Private Equity Real Estate Fund Performance: A Comparison to REITs and Open-end Core Funds

by

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Abstract

We provide a comprehensive examination of the return performance of closed-end, private equity real estate (PERE) funds relative to the performance of listed real estate stocks (REITs) and the NCREIF ODCE fund index. We first match each PERE fund in our sample and its realized internal rate of return and equity multiple with the return that would have been earned by an LP investor on an investment in the designated benchmark over each fund's investment horizon. Overall, we find that closed-end PERE funds have underperformed listed REITs. In contrast, we find similar overall performance between PERE and the NCREIF ODCE fund index. We also examine the determinants of the relative performance spread between the PERE funds and the equity REIT index and find that the spread widens with interest rate environment variables (Treasury yields and default spreads) and narrows with broad macroeconomic performance indicators (growth rate of GDP).

Key Findings

1. Closed-end PERE funds underperform listed REITs – both on average and by the percentages of individual funds.
2. The performance spread widens with interest rate environment variables (Treasury yields and default spreads) and narrows with broad macroeconomic performance indicators (growth rate of GDP).
3. The overall performance between PERE and the NCREIF ODCE fund index is similar.

Topics:

Return performance, private equity, real estate, open-end core funds, economic environment

BACKGROUND AND MOTIVATION

Private equity real estate (PERE) funds have become an increasingly common mode of access for investing in commercial real estate (e.g., Arnold, Ling, and Naranjo, 2019). According to Preqin, the aggregate PERE fund capitalization exceeded $992 billion as of year-end 2019 (Preqin, 2020). Preqin predicts the aggregate PERE fund capitalization will exceed $1.2 trillion by 2023.[1] Frequently stated advantages of investing in non-listed real estate funds, relative to investing directly in private commercial real estate (CRE) as the sole equity investor, 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, potential diversification benefits, and access to expert management. In addition, many investors are attracted to non-listed CRE funds because of their expected high correlation with the underlying CRE market. However, PERE funds, especially closed-end funds, typically suffer from the same lack of liquidly as direct investments in CRE.[2]

The U.S. listed real estate market has grown at an equally fast rate. According to Nareit, the market capitalization of listed equity REITs was $9 billion at the end of 1991. By year end 2020, this market capitalization had increased to $1.2 trillion. Analogous to PERE, listed CRE provides investors the opportunity to increase their portfolio's exposure to CRE without the burden of acquiring, managing, and disposing of direct property investments in multiple markets with unfamiliar political and market structures. However, unlike PERE investments, listed CRE stocks provide investors with a high degree of liquidity and transparency and relatively low transaction costs. Moreover, shares of listed CRE companies can be purchased in small dollar denominations.

We examine the performance of closed-end PERE funds relative to the performance of listed equity REITs and the Open-end Diversified Core Equity (ODCE) index produced by the National Council of Real Estate Investment Fiduciaries (NCREIF).[3] The NFI-ODCE Index measures the

[1] Over the period 2015 through 2019, the real estate investor universe has grown by over 30%, now with over 7,600 institutional investors reporting real estate allocations (Preqin, 2020).

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

[3] Established in 1982, NCREIF is a not-for-profit 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 (see www.ncreif.org). The property composition of the NPI changes quarterly as data contributing NCREIF members buy and sell properties. However, all historical property-level data remain in the database and index. NCREIF's flagship index, the NCREIF Property Index (NPI), tracks property-level quarterly returns on a pool of properties acquired in the private market for investment purposes only.

returns of the largest private real estate funds pursuing a core investment strategy, which is typically characterized by low risk, low leverage, and stable properties diversified across the U.S.

We first carefully match the investment horizon of each PERE fund in our sample with the corresponding investment horizon on the chosen benchmark. This "horse race" approach to determining the relative performance of PERE is superior to simply comparing an index of PERE return performance to a designated benchmark for several reasons. First, the PERE return indices supplied, for example, by Cambridge Associates and Preqin combine estimated peridoc (e.g., quarterly) returns for a sample of funds with a range of vintage years. However, our research clearly shows that PERE performance varies significantly by vintage year; therefore, combining funds of different vintages to produce an estimated PERE return in a particular quarter or year can produce misleading results, especially if the researcher is unaware of how the mix of funds in the reported index varies over time. A second advantage of our approach is that it allows us to determine the perentage of funds that outperform a selected benchmark over their investment horizon. With the matched set, we calculate the unconditional (mean and median) return performance differences of the matched sample. We also examine the determinants of the relative performance between the PERE funds and the equity REIT index we use for comparison. Although several papers have examined dimensions of PERE performance,[4] to our knowledge no research has examined the performance of individual PERE funds relative to listed equity REITs and relative to the NCREIF ODCE Index using fund-level data.

DATA

Total returns of non-listed CRE assets, such as PERE funds, which are typically reported 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, quarter-to-quarter 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 quarterly valuations rather than transaction prices is well known to produce lagging and smoothing in the reported quarter-by-quarter capital appreciation reported by the manager;

[4] See, for example, Hahn et. al, 2005; Tomperi, 2010; Bond and Mitchell, 2010; Alcock et al., 2013; Fisher and Hartzell, 2016, Delfim and Hoesli, 2016, Bollinger and Pagliari, 2019, Gupta and Van Nieuwerburgh, 2021, and Riddiough, 2021. See Riddiough and Wiley (2021) for a comparison of the performance of PERE to unlisted REITs.

therefore, estimated total returns suffer from serial correlation over time.[5] We mitigate this interim measurement problem by comparing holding periods returns and equity multiples measured over the life of the PERE fund.

The source of our PERE data is Cambridge Associates (CA). CA's PERE dataset contains information on 950 distinct PERE funds, enabling the most exhaustive investigation of their performance to date. The time frame examined is 2000Q1 through 2019Q4, or eighty (80) quarters. The information provided by CA includes the fund name, the year of legal inception (what we refer to as "vintage"), fund size in U.S. dollars (which are aggregate investor commitments, known as assets under management, or "AUM"), and the quarter during which each fund's capital was at least 25%, 50%, and 75% called from its limited partners by the general partner.

Additionally, CA provides performance metrics for each quarter including the net, to-date, internal rate of return (IRR) projected to be earned by LPs and the projected LP equity multiple (EM), defined as the total amount of cash expected to be distributed to LPs, divided by the total amount of equity invested by the LPs. This information is available beginning the later of Q1 2000, or the first quarter the fund began reporting to CA. The performance metrics are available for the lessor of 80 quarters or the number of quarters reported by the manager based on the vintage and life of the fund. CA also classifies each fund as fully "liquidated," "still active," or indicates the manager has "stopped reporting." The IRR and EM reported to CA by each manager are quite speculative early in each fund's life given limited capital deployment, uncertain performance, and few, if any, cash flow distributions to investors. The reported IRR and EM become more representative of each investor's actual experience through the passage of time.

CA also provides limited information on the geographic target of a fund's investment. Typically, funds are identified as predominantly U.S. (domestically) focused, internationally focused, or in a few instances, a non-U.S. country or region of focus. CA also indicates whether the fund's initial investment mandate was core, core-plus, value-added, development, opportunistic, or distressed debt.

CA receives fund performance data directly from the manager, but validates much of this reporting with fund investors. CA does not make individual fund information publicly available unless a manager is in the market raising a new fund or the manager provides CA permission to

[5] For a discussion of the lagging and smoothing inherent in appraisal-based property valuations, see Fisher and Geltner (2000) and Geltner and Ling (2007) and references therein.

"unlock" their fund data to an identified data subscriber. The confidentiality provided to managers helps to mitigate 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.

The comprehensive 950 fund sample provided by CA includes funds sponsored by 290 managers, with $780.6 billion of assets under management (AUM) (see Exhibit 1). We manually exclude 123 funds identified as private debt funds, homebuilder lot acquisition or development funds, infrastructure funds, or health care funds because they are less representative of commercial or multifamily residential real estate exposures.[6] We exclude 61 the funds with vintages from 1987 to 1999 because CA did not provide performance data prior to 2000. These deletions produce a preliminary sample of 766 PERE funds with AUM of $624.5 billion, of which 465 funds are identified as primarily U.S. focused. CA classifies 301 funds as internationally focused.

(Exhibit 1 here)

At year-end 2019, CA reported that only 216 of the 950 PERE funds were "liquidated." The remainder were classified as "active," possibly creating a small number of final (liquidated) observations for analysis. We do not to rely on a "fully liquidated" designation from CA to include the fund in our analysis because we believe many funds are economically dormant before being designated as fully liquidated by CA and should therefore be included in our sample. Numerous private equity researchers follow a "seasoned fund" approach to sample selection that assumes that if a fund is at least four or five years old, the performance metrics reported by CA or other data providers can be considered final (e.g., Harris, Jenkinson, & Kaplan, 2014). Following this seasoned fund sampling approach, the exclusion of funds that came to the market after 2014 further reduces our sample by 129 funds. After removing six funds with missing data and one fund whose reported IRR was zero, our seasoned fund approach produces a sample of 630 PERE funds with AUM of $480.0 billion. Of these, 375 are identified by CA as funds that invest primarily in the U.S; 255 funds are classified as international PERE funds.

[6] We distinguish between private debt funds, excluded bond-like investments for our analysis, and non-performing loan funds, included in our analysis. Non-performing loan funds are often a high-risk mode of access to real estate investments through foreclosure proceedings or voluntary deed-in-lieu of foreclosure transfer from debtor to creditor.

For a variety of reasons, including potential fund manager final timing manipulation, it is likely that some funds with a vintage year of 2014 or earlier are economically alive and therefore not reporting final performance metrics.[7] To investigate this final fund sample selection issue, we develop an additional algorithm to establish whether each fund's reported IRR is effectively final and therefore should be included in an alternative "economic fund life" sample that we use for a series of additional robustness tests. Our algorithm is based on the assumption that, if the reported IRR remains constant, or nearly so, for a sufficient number of quarters, the fund's reported IRR is final, even if not designated so by CA. Funds often maintain accounts and sometimes reserves for a number of years after the cash flow distributions, and therefore their returns, are largely finalized. For example, reserves may be held as a cushion against a future lawsuit or some other unexpected event that will require a cash outlay. In such situations, the fund may be economically complete long before it is fully liquidated from a legal perspective.

Our additional economic fund life sampling approach starts with the 766-fund sample that excludes non-CRE funds and funds with vintage years prior to 2000 (top panel of Exhibit 1). As in the seasoned fund sampling approach, we delete 129 funds with vintage years after 2014 as well as 19 funds that have called less than 50% of committed LP capital and 28 funds that were in existence for less than 20 quarters. Next our algorithm scans the quarterly IRR reported by each remaining fund and determines whether the reported fund IRR remains unsettled or is effectively stable using three related criteria. First, is the variation in the reported IRR over a predetermined number (N) of consecutive quarters within a tolerable, immaterial range? Second, for how many consecutive quarters must the reported IRR exhibit variation within the acceptable range before we designate the fund as economically final. Finally, is an acceptable variation in IRR over N consecutive quarters measured in terms of a simple average of the *absolute* value of the variation from the mean over the N quarters, or measured as the *exponential* average of the absolute value of the variation over the N quarters?

We tested an IRR tolerance of five to 50 basis points in five basis point increments over a period of one to eight quarters in single quarter increments. Ultimately, we decided that if a fund does not report an average absolute change in IRR of more than 15 basis points over six

[7] Given a sufficient period of hindsight, researchers can ex-post establish whether a performance metric reported in a particular quarter is stable and therefore final. The challenge, without the benefit of hindsight, is to estimate when *interim* reporting becomes final.

consecutive quarters, the IRR reported at the beginning of the six quarters is used as the fund's final IRR, regardless of CA's categorization or its vintage year. We also visually inspected each fund's reported IRR from quarter-to-quarter to determine if our algorithm does an acceptable job of identifying when a reported IRR is, effectively, final. This final sample selection criteria removed an additional 247 funds, which resulted in much more restrictive sample of 342 PERE funds with AUM of $241.1 billion, of which 211 (131) funds are identified as U.S. (international) funds. We use this significantly reduced economic fund life sample for a restricted number of fund sample selection robustness checks.

Summary Statistics

As Exhibit 2 illustrates, the mean IRRs on the fund and the corresponding returns on the FTSE EPRA/NAREIT U.S. Net Total Return Index for the seasoned fund sample are 8.69% and 10.34%, respectively. Thus, the sample of 375 domestic funds underperformed the REIT index by an average of 165 basis points annually. The corresponding fund and equity REIT *median* returns on the domestic equity REIT index are 10.71% and 10.58%, respectively. Thus, based on medians, the seasoned fund sample outperformed the corresponding *median* return on the equity REIT index by 13 basis points. The large differences in mean and median fund IRRs indicates that return performance is highly skewed to the left in our seasoned fund sample.

(Exhibit 2 here)

In contrast, the equally weighted mean IRR of the 211 domestic funds in the economic fund life sample is 8.12%. The corresponding mean return on the domestic equity REIT index is 9.98%. Thus, these 211 funds underperformed the REIT index by an average of 186 basis points annually. This is 21 basis point greater than the mean underperformance of the funds in the larger, less restrictive, seasoned fund sample. The equally weighted *median* IRR of the 211 domestic funds is 8.63%; the median return on the REIT index is 10.30%. Thus, based on medians, the sample of 211 funds underperformed REITs by 167 basis points.

While both the seasoned fund and economic fund life samples show significant fund underperformance on average (i.e., 165 bp and 187 bp average underperformance, respectively), the two sampling approaches do show variation in their average fund performances. The equally weighted mean of the economic fund life sample is 57 basis points lower (8.12% versus 8.69%) than the mean of the seasoned fund and the *median* of the more restrictive sample is dramatically lower (8.63% versus 10.71%). This suggests that our algorithm's exclusion of the additional 164

U.S. funds (375 less 211) removes funds averaging IRRs of 9.42%, or 130 basis points greater than the funds determined by our algorithm to be final.[8]

The equally weighted mean EM of the 375 domestic funds in the seasoned fund sample is 1.38. The corresponding EM on the domestic equity REIT index is 1.61. Thus, the mean EM for domestic funds is 0.23 less than the mean EM that would have been earned on an investment in the equity REIT index. Among the 211 funds in the more restrictive sample, the mean EM of 1.38 is 0.33 less than the mean REIT EM.

Panel A of Exhibit 3 displays the vintage year variation of PERE activity by fund count for the 630 funds in our seasoned fund sample; panel B displays the vintage year variation of the 342 funds in our economic fund life sample. PERE fund raising activity increased steadily from 2001 through 2007. Over this period, the average fund size increased from approximately $400 million AUM to over $900 million AUM. However, the number of funds coming to market dropped sharply with the onset of the global financial crisis, as did average fund size. Fund raising activity and average fund size generally increased from 2011 through 2014. As expected, a year-by-year comparison of Panel A and Panel B reveals that the number of funds in our economic fund life sample is always less than the seasoned fund sample; these differences are notably significant after 2009.

(Exhibit 3 here)

Performance by Fund Characteristics

Exhibit 4 displays vintage year variation in the performance of U.S. PERE for the seasoned fund sampling approach. Panel A depicts the equally weighted IRR average for U.S. funds, while Panel B depicts the mean IRRs for international funds. We observe large variation in IRRs across vintage years. For example, the mean IRR of U.S. funds exceeded 20% in 2001 but fell to -5.58% among funds brought to market in 2005. 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 CRE pricing downturn that began in most parts of the U.S. in late 2007 or 2008 (Chervachidze and Wheaton, 2013; Duca and Ling, 2020). The mean IRR, however, jumped to 6.44% in 2007, to 15.19% in 2008 and to 16.76% in 2009. This sharp rise in reported performance

[8] 9.42% is calculated by solving the following expression for R: 8.69% x (375/375) = [(211/375) x 8.12%] + [(164/375) x R].

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 benefited from the eventual recovery in CRE markets. Mean IRRs ranged from 9.93% to 14.68% for funds with vintage years of 2010-2014. The time-series pattern for funds with international exposures (Panel B) is similar, but more volatile. Overall, the large variation in reported IRRs across vintage years displayed in Exhibit 4 suggests that economic cycles and the macroeconomic variables that drive these cycles are important determinants of fund performance.

(Exhibit 4 here)

Exhibit 5 provides equally weighted descriptive statistics for final IRRs and equity multiples for our seasoned fund sample disaggregated by fund risk profile, manager type, fund size, and pre- or post-2006 vintage. The mean IRR for the 132 high risk funds is 7.74%; the corresponding mean IRR for the 243 lower risk funds (core, core-plus, and value-added) is 9.21%. This 147 basis-point differential is consistent with the findings of Pagliari (2017), Fisher and Hartzell (2016), and Arnold, Ling, and Naranjo (2019). The median IRR for higher risk funds is 39 basis points lower than the corresponding return for low risk funds. The mean IRRs are substantially lower than the corresponding means, which further indicates that fund performance is skewed to the left. The mean equity multiple produced by high-risk funds is 0.05 lower than the multiple produced by lower risk funds; the median high-risk equity multiple is 0.03 lower. Only the top quartile high-risk funds outperformed their respective quartile of low risk funds, albeit marginally with a 0.10% IRR difference.

(Exhibit 5 here)

The managers of 327 funds (87%) in our seasoned fund life sample are private entities; 48 funds are managed by affiliates of publicly-traded entities. The mean (median) IRR for private managers is 9.01 (10.54%); the mean (median) IRR for funds managed by publicly-traded entities is 6.50% (10.82%). However, the volatility of LP returns with private managers is slightly higher, as evidenced by the 25^{th} and 75^{th} percentile IRRs. The mean (median) equity multiple produced by private managers is 0.03 greater than public managers; the median is 0.07 higher.

Arnold, Ling, and Naranjo (2019) find that fund size is positively associated with performance, although this relationship is stronger for funds with an exposure to international properties. We

define large (small) funds as being above (below) the sample median. The mean IRR for large funds in our domestic seasoned fund sample is 8.36%; the corresponding mean IRR for small funds is 8.98%. While this 62 basis-point differential might appear inconsistent with the earlier findings in Arnold, Ling, and Naranjo (2019), the performance comparison of large funds versus small funds in that prior study was conducted on a value weighted basis whereas the performance metrics reported in Exhibit 5 are equally weighted. This suggests that smaller funds outperform large funds on average, but the mega-funds running the largest AUMs dominate both small and large funds. The median IRR for large funds is 152 basis points lower than the corresponding return for low risk funds. The mean equity multiple produced by large funds is 0.10 lower than the small fund multiple.

The mean (median) IRR for the 267 funds in our domestic sample that came to market in 2006 or afterwards is 10.70 (11.66%). In contrast, the mean (median) IRR for funds with vintage years prior to 2006 is 3.73% (3.01). These large differences reflect the poor performance of many closed-end PERE funds that came to market in the years immediately preceding the financial crisis.

THE RELATIVE PERFORMANCE OF PERE

Comparing PERE and Equity REIT Returns

Our research methodology is similar in spirit to the use of a private market equivalent (PME) as a benchmark to evaluate the performance of a private equity fund. The PME, a performance metric developed by Kaplan and Schoar (2005), compares the return a fund investor earned net of fees to what that same investor would have earned in equivalently timed investments in an appropriate public market index. However, calculation of the PME requires data on all limited partner capital investments (calls) and cash flow distributions over the life of the fund. Such data are not available to us from Cambridge Associates.

Our stylized PME approach uses the quarter that a fund becomes 50% called and the effective duration in quarters of the invested capital, which we derive from the mathematical equivalency of the net IRR and net equity multiple. This stylization allows us to covert each fund's multiple capital inflows and outflows into a single inflow and single outflow, over a defined investment horizon, and compare that same investment in an index over the equivalent time horizon. Since the actual fund IRR and equity multiple provided by Cambridge Associates is a dollar-weighted calculation, the conversion of the cash flows to a single inflow and single outflow allows comparability of the fund's returns to the time-weighted returns of a benchmark index. See the

Appendix for an explanation of how we determine the duration of the fund's life and an analysis of the robustness of our methodology.

Adjusting for the Relative Risk of PERE

Relative to equity REITs, the typical closed-end PERE fund is significantly less liquid, uses more financial leverage, and requires investors (LPs) to maintain liquid assets ("dry powder") for capital calls of indeterminate size and timing. Research in listed stock markets consistently finds a significant positive return premium for stock illiquidity (Amihud et al., 2015; Chaieb et al., 2020), although estimates of an appropriate *ex ante* illiquidity premium vary widely with the estimation methodology, sample period, and sample selection. Moreover, even the most illiquid listed stocks are more liquid than closed-end PERE funds. Sorensen et al. (2014) find that the cost of illiquidity in the broader private equity market is comparable to the cost of the GP's total compensation. We therefore believe that a 200 basis point upward adjustment to the annualized IRR earned on each fund's REIT benchmark is a conservative adjustment for the illiquidity of PERE funds relative to liquid REITs.

Over the 2000 to 2018 period, the use of financial leverage boosted equity REIT returns by an average of over 3.0 percentage points annually (Ling and Naranjo, 2015). During this period, the typical equity REIT employed about 35-40% leverage. Although the leverage employed by closed-end PERE funds is not readily observable, we estimate the typical fund in our sample employed 60-70% leverage based on industry sources and inspection of private placement memorandums. A 100 basis point upward adjustment to the annualized IRR earned on each fund's REIT benchmark is a conservative adjustment for the greater use of leverage by PERE funds.

Unlike investors in open-end PERE funds, LP investors in closed-end funds incur an opportunity cost associated with maintaining sufficient liquidity in their portfolio to cover capital calls by the fund manager of uncertain magnitude and timing. This opportunity cost, which is ignored in industry calculations of IRR, is time-varying and unique to each investor. It may also vary for the same investor under different circumstances (i.e., market conditions, alternative sources of liquidity, the relative maturity of the PERE investment program). Since the opportunity cost of keeping dry powder is difficult to estimate *ex ante* and varies with the circumstances and risk aversion of the investor, Arnold, Ling, and Naranjo (2017) propose the use of a range of costs. We initially adjust upward the annualized IRR earned on each fund's REIT benchmark by 125

basis points (annually), which is on the low end of the estimates provided by Arnold, Ling, and Naranjo (2017), to account for this opportunity cost of maintaining dry powder. In our comparisons of PERE performance to listed REITs, we therefore argue that annual IRR adjustments for illiquidity, financial leverage, and the opportunity cost of waiting of at least 425 basis points is reasonable.

However, arguments can be made for the consideration of additional factors when assessing the risk of PERE relative to equity REITs. For example, during our sample period, REITs generally engaged in relatively low-risk core real estate investment strategies focused on high-quality stabilized properties. As a result, relative to PERE funds, they typically take on less development and operational risk and deliver a significant portion of investors' total returns through quarterly dividend distributions. In contrast, some argue that relative to private market investments, REITs expose investors to greater short-term return volatility as well as higher correlations with the broader equity market. In addition, private market investments may provide different risk factor exposures than REIT investments, which may be of value to some investors. To demonstrate the sensitivity of our horse race results to different risk adjustments, we also provide results assuming adjustments of 200, 425, and 600 basis.

The core funds in the NCREIF ODCE Index generally pursue a diversified, low risk/return strategy with a long-term horizon. They tend to invest in "best-in-class" traditional asset classes (i.e., office, retail, industrial, multi-family properties) in prime locations that are generally well-maintained assets with stable cash flows and high occupancies. These funds generally use little or no debt and the income stream, which is less difficult to predict than future price appreciation, represents the majority of expected holding period returns.

In contrast, value-add closed-end (lower risk) PERE funds tend to invest in moderate-to-high risk/return strategies with short- to medium-term horizons. Value is expected to be added through re-leasing and/or redevelopment activities. Thus, value appreciation often comprises a majority of expected total return. More leverage is also typically employed. Opportunistic PERE funds pursue even higher risk investment strategies, which often include ground-up development or conversion projects financed with even greater leverage. Unlike, closed-end funds, investors in ODCE funds do not face an opportunity cost of waiting for capital calls. In short, it could be argued that, when comparing PERE funds to ODCE funds, adjustments are required to compensate for the opportunity cost of keeping dry powder and for the extent to which the investment strategy of the

average closed-end PERE fund is riskier than the strategy employed by the typical open-end fund tracked by the NCREIF ODCE Index.

With respect to liquidity, ODCE funds provide some ability for investors to enter and exit on a quarterly basis, which would seem to make ODCE funds more liquid than closed-end PERE funds. However, investors in ODCE funds often must provide significant advance notice and can even be required to wait in a multiple quarter or multiple year queue to liquidate their positions. Therefore, the extent to which ODCE funds are more liquid than the closed-end funds in our sample is debatable and readers are invited to make their own assessments.

Results

Panel A of Exhibit 6 compares the IRR performance of the domestic funds in our seasoned fund sample to the corresponding FTSE-NAREIT return--without risk adjustments. The realized IRR performance of each fund's REIT benchmark is subtracted from the fund's realized performance. As reported in Exhibit 2, the mean IRR underperformance of our 375 domestic funds is 165 basis points. Of these, 171 (46%) performed better than the REIT index; 199 funds (53%) underperformed the REIT index. The IRRs for five funds were within (plus or minus) 10-basis points of the benchmark REIT return.[9]

(Exhibit 6 here)

Panel B of Exhibit 6 displays the percentage of over and underperforming funds assuming different risk adjustments. With a 200-basis point risk adjustment, the percentage of funds that outperformed the REIT index declines from 46% to 38%; the percentage that underperformed increases from 53% to 61%. With a 425-basis point risk adjustment, only 32% of funds outperformed REITs in head-to-head competition. In contrast, 68% of funds underperformed equity REITs. Finally, with a 600-basis point risk adjustment, only 27% of sample funds outperformed the REIT index while 72% underperformed. As a sector, PERE clearly underperformed equity REITs during our sample period with the degree of underperformance increasing with the assumed risk adjustment.[10]

[9] The selection of a 10-basis point tolerance for categorizing over and under performance has little effect on the results. With a 10-basis point tolerance, 53.1% of the funds are categorized as underperforming relative to the REIT benchmark. When we increase the tolerance to 25- and 50- basis points, the percentage of underperforming funds decreases to 52.3% and 51.2%, respectively.

[10] This underperformance is consistent with the research findings of Ludovic Phalippou, who has frequently documented the underperformance of leveraged buyouts and venture capital funds. See, for example, Morris and Phalippou (2020).

Exhibit 7 plots the average outperformance of the 375 domestic funds in our seasoned fund sample by vintage year, unadjusted for risk. The average fund with a vintage year from 2000 to 2006 underperformed equity REITs, especially those that came to market in 2004 and 2005, just before the global financial crisis. Funds that came to market in 2007-2009 produced an average IRR in excess of the REIT benchmark as these funds benefited more than REITs from the strong recovery from the global financial crisis. Since 2010, PERE has performed similarly to equity REITs--prior to any adjustments for risk.

(Exhibit 7 here)

In recent years, non-core property types, such as cell towers, infrastructure, single-family rental homes, and self-storage properties, have constituted an increasing percentage of the FTSE EPRA/NAREIT U.S. Net Total Return Index. We therefore replicate the results reported in Exhibit 6 using a REIT total return index that consists of only the traditional core property types: apartments, retail, office and industrial. The percentage of over and underperforming funds, 46% and 53%, respectively, are identical to those reported in Exhibit 6. This is because our index of core property returns and the FTSE EPRA/NAREIT U.S. Net Total Return Index over our 2000 to 2014 sample have a quarterly correlation of over 99%.

In the results reported in Exhibit 8, we use the net of fees returns on the NCREIF ODCE Index as the benchmark for comparison.[11] Without adjustments for risk, the mean IRR outperformance of our 375 domestic funds is 126 basis points. Importantly, the average outperformance is driven by some high relative performers given the median outperformance drops significantly to only 19 basis points. Looking at the individual horse races, 213 funds (57%) performed better than the return that would have been generated by an investment in the NCREIF ODCE Index; 158 funds (42%) underperformed the ODCE. Although not separately displayed, when a 100-basis point risk adjustment is applied for only the higher relative financial leverage risk of PERE, 50% of the

[11] Funds included in the NCREIF ODCE Index invest in private equity real estate. At least 80% of the market value of net assets must be invested in real estate, and no more than 20% in cash or cash equivalents. At least 80% of the fund's market value must be invested in private equity real estate properties, and no more than 20% in real estate debt instruments. At least 95% of the market value of real estate must be invested in the U.S. properties and at least 80% must be invested in office, industrial, apartment and retail properties. At least 80% must be invested in operating properties, and no more than 20% invested in (pre)development/redevelopment or initial leasing / lease-up. Leverage is limited to 40% of the market value of net assets. Finally, no more than 65% of the market value of real estate may be invested in one property type or one geographic region. Funds in the ODCE Index must also comply with the NCREIF Real Estate Information Standards, including annual audits, quarterly valuations, and time-weighted returns (for more information, see www.ncreif.org).

PERE funds outperformed ODCE and 48% of the funds underperformed. Overall, our results show that PERE funds have similar performance to the NCREIF ODCE Fund Index.

(Exhibit 8 here)

Exhibit 9 displays the return distribution of funds, unadjusted for risk, in our seasoned fund sample with exposure to international properties. For performance comparisons, each PERE fund IRR is time-matched with the corresponding return on the FTSE EPRA/NAREIT Developed Real Estate ex-U.S. Return Index. This index excludes U.S. equity REITs. Panel A of Exhibit 9 displays the performance distribution using raw IRRs. The mean IRR underperformance of our 255 international funds is 194-basis points. Forty-six percent (118 funds) performed better than the international REIT benchmark for each fund; 53% (135 funds) underperformed the international REITs. Although not separately displayed, when the IRR earned by international REITs is adjusted upwards by 425-basis point, the mean underperformance of PERE funds increases to 619 basis points and only 32% of the international funds outperformed international REITs. Overall, the results presented in Exhibit 9 reveal that, on average, international PERE funds also underperformed relative to international REITs, but by a lesser degree than domestic PERE funds.

(Exhibit 9 here)

THE DETERMINANTS OF RELATIVE PERE PERFORMANCE

Overall, our performance comparisons show that PERE often underperforms relative to equity REITs. In this section, we provide further evidence showing that this underperformance is in part related to various macroeconomic exposures. We define relative performance as the fund IRR in excess of the time-matched IRR on the public equity benchmark. We first provide univariate regressions of relative performance on various macroeconomic risk factors as well as fund characteristics. We then provide the results of a multivariate regression. Each regression specification contains vintage year fixed effects. Exhibit 10 provides the various regression results. T-statistics are in parenthesis; *, **, *** are indicators of statistical significance at the 10%, 5%, and 1% levels, respectively.

(Exhibit 10 here)

In first two specifications (1) and (2), we report the influence of interest rates and a proxy for economy-wide credit risk on the relative performance of PERE funds. *Treasury_10* is defined as the average yield on 10-year Treasury securities from the quarter in which each fund's committed capital was 50% deployed to the end of its investment horizon. *BBB_Spread* is defined as the

corresponding average BBB bond spread relative to 10-year Treasuries over the fund's investment horizon. We find a positive and statistically significant relation between the relative performance of U.S. PERE and both *Treasury_10* and *BBB_Spread*. These estimated positive net exposures of relative PERE performance to *Treasury_10* and *BBB_Spread* are also consistent with PERE investments displaying greater risk exposures relative to a more diversified equity benchmark.

In the third specification (3) we provide univariate regression results using the annualized average 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 (*US_GDP*). We find a negative and statistically significant relation between the relative performance of U.S. PERE and *US_GDP*. This univariate result suggests that the performance spread narrows with increases in average economic growth.

We next examine the impact of three fund characteristics on relative performance. *Public_Mgr* is a dichotomous variable set equal to one if the fund is managed by a public entity. *High_Risk* is a dichotomous variable set equal to one if the fund pursues an opportunistic, development, or distressed property strategy. *Large_Fund* is a dummy variable that equals one if the fund's AUM is above the sample mean. Looking at the univariate fund characteristic regression results in specifications (4) through (6), we see that none of these fund characteristics explain the relative performance of U.S. PERE versus the benchmark.

The last specification (7) in Exhibit 10 provides multivariate regression results that include both the macroeconomic factors and fund characteristics. In this regression, we again see that relative fund performance widens with the interest rate environment variables, but the other variables in the regression absorb the GDP effects. The adjusted R-squares from the various specifications are moderately high, ranging from 17.1% to 25.5% for the multivariate specification.

SUMMARY AND CONCLUSION

In this paper, we provide a comprehensive examination of the return performance of closed-end, private equity real estate (PERE) funds relative to the performacne of listed real estate stocks (REITs) and the NCREIF ODCE fund index. We first match each PERE fund in our sample and its realized internal rate of return and equity multiple with the return that would have been earned by a LP investor on an investment in the designated benchmark over each fund's investment horizon. With the matched set, we conduct a thorough examination of the differences in return

performance. This "horse race" approach to deteming the relative performance of PERE is superior to simply comparing an index of PERE performance, comprised of an often unknown mixture of funds of different vintages, to a designated benchmark.

We also perform a battery of conditional, relative performance tests across a range of private equity fund characteristics, investment horizons, and economic cycles. We further examine the unconditional and conditional relations between the FTSE EPRA/NAREIT U.S. Net Total Return Index and PERE returns.

Overall, we find that closed-end PERE funds have underfperformed listed REITs, even before adjusting for risk, leverage, illiquity, and the uncertain investment timing associated with unfunded capital commitments. In contrast, we find similar overall performance between PERE and the NCREIF ODCE fund index, though there is substaintial cross-sectional variation in individual PERE fund performance relative to NCREIF ODCE. Finally, we find that the relative performance spread widens with interest rate environment variables (Treasury yields and default spreads) and narrows with broad macroeconomic performance indicators (growth rate of GDP).

Our paper contributes to a body of literature that compares the return performance of listed CRE stocks to private market benchmarks. Our findings provide additional support for the superior performance of the listed CRE stocks relative to a private market alternative. Our comprehensive findings on the significant variation in the relative performance of PERE across funds and over time also contributes to a gap in the private equity literature whereby the rewards and risks facing PE investors are not well understood. Our findings have important implications for PERE investment and allocation strategies as well as fund manager selection and reporting behavior. In this regard, an important open question is the extent of interim and final performance reporting biases by GP's and the factors that drive this reporting behavior.

APPENDIX[12]

The following explains the conditions under which the duration of the fund can be determined from the fund's IRR and equity multiple. Let $Call_t$ be the capital call at time t, where $Call_t < 0$. Let $Distn_t$ be the distribution to the LPs at time t, where $Distn_t > 0$. The present value of the fund's cash inflows and outflows is

[12] We thank Greg MaKinnnon, the Editor, for his helpful insights and contribution to this appendix.

$$\sum_{t=0}^{T'} \frac{Call_t}{(1+r)^t} + \sum_{t=0}^{T'} \frac{Distn_t}{(1+r)^t},$$

where T' is the actual end of life of the fund.

Consider a hypothetical fund (benchmark) that produces cash inflows and outflows equal in total magnitude to the actual fund; however, all cash outflows (capital calls) occur at time *t*=0 and all cash distributions occur at time *t* = *T*. The present value of the alternative fund's cash flows is

$$\sum_{t=0}^{T} Call_t + \frac{\sum_{t=0}^{T} Distn_t}{(1+r)^T}$$

Note that because total cash inflows and outflows are the same, the two funds will have the same equity multiple. Equating the two present values results in:

$$\sum_{t=0}^{T'} \frac{Call_t}{(1+r)^t} + \sum_{t=0}^{T'} \frac{Distn_t}{(1+r)^t} = \sum_{t=0}^{T} Call_t + \frac{\sum_{t=0}^{T} Distn_t}{(1+r)^T}$$

If we use the fund's actual IRR as the discount rate, then the left-hand-side of the above equation is zero, so:

$$0 = \sum_{t=0}^{T} Call_t + \frac{\sum_{t=0}^{T} Distn_t}{(1+IRR)^T}$$

This means that the fund's IRR is also the IRR of the alternative fund. Now, solve this equation for *T*, which is the time horizon that produces the same IRR as the original fund:

$$(1+IRR)^T = \frac{\sum_{t=0}^{T} Distn_t}{-\sum_{t=0}^{T} Call_t}$$

$$(1+IRR)^T = Multiple$$

Thus, the implied duration of the actual fund is

$$T = \frac{\ln(Multiple)}{\ln(1+IRR)}.$$

With this backdrop in mind, an important question is under what conditions is the IRR we calculate for the benchmark alternative fund equal to the IRR on the benchmark that we would calculate with the PME method? That is, when is our calculated IRR equal to the IRR that would be calculated if we knew the actual magnitude and timing of the cash inflows and outflows on the PERE fund? The answer to this question depends on the volatility of the periodic returns on the benchmark index over the life of the fund. In particular, it can be shown that our method for

determining the time-matched return on the benchmark index is equivalent to the true PME if the periodic returns on the benchmark index are constant over the duration of the fund's life and is quite close if the benchmark index displayed moderate (typical) volatility over the fund's life.[13]

We also tested whether the two methods are sufficiently equivalent when the chosen benchmark experiences extreme volatility. The answer depends on when that index volatility occurs during the life of the fund, the magnitude of the volatility, and what amount of LP capital is invested in the fund when the index volatility occurs. If there are actual fund capital calls that precede our investment horizon start date, by definition when less than 50% of committed capital is subjected to that volatility. However, the volatility that occurs during the investment horizon, no matter how extreme, is largely captured by our methodology, subject only to some slight variability based on actual capital weighting between the period at 50% called and when the fund is fully called.

While our approach captures volatility occurring during the investment period, there is the rare possibility of extremely high index return volatility occurring immediately after the end of our calculated investment horizon, which could possibly create some potential differences between a true PME and our stylized PME. To examine the extent to which the volatility of the REIT return index is related to our measure of fund under/over performance, we regressed our measure of excess fund returns (using both raw excess returns and absolute returns) against the quarterly volatility (measured both during the investment period and over the fund's life) of the time-matched return on the benchmark index and found little significance. Importantly, the few cases of significance that we found includes both positive coefficients (which would indicate increased relative fund performance) and very few negative coefficients (which would indicate decreased relative fund performance). We also accelerated and lagged our investment horizon (25% called and 75% called) and the results remain robust, which suggest that post-investment horizon return volatility does not influence the results at a 10 bps "too close to call" threshold when determining

[13] Although PME is a widely used private equity performance metric, it is important to note that it has some issues. The denominator blends predictable management fees and difficult to predict capital calls; arguably management fees should be discounted at the risk-free rate. The LPs' cash distributions have a different risk profile than the underlying fund asset(s); therefore, these distributions should be discounted at a different rate than the cash flows on the underlying fund assets. In addition, the PME does not account for the LPs' cost of illiquidity and the levered beta of private equity investments is unlikely to equal one, as assumed by use of the PME. See Sorensen et al. (2014) for more discussion of these issues.

whether a fund won its horse race against the benchmark. Using an even wider zero difference range of 50 bps, our findings remained robust.

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Exhibit 1
Private Equity Real Estate Sample Construction

	Fund Count	Mgr. Count	Total AUM ($Bn)
CA Initial Sample	950	290	$780.6
Filters			
Non-CRE Equity Funds, Credit Funds, Homebuilder Lots, and Locked Data	123	38	$126.3
Pre-2000 Funds	61	17	$29.8
Remaining CA Fund Samples			
All PERE Funds	766	248	$624.5
U.S. PERE Funds	465	167	$308.9
International PERE Funds	301	110	$315.6
Seasoned Fund Sample Approach			
Filters			
Post-2014 Funds	129	69	$143.7
Outlier IRR	1	0	$0.2
Missing Data	6	0	$0.6
All PERE Funds	630	232	$480.0
U.S. PERE Funds	375	151	$220.0
International PERE Funds	255	103	$260.0
Economic Fund Life Sampling Approach			
Filters			
Post-2014 Funds	129	69	$143.7
< 50% Capital Called	19	4	$22.1
< 20 Qtrs Maturity	28	3	$47.6
Outlier IRR	1	0	$0.2
Average IRR Variability > |15| bps per qtr. over 6 consecutive qtrs.	247	61	$169.8
All PERE Funds	342	164	$241.1
U.S. PERE Funds	211	112	$107.8
International PERE Funds	131	67	$133.3

This exhibit describes our sample construction using Private Equity Real Estate Data (PERE) from Cambridge Associates (CA). The "Seasoned Fund" sampling approach includes PERE funds that have at least five years of seasoning. The "Economic Fund Life" sampling approach includes PERE funds from 2000-2014 vintages, whose capital is at least 50% called, that have a minimum maturity of 20 quarters, and display an average absolute IRR variability tolerance of 15 bps or less, per quarter, over six consecutive quarters.

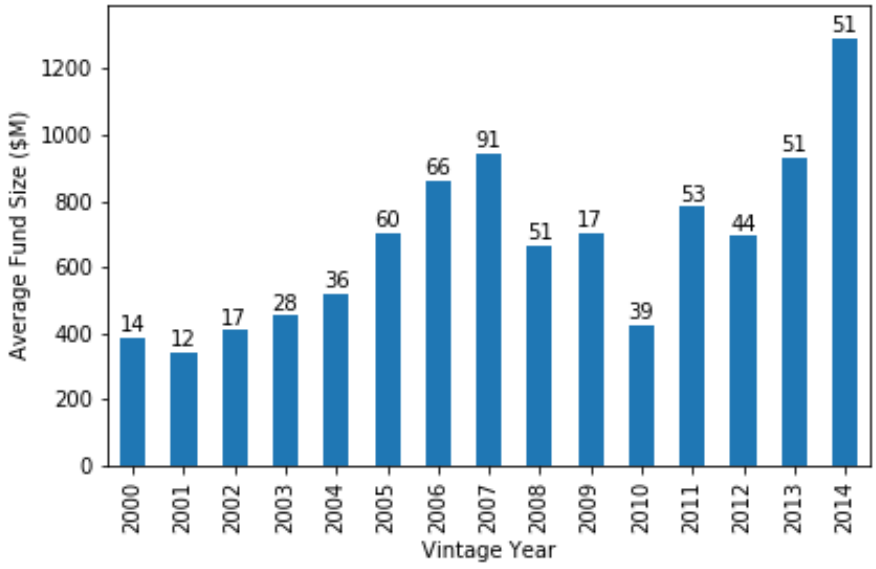
Exhibit 2
U.S. Private Equity Performance versus U.S. Equity REITs using Seasoned and Effective Fund Life Approaches for Fund Samples

	IRR Performance Metric				Equity Multiple Performance Metric			
	Mean	Median	25th %	75th %	Mean	Median	25th %	75th %
Seasoned Fund Approach: 375 funds								
Fund performance	8.69	10.71	3.34	16.04	1.38	1.45	1.18	1.64
Equity REIT performance	10.34	10.58	3.32	16.32	1.61	1.43	1.16	1.89
Difference	-1.65	0.13			-0.23	0.02		
Economic Fund Life Approach: 211 funds								
Fund performance	8.12	8.63	1.35	16.13	1.38	1.45	1.07	1.68
Equity REIT performance	9.98	10.30	7.90	12.37	1.70	1.57	1.34	1.97
Difference	-1.86	-1.67			-0.32	-0.12		

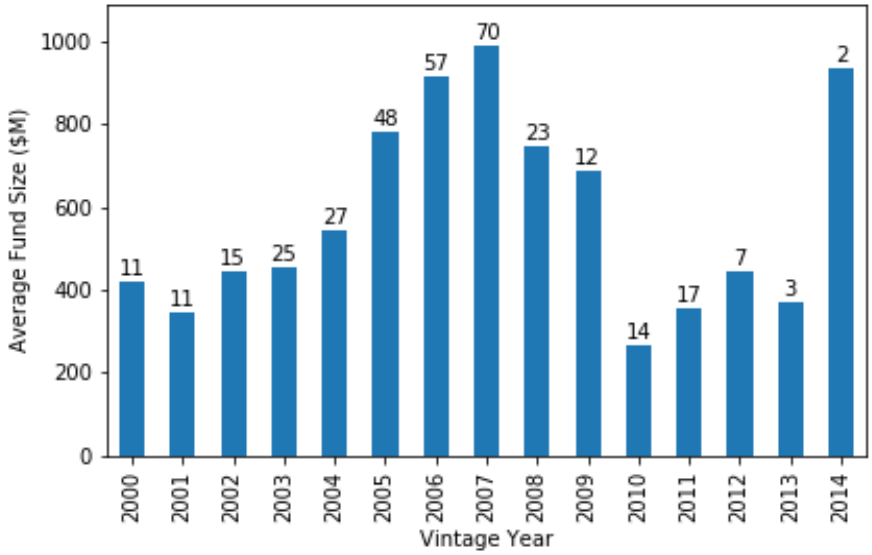
This exhibit provides descriptive statistics on Internal Rate of Return (IRR) and Equity Multiple (EM or MOIC) performance metrics for U.S. Private Equity Real Estate (PERE) funds using 2000-2014 fund vintages compared to a U.S. Equity REIT benchmark. For performance comparisons, each fund is time-matched with the corresponding performance of the FTSE EPRA/NAREIT U.S. Net Total Return Index.

Exhibit 3
Mean Fund Size in ($) Millions and Fund Count by Vintage Year

Panel A: Seasoned Fund Approach Sample



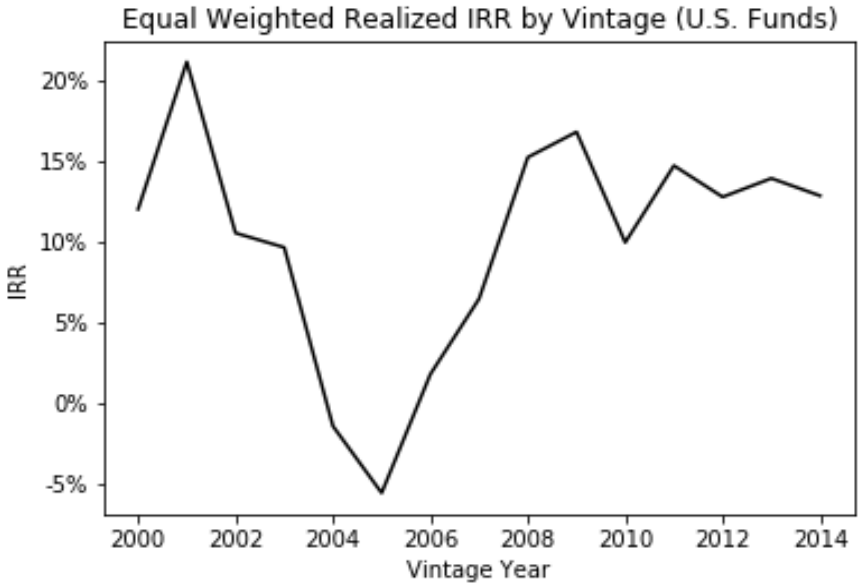
Panel B: Economic Fund Life Approach Sample



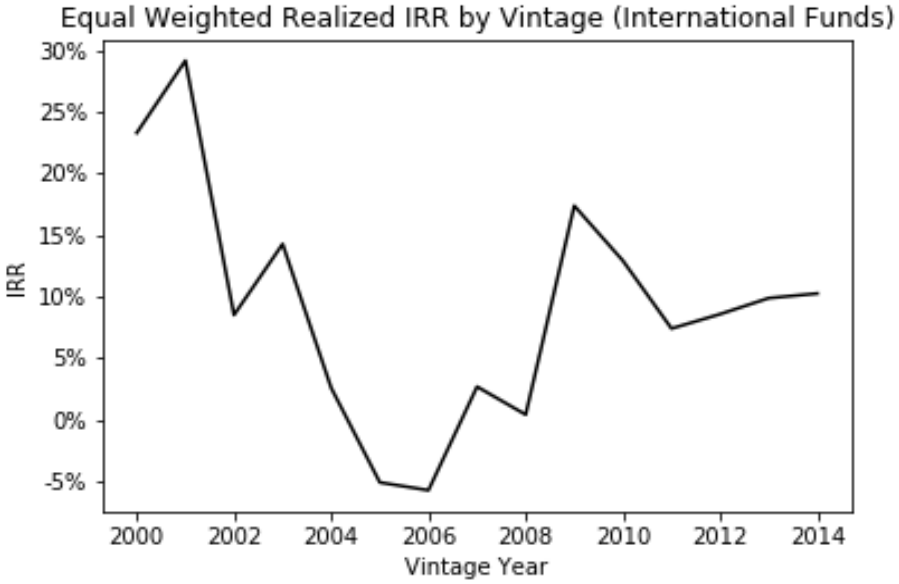
This exhibit displays the vintage year variation of Private Equity Real Estate (PERE) activity by fund count and by mean fund size, unadjusted for inflation, based on total committed capital.

Exhibit 4
Average Realized IRRs by Vintage Year

Panel A: U.S. Funds



Panel B: International Funds



This exhibit displays the vintage year variation in performance of U.S. PERE for the "Seasoned Fund" sampling approach. The performance is measured as the equally-weighted average of realized IRRs by vintage year.

Exhibit 5
U.S. Private Equity Real Estate Fund Characteristics and Performance

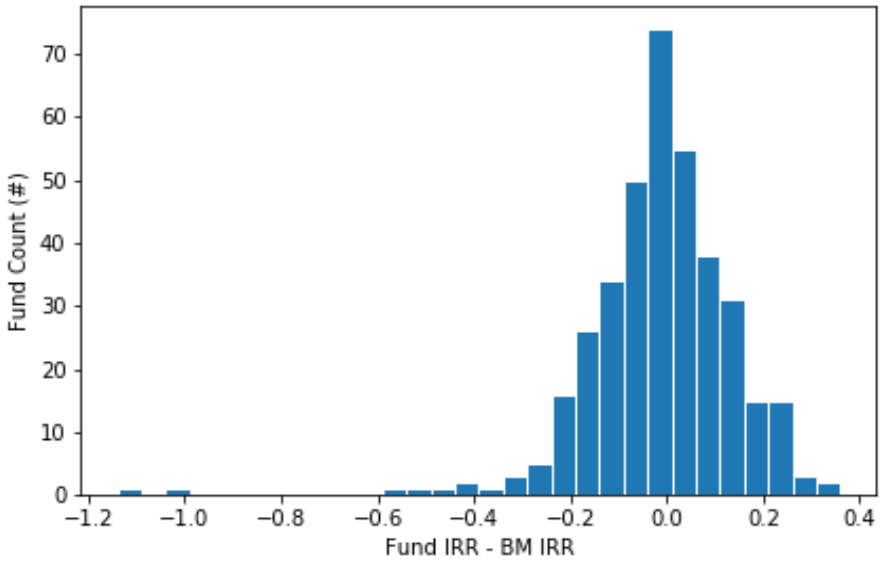
Fund Characteristics	Count	IRR Performance Metric				Equity Multiple Performance Metric			
		Mean	Median	25th %	75th %	Mean	Median	25th %	75th %
High risk funds	132	7.74	10.38	1.83	16.04	1.35	1.42	1.12	1.66
Low risk funds	243	9.21	10.77	4.35	15.94	1.40	1.45	1.20	1.63
Difference		-1.47	-0.39	-2.52	0.10	-0.05	-0.03	-0.08	0.03
Private manager	327	9.01	10.54	3.03	16.18	1.39	1.45	1.16	1.64
Public manager	48	6.50	10.82	5.20	13.70	1.36	1.38	1.25	1.67
Difference		2.51	-0.28	-2.17	2.48	0.03	0.07	-0.09	-0.03
Large Funds	175	8.36	9.82	2.38	14.56	1.33	1.38	1.12	1.60
Small Funds	200	8.98	11.34	4.49	16.64	1.43	1.49	1.21	1.69
Difference		-0.62	-1.52	-2.11	-2.08	-0.10	-0.11	-0.09	-0.09
Vintage ≥ 2006	267	10.70	11.66	7.03	16.24	1.45	1.47	1.30	1.65
Vintage < 2006	108	3.73	3.01	-3.80	12.66	1.21	1.22	0.78	1.64
Difference		6.97	8.65	10.83	3.58	0.24	0.25	0.52	0.01

This exhibit provides equally-weighted descriptive statistics on the performance of U.S. Private Equity Real Estate (PERE) funds by fund characteristics for the "Seasoned Fund" sample.

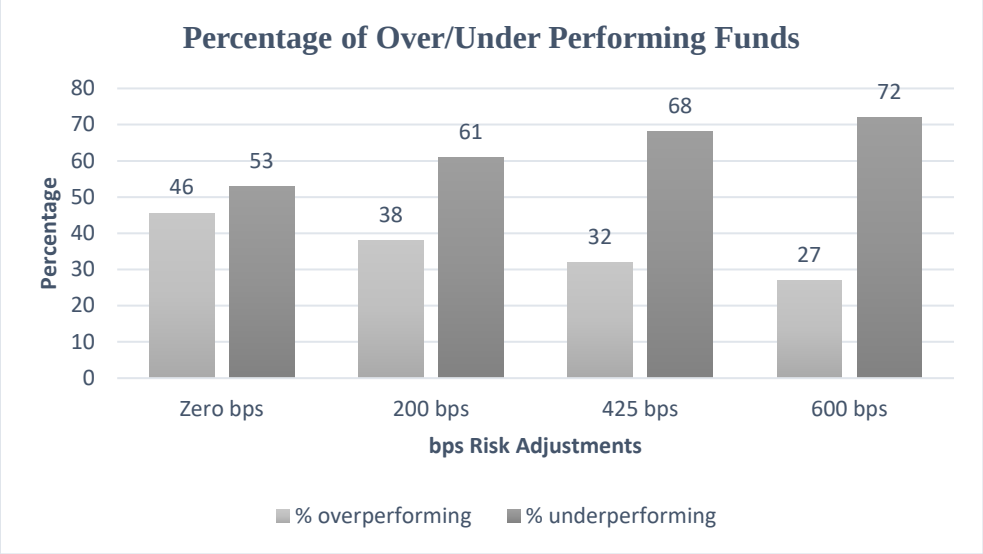
Exhibit 6
Distribution of U.S. PERE Performance vs. U.S. Equity REITs

Panel A: Raw Fund IRRs

	Number of Funds	Percent of Funds (%)
Fund IRR - BM IRR > 0	171	46
Fund IRR - BM IRR = 0	5	1
Fund IRR - BM IRR < 0	199	53
Total	375	100

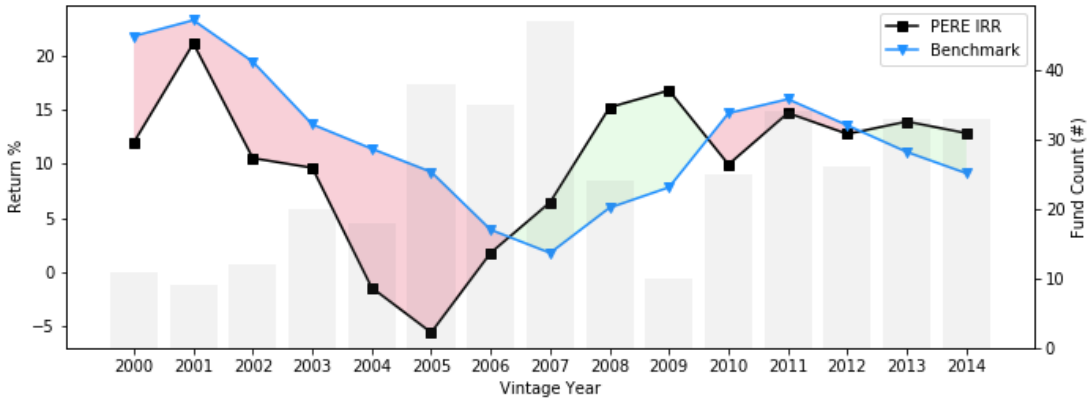


Panel B: Risk-adjusted Relative Fund Performance



Panel A displays the distribution of U.S. PERE fund performance (seasoned sample) versus U.S. Equity REITs using IRR as the performance metric. In Panel A, we show the performance distribution using raw (unadjusted) IRRs; The "= 0" bucket contains funds with IRRs within a 10^{th} of a basis point of the benchmark. Panel B contains the performance distributions after upward adjusting the equity REIT returns by zero, 200, 425, and 600 basis points, respectively to account for the greater risk of the PERE funds.

Exhibit 7
Performance of U.S. PERE Funds vs. U.S. Equity REITs by Vintage Year

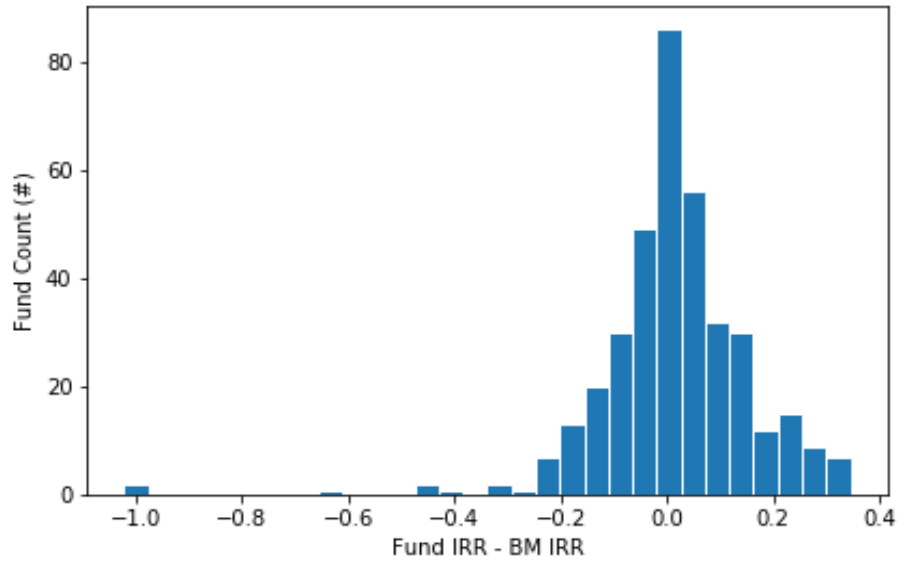


This exhibit displays the performance of U.S. PERE funds (Seasoned Sample) versus U.S. Equity REITS by vintage year using IRR as the performance metric. The benchmark returns are not adjusted for risk.

Exhibit 8
Distribution of U.S. PERE Performance vs. Alternative Benchmarks

U.S. PERE vs. NCREIF ODCE

	Number of Funds	Percent of Funds (%)
Fund IRR - BM IRR > 0	213	57
Fund IRR - BM IRR = 0	4	1
Fund IRR - BM IRR < 0	158	42
Total	375	100

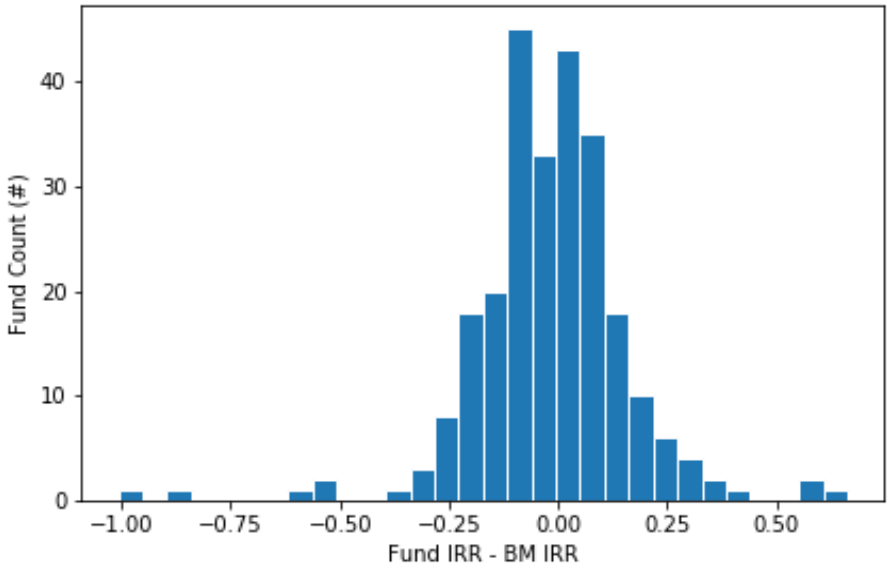


This panel displays the distribution of U.S. PERE fund performance (seasoned sample) compared with the NCREIF NFI-ODCE Index.

Exhibit 9
Distribution of International PERE Performance vs. International Equity REITs

Panel A: Raw Fund IRRs

	Number of Funds	Percent of Funds (%)
Fund IRR - BM IRR > 0	118	46
Fund IRR - BM IRR = 0	2	1
Fund IRR - BM IRR < 0	135	53
Total	255	100



This exhibit displays the distribution of International PERE fund performance (Seasoned Sample) versus International Equity REITS using IRR as the performance metric. We show the performance distribution using raw (unadjusted) IRRs. The "= 0" bucket contains funds with IRRs within a 10th of a basis point of the benchmark.

Exhibit 10
U.S. Private Equity Real Estate Fund Relative Performance Exposures

	Regressions of PERE in Excess of the NAREIT Benchmark						
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treasury_10	0.080***						0.058***
	(4.155)						(2.668)
BBB_Spread		0.115***					0.140***
		(5.22)					(3.591)
US_GDP			-0.022**				0.016
			(-2.312)				(0.946)
Public_Mgr				-0.023			-0.016
				(-1.031)			(-0.748)
High_Risk					0.007		0.001
					(0.441)		(0.044)
Large_Fund						-0.015	-0.022
						(-0.972)	(-1.516)
Constant	-0.283***	-0.209***	0.059*	-0.017**	-0.022**	-0.014	-0.489***
	(-4.439)	(-5.654)	(1.683)	(-2.097)	(-2.413)	(-1.440)	(-4.785)
Vintage Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	375	375	375	375	375	375	375
Adj R^2	0.207	0.228	0.181	0.172	0.170	0.171	0.255

This exhibit provides estimated regression exposures of U.S. Private Equity Real Estate (PERE) fund performance (seasoned sample) relative to the time-matched corresponding performance of the FTSE EPRA/NAREIT U.S. Net Total Return Index on macro environment variables and fund characteristics. The regressions include vintage year fixed effects. T-statistics in parenthesis, and *, **, *** are indicators of statistical significance at the 10%, 5%, and 1% levels, respectively.