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Measuring Performance within the Private Equity Industry

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MEASURING PERFORMANCE WITHIN

THE PRIVATE EQUITY INDUSTRY

By

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Previous academic literature examining the performance of private equity funds has documented that the average private equity fund has failed to outperform public equity markets. This underperformance coupled with a greater risk-return trade-off has failed to discourage investment in private equity markets. In fact, private equity firms have enjoyed record amounts of fund raising over the past several years. This phenomenon has been characterized as a puzzle and its investigation within the academic literature has only just begun. Using a unique and current data set covering private equity returns and their underlying cash flows, we examine performance measurements of private equity funds in the context of their relationships with one another and with public markets; as well as, examine the characteristics of the funds and their managers that drive these relationships. Our findings suggest that private equity investors are partially motivated by misinterpreted performance measurements and that this misinterpretation is

compounded by fund reported residual values. These findings have important policy implications for both private equity fund managers and investors.

JEL Classification: G23; G24; G32; G34

Keywords: Private Equity, Venture Capital, Buyout, Net Asset Value, Residual Value

DEDICATION

This dissertation is dedicated to my loving and supportive wife, Michelle. Without your continuous understanding, patience, and encouragement, this dissertation would never have been started or finished. You are my source of motivation and a constant reminder of how grand life is.

To my parents, Ricky and Bett, thank you for all the love and support that you have given me while I pursued my dreams. My professional accomplishments have been a direct reflection on the values you instilled in me throughout my life.

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CHAPTER I

INTRODUCTION

The past twenty-five years have been a period of phenomenal growth and change for the private equity industry. Private equity firms have increased their capital under management over 23,000%, from $4 billion in 1980 to over $950 billion in 2006, primarily through venture capital and leveraged buyout funds.[1] The industry's increase in size has been accompanied by an increase in its economic significance with 15 of the largest 20 buyouts in history taking place between May 2005 and October 2006. In total, the number of U.S.-based corporations taken private in 2006 was 1,013 at a total investment of $406.2 billion, and $25.5 billion was invested in venture capital projects by private equity firms. This increased activity has forced the finance community to debate whether private equity should be considered an asset class of its own.

Anson (2006) contends that alternative assets, including private equity, are generally a subset of an existing asset class and that investment in these subsets are simply part of different investment strategies. Contrary to this opinion, Meyer and Mathonet (2005) suggest that private equity's economic significance now ranks it with stocks, bonds, and real estate as an asset class of its own. Though academic research has

[1] Source: Thomson Venture Economics, data for partnerships – firms investing own capital only; excludes fund of funds; includes U.S. buyout and venture funds. Figure 1.1 at this end of this chapter exhibits the industry's dramatic increase in size, as well as, its potential to become an even stronger participant in the finance community.

provided extensive coverage of the traditional asset classes, its examination of the private equity industry is only in its infancy. The primary reason for this lag is the result of limited data availability; therefore, many notable research questions regarding the private equity industry remain unanswered. We attempt to bridge this gap by investigating unresolved issues pertaining to the measurement of private equity performance.

Currently, the primary direction of private equity research is concentrated on comparing private equity performance to the performance of public securities. Several studies have documented the returns of private equity relative to public equity with varying results. Most notably, Kaplan and Schoar (2005) find that private equity fund returns approximately equal public market returns for the period 1980 through 2001. However, they document large amounts of heterogeneity across funds when relating returns to fund size and persistence. They find evidence linking performance positively to both the size and sequence number of the fund.[2] This suggests that the managers of larger private equity funds enjoy above average returns and managers experience some level of learning as they progress through fund cycles. Using an updated version of Kaplan and Schoar's (2005) dataset, Phalippou and Zollo (2005) find that PE funds underperform public markets when correcting for a sample selection bias, and they suggest that fund investor learning could partially explain their findings. In a follow-up study, Phalippou and Gottschalg (2006) validate the findings of Phalippou and Zollo (2005) documenting even greater underperformance after correcting for the same sample selection bias found in the original study and writing off all aged investments of the funds

[2] Funds are raised in sequences, such that a manager's first fund is 1, second is 2 and so forth.

with a low probability of recovery. The general consensus of the above studies is that the average private equity investment, which carries greater risk than public securities, has not rewarded investors for assuming this risk.

A prevailing question remains as to why investors continue to allocate large amounts of capital to private equity given its below average performance. Anson (2004) posits that active portfolio managers have fallen into a dangerous habit of "hugging" their benchmarks by holding well-diversified portfolios. As he points out, this strategy minimizes risk, but it also minimizes the probability of the managers' funds outperforming their benchmarks. Therefore, active portfolio managers have turned to alternative assets such as private equity because the concentrated nature of private equity fund portfolios provides an opportunity for excess returns. Specifically, the returns to a private equity fund are normally the result of a fund generating large returns from only a few of its investments that are generally concentrated in the area of expertise of the fund's management.

Based on the "learning" hypothesis of Kaplan and Schoar (2005), it is essential that portfolio managers be able to differentiate between top and poorly performing private equity funds. However, infrequent trading of private equity securities, combined with misunderstood performance measurement techniques employing subjective valuation measures make identifying top performers a complicated issue. In fact, Lerner, Schoar, and Wong (2006) find that the ability to differentiate varies greatly among private equity investors.

Phalippou (2006) posits that investor mispricing could partially explain investor behavior. Based on conversations with private equity investors, he reports that several have confided to him that they assess fund performance based upon internal rates of return and performance multiples. In similar conversations with other private equity investors, we find two very interesting facts. First, private equity investors not only rely on internal rates of return and performance multiples, but they compare these measures to the performance of public equity markets. As will later be discussed, this is a very dangerous practice in that these measures all employ differently calculation techniques. Second, like Phalippou (2006), we find that limited partners are not well informed about the underperformance of private equity documented in the academic literature. We feel that both of these issues relate to inaccurate perceptions, and therefore, incorrect utilization of the private equity industry's currently employed performance assessment measurements.

We seek to add to the recent literature regarding the performance of private equity funds by examining the measurement techniques used in the industry, as well as, those introduced in Kaplan and Schoar (2005) and used in Phalippou and Zollo (2005) and Phalippou and Gottschalg (2006). In performing our analysis, we utilize a new and relatively untested database, Private Equity Intelligence's Performance Analyst Database.[3] In addition to the Performance Analyst Database, Private Equity Intelligence has provided us with the underlying cash flows to the database, which allows us to dissect the nature of a subset of our full sample's cash flows. This new data, supplemented with

[3] One exception is Lerner, Schoar, and Wong's (2006) use of PEI's 2004 Private Equity Performance Monitor which was generated from the Performance Analyst database. Though we utilize some of the same data, we are able to examine the underlying cash flows of the reported performance measures.

Thomson Financial's VentureXpert data, allows us to examine fund performance measurements on a much deeper level than simply cumulative internal rates of return net fees. Specifically, we examine five questions.

First, we compute various performance metrics based upon realized and unrealized cash flows; comparing them with one another and with public market performance. In the prior literature, authors have primarily argued for their chosen measurement technique and against the others. Therefore, we seek to establish the statistical relationship between the differing measurement techniques. Since our data is available through the first quarter of 2006, it allows us to analyze the performance of funds created in the late 1990s, taking into account the massive increase in fund size and realized returns of buyout funds in recent years. Second, we examine whether unrealized investments adversely affect final fund performance measurements. Third, turning our attention to interim unrealized investments, we seek to establish their correct measurement and their predictability of final fund performance. Moreover, in the spirit of Kaplan and Schoar (2005), we examine whether this predictability is stronger for specialized funds. Fourth, we examine whether the unrealized investments of buyout funds are stronger predictors than those of venture capital funds. Finally, we examine whether the predictability of unrealized investments of funds based in the United States are stronger predictors than those of funds based outside the United States.

Our findings suggest that reported residual values have an adverse effect on fund performance measurements, and these effects are most severe in the tenth year of a private equity fund's life cycle. However, in examining the values of unrealized

investments reported in the interim years of a funds life cycle, we find evidence that these interim values reported in the middle of the fund's life cycle are fair predictors of the final amount of capital returned to private equity investors. In addition, we examine the effects of an increase or decrease in the valuation of the fund's holdings by management and find that these values are also good predictors of final fund performance measurements. We find evidence that this predictability relates to a number of fund and firm specific qualities. Our results have important policy implications for both private equity fund managers and investors.

The remainder of this dissertation progresses as follows. Chapter 2 presents a chronological background and general overview of the private equity industry including the typical performance measurements of private equity. We present an analysis of the existing literature and develop of hypotheses in Chapter 3. We introduce our data and sample selection techniques in Chapter 4. In Chapter 5, we examine the results of our statistical analyses. We report all results in tables presented at the end of the chapter in which they are referenced. We provide a summary of the purpose and the findings of our study, practical implications of our study, and areas for future research in Chapter 6.

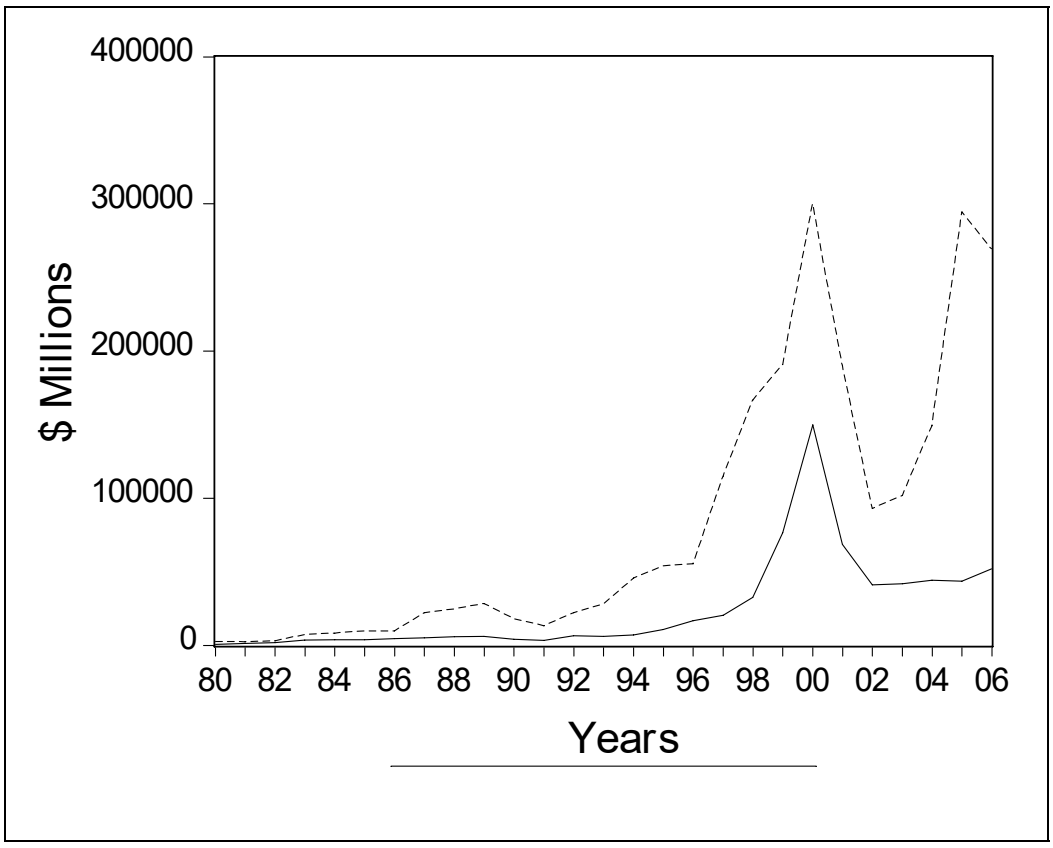

Figure 1.1. Fund Capital Commitments & Investment Activity (1980-2006)

Note: The dotted line represents the yearly commitments in U.S. dollars of capital from private equity investors to private equity funds. The full line represents the yearly dollar value of all private equity fund investments. Source: Thomson VentureXpert.

CHAPTER II

BACKGROUND AND GENERAL OVERVIEW

In this chapter we provide a discussion of the development of the relatively young and rapidly-evolving private equity industry in section 2.1. In section 2.2 we provide a general overview of the mechanics of the private equity industry, and in section 2.3 we provide an extensive discussion of the complexities of private equity performance measures.

Time Periods of the Private Equity Industry

The private equity industry covers three distinct time periods, each characterized differently. As noted by Gompers and Lerner (2001), the early period, when the industry originated, ranges from the mid-1940s to the early to mid-1970s. Funds in this period consisted of a small pool of privileged investors and were established as closed-end funds where limited partners could trade shares among themselves.

The second period began when the U.S. Department of Labor issued a new interpretation of its "prudent man" rule allowing pension funds to invest in private equity.[4] Early deals of this period proved very successful; however, the period began its

[4] The ERISA guidelines set forth by the U.S. Department of Labor had banned pension funds from investing in venture capital funds due to their high risks. According to Anson (2006), the new interpretation indicated that private equity investments should not be considered on a standalone basis, but on its effects on the entire portfolio of holdings. This ruling; therefore, allowed pensions to invest in all legitimate financial securities including the high-risk securities of private equity.

disappointing end in 1989 with the collapse of the junk bond market, the institution of debt moratoriums, and numerous corporate bankruptcies, many of which were associated with the private equity industry. In fact, Kaplan and Stein (1993) found that 26 of the 83 large leverage buyouts of the late 1980s defaulted on their debt commitments, and 18 entered bankruptcy by the end of 1991. This resulted in huge losses for the private equity funds that had financed the buyouts. They attribute this collapse to the overheated nature of the private equity industry during the late 1980s. In an effort to mimic the early successes of the decade, junk bond investors infused huge amounts of capital into buyout markets during in the mid-1980s. The large amounts of capital forced fund managers into highly competitive deals with huge valuation multiples. These transactions are examples of money chasing deals as illustrated in Gompers and Lerner (2000). Kaplan and Stein (1993) observed the effects of these infusions and subsequent deals as disastrous to the private equity industry, nearly driving it into total collapse.

The final period, which continues today, began in 1992 as huge amounts of capital began to flow into the industry from a magnitude of institutional investors. Many of these investors are new to private equity and their effect and behaviors are still unknown. With the infusion of capital arose an entirely new generation of private equity firms, with different characteristics and objectives than those from the 1980s. Most notably, funds are much larger and have more specialized investment portfolios than their 1980s counterparts. In fact, the Blackstone group recently raised the largest fund in history with $15.6 billion in commitments and the Carlyle group expects to have a total

of $85 billion capital under management by the end of 2007. Never before has the private equity industry been such a significant part of the World Economy.

The emergence of new private equity firms raises a central question. Does fund performance differ in funds managed by older more mature firms when compared to funds managed by younger, less experienced firms? Kaplan and Schoar (2005) find evidence suggesting that funds managed by older, more experienced firms outperform those managed by younger firms. A likely follow-up question to this finding is whether performance measurement techniques contribute to this difference. Phalippou and Gottschalg (2006) find that this is probably the case, but the effect is only marginal. Thus, we conclude that the treatment of unrealized investments in performance analysis is perplexing for both young and mature fund mangers.

In addition to the "new" participants of the current period, Meyer and Mathonet (2005) point out that the current period is different from prior periods by corporate governance pressures, the development of a secondary market for fund investments, and a new valuation approach. First, corporate governance mechanisms have changed partnership agreements within the private equity industry, as have similar mechanisms changed the landscapes of public equity markets over the past five years. Second, a recent trend that has developed in private equity markets is the secondary sale of funds' held investments. Prior to this development, funds primarily could only exit investments through public equity markets or through liquidations. In recent years, private equity funds have begun buying and selling each others investments. Though not as lucrative as

a public equity market exit, secondary markets provide greater profit potential than liquidation exits.

Finally, private equity associations have issued new guidelines for valuation and disclosure in recent years. As a result, Meyer and Mathonet (2005) point out that limited partners are forcing general partners to disclose valuations according to these guidelines. Because valuations of investments which have yet to be unloaded by the fund, were much more subjective to the assumptions and judgments of the general partners prior to the new guidelines, many of the new valuations and underlying cash flows are still calculated under similar assumptions. These issues present a logical question. Do the new systematic valuation guidelines affect older entrants, which are familiar with the older nonexistent system of valuation guidelines, more than they affect newer entrants? Or do older entrants exhibit better judgment due to experience when valuing the funds investments? The evidence put forth by Phalippou and Gottschalg (2006) suggests the latter.

General and Behavioral Overview of Private Equity

As noted by Gompers and Lerner (1999) and illustrated in Figure 2.1, private equity funds are typically organized as limited partnership contracts with 10 year life cycles that include fund raising, investing, and harvesting or unloading.[5] Funds are established and managed by a private equity firm termed "the firm" or the "general partner." Those investors that qualify under both SEC criteria and the general partner's

[5] Gompers, Paul, and Josh Lerner, 1999. *The Venture Capital Cycle* (The MIT Press, London) presents an interesting and in-depth look at the mechanics of the VC cycle; however, the majority of this subject is beyond the constraints of this paper.

criteria are recruited as limited partners.[6] These are typically public and private pension funds, university endowments, insurance companies, large banks, large charities, and wealthy individuals. The funds themselves are structured as blind pools in which the limited partners commit a dollar amount to the fund and then assume a passive role until called upon by the general partner to fund an investment, termed a portfolio company. [7] Each limited partner is responsible for its portion of the fund's financing needs.

Since general partners make all investment decisions, limited and general partners only interact for two purposes. The first occurs when the general partner has identified an investment. Once the general partner decides to invest in the portfolio company, it contacts the limited partners to request the pro rata portion of the investment of each limited partner's commitment to the fund. Simply stated, if ten limited partners have each committed equal amounts to the fund, then each limited partner is responsible for ten percent of each investment that the fund makes. These requests are termed capital calls, or drawdowns. Once a general partner decides that conditions are beneficial or necessary to exit an investment, it does so by taking the company public in an initial public offering, conducting a secondary sale to other private equity funds, or writing the company off as a loss. In the event of a profitable exit, the general partner distributes the profit, less its share, to the limited partner. Investments in portfolio companies continue

[6] The Securities and Exchange Commission requires that any private individual or organization have a minimum of $5 million in unencumbered financial assets to be eligible to invest in private equity. However, the criteria for investment set by fund managers are much more complex and more stringent than that set by the Securities and Exchange Commission.

[7] Lerner (2000) states that funds are established as blind pools, so that investors do not attempt at limiting the flexibility of fund management.

throughout the life of the fund; however, all investments must be recovered or written-off by the last day of the fund's life.

The capital call and distribution mechanisms make private equity funds self-liquidating; however, both general and limited partners are subject to liquidity risk because funds normally do not begin distributing funds until deep into the fund's life. Phalippou (2006) points out that the majority of private equity partnership contracts can be extended up to 14 years.[8] According to Pearce and Barnes (2006), private equity funds seek to liquidate their portfolio company holdings between five and seven years from the date of the fund's first investment into that portfolio company.[9] Coupled with Ljungqvist and Richardson's (2003) finding that the majority of funds do not fully invest until year six, limited partners should expect the contract to extend past the tenth year. Therefore, positive cash flow should not be expected until the second half of a fund's life. This exposes both general and limited partners to greater liquidity risk.

In addition to the investment function, general and limited partners interact on a regular basis to evaluate interim fund performance to maintain a healthy relationship.[10] Interim fund performance is imperative to the calculation of fund management fees. Phalippou and Gottschalg (2006) explain the normal fee structure for private equity funds to be two percent of committed capital during the first five years of the funds life and two

[8] All limited partners must agree to extend the partnership for a set amount of time, usually in one or two year increments.

[9] It is not uncommon for private equity funds, especially venture capital funds, to engage in several rounds of investing with a portfolio company.

[10] Performance reports are generally submitted to the limited partners on a monthly basis. Those that do not report on a monthly basis do so quarterly.

percent of unrealized fund investments until the liquidation of the fund, plus twenty percent carried interest if the fund's final internal rate of return is greater than eight percent.[11] Therefore, interim fund performance partially dictates period-to-period cash flows to and from the fund.

In addition to management fees, limited partners must be able to gauge interim fund performance for several reasons. First, interim fund performance is imperative to allow for accurate reporting of a limited partner's overall portfolio, which is partially made up private equity investments. Second, limited partners utilize interim performance measurements in planning for future cash flow needs. Furthermore, Anson (2004) explains that gauging investment performance is important for investors, such as pension fund management, because their bonuses are normally a function of the pension's overall portfolio performance. Finally, Meyer and Mathonet (2005) and Kaplan and Schoar (2005) point out that interim performance is influential in the decision of limited partners whether or not to continue investing with the same private equity firms.

Until liquidation, private equity performance relies on valuations of unrealized investments reported by the fund's general partner, which are subjective in nature. Therefore, until liquidated, subjectivity is a major factor in private equity performance when taking into account both realized and unrealized cash flows. Capital calls from limited partners to private equity funds represent negative cash flows, while distributions of profits from the private equity funds to the limited partners represent positive cash flows. Both capital calls and distributions represent realized cash flow. However, while

[11] Carried interest is simply the general partner's share of the fund's profits.

the fund is still active it still holds ownership positions in portfolio companies. These positions represent unrealized cash flow termed residual or net asset values.

Because private equity funds do not fall under the protective umbrella of United States Securities and Exchange Commission, there are no regulations to govern the valuation practices of portfolio companies. Consequently, reported residual values are subject to the assumptions made by the general partners about the underlying portfolio companies. This issue presents several questions. First, if considered the terminal value of a series of cash flows for a private equity fund, do reported residual values adversely affect fund performance measurements? If so, why are limited partners willing to accept a fee-based structure based upon these values? Presumably, limited partners must believe that interim residual values are accurate and have some predictability about the final return of the fund. We examine these issues and questions in greater depth in the following section and in Chapter 3.

Private Equity Fund Performance Measurements

Performance data on private equity funds is quite complex when compared to public securities performance data such as that provided via the Center for Research in Securities Prices (CRSP). Daily closing prices combined with periodic dividend and interest payments allow for easy return calculations for publicly traded securities. However, the closed-end, self-liquidating nature of private equity funds make it quite difficult to calculate reliable realized return measurements for funds. Specifically, fund managers report cash flows on a monthly or quarterly basis because capital calls and distributions do not occur in a set pattern. In fact, the actual return of the fund is only

known once the fund is fully liquidated or reaches the end of its life cycle. This is true regardless of the cash flows realized during the life of the partnership.

The private equity industry has developed the following measurement alternatives to evaluate performance both on an interim and post-liquidation basis: the internal rate of return, the value multiple, the distribution to paid-in ratio, and the residual value to paid-in ratio. The public market equivalent or profitability index utilized in Kaplan and Schoar (2005), Phalippou and Zollo (2005), and Phalippou and Gottschalg (2006) represents another performance measurement alternative.

In order to understand each performance measurement, one must first understand the cash flows of a private equity fund. Since performance measurements are calculated from the limited partner's point of view, capital calls are considered negative cash flows. Conversely, distributions are considered positive cash flows. Though the cash flow designations of capital calls and distributions are easily understood, the cash flow designation of residual values can be quite ambiguous. The main decision is whether to assume that the reported residual value represents the terminal value of a fund's cash flow stream. If so, then residual values are considered a distribution. It is important to note that all performance measurements reported by fund managers are calculated with residual values included in the cash flow streams.

Internal Rate of Return

The private equity industry's de facto standard for measuring returns is the internal rate of return (IRR). In fact, Meyer and Mathonet (2005) point out that venture capital associations, the Association for Investment Management and Research, and the

CFA Institute consider the IRR to be the most appropriate return measure for private equity. IRRs can be calculated from the inception of a fund to any point in time during the fund's life up to and after termination. The IRR represents a percentage rate of return at which the net cash flows of a fund over time can be discounted back to zero at the present. In practical terms, the IRR is the average "work-rate" of a limited partner's investment.

Two critical decisions must be made when calculating an IRR. The first is whether to use cash flows that are gross or net of fees and carried interest to the limited partners. This decision can have a great impact on the calculation of the IRR, especially late in the fund cycle when the majority of disbursements are made by the fund. If calculated gross of fees, the IRR will overstate the true IRR of the fund to limited partners. Second, Metrick (2007) illustrates the importance of the decision of whether or not to include residual values in IRR calculations. In practice, the majority of participants in the private equity industry consider the residual value reported by the general partners to be the terminal value when calculating IRR. However, Phalippou and Gottschalg (2006) reason the majority of residual values reported by funds after the ten year point should be written off as "living deads."[12] Recognizing these concerns, we calculate IRR net of fees under two specifications. The first is to include the residual value as the terminal value in the cash flow stream and the second is to write-off all residual values letting the final realized cash flow become the terminal value.

[12] "Living Deads" represent underperforming portfolio companies still held in a private equity fund's portfolio.

The standard calculation for the IRR since inception is that which satisfies the following equation:

$$\sum_{i=0}^{n} \frac{CF_i}{(1+IRR)^i} + \frac{RV_n}{(1+IRR)^n} = 0, \qquad (1)$$

where:

CF_i = Net Cash Flows to the Fund;

RV_n = Residual Value (can be written off); and

IRR = Internal Rate of Return.

Meyer and Mathonet (2005) illustrate how a private equity fund IRR follows a J-Curve or hockey stick pattern over the fund cycle. The early years of a fund are generally the period of capital calls from limited partners to finance a fund's investments in portfolio companies. As a result, the IRRs of funds early in their life cycles are generally negative or close to zero. This period of low returns is exceptionally bad for venture capital funds and has been termed the "Valley of Tears." As a fund progresses through its cycle, the IRR generally increases at an increasing rate before leveling off close to the end of the fund cycle.

The major advantage of using IRR is that it makes the appropriate adjustments for the time value of money when dealing with the heterogeneous nature of fund cash flows. Specifically, the IRR represents a cash-weighted rate of return where all relevant cash flows are weighted accordingly. That is, those cash flows that take place early in the fund cycle are given greater weight than those taking place later. One other advantage of IRR is that it is intuitive to investors. This is an advantage because IRR is simply calculated as a percentage rate of return, unlike other measurement techniques such as the

value multiple which is calculated as a ratio. Another advantage is that IRR can be compared to a hurdle rate in order to judge the success of the fund.

An effective measurement technique, IRR is not without its disadvantages. When examined in isolation, the interpretation for the IRR is very subjective. What constitutes a superior performance by a fund varies from individual to individual. In addition, the mathematics of solving for the IRR within the quadratic equation can present several problems. The first is that a fund could have multiple IRRs if there are numerous sign changes during the fund cycle. The findings of Ljungqvist and Richardson (2003) suggest that the majority of sign changes can occur between years four and eight; therefore, interim IRRs could be over or understated. However, most private equity funds follow a negative-to-positive cash-flow pattern so this normally is not a major problem. In addition, Meyer and Mathonet (2005) point out that general partners must decide whether to realize short-term gains on investments to optimize IRR or to wait for longer periods of time to optimize return multiples and/or realized returns. Furthermore, if follow-on fundraising is dependent on current fund performance as suggested by Kaplan and Schoar (2005), then managers of struggling funds have a disincentive to keep performing. Simply, because IRR weights earlier performance greater than later performance, fund managers of underperforming funds have a low probability of improving performance. Therefore, fund raising ability will be quite diminished.

Although interpretation, mathematical, and short-term management problems weaken the IRR, its greatest weaknesses are its reinvestment of returns assumption, the treatment of residual values in the calculations, and assuming the same discount rate for

capital calls and distributions. In calculating IRR, one assumes that cash distributions in all periods are reinvested into the fund. Both Meyer and Mathonet (2005) and Gompers and Lerner (1996) explain how reinvestment is impossible in that most funds typically have covenants restricting the reinvestment of capital gains. In times of higher returns, this assumption will inflate annualized versions of a monthly or quarterly IRR. We therefore can conclude that this assumption artificially inflates the true IRR of the fund upward.

The effects of residual values upon IRR can severely alter its calculations. Metrick (2007) illustrates how including the residual value of the fund as the terminal cash flow is misleading, especially for younger funds in which the majority of their investments are still unrealized. Specifically, the effect of including the residual value in cash flow streams is an upward inflation of the actual IRR. This upward inflation is the result of the cash flow associated with the reported residual value remaining unrealized. It is impossible to determine how much of or when the reported residual value will be distributed. Furthermore, current data does not allow research into the amount of capital actually realized from reported residual values. The practice of including the residual value as the terminal cash flow is performed both in interim and in final IRR calculations. The question remains whether this should be considered acceptable practice.

Ljungqvist and Richardson (2003) point out that a major weakness of the IRR is that it assumes that capital calls and distributions are discounted at the same rate. They argue that capital calls should be discounted at a lower rate than distributions. They argue that capital calls should be discounted at the risk free rate while distributions

should be discounted at a rate equal to the return of public equity securities. Therefore, IRRs overstate the performance of the fund relative to its risk profile.

The question remains as to how one should use IRR in fund performance evaluation. In order to eliminate the subjectivity of the IRR, one should compare it to a hurdle rate. Grinblatt and Titman (2002) state that the appropriate hurdle rate for comparison of IRRs should be a rate that makes the sum of a fund's discounted cash flows equal the current value of a tracking portfolio of cash flows of an appropriate peer group. According to Pearce and Barnes (2006), this peer group should encompass several areas to be considered accurate. First, the peer group should included funds with the same vintage year as the fund being evaluated. It is not logical to compare a fund raised in 1980 to a fund raised in 1990 or 2000 because each is exposed to different market conditions that affect their decisions. Second, the peer group should be comprised of funds from the same industry sector as the fund being evaluated. This allows the fund to be compared to other funds facing similar market conditions as well as funds with similar risk compositions. In order to control for differing levels of competition among funds, the peer group should be made up of those funds located within the same region as the fund being evaluated.

Phalippou and Gottschalg (2006) point out that the major error made by those using IRR is to compare it with the return on public markets, such as, but not limited to, the S&P 500 index. Because indexes are time-weighted measurements and the IRR is a cash-weighted measurement, the two should not be compared. Furthermore, Metrick (2007) cautions that investors should not try to deduce the amount of money a fund made

for them by using the IRR. Instead, he states that investors should answer the question how well did the fund do with our money while it had it. Though the IRR is not without limitations, it proves an accepted and important measurement for private equity fund performance.

Value Multiple

The value multiple, as described by Meyer and Mathonet (2005) and Metrick (2007), is designed to measure the total value that the limited partner has derived from its interest in the partnership. It is designed to incorporate both the realized and unrealized cash flows from and to the fund and is calculated as follows:

$$Multiple_n = \frac{\sum_{i=0}^{n} CIF_i + RV_n}{\sum_{j=0}^{n} COF_j} \quad (2)$$

where:

CIF_i = total cash distributions at the end of time period *I* from the fund to its limited partners;

COF_j = total cash investments at the end of time period *I* from the limited partners to the fund; and

RV_n = residual Value of the fund's remaining portfolio company investments at the end of time period *i.*

The primary strength of the value multiple is its ease of interpretation. Simply stated, the value multiple can be multiplied by the amount of capital invested in the fund to determine the amount the fund has returned. However, the value multiple does not incorporate the time value of money when evaluating cash flows. Therefore, it does not

show the quickness that one partnership has returned value to its investors relative to another. Meyer and Mathonet (2005) point out that another potential weakness is that the value multiple includes the residual value. As with IRR, the inclusion of the residual value as the terminal value over-inflates the amount of capital the fund has returned. Again, this is due to the inability to ascertain how much of the residual value will be realized.

Distribution to Paid-In Ratio

Due to the residual value limitations of both the IRR and value multiple; Zhu, Davis, Kinniry, and Wicas (2004) and Meyer and Mathonet (2005) propose using the distribution to paid-in ratio for evaluating private equity returns. A more conservative measure than the IRR and value multiple, the distribution to paid-in ratio excludes the subjective valuations included in residual values and does not assume the reinvestment of distributions. The distribution to paid-in ratio measures the cumulative cash distributions to limited partners relative to the cumulative invested capital from limited partners and is calculated as follows:

$$DPI_n = \frac{\sum_{i=0}^{n} CIF_i}{\sum_{j=0}^{n} COF_j}, \quad (3)$$

where:

CIF_i = total cash distributions at the end of time period *I* from the fund to its LPs; and

COF_j = total cash investments at the end of time period *J* from the LPs to the fund.

The ratio conservatively measures performance on a realized basis by excluding distribution reinvestment and the number of periods the fund has taken to generate this return. Like the value multiple, the distribution to paid-in ratio is weakened by the fact that it does not take into account the time value of money. Though both are conservative measures of performance, Metrick (2007) explains that both the value multiple and the distribution to paid-in ratios should be used to measure the dollar amount returned to investors for every dollar invested.

Residual Value to Paid-In Ratio

Though the distribution to paid-in ratio provides general and limited partners with a metric to measure the performance of the fund on cash realized basis, it is also important for the partners to measure how much of their investment is still locked-up in a fund. Meyer and Mathonet (2005) and Metrick (2007) propose using the residual value

to paid-in ratio for this measurement. Specifically, it measures the value of invested capital that remains in the fund and is calculated as follows:

$$RVPI_n = \frac{RV_n}{\sum_{j=0}^{n} COF_j}, \tag{4}$$

where:

RV_n = the residual value reported by the general partner at the end of time period *J*; and

COF_j = total cash investments at the end of time period *J* from the limited partners to the fund.

It is important to note that due to the subjective nature of the assumptions behind the valuation of portfolio companies, the residual to paid-in ratio potentially is a noisy and inaccurate measure across funds.

Profitability Index

The final return measure introduced by Kaplan and Schoar (2005) and utilized by Phalippou and Zollo (2005) and Phalippou and Gottschalg (2006) is the profitability index. As with the IRR, the profitability index can be computed on a purely realized basis or on a realized plus unrealized basis by including the residual values as the terminal value. The profitability index measures the present value of the fund distributions relative to the present value of capital calls. It is calculated as follows:

$$PI_n = \frac{\sum_{i=0}^{n} \frac{CIF_i + RV_i}{(1+r)^i}}{\sum_{j=0}^{n} \frac{COF_j}{(1+r)^j}}, \quad (5)$$

where:

CIF_i = total cash distributions at the end of time period *I* from the fund to its LPs;

COF_j = total cash investments at the end of time period *J* from the LPs to the fund;

RV_n = residual value of the fund's remaining portfolio company investments at the end of time period *I* (can be written off); and

r = Represents the discount rate, normally equal to a benchmark rate such as the return of the S&P 500 over period n.

As with IRR calculations, we calculate the profitability index net of fees under two specifications. The first is to include the residual value as the terminal value in the cash flow stream and the second is to write-off all residual values letting the final realized cash flow become the terminal value.

The major strength of the profitability index is that it allows for a direct comparison between an investment in a private equity fund to an identical investment in another financial security, such as an equity index. A profitability index greater than one

indicates that the fund outperformed its benchmark, and a value less than one indicates underperformance.

However, the profitability index is not without flaws. If the residual values are included, then they can overstate the true profitability index of the fund can be overstated if the residual values are included in the cash flow stream. In addition to the residual value problem, choosing an incorrect discount rate can severely bias results. Kaplan and Schoar (2005), Phalippou and Zollo (2005), and Phalippou and Gottschalg (2006) all use the annualized return of the S&P 500 index over the life of a fund as the discount rate. Though this seems intuitive, it poses two problems. The first is that the S&P 500 is traded daily in heavy volume while private equity is traded sparsely with thin volume; therefore when used as the discount rate, the S&P 500 does not fully reflect the risk profile of private equity funds. Second, as in the IRR calculation and suggested by Ljungqvist and Richardson (2003), capital calls and distributions should not be discounted at the same rate. Therefore using the return of the S&P 500 Index as the discount rate, as acknowledged by Phalippou and Gottschalg (2006), will bias the profitability index upward. Regardless, we follow the previously accepted practice of the above studies and utilize the annualized return of the S&P 500 index in our profitability index calculations. Even with its limitations, like the IRR the profitability index is an accepted and important measurement for private equity fund performance when comparing it to the performance of other financial securities.

Conversations with Limited Partners

In conversations with limited partners, we found that none utilized all performance measures in evaluating fund performance. The majority indicated that they use the IRR, value multiple, and distribution to paid-in ratios only. In addition, the majority of them stated that they preferred the realized cash flow plus residual value specification for these performance measurements. Interestingly, they indicated that they were skeptical about the predictability of interim residual values, albeit counterintuitive to utilize a measure for one purpose but not the other. Furthering our conversations as to why some limited partners remain with underperforming general partners, the limited partners we spoke with believe that an internal rate of return greater than some arbitrary rateand a value multiple greater than two indicates a high-quality performing fund. These conversations emphasize the fact limited partners do not fully understand the behaviors of private equity performance measures.

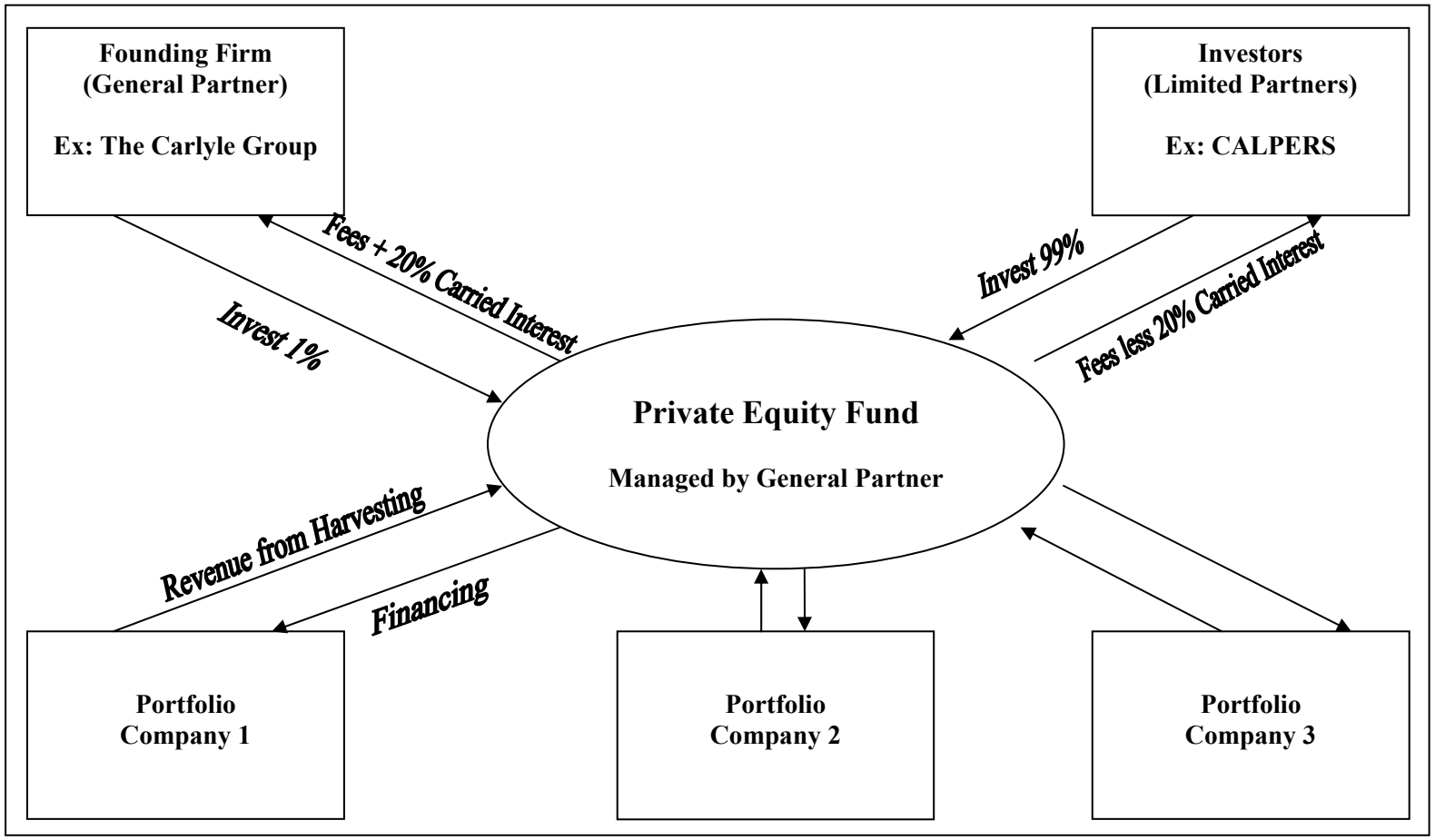

Figure 2.1 Private Equity Fund Flow

Note: The above illustrates the capital flow of the typical private equity fund. Private equity funds are established by private equity firms or general partners by raising capital from select investors termed limited partners. General partners provide 1% and limited partners provide 99% of the total capital to establish the fund. Managed by the general partner, private equity funds invest by providing equity financing to portfolio companies. Once the general partner consider the time appropriate to exit or harvest the fund's investment in a portfolio company it does so by taking the company public through an initial public offering by conducting a secondary sale, or by write-off.

CHAPTER III

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

This chapter provides an extensive discussion of the existing literature to identify the gaps still present in private equity research. We conclude each subsection with the development of our six major hypotheses.

Differentiating Between Private Equity Performance Measurements

Our paper builds on the recent body of literature addressing the performance of private equity funds by examining the measurements used to evaluate fund performance and the treatment of unrealized investments when calculating these measurements. Current and prior literature produced varying results when comparing the performance of private equity with that of public equity markets. As have the results on this issue varied, so have the performance measurements employed and the treatment of residual values within these measurements.

As discussed by Phalippou (2006), the academic literature regarding fund performance differs greatly, drawing on several different data sources as well as the two different methodologies employed. The first methodology, which is generally found in the older studies, examines performance gross of fees utilizing transaction data. For example, Swenson (2000), Cochrane (2005), and Hwang, Quigley, and Woodward (2005) concentrate on the returns generated by the funds' portfolio company investments

and their contribution to overall fund performance. Alternatively, Ljungqvist and Richardson (2003), Jones and Rhodes-Kropf (2004), Kaplan and Schoar (2005), Phalippou and Zollo (2005), Nielsen (2006), and Phalippou and Gottschalg (2006) examine fund performance by concentrating on fund-level returns. Though these studies employ three different data sets, their studies are similar in that they examine the individual cash flows of funds and their relation to overall fund performance relative to the performance of public markets. However, they differ in their treatments of residual values as they pertain to these cash flows. It is important to acknowledge that although these studies examine a different question than our study; to date, this literature remains the only private equity literature regarding performance.

Cochrane (2005) examines the effects that portfolio investments have on venture capital fund performance. He analyzes 7,765 portfolio companies over 16,852 financing rounds provided by the Dow Jones VentureOne Database from January 1987 to June 2000. Under the assumption that the change in the log of the company's valuation follows a log-normal CAPM distribution and after modeling for a sample selection bias, he uses a maximum likelihood approach to derive the alpha and beta of the log-CAPM. He finds a 59 percent annual gross return and excess risk-adjusted returns of 32 percent. However, as the author acknowledges, his data is biased upward due to missing transaction data. Using the same dataset and after filling in much of the missing transaction data, Hwang, Quigley, and Woodward (2005) study the effects of individual venture capital (VC) returns on fund performance over the same time period. They conclude that VC fund gross returns outperformed the S&P 500, but not in an amount

that is statistically significant from zero. Therefore, it is safe to assume that net returns would underperform the S&P 500 after paying fees and carried interest to the general partners.

In the first major study of leveraged buyout transactions, Swenson (2000) provides evidence that buyout funds underperform the S&P 500. His data is extracted from the private placement memorandums collected by the Yale University Endowment. [13] Specifically, he studies the returns for 542 buyout transactions over the period 1987 to 1998. His initial results indicate that the average investment in leverage buyout funds produced an annual return of 48 percent when the annual return to the S&P 500 was approximately 17 percent. However, he found that when he levered the S&P 500 at the same level as the leverage buyout transactions, it would have generated an annual return of 86 percent gross of fees. He points out that one of the most important keys to successful investing in the leveraged buyout market is participating in the best deals. At the time of his study, Yale had participated in 21 percent of the best deals, leading to the leveraged buyout portion of the Yale Endowment outperforming the S&P 500 by eight percent net of fees. The Yale Endowment has long been attributed as being one of the most successful endowments in the world, and much of its success can be attributed to its private equity investments.

One could deduce from Swenson's (2003) findings that successful investing in private equity is simply a matter of examining the private placement memorandums put out by the private equity firms and choosing those firms that have invested in the best

[13] The private placement memorandum is essentially the equivalent the prospectus in the mutual fund industry.

deals. However, it is important to acknowledge that these memorandums are plagued by a severe survivorship bias. Since private equity firms are exempt from SEC regulations and can include what they wish in their memorandums, Phalippou (2006) rationalizes that only those private equity firms that have been successful will be willing to include their histories. Therefore, to gain access to the best funds that are managed by the top firms, investors are faced with the challenge of accurately evaluating past performance of lower sequenced funds by the top firms. Kaplan and Schoar (2005) explain that this challenge can be quite difficult because follow-on funds are established before their immediate predecessor fund is liquidated. Therefore, it is essential that general and limited partners understand interim fund performance measurements and the assumptions regarding realized and unrealized investments behind these measurements. Consequently, one of the main purposes of the current study is to evaluate the effect of residual values upon the five major performance measurements.

In the seminal study concentrating on fund-level returns, Gompers and Lerner (1997) examine the risk-adjusted performance of the E.M. Warburg, Pincus & Co. group of funds. Specifically, they marked-to-market each investment on a quarterly basis, beginning in 1972 and ending in 1997, obtaining the quarterly cash flows of each Pincus fund. They use these cash flow values within CAPM and Fama-French three-factor regression models. Their findings suggest that the Pincus group generated annualized excess risk-adjusted returns, measured by alpha of the regression models, of greater than 7 percent. The most notable study invoking fund-level analysis is Kaplan and Schoar (2005). Examining net returns, both the IRR and the profitability index of two samples

of 746 and 1,090 funds provided by the Venture Economics cash flow database, they find that average private equity fund performance essentially equals that of the S&P 500 over the sample period from 1980 to 1997. This is similar to the findings of Hwang, Quigley, and Woodward (2005). However, they document a large amount of heterogeneity among their sample relating to fund size and experience. Most importantly, their findings indicate that PE fund performance is positively related to fund size and sequence number.

Using the same data set as Kaplan and Schoar (2005) but employing a different methodology based on general partner estimates of value change, Jones and Rhodes-Kropf (2004) find very similar results to Kaplan and Schoar. Specifically, they substitute quarterly estimates of value for cash flows and find similar results to Kaplan and Schoar (2005) that the average private equity investment has failed to outperform public equity markets. The fact that substituting the estimates of value for cash flows does not affect results seems to suggest that interim values supplied by general partners could be accurate predictors of the funds' final value and final return.

Phalippou and Zollo (2005) document significant underperformance of PE funds when compared to the S&P 500. Analyzing an updated version of Kaplan and Schoar's (2005) data and correcting for sample selection bias, they find that PE firms underperform the S&P 500 by 3.3 percent per year. In a follow-up study utilizing the same data, Phalippou and Gottschalg (2006) find an underperformance of 3.83 percent after adjusting for the same sample selection bias as identified in Phalippou and Zollo (2005), but also writing off all living deads.

These latter studies clearly establish that the average private equity investment has failed to produce the desired above average returns relative to public equity markets. Then why do investors continue to invest in private equity funds despite its poor performance? The answer is the heterogeneity in fund performance documented by Kaplan and Schoar (2005). They find that the difference in fund performance measured by the IRR between funds in the 25th and 75th percentiles was approximately 19 percent. This heterogeneity greatly underscores the importance of identifying top performing funds and could possibly explain why investors continue to invest in private equity. In an attempt to gain access to funds in the upper percentiles, investors are willing to incur losses in early funds in order to position themselves for entry into later funds. This is essentially the learning hypothesis introduced by Kaplan and Schoar (2005). In addition, Phalippou and Zollo (2005) and Phalippou and Gottschalg (2006) posit that mispricing could be a partial explanation for continued investment. That is, attempts to gain access to the upper percentiles could result in mispricing or more likely could cause the misinterpretation of key performance measurements, which could partially explain the continued investment. This leads us to our first hypothesis: Private equity performance measurements are positively correlated; and therefore, this correlation makes differentiating between each measurement difficult:

$$H_1: \rho_{PerformanceMeasurements} > 0,$$

where rho is the correlation of the following performance measurements: IRR, multiple, distribution to paid-in ratio, residual value to paid-in ratio, and profitability index. Both

IRR and the profitability index are calculated under the two specifications regarding residual values.

Only Phalippou and Gottschalg (2006) directly examine the effects of residual values on fund performance.[14] They find that writing off residual values further decreases average fund performance by 53 basis points, the difference of 3.83 percent from their study and the 3.3 percent from Phalippou and Zollo's (2005) study. This finding highlights the fact that the quality of reported residual values has developed into a subject of great debate both in the academic literature as well as in the private equity markets. Unlike mutual funds where their net asset values are based off marking-to-market a fund's investments, a private equity fund's residual value is based on subjective valuations determined by the general partners. This could lead to possible manipulations of the residual values by the general partners in an effort to prop-up lower performing funds in the short-run. Therefore, the existence of residual values and their effects upon performance measurement techniques have only begun to be examined. Simply put, the inclusion of residual values as the terminal cash flow significantly creates a significant upward bias to performance measurements. This leads us to our second hypothesis: the means of the IRR and Profitability Index based upon realized cash flows are statistically less than the means of the IRR and Profitability Index based upon realized cash flows plus residual values:

$$H_2: \bar{\chi}_{Performance(CF)} < \bar{\chi}_{Performance(CF+RV)},$$

[14] All other studies including Kaplan & Schoar (2005) and Phalippou & Zollo (2005) considered reported residual values as the terminal positive cash flow.

where X-bar Performance (CF) represents the mean of our performance measurements calculated under specification one and X-bar Performance (CF+RV) represents the mean of our performance measurements calculated under specification two.[15]

Predictability of Interim Residual Values

General and limited partners must have the ability to evaluate a fund's performance, and ultimately the general partner's performance, on an interim basis. Generally, limited partners do not have the ability to easily exit the partnership agreement pre-termination. In fact, Lerner and Schoar (2004) and Phalippou and Zollo (2005) point out that limited partners exiting funds early incur large penalties, usually only liquidating their positions at the original cost of their investments into the fund instead of their portion of the fund's current market value. Phalippou and Gottschalg (2006) identify the characteristics of funds that report residual values after the 10th year in the fund cycle. Particularly, these funds have not shown any activity in three years and have low performance as measured by the profitability index. Though unable to exit their investments without incurring huge losses, limited partners still benefit from having the ability to predict final return. For example, Anson (2006) points out that pension fund managers must be able to predict future cash flows to match with ever-increasing benefits obligations.

Though important for current fund performance prediction, interim returns are not as important for the limited partners monitoring their current fund investments as they are

[15] This hypothesis only applies to the IRR and Profitability Index because the inclusion or omission of residual values is not an option within the calculations of the Value Multiple and Distribution to Paid-in Ratio.

for evaluating future investment decisions such as whether to invest in follow-on funds with the same private equity firm. Since general partner survival is dependent upon raising subsequent funds, they must do so in a timely fashion. In fact, Kaplan and Schoar (2005) find that the general partners raise follow-on funds only four or five years into the life of the current fund. Recent activity suggests that this time period has been cut to nearly two years. Incidentally, general partners would find it quite difficult to raise capital without providing some indication of their past performance. Therefore, it is not only important to measure fund returns on a post-liquidation basis but is also important to measure returns on an interim basis beginning at the fund's inception.

Kaplan and Schoar (2005) find that fund performance positively relates to fund size and sequence number. Moreover, they find that venture capital funds perform better than buyout funds. This is expected due to the greater risk associated with venture capital funds. In extending the Kaplan and Schoar (2005) model for predicting returns, Phalippou and Gottschalg (2006) find that interim profitability indexes are positive predictors of a fund's final profitability index. This is not unexpected; however, they find that a modified residual value to paid-in ratio, defined as the residual values as a percentage of the present value of the amount invested in the fund, have very little predictive ability. In fact, their findings suggest that residual values only possess predictive abilities for large funds and funds of more established fund families, but only in the early years of the funds' cycles. This is counterintuitive and against Kaplan and Schoar (2005) theory that residual values should become more accurate and revert towards zero as the fund cycle progresses. Although the residual value to paid-in ratio is

the preferred industry standard for evaluating residual values, we believe that this measurement incorrectly evaluates residual values for predictive purposes. By using the present value of a fund's capital calls as the discounting factor, one is failing to take into account distributions that have already been dispersed to the limited partners. This would severely lower the ratio of residual values relative to the amount of the investment remaining in the fund. This heavily influences those residual values reported later in the fund cycle and could possibly explain the findings of Phalippou and Gottschalg (2006). We correct this measurement and hypothesize the following: Interim residual values are predictors of final fund performance:

$$H_3: \beta_{RV} \neq 0,$$

where beta represents the predictability of reported residual values on final fund performance.

Fund Characteristics and Residual Values

Residual Values of Specialized Funds

As more capital has been committed to private equity firms, funds have become more specialized. Examining the post-buyout performance of 89 portfolio companies in the United Kingdom between 1995 and 2002, Munari, Cressy, and Malipiero (2005) find that buyouts by more specialized private equity firms have higher profitability levels. This highlights the importance of specialization in that improved profitability levels of portfolio companies should increase the performance of private equity funds once these portfolio companies are unloaded. As pointed out by Metrick (2007) and Pearce and

Barnes (2006), venture capital funds are normally much more specialized than their buyout counterparts. In fact, Gompers, Kovner, Lerner, and Scharfstein (2005) find that specialized venture capital funds with considerable industry experience are more successful when compared to those funds with less experience. They further find that funds that are more specialized adapt better to changing conditions in public equity markets when compared to less specialized funds. Recent trends in leveraged buyout markets suggest that buyout funds also have become more specialized.

Therefore, specialized fund managers should be better at valuing there portfolio companies prior to unloading than less specialized fund managers. As a result, reported residual values of specialized funds should be a more accurate reflection of the value that portfolio companies earn the fund at the time of unloading. We hypothesize the following: the difference in fund reported performance measurements and actual performance measurements of specialized funds is less than the difference of non-specialized funds:

$$H_4 : \beta_{SPEC} < 0,$$

where beta represents the estimated effect of specialized funds on the difference between reported and actual performance measurements.

Residual Values of Buyout Funds

In examining the predictive ability of residual values, Phalippou and Gottschalg (2006) find modest evidence for predictability of those residual values of larger sized funds. The authors state that they view this result as surprising. Alternatively, we view of this finding as intuitive. As with many of their other results, the authors find this

predictability has a stronger significance in the earlier years of the fund cycle. Our view is that the results of the interim residual values of larger funds points towards a greater conclusion. Because the largest private equity funds are normally leveraged buyout funds, we posit that the residual values of these funds should be accurate estimates of portfolio company valuations. Our belief is that buyout fund managers base interim valuations on each individual portfolio company's former public market valuation. As a result, reported residual values of buyout funds should more accurately reflect the value that portfolio companies contribute to the fund at the time of unloading. Therefore, we hypothesize the following: the difference in fund reported performance measurements and actual performance measurements of buyout funds is less than the difference of non-buyout funds:

$$H_5 : \beta_{Buyout} < 0,$$

where beta represents the estimated effect of buyout funds on the difference between reported and actual performance measurements.

Residual Values of United States Based Funds

The private equity industry has experienced many changes during the current period. One of the major changes has been the establishment of valuation guidelines by the major associations that provide direction for the private equity industry. These guidelines are the result of collaboration between the industry associations to push the industry towards more uniform reporting standards of fair market values rather than simply valuations at cost. Though only guidelines, two significant developments have helped move general partners in the direction of reporting residual values at fair market

values. First, most partnership agreements are now written to stipulate that valuations are to be based on fair market value practices. Second, the number of U.S. based public pension funds investing in private equity has exploded over the last fifteen years. Due to United States Freedom of Information laws, many of these funds have been forced to make available their private equity holdings and performance history. As a result, fund managers operating funds in the U.S. have been trending towards reporting residual values at fair market values. Recently, these events have led to the issuance of FASB 157, which provides generally accepted accounting principles (GAAP) for reporting alternative assets at fair market values. Though the practice of reporting under fair market value assumptions is the current trend in the British and European private equity industries, we feel that the push towards these practices has been much stronger in the United States. As a result, reported residual values of U.S.-based private equity funds should be more accurately reflect the value that portfolio companies will contribute to the fund at the time of unloading. Therefore, we hypothesize the following: the difference between fund reported performance measurements and actual performance measurements of U.S.-based funds is less than the difference of non-U.S. based funds:

$$H_6 : \beta_{NAT} < 0,$$

where beta represents the estimated effect of buyout funds on the difference between reported and actual performance measurements.

CHAPTER IV

DATA AND SAMPLE SELECTION

This chapter introduces the data and sample selection techniques used to test our hypotheses. Currently only two firms, Private Equity Intelligence (PEI) and Thomson's Venture Economics, track private equity fund returns on an adequate scale for an empirical analysis.[16] We obtain and use proprietary performance data provided by Private Equity Intelligence located in London, England. Unlike the performance datasets in prior studies, especially those using Thomson's Venture Economics performance data, we are able to identify the individual funds in our sample.[17] This enables us to supplement the individual performance measurements of the Private Equity Intelligence data with each fund's characteristic data obtained from the Thomson Financial VentureXpert (VX) database via the Securities and Data Corporation (SDC) platform. While the anonymity of the samples of prior studies greatly limited the scope of those studies, our data enables us to perform a more in-depth analysis of the different

[16] The Venture One database owned by The Dow Jones Company covers the individual transactions made between private equity funds and portfolio companies, but one would have to calculate fund cash flows based on many assumptions. Recently, new data management firms, such as VC Experts, have entered into the private equity data management market. However due to their tardiness of data collection, these recent entrants will not have viable data sets for another 8 to 12 years.

[17] Kaplan and Schoar (2005) acknowledge that the anonymity of their sample precludes them from extending their study past their primary size and persistence examinations. However, a recent study by Phalippou and Gottschalg (2006) utilizes Thomson's "investment database". From this database, they are able to identify the type of fund, fund size, fund sequence, and the fraction of investments exited via an initial public offering or a merger and acquisition. However, it is not clear whether they can identify the exact fund by name.

measurements used to assess private equity performance, the assumptions behind them, and how fund and firm characteristics affect these measurements.

Data

Private Equity Intelligence

The performance data utilized in Kaplan and Schoar (2005), Phalippou and Zollo (2005), and Phalippou and Gottschalg (2006) were provided by Thomson's Venture Economics, but this data has since become unavailable to the academic and financial communities on an individual fund basis.[18] Therefore, we utilize return data on the fund level provided via the Performance Analyst Database of Private Equity Intelligence. In tracking over 3,100 funds, Managing Directors Mark O'Hare and Nick Arnott assemble data from a variety of sources in North America and Europe. These sources include voluntary reporting by general and limited partners, publications available in the public domain because of legislation, and the financial reporting practices of some limited partners, such as public pension funds.

Specifically, we obtain the following cumulative fund-level performance data as reported quarterly by the general partners: internal rates of return, value multiples, distribution to paid-in ratios, and residual value to paid-in ratios. We also obtain fund-level characteristic data of fund vintage year and the percent of the fund commitment that has been called. In addition to these data, PEI has provided the underlying cash flows, including reported residual values, for roughly 222 mature funds. These cash flows allow us to add several dimensions to our study. First we are able to complement the PEI

[18] Venture Economics still provides return data in aggregate form.

performance data with our own calculations of IRR, value multiples, distribution to paid-in ratios, residual value to paid-in ratios as well as calculating the profitability index. Finally, cash flow analysis allows us to calculate our performance measurements on an interim basis, as well as examine the residual values reported by the general partners.

Thomson Financial's VentureXpert Database

We supplement the PEI data with data obtained from the Thomson Financial VentureXpert database accessed through the Securities Data Corporation (SDC) platform. Specifically, we obtain firm and fund data in order to examine those specific characteristics, which might affect performance measurement. Data obtained regarding funds are as follows: the size of the fund, fund sequence number, sequence type, fund type, fund's average company and financing round investments, maximum company and financing round investments, minimum company and financing round investments, the fund's total dollar amount invested in all portfolio companies, the number of portfolio companies the fund has invested in, and the number of financing rounds the fund has participated in. We also obtain the following data regarding general partner firms: firm name and founding date, firm's total capital under management, the minimum company sales the firm requires for investment, firm's average company and financing round investments, maximum company and financing round investments, minimum company and financing round investments, the firm's total dollar amount invested in all portfolio companies, the number of portfolio companies the firm has invested in, and the number of financing rounds the firm has participated in.

Sample Selection

In constructing our sample, we combine the performance data obtained from PEI with that obtained from VX. This provides us with an accurate sample containing both individual fund performance data and fund characteristic data. We then subset our data using those funds for which we have the underlying cash flows to recompute the performance measurement presented in Section 2.3 of Chapter 2. This enables us to not only determine the accuracy of fund reported performance measurements and the effects of residual values on these measurements, but also allows us to examine residual value behavior associated with certain fund and firm characteristics.

In selecting their sample, Kaplan and Schoar (2005) employ the use of "quasi-liquidated" funds, or funds that have been liquidated or have not reported any cash flow for the last two years of their sample. Phalippou and Zollo (2005) and Phalippou and Gottschalg (2006) utilize a similar sample selection technique, but include funds that have not shown any cash flow activity over the past eighteen months during the sample period. In continuing with these sample selection practices, we select only those funds that are at least 10 years old and have not shown any cash flow activity for at least eighteen months for inclusion in our sub-sample. Therefore, the last funds included in our sub-sample are those from the 1996 vintage class. It is important to note that this allows us to evaluate fund performance on funds raised three years after the funds examined in the Phalippou and Zollo (2005) and Phalippou and Gottschalg (2006) data sets.

Data Description

Merging of Private Equity Intelligence to VentureXpert

Though merging data sets normally involves simply executing the merge command in statistical software, merging the PEI data to the VX data proved to be quite a difficult task that revealed several variations and discrepancies in the data. Specifically, both reported slightly different names or abbreviations for numerous funds. PEI staff explained that both they and Venture Economics could be acquiring information on a particular fund from different limited partners. This could cause the assigned fund name to differ. In addition, similar to public equity markets, the private equity market has experienced some consolidation through merger activity and many names have been combined and/or changed in the process. It is important to note that no central data exists for private equity fund identification such as the EDGAR database provided by the U.S. Security and Exchange Commission for publicly traded equity securities. Therefore, there are not single identifiers such as CUSIP numbers assigned to publicly traded equity securities.

We also found several funds that were identified as either a venture capital or buyout fund by PEI, but identified differently by VX. This discrepancy is the result of VentureXpert having several different classifications of both venture capital and buyout funds. In order to label the fund correctly, we accessed the private equity firm's website and were able to identify all but two funds correctly. These funds were removed from the sample. We also found that both databases reported different sequence numbers for some funds. Because prior studies utilized the sequence numbers provided by VX, we feel that

is only appropriate for us to do the same. Finally, we found that the vintage years reported by PEI proved incorrect for several funds. We know this because these funds had cash flow activity prior to the vintage year reported by PEI. Therefore, we use those vintage years provided by VX.

Full Fund Sample

In Table 4.1, we provide descriptive statistics of the funds comprising our sample. We divide our full sample into the industry's two main periods by fund vintage year, 1980 to 1991, and 1992 to 1996. Descriptive statistics for periods one and two are presented in Panels A and B, respectively.

As expected, the number of funds reported in Panel B is approximately five times the size of that reported in Panel A. This difference highlights the unprecedented growth in the industry during the 1990s. Not only is the sample size larger in the 1992 to 1996 period, but the size of the funds as well as the investment behaviors of both venture capital and buyout funds changed dramatically during the latter period. Specifically, deal sizes increased while the average number of investments in portfolio companies decreased. Even more interesting is the finding that the number of financing rounds the funds participated in decreased at a greater rate than the number of deals the funds entered. Funds during the current period have supplied capital to their portfolio companies in fewer financing rounds. As described by Gompers and Lerner (2000), this behavior is probably the result of too much money chasing too few deals.

Prior to the push towards fair market valuations, private equity funds, especially venture capital funds, would only reevaluate their portfolio company valuations at each

round of financing. Therefore, this has important implications for the current study. First, fewer financing rounds should increase the predictability of the residual values of buyout funds. Since buyout funds are in the business of taking publicly traded companies private, their residual values would be based upon the original valuations that were actually set by the public market at the time of purchase for each portfolio company.

Full Firm Sample

We provide firm descriptive statistics in Table 4.2. Similar to Table 4.1, we divide our sample into those funds founded before and after January 1, 1992. We observe that capital under management for the older firms is more than double that of younger firms. This is expected in that older firms have had more time to prove their success and raise more follow-on funds. In fact, Kaplan and Schoar (2005) find that each subsequent fund a firm raises is larger than the previous. Surprisingly, the average portfolio company investment for the younger firms is larger than that of the older firms, $13.4 and $12.1 million, respectively. One would expect larger firms to have the ability to invest larger amounts in portfolio companies. A possible explanation of this finding is that younger firms are forced to pay higher premiums to portfolio companies in the auction process. This is important because higher premiums paid for portfolio companies could result in inflated residual values early in the fund cycle causing their reversion pattern to be accelerated at the end of the holding period of a portfolio company. This could partially explain the significance of reported residual values early in the fund cycle reported by Phalippou and Gottschalg (2006).

Sub-sample

Our subset of funds and firms, presented in Table 4.3 provide us with the underlying cash flows of the funds reported net of fees and including yearly reported residual values. Our sub-sample is concentrated on those funds operated during the current period of the private equity industry; thus, the characteristics of our sub-sample are much more similar to that of Panel B in Table 4.1. However, it is important to illustrate that the firm characteristics tend to indicate that our sub-sample is concentrated in larger more experienced firms concentrated in the buyout industry. We must acknowledge that our data is weighted heavier in buyout funds, where the Venture Economics data is weighted heavier toward venture capital funds. This is important in that this could cause the reported residual values of the funds of these firms to be more accurate than those of funds raised by younger firms.

Data Comparison to Prior Studies

Since this is the first use of the PEI performance data, it is important to establish that it behaves similar to that of the Venture Economics data utilized in the major studies of private equity performance. Table 4.4 presents a comparison of the behavior of the PEI performance data relative to the Venture Economics data utilized in prior studies. Because the two studies included in Table 4.4 never ran duplicate models or utilized the same data, we present the ranges of the main beta coefficients for those variables that were consistent in the empirical models examined by Kaplan and Schoar (2005) and Phalippou and Gottschalg (2006). We then ran a model based upon those variables using our data of the following ordinary least squares regression:

$$\mathrm{Re}turn_{PI} = \alpha + \beta_{Size} + \beta_{Sequence} + \beta_{VCDUM} + \varepsilon \quad (6).$$

Our fund size beta coefficient of 0.23 falls within the range of 0.02 - 0.28 set by the Phalippou and Gottschalg (2006) study. The sequence beta coefficient and coefficient for the venture capital dummy for our model is within the range set by the both studies. Therefore, we conclude that the Private Equity Intelligence data behaves similar to that of the Venture Economics data utilized in prior studies.

Possible Limitations of the Data

Because both databases contributing to our sample receive much of their data from general and limited partners, we in no way can verify the accuracy of the data. However, both Private Equity Intelligence and Thomson support the validity of their data. Since both general and limited partners are providing data, and additional data is gathered in the public domain, inconsistent reporting can be identified by PEI and Thomson.

We also acknowledge that there are a lower number of observations during earlier periods of the sample compared to the current period, and we acknowledge that this bias skews results towards the latter portion of our sample. Because of the immaturity of the industry and the subsequent immaturity of data collection efforts, all previously discussed studies suffer this same weakness. Finally, we acknowledge that much of the data in VentureXpert is sparse to non-existent. The majority of this non-existent data is information regarding portfolio companies. Because our paper concentrates on fund and firm characteristics, this does not adversely affect our results.

Table 4.1. Fund Sample Descriptive Statistics

Panel A. Vintage Years, 1980 – 1991

	Total PE (N = 274)			Venture Capital (N = 204)			Buyout Funds (N = 70)		
Items ($ millions)	Mean	Median	Stand. Dev.	Mean	Median	Stand. Dev.	Mean	Median	Stand Dev.
Fund Size	172.8	5.9	435.1	83.5	44.7	160.3	433.4	217.9	762.2
Avg. PC Investment	7.7	1.8	36.3	2.1	1.7	2.4	27.1	5.0	73.8
Max PC Investment	42.8	6.2	284.3	9.7	5.4	18.9	157.7	18.5	589.3
Min PC Investment	0.9	0.1	3.9	0.3	0.1	0.7	3.4	0.6	7.7
Avg. Round Investment	5.4	0.8	30.8	1.0	0.7	1.2	20.7	3.3	63.2
Max Round Investment	40.4	4.3	284.1	7.6	3.8	15.1	154.1	15.5	589.5
Min Round Investment	0.7	0.0	2.9	0.1	0.0	0.4	2.4	0.3	5.8
Total Investment in all PCs	123.2	43.7	379.3	78.2	41.2	200.2	278.9	66.3	692.0
No. of PC Investments	26.4	22.0	22.2	30.3	26.0	22.6	13.7	8.0	15.1
No. of Rounds Participated	65.2	51.0	64.9	77.0	59.0	67.2	26.3	11.0	35.6

Panel B. Funds Vintage Years, 1992 – 1996

	Total PE (N = 1,394)			Venture Capital (N = 805)			Buyout Funds (N = 589)		
Items ($ millions)	Mean	Median	Stand. Dev.	Mean	Median	Stand. Dev.	Mean	Median	Stand Dev.
Fund Size	521.9	225.0	975.9	261.9	137.4	510.0	877.3	425.0	1,296.8
Avg. PC Investment	16.4	5.3	37.3	5.6	4.0	6.9	33.8	15.0	55.5
Max PC Investment	56.2	15.3	135.9	20.8	11.1	50.6	113.4	46.0	197.4
Min PC Investment	8.0	0.8	49.6	1.3	0.5	6.6	18.7	2.0	78.6
Avg. Round Investment	12.8	3.2	33.0	3.5	2.3	5.4	27.8	11.3	49.4
Max Round Investment	51.3	12.4	129.3	17.1	8.0	47.1	106.7	43.6	187.8
Min Round Investment	7.0	0.3	49.3	905.3	170.0	6.1	16.7	1.0	78.5
Total Investment in all PCs	207.9	75.0	413.9	137.3	63.1	294.2	322.2	121.8	536.4
No. of PC Investments	16.6	12.0	20.2	20.4	16.0	21.7	11.0	7.0	16.4
No. of Rounds Participated	30.3	17.0	39.5	40.2	27.0	44.3	15.9	9.0	25.3

Note: Panel A provides descriptive statistics for those funds raised between 1980 – 1991and Panel B provides descriptive statistics on those funds raised between 1992 – 1996. The descriptive statistics presented are as follows: the size of the fund, the average, maximum, and minimum investment in a portfolio company by the fund, the average, maximum, and minimum round investment by the fund, the total amount the fund has invested in all portfolio companies, the total number of portfolio company investments by the fund, and the total number of round investments by the fund. All monetary values are reported in United States Dollars.

Table 4.2. Firm Sample Descriptive Statistics

Panel A. Founding Years, Pre 1992			
	Total PE (N = 338)		
Items ($ millions)	Mean	Median	Stand. Dev.
Capital Under Management	1,828.3	533.5	4,463.8
Min. PC Sales Required for Investment	15,593.8	3,000.0	33,734.6
Avg. PC Investment	12.1	5.3	21.2
Max PC Investment	141.6	35.0	373.8
Min PC Investment	2.0	0.1	13.9
Avg. Round Investment	8.3	2.5	16.8
Max Round Investment	128.4	26.4	359.1
Min Round Investment	1.6	0.03	13.7
Total Investment in all PCs	1,021.0	287.9	2,294.3
No. of PC Investments	96.8	51.0	147.5
No. of Rounds Participated	213.6	90.0	344.7

Panel B. Vintage Years, Post 1992			
	Total PE (N = 361)		
Items ($ millions)	Mean	Median	Stand. Dev.
Capital Under Management	857.0	300.0	2,129.1
Min. PC Sales Required for Investment	11,248.8	5,000.0	14,122.0
Avg. PC Investment	13.4	5.4	27.2
Max PC Investment	81.1	20.0	212.0
Min PC Investment	3.9	0.5	19.3
Avg. Round Investment	9.6	3.0	20.7
Max Round Investment	73.0	15.0	201.7
Min Round Investment	2.9	0.2	126.8
Total Investment in all PCs	372.3	126.8	666.7
No. of PC Investments	33.8	19.0	47.1
No. of Rounds Participated	67.7	30.0	109.3

Note: Panel A provides descriptive statistics on those firms founded prior to 1992 and Panel B provides descriptive statistics on those firms founded during and after 1992. The descriptive statistics presented are as follows: the total amount of capital managed by the firm, the minimum amount of sales of a portfolio company to be eligible for financing under the firm's criteria, the average, maximum, and minimum investment in a portfolio company by the firm, the average, maximum, and minimum round investment by the firm, the total amount the fund has invested in all portfolio companies, the total number of portfolio company investments by the firm, and the total number of round investments by the firm. All monetary values are reported in United States Dollars.

Table 4.3. Sub-Sample Fund & Firm Descriptive Statistics

Panel A. Fund Statistics

	Total PE (N = 222)			Venture Capital (N = 92)			Buyout Funds (N = 130)		
Items ($ millions)	Mean	Median	Stand. Dev.	Mean	Median	Stand. Dev.	Mean	Median	Stand. Dev.
Fund Size	420.2	220.0	621.7	192.6	121.5	231.1	605.8	379.9	763.6
Avg. PC Investment	15.5	5.1	30.0	4.7	3.5	4.6	24.6	13.7	38.2
Max PC Investment	56.3	17.3	127.1	15.7	11.9	20.5	90.2	45.0	164.0
Min PC Investment	2.5	0.4	7.7	0.5	0.2	0.9	4.2	1.0	10.2
Avg. Round Investment	10.9	3.5	25.6	2.6	1.8	2.6	17.8	8.1	33.2
Max Round Investment	52.5	15.3	126.0	12.9	9.0	15.7	85.6	39.6	163.2
Min Round Investment	1.3	0.2	4.9	0.3	0.1	0.7	2.2	0.4	6.4
Total Investment in all PCs	223.2	84.3	387.2	107.2	66.1	206.9	320.2	121.8	36.8
No. of PC Investments	18.9	14.0	29.0	21.2	19.0	15.2	17.0	11.0	46.1
No. of Rounds Participated	36.3	22.0	49.1	48.9	33.5	49.8	25.6	15.0	468.8

Panel B. Firm Statistics

	Total PE (N = 93)		
Items ($ millions)	Mean	Median	Stand. Dev.
Capital Under Management	3,187.8	1,000.0	6,490.1
Min. PC Sales Required for Investment	22,882.8	1,000.0	35,487.1
Avg. PC Investment	20.6	8.1	31.2
Max PC Investment	244.6	50.0	530.4
Min PC Investment	1.7	0.2	7.7
Avg. Round Investment	14.3	4.4	27.7
Max Round Investment	222.4	39.6	512.4
Min Round Investment	0.5	0.0	1.6
Total Investment in all PCs	1,709.1	479.2	3,382.5
No. of PC Investments	103.2	51.0	166.1
No. of Rounds Participated	230.7	86.0	400.0

Note: Panel A provides descriptive statistics for those funds comprising our subset of funds. The descriptive statistics presented are as follows: the size of the fund, the average, maximum, and minimum investment in a portfolio company by the fund, the average, maximum, and minimum round investment by the fund, the total amount the fund has invested in all portfolio companies, the total number of portfolio company investments by the fund, and the total number of round investments by the fund. Panel B provides descriptive statistics for those founding firms of our subset of funds. The descriptive statistics presented are as follows: the total amount of capital managed by the firm, the minimum amount of sales of a portfolio company to be eligible for financing under the firm's criteria, the average, maximum, and minimum investment in a portfolio company by the firm, the average, maximum, and minimum round investment by the firm, the total amount the fund has invested in all portfolio companies, the total number of portfolio company investments by the firm, and the total number of round investments by the firm.All monetary values are reported in United States Dollars.

Table 4.4. Base Variables Comparison

Dependent Variable: Profitability Index			
	Kaplan & Schoar (2005)	Phalippou & Gottschalg (2006)	Current Study
Fund Size	0.03 – 0.18	0.02 – 0.28	0.23
Fund Sequence	–0.01 – 0.43	–0.30 – 0.93	0.16
VC Fund Dummy	0.06 – 0.60	–0.27 – 0.20	0.54
N	350 – 746	852	222

a. Significant at the 0.05 level
b. Significant at the 0.01 level

Note: The dependent variable is the profitability index of our subset of funds. The explanatory variables are the size of the fund, the sequence number of the fund, and a dummy variable indicating whether a fund is a venture capital fund. Columns 1 and 2 present the range of the beta coefficients for the explanatory variables presented in Kaplan and Schoar (2005) and Phalippou and Gottschalg (2006). Column 3 presents the results of a panel regression model of our sample.

CHAPTER V

METHODS AND RESULTS

In this chapter, we provide an empirical development of the methods employed to test our six hypotheses presented in Chapter 3 and the results of these statistical tests. First, we perform a correlation analysis to examine any differences between our performance measurements. Next, we perform one-tailed t-tests for a difference in means of our performance measures under different assumptions. In turning our attention to the predictability of interim residual values, we perform a tobit model and ordinary least squares regression analysis. The results and implications of each statistical analysis are presented at the end of each subsection.

Differentiating Between Private Equity Performance Measurements

Correlation Analysis – Methods

In section 2.3 of Chapter 2, we established that performance measurements utilized by practitioners in the private equity industry and those introduced in the academic literature differed greatly in their interpretations and in what they measure. However, we hypothesize that these measurements are highly correlated making it difficult to differentiate between them. In order to clarify the interpretations of and the relationships between private equity fund performance measurements, we provide a

correlation analysis of these performance measurements. Specifically we calculate the IRR, value multiple, distribution to paid-in ratio, residual value to paid-in ratio, and the profitability index for each fund in our subset of funds on an annual basis under two specifications. We calculate the first specification under the assumption that only realized cash flows should be included, while the second specification assumes that both realized cash flows plus residual values should be included. Since the IRR is the industry standard, we use it as our basis for comparison.

Meyer and Mathonet (2005) contend that concentrating solely on the IRR presents a major problem. Because the IRR places a higher value on cash flows that occur earlier in the fund cycle, general partners might be tempted to realize short-term gains on portfolio company investments to optimize IRR. The same is true for the profitability index. The alternative to this strategy is to wait for longer periods of time to optimize realized returns; therefore, optimizing value multiples and distribution to paid-in ratios. Phalippou and Gottschalg (2006) voice concerns regarding the consequences on fund performance of extending the fund past its intended 10-year cycle. They posit that the majority of the extended funds have little or no activity. This should adversely affect the IRRs and profitability indexes, which value earlier cash flows higher than later ones. In order to examine the effects of extending funds past their intended ten-year cycle, we calculate all return measurements at both the tenth and final year of each fund's cycle.

Before performing their regression analyses, Kaplan and Schoar (2005) compared the IRRs reported by Venture Economics to the IRRs that they computed from the funds' cash flows. They report correlation coefficients of 0.98, indicating that the IRRs reported

by Venture Economics' sources were reported correctly. When comparing their calculated IRRs to their calculated profitability indexes, they report a correlation coefficient of 0.88. This indicates that the two measurements are accurate calculations of fund performance. It is important to note that all performance calculations performed in Kaplan and Schoar (2005) were done so on a cash flow plus residual value basis. Therefore, we are left with the question of whether any performance measurement more accurately reflects fund performance when compared to the other measurements under varying assumptions regarding residual values.

Prior to the passage of FASB 157, the accounting standards for interim residual values stated that the values of all underlying portfolio companies should be reported at cost. However, in the latter part of the 1990s and early 2000s, the National Venture Capital Association and the comparable European associations proposed valuation modified guidelines. In a study that examines residual values prior to and after the issuance of the guidelines, Blaydon and Horvath (2002) show that the valuations of portfolio companies vary greatly among general partners as far back as the late 1980s. Kaplan and Schoar (2005), Phalippou and Zollo (2005), and Phalippou and Gottschalg (2006) posit that residual values should become more accurate the closer a fund gets to its termination. However, Phalippou and Gottschalg (2006) findings suggest the opposite in that residual values only possess predictive qualities early in the fund cycle.

To examine the effect of residual values, we calculate our performance measurements on both a realized and realized plus residual value basis at the two points in the fund cycle described above. Phalippou and Gottschalg (2006) found that by

writing off all "living deads" in their sample, the average profitability index declined by approximately 50 basis points. We extend this analysis further by simply dropping all residual values, whether deemed a "living dead" or not. In doing this, we hope to gain further insight into the effects of all residual values on performance measurement.

In order to test for accuracy among performance measurements, we calculate and compare Pearson correlation coefficients for our performance measurements under both specifications regarding residual values at the tenth and final year of our fund cycles. The purpose of including the tenth year of the fund cycle is to examine the behavior of fund returns at the point in time when the fund should be terminating.

Correlation Analysis – Results

The results of our correlation analysis are reported in Table 5.1. As hypothesized, the majority of the correlations between our four performance measurements are positive and statistically significant at a minimum five-percent level. However, when we examine the correlations of our measurements at the tenth and final year of the fund cycle and under the two specifications regarding residual values, we observe that this correlation decreases. Therefore, it is important to highlight and discuss these decreases and their implications on the understanding of private equity performance measurements.

The different specifications of IRR at both time periods have positive correlations with one another all greater than or equal to .95, with one exception. The IRR calculated under Specification 2 including residual values at year ten has much lower correlations ranging between .68 - .71. Most interestingly is the correlation of 0.68 between the two different IRR calculations at the tenth year. The fact that this correlation is 0.30 less than

the other correlations suggests that private equity fund managers could be manipulating residual values in the tenth year to justify extending the fund cycle. In an effort to promote the idea of extending the fund past its contracted life cycle, fund managers could be over-inflating the residual values. This would increase the desire of limited partners to recoup these investments eventually; therefore, they would agree to extend the fund cycle. However, fund managers partially base valuations of portfolio companies on present public equity market conditions at the time of the valuations. Therefore, the effects of these market conditions on residual values could possibly cause the difference in the correlations documented above. Alternatively, one could argue that the majority of investments made by private equity funds simply take longer to mature; therefore, the tradition 10-year life cycle of the fund is not long enough.

When comparing the correlations of our sample's different performance ratios, such as the Value Multiple and Distribution to Paid-in ratio, we find their correlations are statistically positive ranging from 0.89 to 0.99 in the tenth and final years. This suggests that residual values do not affect the performance ratios to the same degree that they effect IRR and the profitability index.

In examining the correlation coefficients between all IRR calculations and the profitability index calculations are positive and significant, ranging from 0.20 to 0.82, with one exception. The profitability index calculated under specification one including realized cash flow in the final fund year does not have a significant correlation with any of the IRR calculations. This is important in that it proves a distinct difference in what is

measured by final IRR and the profitability index of a fund. We find similar correlations between our profitability indexes and our performance ratios.

Finally, we find the correlation between public equity markets, measured by the annualized return of the S&P 500 over the life of the fund, and our performance measurements not significantly different from zero. This finding supports the hypothesis put forth by Anson (2004) that private equity is an alternative asset. The lower the correlation between private equity and public markets, the greater the potential benefit from diversification essentially expanding the efficient frontier for private equity investors.

Overall, we find partial support of Hypothesis 1 that the performance measurements of private equity introduced in section 2.3 of Chapter 2 are positively correlated. However, when the performance measurements are calculated at differing time periods under different assumptions regarding residual values, we find that correlations between the measurements decrease. These decreases seem most severe in the tenth year of the fund cycle. With the majority of the correlations differing during this point in time due to the inclusion of residual values, users of interim performance measurements should be cautious about there interpretations of these measurements. In the coming sections, we hope to shed some light on the performance and predictability of interim residual values.

Performance Measurements Summary

In Table 5.2, we report the mean, median, standard deviation, maximum and minimums of our performance measurements. The mean of the value multiple at year ten

and at the final year of the fund cycle is approximately 1.66, suggesting that the average private equity fund has returned 1.66 times the capital, including residual values; its limited partners invested. After dropping the residual values included in the value multiple, the mean of the distribution to paid-in ratio is 1.51 at the end of the tenth year and 1.62 at the end of the fund cycle.

Finally, we observe the mean of the residual value to paid-in ratio is 0.92 at the end of the tenth year and 0.07 at the end of the fund cycle. This states that the average value of a private equity fund still has a value of ninety two percent of its invested capital at year ten, but only seven percent at the end of the fund cycle. This has two important implications. First, investors should expect the average private equity fund to ask for an extension of the fund due to the large amount of value that remains in the average fund at the expected termination point of ten years. Secondly, the seven percent value reported at the end of the fund life partially supports the residual reversion hypothesis put forth by Kaplan and Schoar (2005). They argue, but do not test, that if residual values are accurate predictors of a fund's final performance, then residual values should revert to zero by the end of the fund cycle. However, as we point out, our findings only partially support this hypothesis. This suggests that many fund managers still report residual values at the end of the fund cycle.

When comparing IRRs and profitability indexes at the tenth and final year of the fund cycle one must take into consideration that these performance measurements can be calculated both gross and net of residual values. The mean IRRs calculated in the tenth are 18 percent under specification one and 37 percent under specification two. The result

of a one-tailed t-test indicate a statistically significant difference between the two; and provides evidence in support of Hypothesis 2 that residual values over-inflate the actual IRR of private equity funds. This clearly shows the magnitude of the effect of residual values on IRR in the tenth year. This could partially explain the correlation behaviors we observed for year ten in the previous section.

Though the effect of residual values on IRR is quite severe in year ten, their effect on the final IRR is marginal in that we do not find significant difference in the two specifications of the IRR calculation. In fact, the IRR based off realized cash flows is actually greater than that based off realized cash flows plus residual values. We attribute this to many residual values being reported as negatives as they are written off at the end of the fund. Because the profitability index behaves much like the IRR, it is important to point out that we find similar results for it.

Predictability of Interim Residual Values

Predictability of Returned Capital - Methods

In the previous analysis, we observe that eliminating fund residual values as the terminal value in the cash flow analysis of private equity funds increases the relationship between performance measurements. In this section, we seek to expand the literature regarding those fund characteristics that predict fund performance concentrating on interim residual values reported by fund managers.

We first seek to establish whether residual values can predict the amount of capital returned to limited partners over the life of the fund. Because the amount of

capital that can be returned has a minimum value of zero and continues positively to infinity, as suggested by Wooldridge (2006) we introduce a Tobit model to examine the predictability of residual values:

$$Capital^* = \beta_0 + \beta_1(Size) + \beta_2(Experience) + \beta_3(VC) + \beta_4(RV) + \varepsilon\,, \qquad (7).$$

where:

$Capital^*$	=	the dollar amount of money return to limited partners net fees and carried interest;
Size	=	total size of fund commitments;
Experience	=	sequence number of the fund;
VC	=	one if a fund is a VC, zero otherwise; and
RV	=	the residual values reported in years 3 through n-1 of the fund cycle.

Due to the earliest residual values normally being reported at cost, we begin our analysis at year three and continue on an annual basis through the year prior to the end of the fund cycle. The findings of Kaplan and Schoar (2005) establish fund size, fund sequence number, and venture capital fund types to be robust predictors of the final profitability index. Therefore, we include these variables in our Tobit model. As stated in Hypothesis 3, we expect to find that residual values are predictors of the amount of capital returned to limited partners.

Predictability of Returned Capital - Results

The results of our Tobit model are provided in Table 5.3. As expected, both fund size and fund sequence are positive predictors of the final amount of capital returned to

the fund. However, the venture capital dummy variable coefficient is negative but not significantly different from zero. Most importantly, we find that interim reported residual values are statistically significant positive predictors of the amount of capital returned to fund investors over the life of the fund, but only in a limited number of years. Specifically, we find positive coefficients in years five, six, and seven. This finding provides results similar to the ordinary least squares estimates of Phalippou and Gottschalg (2006) that interim residual values are only significant predictors of fund performance early in the life of the fund. Therefore, Hypothesis 3 that interim residual values are predictors of final fund performance is supported on a limited scale.

Predictability of Fund Performance - Methods

Although Phalippou and Gottschalg (2006) write-off all "living-deads" in their sample before calculating their profitability indexes, they do examine the predictability of interim residual values reported by general partners during the contractually allotted time of the fund cycle. Specifically, they test whether the residual values reported in years three through nine have any predictability of final fund performance as measured by the profitability index. Their findings suggest that only the residual values reported by very large funds and/or more experienced funds have any predictability, but the statistical significance is weak. They attribute their findings to noise built into the residual values reported by fund managers. This is consistent with the noisy valuations of portfolio companies found by Blaydon and Horvath (2002).

In their analysis of the predictive power of residual values upon profitability indexes, Phalippou and Gottschalg (2006) develop a model established on the findings of Kaplan and Schoar (2005):

$$Performance = \beta_0 + \beta(Size) + \beta(Experience) + \beta(VC) + \varepsilon, \quad (8)$$

where:

Performance	=	IRR, Value Multiple, Distribution to Paid-in Ratio, Residual Value to Paid-in Ratio or the Profitability Index;
Size	=	total size of fund commitments from LPs;
Experience	=	measurement of a GP's level of experience managing Funds (fund sequence number); and
VC	=	one if the fund is a VC, zero otherwise.

Because the two studies utilize very similar data sets, Phalippou and Gottschalg (2006) and Kaplan and Schoar (2005) produce similar results for the size, experience, venture capital dummy variables. To test the predictability of the residual values, the authors divide each annually reported residual value by the present value of the amount invested in the fund at that time, basically the residual value to paid-in ratio modified to incorporate the time value of money. Although it is a viable and unique measurement, this approach to measuring residual values could affect their results. By using the present value of the capital invested into the fund after year six, the authors are ignoring that amount of capital that has previously been returned to the limited partners through distributions, this ignores any accounting value changes in the residual values. This could be decreasing the level of residual values relative to the amount of capital still

invested in the funds in the Phalippou and Gottschalg (2006) sample. Therefore, we focus our analysis in a different direction.

In testing the predictability of interim residual values on final fund performance, we return to the base model established by Kaplan and Schoar (2005), Equation 6. Building on this model, we add the annual residual value (RRV) reported by fund management. This measurement should provide a much better picture of what is truly occurring on an annual basis with the funds portfolio companies. We expect the coefficient for the annual residual value variables to be positive, indicating that the residual values are predictors of the final performance of private equity funds.

Predictability of Fund Performance – Results

In testing Hypothesis 3 that reported residual values are positive predictors of final fund performance, we utilize the method of panel regression models. The panel consists of funds established in the same vintage years and groups of funds established by the same private equity firm. To control for the heterogeneity of funds established across different vintage years and for funds established by different private equity firms, we include two-way fixed effects. Specifically, we utilize the vintage year of each fund as the time variable and a unique firm number as the other fixed variable. Our models build on Equation 6 where the dependent variable in each model is one of the primary performance measurements discussed in section 2.3 of Chapter 2. We calculate each performance measurement at the end of the fund cycle under Specification 1 to include only realized cash flows. The explanatory variables included in our panel models are the natural logarithms of fund size and sequence number, a dummy variable identifying

venture capital funds, and the natural logarithm of the reported residual value for each year of the fund cycle. We report the results of our regression analyses in tables 5.5 through 5.8.

Internal Rate of Return

In table 5.5, we present the results of our first model with the IRR calculated under specification 1. We find that our model measured the variation in final fund IRR fairly well. The coefficients of determination range from 0.11 to 0.20 for our model where IRR is our dependent variable, indicating that 11 to 20 percent of the total variation in the IRR is explained by our models.

As expected, we find positive coefficients for our fund size, fund sequence, and venture capital dummy variables the greater majority of which are statistically different from zero. This is important because it provides added evidence that our sample of funds behaves much like that of the Venture Economics dataset, which claims to cover 95 percent of the total private equity population. Most importantly, we find that the annually reported residual values are positive predictors of the average private equity fund's IRR and are statistically different from zero in seven of the eleven years examined.

Instead of providing an economic interpretation of each significant result for the Log(RRV) variable, we highlight several of the more important coefficients. Specifically, the coefficient of 0.24 for the Log(RRV) variable in Year 3 indicates that for every one percent increase in value of reported residual values, the final IRR will increase by 0.024 percent above its current level. The same interpretation can be made for all statistically significant coefficients found for this variable. Overall, we feel that

these results provide strong support for hypothesis three suggesting that interim reported residual values are positive predictors of the final IRR for private equity funds. Therefore, we can conclude that for funds with active valuation practices, the interim reported residual values prove to be very important in monitoring the fund on an ex ante basis.

It is important to acknowledge the fact that the coefficients for Log(RRV) in years seven and eight are positive but not statistically different from zero. We feel that a possible explanation for this finding is that fund managers could be holding back on changing the valuations of their portfolio company holdings in anticipation of requesting an extension in the fund cycle in year ten. The idea would be to increase the unrealized values of the fund in the tenth year, which should encourage all limited partners to agree to the extension in hopes of eventually realizing these investments.

Value Multiple and Distribution to Paid-in Ratio

Due to the value multiple and distribution to paid-in ratio having similar interpretations of fund performance, we discuss their results together. Presented in Table 5.6 are the results of our panel model with the value multiple as the dependent variable, while the results for DPI are presented in Table 5.7. It may seem intuitive to assume that the final multiple and final DPI should be equal because funds cannot have a residual value in the final year of the fund cycle. However, funds may report residual values at the end of the fund. In order to terminate the fund, these residual values must be sold at a deep discount or written off. Due to linearity problems, we transformed the dependent variables in both models by taking the natural logarithms of each. We find that the

models explain between 4 and 13 percent of the total variation in the multiple and DPI. This is slightly lower than that found in the IRR specified models.

As expected, the coefficients for our base variables of fund size and venture capital are positive and significant. However, the third base variable of fund sequence is positive in both models, but only consistently statistically different from zero in the DPI model. One could speculate that this is the result of all private equity funds returning to the limited partners similar amounts of capital relative to the capital invested; and therefore, underscores the need for the time value of money component offered by the IRR and profitability measurements.

We find strong support for Hypothesis 3 that reported residual values are positive predictors of a private equity fund's final DPI. However, this hypothesis is not supported by the multiple model. In fact, the Log(RRV) variable coefficients are only significant in years 12 and 13 for the value multiple model. We view this finding as marginal in that we consider the DPI ratio to be a superior performance ratio due to it being calculated on realized cash flow only.

We find coefficients for the Log(RRV) variable statistically different from zero in seven of the eleven years examined in the DPI model. Instead of providing an economic interpretation of each significant result for the Log(RRV) variable, we highlight several of the more important coefficients. Specifically, the coefficient of 0.22 for the Log(RRV) variable in Year 10 indicates that for every one percent increase in value of reported residual values, the final DPI will increase by 0.22 percent above its current level. The same interpretation can be made for all statistically significant coefficients found for this

variable. Therefore, we can conclude that for funds with active valuation practices, the interim reported residual values prove to be very important for limited partners attempting to predict the amount of value created relative to their investments into the fund.

Profitability Index

The results of the profitability index model are presented in Table 5.8. We find that our profitability index model explains between 18 to 31 percent in the variation of a fund's final profitability index. This is similar to the variation found in the Kaplan and Schoar (2005) models measuring profitability indexes. As expected, the base variables of fund size and sequence number are positive and significant. However, an unexpected finding in our sample is that the venture capital dummy variable for this model specification is not significantly different from zero on a consistent basis.

We find evidence in support of hypothesis three that reported residual values are positive predictors of a private equity fund's final profitability index. Specifically, we find statistically significant coefficients for the Log(RRV) variable in 5 of the 11 years examined. Specifically, the coefficient of 0.70 for the Log(RRV) variable in Year 11 indicates that for every one percent increase in value of reported residual values, the final profitability index will increase by 0.07 percent above its current level.

Interestingly, the largest two significant coefficients occur in the tenth and eleventh year of the fund cycle, just after the limited partners have decided to extend the fund. One could reason that this increased predictability is the result of fund managers attempting to placate those limited partners by providing accurate residual value

estimates. This finding is opposite that of Phalippou and Gottschalg (2006), who find that reported residual values only had predictive ability early in the fund cycle. Therefore, we conclude that reported residual values are positive predictors of over or under performance of public equity markets by private equity funds. However, this finding is true only for those residual values reported late in the fund cycle.

Fund Characteristics and Residual Values

Fund Specialization and Predictability - Methods

The development of the modern day private equity industry has taken place during one of the most exciting and explosive economic periods in history, the 1980s through the present. The emergence of high growth technology firms combined with increased economic competition in all sectors has caused a large amount of specialization in the private equity industry, especially in venture capital markets. Meyer and Mathonet (2005) explain the importance of specialization through general partner experience on fund performance. Because limited partners are committing such large sums of capital to funds, they are only willing to do so if they are confident in their chosen fund manager's experience within the fund's targeted sector. Simply stated, a limited partner will be unwilling to invest in a fund specializing in alternative energy investments that would to be managed by a general partner with biotech experience.

Gompers, Kovner, Lerner and Scharfstein (2005) find that one of the key drivers of investment activity within the venture capital industry is sector experience. They further show that general partner experience is not easily transferable between sectors.

Munari, Cressy, and Malipiero (2005) provide further evidence as to the importance of specialization. Their findings suggest that portfolio companies of specialized firms increase profitability which; in turn, should increase fund performance.

The findings of Munari, Cressy and Malipiero (2005) suggests that the managers of specialized funds are better fund managers than those of less specialized funds and; therefore, it could be reasoned that these same managers should be better at valuating their portfolio companies. In Hypothesis 4, we posit that the managers of highly specialized funds report more predictive residual values than their less specialized counterparts. As a result, the absolute value of the difference in the fund reported final performance measurement, calculated under Specification 2, and the actual performance measurement should be less for specialized funds. The utilization of absolute values accounts for the fact that our sample has both positive and negative differences between the two performance measurements. In order to test this hypothesis we introduce an ordinary least squares regression model:

$$Difference_{FinalPerformance} = \beta_0 + \beta(Size) + \beta(Experience) + \beta(Spec) + \varepsilon, \qquad (9)$$

where,

Difference	=	the absolute value of difference between the final IRR or Profitability Index calculated under Specifications 1 and 2;
Size	=	total size of fund commitments from LPs;
Experience	=	measurement of a GP's level of experience managing funds (fund sequence number); and
Spec	=	one if the fund is a specialized fund, zero otherwise.

We expect the estimated coefficient for the specialized funds to be negative, which would indicate that the difference between final performance measurements is different for specialized funds.

Buyout Funds and Predictability - Methods

In Hypothesis 5, we posit that the residual values of buyout funds should be the most accurate in the private equity industry because the underlying portfolio companies were once publicly traded. We reason that public markets are more efficient than private markets and that fund managers should base their valuations upon the former public values of their portfolio companies. In our view, this should increase the efficiency of these valuations; therefore, decreasing the absolute value of the difference in the final performance measurements calculated under Specifications 1 and 2. The opposite should be true for venture capital funds in that many venture capital funds invest in portfolio companies with no acceptable peer group of which to base values. In order to test this hypothesis we replace the SPEC variable in Equation 9 with a dummy variable (BUY) indicating whether a fund is a buyout fund. We expect the estimated coefficient for the BUY variable to be negative, which would indicate that the difference between final performance measurements is different for buyout funds.

United States Based Funds and Predictability - Methods

With the introduction of valuation guidelines and increased pressure by everyday investors of public pension funds in the United States, many private equity funds have chosen to report residual values at fair market values rather than cost. Therefore, in

Hypothesis 6, we posit that the residual values of U.S. based funds should be greater predictors of final fund performance. As a result, the absolute value of the difference in the final performance measurements calculated under Specifications 1 and 2 should be less for U.S. based funds. In testing this hypothesis, we replace the SPEC variable in Equation 9 with a dummy variable (NAT) indicating whether a fund is a U.S. based. We expect the estimated coefficient for the NAT variable to be negative, which would indicate that the difference between final performance measurements is different for U.S. based funds.

Results of Ordinary Least Squares

We present the results of our OLS regression models in Tables 5.10 and 5.11. The dependent variable in each model is the absolute value of the difference of the two calculation specifications for either the IRR or Profitability index calculated at both the tenth and final years of the fund cycle. Results for the difference at Year 10 are presented in Panel A of each table, while the results for the difference in the Final Year are presented in Panel B. We do not include the value multiple and DPI in this analysis in that each either includes residual values or does not; therefore, no difference exists between reported and actual value multiples and DPIs.

Fund Size and Sequence Number

Because this is the first study to examine the degree of the difference in the performance measurement reported by private equity fund management and the actual performance of the fund, we feel it important to discuss the effects of those explanatory

variables carried over from our base model. With the exception of that found in Panel A of Table 5.10, the fund size variable produced a positive coefficient. This is intuitive in that one would expect larger funds to hold more portfolio companies in their portfolios; therefore, increased numbers of held portfolio companies could increase the value estimation error by fund management. In addition, the overall negative coefficient produced by the fund sequence number indicates that older more experience funds are better predictors of the final fund performance.

Internal Rate of Return

In Table 5.10, we present the results of our OLS model with the difference in IRRs as the dependent variable. Within Panel A, we find only economic evidence in support of Hypothesis 4. In Model 1 of Panel B, we find strong evidence in support of Hypothesis 4 that the difference between the IRR reported by fund managers and the actual IRR of the fund is less for specialized funds. Specifically, the coefficient for the SPEC dummy variable in Panel B is negative and statistically significant. However, when we control for the existence of buyout and U.S. based funds in Model 4, we find only economic evidence supporting this hypothesis. We attribute this to the overall difference of the IRR specifications to be quite small. Therefore, we fail to draw a consensus that the residual values for specialized funds are more accurate at predicting the final IRR than those of less specialized funds.

The results for Hypothesis 5 that the difference in IRR specifications is less for buyout funds are similar to those found for Hypothesis 4. In fact, the coefficient for the BUY dummy variable is negative but not significantly different from zero in Models 2

and 4 in Panel A, indicating only economic support for Hypothesis 5. Complementing this result, we find evidence that supports the difference in IRR specifications is be less for buyout funds in the final year of the fund cycle. Specifically, in Model 2 of Panel B we find a negative and significant coefficient for the BUY dummy variable. Similar to the Hypothesis 4 findings, when we control for the existence of buyout and U.S. based funds in Model 4, we find only economic evidence supporting this hypothesis. Consequently, we fail to draw a consensus that the residual values for buyout funds are more accurate at predicting the final IRR than those of non-buyout private equity funds.

Though we find some evidence supporting Hypotheses 4 and 5, the results do not support Hypotheses 6 that the difference in IRR specifications is less for U.S. based funds. Both the economic and statistical evidence suggests that the difference in IRR specifications could be greater for U.S. based funds. We find positve but not statistically different from zero coefficients for the NAT dummy variable in both Models 3 and 4 in Panels A and B. However, we must issue caution in interpreting this finding as fact in that we found no statistical evidence. Therefore, if the difference in IRR specifications is greater for U.S. based funds, the difference is probably only marginal.

Profitability Index

In Table 5.11, we present the results of our OLS model with the difference in the profitability index specifications as the dependent variable. We find strong evidence in support of Hypothesis 4 that the difference in profitability index specifications is less for specialized funds. Specifically, the estimated coefficient for specialized funds in Models 1 and 4 of Panels A and B is negative and significant at the 5 and 1 percent levels. The

negative coefficient is as expected and suggests that the difference in the profitability index specifications are less for specialized funds in both the tenth and final years of the fund cycle. Therefore, we conclude that the residual values for specialized funds are more accurate at predicting the final profitability index than those of less specialized funds.

The results for Hypothesis 5 that the difference in profitability index specifications is less for buyout funds are similar those found for Hypothesis 4. In Model 2 of Panel A, we find the coefficient for buyout funds to be both negative and significantly different from zero at the 5 percent level. However, when we control for the existence of specialized and U.S. based funds, the BUY coefficient retains its economic, but loses its statistical significance. In Panel B, we find negative and significant coefficients in Models 2 and 4. Our conclusion is that residual values of buyout funds are more accurate at predicting the final profitability index than those of non-buyout funds.

Unlike the results for Hypotheses 4 and 5, the findings for the coefficient of U.S. based funds do not provide support for Hypothesis 6. We posited that the difference in profitability index specifications should be less for U.S. based funds when compared to funds based in other countries. Our findings are attributable to the fact that European funds have recently fallen under the same pressures as U.S. funds in reporting residual values at fair market values. Therefore, we conclude that the residual values for U.S. based funds are no more accurate at predicting the final profitability index than those of non-U.S. backed funds.

Table 5.1. Correlation Analysis of Performance Measurements

Pearson Product-Moment Correlation (H_0: $\rho = 0$)													
	IRR_{CF10}	IRR_{CFF}	IRR_{RV10}	IRR_{RVF}	$Mult_{10}$	$Mult_F$	DPI_{10}	DPI_F	PI_{CF10}	PI_{CFF}	PI_{RV10}	PI_{RVF}	*Public*
IRR_{CF10}	1.00												
IRR_{CFF}	0.98[b]	1.00											
IRR_{RV10}	0.68[b]	0.71[b]	1.00										
IRR_{RVF}	0.96[b]	0.98[b]	0.74[b]	1.00									
$Mult_{10}$	0.70[b]	0.72[b]	0.18[a]	0.75[b]	1.00								
$Mult_F$	0.71[b]	0.76[b]	0.16[a]	0.75[b]	0.74[b]	1.00							
DPI_{10}	0.79[b]	0.79[b]	0.18[a]	0.79[b]	0.89[b]	0.83[b]	1.00						
DPI_F	0.71[b]	0.76[b]	0.16[a]	0.76[b]	0.75[b]	0.99[b]	0.83[b]	1.00					
PI_{CF10}	0.73[b]	0.74[b]	0.17[a]	0.74[b]	0.83[b]	0.83[b]	0.93[b]	0.83[b]	1.00				
PI_{CFF}	–0.07	–0.08	0.10	–0.06	–0.13	–0.14	–0.14	–0.13	–0.07	1.00			
PI_{RV10}	0.75[b]	0.76[b]	0.20[b]	0.80[b]	0.95[b]	0.75[b]	0.89[b]	0.76[b]	0.90[b]	–0.09	1.00		
PI_{RVF}	0.75[b]	0.78[b]	0.20[a]	0.82[b]	0.81[b]	0.94[b]	0.80[b]	0.95[b]	0.83[b]	–0.08	0.84[b]	1.00	
Public	0.02	0.02	–0.11	–0.03	–0.01	0.11	0.06	0.12	–0.02	–0.18[a]	–0.10	–0.04	1.00

a. Significant at the 0.05 level
b. Significant at the 0.01 level

Note: Performance measurements are calculated at the tenth (10) and final years (F) of the fund cycle for the IRR, Value Multiple, Distribution to Paid-in Ratio, and the Profitability Index. Internal Rate of Return and Profitability Index are calculated under the two specifications regarding residual values. Measurements subscripted with CF are calculated under specification 1 that includes only realized cash flows and measurements subscripted with RV are calculated under specification 2 that includes the residual value as the terminal cash flow of a private equity fund's cash flow stream.

Table 5.2. Performance Measurement Summary

Panel A: Performance Measurements (Year 10)							
	IRR_{CF}	IRR_{RV}	MULT	DPI	RVPI	PI_{CF}	PI_{RV}
Mean	0.18	0.37[b]	1.63	1.51	0.92	1.16	1.25[a]
Median	0.16	0.22	1.34	1.20	0.94	1.00	1.04
Standard Dev.	0.20	0.84	1.19	1.20	0.45	0.85	1.11
Maximum	0.92	10.04	8.27	8.15	4.60	6.34	10.01
Minimum	–0.07	–0.11	0.00	0.00	0.00	–0.69	0.00
Panel B: Performance Measurements (Final Year)							
	IRR_{CF}	IRR_{RV}	MULT	DPI	RVPI	PI_{CF}	PI_{RV}
Mean	0.18	0.19	1.66	1.62	0.07	2.13	1.19[b]
Median	0.13	0.16	1.48	1.45	0.08	0.98	1.07
Standard Dev.	0.18	0.19	1.07	1.06	0.39	3.33	0.76
Maximum	0.92	0.92	8.26	8.26	1.35	20.50	6.15
Minimum	–0.12	–0.07	0.00	0.00	–2.17	0.00	–0.80

a. Significant at the 0.05 level
b. Significant at the 0.01 level

Note: Panel A provides the mean, median, standard deviation, maximum, and minimum values of our performance measurements calculated in the tenth year of the fund cycle, while Panel B provides the mean, median, standard deviation, maximum, and minimum values of our performance measurements calculated in the final year of the fund cycle. We calculate IRR and the Profitability Index under Specifications 1 and 2 regarding residual values. Using one-tailed t-tests we examine Hypothesis 2 that IRRs and Profitability Indexes based on cash flows plus residual values are greater than these performance measures based on cash flows only.

Table 5.3. Tobit Model Results – Capital Return

Dependent Variable: Amount of Capital Returned to Investors ($ U.S.)											
	Years of the Fund Cycle										
	Y3	*Y4*	*Y5*	*Y6*	*Y7*	*Y8*	*Y9*	*Y10*	*Y11*	*Y12*	*Y13*
Fund Size	1.11[c]	1.07[c]	1.05[c]	1.08[c]	1.12[c]	1.15[c]	1.16[c]	1.23[c]	1.25[c]	1.22[c]	1.77[c]
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Fund Sequence	46.17[c]	46.10[c]	46.07[c]	47.64[c]	48.39[c]	47.76[c]	44.47[c]	42.08[c]	35.23[b]	50.67[b]	12.62
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
VC Dummy	–16.82	–9.54	–5.82	–7.49	–16.19	–24.71	–27.91	–29.07	–14.54	–41.76	50.28
	(0.77)	(0.88)	(0.92)	(0.89)	(0.78)	(0.67)	(0.64)	(0.62)	(0.84)	(0.62)	(0.57)
Residual Value	0.14	0.21	0.30[c]	0.21[b]	0.12[a]	0.01	–0.12	–0.18	0.07	–0.05	–0.54
	(0.22)	(0.21)	(0.00)	(0.01)	(0.10)	(0.92)	(0.11)	(0.13)	(0.78)	(0.88)	(0.13)
Log Likelihood	–1983.5	–1981.7	–1978.2	–1964.4	–1966.3	–1967.7	–1916.6	–1704.5	–1289.2	–966.4	–655.3
R^2_{Anova}	0.81	0.81	0.81	0.81	0.81	0.81	0.82	0.77	0.78	0.78	0.72

a. Significant at the 0.10 level
b. Significant at the 0.05 level
c. Significant at the 0.01 level

Note: The dependent variable for is the total amount of capital returned to the limited partner over the life of the fund. The explanatory variables are the size of the fund, the sequence number of the fund, a dummy variable indicating a venture capital fund, and the reported residual value in years 3 – 13 of the fund cycle.

Table 5.4. Panel Regression Summary Statistics

Panel Regression Independent Variables					
	Mean	Median	Standard Deviation	Maximum	Minimum
SIZE	398,000,000	312,700,000	318,787,166	6,011,600,000	5,500,000
SEQ	4.5	3.0	4.9	34.0	1.0
RRV3	227,132,166	102,907,047	378,863,752	2,828,148,804	0
RRV4	258,399,004	119,785,766	441,714,649	4,029,781,678	0
RRV5	256,946,679	107,107,759	411,661,114	3,557,452,671	0
RRV6	255,370,338	97,483,500	429,648,291	3,738,875,545	0
RRV7	226,846,674	88,513,479	401,329,911	3,606,502,875	0
RRV8	199,524,430	77,264,882	367,492,951	3,361,216,125	0
RRV9	170,648,711	57,506,802	323,172,743	2,410,002,948	0
RRV10	83,836,368	34,921,702	258,614,271	2,086,926,375	0
RRV11	58,323,006	27,009,552	124,068,077	521,593,500	-326,052,609
RRV12	38,774,668	15,246,000	125,550,927	587,573,550	-506,201,448
RRV13	24,893,595	11,465,148	100,379,422	532,696,257	-605,810,784

Note: Provided are the mean, median, standard deviation, maximum, and minimum values of the independent variables of our Panel Regression models. Fund size (SIZE) is the amount of capital commitments used to raise a fund and the fund sequence (SEQ) number represents the fund's position in the sequence of funds raised by the fund family. RRV is the fund's reported residual value on an annual basis. We examine residual values reported in Years 3 through 13 of the fund cycle. Values are measured in millions of U.S. dollars, except for SEQ.

Table 5.5. Panel Regression Results – IRR

Dependent Variable: Internal Rate of Return											
	Years of the Fund Cycle										
	Y3	*Y4*	*Y5*	*Y6*	*Y7*	*Y8*	*Y9*	*Y10*	*Y11*	*Y12*	*Y13*
Log(SIZE)	0.05[c]	0.04[c]	0.04[c]	0.04[b]	0.03[c]	0.03[b]	0.04[b]	0.05[c]	0.07[c]	0.05[c]	0.05[b]
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
Log(SEQ)	0.02[c]	0.02[c]	0.02[b]	0.02[c]	0.02[c]	0.02[c]	0.02[b]	0.03[c]	0.02[a]	0.02[b]	0.02[a]
	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.07)	(0.02)	(0.09)
VC Dummy	0.12[c]	0.11[c]	0.14[c]	0.13[c]	0.14[c]	0.14[c]	0.13[c]	0.12[c]	0.13[c]	0.09[b]	0.04
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.04)	(0.37)
Log(RRV)	0.24[c]	0.15[c]	0.10[c]	0.08[c]	0.02	0.02	0.07[b]	0.08[c]	0.10[c]	0.04	0.04
	(0.00)	(0.00)	(0.00)	(0.01)	(0.52)	(0.48)	(0.02)	(0.00)	(0.00)	(0.19)	(0.28)
F-Value	10.44	13.50	9.60	9.71	7.92	7.94	8.74	11.07	10.32	5.18	3.45
R^2	0.15	0.18	0.14	0.14	0.12	0.12	0.13	0.17	0.20	0.15	0.18

a. Significant at the 0.10 level
b. Significant at the 0.05 level
c. Significant at the 0.01 level

Note: The dependent variable is the final Internal Rate of Return calculated under specification 1. The explanatory variables are the natural logarithms of the size of the fund and the sequence number of the fund, a dummy variable indicating a venture capital fund, and the natural logarithm of the annually reported residual value. We control for fund vintage year heterogeneity and management firm heterogeneity by including two-way fixed effects.

Table 5.6. Panel Regression Results – Log(Value Multiple)

Dependent Variable: Log(Value Multiple)											
	Years of the Fund Cycle										
	Y3	*Y4*	*Y5*	*Y6*	*Y7*	*Y8*	*Y9*	*Y10*	*Y11*	*Y12*	*Y13*
Log(SIZE)	0.08[b]	0.10[b]	0.09[b]	0.09[b]	0.08[b]	0.08[b]	0.07[b]	0.09[b]	0.10[b]	0.07	0.02
	(0.03)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)	(0.02)	(0.03)	(0.03)	(0.20)	(0.68)
Log(SEQ)	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.05	0.03	0.04	0.02
	(0.15)	(0.13)	(0.15)	(0.14)	(0.16)	(0.14)	(0.11)	(0.04)	(0.25)	(0.15)	(0.39)
VC Dummy	0.24[b]	0.22[b]	0.23[b]	0.23[b]	0.24[b]	0.24[b]	0.25[b]	0.27[b]	0.25[b]	0.16	0.11
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.20)	(0.35)
Log(RRV)	0.12	0.07	0.04	0.05	0.09	0.04	0.09	0.10	0.03	0.15[a]	0.28[b]
	(0.49)	(0.43)	(0.67)	(0.52)	(0.19)	(0.52)	(0.19)	(0.17)	(0.74)	(0.10)	(0.01)
F-Value	4.02	4.07	3.95	4.11	4.46	4.12	4.19	5.63	3.40	2.96	2.96
R^2	0.06	0.06	0.05	0.06	0.06	0.06	0.06	0.09	0.07	0.09	0.07

a. Significant at the 0.10 level
b. Significant at the 0.05 level
c. Significant at the 0.01 level

Note: The dependent variable is the natural logarithm of the final Value Multiple. The explanatory variables are the natural logarithms of the size of the fund and the sequence number of the fund, a dummy variable indicating a venture capital fund, and the natural logarithm of the annually reported residual value. We control for fund vintage year heterogeneity and management firm heterogeneity by including two-way fixed effects.

Table 5.7. Panel Regression Results – Log(Distribution to Paid-in Ratio)

Dependent Variable: Log(Distribution to Paid-in Ratio)											
	Years of the Fund Cycle										
	Y3	*Y4*	*Y5*	*Y6*	*Y7*	*Y8*	*Y9*	*Y10*	*Y11*	*Y12*	*Y13*
Log(SIZE)	0.10[b]	0.11[b]	0.11[b]	0.11[b]	0.11[b]	0.10[b]	0.12[b]	0.16[c]	0.21[c]	0.10[a]	0.04
	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.00)	(0.00)	(0.06)	(0.52)
Log(SEQ)	0.05[b]	0.05[b]	0.04[a]	0.05[b]	0.05[b]	0.05[b]	0.05[b]	0.06[b]	0.02	0.04	0.03
	(0.05)	(0.04)	(0.08)	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)	(0.53)	(0.12)	(0.36)
VC Dummy	0.31[b]	0.28[b]	0.32[b]	0.29[b]	0.31[b]	0.30[b]	0.33[b]	0.38[c]	0.40[c]	0.21	0.16
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.11)	(0.24)
Log(RRV)	0.03	0.20[a]	0.16	0.16[a]	0.12	0.14[a]	0.16[a]	0.22[b]	0.31[c]	0.17[a]	0.10
	(0.91)	(0.07)	(0.16)	(0.09)	(0.19)	(0.09)	(0.08)	(0.02)	(0.00)	(0.09)	(0.39)
F-Value	4.29	5.16	4.81	5.21	4.89	5.20	5.34	6.51	6.23	2.85	0.95
R^2	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.10	0.13	0.08	0.04

a. Significant at the 0.10 level
b. Significant at the 0.05 level
c. Significant at the 0.01 level

Note: The dependent variable is the natural logarithm final Distribution to Paid-in Ratio. The explanatory variables are the natural logarithms of the size of the fund and the sequence number of the fund, a dummy variable indicating a venture capital fund, and the natural logarithm of the annually reported residual value. We control for fund vintage year heterogeneity and management firm heterogeneity by including two-way fixed effects.

Table 5.8. Panel Regression Results – Profitability Index

Dependent Variable: Profitability Index											
	Years of the Fund Cycle										
	Y3	*Y4*	*Y5*	*Y6*	*Y7*	*Y8*	*Y9*	*Y10*	*Y11*	*Y12*	*Y13*
Log(SIZE)	0.77[c] (0.00)	0.81[c] (0.00)	0.83[c] (0.00)	0.82[c] (0.00)	0.84[c] (0.00)	0.84[c] (0.00)	0.82[c] (0.00)	0.93[c] (0.00)	0.88[c] (0.00)	0.60[c] (0.00)	0.30 (0.06)
Log(SEQ)	0.14[b] (0.01)	0.17[c] (0.00)	0.16[c] (0.00)	0.17[c] (0.00)	0.17[c] (0.00)	0.17[c] (0.00)	0.16[c] (0.00)	0.18[c] (0.00)	0.19[b] (0.01)	0.20[b] (0.01)	0.19[b] (0.01)
VC Dummy	0.44[a] (0.08)	0.34 (0.19)	0.35 (0.17)	0.38 (0.14)	0.36 (0.16)	0.34 (0.19)	0.37 (0.15)	0.36 (0.19)	0.50[a] (0.10)	0.01[a] (0.09)	–0.56 (0.10)
Log(RRV)	–0.41 (0.47)	0.08 (0.73)	0.26 (0.28)	0.04 (0.83)	0.27 (0.17)	0.33[a] (0.07)	0.06 (0.75)	0.54[b] (0.01)	0.70[c] (0.00)	0.33[a] (0.07)	0.51[a] (0.08)
F-Value	27.14	26.67	27.04	27.31	27.96	28.48	26.85	24.71	16.98	8.38	4.73
R^2	0.30	0.29	0.29	0.30	0.30	0.31	0.30	0.31	0.29	0.21	0.18

a. Significant at the 0.10 level
b. Significant at the 0.05 level
c. Significant at the 0.01 level

Note: The dependent variable is the final Profitability Index calculated under specification 1. The explanatory variables are the natural logarithms of the size of the fund and the sequence number of the fund, a dummy variable indicating a venture capital fund, and the natural logarithm of the annually reported residual value. We control for fund vintage year heterogeneity and management firm heterogeneity by including two-way fixed effects.

Table 5.9. Ordinary Least Squares Regression Summary Statistics

Dependent Variables					
	Mean	Median	Standard Deviation	Maximum	Minimum
DIFFIRR10	0.2080	0.1383	0.2638	1.6034	–0.2238
DIFFIRRF	0.0089	0.0067	0.0385	0.1421	–0.1388
DIFFPI10	0.1001	0.0386	0.5108	0.5434	–3.6662
DIFFPIF	0.9389	0.2659	3.4763	5.3057	–20.1788
Independent Variables					
	Mean	Median	Standard Deviation	Maximum	Minimum
Fund Size	398,000,000	312,700,000	318,787,166	6,011,600,000	5,500,000
Fund Sequence	4.5	3.0	4.9	34.0	1.0

Note: Panel A provides the mean, median, standard deviation, maximum, and minimum values of our performance measurements calculated in the tenth year of the fund cycle, while Panel B provides the mean, median, standard deviation, maximum, and minimum values of our performance measurements calculated in the final year of the fund cycle. We calculate both IRR and the Profitability Index under Specifications 1 and 2 regarding residual values. Using one-tailed t-tests we examine Hypothesis 2 that IRRs and Profitability Indexes based on cash flows plus residual values are greater than these performance measures based on cash flows only.

Table 5.10. Ordinary Least Squares Regression Results – IRR

Panel A: Dependent Variable: Difference in IRR Specifications (Year 10)				
	Model 1	*Model 2*	*Model 3*	*Model 4*
Log(SIZE)	–0.11[a] (0.08)	–0.11[a] (0.07)	–0.12[a] (0.06)	–0.11[b] (0.05)
Log(SEQ)	–0.31[b] (0.01)	–0.28[b] (0.03)	–0.30[c] (0.01)	–0.28[b] (0.06)
SPEC	–0.23 (0.24)			–0.19 (0.32)
BUY		–0.26 (0.16)		–0.24 (0.21)
NAT			0.01 (0.95)	0.00 (0.99)
F-Value	3.38	3.60	2.91	2.35
R^2	0.04	0.05	0.04	0.05

Panel B: Dependent Variable: Difference in IRR Specifications (Final Year)				
	Model 1	*Model 2*	*Model 3*	*Model 4*
Log(SIZE)	0.02[c] (0.00)	0.02[c] (0.00)	0.02[c] (0.00)	0.02[c] (0.00)
Log(SEQ)	–0.01[a] (0.09)	–0.01 (0.18)	–0.01[b] (0.11)	–0.01 (0.15)
SPEC	–0.02[a] (0.08)			–0.02 (0.12)
BUY		–0.02[a] (0.09)		–0.01 (0.20)
NAT			0.01 (0.77)	0.00 (0.77)
F-Value	6.92	6.70	5.91	4.36
R^2	0.08	0.08	0.07	0.08

a. Significant at the 0.10 level
b. Significant at the 0.05 level
c. Significant at the 0.01 level

Note: The dependent variable is the difference between the final Internal Rates of Return calculated under Specifications 1and 2 at the tenth and final year of the fund cycle. The explanatory variables are the natural logarithms of the size of the fund and the sequence number of the fund, and dummy variables indicating specialized funds, buyout funds (BUY), and U.S.-based funds (NAT).

Table 5.11. Ordinary Least Squares Regression Results – Profitability Index

Panel A: Dependent Variable: Difference in PI Specifications (Year 10)				
	Model 1	*Model 2*	*Model 3*	*Model 4*
Log(SIZE)	0.03 (0.12)	0.03 (0.11)	0.03 (0.16)	0.03[a] (0.09)
Log(SEQ)	–0.13[c] (0.00)	–0.11[c] (0.00)	–0.13[c] (0.00)	–0.11[c] (0.00)
SPEC	–0.12[c] (0.00)			–0.15[b] (0.01)
BUY		–0.16[b] (0.01)		–0.04 (0.56)
NAT			–0.04 (0.61)	–0.14[b] (0.01)
F-Value	7.42	7.26	4.56	5.85
R^2	0.00	0.09	0.06	0.12

Panel B: Dependent Variable: Difference in PI Specifications (Final Year)				
	Model 1	*Model 2*	*Model 3*	*Model 4*
Log(SIZE)	0.49[c] (0.00)	0.49[c] (0.00)	0.47[b] (0.01)	0.51 (0.00)
Log(SEQ)	–1.27[c] (0.00)	–1.07[c] (0.00)	–1.22[c] (0.00)	–1.14[c] (0.00)
SPEC	–1.64[c] (0.00)			–1.47[c] (0.00)
BUY		–1.41[c] (0.00)		–1.24[b] (0.01)
NAT			–0.17 (0.80)	–0.19 (0.78)
F-Value	11.75	10.97	7.72	8.60
R^2	0.14	0.13	0.10	0.17

a. Significant at the 0.10 level
b. Significant at the 0.05 level
c. Significant at the 0.01 level

Note: The dependent variable is the difference between the final Profitability Indexes calculated under Specifications 1and 2 at the tenth and final year of the fund cycle. The explanatory variables are the natural logarithms of the size of the fund and the sequence number of the fund, and dummy variables indicating specialized funds, buyout funds (BUY), and U.S.-based funds (NAT).

CHAPTER VI

CONCLUSION

In this chapter, we present a summary of the direction and purpose of the current study including a summary of its findings. We then present the contributions of our findings to the academic body of research regarding private equity funds; as well as, discuss the implications of our findings for practitioners in the private equity industry. Finally, we provide several topics for future research.

Summary of Study's Purpose

The tremendous growth and development of the private equity industry over the past the past two and a half decades has been just short of phenomenal. Many in the financial community credit the private equity industry for being one of the principal drivers of the changes in corporate culture witnessed in the 1980s. In addition, many credit venture capitalists with providing the backbone of the birth and tremendous growth of the "new economy". Most recently, the financial community has observed the industry's effects on the premiums of the current merger and acquisition boom. Though academic research has provided coverage of the industry's effect on its portfolio companies, research has yet to provide an extensive coverage of the workings of the private equity fund. The primary reason for this void has been the lack of available data.

Using proprietary fund-level data provided by Private Equity Intelligence, we attempt to answer one of the most notable questions currently debated both inside and out of the private equity industry. Specifically, we seek to examine the effect of fund reported residual values on fund performance measurements and the predictability of these reported values on final fund performance. Our findings suggest that prior research in this area has over-discounted and examined improper measurements of residual values. Therefore, the results of prior research suggest the role of residual values to be only marginal when comparing the performance of private equity funds to that of public equity markets.

Summary of Results

Our findings provide several contributions to the existing literature regarding the performance measurements of private equity funds. First, the present study is the first to examine all private equity return measurements. Our findings suggest that when evaluating the performance of private equity funds, one should not rely exclusively on one performance measurement, but should incorporate all performance measurements collectively. We base this conclusion on the fact that each measurement evaluates a different aspect of fund performance and behaves differently than its counterparts.

Second, we examine the relation between the different fund performance measurements under varying assumptions regarding residual values. We find that including reported residual values in performance calculations has an adverse effect on these calculations in that it over-inflates the performance measurement. In addition,

including residual values in performance calculations decreases the correlations between performance measurements.

After correcting for incorrect measurements of residual values utilized in previous studies, we find that interim residual values are positive predictors of final fund performance. Overall, our findings on the effects of residual values on final fund performance should illustrate to limited partners the dangers of making investment decisions under their current investment strategy of gauging fund performance. Currently, limited partners report fund performance based upon realized and unrealized cash flows, but do not use interim fund reported residual values to predict final performance of private equity funds. Therefore, our results should encourage limited partners to report fund performance based upon realized cash flows.

Contributions

Our findings provide important contributions to the current body of academic research examining private equity funds and to practitioners in the private equity industry. Particularly, we provide evidence suggesting that residual values reported by funds on a yearly basis are positive predictors of final fund performance. This complements the findings in Phalippou and Gottschalg (2006) and provides a method of reducing the problems in the treatment of residual values that they document.

Our findings have important policy implications for both fund managers and fund investors. First, our findings suggest that the interim performance reporting practices of general and limited partners should include performance measurements based on both realized cash flows and realized plus unrealized cash flows. Our findings could provide

the average investor who finds themselves at the mercy of their pension fund managers a better interpretation of the private equity section in their pension's annual report.

Future Research

Though academic research in the area of private equity is gaining momentum, many pertinent research topics remain. According to a recent article in the Wall Street Journal, an increasing number of mutual funds are beginning to enter private equity markets both as direct and indirect investors. This presents two interesting questions that warrant further examination. First, will mutual fund managers utilize the same performance measurement practices as the private equity industry? If so, what will be the consequences for the everyday investor that is the backbone of the mutual fund industry? Secondly, how will mutual fund managers consistently mark-to-market on a daily basis the valuations of their private equity holdings?

With constantly increasing costs associated with keeping a corporation public, mainly due to Sarbanes-Oxley Regulations, many chief executive officers are opting to take their corporations private. This trend is being financed by leveraged buyout funds which seem to purchase any corporation they wish. Unlike the leveraged buyouts of the 1980s, current leverage buyout funds are not limited by size in what they acquire. This is due to two main reasons. First, leveraged buyout funds have more cash on hand than ever before. These cash reserves combined with banks willing to lend to funds at up to ten times the fund's cash reserves, allows funds to acquire almost any size companies. However for those companies that are too large for a single fund to purchase, leverage buyout funds are forming syndicates to raise the needed capital to purchase the largest

companies. These "club deals" present an interesting topic for further research. Of the club members, which fund's managerial; and therefore, valuation practices will be utilized. Or will each fund value its position in the company purchased by the club. If so, what valuation should limited partners that are invested in more than one of the club member funds use?

The current study involves the examination of the annual valuations, reported as the residual value, of all portfolio companies held by the fund. Our findings suggest that fund managers are probably at least decent at valuating their funds' holdings. A possible follow-up study would be to evaluate the valuations of portfolio companies on an individual basis comparing each company's eventual sale value to the funds' forecasted values.

These are but a few of the interesting topics that remain unanswered about the private equity industry. Never before have financial markets experienced an industry or sub-asset class that has the ability to change and adapt to market developments with the quickness and ease that private equity seems to. With every change and adaptation, a new research question develops. We expect research in private equity to continue gaining momentum and remain relevant for the foreseeable future.

REFERENCES

Anson, Mark J. P., 2004, Strategic Versus Tactical Asset Allocation, *The Journal of Portfolio Management* Winter 2004, 8-22.

Anson, Mark J. P., 2004, Thinking Outside the Benchmark, *The Journal of Portfolio Management* 30th Anniversary Edition, 104-112.

Anson, Mark J. P., 2006. *Handbook of Alternative Assets* (John Wiley & Sons, Inc., Hoboken).

Blaydon, Colin, and Michael Horvath, 2002, What's a Company Worth? It Depends on Which GP You Ask?, *Venture Capital Journal*.

Cochrane, John H., 2005, The Risk and Return of Venture Capital, *Journal of Financial Economics* 75, 3-52.

Gompers, Paul, Anna Kovner, Josh Lerner, and David Scharfstein, 2005, Venture Capital Investment Cycles: The Impact of Public Markets, (National Bureau of Economic Research).

Gompers, Paul, and Josh Lerner, 1996, The Use of Covenants: An Analysis of Venture Partnership Agreements, *Journal of Law and Economics* 39, 463-498.

Gompers, Paul, and Josh Lerner, 1997, Risk and Reward in Private Equity Investments: The Challenge of Performance Assessment, *Journal of Private Equity* 1, 5-12.

Gompers, Paul, and Josh Lerner, 1999. *The Venture Capital Cycle* (The MIT Press, London).

Gompers, Paul, and Josh Lerner, 2000, Money Chasing Deals? The Impact of Fund Inflows on Private Equity Valuation, *Journal of Financial Economics* 55, 281-325.

Gompers, Paul, and Josh Lerner, 2001, The Venture Capital Revolution, *Journal of Economic Perspectives* 15, 145-168.

Grinblatt, Mark, and Sheridan Titman, 2002. *Financial Markets and Corporate Strategy* (McGraw-Hill Higher Education, New York).

Hwang, Min, John Quigley, and Susan Woodward, 2005, An Index for VC, 1987-2003, *Contributions to Economic Analysis and Policy* 4, 1-32.

Jones, Charles, and Matthew Rhodes-Kropf, 2004, The Price of Diversifiable Risk in Venture Capital and Private Equity, (Columbia University).

Kaplan, Steven N., and Antoinette Schoar, 2005, Private Equity Performance: Returns, Persistence, and Capital Flows, *Journal of Finance* LX, 1791-1823.

Kaplan, Steven N., and Jeremy C. Stein, 1993, The Evolution of Buyout Pricing and Financial Structure in the 1980s, *Quarterly Journal of Economics* 108, 313-358.

Lerner, Josh, and Antoinette Schoar, 2004, The Illiquidity Puzzle: Theory and Evidence from Private Equity, *Journal of Financial Economics* 72, 3-40.

Lerner, Josh, Antoinette Schoar, and Wan Wong, 2006, Smart Institutions, Foolish Choices?: The Limited Partner Performance Puzzle, *Journal of Finance*.

Ljungqvist, Alexander, and Matthew Richardson, 2003, The Cash Flow, Return and Risk Characteristics of Private Equity, (Stern School of Business New York University).

Metrick, Andrew, 2007. *Venture Capital and the Finance of Innovation* (John Wiley & Sons, Inc., Hoboken).

Meyer, Thomas, and Pierre-Yves Mathonet, 2005. *Beyond the J Curve: Managing a Portfolio of Venture Capital and Private Equity Funds* (John Wiley & Sons, Ltd., West Sussex).

Munari, Federico, Robert Cressy, and Alessandro Malipiero, 2005, The Heterogeneity of Private Equity Firms and Its Impact on Post-Buyout Performance: Evidence from the United Kingdom, (University of Bologna).

Nielsen, Kasper Meisner, 2006, The Return to Pension Funds' Private Equity Investments: Another Piece to the Private Equity Premium Puzzle?, (Copenhagen Business School).

Pearce, Rupert, and Simon Barnes, 2006. *Raising Venture Capital* (John Wiley & Sons, Ltd., West Sussex).

Phalippou, Ludovic, 2006, Investing in Private Equity Funds, (University of Amsterdam).

Phalippou, Ludovic, and Oliver Gottschalg, 2006, The Performance of Private Equity Funds, (University of Amsterdam).

Phalippou, Ludovic, and Maurizio Zollo, 2005, Performance of Private Equity Funds: Another Puzzle?, (INSEAD).

Swenson, David F. , 2000. *Pioneering Portfolio Management: An Unconventional Approach to Institutional Investment* (Free Press, New York).

Wooldridge, Jeffrey, 2006. *Introductory Econometrics: A Modern Approach* (South-Western College Publishers).

Zhu, Li, Joseph H. Davis, Jr. Francis M. Kinniry, and Nelson W. Wicas, 2004, Private Equity Performance Measurement and Its Role in a Portfolio, *The Journal of Wealth Management* 27-34.