INTERNATIONAL REAL ESTATE REVIEW

2015 Vol. 18 No. 1: pp. 241 – 276

The Relative Performance of Private Equity Real Estate Joint Ventures

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We study the relative performance of private equity real estate joint ventures by using new data that connect investment style, ownership structures, and quarterly cash flows for a large sample of sold properties from 1978-2009. The expansion into joint ventures by private equity core, value-added and opportunistic real estate funds since 1990 has been significant. This paper tests three hypotheses. First, do real estate joint ventures experience higher returns? Second, are investment fund managers generally willing to take on riskier projects in forming joint ventures? Third, are joint ventures formed to procure new business and grow assets under management and maximize fund fees? Tests of these hypotheses are performed by using quantile regressions, to determine whether the returns on joint venture projects are more concentrated in the tails of the return distribution – particularly in the left (low end) tail – than are whole assets. We reject the hypothesis that real estate joint ventures experience abnormal returns overall. However, we do find evidence that there is a lot more risk taking by value-added funds relative to core funds. Our evidence is also consistent with more risk taking by large investment fund managers vs. small investment fund managers.

Keywords

Private Equity, Pension Funds, Real Estate Joint Ventures

1. Introduction

The expansion into joint ventures by private equity core, value-added and opportunistic real estate funds since 1990 has been significant. For example, in percentage terms, joint ventures by private equity core, value-added and opportunistic real estate funds rose from just about 1.5 percent of all transactions in 1990, to 20 percent of all transactions in 2000, and to just under 60 percent of all transactions in 2008-2009 (at least according to those fund managers who report to and are members of the National Council of Real Estate Investment Fiduciaries (NCREIF)); the absolute expansion was from seven joint venture projects (out of 455 total reported transactions) in 1990, to 198 joint ventures (out of 976 total reported transactions) in 2000, and 710 projects (out of 1219 total reported transactions) in 2008-2009. About 25 percent of all reported transactions over the 1978-2009 period are accounted for by joint ventures.

Through the use of property-level data that cover 5,178 joint venture real estate projects and 17,588 whole assets during the period 1978 to 2009, inclusive, three hypotheses are tested in this paper. First, do real estate joint ventures experience higher returns, as theory would imply? Second, how important of a role does risk-sharing play in the formation of a joint venture? Does it encourage joint venture partners to expand outside of their core competency? If so, are the equity partners able to quantify with precision the inherent risks in these joint ventures before they occur? Or does the expansion outside of one's core competency make it harder to quantify risk and thus does it make joint ventures inherently more risky than other investments? Third, are joint ventures formed to procure new business and grow assets under management and maximize fund fees**?** If so, does this, in turn, lead to moral hazard and induce small investment managers to form joint ventures that would appear riskier ex ante?

Determining the relative performance of joint ventures is important for four reasons. First, there is the argument that it is unlikely that a study of private equity real estate joint venture performance would find any positive return performance because such a finding would be inconsistent with the literature in general. Much research has investigated the performance of joint ventures. However, most of this work is noticeably on international joint ventures that involve large and medium-size corporations in one or more countries in which performance is measured in terms of failure rate, rather than return (see Beamish (1993), Beamish and Delois (1997), and Hambrick et al. (2001)).[1]

[1] Some research also exists on the performance of REIT joint ventures. This literature generally finds poor performance is the rule rather than the exception. For instance, see Campbell, Sirmans, and White-Huckins (2006), Hess and Liang (2004), and Damodaran, John, and Liu (1997), Ravichandran and Sa-Aadu, (1988), Gyourko and Siani (1998), and Muhlhofer (2012).

Second, there is the argument that real estate joint ventures are totally different from international joint ventures that are formed to undertake either research and development (R&D), manufacturing, or marketing activity. For instance, real estate joint ventures are generally formed explicitly to invest in larger projects. The standard theory is market inefficiencies in real estate markets increase with deal size, and that these inefficiencies benefit buyers more than sellers (see Smith and Hess (2006)). Also, there is the notion that larger properties mean greater scale economies. Yet because of moral hazard, real estate joint venture partners may end up taking on excessively risky projects as a way to maximize assets under management and maximize fund fees. Also, to the extent that some leading fund managers can generate legitimately high returns, this superior performance puts pressure on other fund managers to keep up and take on excessively risky projects. Hence, it is unclear whether real estate joint ventures generate excess returns. Third, the performance literature has attempted to measure the performance of core, value-added, and opportunistic investments. The evaluation of joint ventures by private equity core, value-added and opportunistic real estate funds offers a new perspective. It is important to have estimates as to whether core, value-added, or opportunistic funds are better able to earn positive excess returns on joint ventures. Finally, the ability of value-added and opportunistic real estate funds to charge higher fund fees hinges in part on the expected benefits of these joint ventures.

There are a variety of ways to investigate these hypotheses. In the present study, we compare the return performance of real estate joint venture projects with the return performance of otherwise comparable whole assets by using quantile regressions (which offers a useful means of testing whether joint venture projects are more concentrated in the tails of the return distribution – particularly in the left (low end) tail – than are whole assets). To identify the effect of joint ventures on return performance at every decile for core, value-added, and opportunistic properties, respectively, we: (1) apply quantile regressions, (2) statistically condition on observable variables, such as low yields and high loan-to-value (LTV) ratios, and (3) parse the data according to size/expertise of the investment manager. We generally expect properties with a very low yield (i.e., a high growth risk) or a high LTV ratio at the time of acquisition to be more apparent in the right- and left-hand tails of return distribution than elsewhere in the distribution. The opposite effect should occur if the yield is high or the LTV ratio is low (which is, in fact, what we find).

So that we might say something about the absolute and relative performances of joint venture projects vs. whole assets, we employ two separate measures of return performance. For the absolute measure of return, we compute the total return on the investment, defined in terms of the internal rate of return (IRR) of the project. For the relative measure of return, we compute the public market equivalent (PME) from Kaplan and Schoar (2005). The PME calculation discounts all cash distributions and reversion value of the property

at the rate of return that the investor would have earned in an equivalent investment in the public market, which, in our case, is measured by the National Association of Real Estate Investment Trust (NAREIT) equity index, and divides the resulting value by the initial equity contribution plus the discounted value of all capital expenditures.

To preview the results of the paper, controlling for property yield, LTV ratio, holding period, property type, and time of acquisition, the results provide evidence of poor performance by real estate joint ventures versus whole assets not only at the bottom of the return distribution, but also at the top of the distribution. Hence, we reject the hypothesis that real estate joint ventures experience abnormal returns overall. However, we do find evidence that there is a lot more risk taking by value-added funds relative to core funds. Quantile regressions for both IRRs and PMEs indicate poor performance for real estate joint ventures formed by value-added funds compared with core funds. We also find evidence of more risk taking by large investment fund managers vs. small investment fund managers. It is possible that such a result is due to the extensive use of benchmarks by large investment fund managers to measure performance.

The remainder of the article is organized as follows. In the next section, we describe our data sources. Our findings with respect to the return performance on core, value-added, and opportunistic real estate investments are presented in a series of figures in Section 3. Section 4 presents a description of the testing methodology used to test for risk-taking tendencies in joint ventures. Section 5 contains the results of our quantile regressions, both for alternative measures of performance and by investment style. In Section 6, we look at whether poor performance can be accounted for by differences in management characteristics. The last section contains concluding remarks.

2. Data

Our primary data set is the so-called NCREIF database. The NCREIF database is a special data set created by the National Council of Real Estate Investment Fiduciaries for benchmarking purposes. The data are collected through voluntary reporting by NCREIF members. Each property in the sample is followed over time and complemented each quarter with new information. The typical data point gives the costs associated with the investment, cash flows from rental collections, and cash flow that would result from the disposition (typically, the sale) of the investment. The drawback of the NCREIF database is that the latter are appraised property values rather than actual market values. The use of these appraised property values has created controversy in the literature. Geltner (1991) questions whether the use of appraised values creates a downward bias in the true standard deviation of returns. Others question whether appraised values create additional noise in the return series (see Barberis and Thaler (2001)). Still others demonstrate

that private equity fund managers may not update appraised property values when limited information is available on the underlying market value of the asset (see Strucke (2011)).

We overcome these biases by using only sold properties in the NCREIF database. If the property is sold, we can then compute a total return on investment (since when the property is sold, NCREIF reports the actual sale price). These returns are the basic input to the analysis. We can also use the exact cash outflows and inflows for all sold properties to compute the PME from Kaplan and Schoar (2005). The PME, as we have computed it from the data, compares an investment in commercial property in the direct market to an equivalently timed investment in the public real estate market. The PME calculation discounts the cash flows from rental collections and the cash flow from the actual sale of the investment as the public real estate market total return and divides the result by the initial equity contribution plus the discounted value of all capital expenditures. For the public real estate market total return, we use the return on the NAREIT equity index. The return on the NAREIT equity index is arguably an appropriate standard of comparison for real estate institutional investors. If the PME index is greater (less) than one, then fund investors earn a positive (negative) abnormal return (compared with what the investor would have earned in the public market).

Table 1 shows a summary of the number of properties in the NCREIF database. The general pattern shows that the number of properties in the NCREIF database increased during the first quarter of each year from 1979 through 2009, except in 2008. The total number of properties decreased 14% from 9,278 in 2007 to 8,014 in 2008. This break in the data is due to a reporting change, which removed all properties for which fair market values were not being reported.

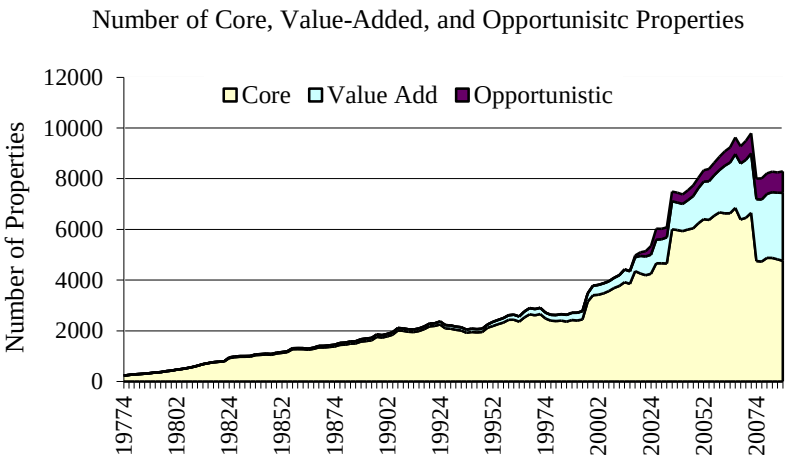
Table 1 also breaks down the number of properties by core, value-added, and opportunistic investments. This breakdown is also shown in Figure 1. To be classified as a core investment, the property must be fully operational and fully let, or close to fully let, generally involving little capital expenditure after purchase, and have an LTV ratio between zero and 50%. To be classified as a value-added investment, it was necessary (1) for the property be actively managed, (2) for the property to have undergone substantial value-added expansion or conversion (in excess of 10% of market value) or a change in use of the property from lower use to a higher and better use (e.g., the conversion of industrial properties into office, or the conversion of rental apartments into condominiums, etc.), and (3) for the property to have an LTV ratio between 50% and 65%. To be classified as an opportunistic investment, the property had to be a new development opportunity or a pre-development property, or a more speculative investment that requires an initial leasing program to attract new tenants. Additionally, the property had to have an LTV ratio in excess of 65%.

Table 1 NCREIF Database. Number of Property Holdings by Investment Style

Year	Core	Value-Added	Opportunistic	Total
19791	260			260
19801	331			331
19811	428			428
19821	569			569
19831	779			779
19841	1040	29		1069
19851	1105	32		1137
19861	1279	39		1318
19871	1545	59		1604
19881	1445	76		1521
19891	1576	99		1675
19901	1734	95		1829
19911	2000	96		2096
19921	1991	102		2093
19931	2097	129		2226
19941	1925	123		2048
19951	2122	126		2248
19961	2436	179		2615
19971	2653	244		2897
19981	2402	229		2631
19991	2428	283	2	2713
20001	3405	373	6	3784
20011	3691	381	7	4079
20021	4355	546	72	4973
20031	4665	933	431	6029
20041	5977	1084	388	7449
20051	6246	1387	406	8039
20061	6673	1672	523	8868
20071	6393	2209	676	9278
20081	4733	2448	833	8014
20091	4762	2680	848	8290

Core properties show a steady increase from 260 properties in 1979 to 6,673 in 2006, and then a small decrease in 2007 to 6,393 properties, and a much larger decrease in 2008 to 4,733 properties. Then in 2009, the number of core properties increased to 4,762. In percentage terms, the entire NCREIF database consisted of core properties in 1979. The low figure is 54% in 2009, with a long and continual decline over the entire sample period. In contrast, value added properties increased from 29 in 1984 to 2,680 in 2009, nearly a 100-fold increase. In percentage terms, value-added properties were about 2.5% of the total properties in 1984, monotonically increasing to over 30% of the total properties in 2009.

Figure 1 **Number of Core, Value-Added, and Opportunistic Properties. Vertical Axis: Property Count. Horizontal Axis: Time in Quarters**



Opportunistic investments steadily increased from zero in the subsample period 1978 to 1998 to 848 properties in 2009. Clearly, the expansion of opportunistic investments is not simply a function of volume of transactions. It is the result of a large number of factors, of which increased transactions are but one. Incidentally, the increases in opportunistic investments did not decrease in percentage terms over the period 1999 to 2009, except in 2009.

Table 2 gives a breakdown of the sample by investment style and property type. In 1978, most core investments were industrial properties, followed next by office and retail properties, at 13% and 15% of total investments, respectively, and then by apartments, at about 4% of total investments. By 2009, the largest fraction of core investments was 45% industrial, followed by 25% in office, 19% in apartments, and 15% in retail. Among value-added investments, the property holdings start out skewed toward industrial and retail, and then become more evenly distributed over time. For example, in 1983, retail constituted 56% of the total value-added investments, while industrial and office were 41% and 3% of the total value-added investments, respectively. By 2009, the holdings in apartments, industrial, office, and retail were 19%, 40%, 25%, and 15%, respectively. Among opportunistic investments, the leading property types are (as of 2009) industrial and apartments – which represent about a third and a third of total opportunistic investments, respectively. The next largest category is office – at 22% of the total investments – followed by retail at 10% of the total opportunistic investments.

Table 2a Summary Statistics. Number of Property Holdings by Investment Style and Property Type: Core Investments

Year	Apartment	Industrial	Office	Retail
19781	9	177	34	38
19791	8	218	50	53
19801	9	268	70	78
19811	11	334	112	107
19821	13	426	191	127
19831	15	507	261	167
19841	17	534	304	176
19851	28	562	330	174
19861	43	635	390	197
19871	53	678	395	205
19881	77	714	415	213
19891	124	778	433	216
19901	161	819	453	274
19911	195	901	495	378
19921	233	913	490	405
19931	314	781	520	449
19941	308	745	460	382
19951	344	757	453	552
19961	461	825	537	587
19971	522	914	602	589
19981	507	713	647	508
19991	526	725	682	469
20001	588	934	1363	482
20011	685	993	1426	550
20021	692	1302	1622	613
20031	670	1536	1632	688
20041	686	2961	1655	539
20051	681	3265	1606	540
20061	783	3489	1655	556
20071	875	3479	1152	671
20081	925	1708	1199	674
20091	828	1727	1092	651

Table 2b Summary Statistics. Number of Property Holdings by Investment Style and Property Type: Value-Added Investments

Year	Apartment	Industrial	Office	Retail
19831	0	11	1	15
19841	0	13	1	15
19851	0	13	1	18
19861	0	15	4	20
19871	1	24	9	25
19881	2	31	13	29

(Continued…)

(Table 2b Continued)

Year	Apartment	Industrial	Office	Retail
19891	7	33	18	33
19901	14	29	21	30
19911	17	24	22	30
19921	18	24	25	32
19931	30	28	31	40
19941	28	32	27	36
19951	30	38	22	36
19961	43	45	52	38
19971	50	61	76	56
19981	60	46	66	55
19991	75	44	90	68
20001	106	57	122	78
20011	108	64	130	83
20021	138	107	179	109
20031	215	285	256	126
20041	229	348	269	186
20051	272	492	303	236
20061	366	598	2367	252
20071	554	732	459	341
20081	633	748	544	393
20091	678	834	575	398

Table 2c Summary Statistics. Number of Property Holdings by Investment Style and Property Type: Opportunistic Investments

Year	Apartment	Industrial	Office	Retail
20001	0	0	1	1
20011	0	0	2	1
20021	8	19	10	4
20031	53	104	74	8
20041	59	87	64	9
20051	60	72	60	9
20061	72	96	64	15
20071	118	118	72	30
20081	190	147	95	41
20091	167	157	107	47

Table 3a Summary Statistics. Number of Property Holdings by Investment Style and Region: Core Investments

Year	East	Mid-West	South	West
19781	26	67	40	127
19791	52	88	50	141
19801	65	119	69	175
19811	88	149	108	224
19821	124	200	168	270
19831	152	238	240	327
19841	171	250	260	359
19851	189	248	276	392
19861	214	300	332	433
19871	217	290	362	476
19881	251	294	382	518
19891	284	301	402	589
19901	322	355	406	651
19911	387	417	435	761
19921	412	416	438	803
19931	415	378	490	814
19941	378	362	454	731
19951	424	391	557	750
19961	515	437	698	786
19971	574	470	789	820
19981	500	418	721	763
19991	491	418	752	767
20001	672	498	884	1351
20011	780	526	956	1429
20021	923	683	1111	1638
20031	994	716	1150	1805
20041	1121	895	1801	2160
20051	1245	921	1913	2167
20061	1259	921	2059	2434
20071	1271	925	2056	2141
20081	1073	654	1362	1637
20091	1097	641	1372	1652

Table 3b Summary Statistics. Number of Property Holdings by Investment Style and Region: Value-Added Investments

Year	East	Mid-West	South	West
19831	1	12	7	7
19841	2	12	7	8
19851	2	12	8	10
19861	4	12	10	13
19871	7	20	16	16
19881	12	25	17	22
19891	16	28	21	27
19901	20	25	19	31
19911	22	23	21	30
19921	26	21	24	32
19931	33	20	34	42
19941	31	24	30	38
19951	33	22	34	37
19961	36	29	58	56
19971	44	43	71	86
19981	47	30	61	91
19991	57	40	70	116
20001	94	50	102	127
20011	98	58	106	134
20021	134	74	147	191
20031	224	127	263	319
20041	264	145	307	368
20051	321	189	425	452
20061	391	221	510	550
20071	517	294	698	700
20081	552	344	794	757
20091	626	365	867	822

Table 3c Summary Statistics. Number of Property Holdings by Investment Style and Region: Opportunistic Investments

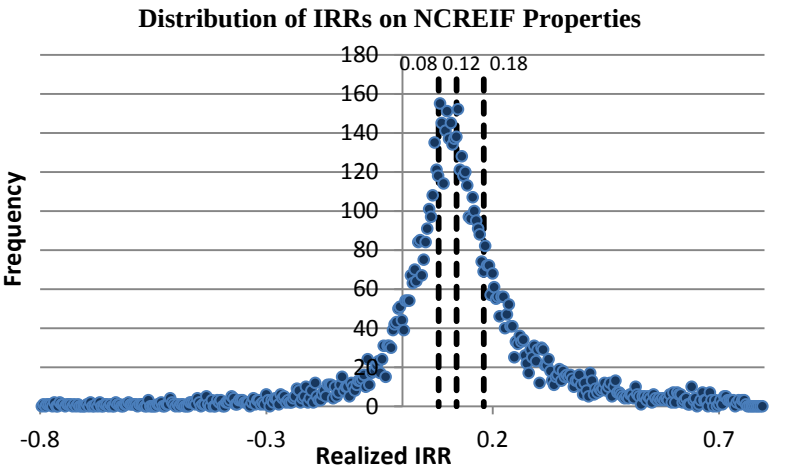
Year	East	Mid-West	South	West
20011	2	0	0	5
20021	22	12	19	19
20031	97	51	120	163
20041	92	41	122	133
20051	94	40	137	135
20061	123	48	178	174
20071	167	72	237	200
20081	210	111	289	223
20091	211	122	271	244

3. Figures

3.1 Property Return Distribution

In this section, we present some of our basic findings by using a series of figures. Figure 2 presents the distribution of returns for all sold properties in the NCREIF database. The distribution has rather large tails and a few rogue values out in the tails. The distribution is truncated from below at -80% and from above at 80% to normalize the distribution and somewhat homogenize the variance. The mean of the returns is 13% and the median is 11.6%, with a (cross-sectional) standard deviation of 0.25.

Figure 2 **IRR Return Distribution on NCREIF Properties, 1978-2009. Vertical Axis: Property Count. Horizontal Axis: Realized IRR**



Typically, most core funds have targeted rates of return between 8% and 12% hurdles. In Figure 2, there are 1,636 observations that cluster between 8% and 12%. Value-added and opportunity funds typically have targeted rates of return between 10% and 12%. Value-added and opportunistic funds typically charge a performance-related fee (usually a 20/80 split of the gross that remains after the 10% to 12% target return). Anecdotal evidence suggests that the all-in hurdle rates for most value-added funds have been set at total return levels between 12% and 18%, while opportunistic funds have all-in targeted 18+% returns. In Figure 2, the number of observations that cluster between 12% and 18% is 1,569, while the number of observations with total returns in excess of 18% is 1,297. Among these categories, a discriminant function conditional on property type, region, LTV ratio, and acquisition year can correctly classify 80% of the total 4,502 observations within these groupings (see Shilling and Wurtzebach (2011)). It is to the left of the target rate of 8%, though, which concerns us in this paper. We generally expect this left-hand

tail to include a high concentration of joint venture projects than elsewhere in the distribution, analogous to a greater disadvantage, the immigrant wage disadvantage among less skilled workers (see Greeley (1976)), or a large class-size effect among lower aptitude students (see Glass et al. (1982)), that is, if the above hypothesis that joint ventures promote risk-taking is true. In contrast, if all projects, that is, lower or higher-yielding projects, benefited equally from joint ventures, one would expect similar regression estimates across the return distribution.

A useful way of thinking about the quantile regressions that are to follow is to focus on the bottom and top quantiles in Figure 2. The quantile that encompasses the bottom 5 percent is -5%, while that of the top 5 percent (i.e., 95th percentile) is 16%. In comparison, the quantile that encompasses the 40th to the 90th percentiles is from 2% to 9%. Lastly, the interquartile range is from 1.25% to 5%. These breakpoints are not altered much if the tails of the distributions are not truncated from below or above. This should not be surprising, given the frequencies for the bottom 1 percentile and the top 99th percentile.

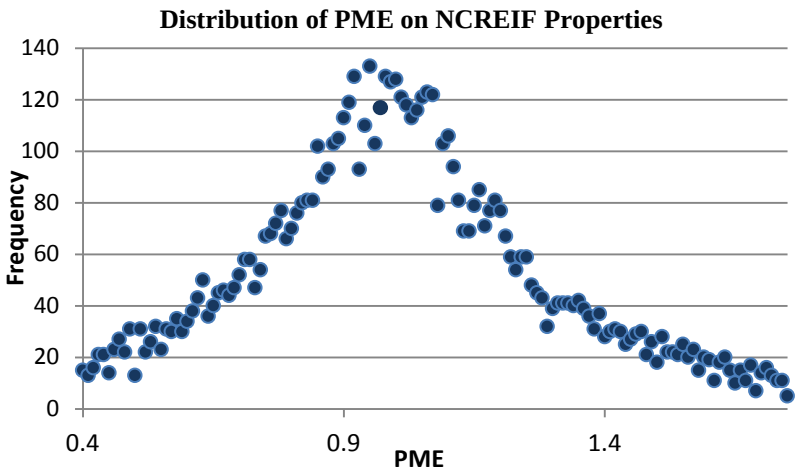
3.2 PME Distribution

We next present the PME distribution, see Figure 3. The figure suggests several interesting conclusions, which are further discussed in the following sections of this paper. First, the PMEs imply that the average private equity core, value-added, or opportunistic real estate investment did not underperform or outperform the NAREIT index, but instead, had the same return as a buy-and-hold strategy of investing in the NAREIT index. The overall sample average PME is 1.0 and the median is 0.99, with a standard deviation of 0.32. Second, we find that properties in the bottom 40th percentile significantly underperform the NAREIT index. The quantile that encompasses the bottom 5 percent is 0.5, while that of the top 5 percent (i.e., 95th percentile) is 1.62. In comparison, the quantile that encompasses the 40th to the 90th percentiles is from 0.93 to 1.44. The interquartile range is from 0.82 to 1.18. Third, properties in the quantile that encompasses the 60th to the 90th percentiles significantly outperform the NAREIT index.

We also examine whether PME performance is significantly related to investment style. The results are summarized in Figure 4. Here, the figure shows the cumulative distribution of the cross-sectional pattern of PME by investment style. For core investments, the average PME is 1.0 and the median is 0.99, with a standard deviation of 0.27. Note to calculate PME on core investments as a whole, in principle, one needs to discount the cash flows from rental collections and the cash flow from the actual sale of the investment at a slightly lower public real estate market discount rate, since leverage is systematically higher for real estate investment trusts (REITs) than private equity core real estate investments. To overcome this problem, we first adjust the return on the NAREIT index for leverage by following the

process described in Geltner and Kluger (1998). We approximate debt returns for REITs by using Moody's BBB corporate bond index. For opportunistic investments, the average PME is 1.03 and the median is 0.99, with a standard deviation of 0.32. As can be seen in Figure 4, the two cumulative distributions for PME for core and opportunistic investments are quite similar, but there are some interesting differences as well. The cumulative distribution of PME for core investments starts out lower than opportunistic investments, but manifests a hump before it begins to converge to 1.00. For value-added investments, the average PME is 1.15 and the median is 1.16, with a standard deviation of 0.34. The distinction in Figure 4 between the cumulative distribution of PME for value-added investments and that of PME for core and opportunistic investments is interesting. The former is far flatter with a significant right tail.

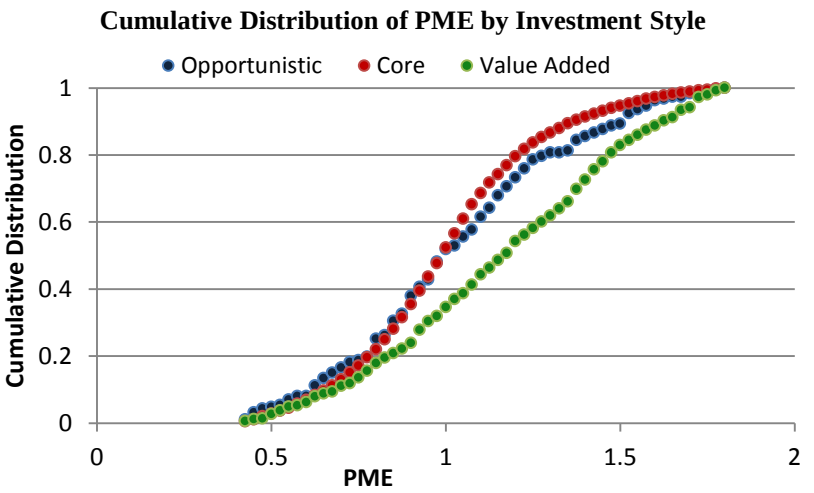
Figure 3 **PME Distribution on NCREIF Properties. 1978-2009. Vertical Axis: Property Count. Horizontal Axis: PME**



3.3 Relation of Property Returns and PME Performance Measure

We are now interested in the relation between property IRRs and our PME performance measures. Table 4 reports regressions of PME on IRRs by investment style. For these regressions, we have proceeded as follows. We estimate a cross-sectional regression of PME on IRR and fixed effects for property type and date of acquisition for all investment styles and then separately for core, value-added, and opportunistic investments.

Figure 4 Cumulative Distribution of PME by Investment Style. Vertical Axis: Cumulative Distribution. Horizontal Axis: PME



The first column of Table 4 reports the results for the whole sample. There is one explanatory variable reported, namely, the property IRR. Property type and date of acquisition specific fixed effects have been included, but not reported. We report t-statistics in parentheses. Several general comments are in order. First, IRR and property type and date of acquisition specific fixed effects explain a large amount of the variation in the PME, but not all of it. For example, for the whole sample as well as core investments, IRR and property type and date of acquisition explain 60% of the variation in the PME. For value-added investments, IRR and property type and date of acquisition explain 70% of the variation in the PME, while for opportunistic investments, the amount of variation explained is 67%. Second, properties with a high IRR also have a high PME, on average (which is intuitively appealing). The coefficients on IRR range from a low of 3.51 for opportunistic investments to a high of 7.09 for value-added investments. All coefficients are statistically significant at the 0.01 level. Third, location specific fixed effects add very little to the explained variation in the PME, which is why the results are not reported. Fourth, property type and date of acquisition specific fixed effects alone explain between 9% and 13% of the variation in the PME for the different investment styles.

Table 4 Relationship between PME and IRR by Investment Style

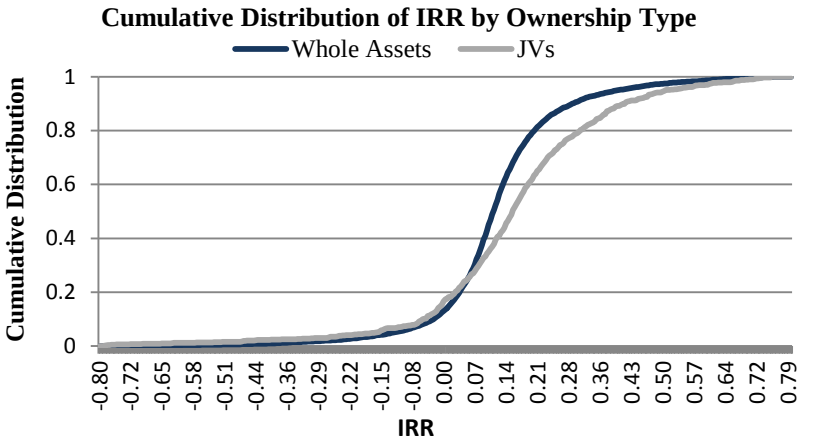
Variable	Total	Core	Value-Added	Opportunistic
IRR	5.85	5.94	7.09	3.51
	(90.3)	(84.6)	(30.5)	(15.3)
Constant	0.84	0.89	1.05	0.89
	(51.4)	(41.7)	(6.9)	(12.4)
R^2	60	60	70	66
F-Value	286.9	256.3	33.6	24.1
Obs	6,979	6,327	492	158

Note: Dependent variable is PME. Independent variables include IRR and property type and date of acquisition specific fixed effects. Property type and date of acquisition specific fixed effects are not reported. t-statistics are reported in parentheses.

3.4 Performance of Joint Ventures vs. Whole Assets

We have disaggregated the sold properties in the NCREIF database into two groups: properties held in joint venture ownership versus wholly-owned properties. Analysis of the IRRs of properties held in joint venture ownership suggests that they are generally riskier (i.e., having the possibility of both extremely high and extremely low returns) than wholly-owned assets. This pattern can be seen in Figure 5. Specifically, in Figure 5, we show the cumulative distribution of property IRRs for the two property groups.

Figure 5 Cumulative Distribution of IRR by Ownership Type (Joint Ventures vs. Wholly-Owned Properties).



Note: Vertical Axis: Cumulative Distribution. Horizontal Axis: PME

The cumulative distribution of IRR for wholly-owned properties has a definite hump in it before it begins to converge on 1.00. The lower 5% tail of the

distribution begins at a return of -80% and ends at return of -11%. The upper 5% tail of the distribution begins at a return of 40% and ends at a return of 80%. On average, 42% of all wholly-owned properties have an IRR between 5% and 15%. In contrast, the cumulative distribution of IRR for joint venture properties starts at -80% and the lower 5 percentile is at -16%. The 95% percentile begins at a return of 50% and ends at a return of 80%. On average, 24% of all wholly-owned properties have an IRR between 5% and 15%.

The point to draw from Figure 5 is that the mean IRR is higher for joint venture than for wholly-owned properties. To test for the significance of the differences in the mean IRRs, we use the Satterthwaite modification of the independent t-test. Levene's test is used to assess the homogeneity of variance. The Levene's test indicates that the variance of the return distribution for joint venture properties is significantly higher than that for wholly-owned properties ($F_{1,10562} = 6.85$, which is significant at the 1% level). Thus, a pooled analysis is not really meaningful for comparing joint venture and wholly-owned properties. A two-tail Satterthwaite test resulted in a p-value of 0.0089, which indicates that the average IRRs for joint venture and wholly-owned properties are significantly different. In the next section, our quantile-level regressions indicate that the concentration of joint venture properties in the tails of the return distribution may be attributed to risk-taking tendencies.

4. Testing for Risk-Taking Tendencies in Joint Ventures

In this section, we present a simple model that can be used to analyze the performance of joint ventures vis-à-vis whole assets at various different levels of riskiness, holding all else equal. The model considers the ex post determinants of property performance, Y_i, for each property i. The dependent variable reflects either the absolute return on the property (i.e., the IRR on the property) or the relative return on the property (i.e., the PME on the property). The reduced form version of the model can written as:

$$Y_i = \beta_0 + \beta_1 A_i + \beta_2 X_{i,k} + \beta_3 JV_i + \varepsilon_i \quad (1)$$

where the explanatory variables are the following: A_i is a set of property characteristics that can affect the investment performance of the property, including yield (i.e., income-property ratio) and the LTV ratio, $X_{i,k}$ is a set of fixed effects for property type and date of acquisition, JV_i is an indicator variable that equals 1 if the property is structured as a joint venture and 0 otherwise, and ε_i is an error term.

Some comments that are related to our explanatory variables should be pointed out. First, the yield variable is demeaned by subtracting its property by date-of- acquisition mean. In this case, a very low yield for property i indicates that a property is expensive relative to its current income and that

there is an element of risk attached to the property in terms of reaching a target rate of return. On the average, then, properties with very low current yields should return (more or less) about what properties with high yields will return. However, properties with very low yields will be riskier as they are more dependent on capital appreciation in order to reach the expected total return target. As a result, one expects the return on the property will probably be farther from the average (generally below the average) at the end of the year (or the end of the holding period) than if one had bought a property with a very high yield. We would therefore expect properties with low yields to be more apparent in the left-hand return performance tail than elsewhere in the distribution. Second, a high LTV ratio indicates a high risk of default. Properties with high default risk will have a wider range of potential returns than properties with low default risk, and any unique feature that may cause the return on the property to be farther above or below the average return should, to some extent, be a good predictor across the quantiles of the return distribution. Third, properties are likely to be within the same quantile depending on the property type (whether apartments, office, retail, or industrial) and the date of acquisition (whether during a boom or bust, a time of cheap debt or not, during a credit expansion or contraction, etc.). Therefore, if we were only to consider property type and date of acquisition specific fixed effects, we should be able to separate out properties into different quantiles.

To estimate (1), we run quantile regressions. More specifically, the parameters in (1) are estimated at various quantiles of the conditional distribution of Y_i, which gives us a more complete picture of the way that joint ventures affect property returns across the return distribution. The quantile regression model is defined as:

$$\begin{aligned} Y_i &= \beta_0(q) + \beta_1(q)A_i + \beta_2(q)X_{i,k} + \beta_3(q)JV_i + \varepsilon_i \\ &= Q_q(Y_i) + \varepsilon_i, \qquad 0 < q < 1 \end{aligned} \tag{2}$$

where $\beta_i(q)$ is the parameter to be estimated for a given value of the distribution's quantile q in $[0,1]$, and $Q_q(Y_i)$ denotes the qth quantile of the conditional distribution of Y_i. Koenker and Bassett (1978) demonstrate that quantile regression models can be estimated by finding the vector $[\beta_0(q), \beta_1(q), \beta_2(q), \beta_3(q)]$ that minimizes

$$\begin{aligned} &\textstyle\sum_{\epsilon_i<0} q\left|Y_i - \beta_0(q) - \beta_1(q)A_i - \beta_2(q)X_{i,k} - \beta_3(q)JV_i\right| + \sum_{\epsilon_i>0}(1 - \\ &q)\left|Y_i - \beta_0(q) - \beta_1(q)A_i - \beta_2(q)X_{i,k} - \beta_3(q)JV_i\right| \end{aligned} \tag{3}$$

by using linear programming techniques. Our interest in estimating (2) is in the comparison of the returns on joint ventures vs. whole assets at various quantiles. While comparisons of the mean or median return on joint ventures vs. whole assets might not show any excess return, comparisons of higher quantiles ought to show a positive excess return, while lower quantiles ought to show a negative excess return if the risk-taking hypothesis is correct.

Alternatively, if joint ventures reduce transactions or allocate risk more efficiently, then it is in the middle and upper-return ranges that we should find evidence of a joint venture effect.

The empirical approach in Equation (1) includes property and acquisition date fixed effects. To test how joint ventures formed by core, value-added, and opportunistic funds perform, we run separate quantile regressions on core and value-added investments. We drop opportunistic investments from the analysis due to the lack of observations.

5. Quantile Regression Results

In this section, we first present a series of quantile regressions to investigate the extent to which property returns (i.e., IRRs) at various quantiles are influenced by joint ventures. In doing this, we distinguish between two types of joint ventures: those with other NCREIF members and those with non-NCREIF members, which allow us to control for a variety of factors that may be important in the performance of a joint venture, including partnering with like-minded individuals who have direct access to the same data, and tend to revise their priors in the same direction (see Shilling, Sirmans, and Slade (2012)). There is also a difference in the focus of these joint ventures. A property-by-property type analysis shows that joint ventures among non-NCREIF members are moderately concentrated among retail shopping centers and hotels, while joint ventures among NCREIF members are more evenly spread out. The intuition for this result is as follows. Public-market penetration rates on mall retail and hotels are quite high (in the 20% to 40% range), compared with much smaller market penetration rates for office, apartments, and industrial (see, for example, Hess and Liang (2004)). Of course, this means that hotel and mall joint ventures are almost a necessity, given the desire of most REITs to hold core assets. However, whether every effort is made by REITs to move core or non-core assets off their balance sheet and into joint venture partnerships ultimately remains an empirical question. Depending on how REITs answer this question, joint ventures among non-NCREIF members could provide materially higher or lower returns than joint ventures among NCREIF members or the average return on whole assets.

We shall use the quantile regressions to estimate NCREIF and non-NCREIF joint venture effects at various points on the return distribution. The results are presented in Tables 5 and 6. Table 5 displays the quantile regressions for core investments. The columns present the coefficient estimates at the following quantiles: 0.10, 0.20, 0.30, 0.40, 0.50, 0.60, 0.70, 0.80, and 0.90. The advantage of the quantile regressions in this context is that we can attach standard errors/t-statistics to the estimated joint venture effects at the various quantiles. These t-statistics are reported in parentheses in Table 5.

Table 5 Quantile Regression Estimates of IRR on Property Characteristics and a Set of Fixed Effects for Property Type and Date of Acquisition (not reported), Core Properties

	Quantile								
	10%	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
Intercept	-0.1361	-0.1281	-0.0222	0.0048	0.0513	0.0455	0.1264	0.2185	0.3089
	(-0.93)	(-2.02)	(-0.42)	(0.11)	(1.27)	(1.12)	(2.93)	(4.36)	(3.95)
Yield	0.3239	0.2492	0.2394	0.2164	0.2648	0.2406	0.2655	0.2772	0.3139
	(6.88)	(5.24)	(6.07)	(5.22)	(6.25)	(6.09)	(8.33)	(7.96)	(4.89)
LTV	-0.0293	-0.0023	0.0127	0.0244	0.0319	0.0425	0.0543	0.0667	0.0844
	(-4.44)	(-0.6)	(3.68)	(8.03)	(10.76)	(13.85)	(12.46)	(22.05)	(12.69)
joint venture*	-0.0118	-0.0118	-0.0079	-0.003	-0.0017	-0.0062	-0.0061	-0.0016	0.0003
	(-2.47)	(-3.75)	(-3.47)	(-1.25)	(-0.53)	(-1.46)	(-1.45)	(-0.3)	(0.05)
joint venture	-0.0001	0.0011	0.0008	0.0002	0.0001	0.0008	0.002	-0.0001	-0.0015
	(-0.03)	(0.49)	(0.39)	(0.11)	(0.06)	(0.41)	(0.91)	(-0.04)	(-0.34)

Note: Yield = income-price ratio demeaned by subtracting its property by date-of- acquisition mean. LTV = loan-to-value ratio. joint venture* = 0-1 dummy variable for joint ventures among NCREIF members. joint venture = 0-1 dummy variable for joint ventures among non-NCREIF members. t-statistics are reported in parentheses

Table 6 Quantile Regression Estimates of IRR on Property Characteristics and a Set of Fixed Effects for Property Type and Date of Acquisition (not reported), Value-Added Properties

	Quantile								
	10%	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
Intercept	0.2549	0.4047	0.3619	0.5637	0.4331	0.5576	0.6597	0.8206	0.5186
	(0.09)	(0.46)	(0.62)	(1.17)	(0.97)	(1.22)	(1.1)	(1.01)	(0.16)
Yield	-0.067	0.3018	0.3202	0.3575	0.4735	0.4695	0.4869	0.4157	1.0056
	(-0.16)	(1.47)	(2.02)	(2.0)	(2.51)	(2.42)	(2.51)	(1.48)	(1.94)
LTV	0.0782	0.0901	0.0894	0.098	0.0907	0.0732	0.077	0.0559	0.0316
	(2.14)	(4.89)	(5.27)	(5.25)	(4.28)	(3.11)	(3.45)	(2.18)	(0.84)
joint venture*	0.05	0.0165	0.0068	0.0009	0.0077	0.0031	0.0023	0.0087	0.0013
	(1.52)	(1.14)	(0.76)	(0.12)	(0.92)	(0.32)	(0.22)	(0.65)	(0.05)
joint venture	-0.018	-0.0145	-0.0112	-0.008	-0.0068	-0.0075	-0.0051	-0.01	-0.0176
	(-1.25)	(-2.39)	(-2.72)	(-2.24)	(-1.55)	(-1.58)	(-1.07)	(-1.48)	(-1.66)

Note: Yield = income-price ratio demeaned by subtracting its property by date-of- acquisition mean. LTV = loan-to-value ratio. joint venture*= 0-1 dummy variable for joint ventures among NCREIF members. joint venture = 0-1 dummy variable for joint ventures among non-NCREIF members. t-statistics are reported in parentheses

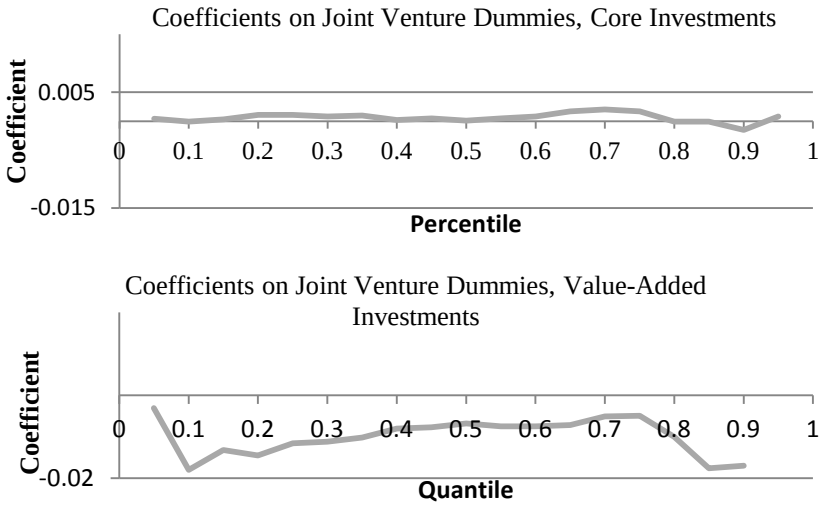
Hypothesis 1: Real estate joint ventures experience higher returns.

The results indicate that there are significant differences in the parameter estimates of the LTV across the ten quantiles. The coefficients associated with the LTV vary significantly from -0.03 to 0.08 as we move from the lowest to the highest quantile. As expected, the coefficient on property yield (YIELD) is relatively stable across the entire return distribution. Holding all else constant, the estimates suggest higher (lower) yields predict higher (lower) IRRs. The coefficient on YIELD is positive and statistically significant at the 10% level across the entire IRR distribution. The negative coefficients on the two joint venture 0-1 dummy variables – joint venture*, joint ventures among NCREIF members, and joint venture, joint ventures among non-NCREIF members – in the bottom quantile mean that the joint venture return distribution is lower than the whole asset return distribution, and significantly so, in the case of the coefficient on joint venture*. The estimated coefficients on joint venture* vary from a low -0.01 in the bottom quantile to -0.00017 in the middle quantile, and to 0.0003 in the highest quantile (and from 0.40 on, the coefficient estimates are insignificant). Thus, it seems joint ventures among NCREIF members have all the pain, but none of the gain. In contrast, the estimate coefficients on joint venture change little over the entire return distribution and are never really significantly different from zero, thus suggesting no significant benefit to joint venture investments compared to wholly-owned, see Figure 6a. Note that additional quantile runs are undertaken at the following alternative quantiles: 0.05, 0.15, 0.25, 0.35, 0.45, 0.55, 0.65, 0.75, 0.85, and 0.95, and displayed in Figure 6a.

Hypothesis 2: Risk-sharing promotes increased risk-taking by core and value-added funds.

Let us now look at the quantile regression results for value-added investments. These results are reported in Table 6. The estimated coefficients on YIELD vary from a low -0.067 in the bottom quantile (and statistically insignificant), to 0.4735 in the middle quantile (and statistically significant at the 5% level), and to 1.0056 in the highest quantile (and, again, statistically significant). It is noteworthy that, among value-added investments, a higher LTV predicts a positive and statistically significant IRR over the entire return distribution, with one exception. The exception is for the highest return quantile. The estimated coefficients on the joint venture 0-1 dummy variable joint venture* range from 0.05 in the bottom quantile to 0.0013 in the top quantile, and always statistically insignificant. The estimated coefficients on joint venture, on the other hand, are negative and statistically insignificant in the lowest and highest quantiles. In all other quantiles, the estimated coefficients on joint venture are negative and statistically significant (or nearly statistically significant). Overall, these results indicate that there is a lot more risk taking by value-added funds relative to core funds, see Figure 8.

Figure 6 Coefficients on Joint Venture 0-1 Dummy Variables, by Investment Style

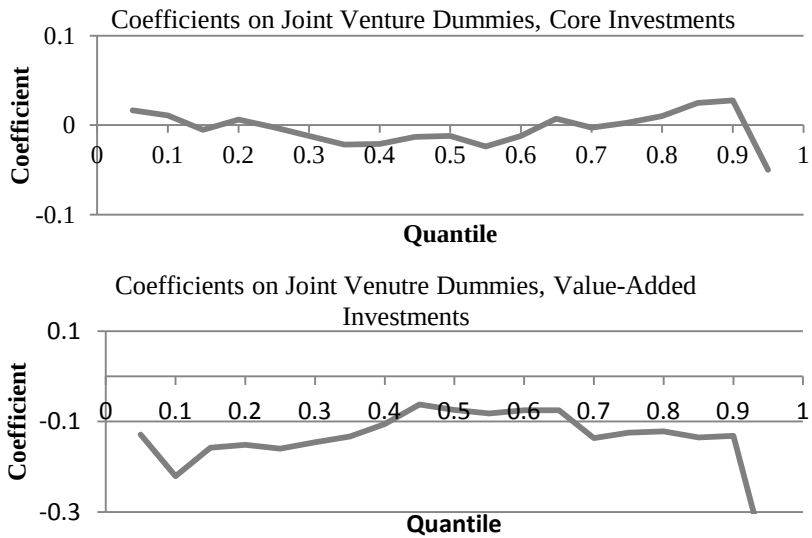


Note: Vertical Axis: Coefficient Values. Horizontal Axis: Quantile. Estimates are obtained from a quantile regression model fitted to property IRRs.

To test the sensitivity of these results, additional quantile regressions are undertaken by using PME as our dependent variable. The results for core investments are presented in Table 7. The estimates indicate that the behavioral patterns observed in Table 5 are robust to alternative measures of return performance. Joint ventures among core investments among non-NCREIF members do not under- or over-perform when compared to whole assets. The estimated coefficients on joint venture vary from 0.0108 in the lowest quantile (and statistically insignificant) to 0.0275 in the highest quantile (and statistically insignificant), see Figure 7a (including the additional quantile runs). However, the estimated coefficients on joint venture* vary from -0.2022 (and statistically significant) in the lowest quantile, to -0.0314 (and statistically insignificant) in the middle quantile, and back to -0.2534 in the highest quantile (and marginally statistically significant).

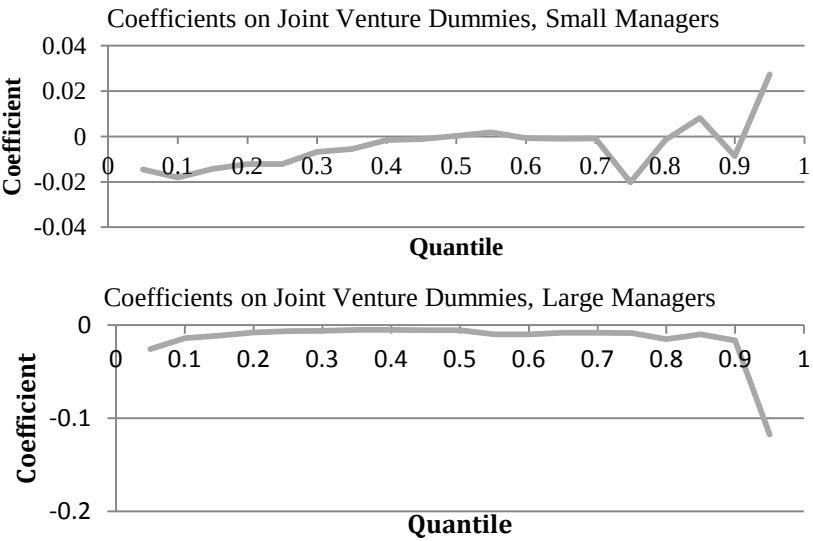
Table 8 presents the quantile regression estimates of the PME for value-added investments. Both YIELD and LTV are positive and highly significant in the highest quantile. One conclusion we would draw is that YIELD and LTV are able to predict both absolute and relative return performances. The estimated coefficients on joint venture allow us to see that joint ventures on value-added properties consistently underperform whole assets. These coefficients vary significantly over the return distribution and are statistically significant for quantiles 0.10 through 0.40, and again in quantile 0.70, see also Figure 7b (including the additional quantile runs).

Figure 7 Coefficients on Joint Venture 0-1 Dummy Variables, by Investment Style.



Note: Vertical Axis: Coefficient Values. Horizontal Axis: Quantile. Estimates are obtained from a quantile regression model fitted to property PMEs.

Figure 8 Coefficients on Joint Venture 0-1 Dummy Variables, by Size of Manager



Note: Vertical Axis: Coefficient Values. Horizontal Axis: Quantile. Estimates are obtained from a quantile regression model fitted to property IRRs.

Table 7 Quantile Regression Estimates of PME on Property Characteristics and a Set of Fixed Effects for Property Type and Date of Acquisition (not reported), Core Properties

	Quantile								
	10%	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
Intercept	3.2211	1.4426	1.7967	1.5157	2.0372	1.2133	0.127	-1.2342	-3.6487
	(3.95)	(3.04)	(4.1)	(4.3)	(4.07)	(2.1)	(0.18)	(-1.19)	(-2.31)
Yield	2.2331	2.2085	2.1776	2.1316	2.0593	2.1861	2.5159	2.6394	2.882
	(4.43)	(5.35)	(7.21)	(6.46)	(5.36)	(4.04)	(4.92)	(4.74)	(3.29)
LTV	-0.1915	-0.0247	0.1382	0.2942	0.4434	0.623	0.8769	1.2263	1.7745
	(-3.34)	(-0.76)	(4.54)	(9.12)	(13.75)	(14.31)	(18.84)	(20.39)	(20.15)
joint venture*	-0.2022	-0.1136	-0.0794	-0.0426	-0.0314	-0.0475	-0.14	-0.1282	-0.2534
	(-3.03)	(-2.78)	(-2.6)	(-1.34)	(-0.78)	(-0.6)	(-2.05)	(-1.61)	(-0.98)
joint venture	0.0108	0.0062	-0.0121	-0.021	-0.0122	-0.012	-0.0027	0.0102	0.0275
	(0.41)	(0.31)	(-0.66)	(-1.23)	(-0.77)	(-0.66)	(-0.12)	(0.35)	(0.47)

Note: Yield = income-price ratio demeaned by subtracting its property by date-of- acquisition mean. LTV = loan-to-value ratio. joint venture* = 0-1 dummy variable for joint ventures among NCREIF members. joint venture = 0-1 dummy variable for joint ventures among non-NCREIF members. t-statistics are reported in parentheses.

Table 8 Quantile Regression Estimates of PME on Property Characteristics and a Set of Fixed Effects for Property Type and Date of Acquisition (not reported), Value-Added Properties

	Quantile								
	10%	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
Intercept	2.6473	2.0426	4.6296	6.4285	2.4768	6.4074	9.7837	6.6345	17.1076
	(0.2)	(0.3)	(0.8)	(0.94)	(0.37)	(0.95)	(1.11)	(0.55)	(0.68)
Yield	-2.5049	0.7092	1.8699	1.6365	-1.1987	0.3569	2.7324	3.7822	7.6665
	(-0.97)	(0.29)	(0.69)	(0.51)	(-0.39)	(0.11)	(0.72)	(0.82)	(1.34)
LTV	0.3337	0.409	0.6935	0.5676	0.6685	0.8527	0.9036	1.0987	1.0621
	(2.06)	(1.86)	(2.53)	(1.91)	(2.5)	(3.28)	(3.23)	(2.68)	(1.95)
joint venture*	0.007	0.098	-0.0023	-0.0155	0.0642	0.0781	0.1935	0.2044	0.1203
	(0.04)	(0.74)	(-0.02)	(-0.18)	(0.58)	(0.61)	(1.2)	(0.95)	(0.4)
joint venture	-0.2208	-0.1517	-0.1456	-0.1053	-0.0742	-0.0751	-0.1365	-0.1217	-0.1317
	(-3.17)	(-2.69)	(-2.93)	(-2.14)	(-1.47)	(-1.26)	(-2.22)	(-1.6)	(-0.99)

Note: Yield = income-price ratio demeaned by subtracting its property by date-of- acquisition mean. LTV = loan-to-value ratio. joint venture*= 0-1 dummy variable for joint ventures among NCREIF members. joint venture = 0-1 dummy variable for joint ventures among non-NCREIF members. t-statistics are reported in parentheses.

6. Are Some Managers Better than Others?

In the previous section, we saw that joint ventures provide materially lower returns (both on an absolute and a relative basis) than the average return on whole assets. The magnitudes of the results are strikingly large (expressed in quarterly returns). The findings hold, however, primarily for value-added investments (more risk taking by value-added funds). A somewhat related test is to ask if small investment managers, relative to large investment fund managers, form joint ventures that would appear riskier ex ante.

Hypothesis 3: Joint ventures formed by small investment managers are used to procure new business and grow assets under management and maximize fund fees.

To address this question, we look at whether the superior performance of joint ventures can be attributed to the size/expertise of certain managers. We construct a manager size variable by ranking all managers by assets under management. We then divide the sample into two equal groups: large and small investment managers. A series of tests are then conducted in order to detect whether biases might exist in the way in which the two groups form joint ventures.

Smaller managers in our sample would be expected to have incentives to form joint ventures in order to procure new business and grow assets under management and maximize fund fees. Whether these joint ventures, in turn, under- or over-perform relative to whole assets is an open question. Small fund managers for which we have data do slightly more joint ventures among non-NCREIF than large fund managers (about 5% more), while large fund managers obviously do slightly more joint ventures among the NCREIF members. A property-by-property type analysis shows that small fund managers are more likely to concentrate on industrial joint ventures and less likely to concentrate on office joint ventures. The reverse generally holds true for large fund managers.

Our first set of tests are reported in Table 9, where we estimate (2) for small investment managers. Here, the dependent variable is property IRR. The estimated coefficients on joint venture* vary -0.0181 in the lowest quantile, to 0.0003 in the middle quantile, and to -0.0086 in the highest quantile (and statistically significant at the 5% level in the lower quantiles). The estimated coefficients on joint venture, on the other hand, are relatively stable across all quantiles and generally statistically insignificant. Note that, when additional quantile runs are undertaken at the alternative quantiles 0.05, 0.15, 0.25, 0.35, 0.45, 0.55, 0.65, 0.75, 0.85, and 0.95, the resulting coefficients on joint venture* are strikingly large. The point estimate on joint venture* in the 0.05 quantile is -0.015. In contrast, the point estimate on joint venture* in the 0.95 quantile is 0.0273. These point estimates are graphically displayed in Figure 8a.

Table 9 Quantile Regression Estimates of IRR on Property Characteristics and a Set of Fixed Effects for Property Type and Date of Acquisition (not reported), Small Managers.

	Quantile								
	10%	**30%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
Intercept	0.2491	-0.0393	0.1554	0.1869	0.2353	0.3558	0.421	0.5015	0.8481
	(1.43)	(-0.35)	(2.09)	(2.65)	(3.78)	(6.45)	(5.66)	(7.12)	(6.33)
Yield	0.5447	0.4295	0.4074	0.3526	0.3329	0.3445	0.3909	0.3876	0.2673
	(5.68)	(5.31)	(6.07)	(4.95)	(5.03)	(5.87)	(6.41)	(6.35)	(3.09)
LTV	-0.0273	-0.0126	0.0078	0.0241	0.0366	0.0471	0.0569	0.0716	0.1045
	(-2.42)	(-2.03)	(1.31)	(3.98)	(6.29)	(9.29)	(8.00)	(9.85)	(10.13)
joint venture*	-0.0181	-0.0121	-0.0068	-0.0016	0.0003	-0.0007	-0.0009	-0.0016	-0.0086
	(-1.4)	(-2.27)	(-1.32)	(-0.22)	(0.03)	(-0.05)	(-0.05)	(-0.11)	(-0.35)
joint venture	0.0039	0.0014	0.0055	0.0016	-0.0006	-0.0017	-0.0005	-0.0023	-0.0017
	(0.69)	(0.41)	(1.61)	(0.43)	(-0.16)	(-0.47)	(-0.11)	(-0.46)	(-0.28)

Note: Yield = income-price ratio demeaned by subtracting its property by date-of- acquisition mean. LTV = loan-to-value ratio. joint venture* = 0-1 dummy variable for joint ventures among NCREIF members. joint venture = 0-1 dummy variable for joint ventures among non-NCREIF members. t-statistics are reported in parentheses.

Table 10 **Quantile Regression Estimates of IRR on Property Characteristics and a Set of Fixed Effects for Property Type and Date of Acquisition (not reported), Large Managers**

	Quantile								
	10%	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
Intercept	-0.4587	-0.2849	-0.1611	-0.0608	-0.0713	0.0839	0.2618	0.1759	0.3466
	(-2.65)	(-3.25)	(-2.11)	(-0.72)	(-0.77)	(1.02)	(2.66)	(1.7	(2.95)
Yield	0.2972	0.1648	0.1612	0.1548	0.1883	0.1891	0.2583	0.36	0.3299
	(3.36)	(2.7)	(3.23)	(2.93)	(3.51)	(3.86)	(5.59)	(5.96)	(4.25)
LTV	0.0018	0.0141	0.0272	0.0365	0.0462	0.0619	0.0813	0.1151	0.1179
	(0.26)	(3.12)	(6.36)	(8.28)	(10.23)	(10.75)	(15.71)	(16.32)	(20.81)
joint venture*	-0.0138	-0.0079	-0.006	-0.0049	-0.0054	-0.0098	-0.008	-0.0149	-0.0099
	(-2.2)	(-2.32	(-1.83)	(-1.31)	(-1.09)	(-2.11)	(-1.47)	(-1.56)	(-0.6)
joint venture	-0.0045	-0.0022	-0.0012	0.0001	-0.0003	0.0003	-0.0001	0.0008	-0.0005
	(-1.11)	(-0.76)	(-0.53)	(0.02)	(-0.13)	(0.11)	(-0.04)	(0.2)	(-0.1)

Note: Yield = income-price ratio demeaned by subtracting its property by date-of- acquisition mean. LTV = loan-to-value ratio. joint venture* = 0-1 dummy variable for joint ventures among NCREIF members. joint venture = 0-1 dummy variable for joint ventures among non-NCREIF members. t-statistics are reported in parentheses.

Table 11 Quantile Regression Estimates of Property PME on Property Characteristics and a Set of Fixed Effects for Property Type and Date of Acquisition (not reported), Small Managers

	Quantile								
	10%	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
Intercept	4.4581	2.7637	2.8629	3.0635	2.6438	3.1348	3.6002	3.3773	5.8162
	(5.61)	(3.06)	(5.48)	(5.42)	(5.3)	(5.31)	(4.25)	(2.62)	(2.47)
Yield	2.2366	2.2873	2.5077	2.478	2.3888	2.939	2.9157	3.5705	3.1088
	(1.93)	(3.22)	(4.28)	(4.1)	(3.76)	(4.31)	(3.88)	(4.68)	(2.85)
LTV	-0.305	-0.076	0.046	0.2405	0.4293	0.5779	0.7447	0.9432	1.1622
	(-4.69)	(-2.1)	(1.25)	(5.65)	(8.68)	(11.65)	(12.35)	(13.93)	(10.74)
joint venture*	-0.219	-0.088	-0.049	-0.036	-0.094	-0.179	-0.245	-0.489	-1.002
	(-2.32)	(-1.38)	(-0.70)	(-0.41)	(-0.73)	(-1.19)	(-1.44)	(-1.46)	(-1.89)
joint venture	-0.027	-0.051	-0.045	-0.058	-0.048	-0.038	-0.023	-0.039	-0.064
	(-0.75)	(-2.01)	(-1.64)	(-1.91)	(-1.62)	(-1.13)	(-0.68)	(-0.9)	(-0.61)

Note: Yield = income-price ratio demeaned by subtracting its property by date-of- acquisition mean. LTV = loan-to-value ratio. joint venture*= 0-1 dummy variable for joint ventures among NCREIF members. joint venture = 0-1 dummy variable for joint ventures among non-NCREIF members. t-statistics are reported in parentheses.

Table 12 **Quantile Regression Estimates of Property PME on Property Characteristics and a Set of Fixed Effects for Property Type and Date of Acquisition (not reported), Large Managers**

	Quantile								
	10%	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
Intercept	1.0886	1.5877	1.3139	1.9864	-0.396	-1.398	-3.714	-6.456	-15.95
	(0.64)	(1.62)	(2.1)	(1.73)	(-0.38)	(-1.3)	(-2.19)	(-3.18)	(-4.61)
Yield	2.8031	2.7589	2.3104	2.0581	1.8572	1.8009	1.6738	2.3301	1.5712
	(4.7)	(5.2)	(6.58)	(5.21)	(3.89)	(3.14)	(2.3)	(2.74)	(1.35)
LTV	-0.072	0.0538	0.1752	0.3081	0.4209	0.605	0.8244	1.1346	1.6452
	(-1.38)	(1.74)	(5.44)	(9.24)	(11.53)	(15)	(16.87)	(17.14)	(15.25)
joint venture*	-0.056	-0.129	-0.077	-0.039	-0.027	-0.021	-0.078	-0.101	-0.006
	(-0.48)	(-1.8)	(-2.5)	(-1.14)	(-0.54)	(-0.32)	(-1.04)	(-1.38)	(-0.03)
joint venture	0.0111	-0.027	-0.039	-0.051	-0.053	-0.055	-0.048	-0.046	-0.043
	(0.35)	(-0.96)	(-1.76)	(-2.5)	(-2.6)	(-2.67)	(-1.8)	(-1.25)	(-0.61)

Note: Yield = income-price ratio demeaned by subtracting its property by date-of- acquisition mean. LTV = loan-to-value ratio. joint venture*= 0-1 dummy variable for joint ventures among NCREIF members. joint venture = 0-1 dummy variable for joint ventures among non-NCREIF members. t-statistics are reported in parentheses.

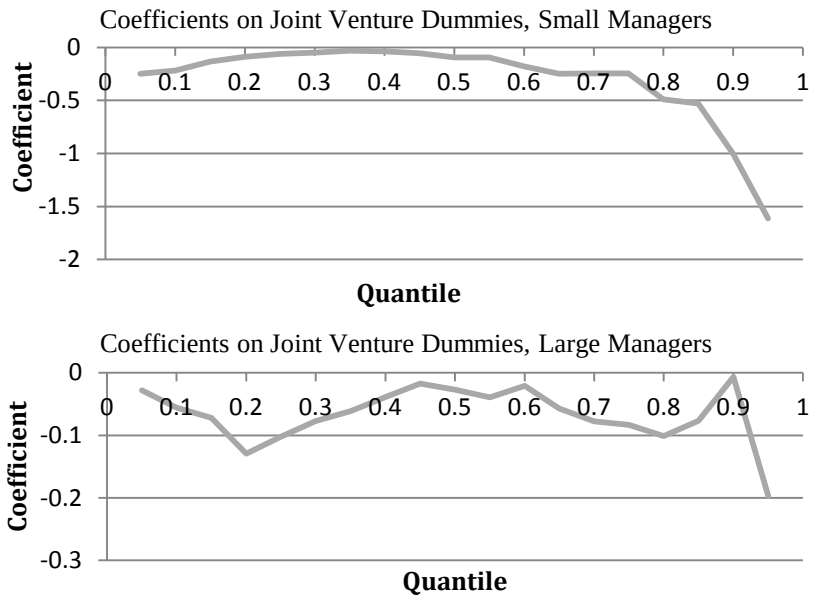
Larger investment managers seem to fare even worse when structuring joint ventures among the NCREIF members, see Table 10. The estimated coefficients on joint venture* vary from -0.0138 in the lowest quantile, to -0.0054 in the middle quantile, and to -0.0099 in the highest quantile (never turning positive). In contrast, the estimated coefficients on joint venture are relatively small and stable across all quantiles. None of the coefficients on joint venture are statistically significant.

It is interesting to compare these results with those in Tables 11 and 12. In Tables 11 and 12, we examine the relative performance of large vs. small investment managers. The dependent variable for each regression is the PME. Three interesting tendencies are apparent. First, in Table 11, the coefficients associated with joint venture* increase from -0.219 to -0.036 as one moves from the 0.10 to the 0.40 quantile and then decreases from -0.094 to -1.002 as one moves from the 0.05 to the 0.90 quantile (apparent relative underperformance). Second, in Table 12, there are also some significant differences in the joint venture* parameters across the quantiles but, unlike the coefficient estimates in Table 11, the results here are not as statistically significant. Compare, also, the results plotted in Figures 9a and 9b. Third, we do not want to emphasize these results too much; however, the coefficients associated with joint venture in Table 12 are sufficiently negative over the 0.40 to 0.70 quantiles as to be statistically significant at the 10% level. If one looks at the coefficients associated with joint venture in Table 11, the point estimates are also sufficiently negative over the 0.20 to 0.50 quantiles as to be statistically significant. Why this is the case is an interesting question and deserves careful study. One answer is that most large investment funds make extensive use of benchmarks to measure performance. Theoretically, then, large investment fund managers, relative to small fund managers, can be influenced by these benchmark measures to take on increased risk through their joint ventures.

7. Conclusions

We have seen in this paper that the distribution of returns for all sold properties in the NCREIF database has rather large tails. We have also seen that the sold properties in the NCREIF database have a PME distribution with an interquartile range that is from 0.82 to 1.18 (which includes a significant number of properties that outperform the NAREIT index and a significant number of properties that underperform the NAREIT index; although, the overall sample average PME is 1.0 and the median is 0.99, thus indicating strikingly similar returns between public and private real estate).

Figure 9 Coefficients on Joint Venture 0-1 Dummy Variables, by Size of Manager



Note: Vertical Axis: Coefficient Values. Horizontal Axis: Quantile. Estimates are obtained from a quantile regression model fitted to property PMEs.

Such distributions do not occur by chance. We then ask if there is something systematic going on in these distributions. We hypothesize that the present expansion into joint ventures by private equity core, value-added and opportunistic real estate funds could explain some of what is going on in the upper and lower tails of these distributions. Specifically, three alternative hypotheses are put forth: 1) real estate joint ventures would be more apparent in the right-hand tail of return distribution than elsewhere in the distribution, because real estate joint ventures are formed by private equity core, value-added and opportunistic real estate funds to acquire larger properties; 2) real estate joint ventures would be more concentrated in both tails of the return distribution – particularly in the left (low end) tail because, unwittingly, real estate joint venture expose joint venture participants to increased risk; and/or 3) real estate joint ventures would be more apparent in the left-hand return performance tail than elsewhere in the distribution, because ventures are the classic agency cost problem cases; that is, managers have their own objectives that may deviate from those of investors. These objectives include wanting to grow assets under management and maximizing fund fees. This means that, everything else equal, managers will almost always want to form joint venture projects to take advantage of the forced risk-sharing should their cash flow forecasts fail to pan out.

When we turn to the empirical evidence, we find that both property yield and LTV are highly significant predictors of both absolute and relative return performances: higher (lower) yields consistently predict higher (lower) returns across the entire return distribution, and the same result holds for higher (lower) LTV ratios. The data are analyzed by using quantile regression techniques. This approach allows for unobserved heterogeneity and enables the determination of the profitability effects at different points of the return distribution. We reject the hypothesis that real estate joint ventures experience abnormal returns. In general, the evidence suggests that real estate joint ventures versus whole assets not only perform poorly in the left-hand tail of the return distribution, but in the right-hand tail of the distribution as well. As shown in Tables 5-8, investment style generally plays an important role in explaining whether real estate joint ventures perform poorly. Our evidence suggests that poor performance is typically found throughout the return distribution for value-added investments (more risk taking by value-added funds) compared with core investments. Furthermore, the quantile regressions for both IRRs and PMEs indicate poor performance for real estate joint ventures formed by value-added funds compared with core funds.

The size of the investment manager also matters in explaining joint venture performance. Relative to small investment managers, joint ventures formed by large investment managers generally display the largest disparity effects. For instance, as shown in Table 9, for small investment managers, the differences in returns on joint ventures and whole assets range from -0.0181 in the 0.05 quantile, to 0.0003 in the 0.50 quantile, and back to -0.0086 in the 0.95 quantile. For large investment managers, the differences in returns range from -0.0138 in the 0.05 quantile, to -0.0054 in the 0.50 quantile, and to -0.0099 in the 0.95 quantile (see Table 10). A reasonable explanation of our findings is that large fund managers are generally willing to take on riskier projects because of their extensive use of benchmarks to measure performance, or they simply have done a poorer job of evaluating joint venture investment risk.

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