0.014***	0.014***	0.016	0.015***
	(3.753)	(2.268)	(2.952)	(3.357)	(1.100)	(3.051)
VintageVolume	-0.000***	-0.000	-0.000	-0.000	0.005*	-0.008
	(-1.091)	(-0.858)	(-1.058)	(-0.127)	(1.804)	(-1.646)
Public Manager	-0.015	-0.018	-0.019	-0.009	-0.016	-0.025
	(-1.071)	(-0.967)	(-0.882)	(-0.656)	(-0.909)	(-1.139)
High Risk	-0.008	0.022*	0.013	-0.008	-0.020	0.012
	(-0.776)	(-1.844)	(0.682)	(-0.816)	(-1.648)	(0.598)
International	-0.038***	---	---	-0.038***	---	---
	(-3.704)	---	---	(-3.762)	---	---
US_GDP	1.697***	2.521***	---	1.494**	3.681***	---
	(2.977)	(3.144)	---	(2.255)	(3.766)	---
ODCE	0.032	0.060	---	0.026	0.064	---
	(1.422)	(1.549)	---	(1.117)	(1.483)	---
Global_GDP	---	---	-0.396	---	---	-2.600
	---	---	(-0.118)	---	---	(-0.660)
Global_IPD	---	---	0.193	---	---	0.253
	---	---	(0.341)	---	---	(0.374)
Treasury_10	4.272***	3.938***	4.367***	2.906***	1.341	3.488***
	(7.724)	(5.606)	(4.614)	(4.353)	(1.521)	(2.987)
BBB_Spread	2.198***	1.452***	2.932***	1.978***	1.356**	2.441***
	(5.659)	(2.714)	(4.720)	(4.277)	(2.140)	(3.094)
Constant	0.118***	0.065	0.067	0.125*	-0.055	0.260**
	(3.414)	(1.473)	(1.295)	(1.942)	(-0.696)	(2.096)
Vintage Years FE	No	No	No	Yes	Yes	Yes
Observations	266	149	117	266	149	117
Adj R^2	0.447	0.423	0.406	0.481	0.496	0.434

Appendix: Independent Variable Definitions

VARIABLE	VALUES	DEFINITION	SOURCE	DATES
FundSize	$USD Dollars	Total fund size, measured as total committed capital, in $US billions.	Cambridge Associates	2006 - 2017
VintageVolume	$USD Dollars	Total annual raised capital volume, in $US billions, per legal year of inception.	Cambridge Associates	2006 - 2017
International	Domestic (0) International (1)	Geographic concentration of the fund as represented by the Manager	Cambridge Associates	2006 - 2017
Public_Manager	Private (0) Public (1)	Manager classification of the fund manager (set to 1 if affiliated with a public company)	Cambridge Associates	2006 - 2017
High_Risk	Low (0) High (1)	Binary risk profile of fund (Development, Distressed, & Opportunistic vs. Core, Core-Plus, & Value-Added).	Cambridge Associates	2006 - 2017
VintageYear	Dummy Variable	Year of fund legal inception	Cambridge Associates	2006 - 2017
US_GDP	Growth %	Annualized change in US GDP in $USD from Deployment Quarter* to Investment Quarter. Proxy for period fund is invested.	Bureau of Economic Analysis (BEA) accessed through Bloomberg	2006 - 2017
ODCE	Growth %	Annualized change in ODCE Total Return Index from Deployment Quarter to Investment Quarter. Proxy for period fund is invested.	NCREIF	2006 - 2017
Global_GDP	Growth %	Annualized change in Global GDP $USD Index from Deployment Quarter to Investment Quarter. Proxy for period fund is invested.	OECD accessed through Bloomberg	2006 - 2017
Global_IPD	Growth %	Quarterly Total Return in the All Sector Global IPD Global Property Fund Index Digest.	IPD (MSCI)	2006 - 2017
Treasury_10	Net Change	Net change in 10-Year Treasury yield from Deployment Quarter* to Investment Quarter. Proxy for period fund is invested.	Bloomberg (comprised of generic US on-the-run Treasury bonds)	2006 - 2017
BBB_Spread	Net Change	Net change in BBB-10Year spread from Deployment Quarter* to Investment Quarter. Proxy for period fund is invested.	Bank of America accessed through Bloomberg	2006 - 2017

*Deployment Quarter is defined as the quarter identified by Cambridge Associates that each fund first reached 50% capital deployment.