Leverage in Private Equity Real Estate

By Jacob S. Sagi and Zipei Zhu*

Draft: March 21, 2022

We review the scant academic literature on the use of leverage in institutional private equity real estate (PERE) investments and summarize a number of stylized facts. The bulk of available evidence supports the view that leverage, as used by high-risk PERE funds, does not adequately compensate limited partners for the risk that it adds.
JEL: E44, G11, G23, L85, R3
Keywords: Real Estate, Private equity, Leverage

A central implication of the celebrated capital structure irrelevance results of Modigliani and Miller (1958) is that, in an ideal (friction-free) setting, leverage creates no value and is essentially part of a zero-sum game of rights and privileges between various asset stakeholders. Because, in practice, leverage seems far from irrelevant, the value in the Modigliani-Miller baseline comes from thinking through the appropriate market frictions that could lead to value creation (or destruction) by its use.

Leverage is prevalent in real estate investments, and even more so in the setting of institutional private equity funds. The purpose of this review article is to outline key questions and existing evidence in an important though underresearched topic in real estate finance: The use of leverage in private equity real estate (PERE) investments.[1] Summarizing the main takeaways, in the presence of market frictions, theory tells us that leverage can amplify skill (or the lack thereof) and shift incentives. With PERE, existing work provides mixed or little evidence that leverage is used to amplify skill and consistently hints that its use

* Kenan-Flagler Business School, UNC Chapel-Hill. Please send correspondence to sagi@unc.edu. We thank (TBA)

[1] The reader is assumed to have basic familiarity with private equity terminology. For a review, please consult any modern textbook on real estate finance (e.g., Hartzell and Baum, 2020).

Electronic copy available at: https://ssrn.com/abstract=4061210

shifts the balance of benefits towards fund sponsors over their limited partners. More work is needed to refine these findings and, more importantly, understand the source of market frictions behind them.

Theory can provide a lens through which one may view the stylized facts and identify key questions. Section I reviews how theory applies to the use of leverage in PERE. Section II of the paper reports on some stylized facts about the use of leverage in PERE. To summarize, a typical closed-end PERE fund employs roughly 65% debt to the value of total assets under management (AUM). Funds managing more risky real estate tend to use more leverage, and there's little evidence that fund terms are adjusted to reflect potential conflicts of interest posed by more intensive use of leverage. Rather, the stylized facts may raise concerns that the scope for conflict of interest may have increased over the past ten years. Among these concerns is an increase in strategic longer-term use of subscription facilities. Section III reviews how existing literature addresses the key questions and concerns raised by theory and stylized facts. The bulk of evidence in the literature points to robust underperformance of high leverage funds on a risk-adjusted basis. In other words, there is little evidence supporting the notion that leverage is employed to enhance skilled management. This suggests that a significant portion of REPE investors are not optimizing standard risk-return tradeoffs in allocating funds to high-leverage REPE funds. Section IV concludes with a discussion outlining various reasons why this might be, pointing to specific need for additional work as well as the challenges faced by researchers who attempt to tackle such work.

I. Good and bad leverage: Theory

How can leverage create value in the context of private equity real estate (PERE)? In principle, constraints on time, skill, and capital — all of which are departures from the frictionless setting of Modigliani and Miller — can conspire to make leverage financing accretive from a value creation perspective. Leverage can act as a skill amplifier by allowing a talented management team to deploy more capital when access to equity is restricted. Debt financing, at least when secured to a tangible asset like real estate, is relatively easy to access. On the other hand, raising private equity capital takes time and effort, and the energies of a skilled general partner management team (GP) might be better spent sourcing

Electronic copy available at: https://ssrn.com/abstract=4061210

positive net present value (NPV) projects rather than courting limited partner (LP) investors.

Tax shielding can be another source of value brought by leverage to investors. This, however, is more pertinent for investment vehicles that are structured as corporations (and therefore subject to double taxation). Because PERE funds are typically structured as pass-through vehicles, debt owed by the fund does not normally afford direct tax shield benefits to investors. Tax shield benefits of leverage will therefore be ignored in this paper.

Another potential benefit of leverage to investors is disciplinary in nature. Debt can increase risk to a fiduciary because default and financial distress impose a cost on management in terms of greater risk of pecuniary and reputational losses. Correspondingly, by financing a project with debt, a manager could be seen to signal confidence in project outcomes and a willingness to accept a higher risk of market discipline should the project underperform.[2] It is important to note that the signaling hypothesis is linked to quality, which in the context of PERE management might be best interpreted as GP skill.

Leverage can also destroy or cannibalize investor value. This usually translates into subpar risk-adjusted investor returns. One source for this is costly financial distress. Delinquency and default are inefficient because contests between borrowers and lenders over cash flow rights are uncertain and expensive, and the transfer of ownership in default typically results in substantial deadweight losses.[3] Lenders factor these potential costs into the pricing of debt through higher loan rates and associated covenants. The presence of the latter alone can restrict the operational flexibility of the financed asset resulting in reduced value. Without any offsetting benefit to the use of leverage, debt will therefore cannibalize equity returns.

Example 1: *Consider a mall acquisition to be financed using a mortgage.*

[2]In the corporate finance literature, the presence of debt is understood to provide the means and motivation for monitoring entrenched managers (Nini, Smith and Sufi, 2012) and ousting them when they perform poorly (Berk, Stanton and Zechner, 2010). These features of debt, however, are arguably more germane to long-lived investment vehicles (i.e., real estate investment trusts or open-ended PERE funds) where the potential for entrenchment is greater. It is perhaps worth pointing out that such funds tend to employ lower levels of leverage. Because PERE fund debt consists primarily of mortgages (see Section II), there is a limit to its role in monitoring overall management performance.

[3]Chu (2016) estimates that foreclosed properties are auctioned by lenders at an incurred average discount of 34% relative to fair market value.

Electronic copy available at: https://ssrn.com/abstract=4061210

Suppose that at the asset level and under competent management, the mall's net income and anticipated price appreciation result in an expected return of $r_A = 9\%$ *per year. Assume that, in the absence of potentially inefficient transfer of cash flow rights (i.e., in delinquency or bankruptcy), a fairly-priced 65% loan-to-value mortgage would have an expected return of* $r_D = 3.5\%$ *per year.*[4] *Assuming that the mall operational outcomes are the same regardless of who owns the mall (i.e., the lender or the manager), and there are no other claimants on the property cash flow, the return to levered equity,* r_E*, can be derived from a value preservation equation (Proposition 2 of Modigliani and Miller, 1958):*

$$r_A = (1 - LTV)r_E + LTV\, r_D, \tag{1}$$

where LTV denotes the loan to value ratio and r_E *is the return to levered equity. Based on this,* $r_E = 19.2\%$*. The presence of deadweight costs (e.g., inefficient asset operation or a fire sale by the bank in the case of foreclosure, or higher servicing costs in delinquency) reduce the performance of the asset in poor asset outcome states (e.g., the fire sale discount). In other words, the introduction of leverage decreases* r_A*. Correspondingly, the lender will be unlikely to accept an expected rate of return lower than* 3.5% *in the face of incurring relatively poorer outcomes, so* r_D *must remain the same or even increase. Holding the LTV constant in Equation* (1)*, a decline in* r_A *combined with a weakly increasing* r_D *necessarily results in a lower* r_E*. For example, if* r_A *declines by* 0.5% *and* r_D *increases by* 0.15%*, then* r_E *drops to* 17.5%*. In other words, the inefficiencies associated with debt financing in states of poor asset performance are borne by the equity stakeholder.* □

Incomplete contracting with asymmetric information is another friction that can cause leverage to be value destroying. For instance, GP contract fees based on assets under management incentivize the GP to grow the asset base without due regard to investor returns in order to obtain a higher fee. Although GPs are expected to co-invest alongside LPs to help mitigate such conflicts of interest, the use of leverage further tilts the incentives towards spurious growth. The

[4]It is important to note that the expected return on a mortgage is necessarily strictly smaller than the mortgage rate. This is because the mortgage rate is a yield that is only realized if all mortgage payments are made (and on time).

Electronic copy available at: https://ssrn.com/abstract=4061210

reason is that, for a fixed asset base, increasing leverage has the effect of reducing the source of alignment (i.e., the amount of GP investment per $1 of AUM). With greater scope for misalignment comes greater chance of investor value destruction (e.g., growth by acquisition of negative NPV investments).

Another source of misalignment that can be made worse through the use of leverage is the carried interest paid to PERE managers when deal or fund performance exceeds a certain threshold (the preferred investor return). To understand this point better, and lay the groundwork for later discussion, consider the following highly stylized example.

Example 2: *Consider the previous mall example, assuming no deadweight costs of default or delinquency and a holding period of one year.*[5] *For this example, abstract from any asset base fee or GP investment participation and assume that, on a deal-by-deal basis, the manager's carry is 20% after investors achieve a preferred internal rate of return of 8%. In other words, the GP stands to receive a bonus of 20% of the profits remaining after paying down the debt, the management fee, and 1.08 times the capital invested by LPs. Assume further that the mall's expected rate of return of* $r_A = 9\%$ *can only be achieved through the exertion of effort without which the expected return is reduced to* $r_A = 7\%$*, which is assumed to be less than the return on a typical unlevered core PERE fund. Under these assumptions, the expected asset outcome results in a bonus only if effort is exerted.*

Consider now adding leverage along the lines of the previous example (without deadweight costs of distress). With GP effort, the expected return to non-debt stakeholders is, as before, $r_E = 19.2\%$*. The expected return without GP effort is* $r_E = 13.5\%$ *— well above the preferred return. By employing leverage, the manager increases the chance of receiving a bonus regardless of effort expenditure. In particular, a manager who earns a bonus without exerting effort does so at the expense of fund investors who would be better off borrowing on their own to invest in an unlevered core PERE fund. Leverage, therefore, can act to dilute the incentives provided by carried interest and increase conflict of*

[5] One year holding periods of individual assets in PERE are observed but are uncommon. See Sagi (2021).

Electronic copy available at: https://ssrn.com/abstract=4061210

interest. □

The preceding discussion outlines positive and negative aspects of leverage. On the positive side, leverage acts as a skill amplifier and permits managers to better focus on driving asset level returns than on raising private equity funds. Leverage also forces managers to risk more of their reputational and personal capital, which can in turn be interpreted as a signal of their skill. On the negative side, leverage introduces deadweight costs of distress which are borne by equity stakeholders, and it increases conflicts of interest generated by standard PERE contract provisions.[6]

II. PERE stylized facts

There exists very little transparency into leverage use by PERE funds. Funds may or may not provide detailed leverage information to investors in offering memoranda or quarterly fund reports. As far as the authors of this paper are aware, there is no generally available large-scale data set that provides a time series panel of fund-level leverage.[7] To provide context for PERE leverage, we examine property-level leverage from the National Commercial Real Estate Investment Fiduciaries (NCREIF), and fund target leverage data from StepStone, and Preqin.

Tables 1 - 3 document summary statistics of fund characteristics for private equity funds tracked by the National Commercial Real Estate Investment Fiduciaries (NCREIF), StepStone, and Preqin. The NCREIF data is reported by fund type: Closed-end funds (CEFs), Open-end Diversified Core Equity (ODCE) funds, non-ODCE open-end funds, and Separate Account funds. StepStone and Preqin classify funds by self-reported risk categories: Core, core-plus, value-added, and opportunistic (in order of increasing risk).[8] Focusing

[6]These trade-offs, in the context of PERE funds, are also discussed in Anson (2012) and Pagliari (2015).

[7]Theoretically, it is possible to create such a data set from existing and generally available data. Properties from funds reporting to NCREIF could, in principal, be identified in fund-level data sets like Preqin or Burgiss, and individual property performance (including leverage) tied back to fund level metrics. Because funds are not identified in the same way across existing data sets, undertaking such a matching exercise would be challenging.

[8]See Hartzell and Baum (2020) for more detail on PERE CEF risk categories. Fairchild, MacKinnon and Rodrigues (2011), MacKinnon (2018), and Couts (2020) discuss PERE core and non-core open-end funds.

Electronic copy available at: https://ssrn.com/abstract=4061210

on the median characteristics, several takeaways concerning fund terms and leverage use can be gleaned from these tables.[9]

First, leverage use across these data sets is broadly consistent. For NCREIF CEFs that employ debt, mortgage balance aggregated at the fund level amounts to 57% of total assets under management for the median fund. Combining all CEF types, Preqin and StepStone funds have a median fund target leverage of 65% of assets under management.[10] The 8% difference between the NCREIF and Preqin/StepStone CEF leverage statistics likely arises from non-mortgage debt (e.g., mezzanine debt or lines of credit). The combined median target leverage across NCREIF open-end funds (ODCE and non-ODCE) is 37%, which is closer to the StepStone median of 40%, possibly because such funds are less likely to employ non-mortgage leverage.[11]

It is apparent that median use of leverage weakly increases with the fund's risk category. Because value-added and opportunistic funds are expected to invest in riskier assets as well, the higher level of leverage essentially "doubles down" on risk when compared to core funds. Correspondingly, also increasing with risk category are fund terms such as target gross returns, management fees, LP preferred returns, GP equity contribution, GP bonus (carry) after achieving LP preferred returns, and the gap between target gross and net returns (i.e., effective costs).

A. Cross-sectional relationship between leverage and fund terms

Theory suggests one might expect some relationship between leverage and fund terms. In a Modigliani-Miller setting, leverage implies higher expected returns, and this should translate into higher preferred returns for LPs, everything else being equal. The signaling leverage hypothesis also points in the same direction: In a separating equilibrium, skilled managers would attract investment by offering higher preferred returns and yet still manage to earn as much (or more) as unskilled GPs. Likewise, because leverage can increase conflict of interest

[9] Outliers in the data sets are less likely to impact median statistics.

[10] Target leverage figures are only reported by StepStone and Preqin for funds that use leverage. For that reason, Table 1 only reports leverage for NCREIF funds that employ non-zero leverage.

[11] Open-end diversified core equity (ODCE) funds focus on creating a portfolio of broad and stable income-producing properties. Non-ODCE funds have more freedom to focus on niche asset types, income stability, and/or geography.

Electronic copy available at: https://ssrn.com/abstract=4061210

between GPs and LPs in the presence of management fees (based on assets under management) and carry, the signaling hypothesis might lead one to expect a negative relationship between leverage and these incentive-based GP payoffs. Correspondingly, greater GP investment participation serves to reduce conflict of interest and might be expected to increase with leverage.

Table 5 reports on a series of cross-sectional regressions of fund target leverage against PERE fund terms. The data is from StepStone.[12] Overall, the table suggests that, among the fund terms examined, and after controlling for the fund's self-reported risk category, target leverage is only related to management fees.[13] The relationship with management fees is positive and economically significant: A fee increase of one percentage point is associated with seven percentage points of higher target leverage even after controlling for the fund's risk category. At first blush, these findings run counter to what be might expected based on theoretical (signaling) considerations. If one can rule out the presence of conflict of interest, however, the stylized facts could be explained by skilled GP market power. Specifically, skilled managers can charge a higher management fee, and increasing leverage will amplify the value they create net of the higher fee. Arguably, leverage should increase in this case to the point where the marginal LP is indifferent to contributing capital to the fund.[14]

To test the credibility of this hypothesis, one would need to demonstrate that GPs using higher leverage are more skilled (e.g., deliver better unlevered performance). Anticipating the discussion in the next section, the literature on this is scant, but generally fails to support the hypothesis.

B. Time series of fund terms

Table 4 documents the evolution of various median fund terms according to fund vintage years, as reported by Preqin for value-added and opportunistic

[12] Preqin fund-level data is often missing one or more of the characteristics explored in the regressions, making it less suitable for cross-sectional analysis.

[13] By contrast, carry does appear to positively vary with preferred returns and target returns (and vice versa). Although not included in the table, GP contribution is insignificantly related to leverage across all regression specifications.

[14] As explained in Section I, debt can impose costs and cannibalize LP returns. From the LP perspective, as debt increases, its role as a GP skill amplifier will be eventually overwhelmed by the costs. From the GP perspective, because of carry and management fees, increasing leverage improves payouts past the point of marginally negative benefits to the LP. In such a setting, to maximize payoffs in a market where LPs compete over managers with skill, a GP would increase debt to the point where LPs are indifferent to investing elsewhere. This mimics the logic in Berk and Green (2004).

Electronic copy available at: https://ssrn.com/abstract=4061210

CEFs. For a given fund attribute, data is only reported in a given vintage year if nine or more data points are available.[15] One striking feature of the data is the muted time-series variation of median fund terms. For instance, median leverage levels from funds with inception vintage years associated with times of distress (2010, 2011, and 2020) are only marginally lower than leverage levels in other years. Everything else being equal, one might expect leverage to vary inversely with the distress costs embedded in mortgage rates (see Example 1 in section I). Naturally, *everything else being equal* is difficult to verify, and it could be that only higher-quality funds come to market in years of distress.

Additionally, it bears stressing that, between 2003 and 2022, mortgage rates decline from roughly 6.1%, averaged across major property types, to 3.6%, and capitalization rates (property income yields) declined from about 8% to 4.2%.[16] This signifies a dramatic decline in the cost of capital across the table's reporting period. Over that period, the LP target return declined by only one percentage point, suggesting that investor expectations of PERE return have hardly budged. As the cost of capital declines, investors can expect (roughly) the same target returns under (roughly) identical fund contract terms only if the value created by GPs increases. It is far from obvious that this is realistic when one considers that institutional competition over assets has substantially increased since 2000, making it harder to take advantage of dislocations in commercial real estate prices.[17] Indeed, as discussed in the next section, there is little evidence supporting an increase in GP value creation over the past decade.

C. Subscription facilities

Subscription facilities are lines of credit extended to CEFs by lending institutions (e.g., banks) against committed but uncalled LP capital. Such facilities have been in use since the 1980s and, at least until the Great Financial Crisis, have been largely used for short-term cash flow smoothing purposes (i.e.,

[15]The average number of funds reporting a given data item (when it is reported in the table) is 33.

[16]The rate data is obtained from NCREIF mortgaged properties. The average LTV of properties from which the mortgage rates are obtained is 57%.

[17]NCREIF assets tracked have grown from about $93B in 2000Q1 to $905B in 2021Q1, corresponding to an annual growth of 11.4% per year; according to data from NAREIT and Preqin, REITs AUM and private equity uncalled capital (so-called 'dry powder') have grown annually by similar amounts. This growth in measure of institutional investment in CRE outpaced, by close to a factor of two, the growth in the overall real estate market as documented by the U.S. Board of Governors of the Federal Reserve System.

Electronic copy available at: https://ssrn.com/abstract=4061210

to avoid making small capital calls).[18] More recently, their use has evolved for longer-term strategic deployment and linked negatively to performance, thereby attracting more scrutiny (Albertus and Denes, 2020; Schillinger, Braun and Cornel, 2019). In particular, by displacing LP capital deployment over prolonged periods of time, it is possible for a GP to more easily achieve preferred rates of return, though at the cost of lower equity multiples. To understand the issues, consider the following example.

Example: *LPs commit $1B to a fund run by a GP who can deploy the capital now, earning in expectations $70M, net of management fees, in each of the next three years, and $1.07B in the fourth year. The fund's LP preferred return is 8%, and the carry is 20%. If the GP calls investor capital now for deployment, then the expected earnings will result in no carry, LP IRR of 7%, and an equity multiple of 1.28. Suppose, instead, that the GP borrows $1B, secured against the LPs' commitment through a subscription facility, paying an annual interest of 2% on the loan. The loan proceeds are invested now, and the loan will be paid down after two years. Assume, further, that investment earnings net of interest paid are held as cash earning a negligible return. After two years, when the loan is paid off, the fund has $100M in cash. This is paid out immediately when the $1B LP capital is called to pay off the loan. So, ignoring carry, expected cash flow at the end of years 2-4 would be, respectively, -$900M, $70M, and $1.07B. Because this yields an IRR of 13%, the preferred return hurdle is met and exceeded. Accounting for carry, the expected cash flow result in carried interest of $19.2M for the GP, an LP IRR of 12.0%, but an LP equity multiple 1.22.*

In the example, the subscription facility is used by the GP to avoid expensive accumulation of preferred LP return. The facility accelerates LP income relative to the date of deployment and this results in a higher IRR to called capital. But because the higher IRR is earned over a shorter period of time and triggers carried interest, the total amount paid to the LP is lower — essentially cannibalized by the interest paid to the facility lender and the carried interest bonus to the GP.

Are LPs hurt by this strategy of deferring capital calls using subscription

[18] See, for instance, https://www.privatefundscfo.com/whose-credit-line-anyway/.

Electronic copy available at: https://ssrn.com/abstract=4061210

facilities? The answer depends on LPs' opportunity cost of capital relative to the facility interest service costs and on where earnings from invested facility capital are parked. If, while waiting for their capital to be called in the example, an LP's funds are held in an investment earning less than 3%, then both the economic equity multiple and IRR over the four-year horizon would suffer relative to deploying with the GP now. What is clear, however, is that the strategy is beneficial to the GP in terms of carry and IRR benchmarking.

Although there has been some recognition of the negative implications of using subscription facility for anything other than cash flow management, at this point not enough is known about how prevalent such practices are or whether they are quantitatively important. This is largely because the standard data vendors tracking PERE funds do not, at this point, provide much insight into the usage of subscription facilities.[19]

III. Key questions, the literature, and new evidence

It is argued in Section I that leverage should be positively linked to GP skill and negatively linked to costs of distress and contractual terms that lead to conflicts of interest. The stylized facts in Section II do not provide clear indications that these relationships hold in practice. It is acknowledged, however, that equilibrium endogeneities can mask relationships imputed from "everything else being equal" considerations. That said, regardless of the endogenous interaction between skill, agency problems, distress costs and leverage, the following predictions should hold true in an equilibrium where investors seek to maximize risk-adjusted returns:

H1 PERE leverage should be positively associated with measures of skill

H2 While PERE leverage may not be positively associated with risk-adjusted net performance, it should not be negatively associated with it.

To connect with the key questions raised by the hypotheses above, the relatively scant literature on the role of financial leverage and its relation with fund

[19]Preqin does report annual survey results on which funds expect to use or not use subscription facilities. Because the survey is voluntary, relatively few funds choose to respond, and facility use isn't quantified. It is therefore unclear what can be surmised from this survey data.

Electronic copy available at: https://ssrn.com/abstract=4061210

returns, characteristics, and terms is first reviewed. Because, theoretically, the presence of skill seems essential to optimal use of PERE leverage, this is then followed by a review of the literature on the more general underperformance of PERE CEFs (which tend to be dominated by high-leverage funds). The full list of papers reviewed is presented in Table 6, detailing the type of data and period spanned (where appropriate).

A. Existing literature on PERE leverage

Though much empirical research is devoted to fund performance, few studies directly investigate the role of financial leverage in PERE funds. An early theoretical study by Anson and Hudson-Wilson (2003) advocates for the mild use of leverage in the service of "productive unleveraged strategies." This is done without offering a deeper theoretical context or empirical support. Fairchild, MacKinnon and Rodrigues (2011) documents the variation of leverage across open-end PERE funds and note the increasing use of leverage in open-end PERE funds over time, which they found to be associated with greater volatility and systematic risk. Importantly, they note that persistently underperforming funds *increased* their use of leverage prior to the Great Financial Crisis. Baum et al. (2011) raise concerns that, despite posting higher returns than core funds, European high-risk funds might exhibit a negative association between leverage and risk-adjusted fund performance. Alcock et al. (2013) explore the timing of leverage choices in economic booms and downturns of 169 global PERE funds from 2001 to 2011 using data from Property Fund Research (PFR). They provide evidence that the excess returns of PERE funds are negatively associated with leverage and, hence, echo the concerns in Baum et al. (2011) about the use of leverage to enhance performance.

As noted by Fairchild, MacKinnon and Rodrigues (2011), there is no commonly accepted definition for traditional PERE fund risk categories (i.e., core, core-plus, value-added, and opportunistic). Most general descriptions attribute increasing risk across categories to a mix of greater risk in the asset base and greater leverage. Using NCREIF data, Shilling and Wurtzebach (2012) document that a major difference between core and either value-add or opportunistic funds is financial leverage. In their study, leverage, together with market conditions, is shown to be one of the most important determinants of

Electronic copy available at: https://ssrn.com/abstract=4061210

the relative performance of funds in different risk categories. A more recent study of open-end PERE funds by MacKinnon (2018) breaks down the Pension Real Estate Association Property Fund Index returns into different attributable sources. These include direct real estate, leverage, cash drag, fund costs, and other portfolio effects. It documents that U.S. open-end core funds from 2008 to 2017 exhibit similar asset-level time-series returns to non-core funds, suggesting that the higher leverage of non-core funds constitutes their primary difference with core funds. Worse, in their examination of asset-level (i.e., unlevered) performance of NCREIF core and non-core funds, Gang, Peng and Thibodeau (2020) and Cypher, Pinkowitz and Rutledge (2020) conclude that core assets strongly outperform non-core assets across multiple dimensions and sub-periods. In other words, using unlevered returns to proxy for skill, there seems to be no evidence in support of H1 (defined at the beginning of this Section) and some evidence decidedly against it.

Pagliari (2020) finds that, net-of-fees and on a leveraged-adjusted basis, value-added funds have substantially underperformed core funds from 1995 to 2012. Opportunistic funds, after leverage-adjustment, are found to have weakly underperformed core funds. Using data from Burgiss, over a different time period (2000 to 2017), Bollinger and Pagliari (2019) hypothetically lever a core fund index to match the downside risk of value-added and opportunistic funds returns reported by Burgiss. They find that levered core, on average and after-fees, outperforms riskier counterparts by about 3%. These results essentially reject H2 in the samples investigated.

As suggested in the previous sections, fund terms such as management fees, carried interest, and promoted interests, should be related to leverage. The only study to examine this directly, by van der Spek (2017), documents detailed interactions of fund performance, leverage, and fund terms using 413 global PERE funds vintage in the 2005-2015 period from the Dutch PGGM database. Consistent with the evidence in Tables 2 and 3, he finds little difference in management fees across value-added and opportunistic funds, but significant differences in effective costs. Consistent with Table 5, van der Spek (2017) also finds that fund leverage increases with management fees, with the relationship stronger during adverse market conditions. Although this could be the equilibrium outcome when GPs bear both market power and skill, as discussed

Electronic copy available at: https://ssrn.com/abstract=4061210

in Section II.A, the studies surveyed in this section cast grave doubts on that hypothesis.

Finally, although they do not investigate fund leverage per se, Arnold, Ling and Naranjo (2017) study how management fees and GP discretion over the timing of calling capital can dilute LP value. This highlights the potential for conflict of interest created through long-term use of subscription facilities (as discussed in Section II.C).

B. Existing literature on PERE underperformance

The underperformance of PERE funds, especially when benchmarked against non-PERE alternatives, is found to be fairly robust to analyzing various samples with different regions, time horizons, and data sources. In an early paper studying U.S. PERE, Ling and Naranjo (2015) find that passive portfolios of core real estate REITs outperform the NCREIF Transaction Based Index (TBI) by 49 basis points (annualized) from 1994 to 2012, after adjusting the public REIT and NCREIF TBI indices for differences in leverage, property type, and management fees. Another study on 79 non-core European funds during a similar period by Kiehelä and Falkenbach (2015) constructs various performance metrics using fund-level cash flow data from Burgiss. It shows that PERE funds, between 1998 to 2009, deliver an average negative IRR and public market equivalent (PME) multiple of 0.89.[20] Similarly, a study by Fisher and Hartzell (2016) also uses granular cash flow data from Burgiss to construct multiple performance metrics for PERE funds (globally). Overall, they find that PERE funds underperform relative to their public market equivalents, such as listed REITs, in a sample with vintages from 1980 to 2008.

More recent studies on U.S. PERE funds similarly provide evidence of underperformance. Many are summarized in Riddiough (2020), who also reports investment performance relative to public market alternatives using fund-level investment performance from Preqin during the 2001-2019 sample period. He finds that PERE funds underperform a public market benchmark by 3.7% per

[20] A fund's PME multiple is the ratio of all fund LP distributions capitalized to some terminal date using the gross return to a benchmark, to all fund LP investments capitalized in the same manner. Essentially, a PME assesses whether an investor would have been better off investing in the benchmark rather than the fund. A PME greater/smaller than one signifies outperformance/underperformance relative to the benchmark.

Electronic copy available at: https://ssrn.com/abstract=4061210

year prior to the Great Financial Crisis (GFC) and by 3.3% during the post-GFC period. Based on a novel methodology, Gupta and Van Nieuwerburgh (2021) match PE fund cash flows with the cash flows imputed by public equities and bonds and attribute PERE fund returns to REIT dividends and capital gains. They estimate a similar degree of underperformance using similar data. Another study by Arnold, Ling and Naranjo (2021) matches the IRR and multiple of each PERE fund with the return that an LP could earn through the fund's benchmark. They find that closed-end PERE funds underperform listed REITs and that the spread between their returns is driven by macroeconomic variables such as Treasury yields, default spreads, and GDP growth.

C. Some new evidence

We conduct some simple tests of H1 and H2 to supplement the evidence cited above. To start, Figure 1 depicts the time series of property-level returns since 2000 for NCREIF closed-end funds with top and bottom quartile leverage (see Table 1). Each series is constructed by calculating the value-weighted appraisal-based returns for all NPI-qualifying properties owned by the funds in the respective leverage quartile. Low leverage funds properties deliver a quarterly return of 2.29%, roughly 50 basis points higher than high leverage funds. The difference is marginally significant with a two-sided t-test yielding a p-value of 0.068. That said, the hypothesis that high leverage funds post better property-level returns can be rejected with a probability of 96.6%. In other words, the data suggests that, over this observation period, skill is not linked to leverage. This simple test focuses directly on leverage differences rather than risk category (i.e., core versus non-core) and is thus a more direct test of H1 than what might be inferred from the results Gang, Peng and Thibodeau (2020) and Cypher, Pinkowitz and Rutledge (2020).

One might be concerned that the difference in returns is primarily driven by the Great Financial Crisis dislocation. Eliminating the worst-performing quarters for high-leverage CEFs from the sample (i.e., 2008Q4 and 2009Q1) still fails to provide evidence of skill and at the same level of confidence (albeit the relative underperformance falls to 35 basis points per quarter). Restricting the sample to 2010 and later still results in 50 basis points of underperformance, and this

Electronic copy available at: https://ssrn.com/abstract=4061210

time equality of means is rejected at the 5% level.[21] In other words, not only is it the case that there is little evidence of skill being amplified through leverage, there is some evidence that skill is *negatively* linked to leverage. This points towards use of leverage that, on average, is value destroying for LPs.

Focusing on H2, Table 7 reports median fund performance ratios calculated in the spirit of public market equivalents (PME — see Footnote 20) for Preqin value-added and opportunistic PERE funds. In the table, instead of a public market benchmark (e.g., REITs, as used by Arnold, Ling and Naranjo (2021)), the NPI index total returns are used because this proxies for unlevered property-level cash flow that one might expect from private markets. This index is then levered to fixed level (e.g., 65%) using prevailing average mortgage rates to proxy for the debt yield. The idea is similar in spirit to the approach in Bollinger and Pagliari (2019) who compare the risk-return attributes of PERE value-added and opportunistic funds to levered core funds. The findings are similar, though weaker. At the median fund leverage of 65% (see Tables 2 and 3), the median fund posts an NPI-equivalent (NPIE) performance multiple of 0.879 and 0.965, depending on whether or not a 1% annual fee is deducted from the NPI Index total returns.[22] While both cases signify inefficiency relative to the benchmark, the results from the more realistic exercise deducting a management fee correspond to relatively muted underperformance. Still, this is consistent with the general picture painted by the literature that funds employing significant leverage underperform for LPs (a rejection of H2).

IV. Conclusions: Need for additional work, data, and benchmarking

The preceding sections provide suggestive evidence that PERE leverage is not typically employed in a manner that is value enhancing. One problem in more definitively establishing this is that detailed data on PERE leverage use is largely unavailable, making it difficult to better investigate the question. Beyond whether or not PERE use of leverage is value destroying on average,

[21] In Section II.B, it is noted that the insensitivity of LP target returns to the secular decline in cost of capital since the Great Financial Crisis is linked to realistic expectations only if GP skill *increased* over this period. The test reported here suggests that this is not the case.

[22] The NPI is not investable. ODCE funds, however, hold properties that are arguably good proxies for NPI constituents but exhibit some leverage as well as a management fee (both of which are not reflected in the NPI). The 1% annualized management fee applied to the NPI acts to approximate an investable unlevered benchmark.

Electronic copy available at: https://ssrn.com/abstract=4061210

other important questions remain. In particular, the investor base for PERE funds is not uniform, and it is important to shed more light on investor-specific frictions that permit inefficient use of leverage. For example, circumstantial evidence points toward a segment of the investor base that focuses on absolute returns and is relatively insensitive to risk. There is also the possibility that investor naivete and current performance benchmarking practices play a role. Another source of friction may be that GPs and their investors have not fully downgraded expectations about managerial skill to the growing institutional competition over commercial real estate assets. In concluding, this section discusses each of these potential contributors to inefficient use of PERE leverage in the hope that future research may address them.

A. Future research directions

Risk-insensitive investors.

A growing literature suggests that some institutional investors flock to alternative investments in order to avoid the daily price volatility endemic to public markets. Seeking a "volatility veil" is sensible if one believes public market pricing is primarily driven by irrational factors (i.e., so-called animal spirits). Given the unusually high presence of institutional investors in public real estate markets (i.e., REITs) and the nearly exclusive nature of institutional participation in PERE, this explanation merits skepticism. Another explanation is that the frequent marking to market that exists in liquid public markets adversely impacts fiduciaries in large investment institutions like pension and endowment funds. This can happen through impact on annual fiduciary bonuses or contract renewals, or through fund draw down rules. Some endowments, for instance, limit withdrawal of funds to a fixed percentage, say 5%, of a rolling average of endowment value (say, three years). A single bad year of public market performance could cause severe budget cutbacks for the following three, and myopic fiduciaries would bear the brunt of disaffection. Correspondingly, because of myopic career concerns, underfunded pension fund fiduciaries might be motivated to record PERE fund target returns in place of actual returns to help bring them in line with funding targets (at least until the investment is fully unwound).

Gupta and Van Nieuwerburgh (2021) and Riddiough (2020) suggest that

Electronic copy available at: https://ssrn.com/abstract=4061210

Pension funds are willing to forego 3-4% of public market performance by opting for the volatility veil afforded by PERE alternatives. Given that REITs generally employ significantly lower levels of leverage as compared with PERE funds, the true risk-adjusted value foregone is likely greater. Although the need for a volatility veil amounts to short-run risk insensitivity, it is not clear whether large institutional investors like pension and endowment funds are insensitive to long-run risk. At this point, there is no direct evidence for that. To the extent that there is long-run risk insensitivity, target returns rather than how they are achieved will drive investment objectives. In particular, inefficient use of leverage could be tolerated and may contribute to the reasons that PERE funds have underperformed REITs. Investigating this further seems to be important. One potential direction for study might be to understand how institutional investors' direct use of leverage (through borrowing) is related to their willingness to invest in PERE funds that employ leverage, and correlate that with fund performance. Much as might be suggested by Bollinger and Pagliari (2019), an institutional investor that is not constrained from borrowing should invest in unlevered PERE funds, thereby enjoying the benefits of a volatility veil and managerial skill while steering clear of the potential pitfalls created by a GP's choice of leverage.

Lack of adequate performance benchmarking.
Arguably, no market is "born" efficient in practice. Rather, capital availability, competition, information, and learning play a role in progressively eliminating frictions. As documented by Ghent, Torous and Valkanov (2019) and imputed from Goetzmann, Spaenjers and Van Nieuwerburgh (2021), the commercial real estate asset market is still not dominated by large deep-pocketed institutional investors that can bear a great deal of idiosyncratic risk and easily shift capital to exploit price dislocations. Historically, as large institutional investors, like pension funds and endowments, shifted allocations towards commercial real estate, the need for benchmarking performance arose — this need played an important role in the creation of the NCREIF. There are currently multiple price and return indices to which portfolio returns can be compared in judging performance. What remains lacking is a theoretically sound approach to employ such indices for benchmarking purposes.

The prevalent benchmarking paradigm for institutional PERE performance

Electronic copy available at: https://ssrn.com/abstract=4061210

consists of a comparison of a fund's return against a chosen index plus a spread. Currently, the NCREIF's ODCE index is the most common index employed in the United States (Trevillion et al., 2018). The chosen spread component is often determined by the perceived risk associated with the fund (i.e., increasing with the fund's risk category). For instance, the spread over ODCE for a value-added portfolio might be 200 basis points (bps) while the spread for an opportunistic portfolio might be 300 bps.[23] Another benchmarking approach employs absolute comparisons (e.g., targeted returns advertised to investors) against actual returns. More recently, some practitioners have adopted the PME approach described earlier, but its use has yet to become widespread among investors.

In employing the "spread over index" approach to benchmarking, current industry practices for institutional CRE investors deviate from the approaches commonly adopted by liquid asset investors. For an undiversified portfolio, the latter typically choose as a benchmark one (or a set of) passive and investable liquid portfolio returns (e.g., the S&P500, the CRSP value-weighted index, etc.), and calculate an "alpha": The intercept term from a regression of the excess returns (i.e., net of some risk-free benchmark) of the benchmarked portfolio against the excess returns of the passive benchmark(s). Use of alpha incorporates risk-adjustment and, in a Modigliani-Miller setting, is neutral to leverage (which increases risk). For example, a levered position in the S&P500 will yield an alpha of zero when the benchmark is the S&P500. For a well-diversified liquid portfolio, one might simply calculate a Sharpe ratio and compare this to historical Sharpe ratios achievable through passive investment in diversified portfolios. In a Modigliani-Miller setting, leverage scales both the expected excess return and the standard deviation of return by the same amount and does not impact the Sharpe Ratio. Thus, like alpha, the Sharpe ratio is neutral to leverage.[24] Use of either measure is consistent with the view that risk-adjusted performance should be measured net of financial engineering that could be easily achieved via leverage.

Both "alpha" and Sharpe ratios cannot be practically estimated for portfolios of illiquid assets, and this likely explains why they are not used in benchmarking

[23] A portfolio of investments in PERE funds may, likewise, be itself benchmarked against a blended spread with the blend representing a value-weighting of individual category spreads.

[24] The exception to leverage neutrality of alpha and the Sharpe ratio is when leverage creates or destroys value, in the manner discussed in Section I.

Electronic copy available at: https://ssrn.com/abstract=4061210

PERE investments. Unlike alphas and Sharpe ratios, the index plus a spread methodology, absolute target return benchmarking, and even PMEs are not inherently leverage-neutral. In particular, increasing leverage can increase expected performance as measured by these standard approaches. For instance, in Example 2 of Section I, inefficient use of leverage leads to cannibalization of returns because the GP earns carry without exerting effort. Investors would be better off borrowing themselves to achieve a levered investment in a core fund. The example's resulting LP expected returns of 13.5%, however, generally exceed expected returns on ODCE plus 300 bps (historically, about 11%), meaning that the fund is expected to 'outperform' based on standard industry measures. Performance of 13.5% would also exceed average REIT returns, so the fund would also be expected to outperform when using a REIT PME benchmark. In other words, by failing to control for leverage, current benchmarking practices theoretically *incentivize* its use in a manner that is decoupled from managerial skill. In the example, standard benchmarking practices allow a fund to masquerade as an outperforming investment despite the fact that it actually destroys investor value.

One obvious direction for future study is to examine whether current benchmarking practices are indeed associated with spurious use of leverage. Whether or not this is true, in practice, it seems important to develop PERE performance measures that are leverage neutral. One example of how this may be done is through comparisons that are strictly on an unlevered basis. This is demonstrated in the performance comparison of high and low leverage funds of Section III. Another example is furnished by the NPIE exercise in Section III, where a PME-like multiple is calculated relative to an index that is levered to the same degree as the benchmarked fund. To successfully implement such performance tests more broadly, both of these exercises would require greater transparency by PERE funds, including periodic reports of fund leverage details and/or asset-level details.

Sluggish expectations.
The numerous studies reviewed in Section III suggest that REITs have outperformed PERE funds in the last two decades. One possible reason is that PERE funds have not played to their strengths relative to REITs. The primary advantage REITs possess over PERE funds is through access to a greater

Electronic copy available at: https://ssrn.com/abstract=4061210

variety of capital sources, both public and private. REITs can finance their operations and acquisitions using the same vehicles as PERE funds as well using public markets securities (common & preferred equity, investment-grade bonds, etc.) and deep unsecured lines of credit. In competing over assets, REITs can raise more capital more quickly than PERE funds and bring to bear greater certainty of execution on individual deals. REITs can also afford to be more "patient" than PERE CEF GPs because REITs are not contractually under pressure to acquire or dispose of assets. These considerations can potentially result in better pricing for REITs and suggest that PERE funds may have to overpay for assets when competing head to head with REITs.

On the other hand, because of their status as untaxed income pass-through vehicles, REITs and their investors tend to focus on growing funds from operations rather than betting on speculative capital appreciation. It is no surprise that real estate development comprises a relatively small portion of REITs' balance sheet (rarely greater than 10%). This suggests that PERE funds may have a relative advantage when it comes to assets whose short-term income potential is low (e.g., ground-up development, land-banking, asset repositioning or redevelopment, distressed assets, etc.). REITs have only risen to prominence in the invested CRE universe over the past twenty years, meaning that concerns about relative advantage might only be a recent phenomenon for PERE funds. If PERE funds, on average, have failed to focus on their relative advantage vis à vis REITs in the past two decades, it stands to reason that they would underperform REITs over that period. Determining the role this might play in explaining documented PERE underperformance is important, not only for academic reasons, but also because awareness of this issue can help the industry pivot more quickly towards a more efficient structure.

B. Final summary and thoughts

PERE is an important component of the institutional CRE investment world and is afforded advantages not inherent to REITs. Because PERE investors do not ordinarily benefit from tax shield benefits of debt or from lenders' monitoring role, the primary PERE advantage to using leverage is to enhance managerial skill. On the negative side, leverage brings a host of pitfalls in the PERE context, including deadweight costs of distress and greater misalignment

Electronic copy available at: https://ssrn.com/abstract=4061210

of interests between investors and GPs. Empirical work fails to find much evidence for managerial skill in those PERE funds that make the most intensive use of leverage: Value-added and opportunistic closed-end funds. There is also little evidence that funds and their investors balance the tradeoffs of leverage against other fund attributes (e.g., base fees, preferred returns, and carry terms). A remaining open question is "why?" Answering this question is key to enhancing our understanding of the value proposition offered by PERE funds — especially those that invest in risky assets that are not as much in the purview of public investment alternatives. It is also paramount in helping investors tune their approach to investing in illiquid assets and helping the industry adjust commonly accepted practices (like performance benchmarking) to create more alignment between managers and investors.

Electronic copy available at: https://ssrn.com/abstract=4061210

TABLE 1— NCREIF fund leverage stats (1983-2021, secured debt, only). For each fund property, leverage is defined as mortgage balance outstanding divided by appraised market value when property data is first recorded in the NCREIF data set. Fund leverage is the average of property leverage. Only NPI properties with non-negative leverage at or below 95% are included. To compare with StepStone and Preqin data, the table excludes funds that do not report any leverage on any property.

PE Fund Type	Num Funds	mean	sd	p5	p25	p50	p75	p95
CEF	309	54%	16%	21%	47%	57%	64%	73%
ODCE	46	31%	20%	7%	15%	24%	50%	66%
Non-ODCE OEF	83	39%	19%	6%	26%	43%	55%	64%
Separate Account	537	44%	18%	10%	32%	46%	57%	72%
Total	975	46%	18%	9%	34%	49%	61%	72%

Electronic copy available at: https://ssrn.com/abstract=4061210

Electronic copy available at: https://ssrn.com/abstract=4061210

TABLE 2— StepStone Fund Terms (2014-2021). The table summarizes US PERE fund terms, as collected and reported by StepStone. Effective cost is the difference between gross and net (LP) target returns. 'Mgt fee' is the average of fees incurred during and after the fund's investment (capital deployment) period.

sector	Stat	Gross target return	Effective cost	Target leverage	Carry	Preferred retn	GP commitment	Mgt fee
Core/Core+ (OEFs)	Num funds	48	44	58	47	32	24	25
	mean	10.0%	1.5%	41.5%	9.5%	7.2%	7.3%	1.1%
	sd	1.7%	0.5%	12.0%	7.0%	0.8%	13.6%	0.2%
	p5	8.0%	1.0%	23.0%	0.0%	6.0%	0.0%	0.9%
	p25	8.5%	1.0%	33.0%	0.0%	7.0%	0.5%	1.0%
	p50	10.0%	1.0%	40.0%	10.0%	7.0%	2.0%	1.0%
	p75	11.0%	2.0%	50.0%	15.0%	8.0%	7.5%	1.2%
	p90	13.0%	2.0%	60.0%	20.0%	9.0%	25.0%	1.5%
Core/Core+ (CEFs)	Num funds	16	14	28	25	22	16	21
	mean	11.2%	1.8%	50.5%	14.3%	7.6%	2.1%	1.1%
	sd	1.6%	0.9%	13.3%	5.3%	0.8%	2.2%	0.3%
	p5	8.0%	1.0%	25.0%	0.0%	7.0%	1.0%	0.7%
	p25	10.0%	1.0%	47.5%	15.0%	7.0%	1.0%	1.0%
	p50	11.0%	2.0%	50.0%	15.0%	7.3%	1.0%	1.1%
	p75	12.0%	2.0%	59.0%	15.0%	8.0%	2.0%	1.3%
	p90	15.0%	4.0%	70.0%	20.0%	9.0%	10.0%	1.5%
Value-Add (CEFs)	Num funds	121	103	197	186	185	155	159
	mean	15.8%	3.0%	62.9%	19.7%	8.2%	3.7%	1.4%
	sd	1.8%	0.8%	8.6%	2.3%	0.9%	4.6%	0.2%
	p5	13.0%	2.0%	50.0%	20.0%	6.5%	1.0%	1.0%
	p25	15.0%	2.0%	60.0%	20.0%	8.0%	2.0%	1.4%
	p50	15.0%	3.0%	65.0%	20.0%	8.0%	2.0%	1.5%
	p75	17.0%	4.0%	65.0%	20.0%	9.0%	3.0%	1.5%
	p90	19.0%	4.0%	70.0%	20.0%	9.0%	10.0%	1.8%
Opportunistic (CEFs)	Num funds	66	47	100	98	98	80	79
	mean	18.9%	3.9%	65.0%	20.2%	8.4%	3.2%	1.5%
	sd	2.1%	1.0%	8.8%	2.1%	0.8%	2.4%	0.2%
	p5	15.0%	3.0%	50.0%	20.0%	7.0%	1.0%	1.2%
	p25	18.0%	3.0%	63.0%	20.0%	8.0%	2.0%	1.4%
	p50	19.0%	4.0%	65.0%	20.0%	8.0%	2.5%	1.5%
	p75	20.0%	4.0%	70.0%	20.0%	9.0%	3.0%	1.5%
	p90	21.0%	6.0%	75.0%	20.0%	10.0%	10.0%	2.0%

Electronic copy available at: https://ssrn.com/abstract=4061210

TABLE 3— Preqin Fund Terms (1998-2021). The table summarizes US PERE fund terms, as collected and reported by Preqin. Target returns are calculated as the midpoint of the range provided by Preqin for each fund for gross and net (LP) fund returns. Effective cost is the difference between gross and net (LP) target returns. 'Mgt fee' is the fees incurred during the fund's investment period (an estimate of management fees after the fund's investment period was not available in the data set investigated here). Data is only reported for variables with at least nine observations.

sector	Stat	Gross target return	Effective cost	Target leverage	Carry	Preferred retn	GP commitment	Mgt fee
Core	Num funds	28	15	37				20
	mean	12.0%	2.4%	45.8%				1.3%
	sd	4.3%	1.4%	20.7%				0.5%
	p5	7.0%	0.5%	0.0%				0.5%
	p25	8.5%	1.0%	33.0%				1.0%
	p50	11.0%	2.0%	50.0%				1.5%
	p75	15.0%	3.8%	62.0%				1.8%
	p90	20.0%	5.0%	70.0%				2.0%
Core Plus	Num funds	49	42	38	15	9		24
	mean	13.6%	2.5%	56.6%	18.3%	9.0%		1.5%
	sd	2.6%	1.2%	13.2%	3.6%	4.3%		0.5%
	p5	10.0%	1.0%	40.0%	10.0%	6.0%		0.8%
	p25	12.0%	2.0%	50.0%	20.0%	7.0%		1.2%
	p50	13.0%	2.5%	60.0%	20.0%	8.0%		1.5%
	p75	15.0%	3.0%	65.0%	20.0%	9.0%		2.0%
	p90	18.0%	4.0%	75.0%	20.0%	20.0%		2.0%
Value Added	Num funds	321	263	234	82	64	14	181
	mean	17.8%	3.4%	62.3%	19.7%	8.4%	4.4%	1.6%
	sd	4.3%	2.1%	12.5%	3.7%	1.3%	3.8%	0.5%
	p5	13.0%	2.0%	50.0%	15.0%	7.0%	1.0%	0.8%
	p25	15.0%	2.0%	60.0%	20.0%	8.0%	2.0%	1.5%
	p50	17.0%	3.0%	65.0%	20.0%	8.0%	3.0%	1.5%
	p75	19.0%	4.0%	65.0%	20.0%	9.0%	5.0%	2.0%
	p90	25.0%	5.0%	75.0%	20.0%	10.0%	15.0%	2.5%
Opportunistic	Num funds	141	105	92	69	30	9	112
	mean	20.3%	4.5%	58.6%	18.8%	8.0%	5.0%	1.6%
	sd	4.7%	2.5%	18.2%	3.4%	1.2%	5.7%	0.8%
	p5	14.5%	2.0%	0.0%	10.0%	6.0%	1.8%	0.5%
	p25	18.0%	3.0%	53.5%	20.0%	7.5%	2.5%	1.5%
	p50	20.0%	4.0%	65.0%	20.0%	8.0%	3.0%	1.5%
	p75	21.0%	5.0%	70.0%	20.0%	9.0%	4.5%	2.0%
	p90	30.0%	10.0%	75.0%	20.0%	10.0%	20.0%	2.0%

TABLE 4— Preqin U.S. Fund terms by Year. The table reports a time series of median US PERE fund terms, as collected and reported by Preqin. Target returns are calculated as the midpoint of the range provided by Preqin for each fund for gross and net (LP) fund returns. Effective cost is the difference between gross and net (LP) target returns. 'Fee' is the proportional fee incurred during the fund's investment period (an estimate of management fees after the fund's investment period was not available in the data set investigated here). Data is only reported for variables with at least nine observations.

Year	Effective cost (%)	LP target returns (%)	Target leverage (%)	Carry (%)	Fee (%)
2003		15			
2004		15.5			
2005		15			
2006		16			
2007		15	65		1.5
2008	3	15	65		
2009	3.5	16			
2010	3	15	61		
2011	3	15	62.5		1.5
2012	3.5	15	65	20	1.5
2013	3	15	65	20	1.5
2014	3.75	15	65	20	1.5
2015	3.5	14	64	20	1.5
2016	3	14	65		1.5
2017	3	14.75	65	20	1.5
2018	3	14	65	20	1.5
2019	3	14	60	20	1.5
2020	2.9	13.5	62.5	20	1.5
2021	3.5	13.5			
2022	3	15			1.5

Electronic copy available at: https://ssrn.com/abstract=4061210

Electronic copy available at: https://ssrn.com/abstract=4061210

TABLE 5— Target Leverage and Fund Terms. The tables reports on a series of regressions of target leverage (in percentage points) against various PERE fund terms using StepStone U.S. CEF data. 'Opportunistic' and 'Value-Add' are dummy variables corresponding to fund risk categories (the baseline category is Core/Core+).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Opportunistic	12.33***	8.271*	8.980**			6.305	6.745*
	(2.609)	(3.485)	(2.806)			(3.525)	(3.064)
Value-Add	9.505***	6.930*	6.553*			5.022	5.431*
	(2.461)	(3.125)	(2.618)			(3.174)	(2.681)
Carry (%)		0.171		0.418		0.0709	
		(0.432)		(0.369)		(0.428)	
LP Tgt Retn (%)		0.634*		0.633*	0.775**	0.496	0.523
		(0.307)		(0.284)	(0.261)	(0.308)	(0.296)
Pref Retn (%)		0.0349		0.294		0.201	
		(0.725)		(0.718)		(0.718)	
Fee (%)			8.202**	8.398**	9.157***	7.294*	7.270*
			(2.795)	(2.791)	(2.697)	(2.864)	(2.830)
Constant	52.73***	43.22***	43.88***	31.07***	38.69***	37.10***	39.41***
	(2.334)	(7.951)	(3.788)	(7.503)	(4.368)	(8.205)	(4.538)
Observations	209	209	209	209	209	209	209
Adjusted R^2	0.089	0.099	0.122	0.118	0.119	0.123	0.131

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 6— Related Literature on Private Equity Real Estate. The table outlines existing studies in four categories: the underperformance of PERE funds, risk factors underlying PERE returns, the role of financial leverage, and fund terms. These studies are classified into sub-categories that focus on different regions and sample periods using various data sources. It is also noted for each study whether it uses indices, performance metrics, property-level metrics, or more granular cash flow data to measure the performance of PERE funds.

Categories	Region	Period	Data	Selected Literature
Underperformance	U.S.	1994-2012	NCREIF TBI (Indices)	Ling and Naranjo (2015)
	Global	1980-2013	Burgiss (cash flows)	Fisher and Hartzell (2016)
	Europe	1998-2009	Burgiss (cash flows)	Kiehelä and Falkenbach (2015)
	U.S.	2000-2017	Burgiss, Cambridge Associates, NCREIF (indices)	Bollinger and Pagliari (2019)
	U.S.	2001-2019	Preqin (performance metrics)	Riddiough (2020)
	U.S.	2000-2017	Preqin (cash flows)	Gupta and Van Nieuwerburgh (2021)
	U.S.	2001-2019	Cambridge Associates (performance metrics)	Arnold, Ling and Naranjo (2021)
Risk Factors	Europe	2001-2007	INREV (performance metrics)	Fuerst and Matysiak (2013)
	Europe	2001-2014	INREV (performance metrics)	Delfim and Hoesli (2016)
	U.S.	2000-2017	Cambridge Associates (performance metrics)	Arnold, Ling and Naranjo (2019)
	U.S.	2001-2019	Cambridge Associates (performance metrics)	Arnold, Ling and Naranjo (2021)
	U.S.	1994-2012	Townsend Group (cash flows)	Farrelly and Stevenson (2019)
Fund Leverage	-	-	-	Anson and Hudson-Wilson (2003)
	U.S.	1999-2010	Investment Property Databank (indices)	Fairchild, MacKinnon and Rodrigues (2011)
	Global	2003-2009	Investment Property Databank, NCREIF-Townsend, Property Funds Research (indices)	Baum et al. (2011)
	Global	2001-2011	Property Funds Research (performance metrics)	Alcock et al. (2013)
	U.S.	1979-2009	NCREIF (property-level metrics)	Shilling and Wurtzebach (2012)
	U.S.	2008-2017	PREA (indices)	MacKinnon (2018)
	U.S.	2000-2017	Burgiss, NCREIF (indices)	Bollinger and Pagliari (2019)
	U.S.	1988-2019	NCREIF (property-level metrics)	Cypher, Pinkowitz and Rutledge (2020)
	U.S.	1997-2014	NCREIF (property-level metrics)	Gang, Peng and Thibodeau (2020)
	U.S.	1995-2012	NCREIF-Townsend (performance metrics)	Pagliari (2020)
Fund Terms	U.S.	1988-2014	Cambridge Associates (performance metrics)	Arnold, Ling and Naranjo (2017)
	Global	2005-2015	Dutch PGGM (performance metrics)	van der Spek (2017)

Electronic copy available at: https://ssrn.com/abstract=4061210

TABLE 7— Levered NCREIF Index Equivalent Median Fund Performance. The table reports median performance ratios for Preqin REPE U.S. value-added and opportunistic CEFs. The performance ratio calculates a PME using the levered NCREIF index as the "public" benchmark. The leverage level is in the first column. The debt yield used is an average of mortgage rates paid by NCREIF members across NPI properties and is time-varying. The second column reports the median fund performance measure assuming no fees are deducted from the NCREIF index returns. The third column reports median fund performance assuming an annual portfolio management fee of 1% is paid and therefore deducted from the NCREIF index returns. A value greater (less) than one in columns two or three corresponds to overperformance (underperformance) relative to the levered benchmark.

Leverage (%)	NPIE with no mgmt fee	NPIE with 1% mgmt fee
50	0.973	1.043
51	0.968	1.039
52	0.965	1.035
53	0.962	1.028
54	0.956	1.026
55	0.945	1.022
56	0.941	1.016
57	0.933	1.01
58	0.927	1.009
59	0.918	1.003
60	0.912	0.996
61	0.911	0.987
62	0.901	0.98
63	0.895	0.977
64	0.89	0.969
65	0.879	0.965
66	0.873	0.964
67	0.865	0.952
68	0.86	0.942
69	0.846	0.937
70	0.841	0.932

Electronic copy available at: https://ssrn.com/abstract=4061210

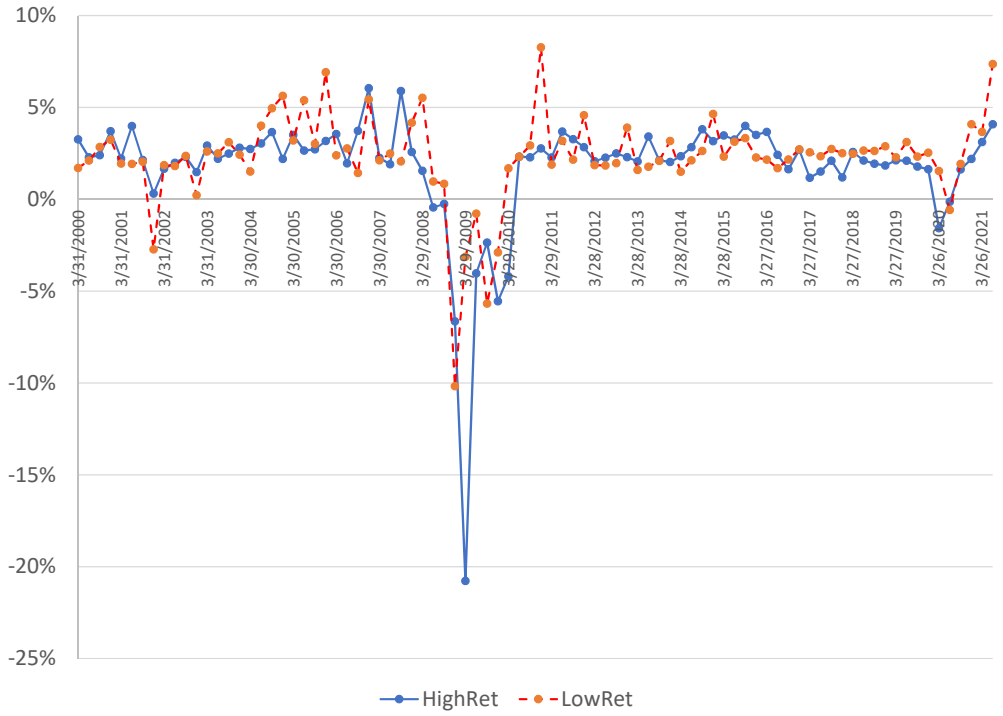

FIGURE 1. Aggregate (value-weighted) property returns for high leverage and low leverage NCREIF CEFs. Each series is created by calculating the value-weighted returns of NPI properties. High (resp. low) leverage funds are top (resp. bottom) quartile CEFs with respect to the use of leverage (see Table 1).

Electronic copy available at: https://ssrn.com/abstract=4061210

REFERENCES

Albertus, James F, and Matthew Denes. 2020. "Private equity fund debt: Capital flows, performance, and agency costs." *Performance, and Agency Costs (May 26, 2020)*.

Alcock, Jamie, Andrew Baum, Nicholas Colley, and Eva Steiner. 2013. "The role of financial leverage in the performance of private equity real estate funds." *The Journal of Portfolio Management*, 39(5): 99–110.

Anson, Mark. 2012. "Asset owners versus asset managers: Agency costs and asymmetries of information in alternative assets." *The Journal of Portfolio Management*, 38(3): 89–103.

Anson, Mark JP, and Susan Hudson-Wilson. 2003. "Should one use leverage in a private equity real estate portfolio?" *The Journal of Portfolio Management*, 29(5): 54–61.

Arnold, Thomas R, David C Ling, and Andy Naranjo. 2017. "Waiting to be called: the impact of manager discretion and dry powder on private equity real estate returns." *The Journal of Portfolio Management*, 43(6): 23–43.

Arnold, Thomas R, David C Ling, and Andy Naranjo. 2019. "Private equity real estate funds: returns, risk exposures, and persistence." *The Journal of Portfolio Management*, 45(7): 24–42.

Arnold, Thomas R, David C Ling, and Andy Naranjo. 2021. "Private Equity Real Estate Fund Performance: A Comparison to REITs and Open-End Core Funds." *The Journal of Portfolio Management*, 47(10): 107–126.

Baum, Andrew, Jane Fear, Nick Colley, Alexandra Notay, and Louise Evans. 2011. "Have property funds performed." *Urban Land Institute Europe Policy and Practice Committee Report*.

Berk, Jonathan B, and Richard C Green. 2004. "Mutual fund flows and performance in rational markets." *Journal of political economy*, 112(6): 1269–1295.

Electronic copy available at: https://ssrn.com/abstract=4061210

Berk, Jonathan B, Richard Stanton, and Josef Zechner. 2010. "Human capital, bankruptcy, and capital structure." *The Journal of Finance*, 65(3): 891–926.

Bollinger, Mitchell A, and Joseph L Pagliari. 2019. "Another look at private real estate returns by strategy." *The Journal of Portfolio Management*, 45(7): 95–112.

Chu, Yongqiang. 2016. "Asset fire sales by banks: evidence from commercial REO sales." *The Review of Corporate Finance Studies*, 5(1): 76–101.

Couts, Spencer. 2020. "Private Real Estate Returns, Style Drift, and Procyclical Risk Taking." *USC Lusk Center of Real Estate Working Paper Series*.

Cypher, Matthew, Lee Pinkowitz, and Sara Rutledge. 2020. "No Encore for Non-core? Property-level Returns in the Private Real Estate Market." *Real Estate Research Institute Working Paper*.

Delfim, Jean-Christophe, and Martin Hoesli. 2016. "Risk factors of European non-listed real estate fund returns." *Journal of Property Research*, 33(3): 190–213.

Fairchild, Simon, Greg MacKinnon, and John Rodrigues. 2011. "Are All Open-End Core Funds Created Equal?" *The Journal of Portfolio Management*, 37(5): 51–67.

Farrelly, Kieran, and Simon Stevenson. 2019. "The risk and return of private equity real estate funds." *Global Finance Journal*, 42: 100471.

Fisher, Lynn M, and David J Hartzell. 2016. "Class differences in real estate private equity fund performance." *The Journal of Real Estate Finance and Economics*, 52(4): 327–346.

Fuerst, Franz, and George Matysiak. 2013. "Analysing the performance of nonlisted real estate funds: a panel data analysis." *Applied Economics*, 45(14): 1777–1788.

Gang, Jianhua, Liang Peng, and Thomas G Thibodeau. 2020. "Risk and returns of income producing properties: Core versus noncore." *Real Estate Economics*, 48(2): 476–503.

Electronic copy available at: https://ssrn.com/abstract=4061210

Ghent, Andra C, Walter N Torous, and Rossen I Valkanov. 2019. "Commercial real estate as an asset class." *Annual Review of Financial Economics*, 11: 153–171.

Goetzmann, William N, Christophe Spaenjers, and Stijn Van Nieuwerburgh. 2021. "Real and private-value assets." *The Review of Financial Studies*, 34(8): 3497–3526.

Gupta, Arpit, and Stijn Van Nieuwerburgh. 2021. "Valuing private equity investments strip by strip." *The Journal of Finance*, 76(6): 3255–3307.

Hartzell, David, and Andrew E Baum. 2020. *Real Estate Investment and Finance: Strategies, Structures, Decisions.* John Wiley & Sons.

Kiehelä, Sami, and Heidi Falkenbach. 2015. "Performance of non-core private equity real estate funds: A European view." *The Journal of Portfolio Management*, 41(6): 62–72.

Ling, David C, and Andy Naranjo. 2015. "Returns and information transmission dynamics in public and private real estate markets." *Real Estate Economics*, 43(1): 163–208.

MacKinnon, G. 2018. "Core versus Non-core: Evidence from Open-End Funds." *PREA Quarterly (Spring)*, 18: 24.

Modigliani, Franco, and Merton H Miller. 1958. "The cost of capital, corporation finance and the theory of investment." *The American economic review*, 48(3): 261–297.

Nini, Greg, David C Smith, and Amir Sufi. 2012. "Creditor control rights, corporate governance, and firm value." *The Review of Financial Studies*, 25(6): 1713–1761.

Pagliari, Joseph L. 2015. "Principal–Agent Issues in Real Estate Funds and Joint Ventures." *The Journal of Portfolio Management*, 41(6): 21–37.

Pagliari, Joseph L. 2020. "Real estate returns by strategy: have value-added and opportunistic funds pulled their weight?" *Real Estate Economics*, 48(1): 89–134.

Electronic copy available at: https://ssrn.com/abstract=4061210

Riddiough, Timothy J. 2020. "Pension Funds and Private Equity Real Estate: History, Performance, Pathologies, Risks." *Performance, Pathologies, Risks (August 27, 2020)*.

Sagi, Jacob S. 2021. "Asset-level risk and return in real estate investments." *The Review of Financial Studies*, 34(8): 3647–3694.

Schillinger, Pierre, Reiner Braun, and Jeroen Cornel. 2019. "Distortion or cash flow management? Understanding credit facilities in private equity funds." *Understanding Credit Facilities in Private Equity Funds (August 7, 2019)*.

Shilling, James, and Charles Wurtzebach. 2012. "Is value-added and opportunistic real estate investing beneficial? If so, why?" *Journal of Real Estate Research*, 34(4): 429–462.

Trevillion, Edward, Alan Gardner, Stewart Cowe, and Colin Jones. 2018. "Current practices in benchmarking real estate investment performance." *Investment Property Forum Major Report*.

van der Spek, Maarten. 2017. "Fee structures in private equity real estate." *Journal of Real Estate Research*, 39(3): 319–348.

Electronic copy available at: https://ssrn.com/abstract=4061210

Data Appendix

This data appendix describes the methodology to construct fund-level quarterly cash flows using historical fund metrics from Preqin. The raw data set contains Fund ID, Fund Size (in USD), Called (%), DPI (%), RVPI (%), and Date for each PERE fund in each quarter from 2000 to 2021. One can calculate the total capital called, total distribution to LP, and residual equity up to each quarter, and back out the capital call and distribution in each quarter. The cash flow in each quarter is the sum of the quarterly capital call and distribution except the last quarter for each fund. For unwound funds, the cash flow in the last quarter is set equal to the residual equity added to the sum of the quarterly capital call and distribution.

The raw panel described above contains missing data and some fund data is concentrated in a small number of quarters comprising a small fraction of the fund's actual life. The following steps are taken to arrive at a "cleaner" panel, facilitating the assessment of fund performance:

1) Fill the missing values of Called (%), DPI (%), and RVPI (%) between the vintage of each fund and its earliest reported quarter. For simplicity, a fund is assumed to start producing or reporting cash flows, at least, from the beginning of the third year after its vintage. The missing quarters are linearly interpolated. For example, if a fund with vintage in 2000 starts reporting (10%, 10%, 90%) for (Called (%), DPI (%), RVPI (%)) in 2004Q1, then the first quarter of non-zero linearly interpolated data is 2003Q2.

2) Fill the missing quarters or the missing values for each quarter in the middle of the reported fund life cycle. After manual check, this type of missing is only found to be a reporting issue. The same linear interpolation approach is applied here.

3) Delete manual errors of entering the wrong values in the middle of the reported fund life cycle. For example, if a fund reports (10%, 5%, 90%), (12%, 10%, 83%), (18%, 3%, 80%), (19%, 15%, 80%), (20%, 15%, 80%) for (Called (%), DPI (%), RVPI (%)) in five consecutive quarters, then it is

Electronic copy available at: https://ssrn.com/abstract=4061210

likely that the reported DPI (%) of 3% in the third quarter is a manual error. In this case, the value is changed to 12.5%.

4) Delete repeated quarters that report the same three reported metrics at the end of the observation period.

Electronic copy available at: https://ssrn.com/abstract=4061210