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Paying for Performance in Private Equity: Evidence from VC Partnerships *

Niklas Hüther[1]
Indiana University

David T. Robinson[2]
Duke University
NBER

Sönke Sievers[3]
University of Paderborn

Thomas Hartmann-Wendels[4]
University of Cologne

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Abstract

We offer the first empirical analysis connecting the timing of general partner (GP) compensation to private equity fund performance. Using detailed information on limited partnership agreements between private equity limited and general partners, we find that "GP-friendly" contracts—agreements that pay general partners on a deal-by-deal basis instead of withholding carried interest until a benchmark return has been earned—are associated with higher returns, both gross and net of fees. This is robust to measures of performance persistence, time period effects, and other contract terms, and is related to exit-timing incentives. Timing practices balance GP incentives against limited partner downside protection.

JEL Classification: G10, G23, G24
Keywords: venture capital, compensation, private equity, VC partnership, pay-performance relation

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[1]Kelley School of Business,1309 E 10TH ST, Bloomington, IN 47405-1701.
E-mail: nhuether@indiana.edu *(Corresponding author)*

[2]Fuqua School of Business, One Towerview Drive, Durham, NC 27708, USA.
E-mail: davidr@duke.edu

[3]Department of Taxation, Accounting & Finance, Warburger Strasse 100, 33098 Paderborn, Germany. E-mail: soenke.sievers@uni-paderborn.de

[4]Department of Banking, Albertus Magnus Platz, 50923 Cologne, Germany.
E-mail: hartmann-wendels@wiso.uni-koeln.de

1 Introduction

Limited partner agreements (LPAs), the contractual arrangements between general partners and their investors, are the central mechanisms that define the terms of general partner (GP) compensation in private equity. These contracts specify management fees, the carried interest earned when private equity investments are exited, as well as the precise timing conventions that govern *when* GPs get paid.[1] Litvak (2009) shows that these timing conventions are a major determinant of the present value of compensation that GPs receive. Her calculations indicate that standard shifts in timing induce changes in the net present value of compensation for medium-performing funds that are at least as large as observed shifts in management fees and carried interest percentages.[2] Despite the economic importance on the timing of the distribution waterfall, there is no empirical evidence connecting variation in carry timing conventions to the actual cash flows that limited partners receive. As a result, the effects of this compensation practice remain shrouded in mystery.

The aim of this paper is to shed first light on this important aspect of private equity compensation. We use a hand-collected, proprietary dataset of management contracts to detail compensation practices in venture capital and connect these practices to investment behavior and fund performance. Our analysis centers around three questions. First, we ask whether there are differences in performance associated with different types of timing conventions. As we explain below, there are striking differences in per-

[1] Standard fee arrangements in venture capital typically require 2-2.5% of committed capital as a management fee (often with reductions or step-downs to invested capital after conclusion of the investment period) and 20-25% of the net return of an exited investment as carried interest. Please see Robinson and Sensoy (2013), Metrick and Yasuda (2010) or Gompers and Lerner (1999) for a more in-depth discussion and analysis.

[2] According to her calculations, an increase in management fee from 2% to 2.5% increases compensation from 15 million USD to 18.75 million USD, a carry increase from 20% to 25% yields 5.07 million USD more, while most importantly the effect of changing the distribution rule from LP-friendly to GP-friendly increases the GP's income ceteris paribus by 6.64 million USD (see Litvak, 2009, p. 205). Replicating her findings with our data shows similar results: a shift in the distribution rule increases the GP's income by 6.94 million USD. Appendix 1 provides detailed calculations and a short explanation on distribution rules.

formance. This finding prompts two additional questions: (a) why are certain timing conventions associated with better performance than others? and (b) why do different timing conventions co-exist given that one type is associated with stronger performance than another?

Historically, the timing of paying carried interest to general partners has followed one of two approaches. Deal-by-deal (DD), or "American," carry provisions allow the general partners to earn carried interest on each deal as it is exited, even if the fund as a whole has not returned sufficient capital to LPs for them to break even. Whole-fund (WF), or "European", carry provisions typically require that invested capital and fees are returned to LPs before the GP is entitled to earn any carried interest.[3]

To illustrate the difference, consider a fund that has exited two investments, the first at a gain and the second at a loss, so that the combined raw return is zero. A GP facing "fund-as-a-whole" carried interest provisions would not yet be eligible to receive carried interest on the strong initial exit, because the fund as a whole had not yet earned a positive return on total invested capital. In contrast, a deal-by-deal contract would allow the GP to earn carried interest on the initial strong exit even though the combined return on the two investments was zero. To guard against overcompensation, deal-by-deal contracts often contain clawback provisions that require the return of carried interest to the LP if, at the end of the fund's life, the fund has not returned sufficient capital. However, because these clawback provisions are triggered at fund liquidation, and because most contracts only require half the after-tax carry to be held in escrow, there is a natural concern that standard clawbacks provisions under-insure against poor performance (Schell, 2016). Moreover, because clawback provisions typically do not require the return of interest, the GP essentially receives an interest-free loan over that time period even if he has to return part or all of the capital he has received.

[3]Some contracts, especially in buyout funds, even stipulate that the LPs earn a preferred return on their investment. In such cases, these contracts typically include a "catchup provision," in which the GP earns accelerated carry after the hurdle is reached, to compensate them for the carry they forfeited on early exits in order to satisfy the hurdle.

Thus, fund-as-a-whole carried interest provisions would appear to safeguard limited partners by ensuring that they receive a certain hurdle rate before general partners receive any compensation. Indeed, European, whole-fund contracts are typically regarded as LP-friendly, while American, deal-by-deal contracts are typically regarded as GP-friendly. As compensation practices have come under increasing scrutiny, many industry observers have argued that limited partners in private equity should insist on LP-first compensation structures (for example, see Institutional Limited Partner Association's Private Equity Principles (ILPA, 2011)). In light of these concerns, the simplest way to frame our analysis is through the question, "Do limited partners earn higher returns with LP-friendly contracts?"

Our first set of results speaks directly to this question. They do not. Indeed, we find strong evidence that GP-friendly contracts are associated with better performance on both a gross- and net-of-fee basis. The public market equivalent (PME) is around 0.82 for fund-as-a-whole (LP-friendly) contracts but is over 1.24 for deal-by-deal (GP-friendly) contracts. This means that whole-fund contracts are associated with net present value losses of nearly 18 cents per dollar of invested capital, while in deal-by-deal funds the present value of distributions exceeds that of contributed capital by about 24%.[4] In the same vein, the gross internal rate of return is approximately 14 percentage points higher among the set of deal-by-deal contracts. These differences in gross performance are not fully absorbed by variation in other contract terms. While fees and carried interest percentages are typically higher for deal-by-deal funds, limited partners earn higher net returns in deal-by-deal funds than in funds with whole-fund carry provisions. Limited partners do not, on average, experience better performance with LP-friendly contracts.

[4]We use a Kaplan and Schoar (2005) public market equivalent, or PME, which expresses the return to a private equity investment in terms of its excess over a publicly investable benchmark, so that a PME of 1.1 implies that the PE fund outperformed its benchmark by 10% over the life of the fund (typically around 10 years). See Kaplan and Schoar (2005) or Robinson and Sensoy (2013) for more details.

Why are GP-friendly contracts associated with better performance? One obvious reason relates to GP quality: better GPs, all else equal, are presumably better able to extract more favorable deal terms, and thus would be more likely to have GP-friendly contract terms in place. If, whether by informational holdup as suggested by Hochberg, Ljungqvist, and Vissing-Jørgensen (2014), or simply by industry convention, GPs have limited ability to vary the amount of fees and carry in LPAs, then GPs may not be able to fully capture the rents associated with their better performance.

To explore this channel, we model contract assignment as a function of observable performance characteristics. The richness of our data allow us to include many measures that are typically unavailable in this empirical setting. For example, we have detailed track records of managers, which allows us to measure past performance, even for managers operating first-time funds (by looking at the performance of the funds with which they were previously affiliated). We have financial performance measures that are dated as of the time of fundraising, so that we know the performance that would have been observable to the LP at the time the commitment to the fund occurred. Indeed, we find clear evidence of this GP quality effect in our sample: funds with longer track records and stronger past performance are more likely to command deal-by-deal contracts.

To explore whether this is the whole story, in the second part of the paper we develop a propensity scoring strategy to compare observationally similar funds, one that receives a GP-friendly contract, one that does not. Deal-by-deal contracts are still associated with higher performance; indeed, conditioning on observables removes around one-third of the overall difference in performance. This indicates that either unobservable differences in quality simultaneously drive contract assignment and performance, or that contracts change behavior by affecting incentives.

The fact that a large amount of the overall difference in performance cannot be explained by factors that would be observable to the LP at the time of the commitment lead us to the third part of our analysis, which provides direct evidence of differences in

behavior across contract types. Among whole-fund contracts, exits cluster early in the fund's life, approximately around the natural time for a firm to begin fundraising for its next fund. This is consistent with the grandstanding effect first documented by Gompers (1996). The evidence indicates that they "pull" successful investments forward in time. Although it is difficult to establish a counterfactual, a natural question is whether these exits would have been stronger still were it not for this grandstanding. In comparison, GP-friendly exit times more closely match the expected evolution of the underlying asset valuations of the portfolio companies in question. Similarly, GPs in LP-friendly contracts undertake less risky investments than those in GP-friendly contracts. This points to the idea that LP-friendly contracts induce the tendency to play it safe and "put some points on the board." Finally, for funds that have not returned capital to LPs, whole-fund contracts have longer waiting times to exit than deal-by-deal funds, consistent with the idea that the incentives to delay exits given whole-fund contracts are strongest in situations when the bulk of the realized return would be forfeited by the GP.

If, empirically, one contract form appears to dominate the other, then why are both types of contracts observed simultaneously in the market? One way to understand the GP quality channel is that variation in expected GP quality creates variation in the costs and benefits of alternative contract provisions. In other words, providing incentives for strong GP effort may come at the expense of insuring against poor GP performance. A closer examination of the incentive properties of these contracts supports this interpretation. Whole-fund carry provisions essentially compensate the GP with an option on a portfolio of investments, whereas deal-by-deal compensation is akin to a portfolio of options. Deal-by-deal provisions offer sharper incentives when investment-specific effort can have a large influence on the value of an individual exit, but their reliance on ex post settling up through clawbacks leaves the LP exposed to underperformance. Alternatively, whole-fund contracts protect LPs against underperformance but potentially blunt the incentives of GPs by allowing past exits to create a "debt overhang problem"

that may undermine the effort incentives in an on-going investment. Consistent with the idea that concerns around would-be clawback provisions drive LPs to favor whole-fund contracts, we find that investments in whole-fund contracts are more likely to be underwater - in other words, they are more likely to have triggered clawback provisions had they been structured as deal-by-deal contracts.

Taken together, these results demonstrate the different cost-benefit tradeoffs of the alternative contract forms. When concerns surrounding clawing back overcompensation are the greatest, the added security of the whole-fund structure outweighs the effect such a structure has on incentives. When providing incentives for risk-taking is the more salient consideration, the deal-by-deal structure dominates. This helps explain why we observe both types of contracts simultaneously in the market when at first blush, one contract form appears to dominate the other.

Relative to prior work, the novel feature of our analysis is its focus on carry-timing rules and the use of the data that allows new empirical analysis. We build on a number of recent papers. The closest is probably Litvak (2009), who establishes the importance of carry timing in a sample of contracts with no connected cash flow data. Gompers and Lerner (1999) and Metrick and Yasuda (2010) also analyze contracts, but do not have direct access to detailed cash flows. Choi, Metrick, and Yasuda (2012) model a variant of deal-by-deal contracts using simulations, but they do not employ actual fund contract and performance data. Robinson and Sensoy (2013) use larger, but coarser data and perform similar analysis with regards to the GP-friendliness of carry contract and fund performance, but they do not analyze carry timing rules; instead they analyze carry-percentage level and exit behavior around carried interest hurdles.

Our work is also connected to Axelson, Strömberg, and Weisbach (2009) who argue for the optimality of whole-fund compensation structures in private equity. At first blush, our results would seem to contradict their predictions: we show that deal-by-deal contracts outperform whole-fund contracts, whereas their model produces a whole-fund

structure with deal-by-deal leverage as the optimal contract. Importantly, they only consider buyout funds, while we focus exclusively on venture capital funds; the inability to access deal-specific leverage in venture capital, and the heavy right-skewness of venture returns are important differences between their setting and ours. Recent work by Hüther (2016) shows that in a model with no leverage considerations, whole-fund contracts are optimal when the skewness of returns is low, whereas deal-by-deal contracts are optimal when skewness is higher. In addition, the whole-fund structure in their model includes a hurdle rate and catchup provision which are typical for buyout but not for venture capital funds. Extending our empirical analysis into the buyout setting would provide a more direct test of their model's predictions.

The remainder of the paper is organized as follows. Section 2 discusses the data. Section 3 presents the main performance findings. Section 4 explores how contract types are determined in the market based on GP background and experience, while Section 5 provides evidence on the specific types of behavioral differences associated with the contracts. Section 6 concludes.

2 Data Description

The data in our study were provided to us by one of the largest international limited partners in the world on an anonymous and confidential basis. Although they are a large, global investor, we restrict attention to U.S. venture capital partnerships to narrow the scope of the investment strategies in question. For 85 venture capital funds raised between 1992 and 2005 we have detailed contract data obtained from the limited partnership agreements along with information on all 3,552 portfolio companies in which the venture capital funds (GPs) invested. Common examples of such portfolio companies are Google, Facebook and others.

Our data allow us to measure precisely the timing and size of all cash flows exchanged between each of the 85 funds and the 3,552 portfolio companies.[5] Importantly, our data provider undertakes special efforts to gather gross cash flow data, since normally the GPs transmit any gains on their capital net of fees (see, e.g., Metrick and Yasuda, 2010; Robinson and Sensoy, 2013). In addition, we have access to other internal information collected by our data provider in the due diligence process. This includes industry and fund management experience, age of the venture capital company, number of previous funds, investment focus and objective of the fund.

2.1 Sample Representativeness and Basic Summary Statistics

In this section we compare our sample to publicly available data collected by Thompson One and the other above mentioned studies in order to analyze the representativeness of our sample. In addition, we also briefly describe the three VC compensation elements established by Litvak (2009).

—Please see Table 1—

Table 1, Panel A reports characteristics of the fund and its general partners. The average first closing date in our data is December 2000, which is close to the comparable funds from the Thompson One database. However, we find that our sample consists of statistically and economically larger funds than the average from Thompson One. Partly, this is attributable to the fact that the large size of the Investor in question precluded them from investing in small funds. However, if compared to other recent studies with contract data, e.g., Litvak (2009) or Metrick and Yasuda (2010), we find that the size of our analyzed funds is similar (556 million USD vs. 401.7 million USD as

[5] Our sample size is comparable to that of a number of other studies of detailed contract characteristics with hand-collected datasets. For example, Litvak (2009) uses a hand-collected sample of 68 funds, and Metrick and Yasuda (2010) have access to 94 funds provided by a single investor.

in Litvak (2009) or 322 million USD as reported by Metrick and Yasuda (2010)). The percentage of early stage focused funds with 56% is similar to the overall statistics in the Thompson One database (45%), but overall the sample tilts towards larger, more early stage funds than many industry datasets.

While the age of the venture capital firm included in our sample is comparable to the overall investment universe approximated by Thompson One, our GPs are on average larger in terms of their previous investment activity. To capture this we compute the size of previous funds operated by the same general partners as a fraction of the total investment activity in the sector over the previous ten years. The GPs in our sample have committed about four times as much capital as the average in Thompson One. They are more experienced by a number of other measures as well. They have raised 2.8 funds on average, in contrast to 1.7 funds in the Thompson One data.

Although researchers and especially practitioners highlight the tremendous importance of investment experience in the industry, to the best of our knowledge no study has direct access to all curriculum vitas and other detailed information of the investment team. In addition to the standard measures of GP experience, our detailed access to due diligence materials allows us to measure the average experience of all investment professionals in the fund at the time the diligence materials are circulating. This is important because a first-time *fund* may comprise GPs with a wealth of experience at previous *firms*; their experience is typically unobservable to the econometrician but would surely be observable to a limited partner potentially considering a capital commitment. This allows us to control for previously unobservable variation in experience in our regressions later. The average team has 11.5 years of previous work experience in the industry.

Panel B summarizes contract characteristics, and in particular provides a first glimpse at the key variables of interest in our study; namely, the rules surrounding timing of carried interest payments. Our sample includes 60 deal-by-deal agreements and 25 fund-as-a-whole agreements. Our contracts largely mirror conventional wisdom with regard to

management fees and carried interest percentages. Our 20% carry percentage is in line with previous studies (Gompers and Lerner, 1999, Metrick and Yasuda, 2010, Robinson and Sensoy, 2013), where virtually all funds employ a carry of 20%.

In terms of management fees, our data are similar to many previous studies. The majority (46 cases) uses a 2.5% fee. Furthermore, for 28% of our observations we observe some variation regarding changes in fee basis from committed capital to either managed capital or net asset value. While the change in fee basis is only moderate, a change in fee level is far more pronounced. In roughly two thirds of all cases the fee declines to a mean value of 2% (see also Robinson and Sensoy, 2013).

2.2 Definitions and Detailed Summary Statistics

Turning to our key variables of interest we distinguish between two distributions rules, i.e., GP-friendly deal-by-deal compensation with clawback and LP-friendly fund-as-a-whole compensation with clawback. From Table 1, 71% (60 of 85 total funds) are deal-by-deal.

—Please see Table 2—

Panel A of Table 2 classifies our 85 venture capital funds by age and size of the VC firms, while Panel B shows the breakdown of distribution rules based on fund characteristics. Although the distribution of compensation rules is relatively evenly distributed regarding the age of the venture capital funds, larger VC firms and large funds (Panel B), which are likely to have a successful track record, are capable of negotiating the GP-friendly compensation rule. In contrast, the stage of focus (i.e., early vs. later stage) does not seem to play a main role. These findings confirm basic economic intuition.

3 Carry Provisions and Average Performance

3.1 Average Performance by Contract Type

The summary statics reported in Table 3 lay the foundation for our multivariate analysis by relating the distribution rules, years of relevant work experience and the vintage year of the VC fund to fund performance. We follow Kaplan and Schoar (2005) and calculate the PME by dividing the present value of actual cash outflows by the present value of actual cash inflows, using the observed returns on the publicly tradable index over the same time period as the discount factor. In the spirit of the "tailored PMEs" of Robinson and Sensoy (2016), we calculate ours using the Russell 2000 index, however none of our results are dependent on the particular index used to calculate the PME.[6]

—Please see Table 3—

Table 3 shows that PMEs for funds with a fund-as-a-whole compensation are significantly below deal-by-deal funds. In gross-of-fee terms, whole-fund contracts averaged a PME of 0.833 versus 1.241 for deal-by-deal; net-of-fees the PMEs were 0.967 for deal-by-deal versus 0.638. Performance is highly correlated with years of work experience and is significantly stronger in the 1992-1997 period.

Our data are rich enough to explore finer gradations in contract terms. In particular, we can distinguish between 'strict deal-by-deal', in which the GP is paid on a single deal basis getting paid after each single positive exit, and 'deal-by-deal realized loss', which

[6]In practice, the choice of benchmark in the PME calculation has little impact on the inferences one draws, especially in a setting like ours where most of the comparision is implicitly cross-sectional in nature (Harris, Jenkinson, and Kaplan, 2015, Robinson and Sensoy, 2016). Kaplan and Schoar (2005) use the S&P 500 index as a benchmark. Robinson and Sensoy (2016) also use the S&P 500 but extend their measure with "tailored" PMEs based on different indices being more in line with high growth, high risk characteristics of venture capital investments. In our analysis, we also use the Dow Jones Venture Capital index as a benchmark and also calculate the internal rate of return as an additional performance measure.

occurs when the GP is paid on a single deal basis but has to reimburse previous realized losses before earning carried interest. In addition, 'basic fund-as-a-whole' occurs when the GP receives no carry until LPs get distributions equal to contributed or invested capital, plus where applicable a preferred return. In contrast, 'full fund back' implies that the GP receives no carry until LPs get distributions equal to committed capital, plus where applicable a preferred return.

Panel B of Table 3 explores these finer gradations. It shows that there is a monotonic relationship between fund performance and the GP-friendliness of the contract terms. Strict deal-by-deal contracts are associated with the best average performance; these contracts offer the friendliest terms for general partners because they allow the GP to earn carry regardless of what has happened in prior deals. The differences between the different type of deal-by-deal contracts are less pronounced than the difference between either deal-by-deal contract and the average whole-fund contract.

3.2 Understanding Variation in Fund Performance

Before we turn to the main results in the next section, Table 4 focuses on performance only explained by market cycles, GP and fund characteristics.

—Please see Table 4—

The adjusted R^2 value in Model (1) indicates that vintage year fixed effects explain 13.7% of the total variation in PMEs. Models (2) and (3) connect performance of the fund in question to the observed cash multiple of previous funds at the time of the fund-raising. (For first-time funds this is the average multiple of the last fund associated with each investment professional.) This closely follows the analysis in Phalippou (2010), who argues that the persistence results reported in Kaplan and Schoar (2005) are not achievable in real-time by actual private equity limited partners because the partner

is required to commit to the follow-on fund before the performance of the extant fund is fully known. In Model (2) without vintage year fixed effects, we find no relation, consistent with Phalippou (2010). However, in Model (3) we add vintage year fixed effects to the past performance regression, and the adjusted R^2 value rises to 16.3% and the loading on past performance becomes statistically significant at the 10% level.

Models (4) and (5) introduces our new measure, the years of relevant prior work experience. This variable measures a feature of the private placement memorandum that would be easily observable to the limited partner in question, but is not typically observable to the empiricist observing the data ex post. The measure is highly statistically significant, but small in comparison to the average difference in contract terms. The magnitude of the point estimate indicates that it would take more than ten years of work experience to erase the difference in the average performance between deal-by-deal and whole-fund contracts.

Model (6) introduces both measures simultaneously. Here we see that the explanatory power of the observed multiple jumps dramatically when we hold constant the work experience of the investment team. That is, persistence is strong if it is possible to condition on the past work experience of the investment professionals when comparing two first-time, second-time, third-time, etc., funds. This result is the opposite of what Phalippou (2010) argues and indicates that controlling for information that would be available to limited partners but unobservable to the econometrician is critical for understanding persistence (see also Korteweg and Sorensen, 2017).

Models (7) and (8) include additional controls. Controlling for fund size and the number of past funds adds little to the analysis.

In the remainder of the analysis, we use the variables in model (7) as baseline controls, as this specification has the highest adjusted R^2 of any of the models in Table 4. Model (7) shows that the performance persistence result first documented by Kaplan and Schoar (2005) holds in our sample even when it is based on performance data available at the

time the commitment is made.

3.3 Carry Distributon Rules and Average Performance

We begin in Panel A of Table 5 by exploring the relation between carry distribution rules and gross-of-fee performance. Overall, the results indicate that GP-friendly, i.e., deal-by-deal, compensation is associated with higher performance. The economic effects are also large, slightly below the magnitude of the difference in unconditional means reported in Table 3.

—Please see Table 5—

Column (1) omits vintage year fixed effects but includes the controls from Table 4, Model (7). In this specification the average performance difference in gross performance is 0.406, which is essentially equal to the raw performance difference reported in Table 3. In Column (2) we introduce vintage year fixed effects and the magnitude of the distribution rule dummy drops to 0.322.

Columns (3) and (4) introduce management fees and carried interest. We find that higher fee funds deliver higher gross-of-fee performance, which is consistent with the net-of-fee evidence in Robinson and Sensoy (2013). Column (5) adds contract terms to the specification but omits vintage year fixed effects; this specification is comparable to Model (1) and indeed the point estimate of 0.397 illustrates that controlling for deal terms in the absence of vintage year fixed effects does little to erase the main result. Although the limited amount of variation in the data gives us low power to identify the effect, the loading on carried interest in Model (5) says that VC funds that were able to command more than 20% carried interest under-performed after we control for other contract terms.

When we include vintage year fixed effects in Model (6), however, we see that the inclusion of fees and carry lowers the point estimate on the deal-by-deal dummy from 0.322 in Column (2) to 0.277. The fact that controlling for fees and carry has a larger impact on the deal-by-deal point estimate in the presence of vintage year fixed effects is a reflection of the fact that there is a great deal of time-series clustering of carry and fees, as illustrated in Robinson and Sensoy (2013). All told, the combined effect of vintage year fixed effects, observable GP characteristics and other contract terms erases around one-quarter of the overall performance difference associated with deal-by-deal carry provisions.

The results in Panel A of Table 5 do not allow us to know whether LPs benefit from a higher performance with GP-friendly provisions. They only indicate that GPs are better off with GP-friendly contracts. Panel B of Table 5 turns to the question of net-of-fee performance. This allows us to ask whether LPs are better off in funds with GP-friendly provisions.

We relate contract terms to net-of-fee performance using regression specifications that mirror those reported in Table 5, Panel A. The results are qualitatively similar. In particular, we find that net-of-fee returns are in between 22 to 36 percentage points higher for deal-by-deal distribution rules than fund-as-a-whole rules. In Panel A the analogous coefficients are 28 to 41. If the increased performance were purely captured by the GP, we would expect that there would be no difference in net-of-fee performance based on the distribution rule. In fact, pushing to the extreme, based on the evidence in the mutual fund industry, one might even expect deal-by-deal agreements to return *lower* net-of-fee performance if GPs were essentially able to overcharge for their quality.

In contrast, if the difference in performance owed strictly to induced incentives, and LPs were able to pin GPs down to their participation constraint, then we would expect the coefficients on net-of-fee performance to exactly equal those obtained for gross-of-fee performance. Instead, we see a result in the middle, indicating that the gains are

shared between the two parties, with the bulk of the extra returns flowing directly to limited partners in the form of higher net-of-fee returns. Turning to management fees, Table 5, Panel B shows that performance is no longer significantly positively related to management fees, in contrast to the finding in Panel A. This result supports the finding that differences in bargaining power drive the relation between management fees and performance.

The comparison of gross and net of fee returns is important for several reasons. First, it helps us to shed light on rent extraction and GP's bargaining power. One could argue if it were the case that GP-friendly provisions were purely a form of rent extraction, and that better quality GPs (or higher status GPs) were better able to bargain on their own behalf, then we would expect to see no results on net-of-fee returns. Instead the results suggests that better quality GPs do not extract the entire performance differential between LP- and GP-friendly fund types.

—Please See Figure 1—

Figure 1 summarizes the results of this section. Blue columns on the left are gross-of-fee performance, red columns on the right are net-of-fee. The columns marked "Raw" reflect the uncorrected differences from Table 3. "History" summarizes column (1) of Table 5. The columns labeled "Vintage" adds vintage year fixed effects to the historical performance controls. This corresponds to Column (2) of Table 5. Finally, "Contracts" adds contract terms; this is Column (6) from Table 5. The table shows that there are pronounced differences between deal-by-deal and whole-fund contracts that persist even after controlling for vintage years, for contract terms, and for observable past performance. Moreover, much of this performance accrues to limited partners, it is not simply captured by general partners.

4 Understanding Contract Assignment

The results thus far demonstrate a correlation between the timing of carried interest and fund performance. One obvious explanation for this result is that better quality GPs are more likely to sort into GP-friendly contracts. In this section we explore this channel by exploring how GP characteristics are correlated with the observed distribution rules. First we model the probability that a GP receives a GP-friendly contract as a function of observable characteristics. Then we decompose the observed performance differential using a propensity score analysis to assess whether assignment based on observable characteristics captures the bulk of the difference in performance between GP- and LP-friendly contracts.

4.1 Probit Analysis

Table 6 displays estimates of probit models where the dependent variable equals one if we observe a fund with a deal-by-deal structure and zero otherwise. For the explanatory variables we consider GPs' investment histories and industry experience. The results in Panal A of Table 6 show that not being a first time fund is significantly related to the probability of a deal-by-deal compensation. Establishing a relationship with a GP and being able to invest in follow-on funds is often seen as an important reason for investing in a first time fund. Based on careful reading of due diligence reports and conversations with investors, a first time fund is generally viewed as a high risk investment.

—Please see Table 6—

The increments in pseudo R^2 from column (1) to column (6) in Panel A tell us that most of the variation in the distribution rule is related to market conditions and the "No first time fund" dummy. In columns (3) and (4) we introduce the average venture capital experience of the managing partners (in years) and the previous fund's gross return

multiple. In contrast to the return multiple, the positive loading on work experience is only significant when controlling for previous fund performance (column 5). Investors seem to discount work experience in their investment decision if managing partners do not have any track record in previous venture capital firms.[7] Controlling for fund size (column 6) slightly increases the explanatory power of variables in model (5).[8]

Table 6 Panel B introduces interaction terms between "No first time fund dummy" and "years of relevant work experience" to explore whether less noisy performance signals increase the probability of a deal-by-deal contract. Across all models we find a significant positive loading on work experience, i.e. that the probability of a deal-by-deal provision increases with partners' previous work experience in a first time fund. The results hold whether we exclude vintage year fixed effects (columns 1-3) or include them (columns 4-6). The structure of the regression equation essentially splits the overall effect of work experience into two components, a part that obtains among the sample of first time funds, and a part that obtains among the sample of second-or-higher funds. The loadings imply that the years of relevant work experience is a significant predictor of receiving GP-friendly contracts only among first-time funds—those funds for which track records are the most noisy.

Overall, these results are consistent with the idea that GPs with higher bargaining power are able to obtain GP-friendly provisions in the limited partner agreements they strike with investors.

[7]We find a significant positive loading on work experience in column (3) of Panel A if we exclude observation of funds without track record of their managing partners.

[8]In non-tabulated results, we estimated all models without vintage year fixed effects and find that previous work experience and past performance (if winsorized) no longer have a significant loading. Evidently, the choice of the distribution rule is less affected by measures of performance in good market conditions.

4.2 Propensity Score Matching

The results thus far show that the timing of carried interest affects fund performance, and they suggest that at least some portion of this owes to the fact that higher-talent GPs receive better contracts. The question is whether this is the whole story. Towards this end, in this section we implement a propensity score matching analysis first proposed by Rosenbaum and Rubin (1983), which allows us to match treated (that is, GPs with deal-by-deal contracts) to non-treated (whole-fund contracts) funds based on a high-dimensional set of matching characteristics.[9] This allows us to compare the performance of a fund that received a deal-by-deal contract to an observationally similar fund that did not. Under the assumption that there is no selection on unobservables, the difference between the treated and observationally similar untreated funds is then a causal estimate of the treatment effect of contract assignment. We discuss the importance of this assumption in greater detail below.

Table 7 presents the analysis. In Panel A, we report the Probit model that generates the propensity score used to match deal-by-deal and observationally similar whole-fund contracts. The point estimates reported in Panel A closely match those in Panel A, column 6 of Table 6. The key difference is that instead of introducing vintage-year fixed effects, we include two "vintage-year period" effects, one for the 1992-1998 period, another for the 2002-2005 period. This broadens the scope for matching, allowing a 1993 vintage fund that received a deal-by-deal contract to be matched against a 1995 firm that was similar along observable dimensions but instead received a whole-fund contract. Using annual fixed effects instead would restrict matches to being in the same vintage year; this would result in many more treated observations falling outside a common support and therefore being dropped from the sample forming the comparison reported

[9] See Roberts and Whited (2012) or Li and Prabhala (2005) for detailed discussions of finance-related applications in which propensity-score models are used to address endogeneity concerns in corporate finance.

in Panel B.[10]

—Please see Table 7—

Panel B reports two forms of propensity score matching, radius-matching and 3-nearest neighbor matching. Column 2 of Panel B reports the average performance under treatment with deal-by-deal, both for the unmatched sample (the upper row) and the matched sample (the lower row). Columns (3) and (4) report the average treatment effects on the treated for both types of matching algorithms. That is, columns (3) and (4) report the difference between the observed performance of the deal-by-deal sample and the hypothesized performance of that same sample if they had instead received whole-fund contracts, making use of the matched neighbors to compute this hypothesized counterfactual quantity. Thus, the matching algorithm indicates that about 75% of the observed average difference in gross PME remains after controlling for the endogenous sorting of high quality GPs to GP-friendly contracts based on observable characteristics. The remainder could be associated with unobservable characteristics (unobservable to the econometrician, i.e. not found in due diligence documents) or the contract itself induces the GP to behave differently than they might otherwise facing different contract conditions.

Propensity score matching indicates that a larger fraction of the difference in net PME is attributable to contract assignment. One reason for this is the fact that contract terms are correlated: deal-by-deal contracts also are more likely to have higher carried interest provisions and higher fees, which in turn means that the value flowing back to the LP is commensurately lower.

The quality of the matching exercise can be assessed from Panel C. Column (2) reports the average value of the relevant independent variable among the set of deal-by-

[10]The common support assumption discards any treated observation that has a propensity score greater than that of the highest untreated observation. In our setting, this removes nine deal-by-deal LPAs from the comparisons reported in Panel B.

deal contracts that are matched as well as those that are unmatched. Columns 3 and 4 report differences in means between the treated and control group, both before and after matching. The goal is to obtain estimates of the propensity score that statistically balance the covariates between treated and control group. Thus, the fact that the differences are insignificant after matching indicates a good balancing.

The critical identifying assumption required to attach a causal interpretation to the differences we have reported above is that each fund has the same probability of receiving a deal-by-deal contract conditional on the observed propensity score (see Rosenbaum and Rubin, 1983 or Dehejia and Wahba, 1999). We cannot rule out that there is no selection on unobservables, which would violate the conditional independence assumption. Nevertheless, we have access to the same performance and due dilligence information that is also available to the investor. Thus, these unobservable differences would also have to be unobserved by the investor, or else observable but only in a manner that is not somehow captured in the recorded due diligence materials. Given the likely positive correlation between selection and treatment, either of these possibilities would lead our propensity score analysis to understate the true impact of selection. It is important to bear this consideration in mind when interpreting the results from this section; however, it is equally important to bear in mind that our goal is simply to ask whether selection is likely to account for the entire difference in observed performance between the two types of contracts.

5 Direct Evidence of Behavioral Differences

The previous sections demonstrate that GP-friendly contracts are associated with higher returns, both on a gross and net of fee basis, and that these return differences are not entirely due to observable differences in inherent GP quality. In this section we provide direct evidence that contracts are associated with different types of investment. To do so

we proceed in three steps. First we examine how the timing of exits varies across contract types, second we analyze effort incentives, then we examine differences in risk-taking and contract timing.

5.1 Exit Timing

Figure 2 illustrates the timing of investment and exit decisions according to whether the fund follows a whole-fund or deal-by-deal carry scheme. The left column of Figure 2 depicts the distribution of investment times for the two types of contracts as a function of fund age. This is generated by pooling all initial investments by fund age for each contract type and then plotting the distribution of investments. There is very little difference in the distribution of investment times: for both contract types the median investment occurs in about the 7th or 8th quarter of the funds' existence (dashed line; solid line equals the mean), meaning that funds have made about half of their initial investments by the beginning of their third year of existence.

—Please see Figure 2—

Unlike with investment times, there are substantial differences in the distribution of exit times by contract type, as can be seen by the two graphs in the right column of Figure 2. For deal-by-deal funds, the mean exit occurs in around the 29th quarter, while for whole-fund the mean occurs in about the 33rd quarter. These differences in means and medians mask substantial variation in the overall distribution, however. Deal-by-deal distribution times follow the evolution of net asset values that one would obtain by using the parameters in Metrick and Yasuda (2010) and forecasting the evolution of NAVs.[11] This is consistent with the idea that managers under deal-by-deal contracts are acting under an incentive to maximize the value of each exit irrespective of how it is connected to the broader portfolio they manage.

[11] Calculations based on simulations are available from the authors on request.

In contrast, whole-fund contracts are associated with a first spike in distributions between the 16th and 18th quarter of the fund's life, and a later spike around the 40th quarter of age. The first spike coincides roughly with the end of the funds' investment period, and hence the need to raise a follow-on fund. This is related to findings in a series of papers (see Barber and Yasuda, 2017; Brown, Gredil, and Kaplan, 2016; Jenkinson, Sousa, and Stucke, 2013 and Chakraborty and Ewens (2017)) connecting the timing of fund-raising decisions to revisions in the stated net asset values of the underlying assets under management of the GP: it suggests that whole-fund contracts operate under an increased incentive to grandstand, posting early returns to investors in order to send a signal of the fund's underlying quality.

—Please see Figure 3—

In line with the findings by Robinson and Sensoy (2013), GPs also tend to cluster exits just after GPs' start earning money (break-even (BE) fund quarter (dotted line)), in case they underlie a whole-fund carry distribution. By displaying the densities of exit times for whole-fund and deal-by-deal distributions in one graph (see Figure 3), one can see that GPs with a whole-fund compensation delay exits compared to funds with a deal-by-deal distribution. We cannot observe the counterfactual of what would happen to performance if GPs held investments for shorter or longer than they actually do. However, in unreported results, we find that the average investment PMEs of these exits are in fact lower compared to early exits for funds with a whole-fund carry provision. It seems that these GPs hope for better exits as long as the fund's expenses are not recouped.

—Please see Table 8—

Table 8 examines this in greater detail with hazard rate models that model the hazard of exiting a portfolio company investment as a function of the carry provisions. Columns

(1) and (2) report multiple observations per failure specifications using the entire data set. Hazard impact factors are reported. The coefficients on deal-by-deal carry provisions indicate that relative to whole-fund carry provisions, deal-by-deal contracts have a higher exit probability. Column (2) introduces dummy variables for the level of carried interest earned by the GP in question. LPAs with higher GP carried interest percentages are associated with longer holding times, but this is imprecisely estimated. Funds with higher observed prior multiples exit more slowly, as do larger investments. Funds with more experienced management teams are more likely to exit.

In Column (3) we introduce an interaction term between the strict deal-by-deal indicator and a dummy for whether the fund is likely in fund-raising—specifically, a dummy variable that is equal one during fund-quarters 12 through 22. The main effect of the fundraising period accelerates exit, but this effect is modest in the full sample. The interaction term indicates that investments undertaken in funds with deal-by-deal contracts are associated with a markedly lower hazard of exit during the fundraising period, confirming the intuition provided by Figure 3. This effect is highly statistically significant.

Columns (4) and (5) split the sample according to whether the investments in question were above or below their initial investment cost and repeats the analysis of Column (3). Comparing the point estimates on the interaction term across the specifications illustrates that funds with whole-fund contracts are exiting strong investments early, presumably in order to "put points on the board," in a manner consistent with the findings of Barber and Yasuda (2017) and Brown et al. (2016). In the subsample of in-the-money investments, the main effect of the fundraising time-period dummy dramatically increases the hazard of exit and is highly significant. The combined interpretation is that having profitable investments to exit during the natural fundraising time-period is highly correlated with exit for whole-fund contracts, but not for deal-by-deal contracts.

5.2 Effort

The findings presented immediately above call into question whether effort incentives might be distorted for these later exits. Manso (2011) shows that the tolerance for early failures and the prospect of pay for performance later on motivates more innovative business strategies. His findings in the broad area of managerial compensation, map nicely into the deal-by-deal and whole-fund context. Basically, early failures lower the overall probability that the fund outcome reaches the GP's whole-fund compensation threshold. Therefore, the GP might be inclined to exert less effort for follow-on exits compared to whole-fund since he faces the risk of not being compensated for their success. Figures 4 and 5 present cumulative distribution functions of realized investment PMEs conditional on the performance of early exits. Exits are considered early if they occur within the investment period (typically five years), and late if investments are realized after the investment period.[12] Early fund exits are labeled as strong if the ratio of top quartile (based on early exits of all funds) to total exits exceeds the ratio of bottom quartile to total exits by at least fifty percent.[13]

—Please see Figures 4 and 5—

In line with our fund level results, Figure 4 shows that conditional late realized investment PMEs are more likely to be lower for a whole-fund compared to a deal-by-deal compensation. This difference increases conditional on weak early exits, as shown in Figure 5. Higher PMEs of late exits for deal-by-deal funds can be realized especially in the midrange performance. This finding illustrates the important effort incentive effects in correspondence to the compensation effect in terms of present value differences between distribution rules for mediocre funds, pointed out by Litvak (2009)

[12]To compute this, we used the actual date of the investment period as stated in the due diligence materials.

[13]Our results hold for various percentage differences between top and bottom quartile ratios. No whole-fund in our sample has reached the profit zone within the investment period.

and confirmed for our sample in the appendix. The result is also in line with the industry conjecture that little time is required for real winners - or worst performers and that allocating the bulk amount of time to those middle portfolio companies is most efficient.

5.3 Market Timing and Risk-taking

The evidence in Figure 2 suggests that general partners facing deal-by-deal contracts have a reduced incentive to exit early in order to signal their quality to investors. To explore exit timing in more detail, Figure 6 examines how the exit times line up with broader market conditions.

—Please see Figure 6—

In the left column of Figure 6 we sort fund quarters not chronologically but instead by contemporaneous market returns over that quarter. Towards the left are quarters associated with low market returns; towards the right market returns improve. Then we plot the distribution of exits as a function of these underlying market conditions along the vertical axes. This allows us to plot the gross PME realized on each exit as a function of the market conditions when the exit occurred.

The blue line in the top portion of the left column shows PMEs for deal-by-deal funds; the fact that it is almost always above the red line (for whole-fund) indicates that in most market conditions deal-by-deal funds outperform whole funds by a small margin. But this margin grows substantially in the quarters with the very strongest market returns. This indicates that deal-by-deal funds are able to generate large exits in strong market conditions. This is not to say that deal-by-deal managers possess market-timing skill in the traditional sense of the word, just that they are relatively better at exiting in strong market conditions than whole-fund managers are.

The final piece of behavioral evidence appears in the right column of Figure 6. Here we use the method described in Ljungqvist, Richardson, and Wolfenzon (2017) to compute the volatility of venture capital investments at the portfolio company level. This allows us to plot the evolution of risk-taking over the fund's life as a function of whether it is associated with whole-fund or deal-by-deal carry. The difference in fund structures is striking. Whole-fund contracts are associated with less risk-taking upfront, but their risk-taking spikes as the fund's age grows. In contrast, deal-by-deal contracts are more uniformly concentrated in higher risk investments throughout the fund's life.

—Please see Figure 7—

These factors culminate in return distributions that look quite different for whole-fund and deal-by-deal constracts. Figure 7 plots returns for deal-by-deal and whole-fund contracts in terms of multiples on invested capital. The distribution of returns is significantly more right-skewed for deal-by-deal contracts than for whole-fund contracts. Among the set of whole-fund contracts, the maximum multiple on invested capital is around 2.5, whereas for deal-by-deal contracts exceed 3.5 times invested capital in some instances. While our results cannot dispel that the difference in average returns, whether measured by PME or any other measure, stems from selection on unobservables, we find that exit-timing, market-timing and risk-taking in deal-by-deal contracts rather square with extreme returns that drive performance in venture capital.

6 Conclusion

Private equity compensation practices have come under increasing scrutiny in recent years. Many practitioners, academics and industry observers have called for broad changes in the way that general partners are compensated, placing special emphasis on the timing of when LPs and GPs receive their carried interest compensation. Indeed,

the Institutional Limited Partners Association (ILPA) argues that "A standard all-contributions-plus-preferred-return-back-first model must be recognized as a best practice" ILPA (2011).

Suggestions such as this are of course predicated on the implicit assumption that these LP-friendly terms and conditions are in fact good for limited partners. This ignores two possible roles that contracts may play. One is that contracts effect incentives–that altering the compensation structure that GPs face will in turn alter their behavior. The second is that contracts signal quality–that GPs and LPs can use the heterogeneity in the friendliness of compensation provisions as a way of allowing GPs of imperfectly observed quality to signal their ability.

This paper uses hand-collected, proprietary data connecting the terms of private equity management contracts to investment outcomes to show that GP-friendly contracts are associated with higher performance, both for the general partners as well as the limited partners. In other words, we find better investment performance for limited partners among the set of deals supported by GP-friendly contracts than among the set of deals supported by LP-friendly contracts. This finding does not support the oft-stated view that overly friendly management contracts destroy value for limited partners. All results are consistent with the opposite to be true.

We, of course, urge caution in making causal claims. The ultimate thought experiment would be to randomly assign contracts to GPs and compare performance across GP-friendly and LP-friendly contracts. No such random assignment occurs in reality. Thus, one reason for these findings is that the presence of GP-friendly terms is endogenous to the characteristics and past experience of the general partner. Better general partners command better compensation on average.

But our analysis suggests that there is more to the story than this. Indeed, the assignment of deal-by-deal contracts to better general partners is itself a reflection of the fact that the two contracts offer different tradeoffs between incentives for effort

and downside protection for LPs. Moreover, the terms of the contract appear to cause general partners to behave differently than they would have otherwise. LP-friendly contracts seem to penalize early unsuccessful exits as GPs are less likely to reach the carry threshold. This is particular problematic for VC funds, since their investment return distribution is on average strongly right skewed. GPs for these funds seem to be less motivated to exert effort conditional on poorly performing previous exits. GPs operating funds under LP-friendly contracts appear to begin by generating early exits in relatively less risky deals. This suggests they have a motive to "put points on the board," consistent with the classic "grandstanding" results of Gompers (1996).

There are a number of potentially competing mechanisms behind this finding. One is that the whole-fund provisions induce general partners to exit investments early so that they can begin earning carried interest. The idea is that early in the fund's life they wish to return invested capital as quickly as possible so that they can begin earning carried interest. If this is at work then the LP-first compensation structure appears to undermine the LPs performance, as it induces GPs to exit early.

A second potential mechanism is more subtle and is based on a signaling argument. The idea here is that if market participants know that the pool of whole-fund contracts contains low quality GPs as well as high quality, but as-yet unproven, GPs, then general partners may use early exits as an attempt to signal their quality. (This is closer in line with the spirit of the classic grandstanding result of Gompers, 1996). If this is the primary mechanism behind the early exit, then abolishing deal-by-deal carried interest, as suggested by ILPA and other industry observers, would cause known high quality GPs to pool with everyone else, and the lack of an alternative available contract would presumably undermine the incentive to exit early. It is not possible to differentiate between these potential mechanisms, and it is important to recognize that they have potentially different welfare implications for limited partners. Thus, if anything, this paper shows that policy makers should proceed with great care when prescribing changes

to the contractual environment of private equity investment. Policy stances that would seem superficially to be desirable for limited partners are not obviously better. Indeed, our results suggest that venture investors get what they pay for, at least on average.

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Appendix: Economics of Distribution Rules

This appendix briefly describes the different distribution rules, also known as the "distribution waterfall". While the management fee and the carried interest are well understood in prior research, the distribution rules define *when* the general partner is entitled to profits. Given that the typical life of a venture capital fund is ten years plus an additional one or two-year extension possibility, it is obvious that it matters whether the GP earns income associated with above-cost exits in, e.g., year four or year ten of the fund's life. Thus, in this appendix we first describe the distribution rules and second we apply the same methodology as in Litvak (2009) to our data to shed light on the economic importance of the waterfall.

The most GP-friendly contract is the "strict deal-by-deal" (sDbD) payment structure, where the GP keeps the amount of variable compensation according to the agreed profit split (carried interest), i.e., each deal is evaluated on its own and the positive or negative exit history of previous investments does not matter. Another, still GP-friendly, payment contract is the so-called "deal-by-deal realized loss" (DbDrl) structure. Here, the history of earlier exits are taken into consideration and the GP has to return invested capital in all realized investments -but not capital invested in unrealized investments- before the GP is entitled to any profits. However, this cannot be the whole story, given that limited partners (LPs) are professional investors, who want to be protected from downside development and -at least- recoup the invested capital after the ten year life span in case the whole fund is exited below costs. Thus, to prevent that the GPs earn profits in these adverse states of the world, the typical limited partnership agreement (LPA) contains a clawback provision stating that the GP has to repay the necessary carried interest so that the LP is compensated in case there are any remaining losses on invested capital at the end of the fund's life.

Nevertheless, one has to recognize that both deal-by-deal (DD) payment structures allow the GP to earn interest payments on early distributions, which are not claimed back by the LP even if the fund is exited at a loss. Thus, Litvak (2009) refers to this form of distribution as an interest free loan to GPs from LPs.

In contrast, the two LP-friendly whole-fund (WF) distribution rules differ with regard to the amount that has to be returned from the GP to the LP throughout the fund's life. While "basic fund-as-a-whole" requires each investor to regain their total capital contributions before the LP is entitled to receive any carried interest, "full fund back" even means that not only all drawn money but an amount equivalent to the full committed capital has to be paid to LPs prior to any carry entitlement of the GP. Thus, at the fund liquidation date, disregarding the differences in interest rate payments, a DD with clawback equals a WF compensation with clawback, where the GP is not paid until the LPs have received distribution equal to the fund's total capital.

Turning to the second part of the analysis we next show how large the economic impact is moving from a deal-by-deal compensation to a whole-fund compensation closely following the approach used by Litvak (2009). We estimate the impact of these rules on the GP's compensation based on our proprietary dataset and also incorporate quarterly average cash flow data by fund vintage year provided by Thomson One. Please note that estimation of the economic importance requires assumptions about the fund life, the timing and the amount of invested capital as well as the corresponding distributions to the GPs in order to calculate the value of the interest-free loan created by the four distribution rule refinements. Given that the impact of the distribution rules differs across economic cycles, we use different vintage years that are associated with low, medium and high profit funds.

Carefully note that Thomson One provides net cash flows, excluding management fee and carried interest. Thus, we calculate the GP's compensation as profits based on the distribution rule refinement divided by the LP's profit percentage times the GP's profit

percentage. For each of the four distribution rule refinements we employ the following approach defining how to associate these refinements with the observed distributions. For a "strict deal-by-deal", the GP receives carry if the funds' average distributions to investors exceed the first quarter average takedowns. Afterwards, she receives distribution if the former is higher than the second quarter and so on. The procedure is identical for a "deal-by-deal realized loss", except that once the GP has received her first distribution, negative differences between the quarters' average distributions to LPs and related average takedowns are subtracted from GPs' payoffs. In case of a "basic fund-as-a-whole" we compare the cumulative amount of the fund's distributions to LPs and the amount that was taken down to date. The GP gets the carry for the positive difference between the former and the latter. Considering a "full fund back" the GP receives carried interest in each quarter on gross fund profits defined as the positive differences between cumulative distributions to date and committed capital. Finally, the present value (PV) calculation of the periodic carry payouts is performed using a 10 percent discount rate assuming an eleven-year fund life (ten year + one year extension to allow exiting of the last investments; see also Litvak (2009)). The economic importance of the different distribution rules and the carry percentage is shown in Table A1. The results are based on a 100M USD fund that has the cash-flow schedules of an average medium-profit fund (average 1997 vintage-year fund).

Table A1: Value of distribution methods

This table shows the impact of a change in carried interest percentage and distribution rule on GP compensation for an average 100M USD fund with a life time of eleven years raised 1997 (medium profitability year with net return multiple of 1.92). In columns (1) and (2), the distribution rule is held constant ("basic fund-as-a-whole") and carry percentage changes from 20% to 25%. In columns (3), (4), (5) and (6) the carry percentage is held constant (20%) and the distribution method changes from most LP-friendly ("full fund back") to most GP-friendly ("strict deal-by-deal"). Discount rate is 10% for carry p.a..

	Present Value of Carried Interest (Basic fund-as-a-whole distribution rule)		Effect of Distribution Rule on Present Value of Carried Interest (20% Carried Interest)			
	(1)	(2)	(3)	(4)	(5)	(6)
	20% Carried Interest	25% Carried Interest	Full fund back	Basic fund-as-a-whole	Deal-by-deal realized loss	Strict deal-by-deal
	Medium-profit fund with return multiple of 1.92 (Average for Vintage Year 1997)					
Value	13.10	17.47	11.99	13.10	17.80	18.93
Difference		4.37	1.11	4.70	1.13	
Ratio		1.33	1.09	1.36	1.06	
Average			12.55		18.37	
Difference				5.82		
Ratio				1.46		

As shown in Table A1 an increase from 20% to 25% carry, assuming "basic fund-as-a-whole" distribution method, increases the PV of carry by a factor of 1.33, or 4.37M USD for the medium-profit fund. Most importantly, considering a shift from a deal-by-deal to a whole-fund regime increases the PV of carry by a factor of 1.46 or 5.82M USD. Thus, the effect of a change between these two distribution schemes is economically large and has the same order as a change in carry percentage.

In unreported results we repeat this analysis for a fund raised in 1999 (low profitability starting year with net return multiple of 0.42) and a fund raised in 1993 (high profitability year with net return multiple of 2.63). While for a high-profit fund moving ceteris paribus from LP to GP-friendly compensation yields around 2M USD higher compensation for the GP (in present value terms), this effect turns out to generate only approximately a 1M USD increase in salary for a low profit fund. Overall, these results are in line with Litvak (2009), who based her calculations on data provided by Sand Hill Econometrics.

Tables

Table 1: Sample representativeness and GP compensation terms

Panel A reports comparisons between average characteristics of our data and that of Thompson One data, excluding our funds. We use Thomson One's Fund Statistics Report with the report date of March 31, 2012. Panel A shows fund data as follows: "First closing" denotes the mean first date of closing, while "Size" denotes the fund's committed capital in million USD; "Early stage focus" is an indicator variable which takes the value of one, if fund stage is classified as seed or early and zero for balanced and later. "VC Company Size" expresses the size of the company in questions (across all it's previous funds) as a fraction of the total capital it raised relative to the total amount raised by all venture organizations (i.e., investors' commitments) over the ten years preceding each fund. "VC Company Age" shows the age of venture capital company, i.e., the time of the closing of the first partnership that the venture capital organization raised to the closing of this fund. The variable "# of past funds" gives the number of past funds of the VCC, and "years of rel. work experience" denotes the average number of years the principal fund managers have spent in positions in venture, private equity management and finance as measured by the Investor. The third column in Panel A presents the p-values associated with the null hypothesis that the moments of these distributions are identical. (Unreported median results are qualitatively the same).
Panel B tabulates contract terms. "Carry Timing" shows the number of deal-by-deal vs. whole-fund contracts in our sample. "Carried Interest" splits the sample according to the level of carried interest as the percentage of the fund's profit. "Management Fees" provides a breakdown regarding the level of annual management fees as the percentage of the fund's committed capital at the beginning of the fund's life. "Fee Timing" includes the following three categories: "% of funds changing fee basis after investment period" is the proportion of funds that changes its fee basis from committed capital to net invested capital after the completion of the investment period (which is typically five years for a ten-year fund). "% of funds changing fee level after investment period" is the proportion of funds that changes its fee level from its initial fee level after the completion of the investment period. "% of funds changing both basis and level" is the proportion of funds that changes both its fee basis and fee level after the investment period.

	Our sample: Cash-flow data with LPAs	Mean in Thompson One excluding our sample	P-values testing for diff. between our sample and Thompson One
Panel A: Fund and Company data			
First closing	December 2000	September 2000	0.006
Size (m USD)	556.004	85.404	0.000
Early stage focus	56%	45%	0.042
VC Company Size (% of Industry $)	0.589%	0.144%	0.000
VC Company Age (in years)	10.29	9.01	0.106
# of past funds	2.81	1.71	0.001
Years of rel. work experience	11.55	-	-
Panel B: Contract Characteristics			
Carry Timing:			
# of funds with deal-by-deal carried interest		60	
# of funds with whole-fund carried interest		25	
Carried Interest:			
# of funds with carry percentage $> 25\%$		4	
# of funds with $20\% <$ carry percentage $\leq 25\%$		40	
# of funds with carry percentage $= 20\%$		40	
# of funds with carry percentage $< 20\%$		1	
Management Fees:			
# of funds with initial fee level equal to 2.5%		46	
# of funds with initial fee level equal to 2%		24	
# of funds with initial fee level less than 2%		15	
Fee Timing:			
% of funds changing fee basis after investment period		28.2%	
% of funds changing fee level after investment period		67.1%	
% of funds changing both basis and level		8.2%	

Table 2: General partner, fund characteristics and fund performance

This table presents the number of all distribution rules of the 85 sample limited partnership agreements for several GPs (panel A) and fund characteristics (panel B). "Age of venture capital organization" refers to the time of the closing of the first partnership that the venture capital organization raised to the closing of this fund. "Size of venture capital organization" is the ratio of the capital invested in the organizations funds, in USD, whose first closing was in the ten calendar years prior to the year that this fund closed, to the total amount raised by all venture organizations (i.e., investors' commitments) in these years, again in USD. "Stage focus" splits the sample into early stage funds and other stage funds. Being precise, "early stage focus" is a dummy variable which takes the value of one, if fund stage is classified as seed or early and zero for balanced and later. "Fund size" is the total capital committed to the venture fund, specified in the partnership agreement.

	deal-by-deal	whole-fund
Panel A: GP characteristics by distribution method		
Age venture capital organization		
5 years or less	28	10
Between 5 and 15 years	13	9
More than 15 years	19	6
Size of venture capital organization		
No earlier funds	11	5
Between 0% and 0.5%	29	15
Greater than 0.5%	20	5
Panel B: Fund characteristics by distribution method		
Stage focus		
Early stage focus	26	13
Other stage focus	34	12
Fund size		
$100m or less	8	6
Between $100m and $500m	29	14
Greater than $500m	23	5

Table 3: VC Fund Performance and Distribution Rules: Raw results

Panel A reports the mean, median in percent and standard deviation [s.d.] of the public market equivalent (PME) based on the Russell 2000 for the two distribution rules "deal-by-deal" and "whole-fund". The PME is calculated by discounting the actual cash outflows and cash inflows of the fund with the returns on the Russell 2000 over the same time period and forming the ratio of the discounted cash inflows over the discounted outflows. "Years of rel. work experience" denotes the average number of years the principal fund managers have spent in positions in venture, private equity management and finance as measured by the Investor. "Vint. year/first closing" denotes date of fund's first closing. Panel B presents raw (mean) fund PMEs broken out by closer refinements of the distribution rule. "Strict deal-by-deal" dummy takes the value of one if the GP is paid on a single deal basis getting paid after each single positive exit, and zero if the GP is paid on a "whole-fund" basis or on a "deal-by-deal realized loss" basis; "deal-by-deal realized loss" dummy takes the value of one if the GP is paid on a single deal basis but has to reimburse previous realized losses, and zero if the GP is paid on a "whole-fund" basis ; "basic fund-as-a-whole" dummy takes the value of one if the GP receives no carry until LPs get distributions equal to contributed or invested capital, plus where applicable a preferred return, and zero if the GP is paid on a "deal-by-deal basis". "Full fund back" equals the value of one if the GP receives no carry until LPs get distributions equal to committed capital, plus where applicable a preferred return, and zero otherwise.

Panel A: Fund returns gross / net cash flow based						
	Gross PME			Net PME		
	mean	median	[s.d.]	mean	median	[s.d.]
Distribution rule						
Deal-by-deal	1.241	1.051	[0.580]	0.967	0.860	[0.520]
Whole-fund	0.833	0.702	[0.492]	0.638	0.509	[0.472]
Years of rel. work experience						
6 years or less	0.841	0.676	[0.526]	0.557	0.511	[0.267]
Between 6 and 10 years	1.035	0.998	[0.610]	0.828	0.759	[0.589]
Greater than 10 years	1.226	1.137	[0.562]	0.962	0.902	[0.506]
Vint. year/first closing						
Jan '92 - Dec '97	1.794	1.475	[1.094]	1.628	1.296	[1.019]
Jan '97 - Dec '99	1.220	1.076	[0.499]	1.071	1.007	[0.506]
Jan '00 - Dec '01	1.025	0.998	[0.542]	0.721	0.761	[0.419]
Jan '02 - Dec '05	1.166	1.050	[0.317]	0.963	0.850	[0.271]

Panel B: Finer Contractual Details				
	Gross PME	p-value ttest	Net PME	p-value ttest
Strict deal-by-deal (GP-friendly:1)	1.267		1.003	
Otherwise (GP-friendly:2 - 4)	1.032	0.074	0.794	0.078
Deal-by-deal realized loss (GP-friendly:2)	1.204		0.929	
Otherwise (GP-friendly:3,4)	0.833	0.017	0.638	0.042
Basic fund-as-a-whole (GP-friendly:3)	0.870		0.646	
Otherwise (GP-friendly:1,2)	1.237	0.018	0.967	0.021
Full fund back (GP-friendly:4)	0.737		0.619	
Otherwise (GP-friendly:1 - 3)	1.152	0.071	0.893	0.189

Table 4: Explaining gross fund returns

This table presents ordinary least squares (OLS) regression estimates of the determinants of VC fund performance gross of carried interest and fees in 85 U.S. venture capital partnerships. The dependent variable is the Russell 2000 Public Market Equivalent (PME), calculated by discounting the actual cash outflows and cash inflows that the fund received with the returns on the Russell 2000 over the same time period and forming the ratio of the discounted cash inflows over the discounted outflows. "Years of rel. work experience" denotes the average number of years the principal fund managers have spent in positions in venture, private equity management and finance as measured by the Investor. "Observed Prior Multiple" denotes the previous fund's gross multiple, before carried interest and fee payments, at the time of the fund commitment. "Fund size" denotes the fund's committed capital in million USD. The variable "# past funds" is the number of previously raised funds. Heteroscedasticity robust standard errors are reported in parentheses below point estimates. One/ two/ three asterisks represent significance at the 10%/ 5%/ 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Years of rel. work experience				0.028**	0.031**	0.037**	0.036**	0.035**
				(0.012)	(0.015)	(0.015)	(0.015)	(0.015)
Observed Prior Multiple		0.049	0.086*			0.122**	0.118**	0.123**
		(0.044)	(0.049)			(0.050)	(0.055)	(0.056)
Log(fund size)							1.397	2.093
							(1.941)	(1.948)
Log(fund size)^2							−0.064	−0.110
							(0.117)	(0.119)
# past funds								0.022
								(0.021)
Vintage year FE?	yes	no	yes	no	yes	yes	yes	yes
Observations	85	85	85	85	85	85	85	85
Adjusted R-squared	0.137	0.000	0.163	0.062	0.211	0.272	0.311	0.309

Table 5: Distribution rules and fund performance

This table presents OLS regression estimates of VC gross-of-fee and net-of-fee fund performance. The dependent variable is the Russell 2000 PME. "Deal-by-deal" is a dummy that takes the value of one if a deal-by-deal structure is agreed, and zero otherwise. The variable "PV mgmt. fee" is calculated ex post based on actual fee payments, discounted at 5%. "Carried Interest" is the level of carried interest as the percentage of the fund's profit. "Years of rel. work experience" denotes the average number of years the principal fund managers have spent in positions in venture, private equity management and finance as measured by the Investor. "Observed Prior Multiple" denotes the previous fund's gross multiple, before carried interest and fee payments, at the time of the fund commitment. "Fund size" is fund committed capital in millions of USD. Heteroscedasticity robust standard errors are reported in parentheses below point estimates. One/ two/ three asterisks represent significance at the 10%/ 5%/ 1% level, respectively. 85 observations, one per VC fund.

Panel A: Gross-of-fee performance

	(1)	(2)	(3)	(4)	(5)	(6)
Deal-by-deal	0.406***	0.322***			0.397***	0.277**
	(0.137)	(0.113)			(0.129)	(0.111)
PV mgmt. fee			0.049**		0.039*	0.043*
			(0.023)		(0.023)	(0.025)
Carried Interest				1.575	−2.739	−0.529
				(2.580)	(2.329)	(2.325)
Years of rel. work experience	0.033***	0.040***	0.031**	0.035**	0.032***	0.036**
	(0.012)	(0.015)	(0.015)	(0.016)	(0.011)	(0.015)
Observed Prior Multiple	0.046	0.099*	0.123**	0.116**	0.055	0.107*
	(0.050)	(0.054)	(0.056)	(0.054)	(0.052)	(0.057)
Log(fund size)	1.439	2.161	0.531	1.952	−0.120	1.110
	(2.717)	(1.796)	(2.234)	(2.047)	(3.268)	(2.086)
Log(fund size)^2	−0.086	−0.114	−0.012	−0.098	0.011	−0.050
	(0.162)	(0.109)	(0.134)	(0.125)	(0.194)	(0.127)
Vintage year FE?	no	yes	yes	yes	no	yes
Adjusted R^2	0.152	0.361	0.359	0.306	0.166	0.384

Panel B: Net-of-fee performance

	(1)	(2)	(3)	(4)	(5)	(6)
Deal-by-deal	0.357***	0.252**			0.359***	0.219**
	(0.134)	(0.095)			(0.128)	(0.100)
PV mgmt. fee			0.035*		0.028	0.029
			(0.021)		(0.022)	(0.022)
Carried Interest				1.552	−2.981	0.057
				(2.084)	(2.122)	(1.847)
Years of rel. work experience	0.029***	0.034***	0.027**	0.029**	0.028***	0.031**
	(0.010)	(0.012)	(0.012)	(0.013)	(0.010)	(0.012)
Observed Prior Multiple	0.003	0.054**	0.072**	0.066**	0.012	0.059**
	(0.029)	(0.026)	(0.030)	(0.028)	(0.031)	(0.029)
Log(fund size)	0.713	1.247	0.027	1.195	−0.728	0.675
	(2.392)	(1.509)	(1.759)	(1.723)	(2.796)	(1.663)
Log(fund size)^2	−0.044	−0.057	0.019	−0.052	0.046	−0.023
	(0.143)	(0.092)	(0.106)	(0.106)	(0.166)	(0.102)
Vintage year FE?	no	yes	yes	yes	no	yes
Adjusted R^2	0.117	0.426	0.417	0.386	0.126	0.434

Table 6: Determinants of distribution rule provisions

This table presents estimated coefficients from probit models with the dependant variable equal to one if the fund's distribution rule provision is deal-by-deal, and zero otherwise. "No first time fund" takes the value of one, if the GP has raised a fund before, and zero otherwise. "Years of rel. work experience" denotes the average number of years the senior professionals have spent in positions in venture, private equity management and finance as measured by the Investor. "Observed Prior Multiple" denotes the previous fund's gross multiple, before carried interest and fee payments, at the time of the fund commitment. "Fund size" denotes the fund's committed capital in million USD. Heteroscedasticity robust standard errors are reported in parentheses below point estimates. One/ two/ three asterisks represent two-tailed significance at the 10%/ 5%/ 1% level, respectively. 85 observations, one per VC fund. Panel A reports simple effects of investment history and work experience, while Panel B reports the effect of partners' work experience on the choice of a deal-by-deal provision depending on the GP's investment history

Panel A: Simple effects of investment history and work experience						
	(1)	(2)	(3)	(4)	(5)	(6)
No first time fund		0.813**	0.733**	0.801**	0.711*	0.505
		(0.342)	(0.354)	(0.363)	(0.370)	(0.403)
Years of rel. work experience			0.060		0.078*	0.085*
			(0.042)		(0.043)	(0.044)
Observed Prior Multiple				0.252**	0.290**	0.283**
				(0.109)	(0.114)	(0.119)
Log(fund size)						0.511
						(7.339)
Log(fund size)^2						0.013
						(0.441)
All specifications include vintage year fixed effects						
Observations	85	85	85	85	85	85
Pseudo R-squared	0.067	0.116	0.130	0.141	0.166	0.184
Panel B: Work experience by investment history interaction						
	(1)	(2)	(3)	(4)	(5)	(6)
No first time fund	0.291	0.138	0.248	0.387	0.215	0.213
	(0.828)	(0.870)	(0.898)	(0.834)	(0.887)	(0.907)
Years of rel. work experience	0.098*	0.107*	0.109*	0.099*	0.109**	0.112**
	(0.055)	(0.055)	(0.056)	(0.055)	(0.055)	(0.056)
Years of rel. work experience ×	−0.108	−0.089	−0.084	−0.120	−0.099	−0.079
No first time fund	(0.083)	(0.086)	(0.091)	(0.080)	(0.082)	(0.088)
Observed Prior Multiple		0.242**	0.230**		0.275**	0.268**
		(0.108)	(0.116)		(0.115)	(0.121)
Log(fund size)			2.409			1.306
			(7.974)			(7.567)
Log(fund size)^2			−0.118			−0.038
			(0.477)			(0.455)
Vintage year FE?	no	no	no	yes	yes	yes
Observations	85	85	85	85	85	85
Pseudo R-squared	0.110	0.146	0.164	0.152	0.180	0.184

Table 7: Propensity score matching on GP quality

This table presents raw (mean) fund returns and raw covariates of propensity score matching on pre-contract differences in GP quality (distribution rule relevant fund characteristics). First, propensity score matching involves an estimate of a probit model to select deal-by-deal on observable pre-treatment covariates (Panel A). Column 2 of Panel B reports the average performance under treatment with deal-by-deal (DD)(unmatched sample (column 1) and the prediction of such conditional on observable pre-treatment covariates as described in Panel A (matched sample (column 1)). The average treatment effect on treated LPAs with deal-by-deal is reported in column 3 and 4. These last two columns differ in propensity score matching algorithms: radius matching with caliper(0.1) (column 3) and 3-NN matching with replacement and caliper(0.1). In all our matching algorithms we impose a common support. Nine LPAs with deal-by-deal are out of the common support and are discarded with a total of 76 LPAs remaining. In Panel C we test for the balancing of the treated. Column 2 reports the mean in the treated with difference to non-treated LPAs displayed in columns 3 and 4 both before and after matching, in reference to the matching algorithm described above. For a good balance, differences in means should not be significant after matching. All variables are as defined in previous tables.

Panel A: Probit model estimation for the propensity score

$$Pr(\mathrm{DR_i} = 1|\mathrm{X_i}) = F(12.497 + 0.558 \cdot \mathrm{No\_first\_time\_fund_i} + 0.092^{*} \cdot \mathrm{Years\_of\_rel\_work\_experience_i} + 0.225^{*} \cdot \mathrm{Observed\_prior\_multiple_i} + 1.339 \cdot \mathrm{Log(fund\_size_i)} + 0.261 \cdot \mathrm{Log(fund\_size_i)}^2 + 0.750 \cdot \mathrm{Vintage\_year\_92\_98_i} + 0.591^{*} \cdot \mathrm{Vintage\_year\_02\_05_i})$$

Diagnostics:
LR test: all coefficient = 0, χ^2 −stat.: 17.43** Pseudo-R^2: 0.169 N: 85

			Radius matching	3-NN matching
	Sample	DD	Diff. Mean	Diff. Mean
	(1)	(2)	(3)	(4)
Panel B: Propensity score matching on distribution rule				
Gross PME	Unmatched	1.237	0.404***	0.404***
	Matched	1.238	0.345**	0.338**
Net PME	Unmatched	0.967	0.328***	0.328***
	Matched	0.958	0.252*	0.196
Panel C: Covariate balance				
		Average	Differences in X_i	
X_i	Sample	Treated	between Treatment and Control:	
No first time fund	Unmatched	0.833	0.273***	0.273***
	Matched	0.804	0.079	0.059
Years of rel. work experience	Unmatched	11.265	−0.843	−0.843
	Matched	11.351	1.103	1.676
Observed Prior Multiple	Unmatched	1.751	0.5179*	0.5179*
	Matched	1.660	0.219	0.282
Log(fund size)	Unmatched	8.582	0.2728**	0.2728**
	Matched	8.504	0.083	0.066
Log(fund size)^2	Unmatched	73.849	4.548**	4.548**
	Matched	72.503	1.407	1.127
Vintage Year '92-'98	Unmatched	0.167	0.007	0.007
	Matched	0.176	−0.068	−0.072
Vintage Year '02-'05	Unmatched	0.417	0.177	0.177
	Matched	0.373	−0.030	−0.046

Table 8: Fund investment exit times for strict deal-by-deal (GP-friendly: 1) vs. whole-fund (GP-friendly: 3 + 4) contracts

This table presents hazard ratios associated with the GP's decision to sell/hold portfolio investments unregarding outcome and at loss/gain. We estimate Cox proportional hazards models. Hazard ratios can easily be converted into coefficients. The failure event is the exit so that each portfolio company is at risk during the holding period. If the fund exits the investment in several stages, we use the last transaction date in order to observe the return multiple and differenciate between exits over and under costs. Investments that are not exited by the end of our sample period are treated as right-censored with corrected estimators. "Strict deal-by-deal" (sDbD) dummy takes the value of one if the GP is paid on a single deal basis getting paid after each single positive exit, and zero if the GP is paid on whole-fund basis. "Fundraising Quarters" (FR Qtrs) dummy takes the value of one between quarters 12 and 22 of the fund's life, which typically represents the period of a new fundraising, and zero otherwise. "Carried Interest" dummy of 15% is omitted from the models. "Log(investment cost)" describes the log of investments cost of capital. "1999Q1 to 2000Q1" dummy is a time-varying covariate: over the fund's life, it equals one only in 1999Q1-2000Q2. "Quarterly return on Russell 2000" is the quarterly return on the Russell 2000 index. Another time-varying covariate is "BAA cor. bond yield" measuring the the yield on corporate bonds (using Moody's BAA bond index estimated quarterly in March, June, September, and December). Additional covariates are estimated as defined in Table 4. All models include time fixed effects. Standard errors, shown in brackets, are adjusted for clustering on fund (that is, investments undertaken by the same fund are not assumed to be independent). One/ two/ three asterisks represent significance at the 10%/ 5%/ 1% level, respectively.

		(1)	(2)	(3)	(4)	(5)
	time-varying?				multiple$\geq$1	multiple$<$ 1
Strict deal-by-deal (sDbD) vs. whole-fund	no	1.353**	1.402***	1.511***	1.571**	1.524***
		(0.166)	(0.176)	(0.199)	(0.292)	(0.215)
Fundraising Quarters (FR Qtrs)	yes			1.064	1.424*	0.915
				(0.152)	(0.275)	(0.158)
sDbD x FR Qtrs	yes			0.701**	0.580**	0.789
				(0.122)	(0.160)	(0.161)
PV mgmt. fee	no		1.015	1.015	1.013	1.018
			(0.030)	(0.030)	(0.040)	(0.034)
Carried Interest (20%)	no		0.986	0.997	0.426*	1.528
			(0.353)	(0.357)	(0.208)	(0.519)
Carried Interest (22.5%)	no		0.581	0.590	0.255***	0.884
			(0.225)	(0.228)	(0.133)	(0.348)
Carried Interest (25%)	no		0.750	0.757	0.268***	1.337
			(0.250)	(0.252)	(0.131)	(0.432)
Carried Interest (30%)	no		0.840	0.842	0.336***	1.272
			(0.193)	(0.192)	(0.090)	(0.321)
Years of rel. work experience	no	1.009	1.011**	1.001**	1.020**	1.008
		(0.006)	(0.005)	(0.005)	(0.009)	(0.007)
Observed Prior Multiple	no	0.857**	0.864**	0.858**	0.850	0.866**
		(0.066)	(0.063)	(0.064)	(0.093)	(0.062)
Log(investment cost)	no	0.588***	0.600***	0.600***	0.680***	0.517***
		(0.033)	(0.034)	(0.035)	(0.084)	(0.042)
1999Q1 to 2000Q1	yes	1.253	1.136	1.160	1.720	0.984
		(0.393)	(0.360)	(0.367)	(0.888)	(0.249)
Quarterly return on Russell 2000 (%)	yes	0.998	0.998	0.998	0.995	1.000
		(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
BAA cor. bond yield (in %)	yes	6.098	6.411	6.378	9.421	5.050
		(6.836)	(7.260)	(7.291)	(13.520)	(6.599)
Observations		46.364	46.364	46.364	22.078	24.286

Figures

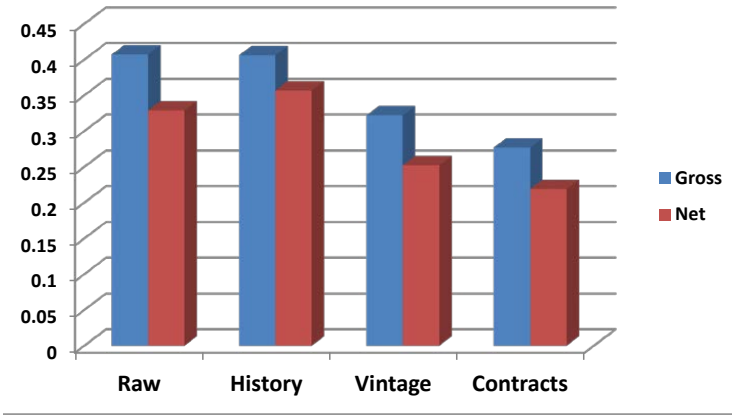


Figure 1: Summary of Performance Results.
This figure summarizes the performance difference between deal-by-deal (DD) and whole-fund (WF) carry timing. Blue columns are gross-of-fee performance, red are net-of-fee. The columns marked "Raw" reflect the uncorrected differences from Table 3. "History" summarizes column (1) of Table 5. The columns labeled "Vintage" adds vintage year fixed effects to the historical performance controls. This corresponds to Column (2) of Table 5. Finally, "Contracts" adds contract terms; this is Column (6) from Table 5.

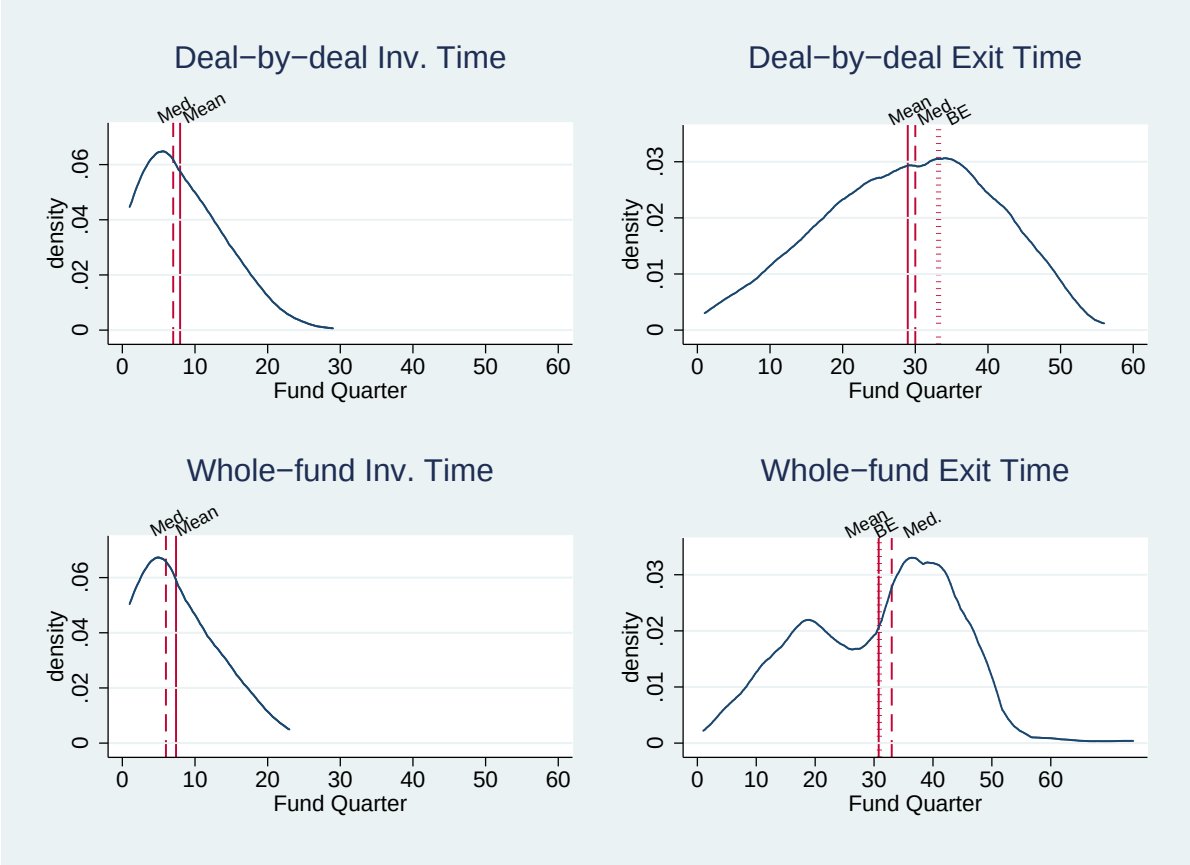


Figure 2: Portfolio Companies Investment and Exit Times by Fund Quarter.
The left column of this graph depicts the distribution of investment times, denoted "Inv. Time", for the two types of contracts, i.e., deal-by-deal and whole-fund contracts, as a function of fund age. This is generated by pooling all initial investments by fund age for each contract type and then plotting the distribution of investments. The right column depicts the distribution of exit times by contract type. In addition, the plots contain the mean, median (Med.) and break-even (BE) point time marked by the different red lines.

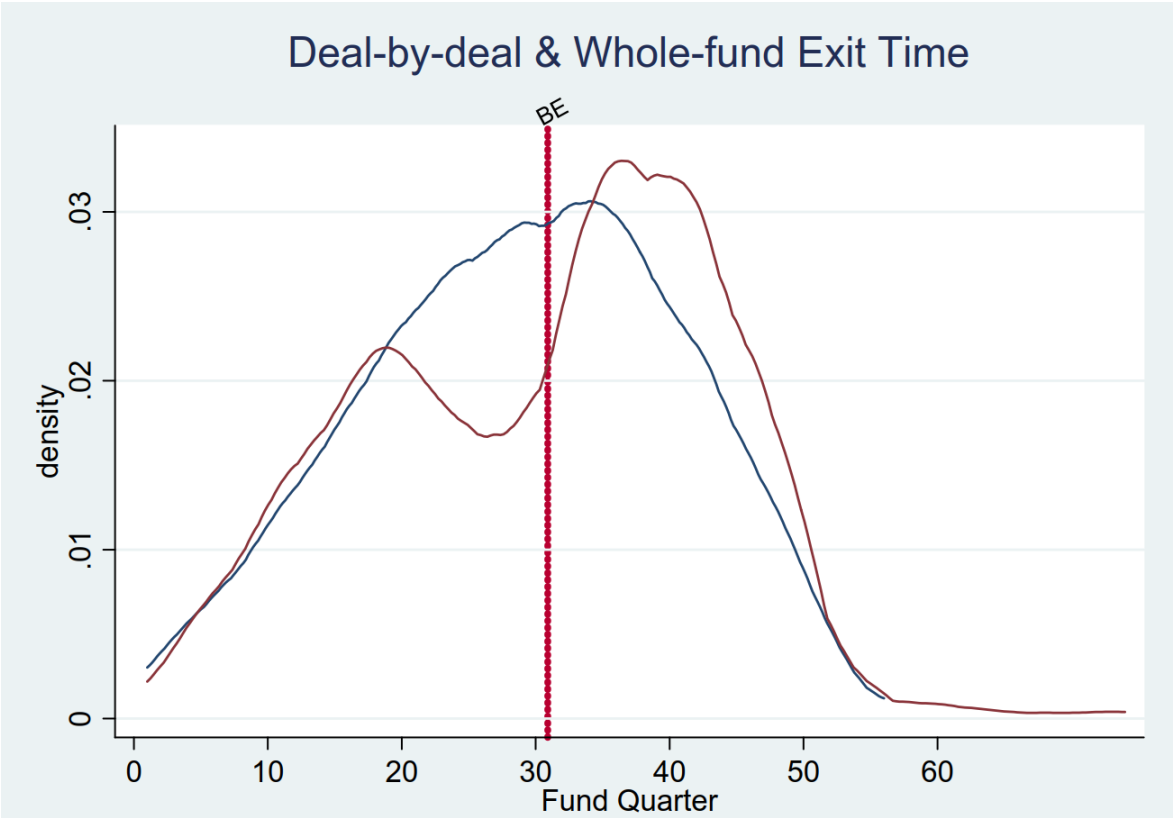


Figure 3: This figures combines the right-hand side graphs from Figure 2. It shows deal-by-deal (blue line) and whole-fund (red line) exit times by fund quarter with whole-fund break-even (BE) point indicated by the red line.

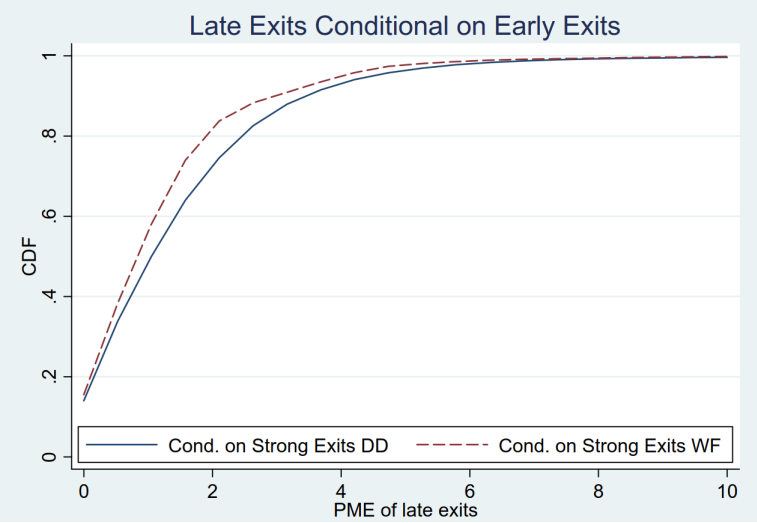


Figure 4: Cumulative Distribution Function of deal-by-deal (DD) & whole-fund (WF) Investment PMEs conditional on early **strong** exits.

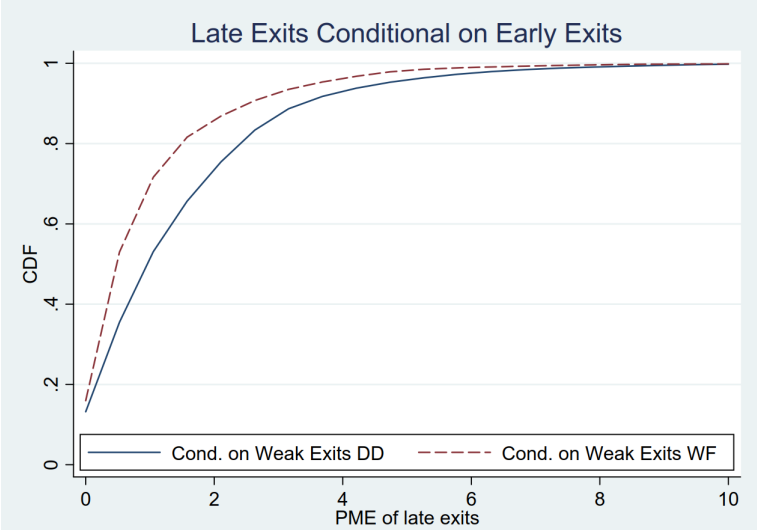


Figure 5: Cumulative Distribution Function of deal-by-deal (DD) & whole-fund (WF) Investment PMEs conditional on early **weak** exits

"Early" is measured according to the investment period stated in the confidential agreements provided by the investor. Typically, the investment period lasts 5 years. Early fund exits are labeled as strong if the ratio of top quartile (based on early exits of all funds) to total exits exceeds the ratio of bottom quartile to total exits by at least fifty percent.

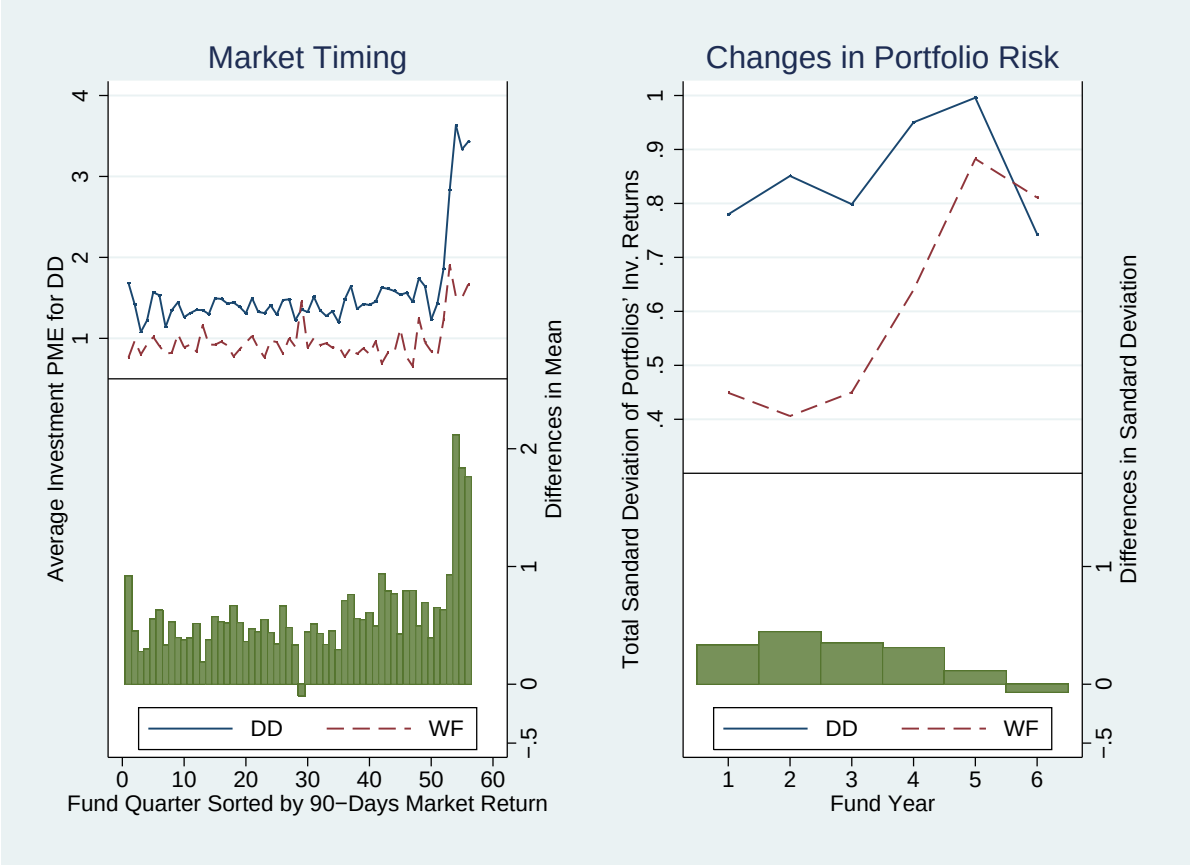
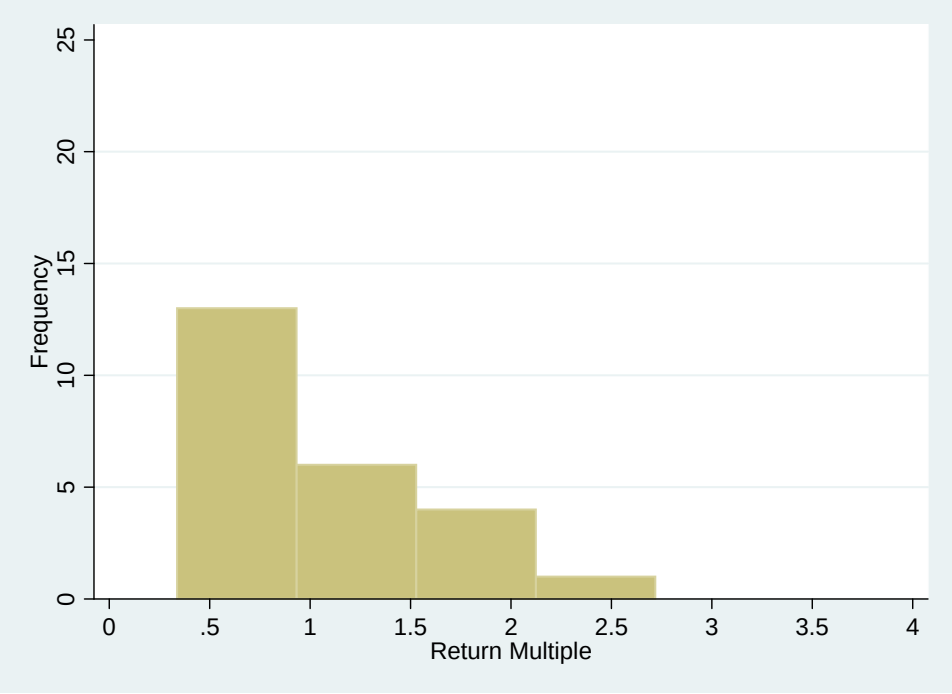
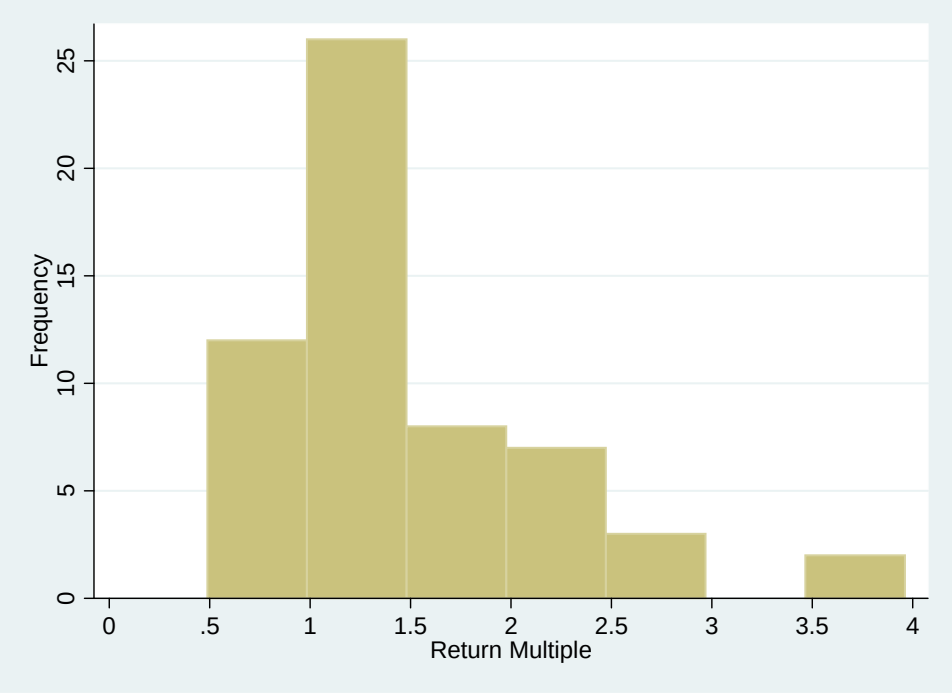


Figure 6: Market Timing and Changes in Portfolio Risk.
The left column shows fund quarters sorted by contemporaneous market returns. Towards the left are quarters associated with low market returns; towards the right market returns improve. The plotted lines shows the distribution of exits measured by their PMEs as a function of these underlying market conditions along the vertical axes.
The blue line in the top portion of the left column shows PMEs for deal-by-deal funds (DD); the fact that it is almost always above the red line (whole-fund; WF) indicates that in most market conditions deal-by-deal funds outperform whole-funds by a small margin. This margin grows substantially in the quarters with the very strongest market returns.
The right column of this figure shows the volatility (calculated according to Ljungqvist et al. (2017)) of venture capital investments at the portfolio company level. Thus, the evolution of risk-taking over the fund's life is displayed as a function of whether it is associated with whole-fund (red line; WF) or deal-by-deal carry (blue line; DD). Whole-fund contracts are associated with less risk-taking upfront, but their risk-taking spikes as the fund's age grows. In contrast, deal-by-deal contracts are more uniformly concentrated in higher risk investments throughout the fund's life.



Panel A: Funds with whole-fund compensation



Panel B: Funds with deal-by-deal compensation

Figure 7: This figure presents the frequency distribution of the sample funds' return multiples for funds with a whole-fund compensation (Panel A) and funds with a deal-by-deal compensation (Panel B)