Leverage in Private Equity Real Estate

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Summary

Private equity real estate (PERE) refers to professionally managed pooled investments in the real estate market available only to institutions (e.g., pension funds), private accredited investors, and high-net-worth individuals. In the ownership structure of PERE funds, general partners (GPs) serve as the active fund managers who raise an extensive amount of external capital from limited partners (LPs) to acquire and operate commercial real estate properties. Debt financing, namely the use of leverage, is prevalent in real estate investments and even more so in the setting of PERE funds. Though much empirical research is devoted to PERE fund performance, few studies directly investigate the role of financial leverage in PERE funds.

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 (Modigliani & Miller, 1958). In practice, however, leverage seems far from irrelevant due to the existence of market frictions that could lead to value creation (or destruction) by its use. Financial economic theories indicate that leverage can amplify skill (or the lack thereof), reallocate cash flow rights, and shift incentives in the presence of market frictions. With PERE, existing work provides mixed or little evidence that leverage is employed to amplify skill and consistently hints that its use shifts the balance of benefits towards fund sponsors over their limited partners.

Based on data from Preqin and StepStone, a typical closed-end PERE fund targets 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 is little evidence that fund terms are adjusted to reflect potential conflicts of interest posed by more intensive use of leverage. Rather, stylized facts 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. The bulk of evidence in the literature points to robust underperformance of high leverage funds on a net-of-fee risk-adjusted basis. In other words, there is little evidence supporting the notion that leverage is employed to enhance skilled management and to benefit LPs. This suggests that a significant portion of PERE investors are not optimizing risk-return tradeoffs in allocating investments to high-leverage PERE funds. More work is needed to refine these findings and, more importantly, understand the source of market frictions behind them.

Keywords: real estate, private equity, REITs, leverage, risk, portfolio management, performance evaluation, risk-adjusted return, agency problem

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 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.[1] 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

[1] In the corporate finance literature, the presence of debt is understood to provide the means and motivation for monitoring entrenched managers (Nini, Smith, & Sufi, 2012) and ousting them when they perform poorly (Berk, Stanton, & 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, there is a limit to its role in monitoring overall management performance.

transfer of ownership in default typically results in substantial deadweight losses.[2] 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 an office building acquisition to be financed using a mortgage. Suppose that at the asset level and under competent management, the property'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.[3] Assuming that the building's operational outcomes are the same regardless of who owns the property (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 & Miller, 1958):

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

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. □

The preceding example demonstrates how leverage can destroy value in the form of risk-adjusted returns. One might counter, however, that skillful management of the asset can overcome the drag caused by the inefficiency of debt financing.

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

[3] 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).

Moreover, as previously discussed, leverage is necessary to allow GPs to invest more of their efforts in driving additional asset value rather than in raising equity financing. This latter argument, focusing on GP effort, assumes that GP and LP interests are aligned. It is commonly believed that carried interest paid to PERE managers when deal or fund performance exceeds a certain threshold (the preferred investor return) helps ensure interest alignment. The next stylized example illustrates that, in the presence of carry, leverage can distort alignment of interests.

EXAMPLE 2:
Consider the previous office property example, assuming no deadweight costs of default or delinquency and a holding period of one year.[4] 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 property'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 now expects to earn a bonus even if no effort is expended to drive fundamental asset value. If investing effort is costly to the GP, leverage can dilute the incentives provided by carried interest. Worse, a manager who earns a bonus in expectation without exerting effort (and creating value) 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 can therefore act to increase conflict of interest. The presence of deadweight costs of distress exacerbate this problem. □

The conflict of interest generated by leverage in the previous example can arise from incomplete contracting in the presence of asymmetric information: Effort is difficult to observe (i.e., not contractible) and LPs cannot truly know whether poor returns are generated through bad luck or insufficient skill. If skilled management by the GP can be assured then there is no doubt that GPs can

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

benefit both themselves and LPs.[5] In practice, carried interest is typically viewed as a financial incentive to apply skill so as to earn higher risk-adjusted returns for LPs. If costly effort was not involved, there would not be a need for incentives. Ultimately, the question of whether the use of leverage generates value for LPs comes down to whether the GP possesses sufficient skill relative to the effort it takes them to deploy it. What is certain, is that carry in the absence of skill cannibalizes LP value and this is made worse by leverage.

Although GPs are expected to co-invest alongside LPs to help mitigate conflicts of interest, the use of leverage can overwhelm this mechanism and reduce the source of alignment.[6] With greater scope for misalignment comes greater chance of LP value destruction (e.g., growth by acquisition of negative NPV investments). For instance, suppose that the GP can only apply skilled management to a single project like the one in Example 2, to earn $r_A = 9\%$ in expectation, and that taking on two such projects would stretch the GP too thin, having the same impact on outcomes as exerting no effort in either project (below market returns of $r_A = 7\%$ in each project). Under moderate assumptions over asset-level volatility and interest rates, co-investing 5% in one project that is all-equity financed and exerting full effort may yield a lower present value for the GP than co-investing 5% of equity in two projects, each financed with 50% leverage. In both cases the GP provides the same dollar amount and the same share of invested equity but may prefer the larger scale even though the total value created is negative. This is because the juicing of carried interest through leverage may overwhelm the loss to the GP from not being able to apply skilled management at scale.

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.[7]

[5]Taking effort as fixed (i.e., essentially contractible) and abstracting away from costly GP effort to create additional asset value, Riddiough (2021) shows that choice of leverage is insensitive to the amount of carried interest. This result may not hold if costly effort is required to apply the GP's skill.

[6]The effects of leverage are not monotonic. Riddiough (2021) shows that, at sufficiently high levels of leverage, distress costs from debt begin to cannibalize the GP's total compensation. Negative effects of high levels of debt on PERE returns are also explored via a simulation study in van der Spek and Hoorenman (2011).

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

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 comprehensive time series panel of fund-level leverage.[8] 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 that report leverage information and are tracked by the National Commercial Real Estate Investment Fiduciaries (NCREIF), StepStone, and Preqin.[9] 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, more comparable with each other than with NCREIF, classify funds by self-reported risk categories: Core, core-plus, value-added, and opportunistic (in order of increasing risk).[10] Focusing on the median characteristics, several takeaways concerning fund terms and leverage use can be gleaned from these tables.

First, despite the different periods covered by the three data sets, leverage use across them 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.[11] Non-mortgage debt (e.g., mezzanine debt or lines of credit) may partially account for the 8% difference between the NCREIF and Preqin/StepStone CEF median leverage statistics. 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

[8] 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.

[9] For each property in their fund, NCREIF funds provide extensive quarterly reports on owned properties, including remaining mortgage balance. By contrast, data obtained from Preqin and StepStone is at the fund, rather than property, level. Only about 10% of funds in Preqin and StepStone report leverage information (in the form of "target leverage"). While some individual deal-level information is available from Preqin, it is sparse and only 5% of deals report leverage information.

[10] See Hartzell and Baum (2020) for more detail on PERE CEF risk categories. Fairchild, MacKinnon, and Rodrigues (2011), MacKinnon (2018), and Couts (2022) discuss PERE core and non-core open-end funds.

[11] 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.

likely to employ non-mortgage leverage.[12]

It is apparent that median use of leverage increases when moving from the low-risk categories (core and core-plus) to the high-risk categories (value-added and opportunistic). Within the high-risk category, however, there is little difference in how much leverage is employed. Because value-added and opportunistic funds are expected to invest in riskier assets as well, their higher levels of leverage essentially "doubles down" on risk when compared to low-risk funds. Correspondingly, also increasing with risk category are fund terms such as target gross returns, base 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).

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 for equity capital, 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 between GPs and LPs, the signaling hypothesis might lead one to expect a negative relationship between leverage and carry.[13] Correspondingly, greater GP investment participation serves to reduce conflict of interest and might be expected to increase with leverage.

Table 4 reports on a series of cross-sectional regressions of fund target leverage against PERE fund terms. The data is from StepStone.[14] 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.[15] The relationship with management fees is positive and economically significant: A fee increase of 0.8 percentage points, roughly corresponding to moving from the fifth to ninety-fifth fee percentiles, is associated with six

[12]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 and capital gains growth, and/or geography.

[13]In a model without signalling, and where GP skill is fixed and the GP can extract all rents up to the LP's participation constraint (e.g., Riddiough, 2021), leverage set by the GP can be negatively related to carry. This is because increasing carry, while keeping leverage constant, will increase the GP's extracted rents. In such a setting, a higher carry might be accompanied by lower target leverage in order to meet the LP's participation constraint.

[14]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.

[15]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.

percentage points of higher target leverage even after controlling for the fund's risk category. At first blush, it isn't clear how these findings fit into a theoretical (e.g., signaling) framework. Because management fees are typically applied to contributed equity capital rather than total AUM, one simple explanation is that the larger asset base that comes with greater leverage requires more managerial overhead.[16] Another explanation comes from considering that skilled GPs with market power may command a higher management fee, and increasing leverage can 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.[17] In evaluating the second explanation, it is worth noting that LPs may find it hard in practice to identify skill in individual GPs, especially if they lack prior fund history (Korteweg & Sorensen, 2017). Indeed, the literature discussed in the next section, while scant, generally fails to support the hypothesis that GPs using higher leverage are more skilled (e.g., deliver better unlevered performance).

Time Series of Fund Terms

Table 5 documents the evolution of various median fund terms according to fund vintage years, as reported by Preqin for value-added and opportunistic CEFs. For a given fund attribute, data is only reported in a given vintage year if nine or more data points are available.[18] 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 presented earlier). 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 declined 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%.[19] 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

[16] Although industry organizations, such as INREV, regularly publish fee statistics, there is relative lack of transparency around the specifics of management fee structures (see, for instance, https://www.stepstonegroup.com/news-insights/uncovering-the-costs-and-benefits-of-private-equity/).

[17] As explained in the Theory section, debt can impose costs and cannibalize returns. From the LP perspective, as debt increases, its role as a GP skill amplifier will be eventually overwhelmed by the costs. Because of carry, increasing leverage may improve GP 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).

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

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

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.[20] Indeed, as discussed in the next section, there is little evidence supporting an increase in GP value creation over the past decade.

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., to avoid making small capital calls).[21] More recently, their use has evolved for longer-term strategic deployment and linked negatively to performance, thereby attracting more scrutiny (Albertus & Denes, 2020; Schillinger, Braun, & 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 3:
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 LP IRR of 7%, no carry, 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.

[20] 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 measures 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.

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

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 of 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 interests hurt, in practice, by this strategy of deferring capital calls using subscription 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.

Albertus and Denes (2020) find that poorly performing funds are significantly more likely to use a subscription line of credit. This is consistent with the underlying GP-LP conflict suggested by the example above. Moreover, using subscription facilities itself can be viewed as effectively increasing the overall fund leverage. A higher leverage directly increases the expected value of GPs' promote and exacerbates the conflict.[22] To summarize, although there has been some recognition of the negative implications of using subscription facilities for anything other than cash flow management, 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.[23]

Key Questions, the Literature, and New Evidence

It is argued in the Theory section that leverage should be positively linked to GP skill and negatively linked to costs of distress and contractual terms that

[22]Since the promote can be viewed as a call option by the GP, leverage increases the volatility of the promote and hence its expected value.

[23]Burgiss reports the amount of subscription facilities for only a small sample of buyout funds in North America. Similarly, Preqin does report annual survey results on which PERE 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.

lead to conflicts of interest. The stylized facts presented earlier 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 net-of-fee 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.

H1 follows from observing that leverage in PERE does not clearly offer tax advantages to investors. Thus, to balance leverage costs to LPs from potential distress and carried interest value erosion (see the examples in the Theory section), one expects that GPs offer offsetting benefits from skilled management. H2 simply states that, at the very least, the use of leverage should not hurt LPs (in risk-adjusted terms).

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 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). A full list of papers reviewed is presented in Table 6, detailing for each paper the type of data and period spanned (where appropriate).

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 et al. (2011) document 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, Fear, Colley, Notay, and Evans (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, Baum, Colley,

and Steiner (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 absolute performance at the expense of risk-adjusted performance.

As noted by Fairchild et al. (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 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. He 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. These findings are also consistent with those in Couts (2022). 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, the author finds little difference in management fees across value-added and opportunistic funds, but significant differences in effective costs.[24] Consistent with Table 4, 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 earlier, 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 echoes the potential conflict of interest, discussed earlier, that may be created through long-term use of subscription facilities.

Existing Literature on PERE Underperformance

The underperformance of PERE high-risk funds, when benchmarked against low risk-PERE and non-PERE alternatives, is found to be fairly robust across regions, time horizons, and data sources. One takeaway from this literature is that LPs, on average, would have been better off investing in real estate through vehicles different from non-core PERE funds (e.g., REITs or core PERE funds). While not directly addressing the question of whether leverage is beneficial in the PERE context, the relative absence of investment benefits suggests that, on average, GP skill is not employed to the ultimate benefit of LPs. This makes for indirect evidence against H2 because PERE non-core CEFs make considerably greater use of leverage than the alternatives against which they have been benchmarked in the literature.

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, delivered an average negative IRR and public market equivalent (PME) multiple of 0.89.[25] 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,

[24] Effective costs, also known as fee drag, is the difference between the gross and net LP return.

[25] 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.

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. Riddiough (2022) provides a summary of these studies and, separately, 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 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 non-core fund with the return that an LP could earn through the fund's benchmark. They find that closed-end PERE funds underperform listed REITs as well as open-ended core funds, and that the spread between their returns is driven by macroeconomic variables such as Treasury yields, default spreads, and GDP growth.

It is especially important to note that the underperformance of non-core CEFs is robust to using either public or private benchmarks. Although there is little evidence to demonstrate that REITs hold substantially different real estate assets than PERE funds (Pagliari, Scherer, & Monopoli, 2005; Riddiough, Moriarty, & Yeatman, 2005), direct comparability is not a forgone conclusion.

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 deliver a quarterly property-level (unlevered) return of 2.29%, roughly 50 basis points higher than property-level returns of 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.[26]

One might be concerned that the difference in returns is primarily driven by the Great Financial Crisis dislocation. Eliminating the worst-performing quarters

[26]This is a more direct test of H1 than what might be inferred from the results in Gang et al. (2020) and Cypher et al. (2020).

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 time equality of means is rejected at the 5% level.[27] 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 (PMEs — see Footnote 25) for Preqin value-added and opportunistic PERE funds and using LP distributions (net of fees). In the table, instead of a public market benchmark (e.g., REITs, as used by Arnold et al. (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 a fixed level (e.g., 65%) using prevailing average mortgage rates to proxy for the debt yield.[28] 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.[29] 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).

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, other important questions remain. In particular, the investor base for PERE

[27]Earlier, it was 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.

[28]Quarterly mortgage rates are generated from the average interest rate paid by NCREIF properties that report non-zero leverage and within one year of their acquisition.

[29]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.

funds is not uniform, and it is important to shed more light on investor-specific frictions that might 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 adjusted expectations about managerial skill to reflect the growing institutional competition over commercial real estate assets. In the ensuing, each of these potential contributors to inefficient use of PERE leverage is discussed in the hope that future research may address them.

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 belief merits healthy skepticism. Another way to rationalize an institutional need for a volatility veil 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 fund 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).[30]

Gupta and Van Nieuwerburgh (2021) and Riddiough (2022) suggest that 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

[30] Jackson, Ling, and Naranjo (2022) report that GPs managing outsized proportions of underfunded pension plans' portfolios are more apt to overstate interim returns. They interpret this as evidence that some LPs, through their conflicted fiduciaries, are drawn to invest more in GPs that cater to a need for manipulated returns.

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 investable 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 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, Gardner, Cowe, & Jones, 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.[31] Another benchmarking approach employs absolute comparisons (e.g., targeted returns advertised to investors against actual returns). More recently, some

[31] 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.

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). 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. Both alpha and the Sharpe ratio represent measures of risk-adjusted returns and, under ideal conditions, are neutral to leverage.[32]

Although, in principle, one can measure alpha for a private equity fund (see, for instance, Gredil, Griffiths, & Stucke, 2022), doing so before the fund is fully liquidated can be problematic because of reliance on the self-reported value of the fund's net asset value.[33] Moreover, the Leland (1999) critique may be especially germane because leverage would naturally change dynamically over the fund's life and because of the option-like features of carried interest impact LP cash flow. This may explain why standard risk adjusted metrics like alpha and the Sharpe ratio are not used in benchmarking PERE investments.

Unlike alphas and Sharpe ratios, the index plus a spread methodology, absolute target return benchmarking, and PMEs are not leverage-neutral even under ideal conditions. In particular, increasing leverage can increase expected performance as measured by these standard approaches. For instance, in Example 2 of the Theory section, 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 make a levered investment in a core fund. The example's objectively inferior LP expected returns of 13.5%, however, generally exceed expected returns on ODCE plus 300 bps (historically summing to about 11%), meaning that the fund is expected to 'outperform' based on standard industry measures. Performance of 13.5% also exceeds average historical REIT returns, so the fund would also be expected to outperform when using a REIT PME benchmark — this is simply because REITs employ about half of the leverage typically used by PERE funds. In

[32]The "ideal conditions" refer to a world in which market frictions are absent *and* the CAPM holds. Leland (1999) discusses how both alpha and the Sharpe ratio may no longer be valid risk-adjusted measures of return, even in the absence of market frictions, if applied to dynamic investment strategies (e.g., in strategies in which leverage changes dynamically, as is the effectively the case with the use of options).

[33]Some headway has recently been made with this issue. Brown, Ghysels, and Gredil (2022) propose a bias-free methodology for estimating fund NAVs using available data at any point during the fund's life.

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 and a superior passive alternative is available (e.g., a leveraged investment in a core fund or in a REIT index).

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, even if only under ideal conditions. One example of how this may be done is through comparisons that are strictly on an unlevered basis. This is demonstrated in the new evidence, provided earlier, on performance comparison of high and low leverage funds. Another example is furnished by the NPI-Equivalent exercise, also earlier presented as new evidence, 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 Adjustment of Strategies and Expectations

Existing studies suggest that REITs have outperformed PERE funds in the last two decades. One possible reason is that, over that period, GPs have not fully adjusted their strategies and LPs have not fully adjusted their expectations, to reflect a more competitive current investment landscape than might have existed earlier.

When they first appeared on the institutional CRE investment scene in the 1980's and 1990's, PERE funds performed well, making a strong case for value creation through this type of investment vehicle. The last twenty years, however, featured exponential growth in professionally managed institutional investment in CRE. For instance, according to NAREIT, the market capitalization of public equity REITs grew nearly tenfold between 2000 and 2020.[34] Growth in NCREIF privately held assets grew by a similar amount over the same period. Since 2000, the huge inflow of institutional capital, competing over a CRE asset pool growing at a much slower pace, might have made it harder to continue to replicate the outsized value creation experienced before 2000.

In particular, it is really only since the mid-1990s, after legislative barriers to institutional participation in REITs were removed, that REITs became a viable institutional investment alternative to PERE. As an investment vehicle, REITs

[34]Many consider early 90s as the start of the modern REIT era, beyond which equity REITs boomed to become the dominant asset type in public commercial real estate investments.

have comparative advantages and disadvantages relative to PERE and it is possible that the recently documented underperformance resulted from failure by GPs and LPs to fully internalized these. To understand this better, it is useful to list the comparative advantages and disadvantages. One primary advantage REITs possess over PERE funds is through access to a greater 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 market 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 within a legally defined term. These considerations can potentially result in better deal-level 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 more on growing funds from operations 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.).

To conclude, if PERE fund GPs and LPs have been slow to change their focus towards their relative advantage vis à vis REITs, it stands to reason that they would underperform REITs over the period when REITs rose to prominence as a viable institutional CRE investment alternative. There is circumstantial evidence for this. Pagliari et al. (2005) find little differentiation between property-level returns for portfolios held by REITs versus those held by private equity funds. Correspondingly, Shilling and Wurtzebach (2012) suggest that leverage, rather than fundamental asset characteristics, comprises the primary difference between core and non-core PERE funds. To the extent this is true, simply levering core assets that a REIT could acquire, finance, and sell under better terms would fail to play to PERE funds' relative advantages as investment vehicles. It is important to further investigate the role sluggish adjustment to GP strategies and LP expectations might play in explaining documented PERE underperformance, not only for academic reasons, but also because awareness of this issue can help the industry pivot more quickly towards a more efficient structure.

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 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., 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.

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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%

TABLE 2— StepStone Fund Terms (2014-2021). The table summarizes US PERE fund terms, as collected and reported by StepStone. Effective cost, or fee drag, 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%
	p95	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%
	p95	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%
	p95	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%
	p95	21.0%	6.0%	75.0%	20.0%	10.0%	10.0%	2.0%

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, or fee drag, 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%
	p95	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%
	p95	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%
	p95	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%
	p95	30.0%	10.0%	75.0%	20.0%	10.0%	20.0%	2.0%

TABLE 4— 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)
High-risk fund	9.505***	6.930*	6.553*			5.022	5.431*
	(2.461)	(3.125)	(2.618)			(3.174)	(2.681)
Opportunistic fund	2.828*	1.341	2.427			1.283	1.315
	(1.404)	(1.546)	(1.385)			(1.525)	(1.515)
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 5— 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, or fee drag, 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

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 (2022)
	U.S.	1995-2012	NCREIF-Townsend (performance metrics)	Pagliari (2020)
	U.S.	2000-2017	Preqin (cash flows)	Gupta and Van Nieuwerburgh (2021)
	U.S.	2001-2019	Cambridge Associates (performance metrics)	Arnold et al. (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 et al. (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 et al. (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 et al. (2020)
	U.S.	1997-2014	NCREIF (property-level metrics)	Gang et al. (2020)
Fund Terms	U.S.	1988-2014	Cambridge Associates (performance metrics)	Arnold et al. (2017)
	Global	2005-2015	Dutch PGGM (performance metrics)	van der Spek (2017)

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

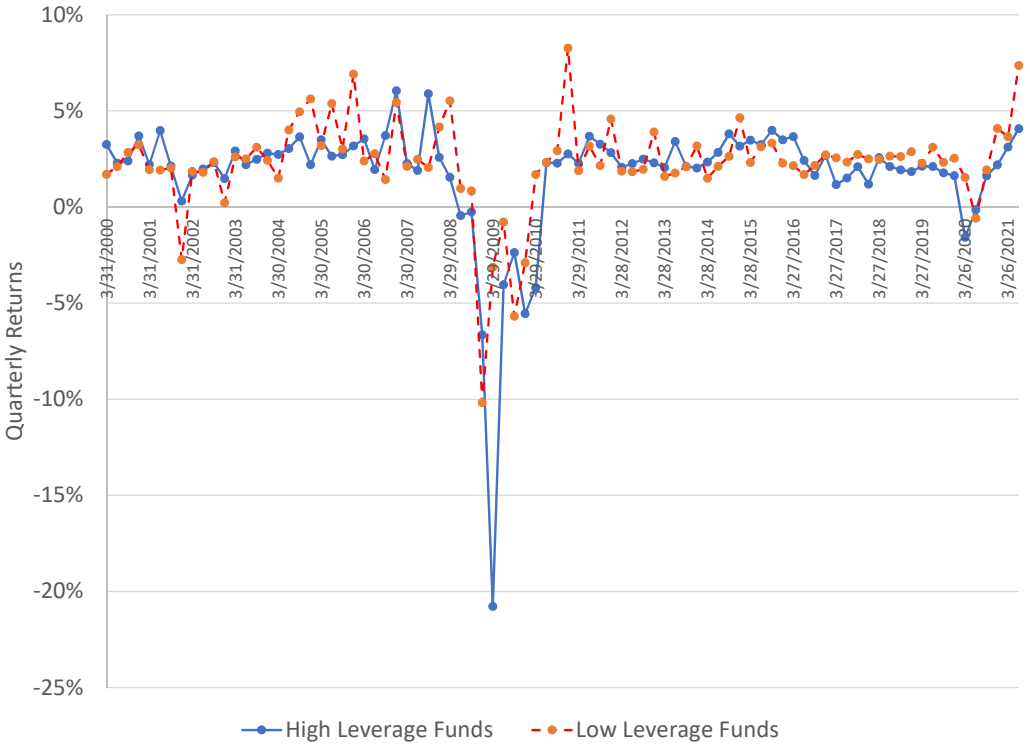

FIGURE 1. Aggregate (value-weighted) property returns for high leverage and low leverage NCREIF CEFs. Each series is created by calculating the value-weighted returns of NPI properties. High (resp. low) leverage funds are top (resp. bottom) quartile CEFs with respect to the use of leverage (see Table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

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Data Appendix

This data appendix describes the methodology to construct fund-level quarterly cash flows using historical fund metrics from Preqin. The raw data has 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 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 combination of (Called (%), DPI (%), RVPI (%)) at the end of the observation period.