Revisiting Performance Persistence in Real Estate Funds

by

ROBERT A LAFEVER
Bachelor of Science, Finance, 1999
Bachelor of Science, Marketing 1999
Arizona State University

AND

LUIS CANIZO
Bachelor of Science, Civil Engineering, 1993
Polytechnic Univ. of Madrid
Masters of Business Administration, 1998
MIIT Sloan School of Mgmt

Submitted to the Department of Urban Studies and Planning
in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE IN REAL ESTATE DEVELOPMENT

at the
Massachusetts Institute of Technology
September 2005

Revisiting Performance Persistence in Real Estate Funds

by

ROBERT A LAFEVER and LUIS CANIZO

Submitted to the Department of Urban Studies and Planning
on August 5, 2005

in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Real Estate Development
at the Massachusetts Institute of Technology

Abstract

In this thesis, real estate opportunity fund returns were analyzed for evidence of persistence in subsequent funds from the same manager; it is designed to update and enhance a prior thesis performed by Cathy C. Hahn (2003), using both parametric and non-parametric tests. Tests were performed on gross and net returns covering the period from 1991-2004.

These tests confirm the prior finding that past fund performance is a significant indicator of future fund performance within the same firm. Our study also found the strongest evidence of persistence to exist in the extreme performers ranking in the top and bottom quartile amongst their vintage year peers. Additional tests for persistence, as well as effects of fund characteristics on performance, were employed using a methodology similar to that performed on private equity funds by Kaplan and Schoar (2003). Our tests yielded similar results to those found by Kaplan and Schoar(2003), but were not substantiated with statistical significance.

Thesis Supervisor: David Geltner
Title: Professor of Real Estate Finance

Acknowledgements

We are indebted to Pension Consulting Alliance, Inc. for generously providing the data used in this thesis. Thank you to Nori Gerardo-Lietz for providing direction and input throughout the process, and to Denise Mouchakkaa for providing the data and educational literature. We would also like to thank Cathy C. (Thea) Hahn for her advice, and help understanding the prior analysis. Finally, we would like to thank David Geltner for his patience, guidance and interpretations. The authors alone are responsible for any errors.

Table of Contents

I. Introduction

The real estate opportunity fund industry has grown tremendously over the last decade. Equity commitments have increased from $4.7 billion in 1993 to almost $100 billion in 2002.[1] Despite the increase in capital commitments, and the relative importance to investors and the economy as a whole, little research has been conducted on the returns of these investments. One major obstacle in performing the research is the lack of available public data. Proprietary data covering virtually the entire existence of the industry (1991-2003) has been provided for this thesis by Pension Consulting Alliance.

This thesis is designed to update and enhance a prior MIT thesis titled "Real Estate Opportunity Funds: Past Fund Performance as an indicator of Subsequent Fund Performance" (Cathy C. Hahn 2003). Both parametric and non-parametric tests will be performed to determine if managers are able to obtain a constant alpha in their subsequent funds, producing serial performance correlation. "Alpha" is defined as the abnormal return of an investment, either excess or deficient return. The capital asset pricing model states that the expected value of alpha is zero, and that sample alphas should be unpredictable.[2] Due to the private nature of the real estate market it seems possible for firms to achieve constant alpha as they locate and capitalize on over-discounted risk or overlooked value enhancement opportunities to reach their target investment returns. This thesis also examines other factors to determine their affect on performance such as: historical and current fund size, fund sequence number, and the effect of subsequent fund growth.

[1] Pension Consulting Alliance, "Real Estate Opportunity Funds: Déjà vu All Over Again,"May 2003, p.5.
[2] Zvi Bodie, Alex Kane, and Alan Marcus, Investments, (New York: McGraw-Hill, 2002) p.303

II. Literature Review

Mutual Funds

Most studies related to performance persistence have been performed on the mutual fund industry. These studies generally find evidence of persistence in mutual fund returns, with the strongest evidence occurring in the short term and with poor performance [eg. Hendricks, Patel, and Zeckhauser (1993), Shukla and Trzcinka (1994), Brown and Goetzmann (1995), Carhart et al. 1996)].

Goetzmann and Ibbotson (1994) studied patterns in mutual fund returns over the short-term. Two-way contingency tables using returns and alphas (the excess return divided by the amount of associated risk) were constructed for the fund returns over one-year, two-year, and monthly periods. Evidence of persistence was strongest in the monthly periods; regression analysis confirmed the results.

Carhart (1997) studied other factors that could contribute to the serial correlation in mutual fund returns. Carhart concluded that persistence was only evident in poor performing funds, which could be caused by illiquid under performing stocks.

Pension Funds

Christopherson, Ferson and Glassman (1998) studied the evidence of persistence in the relative investment performance of large, institutional equity mangers. They used a conditional approach with time-varying measures of risk and abnormal performance, which they found to be a better method of detecting the persistence than traditional approaches. Persistence was measured using cross-sectional regressions of future excess returns on past excess returns (or

alpha). Similar to the evidence of persistence found in mutual funds, the study concluded that persistence is concentrated in the poorly performing managers.

Private Equity

A working paper by Kaplan and Schoar (2003) studies the characteristics of fund performance in the private equity industry, appearance of persistence in fund performance, and the relation of fund performance to capital flows, fund size and overall fund survival. Regression analysis was performed using various fund characteristics and historical fund returns, while controlling for year and firm fixed effects. The study concludes that returns persist strongly across funds raised by the same firms. Not only was persistence evidenced between the first fund and subsequent fund, but also between the current fund and the second previous fund. The study also showed that performance increases with fund size and experience (subsequent funds have higher returns). The relation between fund size and performance is concave, suggesting fund performance increases with size until it becomes a mega-funds, at which time its returns decrease. This is different from the mutual fund industry, where the size to performance relationship is convex. The study also found that funds raised and started in boom[3] times are less likely to raise follow-on funds, which is attributed to poor performance.

III. Data

The collection of data for this thesis has been kindly provided by PENSION CONSULTING ALLIANCE Inc.[4] Pension Consulting Alliance (PCA) collects information on

[3] Boom times are determined when the S&P 500, Nasdax Composite Index and venture industry returns are high for the current and prior year.
[4] Pension Consulting Alliance Inc. : www.pensionconsulting.com

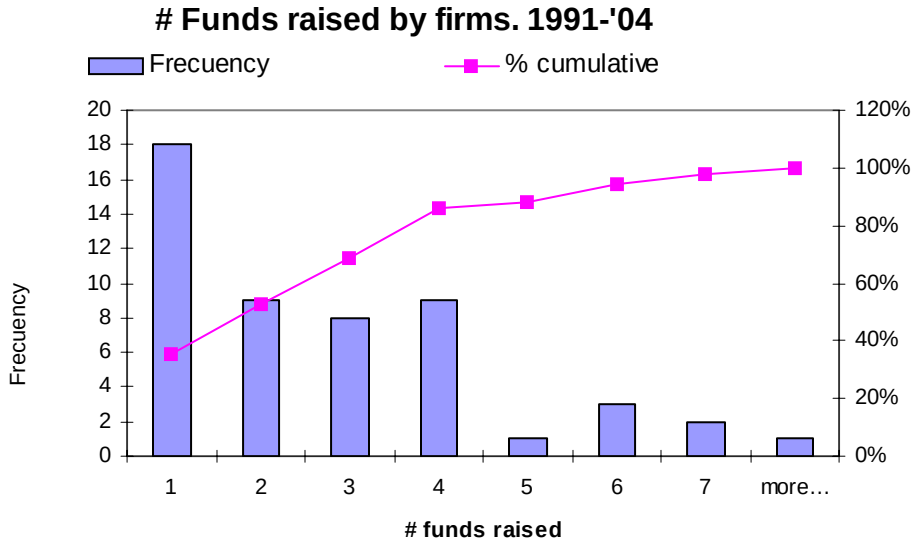
real estate opportunity fund returns, as they provide advisory services for most of the main institutional investors in the industry. Their data set is based on voluntary reporting by the fund managers, in this case focusing on real estate opportunity funds[5]. All of the firm identities have been withheld to protect confidentiality.

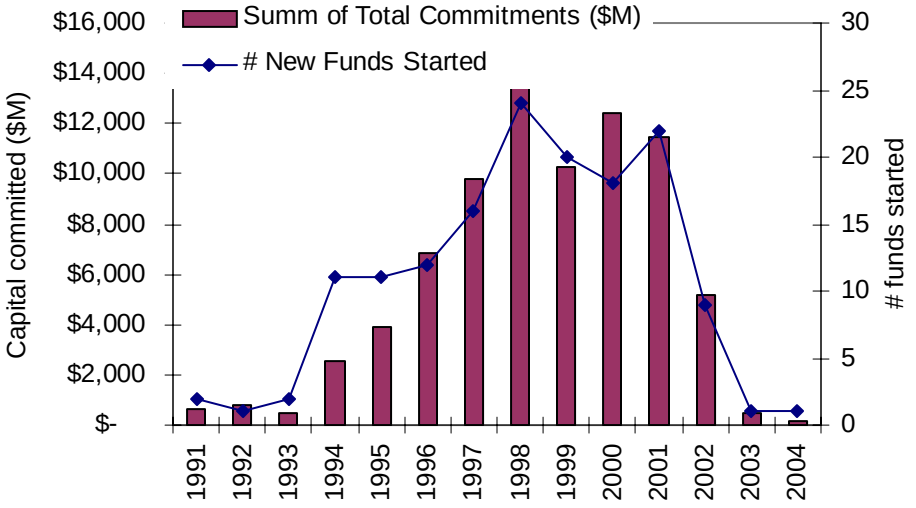
The data set herein examines firms with vintage years between 1991 and 2004. Cathy C. Hahn used a previous version of the database with returns through vintage year 2001 in her 2003 study referenced above. The rapid growth of the opportunity fund industry can be clearly seen in the sharp increase in the number of funds created in later years. From the original data set with 43 managers and 110 funds started between 1991 and 2001, PCA has increased their sample to 65 managers and 200 funds started through 2004.

The data set was cleared from 55 incomplete questionnaires. Of those deleted funds, 32 correspond to new reported funds between 2002-2004, for which there is no performance measure since deployment of the capital has not yet been realized. Of the remaining funds, only 18 firms (35% of the population) had raised one single opportunity fund. In fact, of the 51 firms finally analyzed, 24 of them (47% of the set) have managed three or more funds in the considered period. The data reveals the spectacular growth in the number of opportunity funds originated, growing from the 2 funds reported in 1991 to the 23 funds documented in 1998. In the later years, we see a sharp diminution in the number of funds and total capital, however this is probably due to the data clearing of the uncompleted questionnaires.

[5] More detailed background on real estate opportunity funds and survivorship/selection bias can be found in Cathy Hahn, "Real Estate Opportunity Funds: Past Fund Performance as an indicator of subsequent fund performance", MS thesis, MIT, 2003, pp. 6-12.

The total investment in Real Estate opportunity funds considered in the analyzed data adds up to 79 Billion US$ once cleared of the uncompleted questionnaires[6].



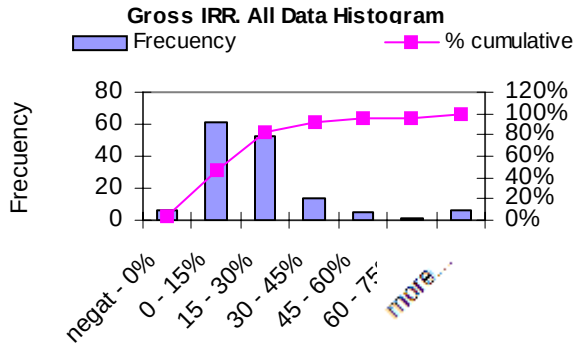


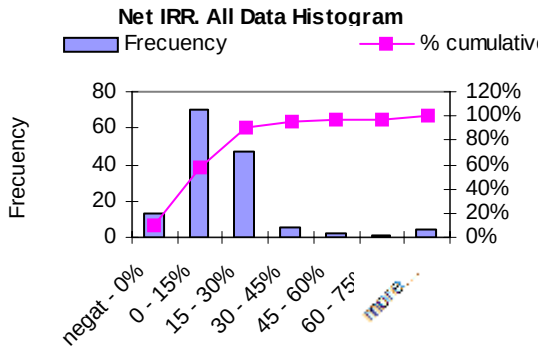
The performance data disclosed by PCA falls into two mayor categories: (1) performance measures from funds that have been liquidated, and (2) the performance measures estimated by the managers of funds that are still active. As discussed by Cathy Hahn, the performance data of

[6] Considering even the incomplete data, the committed capital adds up to over a $100 Billions in the 1991-2004 period.

funds still active represent an added difficulty, since the valuation of the residual asset is calculated with heterogeneous criteria.

Opportunistic real estate funds share a common characteristic with general private equity funds: being highly illiquid and not subject to constant market valuation (as is the case with mutual funds). Thus, the performance of a fund is characterized by a single return measure, which is calculated at the end of the end of the life of the fund. The returns provided by PCA data set are either Gross Internal Rate of Return (IRR) or IRR Net of management fees and carried interests. Only 4% of the funds report negative gross results, but once fees are deducted, 9% of the funds end up with losing Net IRRs.

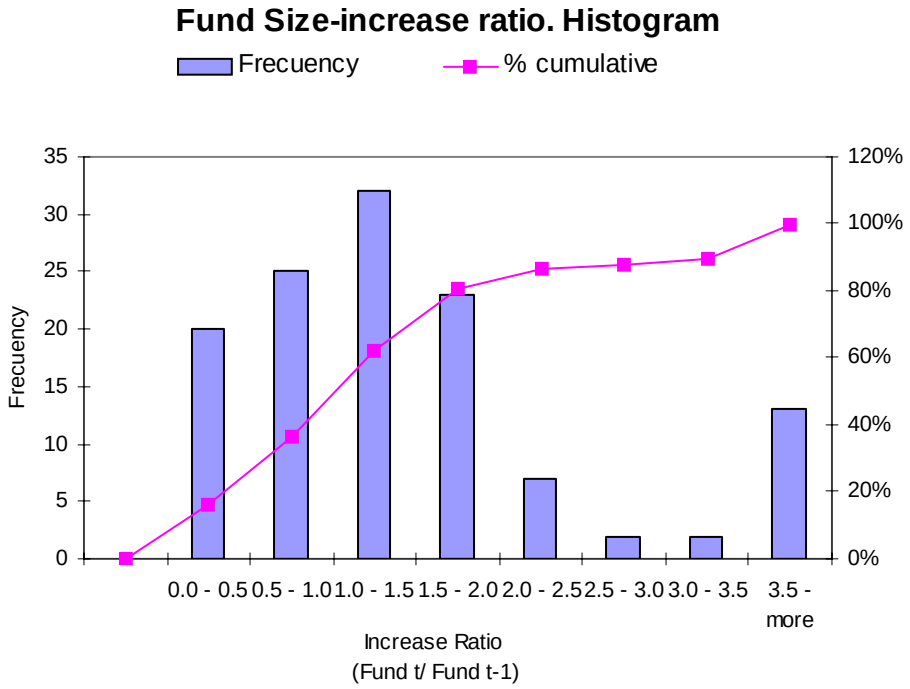


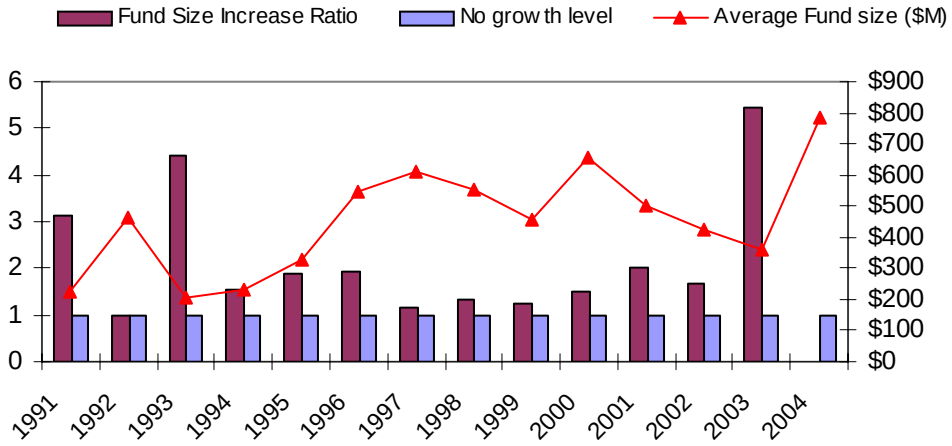


The overall Average Gross IRR for the set is 24%, falling to an Average Net IRR of 15%, which is in line with the general expectations of the capital market for such opportunistic funds. Average Performance of funds also varies across time through the period of study. Again, in the early years, and again in the later years, we find surprising returns due to the limited number of data points.

Vintage Year	Average Gross IRR	Average Net IRR	Weighted Avg. Gross IRR	Weighted Avg. Net IRR
1991	38%	35%	43%	40%
1992	22%	18%	22%	18%
1993	32%	28%	26%	24%
1994	21%	18%	20%	17%
1995	22%	17%	20%	12%
1996	16%	11%	16%	9%
1997	10%	8%	7%	6%
1998	14%	10%	13%	9%
1999	35%	16%	16%	6%
2000	30%	22%	33%	23%
2001	31%	12%	38%	22%
2002	33%	15%	47%	21%
2003	104%	84%	104%	84%
2004	20%	9%	20%	9%

The size of each fund, in the form of Total Committed Capital, is also reported in the data set. Over 1/3 of the funds subsequently raised by a firm decrease in size from its previous fund. Another ¼ of the funds raised represent an increase from a previous fund of up to 50%. The remaining 38% of the funds experiment an explosive growth above 1.5 times the previous fund. Furthermore, 47 funds of the total data set have a subsequent fund that, at the very least will duplicate them in size.





IV. Prior Results and Methodology: (As Documented in Prior Thesis by Cathy C. Hahn (2003)

This thesis is being performed to update and enhance a prior MIT thesis: "Past Fund Performance as an indicator of Subsequent Fund Performance" (Cathy C. Hahn 2003). The

prior thesis was based on similar data set provided by Pension Consulting Alliance, with data consisting of 43 managers and 110 funds started between the years 1991-2001. The methodology used in her thesis utilized both parametric and non-parametric tests. The parametric tests consisted of regressing fund performance on past fund performance (normalized ranking based on vintage year pears), as well as other fund characteristics as independent variables. Non-parametric tests included analyzing the Spearmen rank correlation coefficient and the Kendall coefficient, as well as constructing and analyzing contingency tables with the chi-squared test and cross-contingency tables. A detailed description of the tests mentioned above can be found in the methodology section of this thesis. The tests were performed on all of the data, as well as funds with a vintage year from 1991-1997, when appropriate. Limiting the data set to funds with a vintage year 1991-1997 allows for a more reliable measure of returns, but significantly reduces the sample size. Some of the key findings from the prior thesis are summarized below.

The Spearmen rank correlation was conducted using subsequent pairs of funds. The results of the Spearman rank correlation indicated a strong correlation between rankings for both net and gross IRR resulting in the null hypothesis of no persistence to be rejected at a 99% confidence level. Similar results were achieved when the data set was limited to funds from 1991-1997. However, the null hypothesis could not be rejected when pairs were separated by a five-year lag. The analysis was then performed with Kendall's Tau and it produced similar results rejecting the null hypothesis at a 99% confidence interval. This test was not reproduced in this thesis due to the fact little enhancement would be achieved.

Contingency tables were then constructed using normalized rank and were assigned a Win/Loss rating based on their relation to the median ranking of their peers. The data produced

68 pairs when using all the reported funds and 23 pairs when using only funds with a vintage year between 1991-1997. The chi-squared test rejects the null hypothesis of no correlation in fund returns at the 99% confidence level when using pairs of all funds, and 97% confidence when restricting the data to vintage years 1991-1997.

The parametric test results also showed strong evidence of persistence. The first test regressed a fund's ranking on the ranking of the firm's previous fund, testing the null hypothesis that a fund's return is independent from the performance of the previous fund within the same firm. The results are strongly significant on both the gross and net numbers and the null hypothesis of no persistence can be rejected at the 99% confidence level. Limiting the funds to those with vintage years between 1991-1997 produces strong results as well. The null hypothesis can be rejected at the 99% confidence level for gross, and the 95% level for net returns. The adjusted R-square indicates as much as 24% of a fund's performance ranking is related to the performance of its manager's previous fund. When regressing the rankings of the previous two funds (Rt-1, Rt-2), the null hypothesis of no persistence can be rejected at the 90% confidence level for all cases with the exception of the analysis on gross IRR for all years. The coefficient for the t-1 coefficient is positive while the coefficient for the t-2 fund is negative.

V. Methodology

Various parametric and non-parametric tests have been used in the past to detect performance persistence in returns of various investment vehicles. This study incorporates methodology from the prior thesis (Hahn 2003) and contributes additional analysis in order to enhance and expand the results. Due to the fact that there is only one performance measure (IRR) for each fund, the analysis is based on the on the relationship between performance of one

fund and the performance of a subsequent fund of the same firm. Results of the tests previously performed in the prior thesis are also of interest, as a point of comparison, due to the increase in data and the addition of subsequent funds by the same manager.

The tests were run on both gross and net returns of the entire database and on data with vintage years from 1991-1997, when the sample size was deemed large enough. The funds with a vintage year of 1991-1997 are at or nearing the end of their life cycle, and therefore the reported returns have a higher probability of being realized, and are not based on manager's projections. However, limiting the data to the early year funds significantly reduces the data set.

Many of the firms report more than one fund with the same vintage year. Due to this factor, our analysis is performed at two different levels. The first being what we refer to as the "firm" level. When performing analyses at the firm level, returns and fund size from all funds started by a firm during a particular vintage year are averaged prior to being paired with a subsequent fund for analysis (example: Firm A started funds 1 and 2 during 1999 and funds 3 and 4 in 2001. Returns and commitment size from funds 1 and 2 would be averaged then paired with the average of funds 3 and 4.) The other level of analysis is what we refer to as the "fund" level. When performing analyses at the fund level, all possible combinations of pairs are made between funds of subsequent years (For example: Firm A starts funds 1 and 2 in 1999 and funds 3 and 4 in 2001. The funds are then arranged to make the following pairs 1-3, 2-3,1-4, 2-4). It is recognized that the multiple funds started by a firm in a single vintage year could be the result of funds with differentiated investment criteria or a fund raised for co-investment.[7] In either case, the funds are treated as separate funds because of the difference in strategy and exposure. In the prior thesis there were only a few instances of multiple funds originated in the same year. In

[7] A co-investment fund would consist of a fund raised to purchase a single asset due to exposure constraints of a diversified fund. The equity interest in the project could be split between the two funds.

those rare cases the returns were averaged which make them comparable (although not exact) to the firm level analysis performed in this thesis.

In order to allow the funds to be compared across different vintage years, the funds are ranked in comparison to their vintage year peers. The funds are given an absolute rank based on IRR with a rank of one being assigned to the highest IRR for that year. The absolute rankings are then normalized by using the equation:

$$NR = (n-r)/(n-1)$$

where n equals the number of funds in the given vintage year and r equals to the absolute rank of the fund. Rankings were assigned for both net and gross IRR's. In the "firm" level analysis where a firm has more than one fund in a given vintage year, the returns are averaged prior to being ranked. If there is only one fund in a vintage year, a normalized rank of .5 is awarded.

Contingency Tables

The first non-parametric test is the construction of contingency tables and application of the chi-squared test and the cross-contingency tables, which was part of the methodology employed in the prior thesis. This methodology has also been used in many other past studies of persistence such as Brown and Goetzmann (1995). The funds are organized into pairs, where the ranking of a firm's given fund is paired a subsequent fund from the same firm. The pairs are compiled at both the "firm" and "fund" level described above.

The first test analyzes how a fund's normalized ranking compares to the median ranking of the additional funds in their given vintage year. If a fund finished above the median, it was assigned a rating of "Win", and if the fund was at or below the median, it was rated a "Loss". The pairs were then assembled in a table based on the ranking of each fund in the pair: win/win.

win/lose, lose/win or lose/lose. A control matrix is then assembled by calculating the expected frequency if the outcomes were completely independent. The two tables are then analyzed using the chi-squared test to determine if the deviation from the expected frequency is statistically significant.

Additional tests were then performed to analyze persistence in the extremities of the rankings. An analysis was performed, awarding a "win" to those funds with a ranking in the top quartile (normalized ranking greater than or equal to .75), and a "lose" was given to the funds with a ranking in the bottom quartile (normalized ranking less than or equal to .25). If a firm earned a ranking placing them in either of the middle quartiles (greater than .25 or less than .75) it was assigned a rating of NS. Only the funds in the top or bottom quartile are paired with a subsequent fund, as we were specifically interested in the extreme performers. If a pair was awarded a win/ns or a lose/ns rating, it was assigned to the win/lose or lose/win quadrant in the contingency table. The results were then compared with the expected frequency using the chi-squared test. The test was also performed using the top third (greater than or equal to .66) and the bottom third (less than or equal to .33) as the win/lose criteria.

Regression Analysis

The first step of our regression analysis was to recreate some of the significant regressions previously performed by Cathy C. Hahn in the previous thesis, using the recent data. The first regression was performed by regressing the ranking of a fund onto the existence of a previous fund. A dummy variable was constructed to signal if the subject fund was the first fund originated by the firm. The formula for the regression is as follows:

$$NR \text{ (Normalized Rank)} = \alpha + \beta EF$$

where EF represents a dummy variable for the presence of an existing fund. This tests to see if a firm's lack of previous experience is affecting their returns in relation to their peers.

The next set of regressions is based on lagged performance. The first regression was performed by regressing the funds performance on the ranking of the firm's previous fund (LR). The equation for the regression is:

$$NR = \alpha + LR\beta$$

where NR equals normalized rank and LR equals the normalized rank of the preceding fund from the same firm. The analysis was repeated by regressing the funds ranking on the ranking of the firms previous two fund. The equation for the regression is:

$$NR = \alpha + LR\beta + LLR\delta$$

where NR again signifies normalized rank, LR represents the lagged rank from the firm's previous fund and LLR represents the ranking from the fund that precedes LR. A final regression was performed using at least a five-year lag. This paired a fund with a subsequent fund that was originated at least five years later. These regressions allowed us to test if past performance is positively correlated to future performance by the appearance of a positively signed coefficient on the independent variable. The different time periods used allow us to test for persistence in both the short and long-term.

Additional regression analysis was also performed based on the methodology employed in the working paper by Kaplan and Schoar (2003), testing for persistence in private equity funds. The first step of the regressions looked at the effect of fund characteristics on the returns. All of the regressions used year fixed effects to account for inter-year variations in returns. All returns for firms with more than one fund in a given year are reported on a weighted average basis for the year.

In the first test, the fund's current IRR regressed on the log of the fund's size and the log of the fund's sequence number. The regression forms the equation:

$$IRRt = \alpha + \beta Log(sizet) + \delta Log(sequencet)$$

where size is equal to the total equity committed to the fund and the sequence number is the number representing the origination order of the funds from the same firm. The next regression used the log(size) and log(sequence) independent variables again and also implements the squared functions of both variables. The second regression is represented by the equation:

$$IRRt = \alpha + \beta Log(sizet)2 + \delta Log(sequencet)2$$

By squaring the independent variables, we are able to look at the functional form of this relationship. We then repeated the regressions using the equations above, but this time we implement firm fixed effects to see the results of the characteristics on funds within the same firm.

The second part of Kaplan and Schoar's (2003) analysis incorporated the lagged returns into the regression. Again, all of the regressions incorporated year fixed effects into the analysis; however, firm fixed effects cannot be used in conjunction with a lagged return in the independent variable. In the first regression, current returns represent the dependent variable while the return of the firm's previous fund was used as the independent variable. This was done to indicate weather prior performance is positively correlated with the current returns by obtaining a positive coefficient in the IRR t-1 independent variable. The regression equation is:

$$IRRt = \alpha + \beta IRR\ t\text{-}1$$

The next analysis followed the same methodology, but regresses current returns on the two previous funds from the same firm. This will analyze the effect of the two previous funds on the current returns. The empirical specification is as follows:

$$IRR\ t = \alpha + \beta IRR\ t\text{-}1 + \delta IRR\ t\text{-}2$$

In the final regression, second previous fund (IRRt-2) represents the only independent variable and is regressed into the current returns. This will show us the correlation between the second previous fund and the current returns. The empirical equation is:

$$IRRt = \alpha + \beta IRR\ t\text{-}2$$

VI. Results and Analysis

Contingency Tables

Contingency tables were constructed using pairs of subsequent funds by the same firm. The first test compared the funds normalized ranking to the median ranking of their vintage year peers. If a fund was rated above the median it was awarded a "win" rating and if it was at or below the median it was assigned a "loss". The pairs were then compiled into a contingency table, with a quadrant representing each possible scenario: win/win, win/lose, lose/win or lose/lose. The null hypothesis is that the first ranking and second ranking are unrelated, giving an expected frequency in each cell of the matrix of one-quarter of the total number of pairs. The tests were run on both gross and net numbers and at both the fund and firm level (described in Methodology Section). The results are shown below.

FIRM LEVEL
Division by Median - All Fund Years

Observed Frequencies

GROSS

	W	L
W	19	19
L	14	25

NET

	W	L
W	21	16
L	14	24

Expected Frequencies

	W	L
W	19.25	19.25
L	19.25	19.25

Total 77

	W	L
W	18.75	18.75
L	18.75	18.75

Total 75

Chi-squared: Gross 0.075656
Net 0.067341

FUND LEVEL
Division by Median - All Fund Years

Observed Frequencies

GROSS

	W	L
W	26	21
L	21	36

NET

	W	L
W	27	21
L	21	36

Expected Frequencies

	W	L
W	26.00	26.00
L	26.00	26.00

Total 104

	W	L
W	26.25	26.25
L	26.25	26.25

Total 105

Chi-squared: Gross 0.016309
Net 0.016556

At the firm level, the Chi-Squared statistic for all years was .0756, and .0673 for gross and net IRR, respectively. This indicates there is a 7.56% chance of obtaining this distribution for gross IRR if the rankings are in fact independent. The percentage decreased to a 6.73%

chance when using net IRR. The null hypothesis of no correlation can then be rejected at the 92% level for gross and the 93% level for net. These are less significant findings than that of the previous thesis (Hahn 2003), where both scenarios were rejected at the 99% confidence level.

At the fund level, the chi-squared tests for all years based on gross and net IRR were .0163 and .0165, respectively. This indicates that the null hypothesis of no correlation can be rejected at the 98% confidence interval for both cases. Per Brown and Goetmann (1995), cross-product ratios were calculated as well. The results are consistent with the chi-squared test as the fund level results show a higher degree of persistence by rejecting the null hypothesis of no correlation at the 96% and 97% confidence level for gross and net returns, respectively.

FUND LEVEL		**Ratio**	**$\delta_{ln(CPR)}$**	**log-odds**	**Z-stat**	**Significance**
Median	**GROSS**	2.12	0.402	0.753	1.873	3.1%
	NET	2.20	0.400	0.790	1.975	2.4%
FIRM LEVEL		**Ratio**	**$\delta_{ln(CPR)}$**	**log-odds**	**Z-stat**	**Significance**
Median	**GROSS**	1.79	0.466	0.580	1.246	10.6%
	NET	2.25	0.472	0.811	1.716	4.3%

The contingency tables were constructed using only the data from 1991-1997. Theses funds are assumed to be fully invested, giving more reliability to their returns.

Firm Level
Division by Median - 1991-1997

Observed Frequencies

GROSS

	W	L
W	6	4
L	3	9

NET

	W	L
W	7	4
L	3	7

Expected Frequencies

	W	L
W	5.50	5.50
L	5.50	5.50

Total 22

	W	L
W	5.25	5.25
L	5.25	5.25

Total 21

Chi-squared: Gross 0.050699
Net 0.119141

The chi-squared tests in the table above reject the null hypothesis of no correlation at the 94% confidence level. The net results are not as significant; the null hypothesis can only be rejected at the 88% confidence interval and in deemed statistically insignificant.

FUND LEVEL
Division by Median - 1991 - 1997

Observed Frequencies

GROSS

	W	L
W	11	5
L	2	14

NET

	W	L
W	11	6
L	3	12

Expected Frequencies

	W	L
W	8.00	8.00
L	8.00	8.00

Total 32

	W	L
W	8.00	8.00
L	8.00	8.00

Total 32

Chi-squared: Gross 0.000796
Net 0.009375

The results at the fund level show much more persistence than the firm level for the 1991-1997 time period. The null hypothesis of no correlation can be rejected at the 99% confidence level. Cross-product ratios were calculated for the 1991-1997 as well. The cross product ratios produce similar results to the chi-squared test. The fund level results are stronger than the firm level and the gross results are stronger than the net. All of the results significantly reject the null hypothesis of no correlation.

FIRM LEVEL 1991-1997		Ratio	$\delta_{ln(CPR)}$	log-odds	Z-stat	Normal Dist	Significance
Median	GROSS	4.50	0.928	1.504	1.621	0.947	5.3%
	NET	4.08	0.932	1.407	1.509	0.934	6.6%
FUND LEVEL 1991-1997		**Ratio**	$\delta_{ln(CPR)}$	**log-odds**	**Z-stat**	**Normal Dist**	**Significance**
Median	GROSS	15.40	0.929	2.734	2.945	0.998	0.2%
	NET	5.24	0.817	1.656	2.027	0.979	2.1%

Additional analysis was performed awarding a “win” to those funds with a ranking in the top quartile (normalized ranking greater than or equal to .75) and a “lose” was given to the funds with a ranking in the bottom quartile (normalized ranking less than or equal to .25). If a firm earned a ranking in the middle quartiles (greater than .25 or less than .75), it was assigned a rating of NS. Only the pairs with a first fund ranking in the top or bottom quartile (win or lose) were paired with subsequent funds, as the objective was to analyze the persistence in the extreme performers. This criterion reduced the sample size at the fund level to 59 for gross and 64 for net and 43 and 42 at the firm level for gross and net, respectively. The results are shown below.

FIRM LEVEL
Division by Quartile

\

Observed Frequencies

GROSS

	W	L
W	9	12
L	14	8

NET

	W	L
W	9	13
L	16	6

Expected Frequencies

	W	L
W	5.38	16.13
L	16.13	5.38

Total 43

	W	L
W	5.50	16.50
L	16.50	5.50

Total 44

Chi-squared: Gross 0.024456
Net 0.081723

FUND LEVEL
Division by Quartile

Observed Frequencies

GROSS

	W	L
W	10	14
L	24	11

NET

	W	L
W	12	17
L	23	12

Expected Frequencies

	W	L
W	7.38	22.13
L	22.13	7.38

Total 59

	W	L
W	8.00	24.00
L	24.00	8.00

Total 64

Chi-squared: Gross 0.015500
Net 0.013646

The results of the chi-squared test for the Firm level are .0244 and .0817 for gross and net, respectively. These results reject the null hypothesis of no correlation at the 97% and 91% confidence level, respectively. As was the case at the median level, the results at the fund level are much more significant. The null hypothesis can be rejected at the 98% confidence level for both gross and net returns. It is interesting to note that, for gross returns at the firm level,

evidence of persistence is much higher in the extremes (top and bottom quartile) than at the median.

The test was also performed using the top third (NR greater than or equal to .66) and the bottom third (NR less than or equal to .33) as the win/lose criteria. The results are shown below.

FIRM LEVEL
Division by Thirds
Observed Frequencies

GROSS

	W	L
W	13	15
L	15	12

NET

	W	L
W	13	15
L	16	10

Expected Frequencies

	W	L
W	9.17	18.33
L	18.33	9.17

Total 55

	W	L
W	9.00	18.00
L	18.00	9.00

Total 54

Chi-squared: Gross 0.054710
Net 0.106117

FUND LEVEL
Division by Thirds
Observed Frequencies

GROSS

	W	L
W	16	18
L	24	17

NET

	W	L
W	16	21
L	24	17

Expected Frequencies

	W	L
W	12.50	25.00
L	25.00	12.50

Total 75

	W	L
W	13.00	26.00
L	26.00	13.00

Total 78

Chi-squared: Gross 0.031972
Net 0.081313

The Chi-squared results are .054 and .106 for gross and net firm level returns, respectively. The null hypothesis of no persistence can be rejected at the 94% level for gross and is insignificant for the net returns (89%). The chi-squared test results for the fund level analysis are .0319 and .0813 for net, allowing the null hypothesis to be rejected at the 96% and 91% confidence levels, respectively. These results are consistent with prior contingency tables. There seems to be a stronger level of persistence at the fund level versus the firm level. There also appears to be stronger evidence of persistence in the gross returns when compared to the net results. This may be attributed to the fee structure, where most of the abnormal returns are being absorbed by the manager, which is typical of a standard carried interest structure set up to compensate the manager for good performance.

It is also interesting to see where the persistence occurred. When analyzing persistence with win/lose based upon the median, essentially all the occurrences above the expected frequency are located in the lose/lose column. This is consistent with what has been found in mutual funds, with the highest level of persistence found in the poorly performing funds. This demonstrates that the market fails to consistently discipline under performers. This phenomenon forces the question of how the under performing funds are able to raise subsequent funds. Is it due to salesmanship? Are they constantly selling another strategy? Is there too long of a return lag for the market to realize the under performance and discipline a firm? These questions present another interesting study in itself. It is also interesting to note that when there is strong evidence signifying that persistence is correlated to the individual firms. Very few firms (at both the median fund and firm level) that showed persistence results (win/win or lose/lose) and were able to raise additional funds were likely to repeat the results. This differs from a previous study

on the mutual fund industry, where persistence was found to be correlated across managers, signifying heard behavior (Brown and Goetzmann 2005).

When analyzing persistence in the extremes (quartiles and thirds), the data produces different results. The results show the probability of win/win and lose/lose to be virtually equal and persistent. This illustrates that performance in the extremes is just as likely to be from exceptional performance than from poor performance.

Firm Level – Median				
	Gross		Net	
	Actual	Expected	Actual	Expected
WW	19	19.25	21	18.75
LL	25	19.25	24	18.75

Fund Level - Top Quartile			
Gross		Net	
Actual	Expected	Actual	Expected
26	26	27	26.25
36	26	36	26.25

Firm Level – Top Quartile				
	Gross		Net	
	Actual	Expected	Actual	Expected
WW	9	5.38	9	5.38
LL	8	5.38	6	5.38

Fund Level - Top Quartile			
Gross		Net	
Actual	Expected	Actual	Expected
10	7.38	12	8
11	7.38	12	8

Firm Level - Top Third				
	Gross		Net	
	Actual	Expected	Actual	Expected
WW	13	9.17	13	9
LL	12	9.17	10	9

Fund Level - Top Quartile			
Gross		Net	
Actual	Expected	Actual	Expected
16	12.5	16	13
17	12.5	17	13

Regression Analysis

In the first part of our regression analysis, we replicated some of the tests that were done in the previous thesis (Hahn 2003), using the updated data. The regressions were performed on both gross and net rankings, at the fund and firm level (described in methodology section). The firm level results provide the best comparison to the results achieved in the prior thesis, although

the methodologies are not exact. These regressions used the ranking of the funds from the previous section as the indicator of performance.[8]

The first test regressed a fund's rank on a dummy variable, indicating if the fund represents the firm's first fund. The number of observations available for analysis has increased from 110 to 128 at the firm level, and 145 at the fund level. The results of this regression show the effect of prior experience on a fund's ranking.

FIRM LEVEL - All Years	Gross	Net
Adjusted R2	-0.005	-0.007
First Fund DV	-0.03	-0.02
t-stat	-0.56	-0.37
p-value	57.44%	71.35%
Intercept	0.52	0.50
t-stat	11.69	11.06
p-value	0.00%	0.00%

FUND LEVEL - All Years	Gross	Net
Adjusted R2	-0.001	-0.006
First Fund DV	-0.05	-0.02
t-stat	-0.95	-0.44
p-value	34.53%	66.33%
Intercept	0.53	0.52
t-stat	12.16	11.73
p-value	0.00%	0.00%

The results of the regression are similar to those achieved in the prior thesis (Hahn 2003). None of the variables are significant, but as was pointed out in the prior thesis, the coefficients are negative. This suggests that firms that outperform peers on one fund are able to raise a subsequent fund, but are unlikely to outperform again.

The next regression regresses a fund's rank on the firm's previous fund's rank. The null hypothesis is: A fund's ranking is independent of the firm's prior fund's performance. The results are summarized in the table below.

[8] The rankings are uniformly distributed, versus normal distribution, may provide a degree of error in the results. A few of the regressions were tested by running a "orbit probit regression" to correct for the distribution and the results were not significantly different.

FIRM LEVEL - All Years	Gross	Net
Adjusted R2	0.043	0.031
LR	0.21	0.19
t-stat	2.11	1.83
p-value	3.86%	7.15%
Intercept	0.38	0.40
t-stat	6.35	6.44
p-value	0.00%	0.00%

FUND LEVEL - All Years	Gross	Net
Adjusted R2	0.041	0.016
LR	0.20	0.14
t-stat	2.32	1.62
p-value	2.21%	10.74%
Intercept	0.39	0.43
t-stat	7.79	8.38
p-value	0.00%	0.00%

The results indicate that the null hypothesis of a fund's current performance is independent of prior fund performance can be rejected at the 97% and 95% confidence level for fund and firm level gross rankings, respectively. The net results are not as strong, with the fund level rejecting the hypothesis at the 92% confidence level, and insignificant at the fund level (89%). Again, this indicates a weaker relationship between previous and future fund performance based on net ranking measures. It is also important to note that the adjusted R2 from the current analysis (4.3%) is significantly lower than the adjusted R2 reported in the previous thesis (24%). Results for 1991-1997 were similar (not reported).

Another regression was performed using the prior ranking of the manager's two previous funds as the independent variables. The results for firm and fund level are shown below.

FIRM LEVEL - All Years		
	Gross	Net
Adjusted R2	0.065	0.018
LLR	-0.04	0.07
t-stat	-0.32	0.50
p-value	75.33%	61.79%
LR	0.33	0.24
t-stat	2.23	1.51
p-value	3.10%	13.76%
Intercept	0.34	0.33
t-stat	3.50	3.14
p-value	0.11%	0.32%

FUND LEVEL - All Years		
	Gross	Net
Adjusted R2	0.057	0.019
LLR	-0.08	-0.06
t-stat	-0.79	-0.57
p-value	43.32%	57.25%
LR	0.27	0.22
t-stat	2.49	1.84
p-value	1.51%	6.96%
Intercept	0.41	0.43
t-stat	5.87	5.81
p-value	0.00%	0.00%

The results indicate that the previous fund's ranking (LR) has a statistically significant positive effect on the current fund for all tests except firm level net returns. In the prior thesis, the second previous fund's ranking (LLR) was statistically significant and had a negative coefficient. The LLR coefficient in the current analysis is not statistically significant at any level, but remains negative. The coefficients imply that a firm's subsequent fund will perform well, but the third fund will revert to the mean.

Due to the investment strategy of opportunity funds, it may take several years after inception to clearly define fund performance. Therefore, it would be difficult for an investor to make a decision based on persistence in the early years of a fund's existence. The final regression uses makes all possible pairs of funds separated by at least a five-year lag.

FIRM LEVEL - All Years		
	Gross	Net
Adjusted R2	-0.028	0.077
5-Y LR	-0.02	0.26
t-stat	-0.19	1.96
p-value	85.39%	5.83%
Intercept	0.46	0.33
t-stat	6.01	4.87
p-value	0.00%	0.00%

FUND LEVEL - All Years		
	Gross	Net
Adjusted R2	-0.016	0.008
5-Y LR	0.03	0.13
t-stat	0.32	1.20
p-value	75.26%	23.36%
Intercept	0.46	0.48
t-stat	7.51	7.52
p-value	0.00%	0.00%

These regression results are statistically insignificant, except for firm level net ranking. This coefficient is significant and indicates a positive correlation. The analysis in the prior thesis paired a fund with the most recent subsequent fund with at least a five-year lag in between, which resulted in 13 pairs. Coefficients for both the gross and net results were statistically significant and negative. The current analysis is a slight variation of the previous regression, by making all possible pairs with at least a five-year lag. This methodology resulted in 58 pairs.

The next set of regression analysis employs a methodology previously performed in a working paper by Kaplan and Schoar (2003) on a private equity returns. It explores how fund returns correlate with partnership and fund characteristics and tests for persistence in the returns. The dependent variable in all cases is the IRR-based returns for the fund. In cases where funds started more than one fund in a vintage year, a weighted average of the return is taken. Independent variables consist of size (equity commitments to the fund), sequence number (the order of funds started within the same firm) and historical lagged returns. Results are shown in the table below. Year fixed effects are used in all calculations to adjust for large inter-year variations in returns.

Dependent Variable - Gross IRR					
column	1	2	3	4	5
Log (Size)	**0.0382**	**0.0508**	**0.0374**	**-0.1098**	**-0.46078**
Std. Error	0.0448	0.1171	0.0448	0.0951	0.4299
P-Value	0.396	0.665	0.406	0.253	0.288
Log (size)2		**-.0013**			**0.0719**
Std. Error		0.0269			0.0877
P-Value		0.96			0.671
Log (Sequence)	**.0215**	**0.0815**		**0.0444**	**-0.0305**
Std. Error	0.0960	0.2518		0.283	0.3047
P-Value	0.823	0.747		0.876	0.92
Log (Sequence)2		**-0.1693**			**0.222**
Std. Error		0.3539			0.4427
P-Value		0.652			0.618
First Dummy			**0.0026**		
Std. Error			0.0486		
P-Value			0.956		
Firm FE	No	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R2	.49	0.48	0.49	0.66	0.65
N of Observ.	128	128	128	128	128

The first three columns show the cross-sectional relationship between fund performance and fund characteristics, without firm fixed effects. Column (1) uses log(size) and log(sequence) as the independent variables. Neither of the point estimates on the variables is significant. Nonetheless, the estimates show that larger funds have higher sequence numbers and realize higher returns. These coefficients are similar results to those achieved in the Kaplan and Schoar private equity analysis.

In column (2), the squared terms of log(Size) and log(Sequence) are included as coefficient on the independent variables to analyze the functional form of this relation. The point estimate on the linear term of log(size) increases when the when the log(size)2 function is included and the analysis, and the coefficient on the log(size) squared function is negative.

Although they are not significant, the coefficients on the independent variables signify a concave relationship between fund size and performance. This indicates that larger funds will have better performance until they become too large, at which time their returns will decline. The results for sequence numbers portray the same concave relationship as size. These findings are similar to Kaplan and Schoar's (2003) findings with private equity funds, but unlike our results, theirs showed statistical significance.

The results in column 3 use a dummy variable to show the effect of having a previous fund on the current returns. The coefficient is insignificant, but slightly positive. A similar regression performed above using rankings was insignificant, but slightly negative.

In column (4) we use the same independent variables in column (1), but we add firm fixed effects. Again, none of the coefficients are statistically significant, but results are similar to Kaplan and Schoar (2003) when analyzing the coefficients. In the linear specifications in column (4), the sign on the fund size coefficient variable becomes negative [from results in column (1)] while the sequence number coefficient does not. The fund size result indicates that while larger funds have higher returns [as shown in column (1)], when a firm raises a subsequent fund that is larger, the returns on the subsequent funds will decline. The sequence number result stays positive with the firm fixed effects turned on. This indicates if the same manager raises a subsequent fund the returns will increase, so long as the subsequent fund does not grow in size.

Column (5) repeats the regression from column (2), but with firm fixed effects turned on. The results indicate a convex relationship with both size and sequence. These findings are in line with the previous results. These results infer that fund returns will decrease as additional funds of increased size are raised. Again, the coefficients were similar to those found by Kaplan and Schoar, but our results lack statistical significance.

As noted in the Kaplan and Schoar (2003) study, the first sign of persistence is seen in the increase in the R2 with the addition of firm fixed effects in columns (4) and (5). The R2 from the regressions in columns (1) and (3) increase by 35% when the firm's fixed effects were included in columns (4) and (5). The outcome on including the firm fixed effects shows that partnerships vary systematically in their returns.

It should be noted that none of our variables in the replication of the Kaplan and Schoar (2003) analysis above were significant. However, the results and implication of the coefficients were very similar to their findings. Private equity is a much more mature industry than that of real estate opportunity funds. Therefore, the private equity study had many more data points (746), which were of higher certainty, due to the fact that the data was limited to funds in the later stages of their cash flow life cycle.

The next part of the Kaplan and Schoar (2003) study implemented lagged returns into the regression to test for persistence. Several regressions using lagged IRR from the previous two funds were performed. Year fixed effects are implemented in every regression. Due to the fact that a lagged IRR is used in the right hand side variable, we cannot simultaneously control for firm fixed effects. The results of the regression are shown below.

Dependent Variable – Gross IRR				
column	1	2	3	4
IRR t-1	**0.499**	**0.867**		**0.782**
Std. Error	0.269	0.452		0.492
P-Value	0.069	0.065		0.123
IRR t-2		**-0.299**	**-0.354**	**-0.434**
Std. Error		0.522	0.823	0.587
P-Value		0.572	0.669	0.465
Log (Sequence)				**-0.247**
Std. Error				0.444
P-Value				0.581
Log (Size)				**0.040**
Std. Error				0.117
P-Value				0.732
Firm FE	no	no	no	no
Year FE	yes	yes	yes	yes
Adjusted R2	0.52	0.52	0.26	0.50
N of Observ.	77	44	44	44

In Column (1) of the table above, IRR is regressed onto the IRR of the previous fund. The coefficient is statistically significant and positive. The point estimate is 0.54, which implies a fund with a 1-unit higher performance in the current fund is associated with a 54 basis point increase in the subsequent fund. These results are consistent with the findings in the private equity industry and with the prior regressions based on ranking.

In column (2), the IRR for the previous two funds are included as right hand side variables. The results produce a significant positive coefficient on the previous fund (LR) and an insignificant negative coefficient on the second previous fund (LLR). This is consistent with the results of the prior regressions run on rankings. The negative sign of the second lagged variable suggests that the fund may be mean reverting.

Due to the negative sign on the increased size and second previous fund coefficients, additional tests were performed to determine the effect of growth on the returns. A growth factor was calculated and regressed with size and lagged IRR. The growth coefficient was negative, but it did not remove the negative sign from the log(size) coefficient. An additional regression was ran with log(size), lagged IRR, and a variable that interacted lag IRR with a dummy variable set at growth of 1.75 times. These results were similar to the other regression. This leads one to believe that growth may have a negative effect on the returns, but it is not the only factor contributing to the negative size coefficient.

The regressions were also performed on the net return numbers. The results are similar to that of those found using the gross number. There is one notable difference, however. The log(size) coefficient in column (4) below is negative and significant. The coefficients in the net and gross regressions are similar, but the net result is significant. The fund characteristic regressions are summarized in the tables below.

Dependent Variable - Net IRR					
column	1	2	3	4	5
Log (Size)	**0.0097**	**-0.0397**	**0.01333**	**-0.1299**	**-0.4917**
Std. Error	0.0353	0.1367	0.0346	0.0698	0.317
P-Value	0.783	0.772	0.702	0.068	0.126
Log (size)2		**0.012**			**0.0752**
Std. Error		0.0309			0.0649
P-Value		0.698			0.251
Log (Sequence)	**0.0394**	**0.0984**		**-0.1581**	**-0.1979**
Std. Error	0.0717	0.193		0.2051	0.2215
P-Value	0.55	0.611		0.444	0.375
Log (Sequence)2		**-0.967**			**0.1099**
Std. Error		0.2736			0.3304
P-Value		0.724			0.74
First Dummy			**-0.0242**		
Std. Error			0.0371		
P-Value			0.515		
Firm FE	no	No	no	yes	Yes
Year FE	yes	Yes	yes	yes	Yes
Adjusted R2	0.42	0.41	0.49	0.63	0.63
N of Observ.	125	125	125	125	125

The regressions were also performed on the net lagged returns in search of evidence of persistence (not reported). The results were very insignificant and showed no signs of persistence. This is similar to the findings in a majority of the tests where evidence of persistence is more prevalent in the gross versus the net returns.

VII. Conclusion

This thesis confirmed many of the findings from Cathy C. Hahn's thesis: "Real Estate Opportunity Funds: Past Fund Performance as an Indicator of Subsequent Fund Performance" (2003) with regard to persistence in real estate opportunity fund returns. The returns were tested

for persistence through the construction and analysis of contingency tables and regression analysis. Although the level of certainty may have decreased in some of the tests performed, the overall results remained statistically significant and showed strong evidence of performance persistence. The persistence was evident when the analysis was performed on the entire database, and when it was restricted to funds with a vintage year between 1991-1997. Consistent with the prior thesis, the current tests found the performance to generally be less persistent in the net returns. This fact leads us to believe that firms absorb the excess return achieved by the way of fees.

Through the construction of contingency tables and analysis with the chi-squared and cross-product ratio tests, strong evidence of performance persistence was found. The study revealed that persistence found using the median ranking as the win/lose divider is weighted toward the poorly performing funds, which is consistent with prior studies performed on persistence in mutual funds [eg. Hendricks, Patel, and Zeckhauser (1993), Shukla and Trzcinka (1994), Brown and Goetzmann (1995), Carhart et al. 1996)]. A higher degree of persistence was also found when analyzing funds consistently finishing in the top or bottom quartile in relation to their vintage year peers. Unlike the median results, the persistence in the extremes was represented by virtually an equal number of persistent winners and losers. When analyzing the output, it was also apparent that the persistence was firm specific. Regardless of whether a fund was a winner or a loser, they were able to raise subsequent funds and were likely to repeat their performance. This differs from a previous study on the mutual fund industry, where persistence was found to be correlated across managers, signifying herd behavior (Brown and Goetzmann 2005). It is difficult to understand why the market does not discipline the funds for poor performance. Are the subsequent funds raised purely through salesmanship? Are they

constantly selling new strategies or outlooks? Are subsequent funds raised in a time interval where the previous fund's returns are not yet realized? This presents an interesting topic for future study.

Regression analysis was also performed on the fund rankings, as was performed in the prior thesis. The results showed evidence of strong persistence between the current and subsequent fund, and a negative, yet insignificant coefficient when including the returns of the second previous fund. Regressions were also performed on ranking of funds with at least a five-year lag in between funds, however the results were insignificant.

An additional analysis was performed to analyze characteristics of fund performance, as well as to test the appearance of persistence in the returns. The tests were modeled after an analysis performed by Kaplan and Schoar (2003) on the private equity industry. The methodology included a more rigorous regression analysis than previously performed, using fund IRR as the dependent variable and fund characteristics and lagged returns as the independent variables. Year-and-firm fixed effects were also used to control to account for variations in returns.

The majority of results from our version of the study were statistically insignificant, but strikingly similar to the significant results found by Kaplan and Schoar. The coefficients in imply that the bigger funds perform better, but if the same firm raises a subsequent fund that grows in size, it's will negatively effect returns. The sequence variable was positively correlated with performance, which indicates that if a firm raises additional funds, returns will increase if they hold the size constant.

The next step of the analysis tested for persistence in the returns. When fund IRR was regressed on lagged IRR from the previous fund, the results showed a positive correlation that

was statistically significant. When the returns from the previous two funds were included as right hand side variables, it produced a significant positive coefficient on the previous fund (LR) and an insignificant negative coefficient on the second previous fund (LLR). The negative sign of the second lagged variable suggests that the fund may be mean reverting. This finding is different from the private equity results, but consistent with the prior regressions performed on normalized rank in the prior and current theses. This could be related to the fact that superior performance presumes that fund managers have the ability to pick undervalued investments. The market in which to find these investments is specialized, competitive, and potentially geographically constrained. In this environment, it is likely to be difficult to maintain continued superior performance, as the size of the fund expands and may lead to mean reversion in performance. Additionally, management structure becomes increasingly more important as the size of the organization grows.

Although a vast majority of our findings using the Kaplan and Schoar (2003) methodology were statistically insignificant, the resulting coefficients from the regressions told a similar story to that found in private equity. The private equity industry has a much longer history and a much more comprehensive database of historical returns than that of real estate opportunity funds. The Kaplan and Schoar (2003) study was performed on a data set of 746 funds when regressing on fund characteristics and 225 observations when using returns of two prior funds as independent variables. These observations only include funds that have matured and have realized a majority of the cash flows, making them less reliant on the manager's projections. The data used for the analysis in this thesis had 128 observations when regressing funds characteristics, and 44 observations when regressing the prior two years' returns. Of these observations used, only small portions of them are based on realized returns, allowing the returns

to be over estimated by overly optimistic managers. A minor abnormality in such a small sample size can have a significant impact on the findings. As the opportunity fund industry continues to grow, mature, and standardize the reporting process, the reliability of the data and subsequent results will increase dramatically. It would be enlightening to run these tests again in the future using more observations and seasoned data. We would expect the majority of the findings to hold true and show more statistical significance when the size of the database increases in the future.

VIII. Appendix

Fund LEVEL.- PARAMETRIC REGRESSIONS based on Normalized Rankings

Summary: Fund Level GROSS IRR existence of previous fund

Regression Statistics	
R^2	0.006
Adjusted R^2	-0.001
Standard Error	0.313
Observations	145

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.53	12.16	0.00%	0.45	0.62
First Fund	-0.05	-0.95	34.53%	-0.16	0.06

Summary: Fund Level NET IRR existence of previous fund

Regression Statistics	
R^2	0.001
Adjusted R^2	-0.006
Standard Error	0.314
Observations	146

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.52	11.73	0.00%	0.43	0.60
First Fund	-0.02	-0.44	66.33%	-0.13	0.08

Sumary: Fund Level GROSS IRR, One lag

Regression Statistics	
R^2	0.050
Adjusted R^2	0.041
Standard Error	0.287
Observations	104

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.39	7.79	0.00%	0.29	0.49
LR	0.20	2.32	2.21%	0.03	0.38

Sumary: Fund Level NET IRR, One lag

Regression Statistics	
R^2	0.025
Adjusted R^2	0.016
Standard Error	0.294
Observations	104

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.43	8.38	0.00	0.33	0.53
LR	0.14	1.62	0.11	-0.03	0.32

Sumary: Fund Level GROSS IRR Two prior funds (2 lags)

Regression Statistics	
R^2	0.083
Adjusted R^2	0.057
Standard Error	0.264
Observations	73

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.41	5.87	0.00%	0.27	0.54
LLR	-0.08	-0.79	43.32%	-0.27	0.12
LR	0.27	2.49	1.51%	0.05	0.48

Sumary: Fund Level NET IRR Two prior funds (2 lags)

Regression Statistics	
R^2	0.046
Adjusted R^2	0.019
Standard Error	0.291
Observations	73

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.43	5.81	0.00%	0.28	0.58
LLR	-0.06	-0.57	57.25%	-0.28	0.16
LR	0.22	1.84	6.96%	-0.02	0.46

Summary: Fund Level GROSS IRR 5 yrs or more lags

Regression Statistics	
R^2	0.002
Adjusted R^2	-0.016
Standard Error	0.269
Observations	58

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.46	7.51	0.00%	0.34	0.59
LR	0.03	0.32	75.26%	-0.18	0.24

Summary: Fund Level NET IRR 5 yrs or more lags

Regression Statistics	
R^2	0.026
Adjusted R^2	0.008
Standard Error	0.283
Observations	57

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.48	7.52	0.00%	0.35	0.61
LR	0.13	1.20	23.36%	-0.09	0.35

FIRM LEVEL.- PARAMETRIC REGRESSIONS

Summary: GROSS IRR, FIRM level existance of previous fund

Regression Statistics	
R^2	0.003
Adjusted R^2	-0.005
Standard Error	0.317
Observations	128

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.52	11.69	0.00%	0.43	0.61
AR	-0.03	-0.56	57.44%	-0.15	0.08

Summary: NET IRR, FIRM level existance of previous fund

Regression Statistics	
R^2	0.001
Adjusted R^2	-0.007
Standard Error	0.324
Observations	128

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.50	11.06	0.00%	0.41	0.59
AR	-0.02	-0.37	71.35%	-0.14	0.09

Summary: GROSS IRR Firm Level One Lag

Regression Statistics	
R^2	0.056
Adjusted R^2	0.043
Standard Error	0.285
Observations	77

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.38	6.35	0.00%	0.26	0.50
AR	0.21	2.11	3.86%	0.01	0.42

Summary: NET IRR Firm Level One Lag

Regression Statistics	
R^2	0.044
Adjusted R^2	0.031
Standard Error	0.294
Observations	75

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.40	6.44	0.00%	0.27	0.52
AR	0.19	1.83	7.15%	-0.02	0.40

Summary: Firm Level GROSS IRR: two lags (trios)

Regression Statistics	
R^2	0.109
Adjusted R^2	0.065
Standard Error	0.265
Observations	44.00

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.34	3.50	0.11%	0.14	0.53
LLR	-0.04	-0.32	75.33%	-0.29	0.21
LR	0.33	2.23	3.10%	0.03	0.62

Summary: Firm Level NET IRR: two lags (trios)

Regression Statistics	
R^2	0.064
Adjusted R^2	0.018
Standard Error	0.295
Observations	44.00

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.33	3.14	0.32%	0.12	0.54
LLR	0.07	0.50	61.79%	-0.21	0.34
LR	0.24	1.51	13.76%	-0.08	0.55

Summary GROSS IRR, +5 yrs lag. FIRM level

Regression Statistics	
R^2	0.001
Adjusted R^2	-0.028
Standard Error	0.276
Observations	36

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.46	6.01	0.00%	0.30	0.61
LR	-0.02	-0.19	85.39%	-0.29	0.24

Summary NET IRR, +5 yrs lag. FIRM level

Regression Statistics	
R^2	0.104
Adjusted R^2	0.077
Standard Error	0.283
Observations	35

	Coefficients	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.33	4.87	0.00%	0.19	0.47
LR	0.26	1.96	5.83%	-0.01	0.53

IX. Bibliography

Books

Bodie, Zvi, Kane, Alex , and Marcus, Alan. Investments, New York: McGraw-Hill, 2002.

Sprent, P. and Smeeton, N.C. Applied Nonparametric Statistical Methods, 3rd edition. New York: Chapman & Hall/CRC, 2001.

Articles

Brown, Stephen J. and Goetzmann, William N. "Performance Persistence." The Journal of Finance Vol 50 no.2 (June 1995), pp. 679-698.

Brown, Stephen J., Goetzmann, William N., Ibbotson, Roger G., and Ross, Stephen A. "Survivorship Bias in Performance Studies." The Review of Financial Studies Volume 5, no. 4 (1992), pp.553-580.

Carhart, Mark M. "On Persistence in Mutual Fund Performance." The Journal of Finance, 50, pp 57-82

Carpenter, Jennifer N. and Lynch, Anthony W. "Survivorship Bias and Attritin Effects in Measures of Performance Persistence." Dept. of Finance, Stern School of Business, New York University August 1999,

Gerardo Lietz, Nori, with Dewey, David, Mattox, Eliza, and Mouchakka, Denise. Real Estate Opportunity Funds: Déjà vu All Over Again." Pension Consulting Alliance, Inc., white paper, May 2003.

Christopherson, Jon A, with Ferson, Wayne E., Glassman, Debra A." Conditioning Manager Alphas on Economic Information: Another Look at the Persistence of Performance." The Review of Financial Studies Spring 1998 Vol 11, No.1, pp. 111-142.

Gerardo Lietz, Nori, with Chan, Denise, and Dewey, David. "Real Estate Opportunity Funds: The Numbers Behind the Story." Pension Consulting Alliance, Inc., white paper, May 2003.

Goetzmann, William and Ibbotson, Roger. "Do Winners Repeat?" The Journal of Portfolio Management Winter 1994 pp. 9-18.

Hahn, Cathy C. "Real Estate Opportunity Funds: Past Fund Performance as an indicator of Subsequent Fund Performance." Massachusetts Institute of Technology, MS Thesis, Sept. 2003.

Hendricks, Darryl, Patel, Jayendu and Zeckhauser, Richard. "Hot Hands in Mutual Funds: Short-Run Persistence of Performance in Relative Performance, 1974-1988". The Journal of Finance (March 1993), pp. 93-130.

Kaplan, Steve and Schoar, Antoinette. “Private Equity Performance: Returns, Persistence and Capital Flows.” MIT Sloan School of Management, working paper, November 2003

Shukla, R. and Trzcinka, C. “Persistent Performance in the Mutual Fund Market: Tests with Funds and Investment Advisors,” Review of Quantitative Finance and Accounting 1993m 115-136

Additional Sources

Oxford University statistics resource website, http://www.stats.ox.ac.uk/~marchini/teaching/booklets/fb.pdf.

Pension Consulting Alliance, Inc. website, http://www.pensionconsulting.com