PRIVATE EQUITY INTRA-FUND PERSISTENCE: FUND PERFORMANCE IN CONSIDERATION OF DIRECT AND INDIRECT COMPENSATION

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ABSTRACT

Private equity fund managers (PEM, or the general partner/GP) exhibit certain performance persistence, or lack thereof, over time. Most scholarly research to date examines inter-fund performance persistence, or the performance at a fund level across multiple specific funds over time. This dissertation examines intra-fund performance, i.e., performance within a specific fund, and posits that investments made later in a specific private equity fund's lifespan will perform worse than earlier investments, reflecting agency cost in terms of residual loss to principals as a result of the direct and indirect compensation structures. Using ROIC (Return on Invested Capital) and the sequence in which investments are made in a fund as empirical evidence of these negative effects of the compensation and contractual arrangements common throughout the industry. This performance analysis will be done within each specific fund in consideration of the effects of both direct compensation from the current fund and indirect compensation expectations of the PEM from future funds. This dissertation relies on agency theory to explain the incentives and costs that lead to a negative relationship between the sequence of an investment in a fund's life and the ROIC of the specific investment. Concepts of risk sharing and information asymmetry, specifically from an agency theory perspective, and the misalignment of interested between investors and PEM support this hypothesis. The most notably areas impacted by this research relate to governance (both investors and public policy), compensation, and incentive structure of private equity funds.

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CHAPTER 1

INTRODUCTION

What is Private Equity and Why Does it Exist

Private equity (PE) primarily has four responsibilities: First, it acts as a financial intermediary between investors and companies, second, it invests only in private companies that cannot be readily traded in a public market, third, the private equity fund manager (PEM) is actively involved in monitoring/management of the portfolio companies, and finally, its goal is to maximizes return to its investors. The PEM's carried interest (equity position) is only paid on realized returns, not on any mark-to-market or current fair value calculation, which is different from mutual or hedge funds trading in public securities, which may have periodic payments of carried interest based on current fair values of their portfolio absent exiting the specific assets. To fulfill these responsibilities, PEMs screen potential investments, monitor and provide governance for investments, and direct the exit process (final liquidity event). The screening process can be simple or complex, depending on the effort put forth by the firm and competition from other investors. Screening also involves determining ideal capital structure, including debt levels and service, which increase returns in a leveraged buyout.

Monitoring can be affected via items as direct involvement in day-to-day management or board control. A key decision for most PEMs is the hiring and firing of key portfolio company management. Combined with positive and negative covenants, and preferred equity investments, leverage can be a disciplinary device over

management. In the final analysis, PEMs seek to provide deal flow (access to deals) and significant alpha returns to their investors via active management.

The PE management process is a semi-sequential process where the above discussed steps occur in order in a general sense, but any one of these steps can be happening at any point in the fund lifecycle depending on the underlying investment and market conditions.

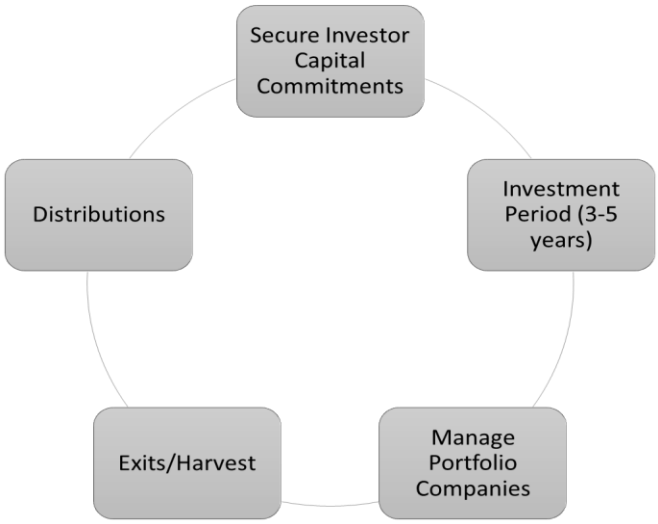

Figure 1. Private Equity Management Process.

The top of Figure 1 can be understood as the following graph of the "fundraising process" which overlaps the various steps. In other words, the process of managing the fund is sequential and the process of fundraising is also sequential, but the overlapping steps can and do transpire concurrently. These steps are explored througout the dissertation.

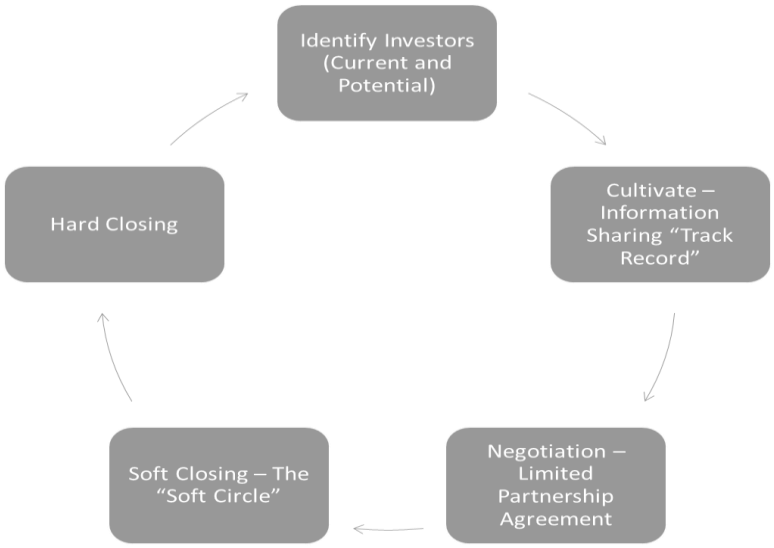

Figure 2.Private Equity Fundraising Process

At this point it is beneficial to outline certain terms commonly utilized in the PE environment:

- **General Partner**, in addition to serving as a legal term for the legal entity for which the investment team is employed, is also generally used to describe the investment fund manager(s) and their team.
- **Limited Partner(s)**, in addition to serving as a legal term for the individual and institutional investors who are the members of the entity that contains the portfolio companies, is commonly used to describe the cash investors in a fund structure.
- **Limited Partnership Agreement (LPA)** is the legal agreement governing the relationship between the GP and LP. Outlines the "fund economics" (see below), but also the strategy of the firm, management fee calculation, limits on investments (geographic, industry, etc.), and other contractual arrangements between the LPs and the GP.

- **Capital Commitment** is the amount of capital committed to a specific fund by LPs.
- **Fund Economics** is the defined split of the economic return, including the accounting of original principal investment amounts of the LPs. The LPs commonly receive a cumulative compounding return in the range of 8-12% of their invested capital. Also includes the calculation of management fee. See Waterfall.
- **Deal Economics** is the defined split between the investment fund and other participants in an individual portfolio company, such as the management team and other investors. See Waterfall below.
- **Investment Period** is the period, typically 3-4 years in which a GP can deploy capital for new investments.
- **Management Fee** is an annual fee earned by the GP intended to cover the costs of the investment process, including the salary and wages of the investment team. Management fee is calculated as a percentage of Capital Commitment ("committed capital") during the Investment Period, but the basis for the calculation switches to the deployed or invested capital after this period.
- **Carried Interest/Promote** is the share of profits which a GP typically receives once a certain threshold preferred return is met for the cash investors. Commonly 20% of all profits with a "catch-up" period after the preferred return for LPs is paid.

- **Waterfall** is a commonly used term that outlines the procedure for allocation of economic return. It is called this because it is outlined in order of payment and it is imagined as a succession of buckets for which as one bucket fills, the remaining amount spills ("waterfalls") over into the next bucket and so on till there is one final profit split arrangement. Note there are Waterfalls at both the deal and fund level. See Fund Economics and Deal Economics.

Intra-Fund Performance and Why It Matters

The body of existing literature on fund performance has focused largely on inter-fund performance (Kaplan & Schoar, 2005; Harris, Jenkinson, & Kaplan, 2014; Valkama, Maula, Nikoskelainen, & Wright, 2013; Marquez, Nanda, & Yavuz, 2015), and even studies that focus on deal-level performance also tend to examine the effect on fund-to-fund performance (Braun, Jenkinson, & Stoff, 2017). As a general concept and mathematical fact, fund-level performance can mask individual deal-level performance by using several high return assets to offset extremely low or non-performing assets. Without a detailed examination of individual deal-level data, it is impossible to know if the fund manager consistently performs across all assets managed within a given fund.

Private equity funds are not like mutual funds, which can put money to work instantaneously due to liquidity of public markets. It may take a private equity (PE) fund many years (most investment periods in contracts are 3-5 years; Metrick & Yasuda, 2010) to fully deploy committed capital. The investment period is typically the period

investors (LPs) expect the committed capital to be deployed, i.e., invested in operating companies.

Notably, this dissertation does not utilize investment specific Internal Rates of Return (Fund IRR). Fund IRR is calculated from "day one" of the first capital infusion from limited partners (LP), and the actual ability of PE managers to effectively create or unlock value at the deal level may be masked by fund accounting and capital flows. One example is the use of warehouse lines of credit at the fund level, a common practice wherein additional leverage can significantly increase fund-level returns and time the cash inflows of a specific investment, thereby increasing investment level returns but ***not*** ROIC. There is also leverage at the portfolio company level. In effect, there can be leverage on leverage, but most fund leverage is short term oriented and paid off within six months of investing. In short, IRR can be manipulated by the timing of cash inflows and outflows resulting in elevated IRR, but the investment may still have a low ROIC. The reason large institutional investors are primarily concerned with ROIC is that it supports long term pension obligations over long periods of time (Gompers et al., 2016).

The general problem of aligning the interests of different participants in various arrangements is common across all organizations. In principal/agent arrangements, a principal hires the agent to represent their interests. Jensen and Meckling (1976, p. 309) noted, "'the problem of inducing an "agent" to behave as if he were maximizing the "principal's" welfare is quite general; not only can it exist between those outside principals that are invested in an organization, but it can also exist within an organization at various levels of management as well as among different investor classes or types.

Each participant's goals may or may not align and are naturally independent with respect to utility maximization (Ross, 1973).

Agency theory dictates that these differences lead to a divergence between the principal and agent resulting in issues such as asymmetric sharing of information and agency costs incurred by the principal due to the lack of alignment of interests (Laffont & Martimort, 2009). There can also be agency issues between different principals in arrangements where there are multiple principals to a principal/agent relationship (Shleifer & Visny, 1986), which in the case of private equity can occur in situations such as the group of LPs containing both larger institutional investors and non-institutional investors, or where there is one investor who has either a majority of the invested dollars or the plurality of invested dollars.

Bendickson, Muldoon, Liguori, and Davis (2016) summarized three main points from agency theory that affect private equity. First, a large element of information asymmetry is always present as the companies are private and the investors do not have access to information required of public companies. PEMs participate in the day to day operations, and the LPs are beholden to the amount of information that PEMs are willing to share. Second, from a risk sharing perspective, the carry component of compensation is tied to existing fund performance, not future fund performance, and is not *pari passu*—in other words, it does not share equally in the profits of the fund and at different points in the production of profits. Third, the indirect compensation of future funds influences investment management decisions in current funds (Chung et al., 2012). For example, if the next fund has been raised, a PEM may hold off on an investment and put it in the next fund instead of utilizing the current fund as the vehicle for investment. The effect of any

one of these items is a negative incentive to manage funds in a manner that produces agency costs in terms of suboptimal returns, which themselves result in a residual loss to LP's. The above leads to the work of Chung, Sensoy, Stern, and Weisbach (2012) and their discussion of direct and indirect compensation and the impact on fund performance.

To empirically test whether fund-level performance is impacted, it is necessary to review a fund's deal-by-deal performance to determine whether they accomplish their goals with the proper efficiency. PEMs inherently understand deal-level importance; for example, Marquez, Nanda, and Yavuz (2014) noted how fund managers can limit the size of future funds not only because of diseconomies of scale but also to signal the best entrepreneurs that they are a worthy partner. Given that PEMs intuitively understand this, this dissertation aims to empirically reinforce their insights and bring that practical understanding into the academic literature via a review of individual deal return distributions within individual funds.

This dissertation's data set contains approximately 30,000 private equity transactions dating from the early 1970s with unique identifiers for individual companies, investments, fund managers, and funds. Performance data consists of return on investment capital (ROIC) and internal rates of return (IRR) for each investment. Note, an individual company can appear as separate investments in the data set for reasons such as the same company was invested in by PEM at different times in different funds, different managers invested in the same company, a company traded between different PEMs, or a company went from private to public and back to private. This is desired for the purposes of this research as it focuses on relative manager performance given their investment choice set.

Other fields include the date of the initial investment in an asset, the exit date if applicable, the country of headquarters, industry sector, industry group (as a subset of sector), fund size, list of fund strategies (not mutually exclusive), the fund number in the array of how many funds a manager has or is managing, and fund-raising status. Utilizing the initial investment date, each investment was sequenced based on ordinal values; for example, if 10 investments were made by a specific fund, the investments were labeled 1–10 and this variable was labeled "Sequence". The last sequence number also represents the total number of investments made by any specific fund, or the fund investment count. The distance ("Distance") between any two investments in a fund was a calculated variable based on the number of days between any adjacent investments in a fund, with the first investment labeled as zero. Fund size ("Fund Size") is the amount of committed capital to a specific fund.

ROIC was regressed on Sequence utilizing both OLS regression and censored mixed effect tobit regression ("metobit"). Control variables were the log of the fund size ("Log of Fund Size") since the range of fund sizes was large, the log of the distance ("Log of Distance") between any two investments in a specific fund since this distance was also large, the year of the initial investment ("Year"), which is a proxy for comparing investments based on the general economic conditions at the time of initial investment, the fund manager ("Fund Manager"), the industry sector ("Industry Sector"), and the industry group ("Industry Group"). Additional regressions were done based on certain funds with a "zero" fund size.

The main result was a statistically significant inverse relationship between ROIC and Sequence in all scenarios tested. For both OLS and metobit, there was a statistically

significant inverse relationship between ROIC and Sequence when no control variables were present with p-values of 0.00100 and 0.04650, respectively. Four different scenarios containing control variables were calculated. In all scenarios with control variables Log of Fund Size, Log of Distance, and Year were present. The four remaining control variables of Fund Manager, Industry Sector, and Industry Group were aligned in a matrix such that Fund Manager was tested and switched between Industry Sector and Industry Group. The statistically significant inverse relationship held up in all scenarios. As a robust test, the same regressions were done substituting IRR for ROIC, but there was no statistical significance in the IRR tests, except for the simple OLS regression of IRR on Sequence, which was negative, which is expected given the direct mathematical relationship between ROIC IRR.

A second data set was secured after testing the primary data set. This data set did not have all the variables used in the primary data set, missing Industry Sector and Industry Group, but it did have Fund Manager. The results of the analysis of this second data set were similar in direction and magnitude as the primary data set.

To better understand the peculiarities of private equity management, Appendix A outlines some basic definitional and existing differences between private equity and mutual funds. This provides an outline of the issues noted in the literature review or that may not be apparent to the average observer. These are generalizations, but for the most part they are applicable to the standard differences between the two different types of funds. Please note, the purpose of this research is not to better understand mutual funds, but to understand private equity performance issues.

In summary, the interaction of the agency costs in the context of PE structural and contractual environment may cause residual loss incurred from underperforming investments made during periods where the PEM's (agent's) interests and the principal's diverge in the latter part of the investment period. This divergence is the result of the direct and indirect compensation issues. This dissertation tests and quantifies that effect by sequencing all the investments in specific funds and testing for an inverse relationship between the sequence in which the investment is done and its ROIC.

CHAPTER 2

LITERATURE REVIEW

Agency Theory to a Behavioral Agency Model

Ross's (1973) work on the "principal's problem" summarizes the basic problem of a principal/agent relationship: How do you solve for a Pareto Efficient fee structure in the presence of information asymmetry and monitoring costs? In concert with bonding costs and the potential for residual loss (Jensen & Meckling, 1976), this is the basic issue underlying the principal agent issue. Ross concludes this difficulty exists across a "broad and relevant class of payoff structures" (Ross, 1973 p. 138). Further, added complexity exists because a PEM may manipulate or control information to maintain or exploit this information asymmetry.

While Jensen and Meckling (1976) integrated theories on property rights, finance, and ownership structure, Shleifer and Vishny (1986) explored situations with larger minority shareholders. The importance of both studies in the context of PE is that carried interest (and possibly management fee) de facto transforms the PEM from a simple agent to an equity participant. Jensen and Meckling (1976) connect property rights, which concerns the allocation of costs and benefits and hence risk, with agency theory, a way to allocate those risks, and expand on three basic costs a principal will incur in their relationship with the agent: 1) monitoring costs, 2) bonding expenditures, and 3) residual loss. This residual cost is the "reduction in welfare experienced by the principal" (Jensen & Meckling, 1976, p. 308) because the agent may not make decisions that maximize the principal's return.

Shleifer and Vishny (1986) touch on multiple shareholders and divergent interests, especially in the presence of larger shareholders who either own a majority or larger minority/plurality ownership. In terms of a PE fund, this might be a larger pension fund or institutional owner. Larger shareholders may incur monitoring and other costs to increase the return for all shareholders, but in the PE sector this may be flipped on its head by the presence of co-investment (Fang, Ivanshina, & Lerner, 2015), wherein larger, powerful institutional investors circumvent some of the residual costs. This can be done with "side-letters", co-investments, and the latest development of separately managed accounts (SMA). These circumventions are an area ripe for further research.

Agency theory as it has been tested and refined over decades, but these problems typically relate to executive compensation in direct principal agent relationship. Deficiencies have been found in the standard applications of shareholders versus management, or management structures. Various articles have found weak or inconclusive relationships between various incentive compensation plans and CEO performance (Jensen & Murphy, 1990; Tosi, Werner, Katz, & Gomez-Mejia, 2000; Frydman & Jenter, 2010). To supplement or explain these deficiencies, various frameworks have been developed to capture the explanatory power of agency theory. For a summary of these frameworks and a breakdown of the research on pay/performance and pay/behavior analysis, see Devers, Cannella, Reilly, and Yoder (2007).

Pay/performance work tends to focus on prior performance and pay as a reward for past achievement (Fama, 1980; Jensen & Murphy, 1990). Governance structure (Conyon & Peck, 1998) or firm size (Tosi et al., 2000) can also affect pay/performance issues. The direction of pay and performance or performance and pay are the main areas

of research; Devers et al. (2007) summarized the pay and performance work succinctly: "although the two areas…(pay as an antecedent of performance and performance as an antecedent of pay) exist concurrently, they remain almost completely disconnected." (Devers et al., 2007, p. 1024)

Pay/behavior is an outgrowth of certain behavioral economic theories that aim to explain performance in terms of behavior utilizing a bounded rationality approach (Pepper & Gore, 2015). The most applicable concept from behavioral research is that shareholders (in this case LPs) can diversify risk across a wide ranging portfolio (Milgrom & Roberts, 1992), but an executive typically has a significant portion of their net worth tied up in the value of the firm, especially if stock-based compensation is involved. Therefore, executives may have excessive risk adversity (Jensen & Meckling, 1976). Likewise, a PEM may have a significant portion of his net worth, including the NPV of future earnings from future funds, tied up in the performance of his fund. The PEM therefore might become risk averse with later investments or focus on increasing the value of the next fund.

Wiseman and Gomez-Mejia (1998) attempted to synthesize agency and behavioral models with their behavioral agency model ("BAM") in response to certain shortfalls they identified, i.e., a lack of development of risk based models (especially in contexts that promote risk-seeking behavior), the assumption of "stable risk preferences" (Wiseman et al., 1998, p. 134), and the connection between governance issues and the agent's risk choices. This is done in a static environment where the available options are only considered, and it does not account for either party modifying the choice set or creating new optionality, which a PEM has the ability to do based in part on the

information asymmetry To create this BAM, they attempt to integrate prospect theory with agency theory. This attempt is probably the closest to understanding the ability of PEM to modify the choice set and create, and possibly eliminate, optionality. In behavioral economics terms, this is a framing problem.

The compensation structure requires the manager to increase their *risk bearing* at the point where the risk of raising the next fund, with its attendant management fees and carried interest, is at its maximum. At this point, the manager is pressured to invest funds that are committed to the existing fund but remain uninvested. This typically occurs in the latter half of the fund investment period. A PEM can diversify away from the risk of the fund by raising additional funds, but the BAM would argue that this framing leads to PEMs taking on sub-optimal risk. Agency theory would also argue that the managers are taking too much risk, but it may not consider the future pay expectations.

More recent models straddle the line between descriptive and prescriptive models. As a practitioner, the appearance is descriptive, but the outcome is prescriptive. It is difficult for a model to account for the myriad methods in which interests can diverge, or to account for the optionality of not only the agent, but of divergent principals and "fortune", or the factors outside the management's control (Wiseman & Gomez-Mejia, 1998; Machiavelli, 1532). Behavioral theories may be the best approach to incorporate as many human behavioral traits (an anthropology, if you will) into our understanding of finance as possible. This author intends to pursue this path in future research.

Agency Theory in the Private Equity Environment

Private equity compensation has been stuck in the same formula for almost the entirety of its existence, and exceptional returns—perceived or otherwise—have masked

any detailed analysis of PE compensation structure. Because of the compensation structure's simplicity, this dissertation relies primarily on the basic residual loss concept of fundamental agency theory to explain the negative relationship tightly related to the existing structural nature of private equity management. The BAM provides additional resources to further explain various actions taken by PEM, but also opens the door to additional research beyond the purview of this dissertation.

In the world of private equity funds, agency theory and more recent behavioral work both neglect to examine how LPs lock themselves into long term contractual relationships unlike a CEO compensation package. Although there are methods to exit and various clauses for withdrawal with cause, the LP is locked into the arrangement for periods upward of and extending beyond ten years. Original, unadulterated agency theory descriptively explains the misalignment of interest and the resulting residual costs, but the inability of the PEM to diversify away from the risk of the fund leads to sub-optimal portfolio decisions. Current research, which includes behavioral related topics, becomes more prescriptive in its approach (even if it semantically descriptive), and although it helps to explain the cause, it raises additional research questions related to how to modify or change PEM compensation.

Returning to the concept of residual losses due to the misalignment of interests at various points in the principal-agent relationship. The compensation and incentive structure of a PE fund is split into two main components: a semi-fixed component in the management fee, which is intended to compensate for time and effort managing the day to day operations of a fund, and variable component of equity in the form of carried interest intended to align interest with investors as well as an incentive to increase overall

performance. Although these two components have different stated purposes, the actual interaction of the two in practice is complicated, as noted in the pertinent research.

Bendickson, Muldoon, Liguori, and Davis (2016) highlighted the two most important aspects of agency theory relevant to PEM: information asymmetry and risk sharing. These aspects are intensified by both the PE investing environment and the legal and the incentive structure between LP's and GP's. Further, the seminal work of Kaplan and Schoar (2005) identified one of the key roadblocks to analyzing private equity performance, or what they term as persistence[1], and that is just that: it's private. There is significant information asymmetry between the investors and the end investments, controlled primarily by the agent or PE fund.

Kaplan and Schoar (2015) found persistence both in outperformance and underperformance. In other words, those that tended to outperform, consistently outperformed, and those that underperformed likewise did so consistently. They also examined the relationship between fund size, capital flows, and what they termed "overall GP survival" (Kaplan & Schoar, 2005, p. 1792). Fundraising generally increases after periods of good overall PE industry performance, but funds raised during that period tend to underperform and subsequent industry underperformance during those periods is due to the weak performance of the newer funds. They were the first to attempt to develop a "Public Market Equivalent" (PME) metric (Kaplan & Schoar, 2005, p. 1797).

Metrick and Yasuda (2011) summarized why privacy equity (PE) exists, outlining four considered responsibilities. First, it acts as a financial intermediary between

[1] Kaplan and Schoar (2005) extended the concept of persistence, or how fund manages perform across time and additional funds, from research on mutual fund managers. For ease of use, we will use the term persistence throughout this paper without quotation marks as we believe it has become a generally accepted term in research of not only mutual funds, but also private equity and venture capital.

investors and portfolio companies. Second, it invests only in private companies that cannot be readily traded in a public market. Third, the private equity fund manager (PEM) is actively involved in monitoring/management of the portfolio companies. Finally, it maximizes return to its investors through a major liquidity event ("exit"). The last item is critical because the PEM's carried interest (equity position) is only paid on realized returns, not on any mark-to-market or current fair value calculation. This is different from mutual and hedge funds trading in public securities, which may have periodic payments of carried interest based on current fair values of their portfolio absent exiting the specific assets.

Metrick and Yasuda (2011) elaborate on firm activities: firms are responsible for 1) screening potential investments, 2) monitoring and providing governance, and 3) directing the exit process (final liquidity event). The screening process can be simple or complex depending on both the effort put forth by the firm and competition from other investors. For example, in the current environment it is well known within the industry that due diligence has been abbreviated and supplemented by insurance policies against certain issues typically dealt with via the diligence process. Screening also involves determining the ideal capital structure, including debt levels and service, which will increase returns in a leveraged buyout. The monitoring can be affected via items as direct involvement in day-to-day management or board control. Metrick and Yasuda (2011) (p. 623) affirm that "private equity investors condition their investments on contractual provisions, such as board seats, veto rights, and various contingent control rights", as this is only a short list of the various manners in which control is exerted. Further, one of the

key decisions most PEMs make is the hiring and firing of key portfolio company management.

Metrick and Yasuda (2010) built a model of what they termed “expected revenue” based on the contract terms in both buyout and venture capital funds. They found approximately two-thirds of expected revenue come from contract components based on fixed terms and not based on performance. For buyout funds, they found higher per partner and per professional compensation in later funds, suggesting buyout funds are scalable, especially relative to venture capital funds. They provide an outline of the typical PE fund structure and compensation: fixed (management fee) and variable (carried interest) compensation, length of funds typically ten years, with a new fund raised approximately every three to five years. Although an excellent summary of fund structure and terms, they concentrate on the compensation of the fund managers, i.e., “expected revenue” and not value provided investors.

Gompers, Kaplan, and Mukharlyamov (2016) found LP’s focus on IRR and ROIC (return on invested capital) as opposed to discounted cash flow (DCF) and net present value (NPV) techniques. The authors note how this may relate to the specific needs and desires of pension funds, also noting that the LPs are effectively outsourcing the typical capital asset pricing model (CAPM), DCF and related analysis to the PE funds themselves. Kortewerg and Sorenson (2017) had several findings, primarily that smaller funds had greater persistence over the long term than larger funds. They attempt to quantify the difficulty of determining the “investable” (their undefined term) persistence of PE managers and illustrate that LPs must examine an excessive amount past deal data to feel comfortable with expected future performance. On a related note, Ewens and

Rhodes-Kropf (2015) made a compelling case that detailed deal-level data is necessary for a thorough evaluation of potential fund performance.

Lopez-de-Silanes, Phalippou, and Gottschalg (2015) found PE firms tend not to scale well, and their research "provides suggestive evidence that this is due to structural features issues that curtail information flow." (p.404, Silanes, Phalippou, & Gottschalg 2015). Marquez, Nanda, and Yavuz (2014) questioned whether fund managers limit the size of their funds not only due to diseconomies of scale as mentioned but also to signal to the best entrepreneurs that they are a worthy partner.

Braun, Jenkinson, and Stoff (2016) analyzed individual deal-level data. They first identify several of the problems with analyzing persistence at the fund level, including timing of capital flows, unrealized gains/losses, and the speed at which capital is deployed. As noted above, PE has issues with capital deployment; it is not immediate and requires multiple years to fully invest funds. Although capital deployment is spread out over time, fund IRR is calculated from the first LP capital infusion. Fund accounting and capital flows, such as warehouse lines of credit at the fund level, also mask underlying performance. Important to note is they recognize the fundraising process interferes with analysis, which will be noted later in this dissertation.

One of their key findings was the maturation of the PE industry. Advantages in both the deal structure and management of the portfolio companies tends to become dispersed. They examined the effect of maturation on the industry, determining that "[w]hen a large amount of capital chases deals, persistence tends to be lower." (Braun et al., 2016, p.275). They found persistence in the top and bottom quartiles when competition is less, but persistence decreased when competition increases. This implies

that the middle two quartiles are random. A random walk down private equity street if you will. In other words, persistence evaporates as the competition intensifies and the industry reaches a certain maturity.

Aigner, Albrecht, Beyschlag, Friederich, Kalepky, and Zagst (2008) surveyed different components to determine what drives performance in PE. There are two key findings in their research: first, a negative relationship between fund size and performance and second, lack of a consistent effect of diversification and/or specialization (this included various sizes and strategies). Achleitner, Bauer, Figge, and Lutz (2012) analyzed secondary buyouts (SBO) from the sellers' viewpoint. They refer to these sellers as the "original" PE firms. They categorized three potential exit avenues: public, private, and secondary and find there is no clear winner or loser among the different exits. They found that SBO probability increases with increased liquidity in debt markets and undrawn capital commitments, and this observation of the impact of undrawn capital, commonly referred to as "dry powder", is important. Dry powder can be considered a pressure point for both buyers and sellers as it is a direct indication of LP commitment that has not been put to work. If the overall industry dry powder is significant, incentives are significantly impacted.

Hege and Nuti (2011) examined the SBO market during the 2007 financial crisis. This importantly illustrates what happens in an illiquid market during an exogenous shock. In this case, the authors examined the secondary market for LP positions in funds, not the underlying portfolio companies. During the crisis, LPs looked to reduce their PE exposure, and the authors studied the effects of what they believed was a temporary illiquidity. Their position did not necessarily contradict Lerner and Schoar (2004), who

state that illiquidity is “defining feature” of PE and that is a screening mechanism for GPs in selecting preferable LPs. Secondary markets, per Hege and Nuti (2011), would throw a monkey wrench into this mechanism and provide and “efficient liquidity” process to thwart these GP attempts. This echoes common arguments for liquid markets in general.

In 2014, Arcot, Fluck, Gaspar, and Hege (2014) examined the rationale and determinants of secondary buyouts (SBO). In their article they reviewed transactions between PE firms and did not examine the secondary market for LP fund positions. This is singular the most comprehensive analysis of variables which may affect the SBO markets. They also create a series of indexes for both “pressures” on both buyers and sellers. They find that contract incentives, such as the contractual obligations with investors in the fund, “induce some PE funds’ to engage in secondary deals, and impact valuation multiples, deal leverage, and syndicate size.” The result is that pressured buyers and sellers exhibit an increased chance of engaging in SBO transactions; moreover, the trading (pricing) multiple is lower when there is a pressured seller, and vice versa. At some level this is common sense, but they provide an exhaustive list of the actual pressure points. The key pressure points appear to be the funds’ investment period/life, unspent capital/deal inactivity, reputational issues, and the frequency of fundraising activities.

Loos and Schwetzler (2017) reviewed fundraising events in PE and in relation to the existence of parallel funds, duration, and exit paths. They found that the following factors increased fundraising; shorter hold periods (of the investments), great number of IPO exits, and industry/style consistency of investments. Castellaneta and Gottschalg (2017) illustrated that the PE form of ownership influences performance. Degeorge,

Martin, and Phalippou (2016) examined the impact of SBO on performance and found it is contextual based on the pressure of the seller and the complimentary skills of the buyer and seller. As mentioned, the SBO market is developing and adds a certain level of liquidity not historically observed in the PE marketplace. Gompers and Lerner (2000) illustrated that as funds flow into the PE space, valuations tend to increase. Tykvova (2017) summarized the VC and PE literatures and produced an agenda for future research areas; additionally, Kaplan and Sensoy (2015) provided a PE performance survey.

Robinson and Sensoy (2013) found no strong relationship between management fees or ownership and LP net returns. Specifically, the general thought is as funds increase in size, compensation shifts from contingent compensation (or variable), i.e., carried interest, to set (or fixed) compensation, i.e., management fees. They reiterated evidence of typical cost burden associated with agency relationships, claiming that their research does *not validate* the inefficiency view of fund compensation structure. The inefficiency view is that high fee structures hurt net of fee returns. This research is important as this paper examines the relationships between fees, ownership, and the performance of specific investment based on sequence.

Robinson and Sensoy (2016) followed up with an analysis of liquidity-related issues. They highlighted the complications of determining the cyclicality (or counter-cyclicality) of PE capital, especially since call and distribution timing is dictated by the fund GP. They believe "most of the volatility in private equity cash flows can be diversified." (p. 536). This research highlighted an ongoing issue in PE (and VC) funds: the effective calculation of properly risk-adjusted returns. Buchner (2016) sought to create a "Public Market Equivalent (PME) to evaluate the risk-adjusted performance of

private equity investments" (p. 154), much like Kaplan et al. (2005) (However, it is important to highlight the active work by scholars to build a risk-adjusted methodology for PE.) They also found funds that call capital during negative economic periods tend to perform better in both relative and absolute terms.

Chung, Sensoy, Stern, and Weisbach (2012) documented a relationship openly acknowledged within the private equity industry: Expectations of future income (primarily in the form of fixed management fees) affects current fund performance. They present a "learning framework" (Chung et al., 2012, p. 3299) for understanding the relationship between current and future funds. Specifically, PEMs seek to annuitize their performance history via management fees for future, and possibly larger, funds.

Chung et al. (2012) illustrated in their rational learning model that indirect pay (renumeration from future funds) can be equal to or greater than direct pay from current funds, especially first-time buyout funds. But they also discuss how the ratio of indirect to direct pay declines over time. An issue they raised that led directly to this research is "whether the pattern of explicit compensation over a partnership's life cycle is efficient" (Chung et al., 2012, p. 3265). This paper starts from this point, asking whether a fund's returns are efficient if the indirect compensation component is at least equal to the direct compensation.

Additionally, Robinson and Sensoy (2013) did not consider gross asset returns, whereas fund distributions are both net of both deal level economics—there can be effective equity participation, commonly referred to as promote at the deal level—and the direct costs associated with the fund management fees and carried interest. The direct compensation issues noted above, combined with Chung et al (2016) perspective on

indirect compensation from fundraising, forms the basis of the reduced returns of assets invested in toward the end of the investment period of a fund within standard agency theory. These hidden agency costs in the form of residual loss are present in the form of suboptimal returns at the gross deal-level returns.

Comparative Research on Intra-Fund Performance

Fund level cash flows is the typical unit of analysis for most research, primarily driven by the lack of access to detailed deal level information, including basic deal level cash flow. Some effort has been put to adjust for this dearth of transaction level data, for example Ang, Chen, Goetzmann, and Phalippou (2018) "introduce[d] a methodology to estimate the historical time series of data" (p. 1,751), but few academics have access to deal-level data. Since this paper was able to obtain transaction-level data, it can bypass issues related to this deficiency.

Barber and Yasuda's (2017) discussion of interim fund performance is the most recent and pertinent article relative to this dissertation. Their analysis targets manager activity during peak periods of fundraising. They note manager strategies of timing high-value exits with fundraising and net asset value (NAV) management. They examine fund-level cash flow and NAV valuations on a quarterly basis and focus on what happens during periods of fundraising. They define high and low reputation GPs not only on performance, but size. They also note the difference between realized value and estimated value in a NAV calculation, with realized having more demonstrably, verifiable measure than the valuation techniques applied by a GP.

They identify two strategies, which can be pursued simultaneously. First, PEMs can exit early on successful investments (called "exit and fundraise" p. 174). Second,

PEMs can “upwardly manage” valuations of unrealized portions of their portfolio. The first strategy can play a role in high reputation managers, but not in low reputation managers. Low reputation GPs appear to upwardly manage NAV. Brown, Kedil, and Kaplan (2019) also discuss NAV manipulation. They utilize fund level data and create a series of calculations to measure manipulation by GPs. With different weighing measures and public market adjustments, they construe their results to imply different levels of manipulation based on the success of different GPs. Both Barber et al (2017) and Brown et al (2019) appeared to be testing truisms (those who are successful were successful, those who were not, were not), but challenging or testing the nature of their results is beyond the purview of this dissertation.

Sequence, which is creating linear variable for the underlying asset performance, practically removes inflated valuations in a NAV when analyzing point in time data. In other words, Sequence is not subject to issues related to over or under inflation of NAV at specific points in time in a process but deal with the end performance metric. If managers were manipulating valuations or timing exists, it would not matter to a regression of ROIC on Sequence.

Ljungqvist, Richardson, Wolfenzon (2007) accessed detailed deal-level data, including dated inflows and outflows from portfolio companies. They focused on how managers respond to market pressures by increasing investment as market conditions improve (less competition and lower credit costs). They also modeled how first-time managers are less responsive to market conditions as they attempt to build a track record. They liken investing in such first-time managers akin to purchasing an option. Their results offer a review of how BO funds react to economics factors; however, they do not

examine how endogenous factors affect fund structure and fundraising. They had access to excellent detailed data and application of the testing in this dissertation to their data could be an area for additional research and study.

Reflective Results from Venture Capital Based Research

This dissertation considers venture capital (VC) investing to be similar, but divergent from the world of private equity. Typically, literature will dissect "private equity" into buyout funds and venture capital funds. VC is different in that the risk of the investment is different from the risk of normal buyout, with a key difference related to ability of the investments to produce leverageable cash flow. Regardless of these differences, certain research has uncovered performance characteristics pertinent, and in some cases convergent, with the results of this dissertation.

In a recent working paper, Chakraborty and Ewens (2016) note write-offs double after a fundraising event. Since they are utilizing portfolio level data, their results bode well for the hypothesis in this dissertation as it relates to a decrease in performance over the course of the BO fund's life. Cochrane (2015) finds that NAV are marked up leading up to and during the fundraising stage. These markups can foreshadow markdowns after the fundraising stage is complete. Hochberg, Ljungqvist, and Vissing-Jorgensen (2014) produced similar research to Chung, Sensoy, Stern, and Weisbach (2012) with respect to how interim fund performance effects fundraising, especially the ability to raise increasingly larger funds, but their research is applied to VC.

CHAPTER 3

HYPOTHESIS

The conceptual model will build upon work done by Chung, Sensoy, Stern, and Weisbach (2012) and apply the concept of residual loss from agency theory. This will be accomplished by testing the relationship of investment performance relative to the investment sequence. Performance is expected to be inversely related to Sequence, especially in consideration of the direct and indirect compensation expectations, or "whether the pattern of explicit compensation over a partnership's life cycle is efficient" (Chung et al., 2012, p. 3265).

Conceptually, agency theory concerns risk sharing and information asymmetry (Bendickson et al., 2016) and the costs incurred by principals due to the friction of the principal agent relationship, termed residual loss. Agency theory dictates that the equity component of a fund structure, the carried interested (carry for short), would increase the alignment and produce a proper sharing of risk and information asymmetry, but a detailed review of how PE firms are arranged illustrates there are multiple pain points where interests diverge and costs are incurred. This paper focuses on residual losses incurred via reduction in the performance of the underlying assets in a PE fund's portfolio and that point is where the investment management process of an existing fund and the management fee calculation plus fundraising process of subsequent funds produces a divergence of interests between the LPs and GPs (Chung et al., 2012).

Shleifer and Visny (1986) study suggest the presence of larger institutional shareholders provides a check against the residual costs due to information asymmetry. However, not only do large institutional shareholders *not* provide a check, they may in

fact encourage more residual costs. Research on co-investments (Fang, Ivanshina, & Lerner, 2015) shed light on how larger institutional investors can disintermediate funds and bypass the fund compensation structure. Although not illuminated via current research, it is common knowledge that larger investors in funds engage in "side-letter" arrangements which contain terms which protect their preference return, retard the payment of carried interest, or in some cases allow the particular larger investor to participate in the carried interest. These "side-letters" in effect are re-allocations of the economics of the fund structure. Therefore, large investors and other investors have inter-agency issues beyond the scope of this dissertation.

Robinson et al. (2013) discussed the shift in the basis for management fee calculation. At some point in the life of the fund, the basis for management fee changes from the amount of committed capital to the amount of net invested capital. In other words, assets which have been either exited or written-off are no longer part of the basis for management fee. By way of example, if committed capital is $100 million dollars, a 2% management fee would be $2.0 million per year during the period commonly referred to as the investment period. When the shift occurs, if the fund has exited or written-off half of its investments (based on cost not fair value), the basis would only be $50 million, and the management fee would only be $1.0 million. The incentive is to hold on to dying or dead companies and to not take write-downs or write-offs of the respective companies. Robinson et al. (2013) did not discuss whether the approaching end of the investment period accelerates investment of uninvested committed capital. This paper argues this incentive, combined with the need to maintain a reputation for "putting money to work"

increases the chance of poor investment decisions towards the end of the investment period.

The sharing of risk shifts disproportionally to the GP at some point during the carried interest calculation. The risk profile shifts for two reasons: they are typically receiving 20% of the profits if successful, but zero percent if the fund did not pass the hurdle rates, but they also look forward to receiving management fees on future funds. From a certain perspective, indirect compensation can be viewed as an attempt by PEM to annuitize their performance in the form of management fees on (larger) future funds. The fundraising process is never delayed until after the complete liquidation of an existing fund as managers must run a parallel and continuous process of investing and fundraising, if for no other reason to cover the ongoing costs of maintaining fund infrastructure via management fees. This is important, as funds themselves have their own revenue (i.e., management fees) and costs (e.g., rent, employees, benefits, travel, etc.). Therefore, fundraising for subsequent funds must begin while the fund executes on existing funds. Also note the aging of the managing partners of a fund. The second point to remember is potential LPs in the next fund are analyzing fund performance based on incomplete data, including unrealized gains/losses.

One possible place to look for better explanations of the economics and management issues of private equity is to examine direct investments, which are commonly referred to as co-investments. Co-investments are opportunities to invest alongside the fund in a specific portfolio company. Typically, the larger key institutional investors are provided a right of first refusal to invest alongside the fund before any other LPs can invest. Fang, Ivanshina, and Lerner (2015) did this and their results “hint at a

complex set of agency problems between intermediaries and the ultimate investors that are not fully captured by most models of financial intermediation" (p. 162). Note their article looked at the increasing phenomenon of direct investing by LPs via what is typically called a co-investment structure. In this case, the LP invests alongside the PE fund in a vehicle not subject to the management fee or carried interest of the fund and, as discussed previously, effects the economics of different principals.

Since the fundraising process runs concurrent with management of existing funds, the question arises as to how managers perform within a specific fund. Is there a curve, distribution, or pattern related to the sequence of investments since some investments will be made and liquidated during periods of fundraising? Does early performance impact later performance positively, negatively, or is the effect neutral or random? Does overall fund performance (quartile performance) lead to different intra-fund performance curves?

The hypothesis is managers tend to underperform on investments made in the latter half of a fund's life. In other words, all performance curves, regardless of overall fund performance will exhibit a negative slope. It is important to remember this paper exams the *gross returns* of individual investments, not the overall fund performance. Therefore, if early investments perform extremely well and the GP distributes the preference return, pass the point of full catch-up, and enter the territory of a straight 80/20 split, the overall fund performance might mask this underperformance. If there is a flat or upward sloping curve, it may be because of salvage efforts. In other words, to increase chances of future fundraising, the fund expands exceptional effort to produce performance, going as far as firing, partially as scapegoats, and then hiring different personnel to fix existing portfolio companies. This is an atypical event and it is more

likely the firm will dissolve or break up then a salvage effort will succeed, as any salvage effort will require some modicum of decent performance in previous funds and might only work for in-between funds. The key aspect is when investments were made relative to the hypothetical fundraising process start, and the point at which the basis for management fee calculations changes, therefore the focus on initial date of investment for each portfolio company converted into the sequence variable.

In addition to expanding less effort in pre-closing due diligence or post-closing management of later investments, fund managers may not hire enough talented employees to keep the performance trend intact. This cost containment measure would nominally increase net returns but does not capture lost returns from underperformance of latter investments. The nominal increase in returns may not affect fundraising significantly, but the cost containment measures will increase managing partners' take-home compensation immediately. The incentive for under-employing at the fund level to increase managing partners' compensation should not be underestimated. This carries over into future funds by increasing the fund management fees at a rate greater than fund cost (Lopez-de-Silanes et al., 2015).

Finally, consider the incentive to "put all the money" to work, which is influenced by two main factors. The first is reputational, the PEM does not want the market to believe he cannot invest all the funds made available to them. The second, as discussed above, is the shift in the management fee calculation from a percentage of *committed* capital to a percentage of *invested* capital. Any uninvested capital at this point would be removed from the basis for management fee calculation.

The above would leave “money on the table” in the way of reduced ROIC on later investments. Additionally, since net to LP IRR is based on the first capital call, the discounted value of later investments to fund IRR carry less weight. Each individual deal has less of an effect on ROIC, but they can in aggregate increase the overall dollar returns to investors. This is a critical point as pension and state retirement funds need to cover large liabilities and meaningful amounts of value may be sacrificed due to decisions made on an individual basis inside PE funds due to the minor effect they may have on fundraising, management fees, and carried interest. Braun, Jenkinson, and Stoff (2016) examined a similar scenario by “assigning each deal into performance quartile and then tracking the performance of the ten subsequent deals” (p.290), but this was not done on an intra-fund basis.

The performance of individual investments declines relative to the sequence of the investment as a result of agency costs issues. Funds with higher initial performance will focus on fundraising and cost containment measures, and under-performing funds have minimal incentive to manage remaining portfolio companies unless they believe some salvage value may assist in raising future funds. Therefore, the curve of performance based on ROIC will exhibit a downward slope. The following hypothesis will empirically test this residual loss by regressing ROIC and the Sequence.

> Hypothesis: There is an inverse relationship between Sequence and investment performance as measured by ROIC.

CHAPTER 4

DATA COLLECTION AND ANALYSIS

The Study

Kaplan and Schoar (2015) and Harris, Jenkinson, and Kaplan (2014) noted the overhanging question of data reliability, accuracy, and measurement in private equity. This dissertation obtained access to a reliable data set from a large institutional investor and looks to peel back the onion and analyze the underlying deals that comprise a fund. Harris et al (2014) utilized a relative new data from Burgiss. The authors found that Total Value to Paid In (also referred to as Multiple On Invested Capital) TVPI/ROIC provided "more explanatory power than IRR" (Kaplan et al., 2014, p 1853). This paper concurs with this assessment, and theirs will be the primary metric for measurement and analysis. Therefore, the dependent variable chosen for this study is ROIC.

A domestically based institutional investor (the "Datasource") has provided a data set of approximately 30,000 transactions by various PE Funds. Adjustments made to the original data file are as follows. Funds with fewer than 6 investments (N=2,947) were dropped as containing an insufficient number of investments to sequence. Observations missing the initial date were dropped (unique N=490). Negative ROIC amounts were dropped (N=15) as either errors or miscalculations. The ROIC ratio can be zero indicating a complete write-off of the investment amount, but a negative amount is not possible definitionally. ROIC greater than 100x (N = 27) were dropped as "unicorns", or exceptional investments with out-sized returns. If included, they led to an abnormally large median and standard deviation for ROIC, as well as a coefficient for Sequence on ROIC larger than if they are excluded. Exhibit 1 contains a list of the dependent,

independent and control variables. If the Distance Between variable was greater than seven years (N=47), those observations were dropped as that long of break represents a significant break in investment activity. The following regressions were run including these transactions, and it did not materially affect the results.

There were three variables included in the database which were not utilized in our analysis either due to questions of validity or complexity, but they have been disclosed in the appendices. They are "Sold By", which is the Datasource self-described assessment of the nature of the selling entity when the initial investment was made, the "Fund Strategy" which is fund reported list value of the particular investment strategy or securities type held by the fund which was excluded for purposes of this research since questions arose as to its validity and the self-reported nature of the strategy versus the actual fund execution plus multiple strategies were reported for several funds so it is difficult to determine which investments in a fund followed which strategy, and "Fund Raising Status" which is also a self-reported category and the validity of which could not be verified at this point. It is hoped that future cooperation with the Datasource may lead to improvement in this variables and inclusion in future research questions. Exhibit 1 lists the variables utilized in the analysis. Following the exhibit is a detailed discussion of the dependent, independent, and control variables.

Exhibit 1: Definition of Dependent and Independent Variables

DV_{ROIC}: ROIC (Return on Invested Capital): simple ratio equal to realized and unrealized value divided by the invested capital.

IV_{Seq}: Sequence in which the investment was executed within an individual fund based on the initial investment date.

Control Variables:

IV_{FM}: Fund Manager of a specific fund or group of funds.

IV_{Sector}: Industry Sector of an investment as defined by Datasource.

IV_{Group}: Industry Group, a subset of Sector, of an investment as defined by Datasource.

$IV_{FundSize}$: Size of committed capital in fund. Converted to logarithmic scale due to larger arithmetic range of fund size.

IV_{Year}: The year of the initial investment in a portfolio company.

IV_{DB}: Distance between any two investments in a fund ("Distance"). Calculated in terms of days between the two initial investment dates. Converted to logarithmic scale due to the large arithmetic range of distances between investments.

The following regressions, including a mixed effect tobit regression, were conducted. The mixed effect tobit regression model was chosen because both ROIC and IRR are left censored dependent variables. All metobit analysis was done in STATA software utilizing the "vce(robust)" option, which utilizes the "robust or sandwich estimator of variance", per the STATA help manual. ROIC cannot be less than zero or negative variable as a complete loss of invested capital would be the worst possible result of an investment. IRR cannot be less than negative 1 (or theoretically approach negative one) since the negative rate of return approaching negative one is an almost or equivalent complete loss of capital. The results are provided in tables to follow.

Regressions represent the following as labeled:

1) Regression excluding the IV of Sequence, but including Log of Fund Size, Log of Distance, Year, Fund Manager, and Industry Sector
2) Regression of ROIC on Sequence
3) Regression of ROIC on Sequence controlling for Log of Fund Size, Log of Distance, Year, Fund Manager, and Industry Sector
4) Regression of ROIC on Sequence controlling for Log of Fund Size, Log of Distance, Year, Fund Manager, and Industry Group
5) Regression of ROIC on Sequence controlling for Log of Fund Size, Log of Distance, Year, Fund Manager, Industry Group but only for funds with Non-Zero Fund Size.
6) Regression of ROIC on Sequence controlling for Log of Fund Size, Log of Distance, Year, Fund Manager, Industry Group but only for funds labeled with Fund Size of Zero (Zero Fund Size) which represent either evergreen funds or independent sponsors.

The Dependent Variable: Return on Invested Capital (ROIC)

ROIC is the simple ratio of realized value and unrealized value (for assets that have not be completely liquidated) divided by the total amount of invested capital. Reporting standards require that PE firms not net any amounts; therefore, the numerator and denominator should be reported as gross amounts. ROIC provides a relative performance measure not influenced by time value and effective netting of positive and negative cash flows made near each other which the IRR is subject to both. Although a subject for future research, IRR can be manipulated and massaged more easily by

adjusting cash flow and choosing liquidity events (adjusting the "hold period") timed to increase the IRR performance, as is seen by some absurdly larger IRR figures in the data. Although IRR has these deficiencies from a performance standpoint, IRR was regressed against sequence as a robustness test.

The Independent Variable: Sequence

The independent variable was created for the purpose of this research and is herein referred to as "Sequence". Sequence is the ordinal value of each investment in a fund based on the date of the first investment into the respective portfolio company. By way of example, if three investments are made in January, March, and June in three different companies, those companies were "sequenced" as investments (1), (2), and (3) in the database. The data set was reduced by any fund that did not have a minimum of 6 investments as the hypothesis testing required a certain minimum number of investments to consider the concept of sequence as important and testable. Removal of funds with five or fewer investments most likely also removed funds in the early stages of the investment period and who had most likely not fully deployed capital available. These funds in the early stage of investing would most likely not be at the point where they would incur agency costs as described in this paper.

Control Variables

The primary control variables are as follows: year of the initial investment made in a portfolio company ("Year"), the overall size of the fund as determined by the committed amount of capital ("Fund Size") which was converted into a logarithmic scale due to arithmetic range of fund size, distance between any two investments in a portfolio ("Distance"), which was also converted into a logarithmic scale due to arithmetic range

of distances between any two investments, the Fund Manager ("Fund Manager") who oversees the investments across multiple specific funds, the Industry Sector ("Sector") of an investment which is high level categorization of the investment industry (e.g., IT, Consumer Goods, etc.), and finally the Industry Group ("Group") which is a subsidiary category of the Industry Sector (e.g., IT – Hardware, IT – Software, etc.).

Results

Summary statistics are provided in Table 1. The data set contains 2,011 specific funds across 810 Fund Managers for an average of 2.5 funds per manager. There are more observations than unique operating companies for one or a combination of the following reasons: the same company was invested in by a PEM at different times in different funds, different managers invested in the same company, a company traded between different PEM, or a company went from private to public and back to private. Since this paper is concerned with fund manager performance within and across funds, the duplication of operating companies in different portfolios at different and possibly simultaneous points is not only acceptable, but desired to see how different managers have acted with the same investment based on agency costs inherent to the specific manager's situation.

As noted above, ROIC in excess of 100 would be a highly unusual investment and observations containing ROIC of 100 or greater were dropped for the data set. The max ROIC would have been 978,899.9 and these 27 observations skewed the mean and standard deviation to such magnitude they would be 37 and 5,726, respectively, if included. Without these observations, the mean ROIC is 2.06, which is a typical target net return to the fund over a 5- to 7-year hold period from an individual investment. Since

this figure is gross, it would imply most funds consisting of the mean ROIC would return less than expected or required to LPs.

The created variable, Sequence, has a mean of 10.17 and a standard deviation of 9.25, implying that most funds are within the range of five to thirty investments based on two standard deviations, which is as expected for the average fund to operate in this range of number of portfolio companies. Please note, that the sequence number is also a running count of number of investments in a specific fund.

Fund Size has a greater range from zero to $21 billion, therefore this variable was converted into a logarithmic scale. The mean Fund Size is $811 million, which is as expected given the Datasource focuses on middle market private equity funds and this fund size would represent a typical middle market fund. A zero figure in Fund Size may indicate a search fund/independent sponsor, both of which do not raise specific amounts of capital but raise funds on a single investment by investment basis or an evergreen fund which does not have a specific amount of capital committed (but may have an upper limit). When converted to a logarithmic scale, these observations (roughly 700) drop off because the log of zero is undefined.

For Distance, the range extends from zero days, which indicates both the first investment of a fund and investments made on the same day, to 2,450 days (slightly less than the imposed limit of seven years noted above) with a mean of 126 days. Because the mean and standard deviation increases and the effect of long distances in investment are important, all observations were retained when Distance was converted to a logarithmic scale. As opposed to Fund Size, zero figures for the log of Distance were kept in order to maintain the sequence variable.

There are 13,842 observations which included the IRR variable, roughly half of the observations with ROIC. The mean was 68.82 (or 6,882% IRR) with a standard deviation of 7,217.54 and a maximum of 843,134.60 if all IRR calculations are included. As discussed previously, IRR is subject to timing considerations and manipulation. IRR greater than 100% (1.0) would represent a doubling of money in a short period of time and most likely are outliers or possible "earnings manipulation". Therefore, IRRs greater than 100% (1.0) were excluded from the analysis which removed 1,044 observations. This results in a mean of 0.1503 (15.03%) with a standard deviation of 0.3731 (37.31%), the maximum is .9999 (99.99%), which is a more realistic and acceptable mean IRR for a middle market investment.

Controlling for Year is intended to deal with the varying economic conditions that may have been present at the time of investment. This is consistent with the manner investors evaluate funds, which is based on "vintage year" defined as the year in which a fund was started and accepted its first capital commitment. Log of Fund Size is simply to see if the size of capital committed to fund effects performance. Log of Distance is included to examine if the theoretical relationship described above is present or absent. Industry Sector and Industry Group, which is a sub-sector categorization, are meant to control for effects of investments in different industries with their own market performance characteristics.

Fund Manager has effect over all the funds under their control and in a qualitative sense they are the unit of analysis.

Table 1.
Summary Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maxi-mum
Fund Managers	810	n/a	n/a	n/a	n/a
Number of Separate Funds	2,011	n/a	n/a	n/a	n/a
Number of Unique Operating Companies	19,184	n/a	n/a	n/a	n/a
ROIC	25,387	2.06	3.37	0	96.00
Sequence	25,387	10.17	9.25	1	94
Fund Size (in millions, except observations)	25,379	$811	$1,968	$0	$21,064
Distance	25,387	126 Days	194 days	0	2,540 days
IRR	13,842	68.64	7,217.54	-1	843,134.60

Notes: This table provides summary statistics for the data set obtained and tested as the primary data source and does not include secondary data source information.

Table 2 contains a summary of the correlations between numeric non-dummy variables. There is a negative correlation between ROIC and the following variables: Sequence, Fund Size, and Fund Size Log. There is a positive correlation between ROIC and Distance, Distance Log, and IRR. The IRR correlation is not as strong as one would expect given the formulaic relationship between the two performance measures. In other words, the cash flows utilized for ROIC should be the same cash flows utilized for IRR, subject to the time value of money concept. This leads to a question on manipulation of IRR as a calculation as timing of cash flows are in some ways easier to move than actual dollar amounts invested.

The positive correlation for Distance is relatively minor, which reflects a greater distance may be the result of either a scarce or abundant investment choice set. Further, either of those situations may be combined with an impatient or patient investing mindset. For example, an impatient PEM may spend several months looking at a scarce choice set and pick an investment under the pressure to "do something". That same impatient PEM confronted with an abundant choice set may spend months agonizing over which is the best and make either a wise or poor decision. A patient PEM confronted with

either situation will decide based on fundamentals and analysis and invested prudently and therefore may take an extended period between investments, but they would also not hesitate to execute quickly on a good opportunity. Because of this randomness, it is difficult to determine if distance should increase or decrease performance as it could be an indication of either an impatient or patient PEM. It is reasonable that the correlation is very low.

Table 2.
Correlations among Numeric non-dummy Variables

	ROIC	Sequence	Fund Size	Distance	FundSize Log	Distance Log	IRR
ROIC	1.0000						
Sequence	-0.0206	1.0000					
	0.0010						
Fund Size	-0.0367	0.1887	1.0000				
	0.0000	0.0000					
Distance	0.0196	-0.0618	-0.0751	1.0000			
	0.0018	0.0000	0.0000				
FundSize Log	-0.0787	0.1533	0.6518	-0.0835	1.0000		
	0.0000	0.0000	0.0000	0.0000			
Distance Log	0.0100	-0.0061	-0.0986	0.6419	-0.0721	1.0000	
	0.1104	0.3325	0.0000	0.0000	0.0000		
IRR	0.0008	0.0326	-0.0024	-0.0034	-0.0005	0.0073	1.0000
	0.9256	0.0001	0.7764	0.6871	0.9529	0.3882	

Notes: This table provides correlations and statistical significance (p-values) of those correlations between continuous numeric values (or their logs) within the primary data source.

Table 3 summarizes the results of the ordinary least squares ("OLS") regressions with no adjustment for the left censored nature of the ROIC variable. ROIC is left censored at zero because the worst possible outcome of an investment would be a complete loss of invested capital. The Tobit model is designed deal with data that is either or both left and right censored. See further analysis below.

In all cases other than the simple regression with no controls, Year, Log of Fund Size, and Log of Distance were always included as control variables. Then, Fund Manager was combined with either Industry Sector or Industry Group. In all cases, there

is a statistically significant *negative* relationship between ROIC and Sequence; p values for the Fund Manager/Industry Sector and Fund Manager/Industry Group p-values of 0.000374 and 0.000422, respectively. This notes the relative statistical significance of the negative relationship when controlling for the primary unit of analysis, the Fund Manager. A discussion of regressions (5) and (6) is below.

Table 3.

OLS Regression Analysis of ROIC on Sequence

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ROIC	ROIC	ROIC	ROIC	ROIC	ROIC
Sequence		-0.00752***	-0.01020***	-0.01010***	-0.01020***	0.01500
		(0.00229)	(0.00288)	(0.00287)	(0.00288)	(0.02790)
Log of Fund Size	-0.29100***		-0.30100***	-0.30100***	-0.30100***	
	(0.0431)		(0.0432)	(0.0432)	(0.0432)	
Log of Distance	-0.000939		0.00352	0.00389	0.00352	-0.00768
	(0.0107)		(0.0107)	(0.0107)	(0.0107)	(0.0519)
Constant	11.54***	2.140***	11.47***	11.60***	11.47***	2.879
	(2.620)	(0.0314)	(2.619)	(2.623)	(2.619)	(2.887)
Observations	24,001	25,387	24,001	24,001	24,001	691
R-Squared	0.130	0.000	0.131	0.132	0.131	0.298
Adjusted R-Squared	0.09950	0.000387	0.100000	0.101000	0.101000	0.16800
Year	YES	NO	YES	YES	YES	YES
Fund Manager	YES	NO	YES	YES	YES	YES
Industry Sector	YES	NO	YES	NO	YES	YES
Industry Group	NO	NO	NO	YES	NO	NO
Non-Zero Fund Size	N/A	N/A	N/A	N/A	YES	NO
Zero Fund Size	N/A	N/A	N/A	N/A	NO	YES
p values	n/a	0.00100	0.000374	0.000422	0.000374	0.59000

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table reports ordinary least squares (OLS) regressions of ROIC on Sequence for the primary data source, which is an ordinal value based on the order in which investments were done in a fund relative to the original investment date for each portfolio company, utilizing the different control variables outlined in at the bottom of the table. The main control variables are the Year in which the investment was made, the Fund Manager (who managers multiple funds within the data set), the Industry Sector and Industry Group (as defined in Appendix C), and the Log of Fund Size, which is the committed capital to the fund original in millions of dollars, and the Log of Distance, where Distance is defined as days elapsed between any two investments in the portfolio. A placebo test was conducted in columns (5) and (6) where all Non-Zero Fund Size funds were segregated and regressed, and all Zero Fund Size funds were segregated and regressed. Zero Fund Size are funds that are evergreen or independent sponsors, and as such should not be subject to the same incentives as funds that are under pressure to raise the next or additional funds. Robust standard errors are listed in parenthesis. The results indicate a statistically significant relationship between the Sequence of an investment (as defined) and the ROIC.

Since ROIC is a left censored independent variable with effects from multiple control variables, additional analysis was conducted utilizing the mixed-effects tobit model ("metobit") per Table 4. Independence assumptions which are most likely violated by the inter-relatedness of the data, as well as homoscedastic assumptions which are most

likely violated by the question of the individual slope of each line for each specific fund and fund manager if analyzed as a single unit. This second assumption is also an area for more research to see how initial success in performance may have a larger negative impact on later performance within each fund. The metobit analysis will report more robust standard errors due to this heteroscedasticity. The mixed-effects model assumes there is variation of the slopes of the best fit lines between groups. In this sense, the metobit model is conservative, making the fewest assumptions. In addition, the data most likely included some level of kurtosis on the lower end, with a larger distribution of low value ROIC figures. This also contributed to the choice of Mixed Effects Tobit model utilized in the associated tables below.

Table 4.

Censored Mixed Effects Regression Analysis ("Mixed Effects Tobit") of ROIC on Sequence

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ROIC	ROIC	ROIC	ROIC	ROIC	ROIC
Sequence		-0.00511**	-0.01060***	-0.01050***	-0.01060***	0.04080
		(0.00257)	(0.00347)	(0.00348)	(0.00347)	(0.0400)
Log of Fund Size	-0.36100***		-0.37100***	-0.37100***	-0.37100***	
	(0.0616)		(0.0617)	(0.0615)	(0.0617)	
Log of Distance	-0.00126		0.00340	0.00349	0.00340	-0.0603
	(0.0126)		(0.0127)	(0.0127)	(0.0127)	(0.0726)
Constant	-27.21	1.717***	-27.18	-26.83***	-25.38	4.880***
	(17.480)	(0.0338)		(9.203)	(28.07)	(1.664)
Observations	24,001	25,387	24,001	24,001	24,001	691
Chi-Squared	.	3.962	.	.	.	.
Year	YES	NO	YES	YES	YES	YES
Fund Manager	YES	NO	YES	YES	YES	YES
Industry Sector	YES	NO	YES	NO	YES	YES
Industry Group	NO	NO	NO	YES	NO	NO
Non-Zero Fund Size	N/A	N/A	N/A	N/A	YES	NO
Zero Fund Size	N/A	N/A	N/A	N/A	NO	YES
p values	n/a	0.04650	0.00231	0.00241	0.00231	0.30800

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table reports censored mixed effects TOBIT ("metobit") regressions of ROIC on Sequence for the primary data source, which is an ordinal value based on the order in which investments were done in a fund relative to the original investment date for each portfolio company, utilizing the different control variables outlined in at the bottom of the table. This regression was conducted to compensate for left censoring of both the Sequence and ROIC variables at zero, as well as to address issues related to independence and homoscedasticity assumptions. The main control variables are the Year in which the investment was made, the Fund Manager (who managers multiple funds within the data set), the Industry Sector and Industry Group (as defined in Appendix C), and the Log of Fund Size, which is the committed capital to the fund original in millions of dollars, and the Log of Distance, where Distance is defined as days elapsed between any two investments in the portfolio. A placebo test was conducted in columns (5) and (6) where all Non-Zero Fund Size funds were segregated and regressed, and all Zero Fund Size funds were segregated and regressed. Zero Fund Size are funds that are evergreen or independent sponsors, and as such should not be subject to the same incentives as funds that are under pressure to raise the next or additional funds. Robust standard errors are listed in parenthesis. The results indicate a statistically significant relationship between the Sequence of an investment (as defined) and the ROIC.

The results are similar with the standard regression model. There is a negative relationship between ROIC and Sequence. Also consistent with the standard regression

model is the significance of the negative relationships. For example, when maintaining Industry Sector as a control variable, the p-value for Fund Manager analysis is 0.00226.

As an additional test the same regressions and metobit analysis was done, but IRR was substituted for ROIC in all applicable cases. The results of both are below in Tables 5 and 6. The same negative and positive relationships held under the respective scenarios related to Fund Manager, except for the direct regression of IRR on Sequence with no control variables were any results statistically significant. Interestingly, the p-values in both analysis for the direct regression were extremely low 0.0000553 and 0.0000259, respectively, for normal regression and metobit. This would indicate the negative relationship between sequence and performance has some additional basis as the correlation between IRR and ROIC is positive, yet minor.

Table 5.
OLS Regression Analysis of IRR on Sequence

	(1)	(2)	(3)	(4)
VARIABLES	IRR	IRR	IRR	IRR
Sequence		-0.00137***	-0.000403	-0.000433
		(0.000339)	(0.000449)	(0.000449)
Log of Fund Size	-0.02340***		-0.02370***	-0.02360***
	(0.00743)		(0.00744)	(0.00744)
Log of Distance	0.000445		0.000625	0.00621
	(0.00171)		(0.00172)	(0.00172)
Constant	-0.0967	0.164***	-0.0996	0.0122
	(0.301)	(0.00483)	(0.301)	(0.302)
Observations	12,284	12,799	12,284	12,284
R-Squared	0.163	0.001	0.164	0.166
Adjusted R-Squared	0.119	0.00119	0.119	0.121
Year	YES	NO	YES	YES
Fund Manager	YES	NO	YES	YES
Industry Sector	YES	NO	YES	NO
Industry Group	NO	NO	NO	YES
p-values	n/a	0.00005	0.369	0.335

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table reports ordinary least squares (OLS) regressions of IRR on Sequence for the primary data source, which is an ordinal value based on the order in which investments were done in a fund relative to the original investment date for each portfolio company, utilizing the different control variables outlined in at the bottom of the table analysis utilizing the different control variables outlined in at the bottom of the table. The main control variables are the Year in which the investment was made, the Fund Manager (who managers multiple funds within the data set), the Industry Sector and Industry Group (as defined in Appendix C), and the Log of Fund Size, which is the committed capital to the fund original in millions of dollars, and the Log of Distance, where Distance is defined as days elapsed between any two investments in the portfolio. Robust standard errors are listed in parenthesis. The results indicate a similarly statistically significant relationship for analysis 2 and 4 between the Sequence of an investment (as defined) and IRR, which is as expected .

Table 6.
Censored Mixed Effects Regression Analysis ("Mixed Effects Tobit") of IRR on Sequence

	(1)	(2)	(3)	(4)
VARIABLES	IRR	IRR	IRR	IRR
Sequence		-0.00141***	-0.000454	-0.000485
		(0.000334)	(0.000446)	(0.000447)
Log of Fund Size	0.704		-0.02380***	-0.02370***
	(50.53)		(0.00785)	(0.00785)
Log of Distance	105.90		0.000770	0.000763
	(119.5)		(0.00179)	(0.00179)
Constant	257.6	0.160***	0.364***	0.468***
	(611.2)	(0.00486)	(0.0978)	(0.101)
Observations	10,675	12,799	12,284	12,284
Chi Squared	.	17.70	.	.
Year	YES	NO	YES	YES
Fund Manager	YES	NO	YES	YES
Industry Sector	YES	NO	YES	NO
Industry Group	NO	NO	NO	YES
p-values	n/a	0.00002	0.309	0.278

*** p<0.01, ** p<0.05, * p<0.1

Notes: This table reports censored mixed effects TOBIT ("metobit") regressions of IRR on Sequence for the primary data source, which is an ordinal value based on the order in which investments were done in a fund relative to the original investment date for each portfolio company, utilizing the different control variables outlined in at the bottom of the table. This regression was conducted to compensate for left censoring of both the Sequence and ROIC variables at zero, as well as to address issues related to independence and homoscedasticity assumptions. The main control variables are the Year in which the investment was made, the Fund Manager (who managers multiple funds within the data set), the Industry Sector and Industry Group (as defined in Appendix C), and the Log of Fund Size, which is the committed capital to the fund original in millions of dollars, and the Log of Distance, where Distance is defined as days elapsed between any two investments in the portfolio. Robust standard errors are listed in parenthesis. The results indicate a similarly statistically significant relationship for analysis 2 and 4 between the Sequence of an investment (as defined) and IRR, which is as expected.

Placebo Test - "Zero Fund Size" Versus Non Zero Fund Size

The data set included funds whose fund size was set at zero. A zero fund size indicated either an evergreen fund or an independent sponsor (sometimes referred to as a search fund). An evergreen fund is one in which LPs generally have an open ended commitment to keep the fund in operation. An independent sponsor is a group which raises money on a deal by deal basis. In both cases, it is common for the carried interest, which is typically labeled "promote", is earned on a deal-by-deal basis. In both situations, and most common in sponsor models, the investors may be different for each investment, or if the same group of investors, the capital contributions may vary from deal to deal.

The agency costs issues discussed in this dissertation would not be present or would be significantly different in an environment of deal-by-deal performance or evergreen commitments. There is no pressure, per se, to assemble a track record to raise a fund. There is no recurring management fee calculation for which the basis of calculation would change after some contractual investment period.

Provided for this difference in agency relationship, one would expect the "zero fund size" funds to not experience the same deterioration in performance as other funds. Therefore, two additional regressions were run for Tables 3 & 4 as compared to the dissertation proposal. Regression (5) excluded all Zero Fund Size funds found a statistically significant negative relationship between ROIC and Sequence with a p values of 0.000374 and 0.00231 for the OLS and METOBIT regressions, respectively, which is not different from when all funds were included. Regression (6) was the placebo test in which only Zero Fund Size "funds" were included (N=691) and there was a positive relationship between Sequence and ROIC, but it was not statistically significant with a p-

values 0.59000 and 0.30800 for OLC and METOBIT regression, respectively. This is further empirical evidence that for typical fund structures with fixed capital commitments and investment periods, there is a negative relationship between investment Sequence and ROIC.

Estimate of Economic Impact

The calculation below is a high-level estimate of the economic impact to a LPs of the empirical results in this dissertation. Utilizing the mean figures, the calculation below estimates the impact at roughly 1% of the fund size (0.106x), or for the mean fund $86 million of gross returns. For funds that produce sufficient returns to pay carried interest, that would equate to a loss of $69 million, or roughly 0.75% of fund returns.

Mean Sequence (as proxy for number of investments)	10
Mean Fund Size (as proxy for average investment fund size)	$811 million
Mean ROIC	2.063X
Coefficient between ROIC and Sequence per METOBIT regression	-.0106
Product of Mean Sequence and absolute value of Coefficient ("residual cost"):	0.106x
Residual Costs for Mean Fund Size	$86 million
Carry Adjusted Impact (adjusted for 20% carried interest)	$69 million

CHAPTER 5

ROBUSTNESS TEST SECONDARY SOURCE

A secondary data source from smaller domestically-based institutional investors was available to provide for additional analysis as a test of the robustness of the primary data set. The tables apply to the variables used, with the exception that there were insufficient data points for the industry sector and industry group. This data set had 1,131 observations, except in the case of IRR where there were only 882 data points.

The results were similar across means and standard deviations. There was consistency and reasonable expectation for means and standard deviation of ROIC. Comparing means and standard deviation for ROIC of this secondary data set to the larger data set: means 2.40 versus 2.04; standard deviation was 3.77 versus 3.35. There were no outliers to remove as the maximums for ROIC and IRR were 61 and 77.12, respectively. Additionally, it was a smaller data set and I aimed to keep as many observations as possible.

Table 7.
Summary Statistics – Robustness Test Secondary Source

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Fund Managers	31	n/a	n/a	n/a	n/a
Number of Separate Funds	89	n/a	n/a	n/a	n/a
Number of Unique Operating Companies	1,074	n/a	n/a	n/a	n/a
ROIC	1,131	2.40	3.77	0	61.00
Sequence	1,131	8.38	6.13	1	32
Fund Size (in millions, except observations)	1,131	$1,076	$1,697	$25	$9,500
Distance	1,044	132 Days	158 days	0	1,639 days
IRR	882	0.52	2.84	-1	77.12

Notes: This table provides summary statistics for the data set obtained and tested from a smaller, secondary source and does not include the primary data source information.

Table 8.
Correlations among Numeric non-dummy Variables – Robustness Test Secondary Source

	ROIC	Sequence	Fund Size	Distance	FundSize Log	Distance Log	IRR
ROIC	1.0000						
Sequence	-0.0621	1.0000					
	0.0368						
Fund Size	-0.0828	0.0869	1.0000				
	0.0053	0.0034					
Distance	0.0901	-0.0740	-0.1137	1.0000			
	0.0036	0.0168	0.0002				
FundSize Log	-0.1758	0.0752	0.7775	-0.1206	1.0000		
	0.0000	0.0115	0.0000	0.0001			
Distance Log	0.0713	-0.1909	-0.0576	0.7105	-0.0514	1.0000	
	0.0165	0.0000	0.0528	0.0000	0.0838		
IRR	0.1390	0.0729	-0.0375	-0.0318	-0.0431	-0.0708	1.0000
	0.0000	0.0305	0.2665	0.3644	0.2006	0.0355	

Notes: This table provides correlations and statistical significance (p-values) of those correlations between continuous numeric values (or their logs) within the secondary data source.

Correlations mirrored the positive and negative relationships seen in the larger data set, with the single exception of negative correlation between Fund Size and Distance in the smaller data set. The correlation for these two variables in the larger data set was small, 0.0023, therefore any difference is minor. Although the correlations were similar in direction, note the correlation between ROIC and IRR in this data set was significantly greater: 0.1442 versus 0.0008. This leads to one of the future research questions about the manipulation of IRR, or even ROIC, by PE funds when they report individual deal level data to prospective investors.

Both regression and metobit analysis mirrored the results of the larger data set (see Tables 9 and 10 below), with one notable exception in the metobit analysis. Given the reinforcing results of the secondary data source, it lends credence to negative relationship between ROIC and Sequence.

Table 9.
OLS Regression Analysis of ROIC on Sequence – Robustness Test Secondary Source

	(1)	(2)	(3)	(4)
VARIABLES	ROIC	ROIC	ROIC	ROIC
Sequence		-0.03830**	-0.03820*	0.00481
		(0.0183)	(0.0223)	(0.0430)
Log of Fund Size	-0.395*		-0.471**	39.77
	(0.222)		(0.226)	(70.43)
Log of Distance	0.04110		0.02970	0.01060
	(0.0576)		(0.0580)	(0.0609)
Constant	5.507	2.723***	5.613	-237.8
	(3.701)	(0.190)	(3.698)	(426.2)
Observations	1,131	1,131	1,131	1,131
R-squared	0.153	0.004	0.155	0.207
Adjusted R Squared	0.0989	0.00297	0.100	0.108
Year	YES	NO	YES	YES
Fund Manager	YES	NO	YES	NO
Industry Sector	NO	NO	NO	NO
Industry Group	NO	NO	NO	NO
*** p<0.01, ** p<0.05, * p<0.1				
p Values		0.0368	0.0877	0.911

Notes: This table reports ordinary least squares (OLS) regressions of ROIC on Sequence for the secondary data source, which is an ordinal value based on the order in which investments were done in a fund relative to the original investment date for each portfolio company, utilizing the different control variables outlined in at the bottom of the table. The main control variables are the Year in which the investment was made, the Fund Manager (who managers multiple funds within the data set), the Industry Sector and Industry Group (as defined in Appendix C), and the Log of Fund Size, which is the committed capital to the fund original in millions of dollars, and the Log of Distance, where Distance is defined as days elapsed between any two investments in the portfolio. Robust standard errors are listed in parenthesis. The results indicate a statistically significant relationship between the Sequence of an investment (as defined) and the ROIC.

Table 10.
Censored Mixed Effects Regression Analysis ("Mixed Effects Tobit") of ROIC on Sequence – Robustness Test Secondary Source

VARIABLES	(1) ROIC	(2) ROIC	(3) ROIC	(4) ROIC
Sequence		-0.03680**	-0.04630***	-0.00926
		(0.0143)	(0.0162)	(0.0451)
Log of Fund Size	-0.37900		-0.47100	39.01
	(0.333)		(0.340)	(25.65)
Log of Distance	0.04910		0.03540	0.02070
	(0.0509)		(0.0513)	(0.0510)
Constant	5.538***	2.490***	5.659***	-231.7
	(1.075)	(0.172)	(1.074)	(154.1)
Observations	1,131	1,131	1,131	1,131
Chi Squared	.	6.625	.	.
Year	YES	NO	YES	YES
Fund Manager	YES	NO	YES	NO
Industry Sector	NO	NO	NO	NO
Industry Group	NO	NO	NO	NO
p Values	n/a	0.0101	0.00416	0.837

Notes: This table reports censored mixed effects TOBIT ("metobit") regressions of ROIC on Sequence for the secondary data source, which is an ordinal value based on the order in which investments were done in a fund relative to the original investment date for each portfolio company, utilizing the different control variables outlined in at the bottom of the table. This regression was conducted to compensate for left censoring of both the Sequence and ROIC variables at zero, as well as to address issues related to independence and homoscedasticity assumptions. The main control variables are the Year in which the investment was made, the Fund Manager (who managers multiple funds within the data set), the Industry Sector and Industry Group (as defined in Appendix C), and the Log of Fund Size, which is the committed capital to the fund original in millions of dollars, and the Log of Distance, where Distance is defined as days elapsed between any two investments in the portfolio. Robust standard errors are listed in parenthesis. The results indicate a statistically significant relationship between the Sequence of an investment (as defined) and the ROIC.

CHAPTER 6

RESEARCH CONTRIBUTION DISCUSSION

Contribution to Academic Research

This dissertation reinforces the findings of previous articles related to decreased performance over time on an intra-fund basis by examining deal-level data specifically for this purpose. This complements prior research focusing on NAV and/or fund level cash flow/performance. Building on existing research of intra-fund performance analysis (Barber and Yasuda (2017), Brown, Gredil, Kaplan (2019), Ljungqvist, Richardson, Wolfenzon (2007), Chakraborty, Ewens (2018)) this dissertation moves from a binary analysis of pre and post fundraising event and seeks understanding at deal level of the stage of fundraising process, including the contractual change in basis of management fee calculation, to better understanding of PE fund manager performance. Moving from the NAV metric to a the ROIC metric that is semi-independent (especially in the case of life-time fund analysis) of managers valuation adjustment and manipulation. Adding a new variable, defined as Sequence, and regressing ROIC on Sequence examines the slope of returns, providing insight on the agency costs over a period of time. The results are congruent with previous research that intra-fund performance tends to decrease over time.

NAV, which is a "point in time" measurement, contains significant estimates and management assumptions on unrealized portfolio asset values. NAV is measured at different points; therefore, it is hard to measure what changed in the NAV calculation between any two points (Barber & Yasuda, 2017). ROIC, on the other hand, is a definitive cash flow based metric with minimal unrealized value in it toward the end of funds' lives.

This dissertation created a variable based on initial investment date: Sequence. Thus, moving beyond a pure binary view of fundraising as a discreet point in time as opposed to an ongoing process. Whereas previous research notes ongoing process nature of fundraising, this dissertation advances thought by providing a new variable. Then, the regression of ROIC on Sequence creates a new approach to examining performance persistence on an intra-fund basis. This new approach further validates the general hypothesis of intra-fund performance persistence having a downward slope.

In addition to theories of agency, the concept of egoism should be considered for further areas of behavioral finance research (Weigel and Locke, 2012). Agency in the sense of how LPs and GPs develop and document the business relationships involved in investing in private companies. Egoism is a personal characteristic and whether and how it is present the leadership class of fund managers. In addition to its obvious impact on the finance discipline—how to identify fund managers who will out-perform in their asset class—there is also a multi-disciplinary impact of this research: Do expectations of indirect compensation effect management of the fund can apply to not just business disciplines of finance, leadership, management, and marketing, but also non-business disciplines such as sociology, psychology, and ethics? If so, how?

Tailoring compensation structures for PEMs has broad scholarly implications, including measuring the relationship between PEMs' actions and the real versus perceived incentives. Do managers of PE funds develop the proper habits to scale, grow, and manage funds? The burgeoning field of "behavioral finance" is searching for understanding of financial phenomenon beyond the standard metrics of alpha and beta. Management/Leadership disciplines will have new tools to analyze leadership and

strategy. Marketing can develop a better understanding of managers to see how consumers view the corporation and its products considering egoistic or altruistic actions of its leaders and employees. Outside of business, sociology/psychology can offer a different perspective on issues of egoism and more importantly the attempt to reconcile a negative and positive views of egoism and self-interest. [See Weigel and Locke (2012) for a summary exchange on positive and negative views of egoism and self-interest.] Fundamentally, this research will build on agency theory to better explain the relationship between performance and fund management incentives.

Contribution to Practice

The single largest beneficiaries of this research in the practical realm are institutional investors. The ability to identify managers who demonstrate persistence performance is critical to the allocation strategy and long-term asset base of LPs. This research will approach the performance of private equity funds in a quantitative manner by examining intra-fund distribution of performance from an agency perspective. In the finance field, it will advance knowledge of how agency is affected by the fund structure and contribute to extant research on what drives fund persistence.

NAV markup/markdown trends identified in prior academic research combined with the fundraising process approach contributes to institutional investors' ongoing efforts to better understand the internal dynamics of PE funds and those who manage them. Just as behavioral economics has redefined the understanding of base economic relationships and the rational or human nature, this research extends the understanding of motivations for PEM (Chung et al (2012), Robinson and Sensoy (2013), Barber and Yasuda (2017), Brown, Gredil, and Kaplan (2019)). As many PEM realize the human

resource aspect of their investment decisions, the same principles apply to the choice of PEM by investors.

The overall issue, as noted below in the contribution to public policy, is *monitor and measurement* tools available to investors. Any and all research that assists investors in peeking through the veil of private equity performance assists investors in their goals of increasing wealth. This research provides one more tool for investors to measure the output of PEM but should also help them with developing new manners of interaction with PEM to increase the return on their investment.

Contribution to Public Policy

The single largest beneficiary of this research in the realm of public policy are those responsible for meeting obligations of state pension and retirement systems. Especially around allocation to the private equity asset class. This research can move one step up from those charged with implementing investment decisions for the good of their public employees in state and local retirement systems but can also influence legislators in decisions regarding regulator and taxation schemes related to private investment. These transformations do not have be punitive initiatives but could simply be changes disclosure or to measurement requirements.

From a regulatory schema, this research raises regulatory questions related to the opaqueness of PE information. In conversations with other academics, the difficulty in obtaining data for analysis was an overarching concern. It would be rational to assume the involvement state pension funds would drive more open disclosure, or at least a higher degree of public scrutiny. It appears to lead to the opposite effect. This research

contributes to the ongoing debate of how the regulatory web should deal with the dearth, and resulting misunderstanding, of PE performance.

As the overall allocation of funds to more opaque mechanisms of capital flow, not just PE, grows, questions of the ability to both *monitor and measure* performance should increase, particularly for legislative bodies. This research is important in that it hopefully provides one more measurement tool (ROIC/Sequence analysis) for those in position of public trust to discharge their duties to the benefit of the public good. This could lead to not only disclosure laws, but also changes to regulatory schemes, tax laws, and the general laws as they relate to the formation of the partnerships and fictional legal entities. Changes to these general laws could change the structure and relationship between not just state retirement systems, but the overall system of capital flows in the realm of privately owned companies. The result should be a more efficient market in private company valuations, and hence capital flows.

CHAPTER 7

CONCLUSION

Summary Findings

An ordinal variable, title Sequence, was created in the data set that represented the order in which investments were made using the initial date of investment for ordering. ROIC was regressed against this variable utilizing both the OLS and Mixed-Effects models. The control variables Year, Log of Fund Size, and Log of Distance were always included as control variables in each regression. The main result was a statistically significant inverse relationship between ROIC and Sequence in all scenarios tested. For both OLS and metobit there was a statistically significant inverse relationship between ROIC and Sequence when no control variables were present with p-values of 0.000823 and 0.00226, respectively. Four different scenarios containing control variables were calculated. In all scenarios with control variables Log of Fund Size, Log of Distance, and Year were present. The four remaining control variables of Fund Manager, Industry Sector, and Industry Group were aligned in a matrix such that Fund Manager was tested and switched between Industry Sector and Industry Group. The statistically significant inverse relationship held up in all scenarios. As a robust test, the same regressions were done substituting IRR for ROIC, but there was no statistical significance in the IRR tests, except for the simple OLS regression of IRR on Sequence, which was negative, which is expected given the direct mathematical relationship between ROIC and IRR.

Areas for Future Research

The effect of Fund Strategy and Sold By on performance is a ripe area for future research once the validity of the such variables can be ascertained. With these, and other variables, would a hierarchal linear model be advantageous? The bifurcation of the funds into groups based on relative early performance may lead examination of whether a greater slope (more deterioration) in later performances exists when a fund starts with exceptional performance. Early success should lead to quicker movement through and to carried interest distributions. This would also make it easier to raise the next fund which will most likely be larger in fund commitment amount. It would also be valuable to segment the Data set by fund size, such as "small, medium, and large" Fund Size.

Does the use of co-investments and separately managed accounts (SMA) by larger institutional investors circumvent some of the agency costs of the fund structure, or in other words require smaller investors to bear a disproportional share of agency costs? Do PEM engage in the equivalent of "earnings manipulation"? Given the much lower than expected correlation between ROIC and IRR in the larger data set there is a possibility that IRR is manipulated to entice less sophisticated, mostly non-institutional, investors who may be under the impression that they are seeking rate of return versus an absolute increase in value. This could lead to analysis whether funds manipulate fund level gross and net ROIC figures by netting down cash flows and not calculating on a true gross basis.

Limitations on Research

Although efforts were made to ensure the validity of the data, it is from two individual sources and has not been subject to review by other researchers. This reflects

the lack of access to data from various public sources. The author applied for access to various "publicly" available databases and was either denied access or told the detailed data was not ready or available for analysis. In addition, the primary and secondary data sources provided only a limited number of variables. Certain confidential information was removed from the data prior to receipt. Additional variables provide greater opportunity to utilize additional control variables in the regression analysis, but they also provide opportunity for additional hypothesis testing. Another general challenge in PE research is consideration of risk adjusted returns. Various academics have worked on created PME (public market equivalency) metrics for consider risk adjusted returns, but as of the writing of this dissertation there is no universal accepted risk adjustment tool for PE.

Conclusion

After creation of the variable Sequence, which is an ordinal value of the timing of fund investments based on the initial investment date for each respective investment, this dissertation found an inverse relationship between the Sequence and ROIC. Illustrating a consistent drop-off in performance over the life of a fund, resulting in real agency costs to investors. Reinforcing prior research which found performance deterioration when analyzing NAV's before and after quasi-arbitrary points considered to signal the end of fundraising event.

Exhibit 2: Summary Comparison Private Equity to Mutual Fund

Issue/Aspect	Private Equity	Mutual Fund
Governance/ Incentives	Raise money in individual funds with definitive lives which eventually force a liquidation point for illiquid assets. Funds have discreet sums and known beginning, therefore cannot increase fund size or change the initial start date for fund IRR calculations. Note the inability to withdraw funds is matched with a difficulty to raise additional capital. This causes issues of indirect compensation (expected fees to be earned from future funds). For instance, see Chung, Sensoy, Stern, and Weisbach (2012).	Incentives are typically tied to funding mechanisms and a portfolio that are highly liquid and fluid. Managers can move in and out of positions in rapid order. Funds also have the functional equivalent of infinite lives.
Risk Adjusted Returns	There is no clear methodology for calculating risk of PE fund, akin to calculating risk of a mutual fund. Attempts to do so are complex underlying risk calculation is carried by each portfolio company. Therefore, calculating the required return on a private equity fund is inherently difficult. Identifying systemic and non-systemic coefficients are also inherently difficult. In other words, risk may be un-assignable to typical categories. IRR is based on initial capital call date; therefore, fund IRR can be skewed by delayed or aggressive investment. The cost of capital for the fund, though, is somewhat fixed.	Risk adjustment techniques and calculations are readily available to MFM. Metrics of performance are well examined and defined across literature and in the industry.
Control of Portfolio Company	Active based on direct and immediate control of management. Can make decisions as to company policy, strategy, and other key decisions quickly and instantly.	Generally passive in public companies with set management teams which they have limited and delayed effect with respect to hiring or firing and only through voting blocs or proxy votes.
Primary Analysis	PEM duty is talent identification and retention. This applies not only to portfolio company management, but to the fund employees (and critically to potential fund partners).	Fundamentally financial analysis based on heavily regulated and audited (thus presumably reliable) publicly available data.

Financial/Non-Financial Portfolio Data	Privately held companies have notoriously unreliable financial and non-financial data.	Heavily regulated and audited (thus presumably reliable) publicly available data.
Employees	For scalability of fund size, talent development within the fund is critical. Typically, feeder organizations (investment banks) do not do the type of work necessary for portfolio analysis, including digging in deep on accounting, operational, human resource, and other issues.	Can scale employees based on readily available stream of employees from predictable sources.
Optionality	PEM deal with companies that have greater optionality due to their size and markets; important because it requires identifying management teams able to exploit this difference in optionality.	MFM deal with established publicly traded companies that are in mature positions and optionality, although present, is not akin to private companies.

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APPENDIX A

SUMMARY OF LITERATURE REVIEW ISSUES ON THE CONSTRUCT PERSISTENCE

Persistence applied to private equity by Kaplan and Schoar (2005) based on mutual fund persistence.		
Issue	**Definition/Analysis**	**Source(s)**
Fund Ownership and Structure	Form of ownership typically single fund with definitive life, investment period, and capital. Activities include 1) screening, 2) monitoring/governance, and 3) exit decision and activities.	Metrick and Yasuda (2011)
Information Asymmetry	PEM bridge information gap between investors and entrepreneurs.	Metrick and Yasuda (2011) Lopez-de-Silanes et al (2015)
Incentives and Compensation	Compensation can take the form of fixed (management fee) and contingent/variable (carried interest). Management fee can also be contingent as the basis for its calculation changes from committed to active capital during the life of the fund. Can also be direct (current fund) and indirect (future fund expectations), which can shift the level of risk taking by PEM.	Chung et al (2012) Robinson and Sensoy (2013) Barber and Yasuda (2017) Brown, Gredil, and Kaplan ((2019)
Illiquidity	Entering and exiting portfolio companies takes tremendous effort and time. Investment in portfolio companies is illiquid and correspondingly so is investment in funds.	Practically all research.
Fund Size or Scalability	Success begets success but increasing fund size can have a negative effect on performance. Open question as to scalability of funds based on management skill.	Kaplan and Schoar (2015) Kortewerg and Sorenson (2017) Lopez-de-Silanes et al(2015) Aigner et al (2008)

Leverage	Funds ability to use leverage at both the fund level and the individual portfolio company level.	Kaplan and Schoar (2015)
PME	Public Market Equivalent. Attempts by scholars to create a metric to compare non-public companies to public and thus make proper risk assessments.	Kaplan and Schoar (2015) Buchner (2016)
Data Availability	Private equity is just that: private. Each author refers to data, typically restricted, they obtained from private sources.	Practically all research.
Risk Adjusted Return	Ability to determine proper risk-adjusted required returns.	Practically all research.
Timing	Fund managers decisions related to timing of investments, capital calls/distributions, and other fund accounting/management issues.	Braun, Jenkinson, and Stoff (2016)
Maturation	As the industry matures, how and what characteristics change. Also, how do LPs adjust their strategy related to investing in PE.	Braun, Jenkinson, and Stoff (2016) Fang, Ivanshina, and Lerner (2015)

APPENDIX B

DATA FIELD DICTIONARY

Field Name	Variable Type	Definition
Fund Holding ID	Categorical	Randomly assigned serial number.
Initial Investment Date	Continuous	Date on which fund executed first investment in an asset.
Exit Date	Continuous	Date of first significant liquidity event.
Sold By	Categorical	Categorizes the type of seller, such as an entrepreneur or carve out from a larger organization. See appendix list of types of sellers.
Valuation Effective Date	Continuous	Most recent date a performance analysis was received from a fund manager. For an asset still held in a fund portfolio, it is the date of the most recent valuation received from the fund manager for an asset. If this date is post Exit Date for a specific asset all realized values from the asset are applicable, excluding minor amounts (escrows, etc.). See Exit Date above.
ROIC Value	Continuous	Return On Invested Capital (ROIC). The sum of realized and unrealized value of an asset divided by the sum of all invested capital in the respective asset. Based on gross deal level values and not net of any deal level carried interest, promote, or other economic participation of the fund.
Gross IRR	Continuous	Internal Rate of Return (IRR) on a gross basis. Standard definition of IRR based on discount rate necessary to produce a net present value equal to zero based on investment dates, realization dates, and the most recent valuation date of unrealized values. Gross implies the IRR is not net of any asset specific allocations of profit which are attributable to other participants in the asset's investment.
Operating Company ID	Categorical	Randomly assigned serial number. Note, the same company can appear multiple times in the database, but for purposes of testing sequence and ROIC, it is appropriate to include as they represent separate transactions. Reasons for multiple inclusion: same PEM investing in the same company but different funds, transactions

		between PEM, or different managers investing in the same company at the same time.
Country	Categorical	Country which asset has its primary base of operations.
Industry Sector	Categorical	Generalized industry categorization of asset operations.
Industry Group	Categorical	Sub-sector categorization of asset operations within the generalized industry categorization of the Industry Sector.
Fund Manager ID	Categorical	Randomly assigned serial number.
Fund Number	Discrete	Sequence of the fund in a manager's history of fund management. For variables with decimal results, this represents either separately managed accounts or one-off fundraising situations, such as follow-on investments or subsequent pledge fund/independent sponsor arrangements.
Fund Size	Continuous	Total amount of committed capital for an individual fund.
Fund Strategy	Categorical	Categorization of fund strategy, such as Buyout Fund, Distressed, etc. See appendix list of fund strategies.
Fundraising Status	Categorical	Reflects state of fundraising for respective fund if traditional fund, or identifies if a non-standard fund type, such as evergreen, BDC, pledge, secondary, or a synthetic.
Valuation before Exit Date?	Logic Test	Compares Exit Date and Valuation Effective Date and Returns False if latter is after the former.

APPENDIX C

LISTINGS OF SECTOR, GROUP, FUNDRAISING STATUS, SOLD BY, SECURITY TYPE, AND FUND STRATEGY

Sector:

Health Care	Materials	Information Technology
Consumer Staples	Industrials	Consumer Discretionary
Communication Services	Energy	Utilities
Real Estate		

Group:

Health Care Equipment and Services	Materials
Software and Services	Food Beverage and Tobacco
Pharmaceuticals Biotechnology and Life Sciences	Capital Goods
Transportation	Consumer Durables and Apparel
Consumer Services	Insurance
Commercial and Professional Services	Household and Personal Products
Technology Hardware and Equipment	Automobiles and Components
Media and Entertainment	Energy
Diversified Financials	Utilities
Semiconductors and Semiconductor Equipment	Retailing
Real Estate	Food and Staples Retailing
Telecommunication Services	Banks
Food, Beverage and Tobacco	

Fundraising Status:

Assumed Closed / Unknown	Closed
Evergreen	Not Raised
Open	Pledge Fund - Active
Pledge Fund - Inactive	Secondary Purchase
Secondary Sale	Synthetic

Sold By (excluded variable):

Take Private	Carve Out	Entrepreneur/Family
PIPE	De Novo	Debt Investment
Growth Capital/Recap	Creditor/Lender	Financial Sponsor
N/A	Secondary Sale	Other

Fund Strategy/Security Type (excluded variable):

Buyout	Buyout; Turnaround/ Distressed	Buyout; Growth Equity
Distressed Debt	Co-Invest	Turnaround/ Distressed
Venture Capital	Mezzanine	Growth Equity
Growth Equity; Mezzanine	Buyout; Growth Equity; Venture Capital	Buyout; Distressed Debt; Turnaround/ Distressed
Real Assets	Growth Equity; Real Assets	Buyout; Real Assets
Buyout; Venture Capital	Growth Equity; Venture Capital	Buyout; Growth Equity; Mezzanine
Buyout; Mezzanine	Distressed Debt; Turnaround/ Distressed	Mezzanine; Debt (Non-Mezz)
Buyout; Growth Equity; Turnaround/ Distressed	Growth Equity; Co-Invest	Buyout; Co-Invest
Buyout; Mezzanine; Debt (Non-Mezz)	Growth Equity; Turnaround/ Distressed; Co-Invest	Real Estate; Debt (Non-Mezz)
Buyout; Growth Equity; PIPE	Debt (Non-Mezz)	Buyout; Turnaround/ Distressed; Debt (Non-Mezz)
Distressed Debt; Growth Equity; Turnaround/ Distressed	Real Assets; Turnaround/ Distressed; Debt (Non-Mezz)	Buyout; Growth Equity; Mezzanine; Turnaround/ Distressed; Debt (Non-Mezz); Venture Capital
Secondaries	Debt (Non-Mezz); Venture Capital	Buyout; Mezzanine; Turnaround/ Distressed
Distressed Debt; Debt (Non-Mezz)	Buyout; Real Assets; Real Estate; Turnaround/ Distressed	Buyout; Debt (Non-Mezz)
Real Assets; Debt (Non-Mezz)	Growth Equity; Turnaround/ Distressed	Real Estate
Mezzanine; Other	Distressed Debt; Growth Equity; Mezzanine	Search Fund
Buyout; Growth Equity; Mezzanine; Turnaround/ Distressed	Buyout; Mezzanine; Turnaround/ Distressed; Debt (Non-Mezz); Venture Capital	Buyout; Growth Equity; Turnaround/ Distressed; Debt (Non-Mezz)
Buyout; Search Fund	Distressed Debt; Turnaround/ Distressed; Co-Invest	Buyout; Other
Real Estate; Turnaround/ Distressed	Buyout; Real Assets; Turnaround/ Distressed	Distressed Debt; Growth Equity
Growth Equity; PIPE	Buyout; Growth Equity; Real Assets	Real Assets; Turnaround/ Distressed

Growth Equity; PIPE; Turnaround/ Distressed	Buyout; Growth Equity; Mezzanine; Debt (Non-Mezz)	Buyout; Real Estate
Other	Buyout; Secondaries; Co-Invest	Buyout; Growth Equity; Debt (Non-Mezz)
Growth Equity; Debt (Non-Mezz)	Mezzanine; Real Estate	Buyout; Growth Equity; Turnaround/ Distressed; Co-Invest
Buyout; Distressed Debt	Growth Equity; Venture Capital; Co-Invest	Distressed Debt; Mezzanine; Turnaround/ Distressed
Growth Equity; Mezzanine; Debt (Non-Mezz)		

APPENDIX D

SUMMARY OF GENERAL FUND ECONOMICS

Robinson et al. (2013, p. 2764), contains a summary of typical economic terms of private equity partnership agreement (the distribution of profits is commonly referred to as a "waterfall"). The second bullet point below reflects current trends since Robinson et al. (2013), which discussed a 100% GP split during the catch, wherein LPs have instituted staggered catch-up calculations where the sharing of profits is disproportional to the GP, but not entirely 100%. This has reduced incentives to accelerate cash distributions. Once the third bullet point is reached, there is an incentive for the PEM to accelerate distributions. If you will, imagine a series of buckets and as each is filled, the next bucket catches the remaining water until the water ends or reaches the final "bucket", or the last profit split:

- First, a preferred return (commonly 8-12%) paid the LPs. Commonly a cumulative (or compounding) return on an annual basis.
- Second, a "catch-up" period in which either PEM receives 100% of the profit (or some disproportional larger share) of profits until they have "caught-up" and effectively received 20% of all profits.
- Third, the PEM receives an 80/20 (LP/GP) split of profits.