Loss Avoidance in Private Equity*

Maria N. Borysoff[1†] and Gregory W. Brown[2]

[1]George Mason University School of Business
[2]UNC Institute for Private Capital and Kenan-Flagler Business School

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Abstract

Private equity investors rely on reported fund performance to make informed investment decisions. This paper provides evidence that buyout funds manage multiples of invested capital (MOICs) for portfolio companies to avoid incurring and reporting capital losses. In the distribution of deal-level MOICs, we document an unusually low frequency of multiples just below 1.0 and an unusually high frequency of payouts that are equal to or just above 1.0. This behavior is consistent with funds attempting to minimize *loss ratios* which are commonly used to assess the riskiness of funds by outside investors and consultants. We document that more experienced general partners (GPs) appear more likely to engage in loss avoidance and do so while they are fundraising for their next fund. Loss avoidance may provide financial benefits because loss-avoiding GPs raise significantly larger subsequent funds relative to their vintage year peers. While loss avoidance may benefit GPs, it is negatively associated with the final fund returns that investors receive.

Keywords— buyout funds, earnings management, loss ratio, performance reporting, private equity

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†Corresponding author: Maria Nykyforovych Borysoff mnykyfor@gmu.edu

1 Introduction

Limited partner (LP) investors in private equity (PE) funds face a difficult problem when trying to assess risk-adjusted performance of a general partner (GP). While LPs rely on standard measures of performance such as the internal rate of return (IRR) or multiple of invested capital (MOIC) to measure fund returns (see Gompers et al. (2016), Da Rin & Phalippou (2017)), there are few good metrics for fund risk. Specifically, metrics like standard deviation or the loading on market risk factors (e.g., a market beta) are hard to measure because there is no time-series of market-based fund returns. Previous research and practitioner accounts suggest that both GPs and LPs use loss ratios as a measure of risk in their fund performance assessment (Gori et al. (2017); Hamilton Lane (2017)). While there are different methods for calculating loss ratios, in each case, the ratio is determined by the number of portfolio companies in the fund with MOICs less than 1.0 (i.e., the cash received from the investment was less than the capital invested). Because a typical fund portfolio has only about 10-20 investments, just one or two additional portfolio companies with a multiple of 0.9 (versus 1.0) can meaningfully affect the loss ratio while having little impact on the overall fund return. As a consequence, private equity GPs may face incentives to avoid incurring and reporting losses on their portfolio investments (Evestment (2019)).

Existing research finds that current and past fund performance affects a GP's ability to raise capital for future funds, thus, affecting the GP's lifetime income (Kaplan & Schoar (2005), Chung et al. (2012), Hochberg et al. (2014)). A fund's current performance consists of two reported variables: realized investments to date and estimates of net asset values (NAV) of any unrealized portfolio holdings. Barber & Yasuda (2017) argue that it is harder for an LP to verify the value of a company still in the portfolio than that of a successfully exited one. Thus, in the presence of a significant information asymmetry between a fund manager and a potential fund investor, interim performance that is backed by verifiable exits has a greater impact on the fundraising prospects of GPs. Previous research has also shown that PE managers appear to manage interim reported NAVs in ways that might benefit them in fundraising for their next fund (Jenkinson et al. (2013), Brown et al. (2019), Barber & Yasuda (2017)). This is possible because LPs rely heavily on past performance when making investment decisions and GPs usually seek to raise their next fund long before most of the investments in the previous fund have been exited. Consequently, investors must rely on some subjective (interim) assessment of fund returns based on either the reported NAVs or their own analysis (or both).

The situation is somewhat different for fully exited deals. Because the fund-level loss ratio depends on the proportion of capital lost in under-performing deals, one effective way of lowering perceived risk and improving reported performance could be to delay an exit if a deal is potentially underwater and the fund believes there is a reasonable chance it can exit later with a valuation at or above 1.0 times its investment. Alternatively, there may be ways a GP could allocate resources, costs, or effort to get a MOIC from just below 1.0 up to or above 1.0 when exiting a deal. In either case, managing the discontinuity around 1.0 should leave a trace in the data. While there is extensive literature documenting evidence of discontinuities in distributions of reported earnings relative to market expectations (or other benchmarks) for publicly listed companies (Burgstahler & Dichev (1997), Degeorge et al. (1999)), there is no literature examining MOIC discontinuities in the private equity industry. In our analysis, we investigate whether PE firms manage reported MOICs in ways that might be consistent with trying to minimize a fund's loss ratio. Absent mandatory disclosure requirements and documented incentives that explain earnings management in publicly traded companies, the mechanisms for loss ratio management will differ from earnings management, but similar methods of analysis can be employed.

This paper uses an extensive buyout deal-level data set from StepStone, a global private markets firm that collects data directly from fund managers during the due diligence process. The data file contains a detailed description of 16,932 investments made by 1,431 funds during the period between 1971-2019. We observe the complete investment history for buyout funds and fund families in the sample. The richness of GP-, fund- and deal-level characteristics within the data set represents the major advantage for our empirical investigation of the determinants and consequences of loss-reporting avoidance.

We begin our analyses by examining the distribution of reported gross MOICs (before management fees and profit shares). We observe unusually small frequencies of multiples reported just below 1.0 (indicating that an investment returned slightly less capital than contributed) and unusually high frequencies of payouts that are equal to or just above 1.0 (indicating that the investment has at least broken even). To assess the significance of the results, we apply Benford's Law (or Benford's distribution) which can identify the probabilities of highly likely or highly unlikely frequencies of numbers and digit combinations in the data. The probabilities are based on the occurrence of digits in randomly generated numbers in large data sets. We estimate that MOICs with digit combinations between 1-0 and 1-3 are statistically significantly over-reported for all fund-types. This suggests that fund GPs manage their investments to avoid incurring or reporting capital losses.

Next, we try to identify the determinants of the observed MOIC distributional anomaly and answer two related research questions. First, why do PE managers seem to under-report small losses and over-report break-even exits? Second, when are PE funds more likely to manage reported MOICs?

We conjecture that increasing value of realized exits requires costly effort on the part of a GP, and thus should be concentrated where the perceived benefits of such effort outweigh the costs and result in the highest perceived payoff. One way to avoid loss reporting is to use a technique known as "rounding up" in the earnings management literature (Das & Zhang (2003)). The amount of effort needed to increase the second post-decimal digit from four to five, thus rounding up the reported MOIC, is minimal. For example, because it is customary to report performance multiples with up to one post-decimal digit, rounding up a MOIC of 0.94X to 0.95X results in a reported MOIC of 1.0X. Thus, managers likely face the highest incentives to influence the multiples near

0.95X to 0.99X, because these MOICs are reported as 1.0X in the performance reports and marketing materials.

Additionally, the pronounced distributional anomaly around the break-even point suggests that funds are sensitive to crossing the line between reporting small gains and small losses. Thus, we are especially interested in the role that realized loss ratios have on deal-level reported MOICs. Consistent with a metric widely used by industry, our primary measure for the loss ratio is the aggregate total dollar losses in deals realized below cost divided by the total capital invested by the fund in all deals.

We hypothesize that PE managers face incentives to avoid reporting losses on their portfolio investments while seeking capital for a new fund. Previous studies find strong evidence of a positive relation between past PE fund performance and subsequent fundraising success (Kaplan & Stromberg (2009), Gompers & Lerner (1998)), which creates incentives for PE managers to report good returns, but may also provide incentives to minimize losses.

We estimate a probability model of break-even investment exit reporting as a function of GP-, fund- and deal-level characteristics. We find that fund managers are more likely to avoid reporting a loss if a fund's loss ratio was smaller. Private equity investors often use loss ratios as a proxy for the level of assumed risk, with over two-thirds of LPs assigning very high importance to them in the due diligence process (Evestment (2019)). Thus, loss avoidance helps keep the loss ratio low and decreases fund's perceived riskiness. This result is analagous to earnings management towards certain thresholds when it is less costly to do so. For example, it is less costly to manage a reported loss ratio towards zero if an investment lost 1% versus 10% of its capital.

Furthermore, we find that the timing of the deal exit plays a significant role in realized MOIC reporting. Specifically, the results demonstrate that loss avoidance significantly decreases after the next fund is raised. For example, the odds of a break-even exit decrease by 62% after a GP raises the next fund. This result suggests that, consistent with earnings management literature, PE managers minimize reported loss ratios to increase firm value, for example, by improving the chances of raising new capital from existing and new investors. Consequently, we estimate a probability model of fundraising success as a function of loss avoiding behavior while controlling for the market environment and fund characteristics. We find evidence that lower loss ratios and break-even exits are associated with higher probability of raising a follow-on fund.

We then examine whether loss avoidance and perceived risk minimization are related to the size of the next fund raised by the GP relative to the size of other same vintage year funds. If a lower loss ratio is associated with raising a larger next fund, there would likely be a direct financial incentive for a GP to minimize the reported loss ratio. In a regression with the (relative) size of the next fund as the dependent variable, we in fact find that funds with smaller loss ratios raise larger subsequent funds.

The presented evidence suggests that loss ratios play an important role in the decision making of both PE investors and managers. In the next analysis, we assess whether empirical data supports the conventional wisdom of using loss ratios as proxies for the level of assumed investment risk. Contrary to common belief, we find that loss ratios are not correlated with the standard deviation of reported returns, a risk measure widely used in both private and public markets. We conclude that, despite their widespread use and intuitive appeal, loss ratios do not measure and reflect risk well.

Finally, we examine the associations between loss avoidance and the ultimate fund performance reported after all deals are realized. We find that loss avoidance negatively affects fund performance. Specifically, the presence of break-even exits is negatively associated with all main measures of fund performance (MOIC, PME, and IRR). Together, the results indicate that loss-avoiding managers reap the benefits of this reporting behavior during the fundraising process while delivering worse performance relative to the managers not involved in loss avoidance.

This paper makes several contributions. First, the findings add to the PE literature that analyzes fund performance reporting. To our knowledge, it is the first to document the manipulation of reported PE fund performance based on realized deal multiples, not net asset values of unrealized portfolio holdings. Second, it expands the earnings management literature that primarily focuses on public markets by demonstrating loss avoidance in private markets. Finally, this study is relevant to participants in the private equity market. Our findings demonstrate that caution should be used when using loss ratios to assess the riskiness of PE investment portfolio, thus, having direct implications for both PE managers and investors.

The paper proceeds as follows: Section 2 describes the data. Section 3 presents cross-sectional MOIC distributions and documents distributional anomalies around 1.0X. Section 4 examines the determinants of PE funds' loss avoidance. Section 5 demonstrates that more experienced GPs with smaller reported loss ratios raise significantly larger subsequent funds relative to their vintage-year peers. Section 6 assesses whether loss ratios measure investment risk and affect the ultimate fund performance. Section 7 concludes.

2 Data

In this paper, we use an extensive new data set of PE investments provided by the StepStone Group, a global private markets firm with more than $500 billion of total capital under advisement, including over $125 billion in assets under management. In this analysis, we specifically examine buyout funds because, in the period since the late 1990s, buyout funds have grown to be the largest type of private fund investment vehicle, and constitute a large fraction of new capital raised in private markets (Braun et al. (2017)). The Stepstone data are obtained directly from GPs as a part of their due diligence process. This feature is important for our research question because it insures against breaks in voluntary reporting by GPs and certain selection biases in other datasets (e.g., those relying on disclosures from public records and Freedom of Information Act requests). GPs that sought capital from StepStone or one or more of its clients were required to provide information about all prior funds and investments. For example, if a GP was raising capital for its fourth fund, it would provide detailed and up-to-date information on funds one, two, and three. Thus, StepStone updates most data at an interval determined by the fundraising cycle, generally every 2 to 3 years. The resulting data set spans the years 1971 to 2019, and yields a sample that contains 16,932 investments by 1,431 buyout funds.

The nature of our research questions implies that we focus on realized deals when analyzing reported fund-level performance. However, recent funds have a high proportion of unrealized deals, meaning that the final performance of these funds can significantly deviate from the reported performance when many of the investments are still unrealized. One way to address this issue is to restrict the sample to funds with fully realized deals, but this reduces the sample size. As a result, we focus on the funds with vintages 1986 to 2010 for which all deals were realized by the end of 2018. This final sample includes 1,038 buyout funds with 9,927 deals.

Tables 1 and 2 report the descriptive statistics of the sample on the fund-level and deal-level, respectively. 21% of the funds reported at least one break-even deal exit (henceforth, *1X funds*). A median *1X fund* is bigger than a non-1X fund, invests in more deals, but reports lower performance and higher loss ratios. The size of the break-even deal is smaller (14M vs. 19M for a non-1X deal), while the holding period is longer. The relatively low number of deal-level observations reported after 2010 is consistent with our requirement to only include funds with fully exited portfolios since many funds were still in the investment phase at the time of the data acquisition.

Funds based in North America comprise 60% of the sample, followed by funds from Europe, Asia and other regions. The median investment size is of comparable magnitude for European and North American deals, with smaller deals located in Asia and other geographical regions. The majority of buyout funds are classified as industry generalists investing primarily in industrials, IT, consumer discretionary, communication services, and healthcare sectors. Most of the funds in our sample were raised in the 1990s and 2000s. The funds raised in the 2000s reported the lowest median IRRs and MOICs, consistent with the negative effects of the financial crisis.

Our data allow us to track each fund's affiliation with a private equity fund-management firm (GP) so that we are able to track multiple funds managed by the same GP over time. Following prior research (Braun et al. (2017), we refer to two or more consecutive funds as a fund sequence. The deal sequence represents a proxy for overall GP experience and contains a relatively high number of deals where the GP has done fewer than 20 previous deals, consistent with new GPs entering the sample over time. 70% of funds in the sample have a prior fund. We are especially interested in these funds because they allow us to analyze the potential consequences of loss avoidance.

Table 14 in the Appendix provides additional fund-level and deal-level summary statistics. The overall mean fund size of $904 million is comparable to Robinson & Sensoy (2011), whose mean fund size was $988 million. The mean (median) fund gross PMEs are 2.0 (1.8), exactly matching fund gross PMEs in the deal-level sample used by Braun et al. (2017), while mean (median) MOICs in our sample are slightly higher, 2.7 (2.4) versus 2.3 (2.0). Overall, the characteristics of the StepStone dataset make us confident that it is representative of the buyout fund investable universe and is well-suited for this study.[1]

3 The Distribution of MOICs

We examine two types of evidence to determine if funds manage MOICs to avoid reporting losses. First, we present simple graphical evidence in the form of MOIC histograms. In this analysis, we also provide comparisons between reported realized MOIC distributions of digits and those predicted by Benford's Law. Benford's Law describes the baseline distribution of digits that prevails in the absence of managing reported values (Thomas (1989), Malenko et al. (2023), Amiram et al. (2015)). We supplement this analysis with

[1]Below we discuss comparisons of our deal-level data with the Burgiss holdings data. This analysis provides further points of comparison and reassurance that the StepStone data are largely representative of the distribution of buyout portfolio company transactions.

the Burgstahler and Dichev statistical test as a robustness check for Benford's Law results. Second, we present formal statistical tests to investigate: (1) Why do PE managers under-report losses and over-report break-even exits, and (2) When are PE funds more likely to manage reported MOICs?

Figure 1 displays histograms of the reported multiples of invested capital for fully exited buyout deals. The spike in MOICs of 1.0 is apparent. Reported MOICS just below 1.0 occur much less frequently than just at or above 1.0. The frequency of deals with MOICs from 0.95 to 1.04X is greater than for any of the nearby ranges and twice that of the 0.85-0.94 range.

To better understand the behavior around MOICs of 1.0, we zoom in to just the range of 0.5 to 1.5X, which should encompass the full range of MOICS that could be easily managed by GPs to avoid losses. Again, the graphs show how the distribution demonstrates a noticeably higher frequency of realizations in the range of 0.95-1.04X as compared to slightly higher or lower MOICs. The difference in frequency of MOICs near 1.0 is statistically significant.

Figure 2 repeats the analysis above but uses reported MOICs for unrealized deals only. The goal is to check whether (1) the distributions observed in Figure 1 are the same irrespective of the deal realization status, and (2) the results change over time, i.e., depend on the length of each investment's holding period. Results demonstrate that MOIC distributional patterns differ between realized and unrealized deals. While realized deals demonstrate pronounced peaks around the break-even point, unrealized deals do not produce consistent distributional patterns. Additionally, the holding period does not have a noticeable effect on reported MOICs. The results suggest that whatever is driving the excess number of MOICs at 1.0X is related to exit valuations and not just the stickiness of intermediate valuations.

We use two approaches to test the statistical significance of the hypothesized loss avoidance by PE funds. First, we apply the Burgstahler and Dichev (1997) statistical test both in its original specification and with the corrections suggested by Burgstahler and Chuk (2014). Second, we analyze whether the reported MOICs comply with the predictions of Benford's Law, which can be used to detect unusual patterns in financial statement data. We use these two approaches because each requires a different set of assumptions and provides an independent assessment of potential distributional anomalies.

Burgstahler and Dichev (1997) assume that, under the null hypothesis of no earnings management, the cross-sectional distributions of earnings are relatively smooth. In our setting, it means that the expected number of reported MOICs in any given interval of the distribution is the average of the number of reported multiples in the two immediately adjacent intervals. The variable of interest is the difference between the reported and the expected number of observations in an interval, divided by the estimated standard deviation of the numerator difference. Under the null hypothesis, these standardized differences will be distributed approximately normal with a mean of zero and a standard deviation of one.

Burgstahler and Dichev (1997) assume that the two numerator components are approximately independent so that their covariance is approximately zero. Burgstahler and Chuk (2014) relax this simplifying assumption that generally results in an understatement of the variance. The resulting standardized differences test is shown to detect management of relatively small amounts by even a small proportion of sample firms.

We assess the discontinuity around MOIC=1X using both Burgstahler and Dichev (1997) and Burgstahler and Chuk (2014) approaches. The standardized differences for the 0.95X-1.04X interval are 7.6 and 6.8 for the two tests, respectively. Thus, for both methods, the test statistics are extremely significant under the assumption that the standardized differences are approximately normal. This evidence is consistent with the existence of a discontinuity at 1.0X.

Despite this strong evidence of discontinuity at 1.0X, research suggests that numbers in an arbitrary range are not evenly distributed even when a seemingly random process generates them. We follow prior work in finance and accounting (Amiram et al. (2015), Malenko et al. (2023), Thomas (1989)) which uses Benford's Law to detect unusual patterns in financial statement data. Specifically, we examine whether reported MOICs demonstrate unusual distributional properties by identifying expected proportions for each of the tens digits (zero to nine) under the null hypothesis of no management in the reported numbers. Benford's Law states that the expected proportion of occurrence of the number X as the first digit, regardless of the source of the numerical data, can be approximated by the following relation:

$$prob(x\ is\ first\ digit) = Log_{10}(x+1) - Log_{10}(x) \tag{1}$$

Under the same approach, the expected proportion for x as the first digit and y as the second digit is:

$$Log_{10}(x+(y+1)/10) - Log_{10}(x+(y/10)) \tag{2}$$

The logarithmic basis of Benford's Law provides a foundation needed for a general significant digit law adapted from Hill (1995). The formula below can be used to calculate the expected probabilities of any combination of first digits (i.e. the first, first-two, first-three, ... first-N digits). The formula can also be used to calculate the second, third, and fourth digit probabilities.

$$Prob(D_1 = d_1, ..., D_k = d_k) = log\left[1 + \left(\frac{1}{\sum_{i=1}^{k} di * 10^{k-i}}\right)\right] \tag{3}$$

Under the null hypothesis of no management of reported MOICs, we would expect the MOIC distribution to approximate the prediction of Benford's Law. Figure 3 reports the distributions of first and second digits for reported multiples of invested capital. The dotted line indicates digit distributions under Benford's Law. The vertical bars include combinations of the first and second digits from the reported MOICs. The overall proportion of MOICs with digit combinations between 1-0 and 2-1 is higher than the expected Benford's Law proportion, with deviations of combinations 1-0 through 1-3 statistically significant at the one percent level. To determine whether the observed deviations from expected proportions are statistically significant, we calculate a Z-statistic as in Thomas (1989) and display these with darker shading in the figure. An analysis of only first digits (not tabulated) reveals significant over-reporting of digits 1 and 2 and under-reporting of digits 4 through 8.

We next take a closer look at the specific MOIC values that drive these results. This step is necessary because the combination of digits 1-3, for example, can be a part of actual reported MOICs of 0.13X, 1.3X or 13X. First, we note that only 941 MOIC observations take values equal or above 10X where digit combinations start to repeat themselves. Therefore, we concentrate on MOIC values between 0.5X and 1.5X where the over-reporting of digits 1 through 3 is most likely to take place. In this setting post-decimal digit combinations become our main variables of interest. Benford's Law suggests that in a random sample, the first digit of financial and other data sets is distributed according to Benford's distribution, with number 1 being over-represented. However, the distribution of the n-th digit approaches the uniform distribution exponentially fast as n approaches infinity (Hill (1995)). Accordingly, we use an expected probability of 0.1 for observing any combination of two post-decimal digits as a comparative baseline for our analysis.

Figure 4 reveals that anomalies in previously reported distributions are driven by buyout funds reporting MOIC values of 1.0X (22.33% of reported values have a zero as both the first and second post-decimal digit vs. 10% expected under Benford's law), and 0.99X (16.33% vs. 10%). Additionally, the untabulated analysis of the entire distribution reveals higher frequencies of multiples of 5 and 10, relative to adjacent MOIC numbers, which is consistent with managers rounding reported numbers towards these thresholds (Thomas (1989), Das & Zhang (2003)). A MOIC=0.99 (just below breakeven) may also be rounded to 1.0X for performance reporting purposes. Overall, the results suggest that managers guide reported multiples towards certain thresholds, with a MOIC of 1.0

representing the most prominent reporting target.[2] We interpret these findings as initial evidence consistent with the hypothesis that GPs engage in MOIC management to avoid reporting a loss on a realized investment.

3.1 Reported MOIC Management - Why and When?

We now investigate two related research questions: First, why do PE fund managers engage in this behavior? Second, when are PE funds more likely to manage reported MOICs? The primary goal of these questions is to identify the incentives for MOIC management.

To address these questions, we hypothesize that PE funds are more likely to manage MOICs to help meet behavioral thresholds: report profits or avoid reporting losses (Degeorge et al. (1999), Burgstahler & Dichev (1997)), and/or sustain previous performance (Das & Zhang (2003)). We conjecture that funds with capital losses are more likely to manage potential subsequent losses towards a break-even point (i.e., MOIC = 1.0X) to minimize loss ratios and improve the overall reported performance of the fund. Alternatively, PE funds with little to no previously reported losses may be reluctant to disclose new capital losses in order to protect their performance record and reputation.

Further, we hypothesize that PE managers face incentives to avoid reporting losses on their portfolio investments while seeking capital for a new fund. Previous studies find strong evidence of a positive relation between past PE fund performance and subsequent fundraising success (Kaplan & Stromberg (2009), Gompers & Lerner (1998)) which can be interpreted as a rational response to updated beliefs about managerial ability. Information asymmetry is a pronounced characteristic of private equity as an asset class. When LPs commit capital into a new fund, they do so without advance knowledge of investment portfolio composition. Given resource constraints that many LPs face during the due diligence stage of their fund selection process, it is not surprising that they place

[2] We also note that there is a visible spike at a multiple of 2.0 (in Figure 1, Panel A) consistent with what is often consider the threshold for a "'successful" deal.

significant weight on the past GP performance. In a comprehensive survey of Limited Partners (LPs), Da Rin & Phalippou (2017) document that PE investors place significant emphasis on MOICs when evaluating PE funds for future capital commitments. Gompers et al. (2016) find that almost two-thirds of the PE investors designate absolute measures of performance such as IRRs and MOICs as the most important fund selection criterion. Additionally, Bollen & Pool (2009) note that breakeven return (no loss) is a powerful anchor for institutional investors that pursue "absolute return" strategies based partly on the desire to consistently achieve positive returns in any environment. Taken together, these factors may create strong incentives for PE managers to under-report losses during the next fund's fundraising period.

3.2 Univariate Results

Figure 5 demonstrates the first two-digit distribution analysis of reported MOICs after the next fund is closed (Panel A) and before/during fundraising (Panel B). While seeking capital for a new fund, PE managers report significantly higher proportions of realization multiples at or just above the break-even point than expected under Benford's law. The deviations from the theoretical distribution are insignificant in the period after the fund raising.

Figure 6 repeats the analysis above but conditions on the presence of investment realizations with a loss at the time of fundraising. Funds with reported losses insignificantly under-report low digit MOICs, while funds with no losses over-report multiples between 1.0X and 1.2 (significant at 1%), and 1.3X and 1.4x (significant at 5% and 10%, respectively).

These results suggest that the funds with fewer reported losses may not be better in picking successful investments, but may be better in avoiding reporting the unsuccessful ones. We explore this possibility further in the multivariate analysis below.

4 Determinants of Loss Avoidance

To examine the determinants of funds' potential loss avoidance behavior, we estimate a multivariate logit regression where the dependent variable, Prob.(MOIC=(0.95-1.04)X), equals one if a multiple of invested capital on a realized deal is reported in the range between 0.95X-1.04X, and zero otherwise. Based on prior research (Braun et al. (2017), Brown et al. (2019), Chung et al. (2012)), the explanatory variables in our model comprise characteristics that we expect to be associated with incentives to avoid loss reporting, in particular proxies for managerial and GP/fund-level incentives. Table 3 provides the complete list of variables and their definitions. Additionally, our model includes vintage-year and geographical region fixed effects and controls for public market performance:

$$\begin{aligned} Prob(0.95X \leq MOIC \leq 1.04X) = & \; LossRatio + AfterFundRaise \\ & + DealSequence + PreviousLoss + FundSize \\ & + FundAgeAtExit + HoldingPeriod \\ & + MarketReturn \\ & + AfterFundRaise * LossRatio \\ & + AfterFundRaise * HoldPeriod + FE \end{aligned} \tag{4}$$

In this specification, we re-calculate a fund's loss ratio at the time of each investment exit (excluding the current deal). There are several methods for calculating loss ratios. The realized loss ratio is a measure of the aggregate dollar losses across all investments realized below cost, divided by the total dollars invested. The impairment ratio, sometimes also called the loss ratio, tracks the total amount of capital in deals valued or realized below cost. For example, a realized loss ratio of 10 percent means that 10 percent of the fund's capital was lost. The impairment ratio of 10 percent indicates that 10 percent of the fund's capital was invested into money-losing deals. Sometimes a loss ratio is defined as the percent of deals which lost money, so a loss ratio of 10 percent means one in 10 deals ended up underwater. In our analyses, we define the loss ratio as the aggregate dollar losses across all fund investments realized below cost, divided by the total dollars invested by the fund because this seems to be the most common metric used in practice. This measure is easily compared across funds of different sizes and with different portfolio compositions. However, our conclusions are robust to using the other definitions of loss ratios.

The results are presented in Table 4. Estimation results indicate negative and highly significant coefficients on *LossRatio* and *AfterFundRaise*. The negative *LossRatio* coefficient indicates that funds with a higher loss ratio at the time of a deal exit are less likely to avoid reporting a loss. In other words, funds that have already racked up reported losses are perhaps less likely to undertake the necessary steps to circumvent reporting further losses. This result is consistent with prior research documenting higher propensity for earnings management when it is less costly to do so. For example, all else equal, it is less costly to manage a reported loss ratio towards zero if a fund has previously lost 1% than 10% of its capital.

The negative *AfterFundRaise* coefficient suggests that loss avoidance significantly decreases after the next fund is raised. To gauge the economic significance, we can calculate that for a buyout fund, the odds of a break-even MOIC reporting are reduced by 62% after a GP raises the next fund.[3]

The interaction between *LossRatio* and *AfterFundRaise* is positive and significant, suggesting a moderating effect of the interaction on the probability of a break-even exit. However, the magnitude of the coefficient is fairly small and does not meaningfully change the interpretations of the individual effects of each variable. Together, these results are consistent with the hypothesis that PE funds avoid reporting losses, especially when raising new funds. Because the effect is stronger when it is less costly to do so, this finding is consistent with prior research on earnings management and supports the hypothesis that a goal of minimizing reported loss ratios is to improve the chances of raising new capital from existing and new investors.

[3] The odds ratio for *AfterFundRaise* is $e^{-0.95} = 0.38$. Thus, the estimated effect is $(1.00 - 0.38) * 100 = 62\%$.

Other results reported in Table 4 provide additional insights into the possible motivations for loss avoidance. The positive coefficient on *PreviousLoss* suggests that the immediate prior deal exit below cost induces subsequent loss avoidance.

Older funds (higher fund age at the time of the investment exit) are more likely to avoid losses suggesting that managers may hold losing investments longer to bring the exit multiple to a break-even point instead of selling earlier at a loss. This result suggests that even though loss avoidance tends to decline after fundraising (based on the *AfterFundRaise* results discussed above), the behavior does not completely disappear even after a GP raises a new fund. We further examine these issues below.

5 Consequences of Loss Avoidance

In this section, we investigate the consequences of loss avoidance. We hypothesize that PE managers face incentives to avoid reporting losses on their portfolio investments while seeking capital for a new fund. Thus, we start our multivariate analysis by estimating a linear probability model where the dependent variable equals one if we observe a follow-on fund, and zero otherwise. Next, conditional on the follow-on fund being raised, we also seek to understand whether avoiding losses influences the size of the next fund raised by a GP relative to the size of other funds in the same vintage year. Other things equal, larger fund size results in higher compensation for a manager, creating a potential incentive for loss under-reporting.

As before, our sample includes the funds that are fully resolved. We are careful to control for the look-ahead bias. Given our deal-level data, we can observe precise investment dates for the current and follow-on funds. Specifically, we identify the date of the first investment by the follow-on fund and then drop all current fund's investment exits that happened after that date. Thus, the calculations of *Loss ratio*, *1X exit fund*, *Deal sequence* and *Market return* are based only on the current fund's deals exited before the next fund's first investment.

To facilitate the comparisons of the estimated effects across vintage years, we standardize all fund-size variables using a z-score normalization (see Appendix A). This standardization allows us to directly compare the magnitude of the estimated coefficients between different funds.

We estimate the following models:

$$\begin{aligned} ProbRaiseNextFund = LossRatio + 1XExitFund + DealSequence \\ + CurrentFundSize + MarketReturn + FE \end{aligned} \tag{5}$$

$$\begin{aligned} NextFundSize = LossRatio + 1XExitFund + DealSequence \\ + CurrentFundSize + MarketReturn + FE \end{aligned} \tag{6}$$

We are especially interested in two variables - *Loss Ratio* and *1X Exit Fund*.

Table 5 presents the results of the estimation. Panel A reveals that higher loss ratios correspond to a lower probability of successful fundraising. In economic terms, the point estimate of -0.25 implies that a fund with a 10% loss ratio has a 15% higher odds of raising a follow-on fund than a fund with a 20% loss ratio. Moreover, reporting a break-even exit while fundraising positively affects the odds of successful fundraising relative to the funds that do not avoid reporting loss-generating exits. Controlling for deal sequence isolates the effect of GP experience on fundraising. The positive and significant coefficient suggests that GPs with established track records are more successful at fundraising relative to less experienced fund managers.

Panel B demonstrates that all fund-specific characteristics of the current fund included in the estimation serve as reliable predictors of the subsequent fund size. The significantly negative coefficient on the *LossRatio* indicates that funds with smaller reported ratios raise larger follow-on funds relative to an average same vintage year fund. To better assess the economic significance, we consider the following example. The size of an average fund in our sample was 904 million USD. The estimated coefficient indicates that for every one unit increase of the loss ratio (on the logarithmic scale), the standardized fund size decreases by 0.4. Therefore, assuming all else being equal, a fund with a previously reported 15% loss ratio is expected to have a follow-on fund that is 171 million USD smaller on average than a fund with a 5% loss ratio. The large magnitude of this estimated effect suggests that a wealth-maximizing GP could have a strong incentive to minimize the loss ratio. Additionally, the *1X exit fund* coefficient suggests that funds that report break-even exits during the fundraising period raise significantly larger follow-on funds.

As in Panel A, the significantly positive *Deal sequence* coefficient reflects the fundraising benefits from having a higher realized deal count. This result suggests that when buyout funds have more time to demonstrate verifiable performance record, they are more likely to raise larger follow-on funds. Positive and strongly significant estimates for *PriorFundSize* suggest positive fund size autocorrelation, i.e., that large funds are followed by large funds and small funds are followed by small funds.

Overall, the evidence in this section reveals the incentives for strategic loss reporting avoidance. Funds with lower loss ratios and break-even deal exits benefit from higher odds of successful fundraising and larger follow-on fund sizes, maximizing future fund manager compensation.

6 Do Loss Ratios Reflect PE Risk and Performance?

We now turn to next question: what do loss ratios measure? The answer is important because with the few options available to quantify the volatility of private equity portfolios and resulting risk, it has become a standard practice to refer to loss ratios as a proxy measure of risk. As noted already, industry surveys of PE managers and investors indicate that loss ratios are a significant part of due diligence, with up to 70 percent of investors describing the ratio as being "extremely" or "very" important in their decision-making process (Evestment (2019)). Empirical results presented in the prior sections corroborate the survey-based evidence of the loss ratio's importance in PE portfolio evaluation. The measure is appealing because it is easy to calculate and understand: the intuition behind it implies that portfolios suffering from higher losses likely assume higher financial or operational risk.

However, it is an open empirical question whether loss ratios help assess the ultimate fund performance and measure investment risk appropriately. Thus, we examine the empirical associations between loss ratios, fund risk, and performance measures.

6.1 Do Loss Ratios Measure Risk?

First, we turn to an intuitive risk measure – the standard deviation of MOICs. The standard deviation of returns is a commonly used risk metric for public market companies and portfolios, though the nature of PE data necessitates a somewhat different method. Specifically, we calculate the standard deviation of MOICs across all deals at the fund level as a measure of the dispersion of returns. A high standard deviation shows a wide disparity among deal returns, thus indicating higher risk. The standard deviation of MOICs allows for more direct comparison across different funds as it provides a measure of performance persistence – how well a fund manager is able to deliver consistent returns over time. One shortcoming is that this measure does not incorporate diversification benefits across deals, so it is not a completely pure measure of fund-level risk.

We calculate the standard deviation of MOICs for every fully realized fund in the sample. Next, we look at measures of both linear and non-linear correlation between loss ratios and standard deviations of MOICs to assess the extent to which the risk measures are related. High levels of correlation would indicate that loss ratios do indeed reflect PE portfolio risk as measured by the standard deviation of MOICs.

Table 6 demonstrates Pearson, Spearman's rank, and Hoeffding's D correlation coefficients between fund loss ratios and fund-level standard deviations of MOICs. The first two rows show the correlations between the variables of interest are close to zero for all three correlation measures. This indicates that no reliable linear or non-linear association exists between loss ratios and the standard deviation of MOICs.

Next, because investors use loss ratios when making decisions about capital commitments to new funds operated by the same GP many years before the current fund is resolved, we calculate the correlations at the end of fundraising for the next fund (the next two rows in Table 6). We observe similar near-zero coefficients in funds without break-even exits. If we limit the sample to the funds with at least one 1X exit, we observe a weak linear relationship between loss ratios and standard deviations of MOICs (0.25 Pearson, 0.23 Spearman).

Together, these results suggest that, despite their widespread use and intuitive appeal, loss ratios may not measure and reflect investment risk well (at least as measured by the standard deviation of deal multiples). Thus, caution should be applied when using loss ratios for fund risk evaluation.

6.2 Loss Avoidance and Fund Performance

In our final analysis, we explore the relationship between loss ratios, loss avoidance and fund performance. PE performance is commonly measured relative to other GPs, using metrics such as the multiple of the invested capital (MOIC), the internal rate of return (IRR), or the public market equivalent (PME) (Kaplan & Schoar (2005), Harris et al. (2014)). When benchmarking in this way, accounting for the dates of fund investments is essential given that market returns vary over time. Our timed deal-level dataset allows for precise benchmarking estimations of portfolio company returns without additional factors that can sometimes confound fund-level return calculations.

Our primary measure of interest is the fund-level MOIC, which compares the sum of all investment proceeds to the sum of all invested cash. It is an absolute measure of performance that does not account for the return of the public markets over the investment period. This provides a measure that is unadjusted for public market risks, which may be more appropriate when considering the total riskiness of the portfolio. The Internal Rate of Return (IRR), captures a fund's time-adjusted return, the performance dimension that the other two measures ignore.

The Kaplan and Schoar (2005) PME effectively calculates the ratio of private asset investment multiple to the public market multiple, providing a measure of the opportunity cost of capital use. One concern with the PME is whether it adequately accounts for the risk faced by fund investors as the calculation of PME requires choosing a public market index as a benchmark. Harris et al. (2014) demonstrate that the average PME is fairly robust to a range of different public market benchmarks such as S&P500, NASDAQ Composite, Russell 2000/3000, and Fama-French size decile portfolios. We use the S&P500 index for holdings in North America, the Europe MSCI performance index for European holdings, the Asia and Pacific MSCI performance index for Asian holdings, and the MSCI World performance index for other holdings. All indices are in US dollars because the StepStone data are reported in USD using exchange rates matched to the timing of cash flows and valuations.

We include all three measures in our analysis to investigate whether and how loss avoidance affects various aspects of PE reported performance.

We estimate a regression model with a fund's performance measure (MOIC, PME, IRR) serving as the dependent variable, as follows:

$$\begin{aligned} FundPerformance &= LossRatio + 1XExitFund \\ &\quad + DealSequence + FundSize + FE \end{aligned} \tag{7}$$

All variables are as previously defined in Table 3.

Table 7, Panel A presents the findings. For all three measures, loss ratios are significantly and negatively related to fund performance; that is, funds with lower loss ratios report higher performance, and vice versa. This finding underscores the motivation to minimize loss ratios, though the relation here is partially mechanical since the loss ratio is also a (partial) measure of fund performance. More interesting is the possibility that attempting to achieve better performance by steering some underperforming deals towards a break-even point could adversely impact fund performance. That is, funds in some way overinvest in avoiding losses and underinvest in other portfolio companies. The significantly negative coefficient on the *1X exit fund* indicator variable for all three performance measures is consistent with this hypothesis.

To address concerns about the mechanical relation between loss ratios and performance, we re-estimated the models in Panel A after dropping break-even exits for loss-avoiding funds and the closest-to-break-even deals for non-loss-avoiding funds. We call these "pseudo-performance measures" because of these adjustments, which were meant to strip out the effects of deals that have performance close to breakeven. The results are tabulated in Panel B and are also consistent with the hypothesis that loss avoidance negatively affects the ultimate fund performance reported after a fund's portfolio is fully realized. In fact, Panel A and B coefficients on the *1X exit fund* indicator variable are insignificantly different from each other. Additionally, these coefficients remain significant across all performance measures.

Combined with the previous results, these findings suggest that fund managers benefit from avoiding capital losses during the fundraising period of their next fund, as this increases the average size of their subsequent funds. However, the effort involved in this activity is not accretive to overall portfolio performance, resulting in lower realized fund returns for investors from loss-avoiding GPs on average.

7 Discussion and Robustness Tests

We have estimated a variety of alternative specifications to the results reported above to gauge the robustness of our findings. We summarize these here and provide tabulated results for many in the appendices.

First, we re-estimated the models assessing the consequences of loss avoidance and the link between fund performance and loss avoidance by including several additional fund-level explanatory variables. These variables include *1st-time fund*, an indicator variable denoting whether the fund is a first-time fund launched by a GP; *Deals at* *fundraising*, representing the number of investments in a fund's portfolio at the time of fundraising for the next fund; *Average deal exit year*, which is the average fund age across all portfolio exits; and *Average deal IRR*, the average Internal Rate of Return of all realized deals. Results are presented in Appendix B. Despite the inclusion of these variables, the magnitude and statistical significance of the coefficients on the main variables of interest, *Loss ratio* and *1X exit fund*, remain relatively unchanged. This consistency alleviates concerns about some potentially correlated omitted variables and endorses the robustness of our initial findings.

We also compare our results with a similar analysis using holdings data provided by Burgiss. We chose not to use Burgiss data for our main analysis because specific entry and exit dates are not available for the deal-level data (just calendar year). However, the Burgiss data offer valuable insights. Notably, the 1X MOIC distributional anomaly is even more pronounced in the Burgiss data, confirming our observations about the over-representation of break-even exits relative to the just below 1X exits.footnoteWe thank Wendy Hu at MSCI-Burgiss for assisting with these calculations.

Furthermore, to assess the generalizability of our findings across different segments of the private equity market, we replicated our analysis using a smaller dataset (also provided by StepStone) that focuses exclusively on venture capital (VC) funds. Risk of VC investments are typically much greater than for buyout investments, and large numbers of losses are expected. Consequently, there appears to be less potential stigma associated with losing deals in VC funds and so one could reasonably expect that the effects we document are weaker (or nonexistent). Despite the distinct business models, risk profiles, and loss rates inherent to VC funds compared to buyout funds, the MOIC distributional anomaly persisted (detailed results are presented in Appendix C). This consistency across different fund types underscores the broader relevance of our findings within the private equity sector and serves as something like an "out-of-sample" test.

We have also conducted an analysis of deal holding periods though we are very cautious in interpreting the results because of concerns about endogenous exit selection timing and how to interpret performance as a function of time (e.g., MOICs will tend to trend up over time just based on market trends). We find evidence that 1X funds hold deals for longer (about 9 months on average) and that 1X deals have holding periods that are about 12 months longer than non-1X deals. These differences in holding periods are a bit larger (around 3 months longer) for top quartile funds though this difference is not statistically significant. Consistent with the regression results discussed above the PMEs of these top quartile funds are also lower for the 1X funds. Together this evidence is consistent with GPs utilizing a strategy of waiting for losing deals to get to break-even while adding relatively less value to these deals (versus other deals managed by the same GP).

8 Conclusions

This paper examines whether PE buyout firms manage deal-level MOICs in a way that is consistent with the GPs minimizing a fund's loss ratio. Our analysis of the distribution of realized MOICs finds strong evidence consistent with the hypothesis that funds avoid reporting exit multiples just below 1.0X. The results suggests that funds are sensitive to crossing the line between reporting small gains and small losses, possibly to minimize their loss ratios, which are frequently used by current and potential investors as a metric for fund risk.

While our analysis provides no evidence of improper or fraudulent behavior by funds, it does suggest that funds may potentially reallocate resources to get small losers to the break-even point. We document that loss avoidance is more prevalent during fundraising periods, when GPs are under more external scrutiny. Loss-avoiding funds are more likely to raise a follow-on fund, and their new funds are larger relative to the new funds of non-loss-avoiding funds. However, while loss avoidance during the fundraising period benefits fund managers, investors get a lower fund return from loss-avoiding GPs after the fund is fully realized. Finally, we show that the use of loss ratios as a risk metric is suspect, as there is no observable correlation between loss ratios and the standard deviation of deal MOICs at the fund-level.

This analysis raises several questions that could be explored by future research. For example, the mechanism by which managers avoid losses is not easy to study. While some evidence suggest that GPs can just wait and hope for better future returns, there may be other operating or financial levers that can be deliberately utilized. Additionally, as more sophisticated measures of private fund risk are increasingly available, research can examine if LPs are better able to assess risk and especially if they can overcome the apparent bias implicit in loss ratios. Finally, Chung et al. (2012) find that younger partnerships have stronger relations between future fundraising and current fund returns than older partnerships. They interpret this finding as evidence that fund flows in the PE industry reflect learning about ability over time, and that the strength of the market-based, implicit pay for performance facing a private equity partnership depends on the extent of its prior track record. Consequently, future research could examine if higher-sequence funds exhibit less distortion in realized distributions than do first-time funds.

References

Amiram, D., Bozanic, Z., & Rouen, E. (2015). Financial statement errors: evidence from the distributional properties of financial statement numbers. *Review of Accounting Studies*, *20*(4), 1540–1593.

Barber, B. M., & Yasuda, A. (2017). Interim fund performance and fundraising in private equity. *Journal of Financial Economics*, *124*(1), 172–194.

Bollen, N. P. B., & Pool, V. K. (2009). Do Hedge Fund Managers Misreport Returns ? Evidence from the Pooled Distribution. *The Journal of Finance*, *64*(5), 2257–2288.

Braun, R., Jenkinson, T., & Stoff, I. (2017). How persistent is private equity performance? Evidence from deal-level data. *Journal of Financial Economics*, *123*(2), 273–291.

Brown, G. W., Gredil, O. R., & Kaplan, S. N. (2019). Do Private Equity Funds Manipulate Reported Returns? *Journal of Financial Economics*, *132*(2), 267–297.

Burgstahler, D., & Dichev, I. (1997). Earnings management to avoid earnings decreases and losses. *Journal of Accounting and Economics*, *24*, 99–126.

Chung, J.-W., Sensoy, B. A., Stern, L. H., & Weisbach, M. S. (2012). Pay for Performance from Future Fund Flows: The Case of Private Equity. *Review of Financial Studies*, *25*(11), 3259–3304.

Da Rin, M., & Phalippou, L. (2017). The importance of size in private equity: Evidence from a survey of limited partners. *Journal of Financial Intermediation*, *31*, 64–76.

Das, S., & Zhang, H. (2003). Rounding-up in reported EPS, behavioral thresholds, and earnings management. *Journal of Accounting and Economics*, *35*(1), 31–50.

Degeorge, F., Patel, J., & Zeckhauser, R. (1999). Earnings management to exceed thresholds. *The Journal of Business*, *72*(1), 1–33.

Evestment (2019). Private markets due diligence survey: Insights into the key factors influencing one of the most critical junctures between investors and fund managers.

Gompers, P., Kaplan, S. N., & Mukharlyamov, V. (2016). What do private equity firms say they do? *Journal of Financial Economics*, *121*(3), 449–476.

Gompers, P. A., & Lerner, J. (1998). What drives venture capital fundraising? *Brookings Papers on Economic Activity. Microeconomics*, (pp. 149–204).

Gori, L., Chizzolini, B., & Gatti, S. (2017). Features and Determinants of Risk in Investment Choices by Private Equity Funds. *SSRN Electronic Journal*, (October), 1–28.

Hamilton Lane (2017). Market overview.

Harris, R. S., Jenkinson, T., & Kaplan, S. N. (2014). Private Equity Performance: What Do We Know? *The Journal of Finance*, *69*(5), 1851–1882.

Hill, T. P. (1995). A Statistical Derivation of the Significant-Digit Law. *Statistical Science*, *10*(4), 354–363.

Hochberg, Y. V., Ljungqvist, A., & Vissing-Jørgensen, A. (2014). Informational holdup and performance persistence in venture capital. *Review of Financial Studies*, *27*(1), 102–152.

Jenkinson, T., Sousa, M., & Stucke, R. (2013). How Fair are the Valuations of Private Equity Funds? *SSRN Electronic Journal*, (February), 1–27.

Kaplan, S., & Schoar, A. (2005). Private equity performance: Returns, persistence, and capital flows. *The Journal of Finance*, *LX*(4), 1791–1823.

Kaplan, S. N., & Stromberg, P. (2009). Leveraged buyouts and private equity. *Journal of Economic Perspectives*, *23*, 121–146.

Malenko, N., Grundfest, J. A., & Shen, Y. (2023). Quadrophobia: Strategic Rounding of EPS Data. *Journal of Financial and Quantitative Analysis*, *58*(8), 3231–3273.

Robinson, D., & Sensoy, B. (2011). Private Equity in the 21st Century: Liquidity, Cash Flows, and Performance from 1984-2010. *NBER Working Paper*.

Thomas, J. K. (1989). Unusual Patterns in Reported Earnings. *The Accounting Review*, *64*(4), 773–787.

Figures and Tables

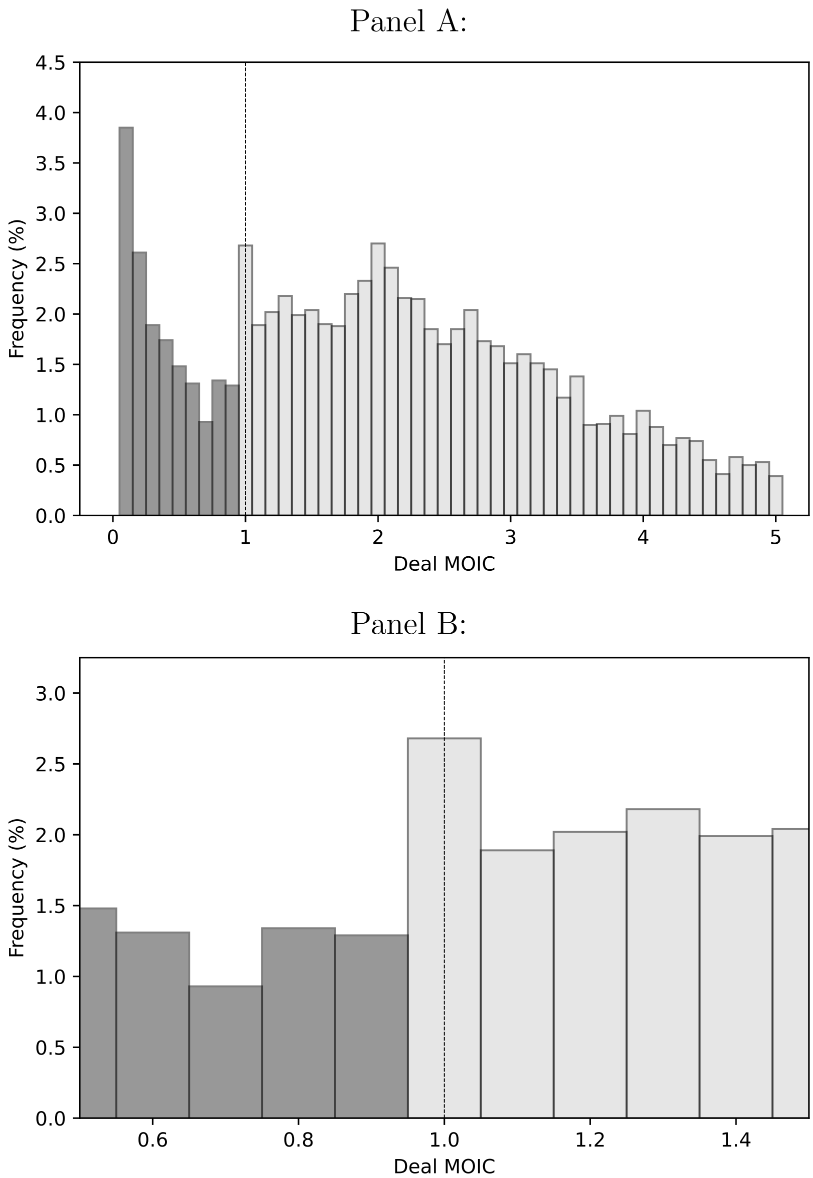
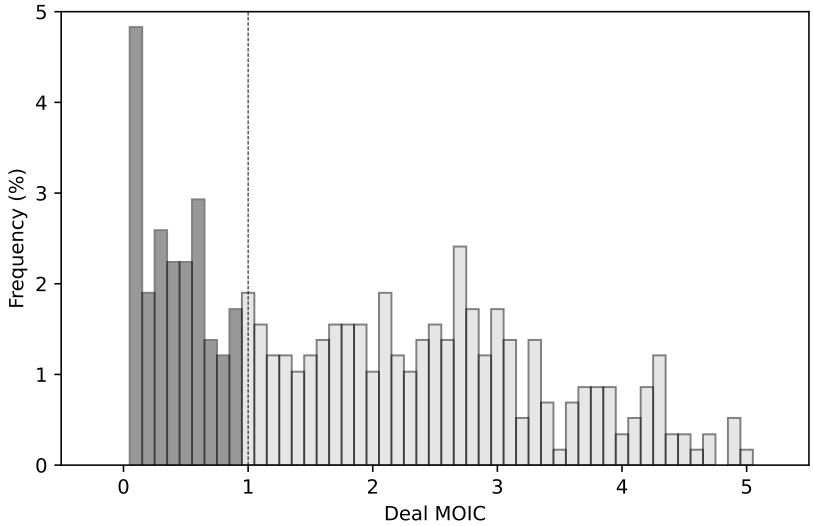


Figure 1: This figure shows the empirical distribution of reported multiples of invested capital (MOICs) for fully exited deals in the sample. Bold vertical bars indicate MOICs below 1 (the break-even point). The dotted line indicates the vertical bar with reported MOICs between 0.95X and 1.04X. The bottom figure represents a closer look at the distribution of realized MOICs within the 0.5X and 1.5 X interval, the main area of interest. Appendix D, Table 13 demonstrates the underlying MOIC distribution.

Panel A:



Panel B:

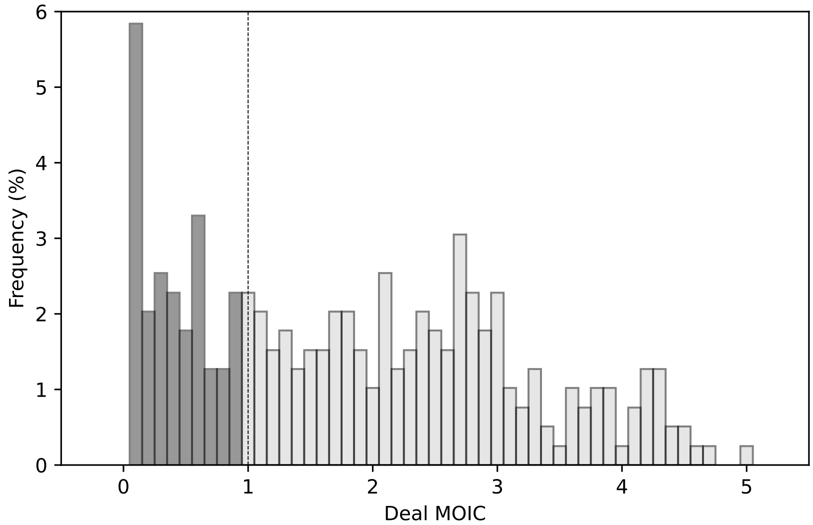


Figure 2: This figure shows the empirical distribution of reported multiples of invested capital (MOICs) for unrealized deals in the sample. Bold vertical bars indicate MOICs below 1 (the break-even point). The dotted line indicates the vertical bar with reported MOICs between 0.95X and 1.04X. Panel A represents all unrealized deals in the sample. Panel B demonstrates MOICs for deals with holding periods longer than 3 years.

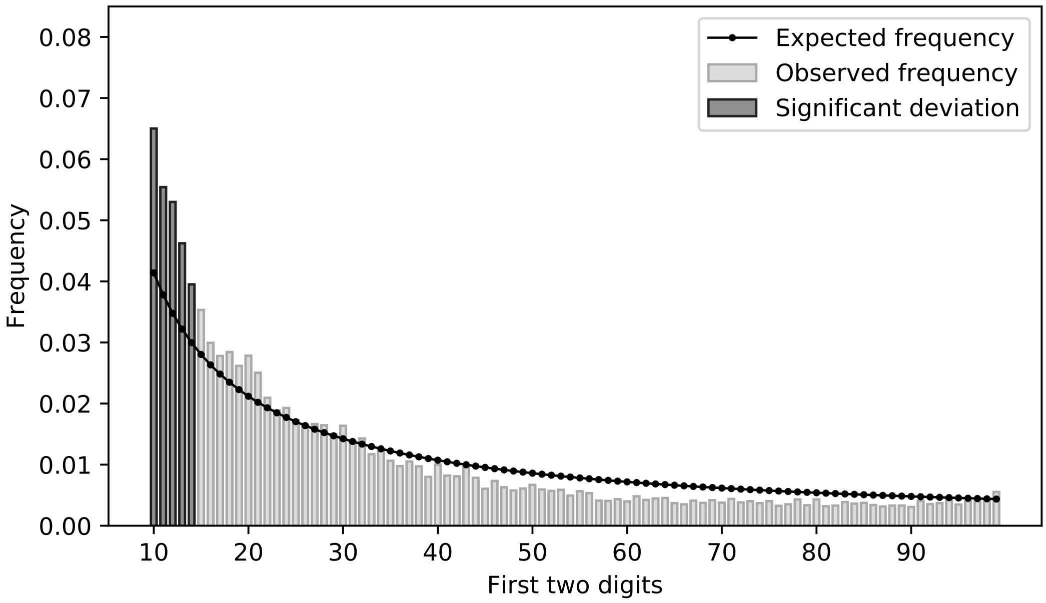


Figure 3: This figure shows the actual vs. theoretical distribution of reported MOICs' first two-digit combinations. Theoretical distributions are based on Benford's Law (see Section 3 for the detailed discussion). Bold vertical bars indicate significant deviations in the number of reported first 2-digit combinations from the theoretical prediction.

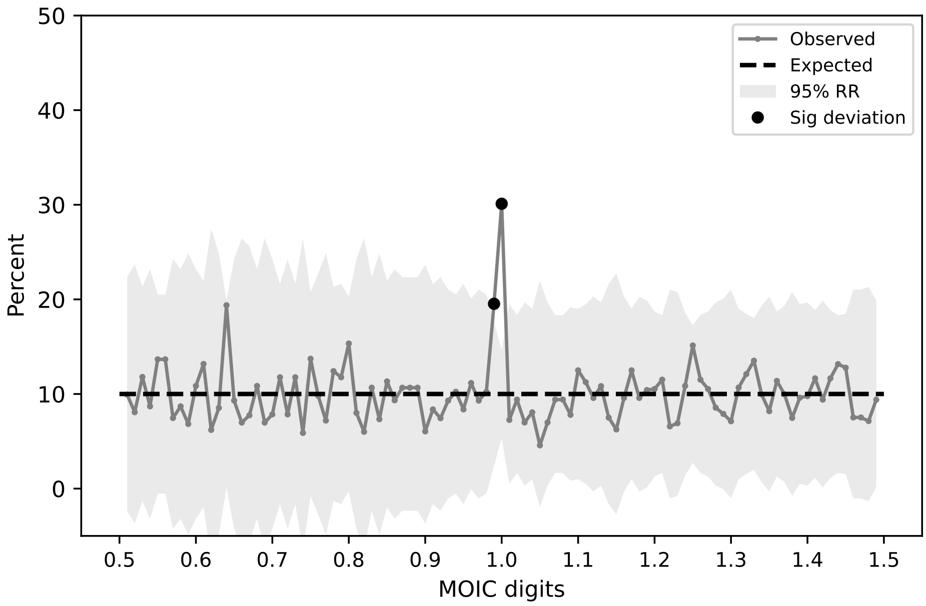


Figure 4: This figure shows the actual vs. theoretical distributions of reported MOICs' three-digit combinations within the 0.5X-1.5X MOIC interval. Theoretical distributions are based on Benford's Law (see Section 3 for the detailed discussion). The shaded area (the rejection region (RR)) indicates the boundaries of the expected 3-digit combinations according to Benford's Law.

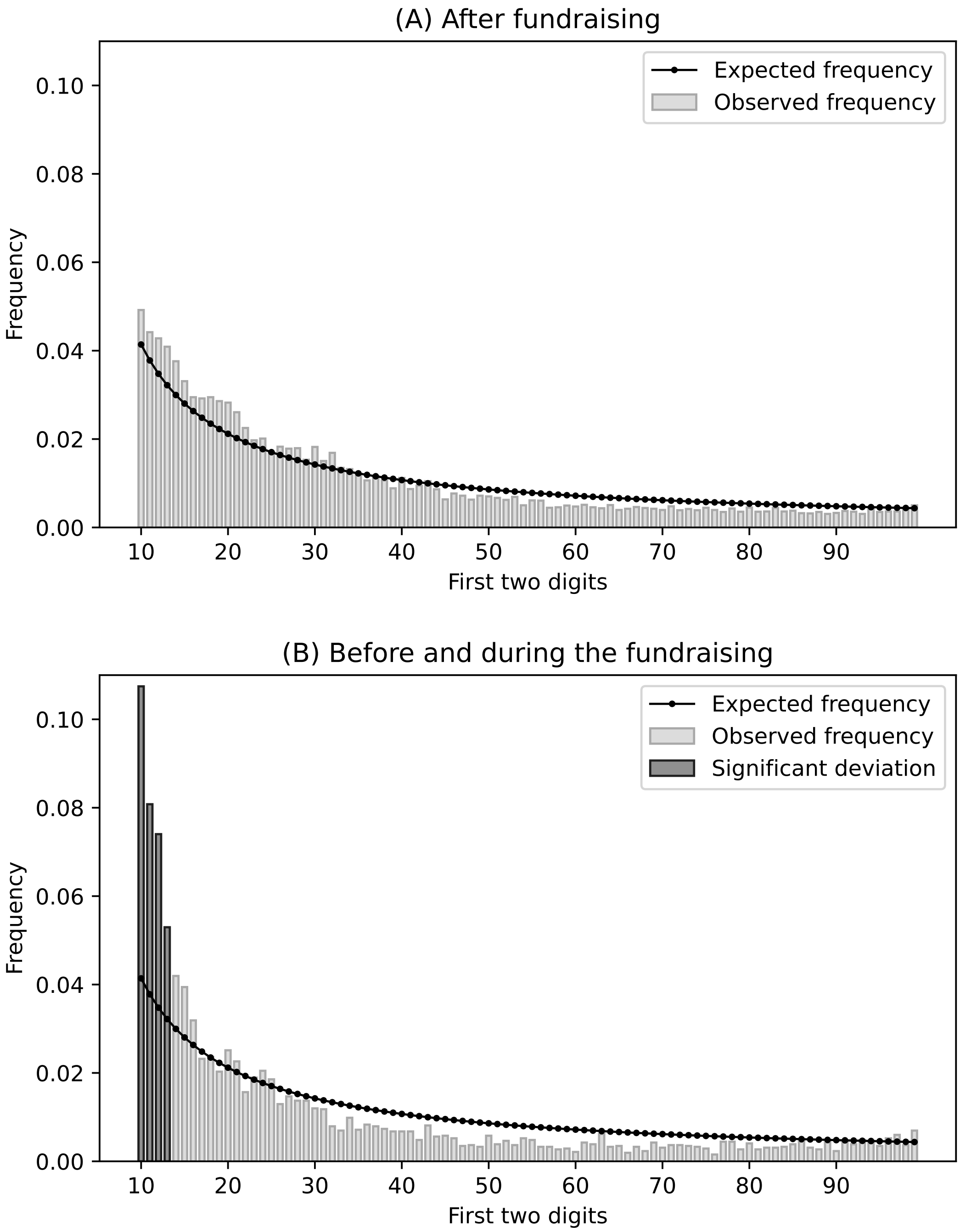


Figure 5: This figure shows the actual vs. theoretical distributions of the reported MOICs' first two-digit combinations before and after the fund-raising period. Theoretical distributions are based on Benford's Law predictions (see Section 3 for the detailed discussion). Bold vertical bars indicate significant deviations from the theoretical distribution.

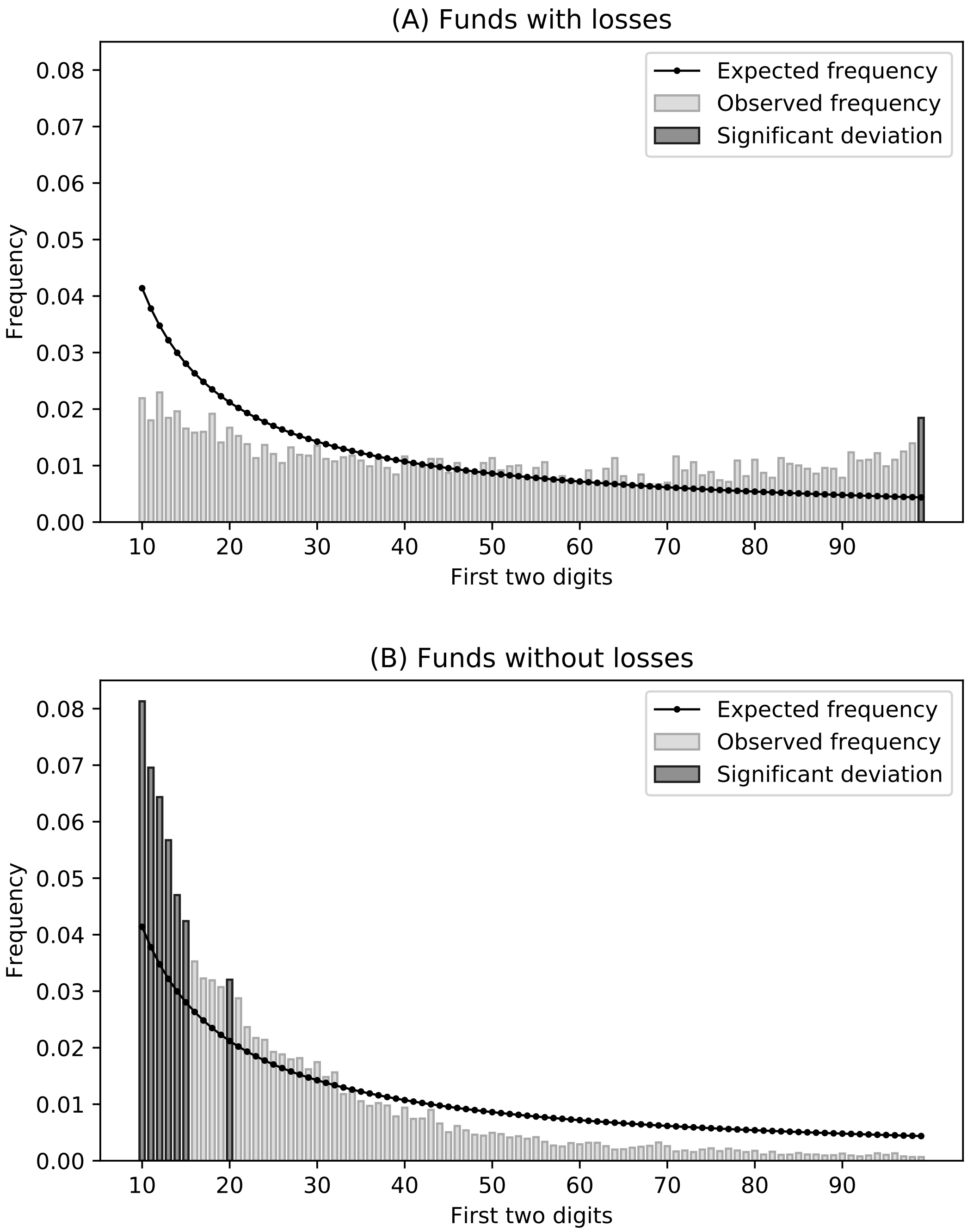


Figure 6: This figure shows the actual vs. theoretical distributions of the reported MOICs' first two-digit combinations for funds with and without reported losses at the time of fundraising (i.e., reported MOIC of less than 1X for at least one fully exited deal). Theoretical distributions are based on Benford's Law (see Section 3 for the detailed discussion). Bold vertical bars indicate significant deviations from the theoretical distribution.

Table 1: Fund-Level Descriptive Statistics

	Obs	Fund Size ($M)	Vintage	LR (% deals)	LR (% capital)	MOIC	IRR	Prev.Fund Ind.	Deal Count
Panel A: Funds									
All funds	1,038	358.40	2002	25.00	16.12	2.41	16.00	0.70	9.00
1X funds	222	450.00	2001	28.06	17.03	2.22	14.65	0.77	13.00
Non-1X funds	816	332.98	2003	24.03	15.60	2.46	16.45	0.68	8.00
Panel B: Time categories									
1971-1990	64	154.00	1988	22.47	14.55	3.20	24.75	0.50	12.50
1991-2000	362	300.57	1998	29.60	20.80	2.41	17.45	0.65	12.00
2001-2010	612	420.78	2006	22.22	13.21	2.35	14.55	0.75	7.00
Panel C: Geographical regions									
Asia	96	302.50	2005	20.20	11.00	2.37	12.50	0.61	7.00
Europe	280	338.07	2003	25.00	16.71	2.39	17.15	0.70	9.00
North America	620	400.00	2001	25.00	16.63	2.45	16.00	0.71	9.00
Other	42	226.00	2005	25.00	10.99	2.28	11.20	0.71	5.00
Panel D: Industry classification									
Consumer Discr.	67	342.00	2001	25.00	20.94	2.46	18.70	0.75	8.00
Energy/Util.	4	182.50	2006	41.71	42.04	2.48	13.80	0.50	9.00
Financials	29	455.00	2005	18.18	10.61	2.22	13.60	0.59	9.00
Generalist	723	400.00	2002	25.00	16.84	2.42	15.40	0.73	9.00
Health Care	19	385.00	2005	25.00	12.78	2.80	16.90	0.58	6.00
Industrials	42	250.00	2005	19.09	11.37	2.43	19.15	0.69	7.00
Infrastructure	7	225.00	2005	35.71	14.86	1.69	7.00	0.71	8.00
Manufacturing	3	190.30	2004	0.00	0.00	3.56	23.00	0.67	5.00
Media/Telecom.	20	307.00	1999	29.29	14.70	2.40	17.85	0.80	10.00
Technology	27	262.00	2000	29.41	15.35	2.38	16.00	0.63	10.00

This table reports fund-level descriptive statistics for 1,038 buyout funds in our sample. Panel A provides basic statistics for funds with reported break-even exits (1X funds) and funds with no break-even realized deals (non-1X funds) separately. Panel B reports summary statistics for funds grouped based on vintage year decades. Panel C demonstrates the geographical groupings of the sample funds. Panel D provides statistics for industry subgroups of the funds.

Table 2: Deal-Level Descriptive Statistics

	Obs	MOIC	Investment Year	Investment Size ($M)	Holding Period
Panel A: Deals					
All deals	9,927	1.98	2001	18.87	5.75
1X deals	257	1.00	2003	14.32	6.76
Non-1X deals	9,670	2.03	2001	18.95	5.73
Panel B: Time categories					
1971-1990	230	2.15	1990	2.76	6.25
1991-2000	4,357	1.65	1998	12.04	5.57
2001-2010	4,948	2.14	2005	26.09	6.00
>2010	392	2.51	2011	39.11	4.38
Panel C: Geographical regions					
Asia	887	1.59	2005	14.00	5.42
Europe	3,148	2.10	2002	19.98	5.59
North America	5,343	2.02	2000	19.80	5.92
Other	549	1.42	2001	9.00	5.50
Panel D: Industry classification (Top 5)					
Industrials	1,833	2.13	2002	19.35	6.07
IT	1,653	1.75	2000	12.68	5.50
Consumer Discretionary	1,616	1.98	2002	21.08	5.85
Communication Services	1,199	1.72	2000	22.67	4.92
Health Care	1,129	2.24	2002	18.40	6.18
Panel E: Sequence categories					
≤20	3,942	2.12	2002	15.12	5.75
21-40	1,728	1.93	2001	21.96	5.87
41-60	998	1.95	2000	24.84	5.83
61-80	711	1.78	2002	21.46	5.46
81-100	517	2.06	2004	25.92	5.83
>100	2,031	1.80	2000	19.34	5.58

This table reports deal-level descriptive statistics for 9,927 unique investments in our sample. Panel A provides basic statistics for break-even exits (1X deals) and deals with MOICs other than 0.95X-1.04X (non-1X deals) separately. Panel B reports summary statistics for deals grouped based on entry-year decades. Panel C demonstrates the geographical groupings of the sample deals. Panel D provides statistics for the Top 5 industry classification of portfolio companies. Panel E sorts all deals into groups based on their sequencing number. To determine the sequencing number, we sort each unique realized deal by the same GP by investment date and assign a count variable to each deal.

Table 3: Variable definitions.

Variable	Definition
After Fund Raise	For a current fund, an indicator variable that is equal to one when the follow-on fund raised by the same GP acquires its first portfolio company.
Deal Sequence	For each GP, we obtain the deal sequence number by (1) sequencing all deals done by a specific GP based on their investment date and (2) counting the number of deals starting with the first deal ever made by a specific GP.
Fund Age at Exit	Years from a fund's start date to the date of the portfolio company exit.
Fund Size	The total amount of capital committed by limited partners (LPs) in U.S. dollars.
Holding Period	Years from the portfolio company's entry date to the exit date.
Loss ratio	A fund-level measure of the aggregate dollars lost across all investments realized below cost, divided by the total dollars invested.
Market Return	Cumulative return on the market index between a portfolio company's entry and exit dates.
MOIC	Multiple of Invested Capital. The ratio of total proceeds realized from to the total amount invested into an individual deal (fund).
Previous Loss	Calculated on the investment exit date as an indicator variable that is equal to one if the previous investment by the same fund was sold below cost.
PME	Kaplan & Schoar (2005) Public Market Equivalent, which compares an investment in a PE fund to an equivalently timed investment in the relevant public market. The PME calculation discounts (or invests) all cash distributions to the fund at the public market total return and divides the resulting value by the value of all cash contributions discounted (or invested) at the public market total return.
Pseudo-IRR, MOIC, PME	Fund performance measures (IRR, MOIC, PME) calculated after dropping (1) 1X deal exits for funds with break-even exits, and (2) deals closest to 1X for funds without break-even exits. The number of dropped deals for funds without 1X exits equals to the mean (=2) or the median (=1) number of break-even exits for 1X funds in the sample.
Vintage Year	Vintage is assigned based on the year of the first investment made by the fund.
1X Exit Fund	An indicator variable equal to 1 if a fund reported at least one exit with a multiple of 1 (a break-even exit), and zero otherwise.

Table 4: Determinants of Break-Even Exit Reporting

Variables	Estimate	Wald Statistic
Loss ratio (log)	-0.72^{***}	-2.77
After fund raise	-0.95^{**}	-2.12
*After fund raise*Loss ratio (log)*	0.53^{**}	1.97
Deal sequence (log)	0.11	1.19
Previous loss	0.50^{***}	2.67
Holding period	-0.21	-1.59
Fund age at exit	0.08^{*}	1.67
Fund size (log)	-0.01	-0.14
Market return (log)	-0.22	-0.68
*After fund raise*Holding period*	0.21	1.60
Vintage year FE	yes	
Geographical region FE	yes	
Number of observations	1,190	
Max-rescaled R-squared	0.10	

This table presents the results from the multivariate deal-level logistic regression where the dependent variable equals one if the multiple of invested capital (MOIC) for a realized deal is reported in the range between 0.95X-1.04X (i.e., the break-even exit), and zero for deal exits with MOICs within the intervals of 0.5X-0.94X and 1.05X-1.5X. Table 2 and Appendix D, Table 14 describe the sample. The explanatory variables are defined in Table 3. Asterisks denote significance as *** for $p < 0.01$, ** for $p < 0.05$, and * for $p < 0.1$.

Table 5: Consequences of Loss Avoidance

Panel A. Probability of raising the next fund

Variables	Estimate	Wald Statistic
Loss ratio (log)	-0.25^{***}	-3.51
1X exit fund	0.58^{**}	2.08
Deal sequence (log)	0.53^{***}	4.10
Fund size (z-score)	-0.07	-0.41
Market return (log)	-0.93^{***}	-2.95
Vintage year FE	yes	
Geographical region FE	yes	
Number of observations	1,038	
Max-rescaled R-squared	0.43	

Panel B. Size of the next fund

Variables	Estimate	t-value
Loss ratio (log)	-0.40^{***}	-3.96
1X exit fund	0.37^{**}	2.01
Deal sequence (log)	0.22^{***}	4.83
Fund size (z-score)	0.51^{***}	20.28
Market return (log)	0.32^{**}	2.21
Vintage year FE	yes	
Geographical region FE	yes	
Number of observations	738	
R-squared	0.56	

This table presents the results from the fund-level multivariate regressions assessing the consequences of loss-avoiding behavior. Panel A reports the parameter estimates from the fund-level linear probability model of a follow-on fund being raised. Panel B demonstrates the result of the OLS regression estimation of the size of the next fund raised by the GP on the prior fund's characteristics. In Panel B, only the funds that have raised a follow-on fund are included. To control for the look-ahead bias, only deals exited before the next fund's 1st investment are included in the estimation of the explanatory variables. All fund-size variables are standardized using z-score normalization (see Appendix A for a description of z-score normalization). Table 1 and Appendix D, Table 14 describe the sample. All variables are defined in Table 3. t-values are robust to heteroskedasticity and autocorrelation. Asterisks denote significance as *** for $p < 0.01$, ** for $p < 0.05$, and * for $p < 0.1$.

Table 6: Do Loss Ratios Measure Risk?

Fund attribute	Pearson	Spearman	Hoeffding's D
(1) Fully realized funds	0.07	0.09	0.00
(2) At the end of fundraising	-0.01	0.06	0.00
(3) Funds with 1X exits	0.25	0.23	0.01
(4) Funds without 1X exits	0.00	0.00	0.00

This table presents Pearson, Spearman, and Hoeffding's D correlations between loss ratios and standard deviations of MOICs, that are calculated (1) at the end of a fund's life for fully realized funds; (2) for a current fund, at the end of fundraising for the next fund by the same GP; (3) at the end of fund life for funds with 1X exits; (4) at the end of fund life for funds without 1X exits.

Table 7: Fund Performance and Loss Avoidance

Panel A. All deals

Variables	MOIC	IRR	PME
Loss ratio (log)	-0.08^{***}	-0.03^{***}	-0.10^{***}
	(-13.85)	(-11.30)	(-12.62)
1X exit fund	-0.05^{***}	-0.02^{***}	-0.03^{**}
	(-2.66)	(-2.47)	(-2.02)
Deal sequence	0.01^{*}	-0.00	0.00
	(1.77)	(-0.54)	(0.39)
Fund size	-0.03^{***}	-0.01^{***}	-0.03^{***}
	(-3.62)	(-3.69)	(-4.65)
Vintage FE	yes	yes	yes
Geographical region FE	yes	yes	yes
Number of observations	1,038	1,038	1,038
R-squared	0.29	0.27	0.27

Panel B. Drop break-even exits

Variables	pseudo-MOIC	pseudo-IRR	pseudo-PME
Loss ratio (log)	-0.11^{***}	-0.03^{***}	-0.07^{***}
	(-13.47)	(-8.87)	(-11.52)
1X exit fund	-0.07^{**}	-0.03^{***}	-0.05^{**}
	(-2.60)	(-2.88)	(-2.35)
Deal sequence	0.00	-0.01^{**}	-0.01
	(0.04)	(-2.19)	(-1.41)
Fund size	-0.04^{***}	-0.01^{***}	-0.04^{***}
	(-3.62)	(-3.58)	(-4.74)
Vintage FE	yes	yes	yes
Geographical region FE	yes	yes	yes
Number of observations	1,038	1,038	1,038
R-squared	0.28	0.25	0.25

This table presents the results from the fund-level multivariate regression estimations of fund performance on fund characteristics. Table 1 and Appendix D, Table 14 describe the sample. The dependent variable measures fund performance based on the Multiple of Invested Capital (MOIC) Internal Rate of Return (IRR), or Public Market Equivalent (PME). Panel A calculates the performance variables using all deals underlying fund performance; Panel B re-estimates fund performance variables after dropping the break-even exits for funds with 1X exits, and the deals closest to MOIC=1 for the funds without 1X exits. PME is calculated based on Kaplan & Schoar (2005). All fund-size variables are standardized using z-score normalization (see Appendix A for a description of z-score normalization). All other variables are defined in Table 3. t-values for coefficients provided in parentheses are robust to heteroskedasticity and autocorrelation. Asterisks denote significance as *** for $p < 0.01$, ** for $p < 0.05$, and * for $p < 0.1$.

Appendix A Z-score Normalization

To facilitate comparisons of estimated effects across investment types and vintage years, we standardize all fund-size variables using a z-score normalization. This standardization also allows us to directly compare the magnitude of the estimated coefficients between different fund types. The z-score transformation is useful when seeking to compare the relative standing of items from distributions with different means and/or different standard deviations. The z-score of an item indicates how far and in what direction that item deviates from its distribution's mean, expressed in units of its distribution's standard deviation. Normalization of data or using z-scores overcomes objections on relativism which can be applied to other methods. The z-score transformation standardizes variables with different observed scales to the same scale. We use the standard formula for calculating z-scores

$$z = (X - \bar{X})/s,$$

where X is the observed value, $\bar{X}$ is the sample average, and s is the sample standard deviation.

Appendix B Robustness check

Table 8: Robustness Check: Consequences of Loss Avoidance

Panel A. Probability of raising the next fund

Variable	Specification				
	(1)	(2)	(3)	(4)	(5)
Loss ratio (log)	-0.25^{***}	-0.24^{***}	-0.35^{***}	-0.28^{***}	-0.38^{***}
	(-3.51)	(-3.49)	(-4.17)	(-3.11)	(-4.47)
1X exit fund	0.58^{**}	0.58^{**}	0.81^{***}	0.77^{***}	0.76^{**}
	(2.08)	(2.09)	(2.46)	(2.20)	(2.33)
Deal sequence (log)	0.53^{***}	0.56^{***}	0.57^{***}	0.55^{***}	0.55^{***}
	(4.10)	(3.73)	(3.56)	(3.29)	(3.55)
Fund size (z-score)	-0.07	-0.07	-0.06	-0.16	-0.03
	(-0.41)	(-0.44)	(-0.32)	(-0.78)	(-0.17)
Market return (log)	-0.93^{***}	-0.93^{***}	-3.41^{***}	-1.06^{**}	-3.29^{***}
	(-2.95)	(-2.94)	(-7.44)	(-1.99)	(-7.09)
1st time fund		0.09			
		(0.36)			
Deals at fundraising			-0.00		
			(-0.1)		
Average deal exit year				-0.61^{***}	
				(-7.51)	
Average deal IRR					-0.01
					(-0.28)
Vintage FE	yes	yes	yes	yes	yes
Geographical Region FE	yes	yes	yes	yes	yes
Number of Observations	1,038	1,038	783	783	748
R-squared	0.43	0.43	0.57	0.65	0.57

Table 8: Robustness Check: Consequences of Loss Avoidance.

Panel B. Size of the next fund

Variable	Specification				
	(1)	(2)	(3)	(4)	(5)
Loss ratio (log)	-0.40^{***}	-0.35^{***}	-0.23^{**}	-0.32^{***}	-0.39^{***}
	(-3.96)	(-3.40)	(-2.25)	(-3.32)	(-3.91)
1X exit fund	0.37^{**}	0.39^{**}	0.36^{**}	0.33^{*}	0.37^{**}
	(2.01)	(2.09)	(1.96)	(1.84)	(2.01)
Deal sequence (log)	0.22^{***}	0.16^{***}	0.26^{***}	0.19^{***}	0.21^{***}
	(4.83)	(3.08)	(5.78)	(4.40)	(4.72)
Fund size (z-score)	0.51^{***}	0.52^{***}	0.57^{***}	0.52^{***}	0.51^{***}
	(20.28)	(20.46)	(21.51)	(21.59)	(20.25)
Market return (log)	0.32^{**}	0.29^{**}	0.37^{***}	0.44^{***}	0.32^{**}
	(2.21)	(1.96)	(2.58)	(3.08)	(2.20)
1st-time fund		-0.24^{**}			
		(-2.27)			
Deals at fundraising			0.01^{***}		
			(-6.04)		
Average deal exit year				-0.14^{***}	
				(-6.17)	
Average deal IRR					0.00
					(0.43)
Vintage FE	yes	yes	yes	yes	yes
Geographical Region FE	yes	yes	yes	yes	yes
Number of Observations	738	738	738	736	736
R-squared	0.56	0.57	0.59	0.59	0.56

This table presents the results from the fund-level multivariate regressions assessing the consequences of loss-avoiding behavior. Panel A reports the parameter estimates from the fund-level linear probability model of a follow-on fund being raised. Wald statistic is shown in parentheses. Panel B demonstrates the result of the OLS regression estimation of the size of the next fund raised by the GP on the prior fund's characteristics. In Panel B, only the funds that have raised a follow-on fund are included. To control for the look-ahead bias, only deals exited before the next fund's 1st investment are included in the estimation of the explanatory variables. All fund-size variables are standardized using z-score normalization (see Appendix A for a description of z-score normalization). Table 1 and Appendix D, Table 14 describe the sample. Model (1) reports the results from Table 5; Models (2)-(5) expand Model (1) by including the following variables: *1st-time fund* represents an indicator variable equal to 1 if the fund is a first-time fund launched by a GP, and zero otherwise; *Deals at fundraising* represent the number of investments in a fund's portfolio at the time of fundraising for the next fund; *Average deal exit year* is the average fund age (in years) across all portfolio exits; *Average deal IRR* is the average IRR of all realized deals. Other variables are defined in Table 3. t-values for coefficients provided in parentheses are robust to heteroskedasticity and autocorrelation. Asterisks denote significance as *** for $p < 0.01$, ** for $p < 0.05$, and * for $p < 0.1$.

Table 9: Robustness Check: Fund Performance and Loss Avoidance

Variable	Dependent variable - MOIC				
	(1)	(2)	(3)	(4)	(5)
Loss ratio (log)	-0.08^{***}	-0.08^{***}	-0.08^{***}	-0.08^{***}	-0.08^{***}
	(−13.85)	(−13.85)	(−11.45)	(−11.41)	(−11.19)
1X exit fund	-0.05^{***}	-0.05^{***}	-0.04^{*}	-0.04^{*}	-0.04^{*}
	(−2.66)	(−2.73)	(−1.84)	(−1.82)	(−1.75)
Deal sequence (log)	0.01^{*}	0.02^{**}	0.01	0.02^{*}	0.01^{*}
	(1.77)	(2.34)	(1.57)	(1.71)	(1.75)
Fund size (z-score)	-0.03^{***}	-0.03^{***}	-0.02^{***}	-0.02^{***}	-0.02^{***}
	(−3.62)	(−3.76)	(−3.07)	(−3.09)	(−2.93)
1st time fund		0.03			
		(1.56)			
Deals at fundraising			0.00		
			(0.21)		
Average deal exit year				0.00	
				(0.38)	
Average deal IRR					0.00
					(1.00)
Vintage FE	yes	yes	yes	yes	yes
Geographical Region FE	yes	yes	yes	yes	yes
Number of Observations	1,038	1,038	1,038	796	761
R-squared	0.29	0.29	0.29	0.29	0.29

This table presents the results from the fund-level multivariate regression estimations of fund performance on fund characteristics. Table 1 and Appendix D, Table 14 describe the sample. The dependent variable measures fund performance based on the Multiple of Invested Capital (MOIC). Model (1) reports the results from Table 7; Models (2)-(5) expand Model (1) by including the following variables: *1st-time fund* represents an indicator variable equal to 1 if the fund is a first-time fund launched by a GP, and zero otherwise; *Deals at fundraising* represent the number of investments in a fund's portfolio at the time of fundraising for the next fund; *Average deal exit year* is the average fund age (in years) across all portfolio exits; *Average deal IRR* is the average IRR of all realized deals. All fund-size variables are standardized using z-score normalization (see Appendix A for a description of z-score normalization). All other variables are defined in Table 3. t-values for coefficients provided in parentheses are robust to heteroskedasticity and autocorrelation. Asterisks denote significance as *** for $p < 0.01$, ** for $p < 0.05$, and * for $p < 0.1$.

Appendix C Robustness Check: VC Funds

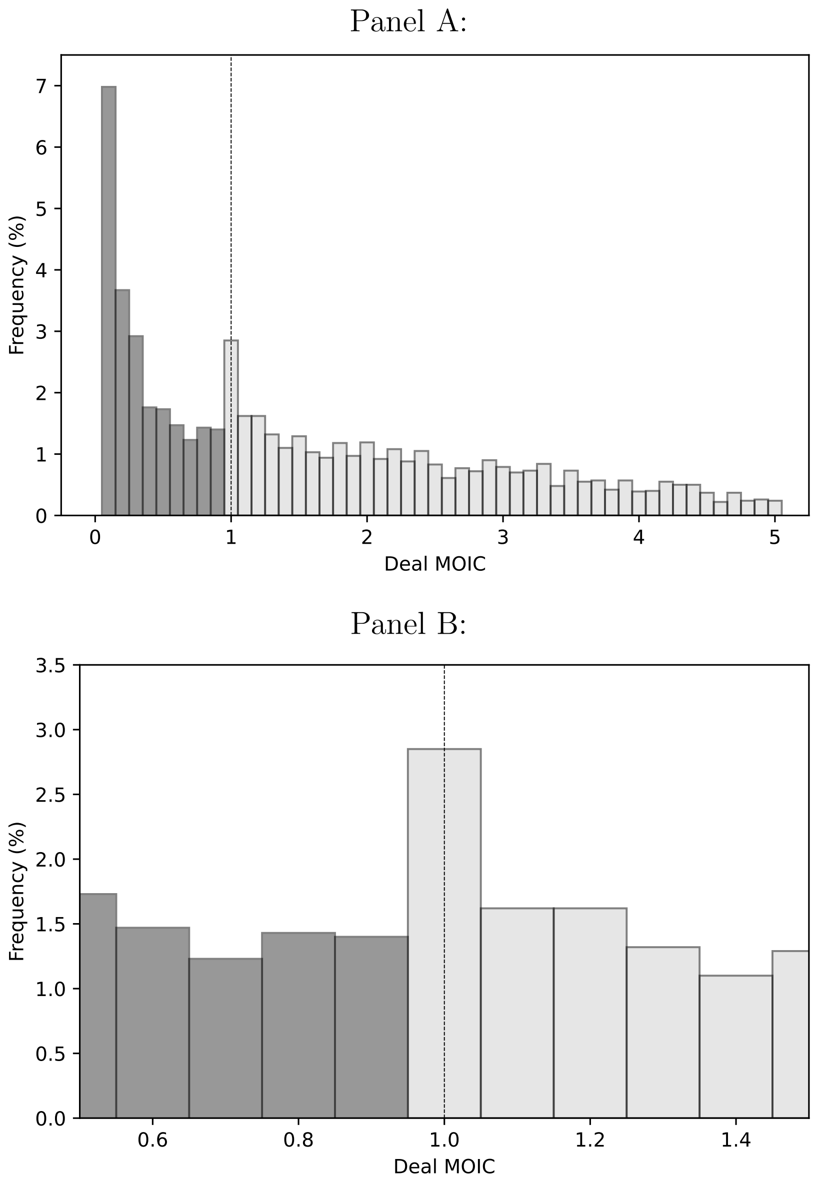


Figure 7: This figure shows the empirical distribution of reported multiples of invested capital (MOICs) for fully exited deals in the VC sub-sample. Bold vertical bars indicate MOICs below 1 (the break-even point). The dotted line indicates the vertical bar with reported MOICs between 0.95X and 1.04X. The bottom figure represents a closer look at the distribution of realized MOICs within the 0.5X and 1.5 X interval, the main area of interest.

Table 10: Determinants of Break-Even Exit Reporting, VC Funds

Variables	Estimate	Wald Statistic
Loss ratio (log)	-0.76^{**}	-2.35
After fund raise	-0.94^{*}	-1.79
*After fund raise*Loss ratio*	0.23^{***}	2.82
Deal sequence (log)	0.05	0.57
Previous loss	-0.12	-0.54
Holding period	-0.41^{*}	-1.83
Fund age at exit	0.16^{***}	2.88
Fund size (log)	-0.30^{***}	-2.89
Market return (log)	0.14	0.35
*After fund raise*Holding Period*	0.17	0.75
Vintage year FE	yes	
Geographical region FE	yes	
Number of observations	747	
Max-rescaled R-squared	0.16	

This table presents the results from the multivariate deal-level logistic regression where the dependent variable equals one if the multiple of invested capital (MOIC) for a realized deal is reported in the range between 0.95X-1.04X, and zero for deal exits with MOICs within the intervals of 0.5X-0.94X and 1.05X-1.5X. The explanatory variables are defined in Table 3. Asterisks denote significance as *** for $p < 0.01$, ** for $p < 0.05$, and * for $p < 0.1$.

Table 11: Consequences of Loss Avoidance, VC Funds

Panel A. Probability of raising the next fund

Variables	Estimate	Wald Statistic
Loss Ratio (log)	−0.31**	−2.40
1X Exit Fund (indicator)	1.58***	3.62
Deal Sequence (log)	0.32*	1.74
Fund Size (log)	−0.40***	−2.51
Market return (log)	−1.34***	−2.76
Vintage Year FE	yes	
Geographical Region FE	yes	
Number of Observations	357	
Max-Rescaled R-squared	0.37	

Panel B. Size of the next fund

Variables	Estimate	t-value
Loss Ratio (log)	−0.27***	−3.13
1X Exit Fund	0.20	1.11
Deal Sequence (log)	0.16***	3.22
Fund Size (z-score)	0.50***	6.90
Market return (log)	−0.36	−1.18
Vintage Year FE	yes	
Geographical Region FE	yes	
Number of Observations	246	
R-squared	0.57	

This table presents the results from the fund-level multivariate regressions assessing the consequences of loss avoiding behavior. Panel A reports the parameter estimates from the fund-level linear probability model of a follow-on fund being raised. Panel B demonstrates the result of the OLS regression estimation of the size of the next fund raised by the GP on the prior fund's characteristics. In Panel B, only the funds that have raised a follow-on fund are included. To control for the look-ahead bias, only deals exited before the next fund's 1st investment are included in the estimation of the explanatory variables. All fund-size variables are standardized using z-score normalization (see Appendix A for a description of z-score normalization). All variables are defined in Table 3. t-values are robust to heteroskedasticity and autocorrelation. Asterisks denote significance as *** for $p < 0.01$, ** for $p < 0.05$, and * for $p < 0.1$.

Table 12: VC Fund Performance and Loss Avoidance

Panel A. All deals

Variables	MOIC	IRR	PME
Loss Ratio (log)	-0.13^{***}	-0.11^{***}	-0.30^{***}
	(-5.51)	(-6.82)	(-5.95)
1X exit fund	-0.01	-0.05^{**}	-0.08^{**}
	(-0.13)	(-2.39)	(-2.00)
Deal Sequence	-0.01	0.00	-0.01
	(-0.46)	(0.25)	(-0.96)
Fund size	-0.04	-0.01^{*}	-0.03^{*}
	(-1.56)	(-1.79)	(-1.83)
Vintage FE	yes	yes	yes
Geographical Region FE	yes	yes	yes
Number of Observations	346	346	346
R-squared	0.27	0.35	0.26

Panel B. Drop break-even exits

Variables	pseudo-MOIC	pseudo-IRR	pseudo-PME
Loss Ratio (log)	-0.27^{***}	-0.08^{***}	-0.25^{***}
	(-6.39)	(-5.90)	(-6.40)
1X exit fund	-0.10^{**}	-0.06^{***}	-0.10^{**}
	(-1.95)	(-2.81)	(-2.30)
Deal Sequence	-0.04^{*}	-0.00	-0.04^{*}
	(-1.64)	(-0.13)	(-1.90)
Fund size	-0.03	-0.02^{*}	-0.03
	(-1.60)	(-1.87)	(-1.58)
Vintage FE	yes	yes	yes
Geographical Region FE	yes	yes	yes
Number of Observations	346	346	346
R-squared	0.36	0.37	0.31

This table presents the results from the fund-level multivariate regression estimations of fund performance on fund characteristics. The dependent variable measures fund performance based on the Multiple of Invested Capital (MOIC), Internal Rate of Return (IRR), or Public Market Equivalent (PME). Panel A calculates the performance variables using all deals underlying fund performance; Panel B re-estimates fund performance variables after dropping the break-even exits for funds with 1X exits, and the deals closest to MOIC=1 for the funds without 1X exits. PME is calculated based on Kaplan & Schoar (2005). All fund-size variables are standardized using z-score normalization (see Appendix A for Z-score normalization description). All other variables are defined in Table 3. t-values for coefficients provided in parentheses are robust to heteroskedasticity and autocorrelation. Asterisks denote significance as *** for $p < 0.01$, ** for $p < 0.05$, and * for $p < 0.1$.

Appendix D Additional Tables

Table 13: Deal-level Multiples of Invested Capital (MOICs) Reported by Fully-Realized Funds

MOIC Range	Buyouts	
	MOICs in range	% of Total Deals
[0.0, 0.0)	777	8.11
[0.0, 0.05)	506	5.28
[0.05, 0.1)	228	2.38
[0.1, 0.15)	141	1.47
[0.15, 0.2)	132	1.38
[0.2, 0.25)	117	1.22
[0.25, 0.3)	97	1.01
[0.3, 0.35)	85	0.89
[0.35, 0.4)	78	0.81
[0.4, 0.45)	88	0.92
[0.45, 0.5)	80	0.83
[0.5, 0.55)	62	0.65
[0.55, 0.6)	67	0.70
[0.6, 0.65)	60	0.63
[0.65, 0.7)	40	0.42
[0.7, 0.75)	49	0.51
[0.75, 0.8)	67	0.70
[0.8, 0.85)	61	0.64
[0.85, 0.9)	56	0.58
[0.9, 0.95)	68	0.71
[0.95, 1.0)	95	0.99
[1.0,1.05)	**162**	**1.69**
[1.05, 1.1)	89	0.93
[1.1, 1.15)	92	0.96
[1.15, 1.2)	90	0.94
[1.2, 1.25)	104	1.09
[1.25, 1.3)	99	1.03
[1.3, 1.35)	109	1.14
[1.35, 1.4)	97	1.01
[1.4, 1.45)	95	0.99
[1.45, 1.5)	91	0.95
[1.5, 1.55)	103	1.07
[1.55, 1.6)	112	1.17
[1.6, 1.65)	71	0.74
[1.65, 1.7)	88	0.92
[1.7, 1.75)	90	0.94
[1.75, 1.8)	122	1.27
[1.8, 1.85)	91	0.95
[1.85, 1.9)	114	1.19
[1.9, 1.95)	109	1.14
[1.95, 2.0)	130	1.36
[2.0, 2.05)	128	1.34
[2.05, 2.1)	112	1.17
[2.1, 2.15)	125	1.30
[2.15, 2.2)	101	1.05
[2.2, 2.25)	105	1.10
[2.25, 2.3)	102	1.06
[2.3, 2.35)	105	1.10
[2.35, 2.4)	91	0.95

This table provides the distribution of reported multiples of invested capital (MOICs) underlying the histogram shown in Figure 1.

Table 14: Additional Fund-Level and Deal-Level Summary Statistics

	N	Mean	S.D.	Min	5th per.	Median	95th per.	Max
Panel A: Deal-Level Summary Statistics								
Deal MOIC	9,927	2.49	2.45	0.00	0.57	1.96	3.38	10.00
Deal Size ($M)	9,927	49.59	98.70	0.01	6.48	18.24	47.89	2144.40
Deal Entry Year	9,927	2001	5.00	1985	1998	2001	2005	2010
Deal Exit Year	9,927	2007	6.01	1990	2003	2007	2012	2018
Holding Period	9,927	6.18	3.28	0.00	3.64	5.84	8.26	25.43
Previous Loss Indicator	9,927	0.33	0.47	0.00	0.00	0.00	1.00	1.00
Panel B: Fund-Level Summary Statistics								
Loss Ratio	1,038	19.48	18.74	0.00	3.25	16.12	29.61	100.00
1X Exit Indicator	1,038	0.21	0.41	0.00	0.00	0.00	0.00	1.00
PME	1,038	2.02	1.64	0.00	1.34	1.80	2.37	30.68
IRR	1,038	19.28	16.14	-39.00	9.70	16.00	25.00	106.00
MOIC	1,038	2.71	1.95	0.00	1.89	2.41	3.10	34.06
Pseudo-PME	1,038	2.20	1.33	0.00	1.45	1.96	2.62	17.48
Pseudo-IRR	1,038	23.81	23.98	-92.87	12.46	18.70	29.70	279.47
Pseudo-MOIC	1,038	2.95	1.79	0.00	2.03	2.61	3.46	21.51
Number of Deals	1,038	11.87	12.38	1.00	5.00	9.00	14.00	147.00
Holding Period	1,038	5.40	2.04	0.08	4.09	5.25	6.50	24.14
Fund Size ($M)	1,038	903.99	1668.55	5.59	158.00	358.40	850.66	21167.40
Fund Vintage	1,038	2002	5.70	1986	1998	2002	2006	2010

This table provides additional summary statistics for the variables in our sample. Panel A reports the summary statistics for deal-level variables and Panel B describes the fund-level ones. Variable definitions are provided in Table 3.

Table 15: Variable Correlations

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Loss Ratio	1												
2	1X Exit Indicator	0.05	1											
3	PME	-0.33	-0.04	1										
4	IRR	-0.34	-0.02	0.65	1									
5	MOIC	-0.45	-0.08	0.8	0.73	1								
6	Pseudo-PME	-0.33	-0.08	0.96	0.65	0.77	1							
7	Pseudo-IRR	-0.39	-0.11	0.65	0.7	0.71	0.71	1						
8	Pseudo-MOIC	-0.44	-0.12	0.76	0.72	0.96	0.81	0.76	1					
9	Deal Sequence	0.16	0.22	-0.11	-0.13	-0.1	-0.18	-0.19	-0.17	1				
10	Holding Period	0.05	0.08	-0.01	-0.12	0.07	-0.03	-0.41	0.04	0.13	1			
11	Fund Size	-0.01	0.1	-0.18	-0.23	-0.21	-0.22	-0.23	-0.24	0.5	0.1	1		
12	Vintage	-0.18	-0.13	-0.18	-0.25	-0.16	-0.12	-0.04	-0.1	0.01	-0.09	0.31	1	
13	Market Return	-0.05	0.07	-0.21	0.04	0.14	-0.2	-0.02	0.12	0.11	0.24	0.1	0.05	1

This table provides Pearson correlation coefficients for the primary fund-level variables utilized our analyses. Variable definitions are provided in Table 3.