Real Estate Returns by Strategy: Have Value-Added and Opportunistic Funds Pulled Their Weight?

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Abstract

Real estate strategies broadly fall into three categories: core, value-added and opportunistic. This empirical examination of net returns from these three strategies indicates that, on a risk-adjusted basis, the value-add funds have strongly underperformed and the returns from opportunistic funds have weakly underperformed the returns available from core funds. In so concluding, this article departs from standard asset-pricing models in two important respects: the total risk is used and the cost of borrowing increases as leverage increases. While the first departure has no substantive effect, the second departure lowers the estimate of the underperformance of non-core funds.

Introduction

Private-market (commercial) real estate strategies broadly align themselves along the following risk/return continuum: "core" funds represent the low-risk/low-return investment and "opportunistic" funds representing the high-risk/high-return investment with "value-added" falling in between. However, as the financial crisis of 2008-2009 unfolded and commercial real estate prices fell precipitously, serious questions about the after-fee performance of value-added and opportunistic commercial real estate funds were raised – see, for example, Fitch (2008) and Troianovski (2009). The essence of these questions can be distilled into: Have these funds "pulled their weight" (*i.e.*, provided excess risk-adjusted returns, net of investment-management fees) over one or more complete market cycles?

Of course, concerns about the after-fee (or the net) performance of higher-risk/higher-return strategies are not confined to institutional real estate investing nor are these concerns necessarily recent. For example, consider: *a*) David Swensen (of the Yale Endowment Fund) has suggested that leveraged buyout funds have substantially underperformed the S&P 500.[1] *b*) Before the 2007-2008 financial collapse, Warren Buffett (of Berkshire-Hathaway) wagered that hedge funds would underperform the S&P 500 over the ten-year period ended in 2017; he has long been skeptical of the after-fee performance of such private funds.[2]

Moreover, these concerns are particularly apt in light of the significant shortfalls faced by many public-sector (defined-benefit) pension plans (*e.g.*, see Novy-Marx and Rauh (2011)). In response, many of the largest institutional investors are substantially increasing their allocations to privately traded alternative investments (including real estate, as well as venture capital, leveraged buyouts, hedge funds, infrastructure, *etc.*). In some instances, rebalancing their portfolios towards these higher-return/higher-risk strategies may be the most politically palatable approach – at least in the short run – as compared to the alternative of seeking additional funds from legislative bodies in order to reduce these shortfalls. So, as these and other investors move to higher-risk strategies, the question of whether or not these higher-risk (real estate) strategies provide positive risk-adjusted returns merits answering.

This paper examines the realized performance of private real estate funds by their three major strategies and finds that the risk-adjusted performance of value-added and opportunistic commercial real estate funds, over the reporting period ended in 2012, failed – on average – to outperform a levered strategy of core real estate funds, after adjusting for fund-management and incentive-based fees.

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[1] For the period 1987-1998, the (gross) return of leveraged buyout (LBO) funds produced a 48% annual return; such funds had a debt-to-equity ratio of 5.2:1. Over the same time period, the return of the S&P 500 was 17% which had a debt-to-equity ratio of 0.8:1. Had the S&P 500 been levered at the same ratio as the buyout funds, the levered S&P 500 would have produced a return of 86% – outperforming the LBO funds by 36 percentage points before the funds' fees and carried interest. See Swensen (2000). A similar – but less dramatic – finding was found when looking at the comparative performance of hedge funds over the 1980-2004 period; see Griffin and Xu (2009).

[2] More specifically, Warren Buffett bet – beginning on January 1, 2008 – Protégé Partners LLC that the S&P 500 would outperform (net of fees and costs) five funds of hedge funds, selected by Protégé Partners, over the ten-year period ended in 2017. See Loomis (2008).

The Performance Data

The NCREIF-Townsend Fund Returns[3] data set is utilized herein; it reports the gross and net quarterly returns by strategy/classification through 2012 and represents more than 600 (active and inactive) funds. The data are then annualized using compounded time-weighted quarterly returns. While returns are available before 1996 (particularly for the core funds), the consensus seems to suggestthat 1996 represents the first year in which the sample size is sufficiently robust for the non-core funds. In addition to the well-known problem of appraisal smoothing – see, for example, Geltner (1993) – there are a number of other potential problems relating most accutely to the data for non-core funds (and the opportunistic funds in particular); these include: "survivorship" bias, voluntary reporting, inconsistent reporting, mark-to-market staleness, incomplete capture of non-core funds, *etc*. For only the first of these problems (*i.e.*, survivorship bias) is any adjustment made. The remainder of the problems represents potential infirmities in the data and the conclusions that follow. Therefore, readers ought to exercise caution when reviewing and interpreting the results that follow. One other caveat: The returns that follow represent average fund performance by strategy.

Taking the reported gross and net returns at face value, the value-weighted (arithmetic) average (annualized) return and its volatility for funds representing these three strategies are computed and plotted in risk/return space, as shown in Exhibit 1. The square icons represent the gross returns from the three strategies, while the circular icons represent the net returns (*i.e.*, the impact of fees, costs and promoted interests) from each of these three strategies.[4] [For purposes of comparison, the NCREIF Property Index ("NPI") is shown via the diamond-shaped icon. Note that the gross return from the average core fund was less than the NPI, which this illustrates the difficulties of managers beating the passive benchmark.]

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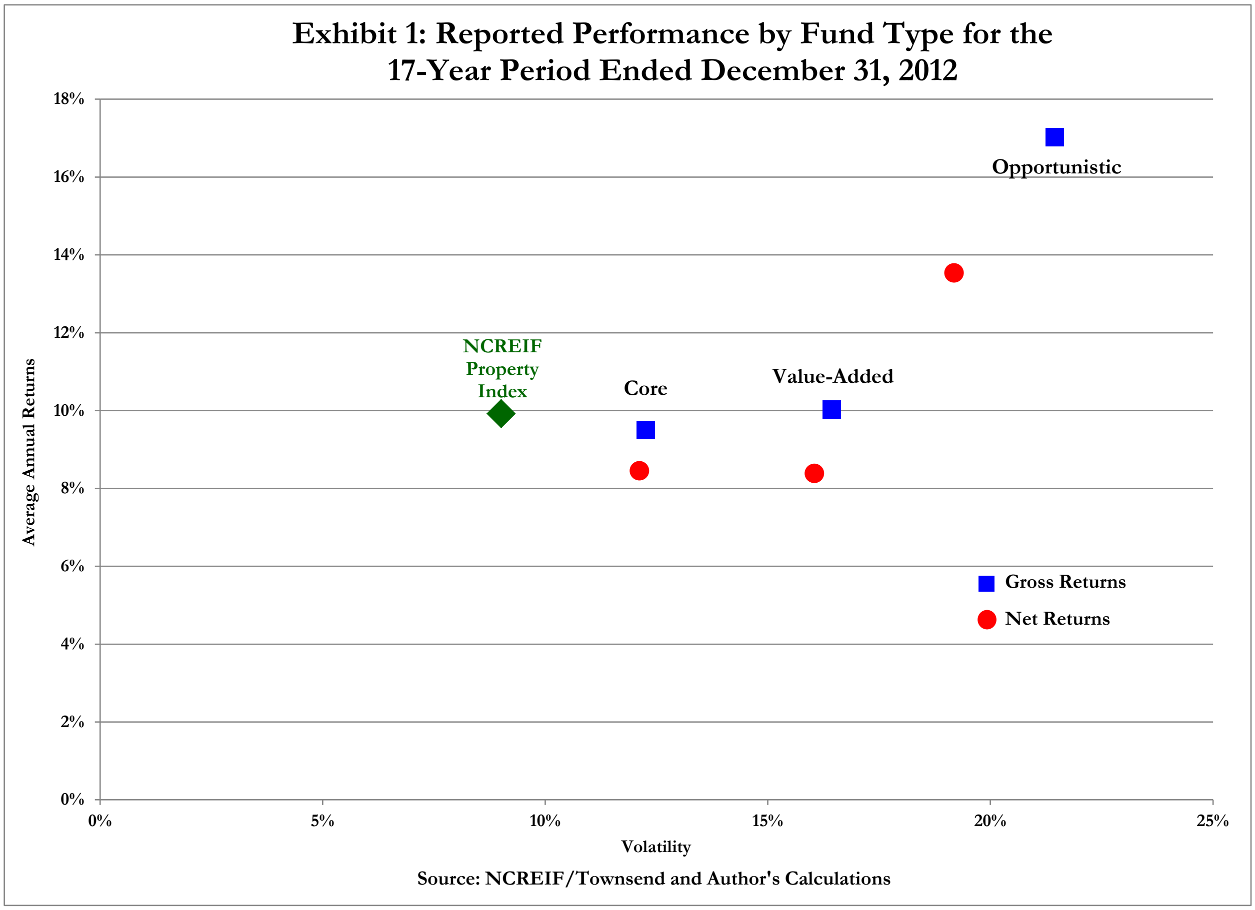
[3] The core funds are represented by the NCREIF Fund Index - Open End Diversified Core Equity ("OCDE"), while both the value-added and opportunistic fund are represented by the "all funds" category within each non-core strategy; for more information, please see: https://www.ncreif.org/townsend-fund-returns.aspx

[4] Altshuler (2016) warns of the potential infirmities of using time-weighted returns (*i.e.*, not the type of compounding annualized returns used here) when the inclusion of the accrued incentive fees may misstate (gross and/or net) returns. The magnitude of such misstatement, if any, is a function of the reporting conventions used, the size of the (accrued) incentive fee and the length of the accrual period. A few points are in order: *a*) the returns used here are based on the NCREIF reporting standards, *b*) time-weighted returns were initially developed to mitigate potential problems created when investors have discretion over the timing of their capital contributions and withdrawals, within a given fund – such discretion is typically not the case the closed-end non-core funds examined here – and *c*) core funds do not generally have incentive fees.



The vertical difference between the gross and net returns (by strategy) represents the sum of the manager's base and incentive fees.[5] On average, the difference between gross and net returns was approximately 105 basis point for core funds, 165 basis points for value-added funds and 350 basis points for opportunity funds.[6] The horizontal difference between the gross and net returns (by strategy) represents the observed reduction in volatility due to incentive fees; however, as noted in Pagliari (2007) and Kritzman (2012), this reduction is largely a statistical illusion – as the investor essentially retains all of the downside risk.

Speaking qualitatively from the vantage point of Exhibit 1, it is apparent that the index of value-added funds were disappointing: Not only were the average net returns for the index of value-added funds lower than the index of core funds' returns, the index of value-added

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5 The NCREIF-Townsend Fund Return data deduct third-party fees and costs before computing gross returns.

6 Spek (2013) finds quite similar differences between gross and net returns, by strategy, using a different data (comprising 440 (domestic and foreign) funds) and using a different methodology (he models the *ex ante* total (base and incentive) fees assuming differing real estate return distributions by strategy).

funds experienced more return volatility.[7] However, it is difficult to make a similar judgment about the performance of the opportunistic funds: While the (net) returns were higher for opportunistic funds than for core funds, the opportunistic funds experienced nearly twice the volatility; accordingly, it is initially unclear whether the opportunistic funds have – on average – over- or under-performed core funds on a risk-adjusted basis.[8] Assessing risk-adjusted performance is the focus of the balance of this paper.

The summary statistics above the dashed lines found in Panel A of Exhibit 2 indicate the reported performance for the seventeen-year period ending in 2012 and correspond to the figures shown in Exhibit 1. The summary statistics below the dashed line indicate the reported performance for the eleven-year period ending in 2006 – before the appearance of the 2007-2008 financial crisis – and the six-year period ending in 2012 – during and after the appearance of the financial crisis. These sub-periods reveal important differences in the reported performances by strategy. Unsurprisingly, average returns fall considerably and volatilities rise measurably in the second sub-period across all three strategies.

Exhibit 2: Reported Performance by Fund Type for the 17-Year Period Ended December 31, 2012

	Gross (Value-Weighted) Returns				Net (Value-Weighted) Returns		
	Core		Non-Core		Core	Non-Core	
Years	NPI	ODCE	Value-Added	Opportunistic	ODCE	Value-Added	Opportunistic
Panel A: Summary Statistics:							
Arithmetic Average:							
1996-2012	9.92%	9.49%	10.02%	17.02%	8.45%	8.38%	13.53%
1996-2006	12.56%	12.90%	15.00%	24.19%	11.81%	13.40%	20.27%
2007-2012	5.07%	3.25%	0.88%	3.88%	2.29%	(0.82%)	1.18%
Standard Deviation:							
1996-2012	9.01%	12.27%	16.45%	21.45%	12.12%	16.05%	19.19%
1996-2006	4.16%	4.74%	6.72%	16.20%	4.67%	6.18%	13.68%
2007-2012	13.48%	19.08%	24.91%	25.04%	18.87%	24.31%	22.83%
Panel B: Differences Tests (1996-2006 *v*. 2007-2012):							
Difference in Means:							
Average Difference	(7.49%)*	(9.65%)*	(14.12%)**	(20.32%)**	(9.52%)*	(14.22%)**	(19.09%)**
Difference in Variances							
Variance Ratio	10.52 ***	16.22 ***	13.74 ***	2.39	16.32 ***	15.45 ***	2.79

Note: * indicates a 10% confidence level, ** indicates a 5% confidence level and *** indicates a 1% confidence level. The test statistic for the differences in means uses a one-sided (lower tail) critical value based on the t distribution. The test statistic for the differences in variances uses a one-sided (upper tail) critical value based on the F distribution.

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[7] For the sake of brevity, the balance of the paper generally avoids – unless needed for particular emphasis – reminding the reader that these findings represent results "on average" of an "index of" core and non-core funds. However, such meaning should be generally construed throughout.

[8] The differences in the means and volatilities, as between core and value-added funds as well as between core and opportunistic funds, are statistically insignificant at conventional confidence levels with the exception of the volatilities of the opportunity funds' returns *vis-à-vis* the core funds – which is significant at the 5% confidence level.

As shown in Panel B of Exhibit 2, the differences in means – as between the two sub-periods – were statistically significant (using a one-sided (lower tail) critical value based on the *t* distribution) across all three strategies. However, the differences in the volatility (as measured by the variance ratio) were statistically significant (uses a one-sided (upper tail) critical value based on the *F* distribution) for only the core and value-added funds; the difference in the volatility of the opportunity funds was statistically indistinguishable from zero. This seems an odd result; in most every financial crisis, there is a "flight to quality" (with riskier assets (*e.g.*, those assets generally found in opportunity funds) falling more in value than less-risky assets (*e.g.*, those assets found in core funds)). Moreover, the presumed fall in asset values of the opportunistic funds would be exacerbated by the generally higher leverage ratios of these funds.

What might explain this muted increase in return volatility over this particularly troubled time *vis-à-vis* opportunity funds? Among the potential reasons, there are these: *a*) The data for opportunistic funds are susceptible to "survivorship" bias (*i.e.*, the tendency of poor-performing funds to stop reporting their results). If so, the returns of opportunity funds are overstated and the volatility of those funds is understated. *b*) The data represent a particular subset of investment managers for which returns were largely unaffected during and after the financial crisis. *c*) The nature of the investment management contracts for opportunity funds requires less frequent reporting of fair market valuations. If so, these "stale" valuations fail to capture the true volatility of such investments. *d*) The underlying property investments of the opportunity funds are more opaque than the properties of core and value-added funds. Consequently, the appraisal of these opaque assets (as well as the mark-to-market effects of funds' indebtedness) is more imprecise. Some opportunistic fund managers may have utilized this imprecision to their advantage, by constraining the (adverse) mark to market of their portfolios.[9]

There is evidence on only the first of these four possibilities. Specifically, a closer examination of the opportunity fund data reveals that the NCREIF-Townsend returns only aggregate funds which reported for all four quarters of a given year; however, the individual quarters show more funds reporting than appear in the yearly data.[10] The disappearing funds show no data in the following quarter and, consequently, we are left to ponder what became

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[9] Brown, *et al.* (2006) find evidence that managers of underperforming private equity funds tend to overstate valuations when fundraising, while outperforming managers understate such valuations.

[10] During and after the 2007-2008 financial crisis, the difference between those opportunistic funds reporting for all four quarters in a given year and those reporting in less than four quarters averaged 21.4 funds (or 8.1% of total funds reporting). These disappearing funds are the focus of this inquiry. Prior to the financial crisis, the difference averaged 16.3 funds (or 13.0% of total funds reporting). However, the reasons for the differences seem very different: Prior to the financial crisis, the difference largely relates to funds entering the data set due to new-fund formations (the exclusion of these entrants may well mitigate the anomalous returns often associated with start-up results). During and after the financial crisis, the difference seems to largely relate to funds leaving the data set due to adverse performance (*i.e.*, potentially contributing to the survivorship bias mentioned above).

of their return(s) in the following quarter(s).[11] Here too, there are several possibilities, including: the disappearing funds were merged with reporting funds, the disappearing funds merely stopped reporting but produced returns comparable to their peers, or the disappearing funds were dissolved with the liquidated assets failing to completely repay the fund's indebtedness (*i.e.*, equity investors lost their entire capital contribution).

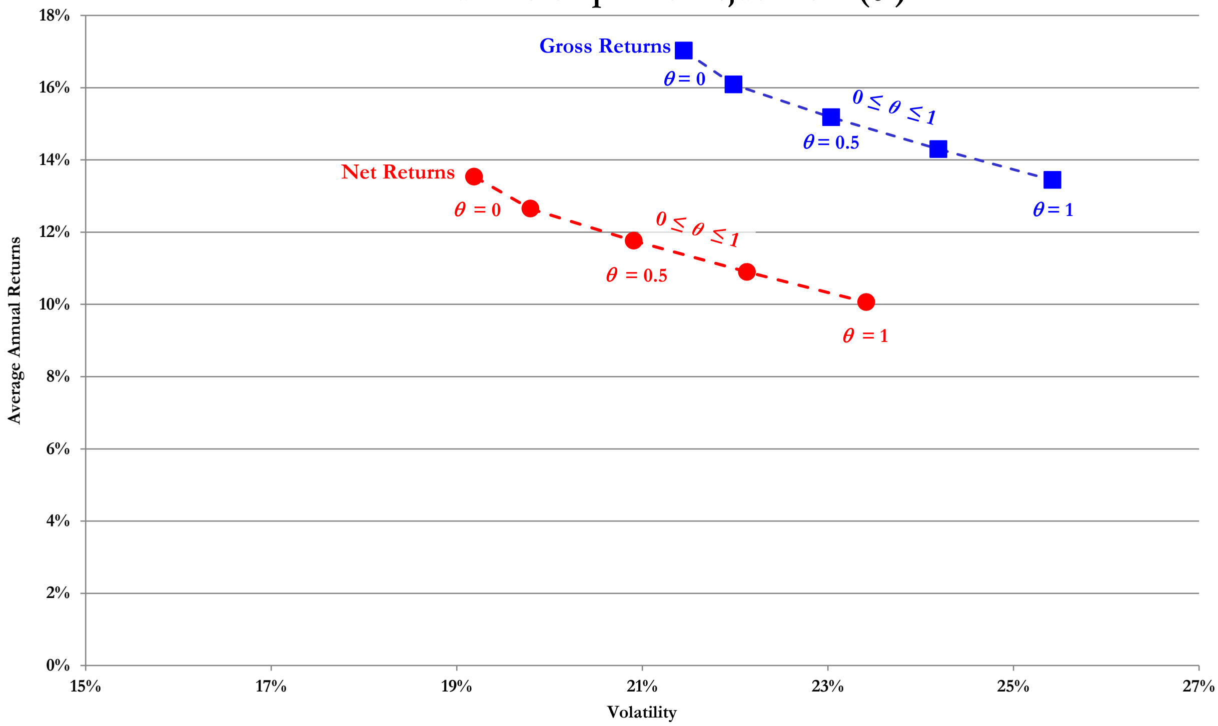
Modifying the Performance Data

One approach to estimating the magnitude of this survivorship bias is to assume that all of the disappearing funds experienced a liquidation event equal to some proportion, θ, of the fund's net asset value. Because the data provide no way of determining the appropriate value of θ, Exhibit 3 illustrates the opportunity funds' gross and net returns and their respective volatilities as θ ranges from zero to 100% assuming that the survivorship-bias problem, if it existed, occurred in the period 2007-2011.[12]

[11] The problems of survivorship bias and other difficulties are not confined to real estate funds. For example, it is notoriously difficult to come by sound data on private-equity returns. For which, there are a good number of investment styles (*e.g.*, venture capital, leveraged buyouts, mezzanine financing, currency overlays, *etc.*) and there are well-known problems of inconsistencies and selection bias. The latter can substantially overstate the reported risk/return characteristics; for example, see Asness, *et al.* (2001) and Cochrane (2005).

[12] By 2012, we assume that the survivorship-bias adjustment (θ) is no longer needed; instead, the difference between the number of funds in the annual data as compared to the number of funds in the quarterly data is more likely attributable to the formation of new funds.

Exhibit 3: Reported Performance of the Opportunistic Funds for the 17-Year Period Ended December 31, 2012 with Survivorship Bias Adjustment (θ)



Source: NCREIF/Townsend and Author's Calculations

Without any empirical support, it is initially assumed that θ equals 50%. Not surprisingly, attempts to mitigate the potential survivorship bias (assuming θ greater than zero) worsen the opportunity funds' return series – reducing the average return (by approximately 180 basis points, when θ = 50%, over the entire seventeen-year period[13]) and increasing the volatility (by approximately 165 basis points, when θ = 50%, over the entire seventeen-year period) of that index's return. See Panel A of Exhibit 4.

Unfortunately, the proposed (θ = .5) adjustment to the opportunity funds does little to mollify the earlier-stated concerns about "stale" valuations and/or muted "marks" to market for opportunity funds during and after the financial crisis. Panel B of Exhibit 4 indicates that the difference (*i.e.*, pre- *v.* post-financial crisis) in the volatility of the opportunity funds was still statistically indistinguishable from zero, even when θ = .5.

[13] However, recall that the survivorship-bias adjustment (θ) applies only to the returns reported for the 2007-2011 time period.

Exhibit 4: Comparison of Reported and Adjusted Opportunistic Performance for the 17-Year Period Ended December 31, 2012

Years	Gross (Value-Weighted) Returns: With $\theta = 0$	Gross (Value-Weighted) Returns: With $\theta = 0.5$	Net (Value-Weighted) Returns: With $\theta = 0$	Net (Value-Weighted) Returns: With $\theta = 0.5$
Panel A: Summary Statistics:				
Arithmetic Average:				
1996-2012	17.02%	15.18%	13.53%	11.76%
1996-2006	24.19%	24.19%	20.27%	20.27%
2007-2012	3.88%	(1.35%)	1.18%	(3.84%)
Standard Deviation:				
1996-2012	21.45%	23.04%	19.19%	20.91%
1996-2006	16.20%	16.20%	13.68%	13.68%
2007-2012	25.04%	25.82%	22.83%	23.95%
Panel B: Differences Tests (1996-2006 *v*. 2007-2012):				
Difference in Means:				
Average Difference	(20.32%)**	(25.55%)**	(19.09%)**	(24.11%)***
Difference in Variances				
Variance Ratio	2.39	2.54	2.79	3.07

Note: * indicates a 10% confidence level, ** indicates a 5% confidence level and *** indicates a 1% confidence level. The test statistic for the differences in means uses a one-sided (lower tail) critical value based on the t distribution. The test statistic for the differences in variances uses a one-sided (upper tail) critical value based on the F distribution.

Unfortunately, the variance ratio (for both gross and net returns) remains statistically insignificant. (The sensitivity of this assumption (θ =.5) is further examined in the Appendix.) Consequently, θ =.5 is a weak proxy ofr attempting to address the potntial infirmities in the opportunity fund data.

Assessing Risk-Adjusted Performance

While "mainstream" finance might argue for utilizing some form of a factor model[14] to disentangle systematic returns ("beta") from positive (or negative) risk-adjusted performance ("alpha"), those multi-factor models typically require data sets (*e.g.*, data on book-to-market, momentum, *etc.*) which are more robust than that available here. Moreover, their emphasis on efficient (public) markets generally includes assumptions (*e.g.*, absence of transaction costs, complete and frictionless markets, *etc.*) often violated in private markets (like commercial real estate). Instead the "law of one price" (via financial leverage) will be used to create a risk/return continuum available to any institutional investor. Against the backdrop of this continuum, the risk-adjusted performance of non-core funds can be determined.

[14] Of such models, a popular single-factor model is the capital asset pricing model (CAPM) (*e.g.*, see Sharpe (1964)) and, among the multi-factor models, there are three-factor models (*e.g.*, see Fama and French (1992)) as well as models that include a fourth factor: "momentum" (*e.g.*, see Carhart (1997)) or liquidity (*e.g.*, Pástor and Stambaugh (2003)). Moreover, because the evaluation of venture capital-like payoffs is particularly challenging (*e.g.*, infrequent and skewed payoffs covering varying time horizons), some form of a stochastic discount factor may be utilized; for example, see: Korteweg and Nagel (2013).

Assessing Risk-Adjusted Performance – Theoretical Basis

To apply the law of one price, consider a one-period model[15] of the levered return on equity (k_e), written as a function of the (unlevered) asset return (k_a), the cost of indebtedness (k_d) and the degree of leverage (LTV). Assuming fixed-rate financing, the volatility of levered equity (σ_e) is a function of asset-level volatility (σ_a) and the degree of leverage. Therefore, financial leverage can be used to transform the risk/return characteristics of the core funds into a higher-return/higher-risk strategy, by utilizing Equations (1) and (2):

$$k_e = \frac{k_a - k_d LTV}{1 - LTV} \tag{1}$$

$$\sigma_e = \frac{\sigma_a}{1 - LTV} \tag{2}$$

Furthermore, the cost of indebtedness is assumed to be an increasing function of the loan-to-value ratio; as leverage increases, lenders require an increasing spread (δ) over the risk-free rate (r_f) and compensation (γ) for additional costs and structural differences as between the commercial mortgage loan market and the Treasury bond market. Conceptually, the cost of risky debt can be described as:

$$k_d = r_f + \gamma + \delta \frac{LTV}{1 - LTV} \tag{3}$$

The default premium (δ) can be viewed as approximating the put option[16] available to borrowers of non-recourse loans. The value of this put option increases as the loan-to-value ratio increases. (To keep matters simple, it is assumed that the loan-to-value ratio and the debt-coverage ratio are mathematical inverses of one another.) Equation (3) is a much-simplified version of more rigorous option-pricing models – *e.g.*, see Merton (1974) and Titman and Torous (1989) – utilized when pricing risky debt.

Combining Equations (1), (2) and (3) transforms unlevered core assets (or funds) into equivalent higher-risk/higher-return strategies. Note that this continuum is curvilinear – rather than the classic linear relationship (*e.g.*, see: Sharpe (1964) and Treynor (1961)) between risk and return[17] – due to the increased cost of borrowing at higher leverage/volatility levels. The steeper the credit curve (*i.e.*, the higher the default premium

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[15] This is merely a variation of Modigliani and Miller (1958) – hereafter referred to as "M&M." Equation (2) derives algebraically from Equation (1), when fixed-rate financing is assumed.

[16] The borrower's ability to "hand back the keys" without incurring further liability is a put option granted to the borrower by the lender in return for a higher interest rate than would otherwise be the case.

[17] The graphic also differs from the typical M&M illustration (which assumes a constant cost of indebtedness) because it explicitly recognizes that the cost of indebtedness increases with the leverage ratio. However, it should be noted that M&M also contemplated an increase in the interest rate as the leverage ratio increases – see footnote #17 therein.

(δ)), the more curvature is found in the law-of-one-price continuum. Consequently, this study differs from the traditional capital asset pricing model (CAPM) in two important ways:

First, risk is measured here in terms of total risk (σ) as opposed to the systematic risk (β) of the traditional CAPM, which is a scaled measure of correlated volatility. This difference in methodology is essentially moot, because this study examines indices of core and non-core returns. These indices are nearly perfectly correlated with one another[18] and, as such, total risk and systematic risk provide essentially identical risk measures. So, while the two approaches produce (near) identical ordering of risk-based measures, the use of total risk serves dual purposes: *a*) it avoids utilizing a CAPM-style approach, where private-market assets are – as noted earlier – particularly ill-suited to many of the assumptions underlying the CAPM, and *b*) it is the risk measure by which lenders price risky debt (see below).[19]

Second, the cost of borrowing is assumed – using, as noted earlier, an approximation of the option-based approach to valuing risky debt – to increase geometrically with the degree of leverage. While it may be a mathematical convenience to assume the cost of borrowing is constant (at the risk-free rate) across all leverage ratios; this is theoretically and pragmatically impossible. As the amount borrowed increases, the lender rationally charges a higher rate of interest in order to protect itself against the rising probability of default and the costs of financial distress.

Unlike the first departure from traditional CAPM-based approaches (in which the effect on risk measures is essentially moot), the second departure (*i.e.*, leverage-dependent *v.* constant borrowing costs) does materially impact the calculation of risk-adjusted returns. That is, any approach that assumes borrowing at the risk-free rate in order to calculate alpha is inherently biased against higher-risk/higher-return strategies.

So, this notion of levered (core) returns provides the foundation by which the performance of the core funds within the NCREIF-Townsend Fund Returns data set are compared to the performance of the non-core funds. (In the alternative, non-core fund returns could be de-levered; however, the data are simply not available to do so.[20]) Moreover, levering the core funds is a far easier task because few of these funds have incentive fees, whereas the non-core funds more typically have incentive fees – making problematic the computation of

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[18] The observed correlation between the index of the returns from core and value-added funds was .961, between core and the opportunistic funds was .862, and between the value-added and opportunistic funds was .934.

[19] That is, the default parameter (δ) of Equation (3) is a model based on the asset's total risk (σ). In equilibrium, the boundary conditions imply that $k_d \rightarrow k_a$ as $LTV \rightarrow 1$. However, because of the endogeneity problems associated with the costs of financial distress, the maximum LTV < 1.

[20] One of the paper's anonymous referees suggested an alternative approach: Combine an index of opportunistic funds with Treasuries such that the combination has the same volatility as an index of core funds; then determine which portfolio has the better returns (given their equivalent volatility).

estimated net returns without knowing each non-core fund's preference-and-promote structure.

It should also be noted that the approach taken here differs from another popular technique, the public-market equivalent ("PME") – see Kaplan and Schoar (2005) – which essentially compares the ratio of the discounted value of the investor's (net) distributions to the discounted value of the investor's contributed capital, where the discount rate is the realized return in the public market from the fund's inception to the time of the final distribution or capital call. While this technique generally attempts to match cash flows, it says little about the risks taken (*e.g.*, applied PMEs will often take the cash flow from a private-equity fund and compare them to the return produced by investing equivalent cash flows in the S&P 500). However, Sorensen and Jagannathan (2015) point out that the PME approach is a valid performance measure provided three conditions are met: *a*) markets are frictionless, *b*) investors have logarithmic preferences and *c*) the return on the investor's total portfolio equals the return on the public market; under these restrictions, the PME approximates Rubinstein's stochastic-discount-factor CAPM (1976).

A real estate application of the PME technique can be found in Fisher and Hartzell (2013), who examined the cash flows and estimated net asset values, as reported by Burgiss for the period 1982-2011, for real estate private equity funds. They found that these funds underperformed in comparison to alternative real estate benchmarks – using variations of the PME technique – and that, while early vintages performed well, more-recent vintages did not.

Assessing Risk-Adjusted Performance – Practicalities

To implement the law of one price, two sets of estimated parameters are needed: *a*) the average leverage ratio of the core funds in the ODCE Index, and *b*) the components that produce the leverage-appropriate interest rate: the risk-free rate (r_f), the structural frictions (γ), the default premium (δ) and the loan term (N).[21] These parameters are estimated annually, such that core funds' returns at successively higher leverage ratios are synthetically created for each year of the analysis.

Estimating Core Funds' Leverage Ratios

While the return data by fund strategy extend back to 1996, data on the average leverage ratios of the ODCE Index funds only extend as far back as June, 2004. Over the period for which the data are available, the average leverage ratio is 23.9%. To simplify, assume that the (rounded) observed average (24%) is representative of the earlier period as well.

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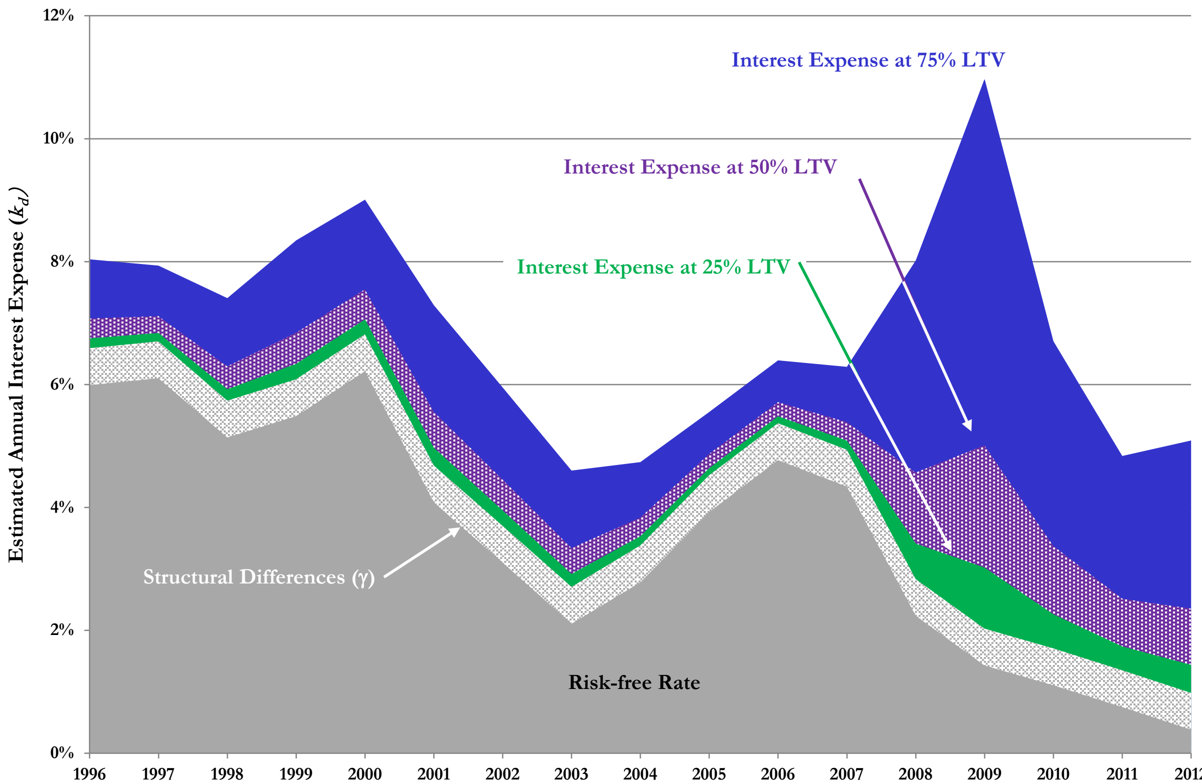
[21] For most of the analysis period, the default premium (δ) varies little with the term of the mortgage loan (N). This changed as a result of the 2007-08 financial crisis; during and thereafter, spreads over Treasuries on short-term mortgage loans are generally higher than long-term loans – all else being equal – due to lenders' concerns about "rollover" or "maturity" risk (*i.e.*, the borrower's ability to refinance the loan upon its maturity). Unfortunately, the data which would permit the sound quantification of this relationship across maturities were not available. So, it is ignored in the analyses that follow.

Estimating Leverage Spreads

In order to estimate the annual interest cost, the data from the American Council of Life Insurers' (ACLI) "Commercial Mortgage Commitments" are used to determine estimated values for structural frictions (γ) and the default premium (δ) for each quarter by identifying the loan's interest rate relative to Treasuries (r_f) – using fixed-rate, conventional mortgage loans on "core" properties – by fitting Equation (3), for each property-type and each quarter to the ACLI data.[22] These quarterly values were then averaged to produce annual values and then weighted by the proportion of each core property type in the NCREIF Property Index during each period to produce estimates of the annual interest rate for core funds for various leverage ratios. The results are summarized in Exhibit 5:

Exhibit 5: Estimates of the Annual Interest Rate at Various Leverage Ratios for the Years 1996 through 2012



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[22] More precisely, ACLI provides the average loan-to-value ratio $\left(\overline{LTV}\right)$ and the average interest rate $\left(\overline{k_d}\right)$ by property type, as well as the risk-free rate (r_f), for each quarter. The default parameter (δ) was estimated as follows: $\delta = \left(\overline{k_d} - r_f - \gamma\right)\frac{1-\overline{LTV}}{\overline{LTV}}$ for each property type and each quarter.

Exhibit 5 also displays the three-year Treasury bond (along with an estimate of the structural frictions (γ = .006)) as a means of indicating the magnitude of the default premium $\left(\delta LTV/(1-LTV)\right)$ for various leverage ratios at varying points in time. Not surprisingly, these premia wane before the 2007-08 financial crisis, spike immediately thereafter, and recede more recently. Capturing the variance in default premia (or "spreads") is an important part of utilizing financial leverage to extend the law of one price to a comparison of core and non-core funds.

Estimating the Term to Maturity

In order to fairly compare the performance of core funds to non-core funds, it is important to match the term of the loans used in the various fund types. Said another way, it is important to control for the effects of varying maturities – presuming that neither core nor non-core funds intended to "play" interest-rate maturities[23] as part of their real estate strategy. Typically, the choice of loan maturity is tied to the expected holding period of the fund's assets. As a general rule, core funds have longer expected holding periods than non-core funds and, consequently, core funds tend to have longer-dated loan maturities than their non-core counterparts.

In the best of circumstances, the maturities of the non-core funds would be matched to the core funds (or *vice versa*). Unfortunately, we have scant evidence on the average loan maturity by fund strategy. Therefore, for purposes of this exercise, the average maturity of the core funds is assumed to be seven years (*i.e.*, N_{Core} = 7) and that the average maturity of the opportunity funds[24] is assumed to be three years (*i.e.*, $N_{Opportunity}$ = 3). While there are many ways to consider the appropriateness of this latter assumption, consider the opportunity fund which has 40% of its indebtedness represented by floating-rate loans and 60% of its indebtedness represented by five-year, fixed-rate loans; its weighted-average term to maturity is approximately three years. (The Appendix examines the sensitivity of these assumptions (N_{Core} = 7 and $N_{Opportunity}$ = 3) in light of the risk-adjusted performance of the opportunistic funds.)

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23 Very few real estate funds explicitly make a "directional bet" on the path of future interest rates. This characteristic seems to reflect the view that, if real estate fund managers have significant skills with regard to forecasting future interest rates, they may be better served by becoming bond-fund managers.

24 Because it is clear that value-added funds have under-performed core funds on a risk-adjusted basis, the focus here is solely on opportunity funds.

The Term to Maturity & Unlevered Returns

The assumption that the average maturity of the non-core funds' indebtedness equals three years is taken to imply that one third of the funds' indebtedness is originated in the current year, one third was originated in the prior year and the final third was originated two years earlier. (Accordingly, $N = 3$ implies a rolling three-year average of three-year maturities for a given leverage ratio.) This pattern of loan originations is then overlaid on to the estimated cost of indebtedness in order to produce an estimated annual interest cost for core funds, such that core funds' returns at successively higher leverage ratios can be synthetically created for each year of the analysis.

Equation (2) is transformed to produce an estimate of the unlevered core-fund/ODCE returns $\left(k_{a,ODCE}\right)$, derived from the observed (and levered) core funds/ODCE returns $\left(k_{e,ODCE}\right)$, as follows:

$$k_{a,ODCE} = k_{e,ODCE}\left(1-LTV\right)+k_d LTV \tag{4}$$

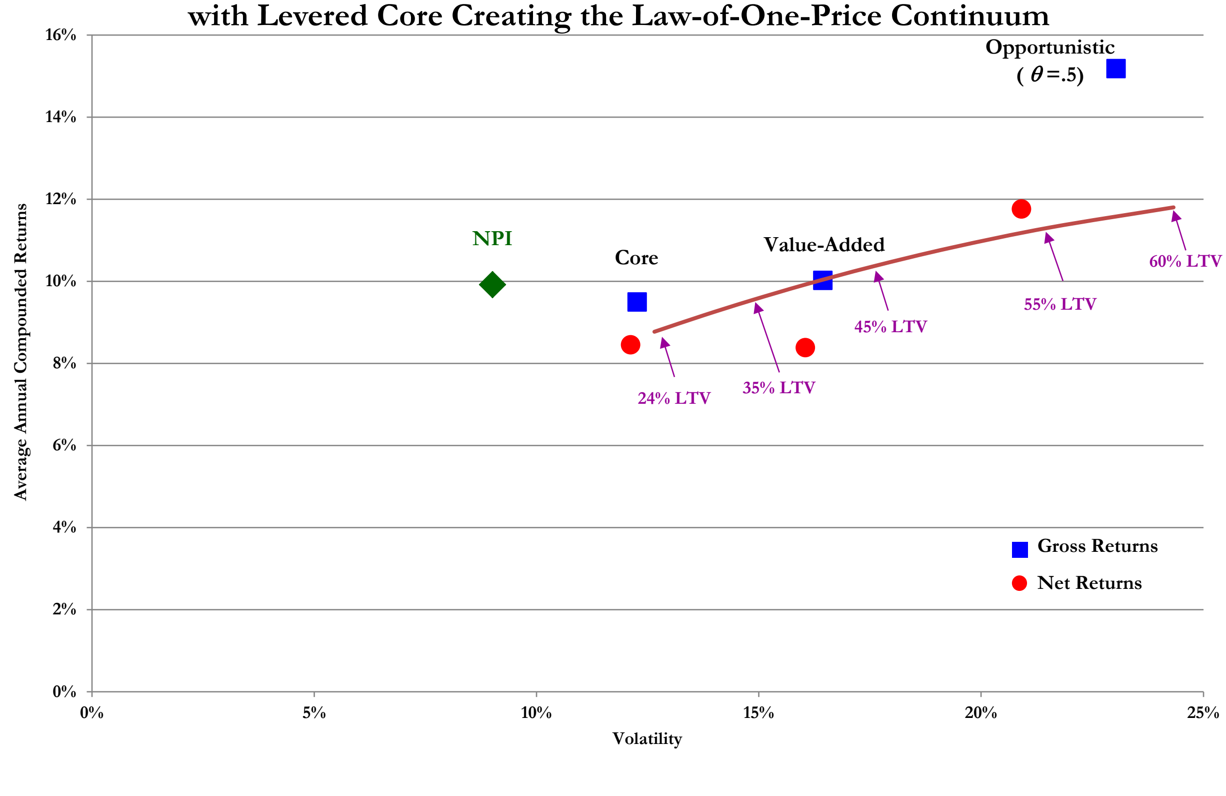
where the cost of indebtedness (k_d) is a function of ODCE's assumed average leverage ratio of 24% and assumed average maturity of seven years. Finally, the estimated unlevered core-fund/ODCE returns $\left(k_{a,ODCE}\right)$ are used as the basis for utilizing greater levels of leverage in order to employ the law of one price and, thereby, creating the equilibrium risk/return continuum. Ultimately, this exercise is imprecise because it is difficult to capture the mark-to-market effect on the fixed-rate debt used within the ODCE funds. For example, the fair market value of the liability increases – which reduces the return on equity – in a falling-rate environment (which is much of what had been experienced during the time frame of this study). So, fixed-rate debt would initially experience rising costs (after consideration of the "mark" and the loan's interest rate), while floating-rate debt would experience falling costs (because of the (generally) lowering interest rates). Unfortunately, the proportion of fixed- to floating-rate debt within ODCE is not available. However, if debts are held to maturity, their fair-market and book values ultimately converge (and the "marks" are reversed).[25]

Assessing Risk-Adjusted Performance – Implementation

When implementing the law of one price (and, in turn, assessing the risk-adjusted performance of non-core funds), the de-levered net core returns $\left(k_{e,ODCE}\right)$ are levered using the estimated cost of indebtedness described above (*i.e.*, assuming a three-year average maturity), – beginning with a leverage ratio of 24%, then 25% and thereafter successively step the leverage ratio in increments of five percentage points (with each increment, the spread to Treasuries increases as indicated by Equation (3)). This is done for each year of the analysis. When finished, a risk/return continuum of net core returns – as shown in Exhibit 6 – over the seventeen-year period ended in 2012 is produced.

[25] While this reversal suggests that average returns are largely unaffected, this reversal would suggest an increase in the volatility of returns. Of course, this proposition applies to both core and non-core funds.

Exhibit 6: Reported and Adjusted Performance by Fund Type for the 17-Year Period Ended December, 2012 with Levered Core Creating the Law-of-One-Price Continuum



For the reader's convenience, selected leverage ratios (of 24%, 35%, 45%, 55% and 60%) along the law-of-one-price risk/return continuum have been indicated in order to provide a sense of the degree of leverage utilized when employing a core-with-leverage strategy.[26]

As noted earlier, the reduction in the reported standard deviation of fund returns is largely a statistical illusion. That is, the reduction in the dispersion (and, therefore, the calculated volatility measure) is attributable to the investor forsaking some of the "upside" return due to the incentive fee; meanwhile, the investor's "downside" risk remains largely unchanged. Consequently, the standard deviations of the funds' net returns are restated such that they are equal to the standard deviations of the funds' gross returns.[27] This is indicated by the triangular icons in Exhibit 7.

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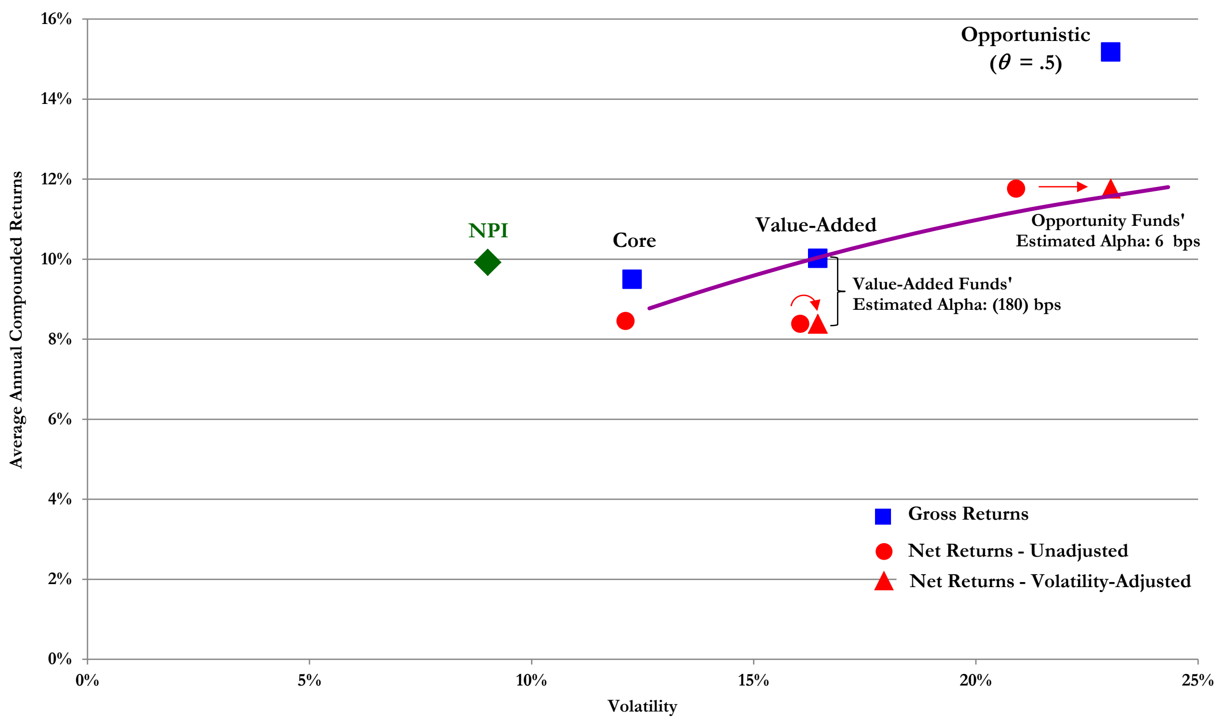
[26] The law-of-one-price risk/return continuum does not begin exactly with the ODCE net returns. Why? Deleveraging the ODCE returns assuming that the average debt maturity is seven years while re-leveraging assuming that the average debt maturity is three years – in order to match the opportunity funds – slightly improves the initial levered ODCE return while adding slightly more risk.

[27] Ultimately, the use of the standard deviation of either gross or net returns is imperfect, because of the asymmetry caused by the promoted interests. However, if the standard deviation of the net returns were to be used, this approach – when coupled with average net return – would understate the downside risk of the non-core funds. And while downside risk measures, such as semi-variance,

The final step is to compare the restated non-core funds' risk/return performance to the core-with-leverage alternative, at the same level of volatility[28] – as illustrated in Exhibit 7:

Exhibit 7: Reported & Volatility-Adjusted Performance by Fund Type for the 17-Year Period Ended December, 2012 with Levered Core Creating the Law-of-One-Price Continuum



As shown in Exhibit 7, the value-added funds underperformed levered core funds (*i.e*, levered to produce identical volatility) by 180 basis points (*i.e.*, negative alpha of 1.80%) per annum. The standard error of this estimate is 0.8% (producing a test statistic with an

could be used, these alternative measures are inconsistent with how financial economics typically postulates the risk/return continuum. (Moreover, the use of semi-variance requires that the user to specify a "target" value; different targets may produce differing estimates of risk-adjusted returns.) For a more detailed discussion of downside risk measures, see Nawracki (1999).

[28] These comparisons between the core-with-leverage and the non-core funds are also imperfect. As earlier noted, the use of non-recourse debt effectively provides a put option to the borrower and, consequently, the investor's/borrower's downside risk is truncated; meanwhile, the inclusion of an incentive fee in the investment-management contract provides a call option to the fund manager and, consequently, the investor's upside risk is also truncated. While this latter asymmetry is mitigated by utilizing the standard deviation of gross returns, it remains true that the levered borrower has a truncated distribution with regard to negative returns. In fairness, this is also true of the non-core funds which almost invariably use high degrees of leverage. Smetters and Zhang (2013) discuss measures to correct for non-normal distributions.

absolute value of 2.14), statistically significant at the 5% confidence level. So, importantly, investors could have merely applied more leverage (bringing the leverage ratio to approximately 40%) to their core-fund investments and substantively outperformed the (net) returns produced by the value-added funds. Among other matters, it argues that investors ought to revisit the fee structure of the value-added funds.[29]

Conversely, Exhibit 7 also shows that the opportunity funds outperformed levered core funds by 6 basis points (*i.e.*, positive alpha of 0.06%) per annum. This small difference – particularly when viewed in the context of an average opportunity fund (net) return of approximately 11.5% with a standard deviation of approximately 23% – is, statistically speaking, indistinguishable from zero. For completeness, the standard error of this estimate is 2.6% (producing a test statistic of 0.25), statistically insignificant at conventional confidence levels.

Similarly, Shilling and Wurtzebach (2012) – who used discriminate functions to examine the risk-adjusted gross return performance of core, value-added and opportunistic strategies (using property-level data focusing on sold properties in the NCREIF database for a period ending in 2009) – suggested that the higher returns of non-core investments were also largely due to leverage (and often "cheap" leverage) and market conditions (fluctuations in the business, credit and real estate cycles). By extension, their use of gross returns makes a compelling argument for the insufficiency of net returns from non-core investments. Alcock, *et al*. (2013) examined the performance of real estate private equity funds, as reported by Property Funds Research for the period 2001-2011. They used (fixed-effects) panel regression models to examine the effects of market conditions and the amount and timing of leverage. They too found, using Jensen's alpha, systematic underperformance and that the amount and timing of leverage does little to enhance risk-adjusted performance.

So, on one level, it could be argued that investors ought to be indifferent between allocations to opportunity funds and to have merely applied more leverage to their core-fund investments. However, on two other levels, this indifference can be questioned.

First and as noted earlier, the data on opportunity funds' returns during and after the financial crisis look suspicious; in particular, it looks like the volatility of those returns was artificially dampened.[30] If so, the alpha estimated in Exhibit 7 is overstated. If the overstatement is sufficient, then investors would have been better served by having allocated to more highly levered core funds (bringing the leverage ratio to approximately 55-60%).

Second, the index returns shown here represent aggregate fund-type performance. As such, these indices greatly dampen the idiosyncratic risks experienced by a single fund. Yet, because no investor holds the index, all investors are exposed to some amount of

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[29] Among others, see Pagliari (2015) for a review of the behavioral issues surrounding incentive fees.

[30] To be fair, another possibility exists: the opportunity funds have greater global diversification – such that their mix of developed and developing economies, mix of debt and equity holdings, mix of currency holdings, *etc*. – produced less-volatile returns during this period of time. The data do not permit us to examine this possibility.

idiosyncratic risk. The more homogenous nature of the assets in core funds suggests that the idiosyncratic risks may be far less when investing in core funds as compared to investing in opportunity funds. If so, investors would have been better served by having allocated to more highly levered core funds (as compared to opportunity funds), because they would have received essentially the same average return with much less idiosyncratic risk.

While both issues are addressed more substantively in the following section, the nearly equivalent (net) risk-adjusted performance of core and opportunistic funds comes as little surprise to advocates of market efficiency (*i.e.*, active investors arbitrage away the surplus that one approach might temporarily hold over the other).[31] It seems that investors, by and large, have (explicitly or implicitly) understood that investing in opportunity funds is an alternative to utilizing higher degrees of leverage in their core portfolios.[32]

Caveats Regarding Risk-Adjusted Performance

Applying backward-looking analyses to expectations about future outcomes should be done cautiously. Markets go through cycles and investors learn (sometimes painful) lessons about what did and did not work in those prior cycles. Moreover, managers adapt to changing market conditions. As markets re-price themselves and managers' business models undergo significant changes, the past can be a poor roadmap for future conditions. Surely, it can be argued that the 2007-08 financial crisis was a once-in-a-generation event which may have disproportionately harmed the performance of the non-core funds. Similarly, the incomplete nature of the data may have unfairly hampered these analyses. More broadly, our model of fund/strategy performance should be regarded as an approximation and, therefore, we ought to concern ourselves with plausible deviations from our approximating model (*e.g.*, see Hansen and Sargent (2008)). So, what caveats should we consider? There seems to be three major considerations: *a*) results which are time-period specific, *b*) the dispersion and (potential) persistence in manager returns and *c*) the sensitivities of the major assumptions used in this analysis.[33]

Time-Period-Specific Results

Any fair-minded analysis of style-based performance ought to embrace at least one full market cycle. The first ten or so years of the analysis period witnessed substantial property appreciation, while the next five or so years witnessed a horrific collapse in property values

31 Other than faulty data, the poor risk-adjusted performance of the value-added funds is more difficult to explain away in theoretical terms.

32 Interestingly, the notion of utilizing higher leverage with portfolios of safer (*i.e.*, core-type) assets seems to be precisely the strategy successfully employed by Warren Buffet's Berkshire-Hathaway. According to Frazzini, Kabiller and Pedersen (2013), "…the secret to Buffett's success is his preference for cheap, high-quality stocks combined with his consistent use of leverage…" The authors indicate that Buffett employs approximately 60% leverage and that this debt is of low-cost (because Berkshire-Hathaway's debt is highly rated (AAA from 1989 to 2009) and because of the "float" associated with its insurance-underwriting business).

33 This last element is examined in the Appendix.

followed by a nascent recovery. These spiking property values beg the question: How specific are these results to the time period chosen? [34]

Before reporting the time-period-specific results, let's acknowledge that this exercise is more theoretical than practical. Because most non-core investing is done through closed-end funds, such investors cannot time their exit dates.[35] Not only are these investors subject to "lock-out" agreements, but their committed capital is generally called over four years and eight years are required before the fund breaks even – see Fisher and Hartzell (2013) for additional details. Accordingly, a performance analysis using the "vintage" of fund commitments is often used to circumvent these constraints. Nevertheless, Exhibits 8 and 9 examine the time-period sensitivity by indicating the alpha investors would have earned in indices of value-added and opportunistic funds at various entrance and exit dates.[36] Each combination was computed in the same manner for which it was computed in the earlier section; as a case in point, an investor entering the non-core market in 1996 and exiting in 2012 would receive exactly the value-added alpha (-1.80%) identified in Exhibit 7.

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[34] As misfortune would have it, 2007 (the year leading into the great financial crisis and the subsequent re-pricing of commercial real estate) seems to have been the year of the sea change in institutional real estate investing. A 2007 survey of many of the largest U.S. pension plans expected net capital flows (in 2007) to real estate of approximately $44.5 billion. Of this amount, $36.3 billion was projected for private, domestic real estate investments. Of this amount, more than 68% was targeted for value-added and opportunistic investments. See: Kingsley Associates and Institutional Real Estate, Inc. (2007). So, more than two-thirds of their fresh real estate capital allocation was drifting into higher-risk strategies – this was a significant change from how most institutional investors had earlier allocated their real estate investments.

[35] The exception is if investors can sell their interests at net asset value (NAV) in the private market for secondary offerings. Then, these results would replicate the alphas available in non-core strategies. To the degree to which investors can only sell their interests at a discount to NAV and that discount increases with the riskiness of the strategy, then the alphas of the non-core funds would be worse than that indicated here.

[36] Both exhibits assume that the investor's minimum holding period is six years. This timeframe not only reflects an estimate of the minimum investment period that many investors face in these non-core funds (again, see Fisher and Hartzell (2013)), but also reflects that shorter holding periods are excessively "noisy" from the standpoint of the summary statistics.

Exhibit 8: Value-Added Funds' Estimated Alpha (with Confidence Level) for Various Holding Periods

Entering Year	Exiting Year: 2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
2007												(3.19%)**
2006											(3.05%)**	(2.92%)**
2005										(2.96%)*	(2.74%)**	(2.68%)**
2004									(1.59%)	(2.45%)*	(2.34%)*	(2.34%)**
2003								(2.82%)***	(1.35%)	(2.13%)*	(2.07%)*	(2.10%)**
2002							(1.39%)*	(2.50%)***	(1.31%)	(2.00%)*	(1.97%)**	(2.00%)**
2001						0.31%	0.06%	(1.62%)	(0.77%)	(1.46%)	(1.47%)	(1.53%)*
2000					0.04%	(0.08%)	(0.24%)	(1.83%)*	(1.00%)	(1.58%)	(1.58%)*	(1.63%)*
1999				0.28%	(0.43%)	(0.52%)	(0.65%)	(2.02%)**	(1.20%)	(1.70%)*	(1.69%)*	(1.73%)**
1998			NA	(0.04%)	(1.45%)	(1.56%)	(1.63%)	(2.72%)**	(1.88%)*	(2.27%)**	(2.21%)**	(2.21%)**
1997		(1.10%)	(0.79%)	(0.95%)	(1.39%)	(1.48%)	(1.59%)	(2.41%)*	(1.47%)	(1.87%)*	(1.86%)*	(1.88%)*
1996	(0.89%)	(0.94%)	(0.69%)	(0.87%)	(1.29%)	(1.39%)	(1.48%)	(2.30%)**	(1.40%)	(1.77%)*	(1.76%)*	$\boxed{\text{(1.80\%)**}}$

Note: * indicates a 10% confidence level, ** indicates a 5% confidence level and *** indicates a 1% confidence level. The test statistic for alpha uses a two-sided critical value based on the *t* distribution.

As is readily apparent from Exhibit 8, there are very few instances in which the index of value-added funds produced positive alpha. Additionally, the few positive instances essentially approach zero. Moreover, it is particularly damning that most investment holding periods between 1996 and 2007 – a period when commercial real estate values were persistently appreciating – produced negative alphas for the index of value-added funds. So, it cannot be plausibly argued that the poor (risk-adjusted) performance realized over the entire seventeen-year period (1996-2012) is attributable to the once-in-a-generation financial crisis. Even in best of times, value-added funds underperformed.

Exhibit 8 also reports the statistical significance of each of the estimated alphas.[37] Unsurprisingly, statistically significant standard errors are generally only associated with the longest holding periods.[38] As a case in point, consider the exit years after 2007, there are 50 estimated alphas (each representing a unique combination of entering and exiting years); all of which are negative. More than 75% of these estimated alphas have test statistics which are statistically significant at conventional confidence levels. In contrast, consider the exit years before 2008: there are 28 estimated alphas (each also representing a unique combination of entering and exiting years); however, only one of these estimated alphas has a test statistic which is statistically significant at conventional confidence levels. Consequently, the

[37] To be more precise, the test statistic for each alpha (given a particular pair of entering and exiting dates) equals $\frac{\hat{\alpha}-\alpha_o}{\frac{s_d}{\sqrt{n}}}$; where: $\hat{\alpha}$ = the estimated alpha, α_o = zero under the null hypothesis, s_d = sample standard deviation of the alpha estimated each period, and n = the number of periods. The absolute value of this test statistic is then compared to the (two-sided) critical value from the *t*-distribution given the appropriate number of degrees of freedom.

[38] At shorter holding periods and, therefore, with fewer observations, it is difficult to produce statistically powerful test results. This problem is a variation of attempting to distinguish luck from skill with regard to investment-management performance (*e.g.*, see Fama and French (2010)); in small samples, luck and skill are virtually indistinguishable from one another.

disappointing (mostly negative) alphas produced before the financial crisis must be tempered with these weak statistical results. Overall, the performance of the value-added funds was quite disappointing. The vast majority of the long-term holding periods produced (substantial) negative alphas which were statistically significant.

Exhibit 9 compares the risk-adjusted performance of the index of opportunity funds to the core-with-leverage alternative (in the same manner as Exhibit 8 and with the same caveats as described above) for the same ranges of entering and exiting years.

Exhibit 9: Opportunity Funds' Estimated Alpha (with Confidence Level) for Various Holding Periods

		Exiting Year											
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Entering Year	2007												(6.13%)
	2006											(2.46%)	(2.86%)
	2005										3.96%	0.51%	(0.37%)
	2004									7.22%	4.60%	1.52%	0.60%
	2003								(0.88%)	6.19%	4.05%	1.39%	0.58%
	2002							(3.78%)	(0.32%)	5.46%	3.62%	1.26%	0.53%
	2001						0.76%	(1.54%)	0.36%	5.04%	3.42%	1.27%	0.60%
	2000					(0.41%)	(0.65%)	(2.47%)	(0.46%)	4.14%	2.78%	0.89%	0.31%
	1999				(1.52%)	(2.24%)	(2.38%)	(3.87%)	(1.54%)	3.03%	1.90%	0.24%	(0.25%)
	1998			(0.47%)	(2.38%)	(3.71%)	(3.81%)	(4.95%)*	(2.53%)	2.18%	1.23%	(0.24%)	(0.66%)
	1997		(1.99%)	(1.66%)	(2.27%)	(3.50%)	(3.60%)	(4.68%)*	(2.31%)	2.41%	1.52%	0.11%	(0.31%)
	1996	(2.00%)	(1.26%)	(1.11%)	(1.64%)	(2.78%)	(2.95%)	(3.93%)	(1.84%)	2.66%	1.82%	0.48%	0.06%

Note: * indicates a 10% confidence level, ** indicates a 5% confidence level and *** indicates a 1% confidence level. The test statistic for alpha uses a two-sided critical value based on the *t* distribution.

Like the value-added funds, it is particularly damning that opportunity funds produced negative alphas for almost all investment holding periods between 1996 and 2007 (*i.e.*, a period when commercial real estate values were persistently appreciating). If opportunity funds underperformed in the best of times, how can it be they outperformed in the worst of times (*i.e.*, in the aftermath of the financial crisis, the positive alphas shown for years ending in 2009, 2010 and, for some starting years, ending in 2011 and 2012, as shown in Exhibit 9)? It would seem that they cannot. As compared to core funds, opportunity funds often have lesser-quality assets financed with more leverage. So, it is axiomatic that their returns are more severely hampered during a market downturn (when there is a "flight to quality"). Therefore and as earlier cited, there are at least two possible explanations: 1) The nature of the investment management contracts for opportunity funds requires less frequent reporting of fair market valuations. If so, these "stale" valuations fail to capture the true volatility of such investments. 2) The underlying property investments of the opportunity funds are more opaque than the properties of core funds; consequently, the appraisal of these opaque assets is more imprecise. Some opportunistic fund managers may have utilized this imprecision to their advantage, by constraining the (adverse) mark to market of their portfolios. If either or both are the case, then the positive alphas shown in Exhibit 9 may be artifacts of a flawed valuation process.[39]

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[39] Perhaps non-core real estate investing has experienced the same sort of evolution as other forms of private equity. For example, Sensoy, *et al.* (2013) argue that the maturation of the (non-real estate) private equity funds – predominately leveraged buyout and venture capital – has led to "an industry-

Exhibit 9 also reports the statistical significance of each of the estimated alphas. Only two of the 78 estimated alphas (each representing a unique combination of entering and exiting years) were statistically significant at conventional confidence levels; those two both occurred with an exit year of 2007. So here too, the evidence is damning: Had investors made their capital contributions in either 1997 or 1998 and held right up to the eve of the financial crisis, such investors would have been better served by having allocated to more highly levered core funds (bringing the leverage ratio to approximately 55-60%). However, the disappointing (*i.e.*, mostly negative) alphas produced for the other pre-financial crisis periods must be tempered with these weak statistical results. Something similar can be said about the mostly positive alphas estimated during and after the financial crisis; they must be also viewed in the context of these weak statistical results.[40] Overall, the opportunistic funds have generally produced results that were statistically indistinguishable from core funds with additional leverage; the exception being long-runs returns ending in 2007 (the period before the financial crisis), which produced negative alphas that were statistically significant.

Dispersion and Persistence in Manager-Specific Results

It is important to reiterate that this study deals with average fund performance by strategy. Because the data mask the performance of individual funds, little can be said about manager-specific performance other than the following broad generalizations:

First, like other areas of delegated investment management, there is widening dispersion of real estate investment managers' performance as they engage in riskier strategies. On average, riskier strategies produce greater dispersion in manager-specific gross returns. See Exhibit 10, which provides summary statistics for fund-level returns, excluding those funds which were in existence for three years or less in the data set. In particular, compare the standard deviation of the index return to the average standard deviation of fund-level returns by strategy. For example, while the standard deviation of the opportunity-fund index was approximately 16%, the average standard deviation of the underlying opportunity funds' returns was approximately 33% – slightly more than a 100% increase – whereas there was very little difference in these two measures for the core funds.[41] The implication is that

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wide decline in returns" (p.25). Harris, *et al.* (2014) find that venture capital funds outperformed public equities in the 1990s, but underperformed in the 2000s.

[40] Another view of these statistical results is to assume that the null hypothesis is true ($\alpha_0 = 0$) and ask the question: For the 36 combinations of dates starting between 1996 and 2003 and dates ending on or before 2008, what is the probability of realizing just two (or fewer) positive alphas? (Another view would be to suggest that 18 of the 36 combinations would have, on average, produced positive alphas.) Because these are overlapping periods of varying lengths, a Monte Carlo simulation (100,000 trials) – utilizing the observed volatility of estimated alphas ($\sigma_\alpha \approx 10.7\%$) and the serial correlation in estimated alphas ($\phi_\alpha \approx 10.1\%$) – indicates that there is less than a 20% chance of doing so. This is an indication that true alpha may well have been negative, but the power of the *t*-tests is hampered by so few observations associated with each estimated alpha.

[41] Caution must be used when interpreting the summary statistics in Exhibit 10. For example, not all funds in Exhibit 10 were in existence (*i.e.*, see "Fund Years") in all seventeen years of this study. Consequently, the standard deviation of the index return is not directly comparable to the average

investors face increasingly asymmetric net returns as the riskiness of the strategy increases; that is, as riskier strategies produce a widening dispersion between "winning" and "losing" fund managers, investors are required to pay larger promoted interests to fund managers of the winning funds while absorbing the entirety of the underperformance of the losing funds.

Exhibit 10: Equal-Weighted Performance Statistics | Gross Annual Returns Across Strategies
for Funds Reporting Four or More of Yearly Returns for the 17-Year Period Ended December 31, 2012

	Core	Non-Core	
	ODCE	Value-Added	Opportunistic
Index-Level Returns:			
Average Return [(a)]	8.37%	7.82%	11.06%
Standard Deviation [(b)]	12.18%	16.03%	16.29%
Fund-Level Returns:			
Number of Funds	16	150	383
Average Fund Life [(c)]	13.4	7.6	7.5
Fund Years [(d)]	214	1,133	2,874
Average Return [(e)]	8.37%	7.82%	11.06%
Standard Deviation [(f)]	12.87%	29.02%	33.26%
Correlation with:			
Strategy Index [(g)]	0.964	0.685	0.551
All Other Funds [(h)]	0.794	0.494	0.279

(a) Represents the (arithmetic) mean equal-weighted annual return for an index of returns by strategy.

(b) Represents the standard deviation of the equal-weighted annual return for an index of returns by strategy.

(c) Represents the average number of years for which each fund, by strategy, was in existence.

(d) Represents the total number of funds, by strategy, combined with the number of years for which each fund was in existence for a full year.

(e) Represents the (arithimetic) mean equal-weighted annual return for each fund within a given strategy.

(f) Represents the average (equal-weighted) standard deviation of the annual return for each fund with a given strategy.

(g) Represents the average correlation, within a given strategy, of each fund with the index return.

(h) Represents the average correlation of each fund with all other funds within a given strategy.

Second and as noted above, the performance measures reported earlier in this study represent aggregate (*i.e.*, value-weighted) performance.[42] The nature of index aggregates is

standard deviation of fund-level returns (*e.g.*, if fewer funds were in existence during periods of high volatility, then the average standard deviation of fund-level returns is lower than would otherwise be the case).

[42] Moreover, Exhibit 2 and accompanying analyses use value-weighted returns for all reporting funds, while Exhibit 10 uses equal-weighted returns for only those funds reporting for four or more years of results.

such that, while the index's return equals the (value-weighted) average of each of the funds' returns, the index's volatility is lower than the (value-weighted) average of each of the funds' volatility.[43] Conversely said, averaging across the measured volatility of all the funds produces a summary statistic which is higher than the reported volatility of the index. The point is simply that investors which are poorly diversified within one or both of the non-core strategies are likely to have experienced significantly more volatility than is represented by the index – even if the selected funds' risk and return matched the average of its peers.

Third, we have little evidence on the persistence of fund managers' performance.[44] Moreover, most managers offer a "family" (or series) of funds. Does outperformance in one of the manager's funds suggest that other funds in the manager's family also outperform? An earlier paper by Hahn, *et al.* (2005) suggests substantial persistence in opportunistic returns by fund manager; however, that paper's conclusions rest on a time period ending before the 2007-08 financial crisis. (As noted earlier, any robust treatment of persistence must cover at least one full market cycle.) A more recent paper by Fairchild, *et al.* (2011) finds substantial persistence in one-year returns by open-end core funds; however, as the authors point out, one-year returns do not match the investment horizons of either the funds or its investors. Tomperi (2010) examined the self-reported rates of return (IRRs), as aggregated by Preqin for funds closed in years 2000 through 2008 for a sample of value-added and opportunistic funds, and generally found that fund size is positively correlated with returns but negatively correlated with sequence (*i.e.*, the offering order within a family of funds). In the arena of (non-real estate) private equity, there is evidence of substantial persistence in returns by sponsor; for example, see Gompers, *et al.* (2010) and Kaplan and Schoar (2005). This issue of persistence is an important one and merits further research. If investors can plausibly use past performance to gauge likely future performance, then it may well be the case that out-performing fund managers in past investments deserve higher-than-average (base and incentive) fees in future funds. If, instead, future performance is unrelated to past performance, then it may well be the case that investors are best served by minimizing (base and incentive) fees in future funds.[45]

Conclusions

This study has examined the risk-adjusted net-of-fee performance of value-added and opportunistic strategies, in relationship to core strategies. Based on the seventeen-year period ending in 2012 (and given all the earlier-stated assumptions and caveats), the net

[43] This statement is true provided that all funds' returns are not perfectly correlated with one another, which they are not – as indicated in Exhibit 10.

[44] Similarly, our data set does not permit us to answer the questions of: (*i*) whether manager X outperformed manager Y, (*ii*) whether certain sub-strategies (*e.g.*, value-added apartments *v.* value-added retail) outperformed or (*iii*) whether certain investor types (public pension plans *v.* corporate pension plans *v.* endowment funds *v.* banks, *etc.*) performed better than others.

[45] In the context of non-real estate private equity, Robinson and Sensoy (2012) find that general partner compensation is largely unrelated to net-of-fee cash flow performance (of predominately leveraged-buyout and venture-capital funds). In the context of (publicly traded) common equities, Fama and French (2010) find actively managed U.S. mutual funds produce, on average, a negative alpha after investment management fees – with very few funds demonstrating long-term skill.

returns from the index of value-add funds have substantially underperformed the indicex of core funds – doing so in a statistically significant manner. Moreover, when looking within the seventeen-year period, there are few instances of value-add funds producing positive alpha (and those that did exist were statistically indistinguishable from zero). Over the same 17-year period, the risk-adjusted (net) performance of an index of opportunistic funds was approximately equal to net returns from an index of core funds. However, when looking within the seventeen-year period, it is apparent that opportunistic funds underperformed prior to the great financial crisis (and occasionally did so in a statistically significant manner); alternatively said, opportunistic funds only pull even with core funds after inclusion of the period encompassing the great financial crisis (assuming that the potential survivorship bias in the data set has $\theta =$ .5). This outcome fails to withstand scrutiny: opportunistic funds generally have lower-quality assets and employ more leverage than their core counterparts; consequently, the flight to quality that occurs during market downturns should have caused opportunistic funds to exhibit worse – not better – relative returns during the financial crisis. The primary explanation of these results would seem to be the staleness of the mark-to-market valuations of the opportunistic funds. Overall, this empirical examination of net returns from these non-core strategies indicates that, on a risk-adjusted basis, the value-add funds have strongly underperformed and the returns from opportunistic funds have weakly underperformed the returns available from core funds.

These criticism of the risk-adjusted performance of non-core funds is exacerbated by the idiosyncratic risks faced by those investors who are poorly diversified within one or both of these non-core strategies.

In concluding that value-added and opportunistic funds have generally failed to produce excess risk-adjusted returns, this article departs from a standard, CAPM-based approach in two important respects: the total risk – rather than the systematic risk – of the returns from such indices is used and the cost of borrowing increases with the degree of leverage – rather than an assumed constant cost of borrowing (at the risk-free rate). While the first departure has no substantive effect, the second departure lowers the estimate of the underperformance of non-core funds (which would have otherwise resulted were debt cost costs assumed to be constant).

Finally, it bears repeating that these results hold for the average fund in each category – not for every fund in a specific category. Further, there are issues with the data availability and reliability for non-core funds (especially so for opportunistic funds). Research on these types of funds is hampered by incomplete coverage of the universe of funds, possible biases in fund inclusion in the indices, issues with return measurement and vintage years, and other issues. So, it would benefit investors and the industry overall to demand greater transparency in these market sectors, allowing more definitive analyses to be conducted. There is, however, no panacea; analysis of the investment management of private-market assets remains an imperfect art.

Appendix: Sensitivity of Major Assumptions

To simplify the following analyses and accompanying discussions, only the results for the opportunistic funds are examined here – as the value-added funds generally produced disappointing (risk-adjusted) performance from varying perspectives. Let's focus on three important assumptions made when estimating the alpha of opportunistic funds: *a*) the proportion (θ) of lost equity for non-reporting opportunistic funds as a result of the 2007-08 financial crisis, *b*) the average term to maturity of the core funds' indebtedness (N_{Core}) and *c*) the average term to maturity of the opportunity funds' indebtedness ($N_{Opportunity}$).

Survivorship Bias Among Opportunity Funds

In the first case, that the magnitude of the survivorship bias (θ) for opportunity funds was assumed to equal 50%. Exhibit 11 illustrates the sensitivity of this assumption by examining the alpha earned by opportunity funds assuming that the proportion (θ) might alternatively equaled 0% or 100%:

Exhibit 11: Opportunity Funds | Sensitivity of Alpha to Assumed Percentage (θ) of Survivorship Bias

Opportunistic Funds' Estimated Alpha, Given θ = 0%

Entering Year	Exiting Year											
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
2007												1.92%
2006											2.81%	1.92%
2005										8.63%	5.33%	4.11%
2004									11.60%	8.91%	6.00%	4.83%
2003								1.78%	10.17%	8.03%	5.55%	4.54%
2002							(0.66%)	2.06%	9.00%	7.20%	5.03%	4.16%
2001						1.96%	0.84%	2.52%	8.19%	6.63%	4.70%	3.92%
2000					0.73%	0.42%	(0.39%)	1.46%	7.06%	5.78%	4.11%	3.44%
1999				(0.67%)	(1.18%)	(1.37%)	(2.00%)	0.20%	5.76%	4.71%	3.26%	2.70%
1998			(0.06%)	(1.68%)	(2.77%)	(2.88%)	(3.33%)	(0.95%)	4.76%	3.91%	2.64%	2.16%
1997		(1.62%)	(1.12%)	(1.55%)	(2.64%)	(2.76%)	(3.16%)	(0.86%)	4.88%	4.08%	2.88%	2.41%
1996	(1.70%)	(0.88%)	(0.59%)	(0.96%)	(1.99%)	(2.15%)	(2.52%)	(0.48%)	5.00%	4.25%	3.11%	2.66%

Opportunistic Funds' Estimated Alpha, Given θ = 50%

Entering Year	Exiting Year											
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
2007												(6.13%)
2006											(2.46%)	(2.86%)
2005										3.96%	0.51%	(0.37%)
2004									7.22%	4.60%	1.52%	0.60%
2003								(0.88%)	6.19%	4.05%	1.39%	0.58%
2002							(3.78%)	(0.32%)	5.46%	3.62%	1.26%	0.53%
2001						0.76%	(1.54%)	0.36%	5.04%	3.42%	1.27%	0.60%
2000					(0.41%)	(0.65%)	(2.47%)	(0.46%)	4.14%	2.78%	0.89%	0.31%
1999				(1.52%)	(2.24%)	(2.38%)	(3.87%)	(1.54%)	3.03%	1.90%	0.24%	(0.25%)
1998			(0.47%)	(2.38%)	(3.71%)	(3.81%)	(4.95%)	(2.53%)	2.18%	1.23%	(0.24%)	(0.66%)
1997		(1.99%)	(1.66%)	(2.27%)	(3.50%)	(3.60%)	(4.68%)	(2.31%)	2.41%	1.52%	0.11%	(0.31%)
1996	(2.00%)	(1.26%)	(1.11%)	(1.64%)	(2.78%)	(2.95%)	(3.93%)	(1.84%)	2.66%	1.82%	0.48%	0.06%

Opportunistic Funds' Estimated Alpha, Given θ = 100%

Entering Year	Exiting Year											
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
2007												(10.00%)
2006											(6.27%)	(6.08%)
2005										0.71%	(2.76%)	(3.18%)
2004									4.33%	1.86%	(1.31%)	(1.86%)
2003								(1.45%)	3.83%	1.74%	(1.05%)	(1.57%)
2002							(4.36%)	(0.62%)	3.53%	1.71%	(0.82%)	(1.31%)
2001						1.96%	(1.84%)	0.19%	3.45%	1.79%	(0.53%)	(1.01%)
2000					0.73%	0.42%	(2.68%)	(0.60%)	2.61%	1.21%	(0.83%)	(1.25%)
1999				(0.67%)	(1.18%)	(1.37%)	(3.97%)	(1.64%)	1.57%	0.40%	(1.41%)	(1.75%)
1998			(0.06%)	(1.68%)	(2.77%)	(2.88%)	(5.02%)	(2.63%)	0.70%	(0.28%)	(1.90%)	(2.17%)
1997		(1.62%)	(1.12%)	(1.55%)	(2.64%)	(2.76%)	(4.78%)	(2.39%)	0.97%	0.05%	(1.49%)	(1.77%)
1996	(1.70%)	(0.88%)	(0.59%)	(0.96%)	(1.99%)	(2.15%)	(4.01%)	(1.91%)	1.30%	0.42%	(1.04%)	(1.34%)

The boxed results in the middle of Exhibit 11 are identical to the results shown in Exhibit 9, because they are based on identical assumptions and methodologies. The values above (θ = 0) and below (θ =1) the boxed results represent the sensitivity of changing the base assumptions with regard only to the survivorship bias[46] of the opportunity funds (during the 2007-2011 period). When the survivorship bias is ignored (θ = 0), opportunity funds

[46] Recall that the survivorship-bias problem, if it exists at all, is assumed to apply only to the 2007-2011 time period.

produce positive alphas in every instance in which the investor holds the investment until to 2009 through 2012 (and for certain starting points ending with 2008). The average difference in annual alpha as between all of the $\theta = 0$ and $\theta = .5$ outcomes equals 1.75%. When the survivorship bias is assumed to be rampant ($\theta = 1$), opportunity funds produce negative alpha in every instance in which the investor holds the investment through 2012, but excluding 2009 and for certain starting points ending with 2010. The average difference in alpha as between all of the $\theta = 1$ and $\theta = .5$ outcomes equals –1.67% per annum. Said another way, every 10 percentage point increase in θ reduces the annual alpha for the index of opportunistic funds by approximately 35 basis points. This perspective ($\theta = 0$, .5 and 1) helps reinforce the earlier conjecture that the opportunity funds' positive alphas may be artifacts of a flawed valuation process. It bears repeating that – see Exhibits 2-4 and the accompanying text – even $\theta = 1$ does little to mitigate the apparently understated volatility of the opportunistic funds' returns during and immediately after the 2007-08 financial crisis.

Core Funds' Average Debt Maturity

In the second case, the average term to maturity of the core funds' indebtedness (N_{Core}) was assumed to equal seven years. Exhibit 12 illustrates the sensitivity of this assumption by examining alpha earned by opportunity funds assuming that the average term to maturity (N_{Core}) might have alternatively equaled five or ten years:

Exhibit 12: Opportunity Funds | Sensitivity of Alpha to Assumed Core Funds' Average Debt Maturity

Opportunistic Funds' Estimated Alpha, Given N_{Core} = 5 Years

Entering Year	Exiting Year: 2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
2007												(5.91%)
2006											(2.22%)	(2.59%)
2005										4.24%	0.81%	(0.05%)
2004									7.54%	4.89%	1.82%	0.93%
2003								(0.46%)	6.51%	4.35%	1.69%	0.91%
2002							(3.23%)	0.12%	5.77%	3.92%	1.56%	0.86%
2001						1.25%	(1.10%)	0.79%	5.35%	3.71%	1.57%	0.92%
2000					0.01%	(0.21%)	(2.07%)	(0.08%)	4.42%	3.05%	1.16%	0.61%
1999				(1.22%)	(1.83%)	(1.96%)	(3.49%)	(1.18%)	3.29%	2.15%	0.49%	0.03%
1998			(0.30%)	(2.12%)	(3.35%)	(3.41%)	(4.62%)	(2.20%)	2.41%	1.45%	(0.01%)	(0.41%)
1997		(1.81%)	(1.43%)	(2.00%)	(3.17%)	(3.28%)	(4.38%)	(2.00%)	2.63%	1.73%	0.34%	(0.06%)
1996	(1.85%)	(1.08%)	(0.90%)	(1.38%)	(2.48%)	(2.60%)	(3.64%)	(1.54%)	2.87%	2.02%	0.70%	0.30%

Opportunistic Funds' Estimated Alpha, Given N_{Core} = 7 Years

Entering Year	Exiting Year: 2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
2007												(6.13%)
2006											(2.46%)	(2.86%)
2005										3.96%	0.51%	(0.37%)
2004									7.22%	4.60%	1.52%	0.60%
2003								(0.88%)	6.19%	4.05%	1.39%	0.58%
2002							(3.78%)	(0.32%)	5.46%	3.62%	1.26%	0.53%
2001						0.76%	(1.54%)	0.36%	5.04%	3.42%	1.27%	0.60%
2000					(0.41%)	(0.65%)	(2.47%)	(0.46%)	4.14%	2.78%	0.89%	0.31%
1999				(1.52%)	(2.24%)	(2.38%)	(3.87%)	(1.54%)	3.03%	1.90%	0.24%	(0.25%)
1998			(0.47%)	(2.38%)	(3.71%)	(3.81%)	(4.95%)	(2.53%)	2.18%	1.23%	(0.24%)	(0.66%)
1997		(1.99%)	(1.66%)	(2.27%)	(3.50%)	(3.60%)	(4.68%)	(2.31%)	2.41%	1.52%	0.11%	(0.31%)
1996	(2.00%)	(1.26%)	(1.11%)	(1.64%)	(2.78%)	(2.95%)	(3.93%)	(1.84%)	2.66%	1.82%	0.48%	0.06%

Opportunistic Funds' Estimated Alpha, Given N_{Core} = 10 Years

Entering Year	Exiting Year: 2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
2007												(6.35%)
2006											(2.72%)	(3.13%)
2005										3.63%	0.20%	(0.68%)
2004									6.89%	4.28%	1.21%	0.29%
2003								(1.30%)	5.88%	3.76%	1.10%	0.28%
2002							(4.02%)	(0.68%)	5.18%	3.36%	0.99%	0.26%
2001						0.57%	(1.70%)	0.06%	4.80%	3.18%	1.03%	0.36%
2000					(0.54%)	(0.80%)	(2.64%)	(0.73%)	3.93%	2.57%	0.68%	0.09%
1999				(1.59%)	(2.35%)	(2.50%)	(4.02%)	(1.79%)	2.84%	1.70%	0.04%	(0.46%)
1998			(0.49%)	(2.43%)	(3.78%)	(3.91%)	(5.07%)	(2.76%)	2.00%	1.05%	(0.44%)	(0.86%)
1997		(1.99%)	(1.68%)	(2.32%)	(3.56%)	(3.73%)	(4.79%)	(2.52%)	2.24%	1.34%	(0.06%)	(0.50%)
1996	(2.00%)	(1.28%)	(1.15%)	(1.69%)	(2.84%)	(3.03%)	(4.03%)	(2.04%)	2.50%	1.64%	0.30%	(0.12%)

Here too, the boxed results in the middle of Exhibit 12 are identical to the results shown in Exhibit 9. The values above (N_{Core} = 5) and below (N_{Core} = 10) the boxed results represent the sensitivity of changing the base assumptions with regard only to the average term to maturity (N_{Core}) of the core funds' indebtedness. When the assumption regarding the average term to maturity of the core funds' indebtedness is shortened to N_{Core} = 5, the opportunity funds' alpha improves by approximately 30 bps on average – relative to our base case (N_{Core} = 7). When the assumption regarding the average term to maturity of the core funds' indebtedness is lengthened to N_{Core} = 10, the opportunity funds' alpha worsens by approximately 20 bps on average – relative to our base case ($N_{Core} = 7$). These effects are attributable to what was generally an upward-sloping yield curve over the analysis period. As the core funds' (levered-equity) returns (proxied by the ODCE index) were de-levered (in order to produce imputed asset-level returns) at assumed debt maturities of 5, 7 and 10 years and then re-levered at an assumed debt maturity of 3 years (so as to replicate the assumed debt maturity of the opportunity funds), the reduction in debt maturities worsened the imputed asset-level returns for core funds (*i.e.*, given known equity-level returns, replacing the higher interest costs associated with long-dated debt with lower interest costs associated with intermediate-dated debt produces lower imputed asset-level returns as the analysis moves from $N_{Core} = 7$ to $N_{Core} = 5$ (or, $N_{Core} = 10$ to $N_{Core} = 7$)). The worsened core-fund returns improves the positive alpha earned by opportunity funds (or, depending on the time period analyzed, narrows the negative alpha earned by opportunity funds). The improvement in core-fund returns is greatest when the difference in assumed debt maturities is greatest (*i.e.*, $N_{Core} = 10$ *v.* $N_{Opportunity} = 3$).

However, these effects are fairly small on balance. The difference between any estimated alpha for opportunity funds when the assumption regarding the average term to maturity of the core funds' indebtedness is shortened to $N_{Core} = 5$ and the corresponding alpha when the assumption regarding the average term to maturity of the core funds' indebtedness is lengthened to $N_{Core} = 10$ averages approximately 50 basis points per annum. Said another way, every one-year increase in N_{Core} reduces the annual alpha for the index of opportunity funds by approximately 10 basis points.

Opportunity Funds' Average Debt Maturity

In the third case, the average term to maturity of the opportunity funds' indebtedness ($N_{Opportunity}$) was assumed to equal to three years. Exhibit 13 illustrates the sensitivity of this assumption by examining the alpha earned by opportunity funds assuming that the average term to maturity ($N_{Opportunity}$) might have alternatively equaled two or four years:

Exhibit 13: Opportunity Funds | Sensitivity of Alpha to Assumed Opportunity Funds' Average Debt Maturity

Opportunistic Funds' Estimated Alpha, Given $N_{Opportunity}$ = 2 Years

	Exiting Year											
Entering Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
2007												(6.47%)
2006											(2.73%)	(3.18%)
2005										3.95%	0.23%	(0.72%)
2004									7.14%	4.42%	1.13%	0.17%
2003								(1.41%)	5.87%	3.69%	0.87%	0.03%
2002							(6.55%)	(1.28%)	4.94%	3.09%	0.60%	(0.13%)
2001						(1.26%)	(3.27%)	(0.53%)	4.54%	2.90%	0.64%	(0.04%)
2000					(2.26%)	(2.33%)	(4.00%)	(1.19%)	3.72%	2.34%	0.35%	(0.26%)
1999				(2.96%)	(3.94%)	(3.99%)	(5.31%)	(2.26%)	2.61%	1.46%	(0.30%)	(0.81%)
1998			(1.03%)	(3.66%)	(5.36%)	(5.37%)	(6.41%)	(3.24%)	1.76%	0.79%	(0.77%)	(1.21%)
1997		(2.86%)	(2.71%)	(3.63%)	(5.07%)	(5.19%)	(6.14%)	(3.02%)	1.99%	1.09%	(0.40%)	(0.83%)
1996	(2.36%)	(2.15%)	(2.19%)	(2.96%)	(4.28%)	(4.42%)	(5.34%)	(2.54%)	2.25%	1.39%	(0.02%)	(0.47%)

Opportunistic Funds' Estimated Alpha, Given $N_{Opportunity}$ = 3 Years

	Exiting Year											
Entering Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
2007												(6.13%)
2006											(2.46%)	(2.86%)
2005										3.96%	0.51%	(0.37%)
2004									7.22%	4.60%	1.52%	0.60%
2003								(0.88%)	6.19%	4.05%	1.39%	0.58%
2002							(3.78%)	(0.32%)	5.46%	3.62%	1.26%	0.53%
2001						0.76%	(1.54%)	0.36%	5.04%	3.42%	1.27%	0.60%
2000					(0.41%)	(0.65%)	(2.47%)	(0.46%)	4.14%	2.78%	0.89%	0.31%
1999				(1.52%)	(2.24%)	(2.38%)	(3.87%)	(1.54%)	3.03%	1.90%	0.24%	(0.25%)
1998			(0.47%)	(2.38%)	(3.71%)	(3.81%)	(4.95%)	(2.53%)	2.18%	1.23%	(0.24%)	(0.66%)
1997		(1.99%)	(1.66%)	(2.27%)	(3.50%)	(3.60%)	(4.68%)	(2.31%)	2.41%	1.52%	0.11%	(0.31%)
1996	(2.00%)	(1.26%)	(1.11%)	(1.64%)	(2.78%)	(2.95%)	(3.93%)	(1.84%)	2.66%	1.82%	0.48%	0.06%

Opportunistic Funds' Estimated Alpha, Given $N_{Opportunity}$ = 4 Years

	Exiting Year											
Entering Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
2007												(5.83%)
2006											(2.27%)	(2.56%)
2005										4.09%	0.75%	0.01%
2004									7.47%	4.88%	1.86%	1.08%
2003								(0.16%)	6.63%	4.49%	1.86%	1.15%
2002							(2.19%)	0.46%	5.92%	4.07%	1.74%	1.10%
2001						1.92%	(0.59%)	1.01%	5.45%	3.82%	1.70%	1.12%
2000					0.74%	0.36%	(1.64%)	0.10%	4.51%	3.15%	1.29%	0.79%
1999				(0.70%)	(1.18%)	(1.45%)	(3.07%)	(1.03%)	3.37%	2.25%	0.61%	0.20%
1998			(0.23%)	(1.75%)	(2.80%)	(2.93%)	(4.22%)	(2.06%)	2.49%	1.55%	0.10%	(0.25%)
1997		(1.79%)	(1.22%)	(1.62%)	(2.65%)	(2.84%)	(3.99%)	(1.89%)	2.70%	1.82%	0.45%	0.10%
1996	(1.99%)	(1.05%)	(0.68%)	(1.02%)	(2.00%)	(2.19%)	(3.28%)	(1.43%)	2.95%	2.11%	0.80%	0.45%

Like before, the boxed results in the middle of Exhibit 13 are identical to the results shown in Exhibit 9. The values above ($N_{Opportunity}$ = 2) and below ($N_{Opportunity}$ = 4) the boxed results represent the sensitivity of changing the base assumptions with regard only to the average term to maturity of the opportunity funds' indebtedness ($N_{Opportunity}$). When the assumption regarding the average term to maturity of the opportunity funds' indebtedness is shortened to $N_{Opportunity}$ = 2, the opportunity funds' alpha worsens by approximately 85 bps on average – relative to our base case ($N_{Opportunity}$ = 3). When the assumption regarding the average term to maturity of the opportunity funds' indebtedness is lengthened to $N_{Opportunity}$ = 4, the opportunity funds' alpha improves by approximately 50 bps on average – relative to our base case ($N_{Opportunity}$ = 3). These effects are attributable to the time-series variation in mortgage interest rates. When the assumption regarding the average term to maturity of the opportunity funds' indebtedness is shortened to $N_{Opportunity}$ = 2, the interest expense for a given year represents the two-year moving (equal-weighted) average of this year's rate and the prior year's rate. When the assumption regarding the average term to maturity of the opportunity funds' indebtedness is lengthened to $N_{Opportunity}$ = 4, the interest expense for a given year represents the four-year moving (equal-weighted) average of this year's rate and the three prior years' rates.[47] Because interest rates were generally declining over the analysis period, the reduction in debt maturities improved the levered returns for core funds. The improved core-fund returns narrows the positive alpha earned by opportunity funds (or, depending in the time period analyzed, worsens the negative alpha earned by opportunity funds).

These effects are, on balance, more impactful than changes in the assumptions about the average term to maturity of the core funds' indebtedness (see Exhibit 12). Here (Exhibit 13), the difference between any estimated alpha when the assumption regarding the average term to maturity of the opportunity funds' indebtedness is shortened to $N_{Opportunity}$ = 2 and the corresponding alpha when the assumption regarding the average term to maturity of the opportunity funds' indebtedness is lengthened to $N_{Opportunity}$ = 4 averages approximately 135 basis points per annum. Said another way, every one-year increase in $N_{Opportunity}$ increases the annual alpha for the index of opportunity funds by approximately 65 basis points.

[47] In general, a fund's average loan maturity $\left(\bar{N}\right)$ equals half of the typical loan's maturity at loan origination (N) – assuming that the fund has an equal amount of such loans coming due each year and that the loan originations occur at the midpoint of each year.

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