Agency Costs of Dry Powder in Private Equity Funds

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Abstract

The amount of non-invested capital in the private equity industry or "dry powder" has raised numerous concerns from public opinion. To obtain insight about the drivers of the dry powder development, we model the investment behavior of a fund sponsor as a function of their expected fees, the latter being a function of their expected returns as well as their profit-sharing agreement with limited partners (LP). Our empirical analysis is performed on 383 funds sponsoring 1,011 US LBO deals over the period 1980 – 2019. We first show that, consistently with the model, the fund management fees, the change in the fee basis computation towards the end of the investment period and the general partner's (GP) expected return based on their track record and experience have a significant impact on the dry powder of the fund. Small funds, funds with low management fees or GP with a weak track record are more likely to have an abnormal level of dry powder at the end of the investing period. This situation leads to agency costs as we give evidence of the loss in performance for funds with abnormal dry powder at the end of the investing period. We find that high levels of dry powder lead to investment distortions where GPs focus more on maximizing their fees rather than maximizing the value for LPs. Deals undertaken at the end of the investing period by funds with a large volume of dry powder are under-leveraged, are larger and performed with less syndication to maximize the equity spent. They also present a significant lower cash on cash return. **Key words**: Dry powder, agency costs, private equity, LBO, investment distortions

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Introduction

Net asset value in private equity funds has grown by more than sevenfold in the last decade to reach 4.5tn end of December 2019 (McKinsey Global Private Markets Review 2019, Preqin, 2020). About $1.5tn, has been raised but have not yet been invested (Preqin, 2020[1]). This "dry powder" (unused or unspent capital) has raised numerous concerns in the financial press and in academia. Both pointed out adverse consequences on the performance of private equity investments and on the direct (fees) and indirect (opportunity) costs charged to investors. In 2012, the Wall Street Journal wrote that "unused capital, known as 'dry powder,' […] could give some managers an incentive to scramble and spend money before it expires." (September 26, 2012, p. 32). Braun and Stoff (2016) show that the private equity investments have become more costly to limited partners (LPs) due to fees charged on a higher volume of unused capital. Although the amount of dry powder relative to the asset under management has stayed relatively constant over time (i.e. one third of asset under management), public opinion argues that "private equity firms now have far more money than they know what to do with" (FT, April 12, 2019)[2] and that a "bubble is about to burst". There is an urgent need for understanding the determinants of the dry powder and its effects on investment decisions of private equity funds. These two issues are at the core of this paper.

Our first claim refers to the impact of the general partner (GP)'s personal objective to maximize fee collection on the levels of dry powder. In a typical private equity fund, GPs collect money from LPs in order to acquire majority stakes in companies during the investment period (usually 5 years after the fund inception). Funds' lifetime is usually limited to ten years and GPs exit their investments after a few years. At the fund inception, LPs commit themselves to provide a certain amount of capital for investments during the investment period (committed capital), which the GP can call when needed for investments, so part of the committed capital remains unused and serves as a buffer for future investments (dry powder). Dry powder is 100% at fund inception and decreases steadily as fund undertakes new investments. GPs get compensated for their services

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[1] https://www.firstrepublic.com/-/media/frb/documents/pdfs/innovators/Preqin-Quarterly-Update-Private-Equity-Q2-2020

[2] "The private equity bubble is bound to burst"

(deal generation, selection, structuring, value adding, exiting) with a fixed component (management fee) and a performance-based component (carried interest). The compensation scheme has a direct impact on the level of dry powder of the fund: In the large majority of contracts, the management fees are computed as a fraction of the committed capital during the investment period but then the computation basis typically switches to the net invested capital (which is invested capital excluding exited investments) during the divestment period. Metrick and Yasuda (2010, p. 2311) show that 84% of the funds in their sample complies with this rule. High dry powder at the end of the investment period means the GPs will lose part of the management fees but it keeps the valuable option to invest later when better opportunities may arrive, which would result in higher carried interest. On the contrary, by spending the entire committed capital by the end of the investment period the GPs will benefit from full management fees but may miss more profitable future investment opportunities and therefore decrease carried interest. In our revenue-based model, the fees are made dependent on leverage of the deal, the GP expected return and the exit timing/duration of the deal. Our model posits a negative relationship between dry powder and management fees while a modest impact of carry interests when taking into account the impact of the change in fee basis computation. Also it gives evidence of a negative relation between dry powder and expected returns: the more confident the GPs are in the future outcome of the deal, the more committed capital their will invest and the less the dry powder. This evidence is consistent with Graves and Ringuest (2018). Consistently with Arcot et al. (2015), higher dry powder leads to lower deal leverage.

We empirically test the hypotheses drawn from our theoretical model of revenue management using a sample of 383 fund sponsoring 1,011 LBO deals in the US the period 1980 – 2019 from S&P Capital IQ and Preqin. We find results that are consistent with the predictions of our model. Small funds, funds with low management fees or GP with a weak track record are more likely to have an abnormal level of dry powder at the end of the investing period.

Our second claim is that deals performed at the end of the investment period with an excess of cash are likely to be distorted: they display significantly higher entry price, less leverage, less deal syndication in a way to maximize the equity spent. This investment behavior leas to lower deal performance but also global fund performance. To investigate the consequences in terms of

investment distortions and performance, our deal analysis covers between 105 and 230 deals executed at least 4 years after the vintage year on which we have sufficient information (deal terms and exit conditions).

We contribute to the literature on dry powder. Two research papers have investigated the impact of dry powder on deal performance. Arcot et al. (2015) show that private equity funds which experience a pressure to buy are more active in secondary buyouts (SBO) and that they use less leverage and pay higher multiples at entry for those SBOs. Among the indicators of pressure, they consider a proxy for the level of unused capital (dry powder) computed as the ratio of the firm sponsor fundraising with regard to its investment over the last three years. Still, they do not find any significant deal distortions for other LBO deals but do not have a direct identification of the dry powder used for each deal. Arcot et al. (2015) and Degeorge, Martin, and Phalippou (2016) show that SBOs made under pressure, i.e. late deals made with excess cash, underperform. We build on their work in two manners. Our study provides a broader focus. First, we do not focus on SBOs only but investigate the general deal distortions for LBO deals. Second, we give some evidence on the relation between abnormal dry powder and *ex ante* LP-GP contract agreement.

The paper proceeds as follows. Section 1 reviews the literature. Section 2 develops our GP revenue management model and illustrates its impact on dry powder decisions. In a first extension of the model, we also integrate the fund decision regarding leverage in relationship with the level of dry powder. Section 3 describes the data. Section 4 performs our fund-level analysis. Section 5 carries out our deal-level analysis. Section 6 concludes.

1. Literature Review

Our research contributes to the literature on agency theory of private equity fund contracts (Axelson, Stromberg, and Weisbach, 2009; Kandel, Leshchinskii, and Yuklea, 2010; Jensen and Meckling, 2012; Axelson et al., 2013) It examines in particular the consequences of the compensation structure of these contracts. Axelson, Stromberg, and Weisbach (2009) build a theoretical framework to study the optimal financial structure of private equity contracts between GP and LPs. They show that the profit-sharing agreement between the GP and LPs as well as the

ex-ante financing (in the form of committed capital) mitigates potential agency conflicts and increases performance. Yet, they also show that (i) these contract features might work well at the beginning of the fund life but leads to investment distortions should the GP not find any good target investments, and that (ii) these contract features might make some funds to be overleveraged. We build a revenue management model and test whether fund contract fees indeed might influence the fund general partner's investment decisions regarding the investment deployment rate. In our theoretical model, the particular 2/20% fee structure, the hurdle rate and the change in the basis of fee computations are taken into account to infer the implications of the remuneration contract on the dry powder. Our theoretical framework is consistent with Metrick and Yasuda (2010) who study the compensation scheme of GPs of private equity funds. Similar to them, we also show that the main determinants of GP investment behavior is related to the collection of management fees rather than carry interests. Contrary to them, however, we do not account for monitoring or transaction fees.

We are not the first to study the negative consequences of dry powder on GP investment decisions in an agency framework. Yet, the literature studying the direct effects of dry powder is scarce. Arcot et al. (2015) integrates a proxy for dry powder into their buying pressure index. They do not however evaluate marginal impact of the dry powder on GP investment decisions neither have a direct identification of the dry powder and the deal characteristics. Focusing exclusively on SBOs, Degeorge, Martin, and Phalippou (2016) define a measure of excess cash using the unspent capital at the time of the deals. Other investment fund distortions have also been related by the literature: funds tend to exit too early (Robinson and Sensoy, 2012) and to over-subscribe (Lopez-de-Silanes and Phalippou, 2008)

Our research integrates the reputation effect of GP (Ljungqvist, Richardson, and Wolfenzon, 2020; Gompers, 1996). Our model features the impact of the fund sponsor track record and experience on the GP investment decisions by making their deployment rate dependent on the GP expected return. Kaplan and Schoar (2005) already showed reputed funds tend to invest early and collect higher returns. Our research also contributes to the literature private equity performance. Yet the literature is recently contrasted. While a vast majority of papers point out an outperformance of private equity investments (Chung et al., 2012; Harris, Jenkinson, and Kaplan, 2014; Robinson and

Sensoy, 2016), recent studies raise doubt on the validity of the performance measures (Phalippou and Gottschalg, 2009; Brown et al., 2016; Phalippou, 2020).

Finally, other studies have related the level of dry powder to market conditions and availability of debt financing. Robinson and Sensoy (2016) show the uncalled capital is endogenous to the market conditions. In their research, they define the market conditions through the public equity market conditions and the debt market conditions. In addition to the market conditions, the structure of the syndicated loans obtained by the fund for a deal could also deliver information on the level of dry powder. Our empirical analysis integrates those controls. Ivashina and Kovner (2011) shows that the relationships with banks is an important factor to get favorable loan terms and consequently, increase the use of leverage in the deal.

2. GP revenue management: an indifference model

In this section, we examine the special situation of excess cash unspent at the end of the investing period when the basis for fee computation changes. We build an indifference model where the GP objective is to maintain their level of fees and to avoid a loss in fee collection due to the change in the basis for fee computation. As more than two-third of the fees are coming from the management fees (see Metrick and Yasuda, 2010), we assume that fees reach their maximum in the investing period.

2.1. *Framework*

Our framework works as follows. During the investment period, the *expected* annual fees collected by the GP are the sum of the management fees computed based on the *committed capital* and the *expected* carried interest based on the current investments. During the divestment/harvesting period, the expected annual fees collected by the GP is the sum of the management fees computed based on the *invested capital* and the expected carried interest based on the current investments. The effect of dry powder on these levels of fees are twofold. On the one hand, a high level of dry powder at the end of the investment period will create an opportunity cost in terms of management

fees. Delaying investments might however pursue the objective to increase the expected carried interest. On the other hand, funds might have an incentive to reduce the level of dry powder at the end of the investment period to avoid the opportunity cost related to the loss in management fees. This might come with a likely decrease in expected carried interest due to investment decisions made under pressure.

Our model is consistent with Metrick and Yasuda (2010) who show that 84% of buyout funds switch the basis for management fee computation from the investing to the harvesting period. Besides, they show that two-third of the revenue of GPs are driven from management fees and that carry interests have a limited contribution to their revenue. We therefore assume that the GP will try to maintain the same level of fee revenues during the harvesting period as in the investing period rather than being in a situation where they could significantly increase these fees. Our focus on the end of the investing period is consistent with Axelson, Stromberg, and Weisbach (2009) studied the profit-sharing agreement between GP and LPs. They showed that while these financial contract features allow to align interests between GP and LP, it might also create investment distortions at the end of the investing period if the GP failed to spot good opportunities at the early stage of the fund life. We examine this particular situation.

2.2. *The revenue management model*

We consider the case of a private equity fund with a 10-year lifespan[3]. We divide this period in two phases. The first five years represents the investment period, i.e. the stage during which the GP searches for potential target companies and invests the capital committed (see among others, Kaplan and Schoar, 2005; Axelson, Stromberg, and Weisbach, 2009). The annual expected fees in any year *T1* during the investment period collected by the GPs is modeled as follows:

$$E(Fees)_{T1} = \alpha_0 K \quad \textbf{(1)}$$

[3] This assumption relies on the observation that in the US private equity industry the fund lifetime is typically set to 10 years.

where α_0 stands for the management fee level and *K* is the committed capital (fee basis). For sake of simplicity, we assume that there is no creation of value on the investments during the investment period (and therefore no carry).

In the second phase, the fund progressively returns the capital to the LPs and collect carry interests on top of management fees. The basis for the computation of management fees in this period is the net invested capital. We assume that the GP will make investment and exit decisions based on the level of their expected fees.

We consider two situations or scenarios for modelling the level of *expected* fees at time *T2* of the second period which corresponds to the beginning of the harvesting period (time 5 or 6 for instance). In both scenarios, the fund has the possibility to exit partially (*x*%) its invested capital at time *T2* and expects a disinvestment of (1-*x*)% of the invested capital at time *T2+1*. We consider *R* as the annualized proportional return on the deal assuming it has been invested at the vintage year: the total return on the deal at time of exit *T2* is therefore the product of *T2* with *R*. The annualized proportional hurdle rate for LPs is *e*.

In scenario 1 (S1), the fund has no dry powder, i.e. all the committed capital is invested by the fund and zero dry powder, we have the following equation:

$$E(Fees)_{T2|S1} = \alpha_0 K(1-x) + \alpha_1[Kx(1+RT2)+ (1-x)K(1+R(T2+1)) - K(1+eT2)] \quad \textbf{(2)}$$

Where α_0 represents the management fees, α_1 stands for the carried interest, *K* is the committed capital, *R* is the expected annualized deal return, *e* stands for the annualized hurdle rate, and finally *x* the exit rate (so (1-*x*)*K* is the no-exited invested capital at time *T2*).

In scenario 2 (S2), the fund has a level of dry powder equal to *(1-a)K* where *a* is the invested part (in percentage) of the committed capital. The management fees are therefore collected on $a\alpha_0 K(1-x)$, i.e. the amount of committed capital invested and not yet exited. Regarding the expected carried interests, it applies on the total expected value creation at *T2* minus the minimum remuneration to be due to LPs corresponding to *a K (1+e T2)*. The total value creation is made of three different parts according to the GP investment behaviour:

- First, we assume that under uncertainty[4], a fund might delay its investment decision with the hope to collect a higher return on future opportunities (Tennert, Lambert, and Burghof, 2018). The part of the investment that has been delayed corresponds to *(1-a)K*. We assume the GP is delaying the investment as they expect to collect an additional return on this investment. The annualized additional return is b. This incremental return b is only applicable to the yet to be invested amount and not the already invested capital. *D* stands for the duration of the investment;
- Second, the GP will collect carried interests on the part of invested capital, they decide to exit (so, *a K x*). The cumulative return on this investment is *R* times *T2* should he/she decides to exit at *T2*;
- Finally, the GP might delay the decision to exit (1-x)% of his/her invested capital. In this case, the GP will collect carried interests in *T2+1 if* he/she decides to exit one year later. The cumulative return on this investment is expected to be *R* times *(T2+1)*.

The equation of expected fees in scenario 2 (S2) is therefore modified as follows:

$$E(Fees)_{T2|S2} = a\alpha_0 K(1-x) + \alpha_1[(1-a)K(1+RD+bD) \\ +aKx(1+RT2) + a(1-x)K(1+R(T2+1)) - aK(1+eT2)] \quad \textbf{(3)}$$

Consistently with Metrick and Yasuda (2010), we assume that the main source of revenue for the GP is the management fees. Therefore, we expect that GP will take investment and exit decisions so that they protect their level of fees in the two scenarios. We expect that it will not be possible to increase the level of fees during the harvesting period with regard to the investing period and therefore that the best GP can achieve is a similar level of fee. This implies that the GP will decide about the level of invested capital *a* or dry powder *(1-a)* so as to be indifferent between scenario 1 and scenario 2 at time *T2*. The GP expects the loss in management fees incurred by delaying investment to be compensated by the expected increase in the carried interest. Equation (4) establishes this indifference relationship:

[4] Uncertain economic outlooks, risky industry or low performance of companies.

$$\triangle E(fees_{T2|S2-T2|S1}) = (1-a)\alpha_0 K(1-x) - \alpha_1[KRT2 + KR - xKR - K - KeT2 + KbD] + a\alpha_1[KRD - KRT2 - KR + xKR + K + KeT2] = 0 \quad \textbf{(4)}$$

From Equation (4), we can infer the following equation determining the amount of invested capital as a function of the contract compensation scheme, GP expected return and time to exit:

$$a = \frac{1}{1 + \frac{\alpha_1(bD)}{\alpha_0(1-x)+\alpha_1[R(T2-x-D)-eT2)]}} \quad \textbf{(5)}$$

Our revenue management model shows a linear negative relationship between the level of dry powder and the management fees. Yet, higher carry induces more dry powder but with a much more moderated impact. Figure 1 illustrates the relationship between the profit-sharing agreement terms and the dry powder.

< Insert Figure 1 >

Figure 1 shows that a variation of 100 basis points in the management fees increase the dry powder by about 30 basis points of the committed capital. A similar increase in the carry only has a limited impact of about 1.59 basis points.

Figure 2 shows the impact of the GP expected return on the level of dry powder for different levels of carry interests. The expected return translates the GP self-confidence in finding good opportunities and depend on his experience and track record.

< Insert Figure 2>

The figure shows a large variation of the dry powder in relation with the GP expected return. We observe a decrease of dry powder to be about 3% of the dry powder as a percentage of the committed capital in relation with an increase of 10% in the expected return.

2.3. *Extension 1: fund leverage*

As a first extension to the basic model, we consider the average financial leverage used to structure the LBO deals in portfolios. The total deal value (invested) of the private equity fund becomes:

$$Deal\ Value = aK + aKL \tag{6}$$

Where *K* corresponds to the equity investment in the deal and *L* is the ratio of debt over committed capital (i.e. equity)

The leverage cost is

$$cost\ of\ leverage = (1 + r_0)aKL \tag{7}$$

Where r_o is the cumulative interest rate paid to the lenders.

In the first scenario, the fund has invested all of its committed capital and therefore, the expected fees collected during the second period is modelled as follows:

$$\begin{aligned} E(Fees)_{T2|S1} = \alpha_0 K(1-x) + \alpha_1[x(K+KL)(1+RT2) + (1-x) \\ (K+KL)(1+R(T2+1)) - KL(1+r_0) - K(1+eT2)] \end{aligned} \tag{8}$$

In the second scenario, the fund has not invested all of its available capital (non-zero dry powder). In this situation, the equation of the expected fees collected during the second period is as follows:

$$\begin{aligned} E(Fees)_{T2|S2} = a\alpha_0 K(1-x) + \alpha_1[(1-a)(K+KL)(1+RD+bD) + ax(K+KL)(1+RT2) \\ +a(1-x)(K+KL)(1+R(T2+1)) - aKL(1+r_0) - aK(1+eT2)] \end{aligned} \tag{9}$$

In equations (8) and (9), *b* represents the incremental return from delaying the investment (assumed to be positive ex ante), *R* is the expected deal return, *T2* time to exit, *e* constitutes the hurdle rate of the fund. L is the leverage or *D*/*K* of the fund and r_o represents the interest rate.

The indifference equation between scenario 1 and 2 can be written as:

$$\begin{aligned} \triangle E(fees_{T2|S2-T2|S1}) = -(1-a)\alpha_0 K(1-x) + \alpha_1(1-a)K[(RD+bD) + (a-1)KR(T2+1-x) - aKeT2] \\ +\alpha_1 L[(1-a)(RD+bD) + (a-1)(R(T2+1-x) - aKr_0)] = 0 \end{aligned} \tag{10}$$

From Equation (10), we can retrieve the determinants of the leverage which may vary during the life of the fund as a function of dry powder, as shown in Equation (11):

$$L = \frac{(1-a)\alpha_0(1-x) + \alpha_1[(1-a)(RD+bD) + (a-1)(R(T2+1-x) - aeT2)]}{\alpha_1[(1-a)(RD+bD) + (a-1)(R(T2+1-x) - ar_0]} \quad \textbf{(11)}$$

Figure 3 illustrates the negative relationship between dry powder and leverage.

< Insert Figure 3 here >

In the situation of a fund which displays a high level of dry powder, the fund is supposed to face pressure to spend equity and use their unspent capital. This pressure will result in the decision to use more equity and less leverage. Panel A shows that the higher the management fee, the lower the leverage, which is also consistent with the assumption of spending equity to collect management fees. Panel B shows that the higher the carry, the higher the fund leverage in order to leverage the performance. Finally, as shown in Panel C, the higher the expected return the higher they can leverage the deal.

3. Data and descriptive statistics

3.1. *Sample*

We start by extracting 12,779 US LBO deals from S&P Capital IQ for the period July 1980 – June 2019 following the transaction types defined by (Davis et al., 2014)[5]. S&P Capital IQ provides the acquisition terms of the LBO transaction for 4,258 deals out of 12,779. Adding Preqin data, we obtain complete information on the LBO acquisition (resp. on the LBO exit) for an additional 398 deals. We use the target name, the target website and several announcement dates (deal announcement year, the year of the deal date, the deal closed year) in order to match the deals. We

[5] The types of transaction selected from Capital IQ are: Going Private Transaction, Leveraged Buy Out (LBO), Management Buyout, Secondary LBO, Platform.

further combine this dataset with EIKON to obtain information on leverage. Information on deal leverage information could be retrieved for a total 1,426 of these deals.

We obtain information on the exit strategy and exit price for a subset of these deals only. In total, we have full information (acquisition and exit terms) on 931 deals, whose we have information on leverage for 491 deals. Table 1 summarizes the merge steps and the different samples that will be used in this study.

< Insert Table 1 here >

To conduct our analysis, we need the value of "dry powder" of the fund at the time it completed the deal. To retrieve this information and match it with our deal sample, we use Preqin which is one of the most used datasets on private equity fund cash flows (Brown et al., 2015; Harris, Jenkinson, and Kaplan, 2014)[6]. Deals from S&P CIQ were matched according to their ID deal, the name of the funds, the fund ID, the firm ID, the deal year and deal month. For the sample of deals with information on acquisitions, we have fund-level data for 1,011 deals (reduced to 578 deals when considering leverage information). Table 2 summarizes the merge steps and different subsamples when we add fund-level information.

< Insert Table 2 here >

In the further analysis, we will refer to the following subsamples of deals with fund-level information:

Sample 1 – LBO deals (with or without leverage information)

- Sample 1.1 – Deals with acquisition information from Table 1, Panel A
- Sample 1.2 – Deals with acquisition and sponsor information from Table 2, Panel A
- Sample 1.3 – Deals with acquisition, exit, and sponsor information from Table 2 Panel A

[6] Information about the fund sponsors and fund flows was retrieved from merging the various modules of Preqin: Private Capital Fund Managers, Private Capital Funds, Private Capital Performance, Private Capital Cash Flow, Private Capital Deals Search Buyout and Private Capital Exits Search Buyout.

Sample 2 – LBO deals with leverage information

- Sample 2.1 – Deals with acquisition information from Table 1, Panel B
- Sample 2.2 – Deals with acquisition and sponsor information from Table 2, Panel B
- Sample 2.3 – Deals with acquisition, exit, and sponsor information from Table 2, Panel B

Our fund-level analysis will be conducted on the largest sample, i.e. sub-sample 1.2. Our deal-level analysis will be conducted on sub-samples 1.2, 1.3 or 2.2.

3.2. *Descriptive statistics*

Table 3 displays information on deal information for samples 1.1 (panel A), 1.2 (panel B), 1.3 (panel C). The variables are classified by entry and exit characteristics. This table shows that deals with more complete information are larger and sponsored by a higher number of funds. The average entry price in panel A is $413mn, while it amounts to $928mn in panel C. The average number of funds involved increases from 1.23 to 1.57. Furthermore, targets are larger in terms of revenues and total assets. Given the limited information on fund sponsor or exit information for our largest sample of 4,656 deals, we will work in subsamples. We test whether samples 1.2 or 1.3 significantly differ from the initial sample 1.1. Except in terms of deal size, the entry multiples or target margin do not display significant differences. On average, deals are acquired at multiples of about 2 times revenue and 11-14 times EBITDA. Regarding the exit characteristics, the average duration of our deals is 4 years and 10 months and exit revenue multiples is about 3.5 (i.e. a cash multiple slightly higher than 2). Our sample presents summary statistics that are similar to summary statistics provided in recent studies[7] (Strömberg, Hotchkiss, and Smith, 2012; Axelson et al., 2013; Arcot et al., 2015).

< Insert Table 3 here >

[7] Arcot et al. (2015) display summary statistics related to buyout deals with an average total enterprise value of $850mn. Average sales multiple of 1.82. Strömberg, Hotchkiss, and Smith (2012) show average target revenues of $1,678mn and an average EBITDA margin of 15%. Axelson et al. (2013) display an average EV/EBITDA of 8.2.

Table 4 provides the same information as table 3 on samples 2.1-2.3 when we include leverage information which is more scarce. The leverage (in percent) is similar across the different subsamples (we do not find any statistical difference) and amounts to approximately 56% on average (median is 59-60%). Consistently with what we have observed in table 3, the deal and target size increase as we include deals with more information available. Deals are acquired at multiples of a bit more than 2 times revenue and 11-16 times EBITDA and exited at about a 3.3 multiple, which constitutes a similar range as in table 3. The average cash multiples (about 1.6) is lower than in table 3 but have similar median as this small sample contains less variation across funds. Investment duration is similar (4 years and 10 months).

For the further analysis that takes into account the leverage, we will mainly use the observations from sample 2.2 (panel B) that does not require exit information.

< Insert Table 4 here >

4. Fund-level analysis

We test the implications of our revenue management model on the deployment rate of GP. Our first hypothesis is that higher management fee will induce a higher deployment rate (or lower dry powder) at the end of the investing period, while the impact of carry interest will be moderate. Our second hypothesis is that the track record of the GP taken as a proxy for expected return on the deals are expected to reduce the use of dry powder as the GP will invest early. We control for related variables such as GP experience but also for variables that could impact the GP deployment rate such as whether the GP is conducting a fundraising phase for a follow up fund.

4.1. *Descriptive statistics and univariate analysis*

Table 5 displays summary statistics on the 383 funds sponsoring LBO deals from Sample 1.2. Description of the variables can be found in Appendix – Table A.1. The average fund size (measured by the committed capital) is about $2bn. The average Total Value over Paid-in Capital or TVPI at the end of the fund life, which sets distributions in relation to the invested capital, is

1.73. This value is comparable to previous studies (Harris, Jenkinson, and Kaplan, 2014) [8]. The average Kaplan-Schoar Public Market Equivalent or KSPME at the end of the fund life is 1.27: it is the ratio of calls over the residual Net Asset Value (NAV) plus distributions, both the numerator and denominator being discounted at the hurdle rate coming from a public market index value (here, S&P500). The average management fee of the sample is 1.90% with a standard deviation of 27 basis points and the average carried interest is about 20.29%. About 11% of the sample is composed of first funds (funds without previous experience); 39% of funds are mid-experienced funds (second or third fund of a PE firm); 50% of the sample is composed of experienced funds (at least the fourth fund of a PE firm).

Our main variable of interest is the dry powder (DP). The mean value of dry powder amounts to 31.5% four years after the vintage year (Y4) and decreases to 9.5% in Y6. About 70% of the investments are usually made within the first three years which is consistent with market practice. Some funds have indeed a clause that require that 70% of their committed capital is invested before launching a new fund (Financial Times, June 18, 2019[9]). Besides, Ljungqvist and Richardson (2003) observe that 50% of funds invest 70% of their committed capital in the first three year of the fund. About 30% of funds are in fundraising phase at vintage year plus 4. PE firms usually raise capital for a new fund every three to five years (Chung et al., 2012). Following Chung et al. (2012), we might expect more pressure to invest for funds having abnormal dry powder at the end of the investing period while in fundraising phase. We observe indeed significantly less funds in the high dry powder group when GP are currently in fundraising phase.

On average, funds have a DP declining by about 22 percentage points between Y4 and Y6. A large variation between funds exists. For example, the average DP in Y4 reaches 7% for the low-DPY4-quartile, compared to 56% of the high-DPY4 quartile. As expected, funds with high level of dry powder are the funds which have the largest change in dry powder between Y4 and Y6.

Table 5 also presents characteristics of funds that have high and low levels of dry powder four year (Y4) or five year (Y5) from the vintage year. We observe that funds with lower levels of dry powder

[8] Harris et al. (2014) display an average TVPI of 1.72 for buyout funds.
[9] "Private equity groups prepare to raise mega funds."

are larger funds. Besides, their performance as measured by their KSPME and their track record (past performance from previous funds measured by their TVPI or KSPME) are significantly better. The differences in their carried interest and management fees are statistically and economically insignificant. Many characteristics can influence the levels of the fees such as the sponsor reputation, its experience, the fund risk. This will be accounted for in the multivariate analysis performed in the next section. As future extension of our theoretical model will include the risk of the deal, we therefore also investigate the risk taken by the fund as a consequence of dry powder towards the end of the investment period. To measure risk, we follow the methodology of Ljungqvist and Richardson (2003). We look at the 48 broad industry groups and their corresponding average beta for publicly traded companies in the same industry. We construct several risk measures. First, we employ the main industry of the PE fund we obtain from Preqin to define the fund beta (called "beta 1"). For diversified funds, we use beta equal to 1. Funds with lower levels of dry powder are active in lower-risk industries than funds with higher dry powder. Another risk estimation, fund beta (called "beta 2"), is computed as the weighted average of the beta's portfolio companies in which the fund has invested in. Each company has been assigned to one of the 48 industry groups and the corresponding beta for publicly traded companies in the same industry was allocated. We also analyze the difference between the two last measures of risk through the variable risk deviation. The HHI (Herfindahl-Hirschman Index) is used to measure the deal concentration. This indicator intends to account for the idiosyncratic risk taken by the fund.

< Insert Table 5 here >

4.2. *Contract features and dry powder : Multivariate analysis*

In this section, we empirically test the implications of the revenue management model. Namely, we test the impact of fund profit-sharing agreement between the GP and LPs as well as the impact of the GP expected return on the GP decision regarding its abnormal level (i.e. above the cross-sectional median) of dry powder towards the end of the investment period, i.e. a vintage year + 4. In non-tabulated results, we test other periods such as vintage year +5 and +6. We obtain similar results but the effects are strongest at year 4.

We run a multivariate probit regression defined as follows,

$$y_{4,i} = \alpha_\nu + \beta_\phi X_i + \gamma_\mu Z_i + \varepsilon_i \quad \textbf{(12)}$$

$$y_{4,i} = \begin{cases} 0 & \text{if } DP_{4,i} \leqslant Median(DP_{4,i}) \\ 1 & \text{if } DP_{4,i} > Median(DP_{4,i}) \end{cases}$$

Where $DP_{4,i}$ is the level of fund dry powder four years after the vintage year, X represents the matrix of ex-ante contract features coming from our theoretical model (carried interests, management fees, expected return measured by the fund sponsor past performance) and Z represents the matrix of control variables (fund size, GP experience, GP fundraising experience (frequent/ infrequent) as defined by Arcot et al. (2015), GP fundraising phase[10]). All regression specifications include vintage year fixed effects.

Table 6 present the results of the multivariate probit analysis based on 372 LBO funds (from sample 1.2 where the vintage year is not available for 11 funds).

< Insert Table 6 here >

Fee information is only available for 72 funds. Yet, the probit analysis on the 372 or 72 funds using in specifications 1 and 2 deliver similar results. Contrary to Arcot et al. (2015), the GP fundraising experience does not influence the level of DP. The size of the fund negatively impacts the level of dry powder. Dry powder at vintage year 4 is significantly reduced when the sponsor firm is open for fundraising (i.e. the launch of a follow-up fund). We add management and performance fees in specification 4: high management fees are significantly related to lower than median level of dry powder at vintage year+4 (at the 5% significance level). Carry interest however is not significant as expected from the theoretical model as well as from the descriptive statistics which showed only

[10] GP fundraising phase dummy is a variable which takes the value of 1 if vintage year + 4 falls within the period of fundraising of the follow up fund. We compute fundraising period as the fundraising starting date of the follow-up fund + 3years (this information is provided for 157 funds) or when not provided, as the vintage year of this follow up fund minus two years (to account for roadshows) up to the vintage year plus one year to account for LPs entering the fund the first year of investment.

small variation in the variable. This result is also expected from the framework of Metrick and Yasuda (2010) who show that two-third of the revenue of the GP comes from the management fees and that carry only makes a smaller part of the total revenues. Our theoretical framework also posits that higher fund returns expected by the GP given their track record are associated with lower level of dry powder and are likely to invest at earlier times of the fund. This result still hold when we control for the GP experience. We empirically show that both experience and past fund returns are negatively related with the probability to have a high level of unspent capital at year 4.

In appendix, Table A.3 replicates the analysis for a slightly larger sample of 142 private equity funds from Preqin. Yet this sample is that the funds are not matched with our deal list from S&P Capital IQ (following Davis et al., 2014). These funds might therefore sponsor VC, growth and LBO deals. In Table A.4., we also replicate Table 6 using an ordinary least squares regression on the absolute level of dry powder. Results from both tables are consistent with Table 6.

4.3. *Fund performance analysis*

To account for the impact of GP investment behaviour induced by his/her deployment rate or dry powder, we analyse the impact of dry powder at year 4 ($DP_{i,4}$) on performance. We run the following least-squares regression:

$$Fund\ performance_i = \alpha_\nu + \beta_\phi DP_{4,i} + \gamma_\mu Z_i + \varepsilon_i \quad \textbf{(13)}$$

Where fund performance is either the TVPI or the KSPME of the fund when the fund is liquidated. Where Z represents the matrix of controls (fund size, GP past performance, GP experience (i.e. fund number series).

Table 7 shows the results.

< Insert Table 7 here >

The fund performance measured by TVPI is significantly related to the performance of previous sponsor funds. This cannot be found when measuring performance with KS-PME which takes into account the time-value of money and opportunity cost of not investing. The results consistently

show that higher levels of dry powder are associated with a poorer performance at the fund level. The results are especially strong when measuring performance with KSPME. In appendix, Table A.5 replicates the analysis for a large sample of 893 private equity funds from Preqin. The limit of this sample is that the funds are not matched with our deal list from S&P Capital IQ (following Davis et al.,2014). These funds might therefore sponsor VC, growth and LBO deals. Results are consistent with Table 7.

5. Deal-level analysis

In this section, we examine the characteristics of deals executed with unspent capital at the end of the investing period. Our revenue management model shows that the fund fee structure as well as the GP expected return based on their track record incentivize them to maintain an excess amount of unspent capital towards the end of the investing period. Our objective is to investigate the existence of any investment distortion and the source of the loss in fund performance pointed out in the previous section. Description of deal-specific variables can be found in Appendix, Table A.2.

5.1. *Investment distortions and unspent capital – univariate analysis?*

From previous literature, we expect the following potential investment distortions induced by large amount of unspent capital: the overutilization of equity financing in deals, inflated entry multiples, as well as a poor selection of investments (see Arcot et al., 2015; Degeorge, Martin, and Phalippou, 2016). However, Arcot et al. (2015) do not find any significant effects on LBO deals other than SBOs. Our sample is made of about 35% of SBOs (as in Arcot et al., 2015) for the US market.

Table 8 compares the entry multiples, leverage, and returns for deals invested at times of high low and high dry powder.

<Insert Table 8 here >

We divide deals in terciles according to the level of dry powder displayed by their sponsor fund one quarter before their executed the deal (controlling for deals executed at the same vintage year).

We then examine the deal characteristics performed by those fund, especially for buyouts executed at least four years after the vintage year. For the latter deals, top-tercile funds pay about 12.6-times EBITDA multiple while bottom-tercile funds about 9.2. Yet, the difference is not significant. We however find a significant difference in cash on cash return between the tercile of funds. The cash multiple in low dry-powder funds reaches 1.84, while it is only slightly above 0.5 in high dry powder funds. We also find a significant difference regarding deal syndication between the two groups. Leverage on deals carried out by top-tercile funds or bottom-tercile funds are similar. Finally, deal size differs by about 117 million $ between the top and bottom-tercile.

5.2. *Investment distortions and deal performance – a multivariate analysis*

We analyse potential investment distortions using deal-level data. We first estimate the performance of deals executed at least four years after the vintage year in relation with the fund dry powder from the last quarter. We then examine fund choices in terms of deal size, entry multiple, leverage, and syndication (deal club) for those specific deals in relation with the fund dry powder from the last quarter. By considering this subset of deal, we focus on investment distortions that could occur due to a change in basis fee computation. We run the following four least-squares regressions:

$$Cash\ Return_d = \alpha_v + \beta_\phi DP_d + \gamma_1 Z_d + \gamma_2 Z_{d,f} + \epsilon_d \quad \textbf{(14)}$$

$$Deal\ Size_d = \alpha_v + \beta_\phi DP_d + \gamma_1 Z_{d,f} + \epsilon_d \quad \textbf{(15)}$$

$$Entry\ Multiple_d = \alpha_v + \beta_\phi DP_d + \gamma_1 Z_d + \gamma_2 Z_{d,f} + \epsilon_d \quad \textbf{(16)}$$

$$Leverage_d = \alpha_v + \beta_\phi DP_d + \gamma_1 Z_d + \gamma_2 Z_{d,f} + \epsilon_d \quad \textbf{(17)}$$

$$Deal\ Club_d = \alpha_v + \beta_\phi DP_d + \gamma_1 Z_d + \gamma_2 Z_{d,f} + \epsilon_d \quad \textbf{(18)}$$

Where the dependent variables are respectively the cash on cash return for the deal (Eq. 14), the deal size (Eq. 15), the entry multiple (Eq. 16), the leverage of the deal (Eq. 17), the syndication or deal club (Eq. 18). Where DP_d is the level of dry powder one quarter before the deal is executed, Z_d represent the matrix of deal control variables (log of the deal size, except for Eq. 15), $Z_{d,f}$

represents the matrix of fund sponsor control variables (fund size, GP experience (or fund number series), GP fundraising dummy[11], the GP past performance). Our analysis includes industry fixed effects and investment year fixed effects. We also test the impact of dry powder on the deal duration but do not find any significant results (non-tabulated).

Table 9 shows that deals executed towards the end of the investment period by funds with high dry powder are associated with lower cash on cash return. These results are not found for deals made at an early-stage of the fund life (non-tabulated results).

< Insert Table 9 here >

We first show a significant negative relationship between the dry powder estimated at the previous quarter to the execution date of the deal and the deal performance. The second specification shows that this relationship is robust to the introduction of fund-level controls. As expected, we find a higher deal performance for more experienced fund and a weaker performance for deals executed during a fundraising phase (another proxy for buying pressure). Specification 3 adds the deal size control which is highly negatively significant: bigger deals tend to deliver lower performance. The significance of our dry powder variable decreases significantly. We therefore examine a cross-effect between these variables in specification 4. We investigate the intuition that funds under buying pressure due to dry powder might be incentivized to spend large amount of equity. We create a dummy variable that takes the value of 1 if the deal size is larger than the median deal size. We therefore investigate the impact of dry powder on deal performance when the executed deal is large or small. We observe that large deals executed by funds with an abnormal level of unspent capital at least four years from the vintage year significantly underperform compared to other deals executed by the funds. In Appendix, Table A.6 replicates the analysis on a larger sample of 123 deals coming from Preqin deal database merged with Preqin fund sponsor database. This sample does not follow the steps of Davis et al. (2014) and might therefore include VC or growth deals. Results are similar to Table 9.

[11] GP Fundraising 2 is a dummy variable which takes the value of 1 if the deal is executed during the fundraising period of a follow up fund.

Table 10 tests equation (15) and shows that deals performed towards the end of the investment period by funds with high dry powder in the previous quarter tend to be significantly larger. We measure deal size by the log of the entry price. Our results are robust to fund-level control variables.

< Insert Table 10 >

Table 11 does not confirm the higher entry multiple of deals executed towards the end of the investing period by funds with large amount of unspent capital (see Table 7).

< Insert Table 11 >

Table 12 tests equation (17) and shows that deals performed towards the end of the investment period by funds with high dry powder in the previous quarter are associated with lower leverage. Our revenue management model already shows that to avoid a loss in fee collection at the end of investing period, funds with high DP are incentivized to take less leverage. The leverage effect exists only in deals closed at or later than four years after the vintage year (in non-tabulated results, we replicate the analysis for deals executed between the first and third year after vintage year). Fund leverage is not related to fund-sponsor controls, neither deal size. Table 13 tests equation (18) and shows that deals executed towards the end of the investment period by funds with high dry powder are associated with less syndication. The dry powder variable is significant at the 10% level even when we control for the size of deal.

< Insert Tables 12 and 13 here >

Given the evidence of Arcot et al. (2015) and Degeorge et al. (2016), we also verify in Tables 9 to 13 that our significant results are not due only to the SBO deals which make up one-third of our deal dataset. In an additional specification, we added a SBO dummy as well as the cross-effect of SB dummy and Dry Powder. Our results still hold while the SBO variables outcome as non-significant (non-tabulated results).

6. Concluding remarks

Our empirical results show that management fees, the GP track record and experience as well as the fund size do influence the percentage of dry powder relative to committed capital of the fund.

We further document that high dry powder levels are potentially associated with investment distortions that deteriorate fund performance. Deals performed with an excess of dry powder are larger and are performed with less leverage, less syndication and a slightly higher entry multiple leading to a lower cash return. Finally, we show that this situation leads to a significant loss of performance for the fund.

Our findings suggest that funds with high dry powder towards the end of the investment period have more interest to spend equity (and therefore to enter into less leveraged deals and less syndication or even too expensive deals) than to maximize the LP returns. Our research contributes to previous research investigating the consequences of buying and selling pressure for secondary buyout funds. Similar to Arcot et al. (2015) and Degeorge et al. (2016), we find that dry powder is associated with investment distortions. Yet our results hold for all leveraged buyout funds and not only for SBOs. We did not find any different effect for SBO deals which constitute one third of our sample. Besides, our study focuses on the marginal effect of the dry powder and relies on a direct estimate between the dry powder and the deal features, which allows us to draw causality conclusions.

This paper also contributes to the understanding of the agency problems in GP-LP relationships. We investigate whether fund contract features might indeed influence the fund general partner's investment decisions. Both our theoretical model and our empirical results support the fact that the basis of computations for management fees significantly affects GP investment behavior and might induce investment distortions. Although policy makers have focused on carry interests to align interests between GP and LPs, we claim that the computation of management fees could play a more important role. These results are of interest not only for academics and policy makers, but may be beneficial for LPs to navigate into this very opaque industry. It can help them to evaluate the track record of GP when proceeding at the fund selection.

References

Arcot, Sridhar, Zsuzsanna Fluck, José Miguel Gaspar, and Ulrich Hege. 2015. "Fund Managers under Pressure: Rationale and Determinants of Secondary Buyouts." *Journal of Financial Economics* 115 (1): 102–35. https://doi.org/10.1016/j.jfineco.2014.08.002.

Axelson, Ulf, Tim Jenkinson, Per Strömberg, and Michael S. Weisbach. 2013. "Borrow Cheap, Buy High? The Determinants of Leverage and Pricing in Buyouts." *Journal of Finance* 68 (6): 2223–67. https://doi.org/10.1111/jofi.12082.

Axelson, Ulf, Per Strömberg, and Michael S. Weisbach. 2009. "Why Are Buyouts Levered? The Financial Structure of Private Equity Funds." *Journal of Finance* 64 (4): 1549–82. https://doi.org/10.1111/j.1540-6261.2009.01473.x.

Braun, Reiner, and Ingo Stoff. 2016. "The Cost of Private Equity Investing and the Impact of Dry Powder." *The Journal of Private Equity*. Euromoney Institutional Investor PLC. https://doi.org/10.2307/44396792.

Brown, Gregory W., Robert S. Harris, Tim Jenkinson, Steven N. Kaplan, and David T. Robinson. 2015. "What Do Different Commercial Data Sets Tell Us About Private Equity Performance?" *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2701317.

Brown, Gregory W, Oleg R Gredil, Steven N Kaplan, James Bachman, Diego Garcia, Tim Jenkinson, Bob Harris, et al. 2016. Do Private Equity Funds Manipulate Reported Returns?" http://www.nber.org/papers/w22493.

Chung, Ji Woong, Berk A. Sensoy, Léa Stern, and Michael S. Weisbach. 2012. "Pay for Performance from Future Fund Flows: The Case of Private Equity." *Review of Financial Studies* 25 (11): 3259–3304. https://doi.org/10.1093/rfs/hhr141.

Davis, Steven J., John Haltiwanger, Kyle Handley, Ron Jarmin, Josh Lerner, and Javier Miranda. 2014. "Private Equity, Jobs, and Productivity." *American Economic Review* 104 (12): 4184–4204. https://doi.org/10.1257/aer.104.12.3956.

Degeorge, Francois, Jens Martin, and Ludovic Phalippou. 2016. "On Secondary Buyouts." *Journal*

of Financial Economics 120 (1): 124–45. https://doi.org/10.1016/j.jfineco.2015.08.007.

Gompers, Paul A. 1996. "Grandstanding in the Venture Capital Industry." *Journal of Financial Economics* 42 (1): 133–56. https://doi.org/10.1016/0304-405X(96)00874-4.

Graves, Samuel B., and Jeffrey Ringuest. 2018. "Overconfidence and Disappointment in Venture Capital Decision Making: An Empirical Examination." *Managerial and Decision Economics* 39 (5): 592–600. https://doi.org/10.1002/mde.2931.

Harris, Robert S., Tim Jenkinson, and Steven N. Kaplan. 2014. "Private Equity Performance: What Do We Know?" *Journal of Finance* 69 (5): 1851–82. https://doi.org/10.1111/jofi.12154.

Ivashina, Victoria, and Anna Kovner. 2011. "The Private Equity Advantage: Leveraged Buyout Firms and Relationship Banking." *Review of Financial Studies* 24 (7). https://doi.org/10.1093/rfs/hhr024.

Jenkinson, Tim, Miguel Sousa, and Rüdiger Stucke. 2013. "How Fair Are the Valuations of Private Equity Funds?" *SSRN Electronic Journal*, no. February 2013. https://doi.org/10.2139/ssrn.2229547.

Jensen, Michael, and William Meckling. 2012. "Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure." *The Economic Nature of the Firm: A Reader, Third Edition*, 283–303. https://doi.org/10.1017/CBO9780511817410.023.

Kandel, Eugene, Dima Leshchinskii, and Harry Yuklea. 2010. "VC Funds: Aging Brings Myopia." *Journal of Financial and Quantitative Analysis* 46 (2): 431–57. https://doi.org/10.1017/S0022109010000840.

Kaplan, Steven N., and Antoinette Schoar. 2005. "Private Equity Performance : Returns , Persistence , and Capital Flows Private Equity Performance : Returns , Persistence , and Capital Flows ∗." *The Journal of Finance* LX (4): 1791–1824. https://doi.org/10.1111/j.1540-6261.2005.00780.x.

Ljungqvist, Alexander, and Matthew Richardson. 2003. The Cash Flow, Return and Risk Characteristics of Private Equity." http://www.nber.org/papers/w9454.

Ljungqvist, Alexander, Matthew Richardson, and Daniel Wolfenzon. 2020. "The Investment Behavior of Buyout Funds: Theory and Evidence." *Financial Management* 49 (1): 3–32. https://doi.org/10.1111/fima.12264.

Lopez-de-Silanes, Florencio, and Ludovic Phalippou. 2008. "Private Equity Investments: Performance and Diseconomies of Scale." *SSRN Electronic Journal*, no. November: 1–28.

Metrick, Andrew, and Ayako Yasuda. 2010. "The Economics of Private Equity Funds." *Review of Financial Studies* 23 (6): 2303–41. https://doi.org/10.1093/rfs/hhq020.

Phalippou, Ludovic. 2020. "An Inconvenient Fact: Private Equity Returns & The Billionaire Factory." *SSRN Electronic Journal*, 1–37. https://doi.org/10.2139/ssrn.3623820.

Phalippou, Ludovic, and Oliver Gottschalg. 2009. "The Performance of Private Equity Funds Author (s): Ludovic Phalippou and Oliver Gottschalg Published by : Oxford University Press . Sponsor : The Society for Financial Studies . Stable URL : Https://Www.Jstor.Org/Stable/30225708 The Performance of Private Equity Funds" 22 (4): 1747–76.

Robinson, David T., and Berk A. Sensoy. 2012. "Do Private Equity Fund Managers Earn Their Fees? Compensation, Ownership, and Cash Flow Performance." *SSRN Electronic Journal*, no. July 2011. https://doi.org/10.2139/ssrn.1890777.

Robinson, David T., and Berk A. Sensoy. 2016. "Cyclicality, Performance Measurement, and Cash Flow Liquidity in Private Equity." *Journal of Financial Economics* 122 (3). https://doi.org/10.1016/j.jfineco.2016.09.008.

Strömberg, Per Johan, Edith S. Hotchkiss, and David C. Smith. 2012. "Private Equity and the Resolution of Financial Distress." *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1787446.

Tennert, Julius, Marie Lambert, and Hans Peter Burghof. 2018. "Moral Hazard in High-Risk Environments: Optimal Follow-on Investing in Venture Capital Finance." *Venture Capital* 20 (4). https://doi.org/10.1080/13691066.2018.1491095.

Table 1: Data collection: S&P CIQ, Preqin deal database, and Eikon LBO loans database.
In panel A, we report deals for which we have information from the combination of S&P CIQ and Preqin (Private Capital Deals Search Buyout dataset and Private Capital Exits Search Buyout dataset). Data added from the combination with Preqin are shown in parenthesis. In panel B, we merge samples from panel A with EIKON loans database (to obtain leverage information). Information on the acquisition means that the acquisition price, the industry of the target, and the name of the target are known. Information on the acquisition and the exit strategy contains deals that additionally have information on the exit strategy (type of exit). Period: July 1980 – June 2019.

	Panel A Without Leverage		**Panel B With Leverage**		
Database(s)	CIQ	CIQ + Preqin	CIQ	CIQ + Preqin	CIQ + Preqin + Eikon
Information on the acquisition	4258	4656 *(+398)*	765 *(+395)*	1160 *(+266)*	1426
Information on the acquisition and the exit strategy	436	1972 *(+1536)*	80 *(+590)*	670 *(+232)*	902
Information on the acquisition, the exit strategy and the exit price	163	931 *(+768)*	40 *(+321)*	361 *(+130)*	491

Table 2: Data collection: Combined S&P CIQ, Preqin deal database, and Eikon LBO loans database matched with sponsor information from Preqin.

This table considers deals for which we have information on the sponsor funds. In panel A, we report deals for which we have information from the combination of S&P CIQ and Preqin (Private Capital Deals Search Buyout dataset and Private Capital Exits Search Buyout dataset). In panel B, we combine samples from panel A with EIKON loans database. Period: July 1980 – June 2019.

	Panel A Without Leverage		**Panel B With Leverage**		
Database(s)	CIQ	CIQ + Preqin	CIQ	CIQ + Preqin	CIQ + Preqin + Eikon
Information on the acquisition	809	1011 *(+202)*	277 *(+151)*	428 *(+150)*	578
Information on the acquisition and the exit strategy	95	757 *(+662)*	31 *(+308)*	339 *(+113)*	452
Information on the acquisition, the exit strategy and the exit price	32	378 *(+346)*	13 *(+172)*	185 *(+70)*	255

Table 3: Summary statistics on LBO deals.

Table 3 displays descriptive characteristics on our deal samples 1.1, 1.2 and 1.3. Variable definitions can be found in Appendix A.2. N is the number of deals, SBO is the number of SBO in our deal sample and N(funds) is the number of funds sponsoring the deals. We test whether samples 1.2 and 1.3 are significantly different from 1.1 on the various characteristics (see Diff test). In order to reduce the effect of outliers, we winsorized the entry price and the target total assets at the 95th percentile.

Panel A – Sample 1.1: Deals with acquisition information					
Deal characteristics	Mean	Std. Dev.	Median	N	SBO
Entry characteristics					
Entry price (million USD)	413.14	650.00	125	4,656	572
Number of funds	1.23	0.63	1	4,656	572
Target revenue (million USD)	968.31	2904.66	274.35	1,702	222
Target EBITDA margin (%)	12.88	9.38	12.84	1,141	122
Entry revenue multiple	1.87	3.37	1.17	1,575	203
Entry EBITDA multiple	14.21	86.68	12.56	1,019	121
Target total assets (million USD)	835.64	1261.63	314.54	1,066	99

Panel B – Sample 1.2: Deals with acquisition and sponsor information							
Deal characteristics	Mean	Std. Dev.	Median	N	SBO	N(funds)	Diff test (1.1 – 1.2)
Entry characteristics							
Entry price (million USD)	717.79	820.96	345	1,011	209	383	(390.233)***
Number of funds	1.41	0.79	1	1,011	209	383	(0.232)***
Target revenue (million USD)	1393.17	3483.38	452.63	532	89	109	(618.051)***
Target EBITDA margin (%)	15.73	12.11	13.79	349	50	63	(4.173)
Entry revenue multiple	1.78	1.46	1.41	490	80	79	0.129
Entry EBITDA multiple	11.75	21.45	9.79	339	49	62	3.687
Target total assets (million USD)	1069.84	1513.82	646.41	317	53	37	(417.209)***

Panel C – Sample 1.3: Deals with acquisition, exit and sponsor information							
Deal characteristics	Mean	Std. Dev.	Median	N	SBO	N(funds)	Diff test (1.1-1.3)
Entry characteristics							
Entry price (million USD)	927.80	872.80	575	378	86	65	(560.65)***
Number of funds	1.57	0.85	1	378	86	65	(0.362)***
Target revenue (million USD)	1787.73	4636.21	595.82	231	47	39	(948.109)***
Target EBITDA margin (%)	17.02	11.72	14.65	162	31	28	4.855
Entry revenue multiple	2.00	1.60	1.52	215	41	35	(0.154)
Entry EBITDA multiple	10.98	8.60	9.85	153	26	27	3.805
Target total assets (million USD)	1315.32	1500.95	673.15	140	23	21	(522.206)***
Exit characteristics							
Exit price (million USD)	1235.97	2585.70	500	378	86	65	
Investment duration	4.82	2.59	4	378	86	65	
Exit multiple	3.39	1.77	3	5	39	8	
Return (cash multiple)	2.15	5.78	1.51	378	86	65	

Table 4: Summary statistics on LBO deals with leverage information. Table 4 displays descriptive characteristics for our deal samples 2.1-2.2 and 2.3. Variable definitions can be found in Appendix A.2. N is the number of deals, SBO is the number of SBO in our deal sample and N(funds) is the number of funds sponsoring the deals. We test whether samples 2.2 and 2.3 are significantly different from 2.1 on the various characteristics (see Diff test). In order to reduce the effect of outliers, we winsorized the entry price, the target total assets and the leverage at the 95th percentile.

Panel A – Sample 2.1 Deals with acquisition information					
Deal characteristics	Mean	Std. Dev.	Median	N	SBO
Entry characteristics					
Entry price (million USD)	891.26	849.69	549	1426	315
Leverage of the deal (%)	55.69	20.05	59.39	1426	315
Number of fund	1.50	0.89	1	1426	315
Target revenue (million USD)	1523.63	3311.49	521.71	792	140
Target EBITDA margin (%)	17.90	16.61	14.50	579	80
Entry revenue multiple	2.09	2.07	1.52	757	131
Entry EBITDA multiple	16.48	102.67	9.77	570	85
Target total assets (million USD)	1242.09	1467.75	604.95	527	66

Panel B – Sample 2.2: Deals with acquisition and sponsor information							
Deal characteristics	Mean	Std. Dev.	Median	N	SBO	N(funds)	Diff test (2.1 – 2.2)
Entry characteristics							
Entry price (million USD)	1035.40	880.62	700.38	578	146	94	(244.838)***
Leverage of the deal (%)	55.74	0.28	59.40	578	146	94	(0.085)
Number of funds	1.57	0.89	1	578	146	94	(0.112)**
Target revenue (million USD)	1749.20	3964.42	641.59	353	69	58	(406.947)**
Target EBITDA margin (%)	16.41	10.91	14.49	262	41	46	2.708**
Entry revenue multiple	2.06	1.56	1.61	332	63	52	0.059
Entry EBITDA multiple	11.11	17.21	10.00	256	41	47	9.731
Target total assets (million USD)	1334.10	1464.43	716.26	232	31	38	(164.341)

Panel C – Sample 2.3: Deals with acquisition, exit and sponsor information							
Deal characteristics	Mean	Std. Dev.	Median	N	SBO	N(funds)	Diff test (2.1 – 2.2)
Entry characteristics							
Entry price (million USD)	1167.49	665.32	883.87	255	67	46	(338.212)***
Leverage of the deal (%)	56.04	18.63	58.98	255	67	46	(4.272)
Number of funds	1.70	0.92	1	255	67	46	(0.245)***
Target revenue (million USD)	1936.97	4906.08	750.00	177	39	33	(532.300)**
Target EBITDA margin (%)	17.67	11.48	15.59	133	26	24	2.883
Entry revenue multiple	2.25	1.68	1.83	164	33	29	(0.207)
Entry EBITDA multiple	10.83	8.08	9.88	125	22	23	7.240
Target total assets (million USD)	1493.49	3085.08	718.05	115	19	18	(321.585)**
Exit characteristics							
Exit price (million USD)	1624.04	3085.08	718.05	255	67	46	
Investment duration	4.85	2.49	5	255	67	46	
Exit multiple	3.28	1.80	3.05	28	5	5	
Return (cash multiple)	1.55	1.46	1.41	255	67	46	

Table 5: Summary statistics on fund sponsor.

Table 5 displays summary statistics on the sample of fund sponsors that are involved in deals from sample 1.2. It also splits the sample in quartiles according to the level of dry powder these funds had in Y4 (vintage year +4) or Y5 (vintage year +5). Q1 (resp. Q4) stands for the lowest (highest) quartile. We perform a difference test on the charactetistics between these two groups. *, **, *** stands for significance at the 10%, 5%, and 1% level.

	All Funds			Q1 Dry Powder Y4		Q4 Dry Powder Y4		Diff Test Y4	Q1 Dry Powder Y5		Q4 Dry Powder Y5		Diff Test Y5
	Mean	Std. dev.	N	Mean	N	Mean	N	(Q1 – Q4)	Mean	N	Mean	N	(Q1 – Q4)
Dry powder Y4	0.315	0.191	383	0.071	96	0.562	95	(0.492)***	0.118	96	0.533	95	(0.415)***
Dry powder Y5	0.179	0.164	383	0.014	96	0.369	95	(0.354)***	0.016	96	0.396	95	(0.38)***
Dry powder Y6	0.094	0.139	383	-0.017	95	0.221	96	(0.238)***	-0.044	95	0.241	96	(0.285)***
Dry powder change (Y4 to Y6)	0.221	0.138	383	0.088	96	0.341	95	(0.253)***	0.163	96	0.292	95	(0.129)***
Fund size (million USD)	2058.09	3173.9	383	2848.481	96	1664.596	95	1183.885***	2644.906	96	1895.209	95	748.697***
TVPI	1.73	0.555	383	1.78	96	1.72	95	0.06	1.76	96	1.71	95	0.05
KSPME	1.27	0.405	383	1.34	96	1.25	96	0.09*	1.33	96	1.25	96	0.08*
Past perf. (TVPI)	1.90	0.610	223	2.06	63	1.78	53	0.276***	1.95	65	1.76	52	0.187**
Past perf. (KSPME)	1.277	1.337	223	1.62	63	1.13	53	0.49*	1.51	65	1.11	52	0.40
Beta_1	1.02	0.152	374	1.00	92	1.04	93	(0.04)*	1.03	93	1.02	92	0.01
Beta_2	1.06	0.090	240	1.04	64	1.06	51	(0.02)	1.05	62	1.06	55	(0.01)
Beta Deviation	0.037	0.150	236	0.06	62	0.02	51	0.04*	0.02	60	0.02	54	0.00
HHI	0.42	0.407	383	0.41	96	0.36	96	0.05	0.40	96	0.38	96	0.02
Management fees (%)	1.90	0.270	166	1.82	39	1.91	50	(0.17)	1.88	36	1.88	47	0.00
Carried interest (%)	20.29	2.227	195	20.54	44	20.55	54	(0.01)	20.23	48	20.49	51	(0.26)
GP Fundraising 1 (%)	0.32	0.470	383	0.41	96	0.23	96	0.18***	0.34	96	0.20	96	0.14**
First fund (%)	0.11	0.318	383	0.13	96	0.11	96	0.02	0.09	96	0.10	96	(0.01)
Mid-experienced fund (%)	0.39	0.490	383	0.33	96	0.43	96	(0.10)*	0.37	96	0.47	96	(0.10)*
Experienced fund (%)	0.50	0.500	383	0.53	96	0.45	96	0.08	0.53	96	0.42	96	0.09*

Sample 1.2

Table 6: Contract features and dry powder.
This table presents the probit regressions corresponding to Equation 12. The dependent variable is an indicator equal to 1 if the level of dry powder at the 4th year (vintage year+4) of the fund is above the median of the sample. This sample is composed of funds that are involved in deals from sample 1.2. * significant at 10%, ** significant at 5%, and *** significant at 1%.

	1	2	3	4
Infrequent fundraiser	0.069	0.147	-0.244	0.152
	(0.152)	(0.385)	(0.463)	(0.547)
Fund Size	-0.096	-0.103	-0.450*	-0.606*
	(0.070)	(0.175)	(0.249)	(0.333)
GP Experience	-0.016	-0.133	-0.186*	-0.273*
	(0.035)	(0.095)	(0.110)	(0.150)
GP Fundraising 1	-0.663***	-1.724**	-1.471*	-1.735*
	(0.180)	(0.676)	(0.761)	(0.927)
Management Fees			-2.731**	-3.334**
			(1.282)	(1.571)
Carried Interest			-0.042	0.013
			(0.116)	(0.148)
GP Past perf. (TVPI)				-1.785***
				(0.646)
Beta_1				0.554
				(1.478)
Vintage Year Fixed Effect	Yes	Yes	Yes	Yes
N	372	72	72	72
Pseudo R-Squared	0.1005	0.2764	0.3388	0.4606

Table 7: Dry powder and fund sponsor performance.
This table presents the results of OLS regressions corresponding to Equation 13. The dependent variable is the TVPI (Total Value Paid in Capital) at the closing of the fund for specifications (1) to (2). The dependent variable is the KSPME (Kaplan Schoar PME) at the closing of the fund in specifications (3) to (4). We consider the funds from sample 1.2 on which we could retrieve the fund performance information and GP control variables. Dry powder Year 4 is the amount of dry powder of the fund at vintage year + 4. Standard errors are reported in parentheses. * significant at 10%, ** significant at 5%, and *** significant at 1%.

	TVPI		KSPME	
	1	2	3	4
Dry powder Y4		-0.442**		-0.413***
		(0.193)		(0.137)
Fund size (million USD)	-0.054	-0.059*	-0.013	-0.015
	(0.033)	(0.034)	(0.024)	(0.024)
GP Experience	0.029*	0.025	0.014	0.009
	(0.017)	(0.017)	(0.012)	(0.012)
GP Past Perf.	0.158**	0.133**	0.015	0.031
	(0.061)	(0.060)	(0.037)	(0.037)
Vintage year fixed effect	Yes	Yes	Yes	Yes
N	223	223	223	223
R-Squared	0.1893	0.2098	0.1626	0.1985

Table 8: Deal distorsions: Summary statistics.
This table presents cash multiple, entry price, entry multiple, leverage and deal syndication of deals performed by funds with a high (Q3) or low (Q1) level of dry powder. Q1 represents the subsample of deals whose level of dry powder (the quarter before the deal execution) is below the 33th percentile. Q3 represents the subsample of deals whose level of dry powder (the quarter before the deal execution) is above the 66th percentile. To determine the percentile, the cross-section of deals executed at the same vintage year are considered. The differences between the two subsample are tested through t-test. Panel A includes all deals from Sample 1.3, 1.2 or 2.2. Panel B only includes deals that occur at or after the fourth year of the fund. * significant at 10%, ** significant at 5%, and *** significant at 1%.

	Sample 1: All deals					
	Q1 Dry Powder		Q3 Dry Powder		Difference Test	Sample
	Mean	N	Mean	N	Q1 – Q3	
Return (cash multiple)	2.013	95	2.005	65	0.007	Sample 1.3
Entry price (in Million USD)	756.159	259	621.081	219	135.077	Sample 1.2
Entry multiple	9.329	86	10.492	65	(1.163)	Sample 1.2
Leverage (in %)	56.933	150	57.081	107	(0.154)	Sample 2.2
Deal syndication	1.467	259	1.474	219	(0.007)	Sample 1.2
	Sample 2: Deal Investment Year >=Vintage year +4					
	Q1 Dry Powder		Q3 Dry Powder		Difference Test	Sample
	Mean	N	Mean	N	Q1 – Q3	
Return (cash multiple)	1.838	28	0.529	17	1.308**	Sample 1.3
Entry price (in Million USD)	563.084	63	680.061	49	(116.976)	Sample 1.2
Entry EBITDA multiple	9.191	34	12.626	26	(3.453)	Sample 1.2
Leverage of the deal (%)	58.526	39	58.343	26	0.216	Sample 2.2
Deal syndication	1.282	63	1.177	49	0.106*	Sample 1.2

Table 9: Dry powder and Cash on cash return.
This table displays the results of the OLS regressions corresponding to Equation 14. The dependent variables is the deal cash multiple. The dry powder (DP) is measured one quarter before the deal is executed. We consider 105 deals from sample 1.3 that are executed at least four years after the vintage year. Deal size is measured as the log of the entry price. High Deal Size (resp. Low Deal size) takes the value of 1 should the deal entry price be above the median cross-sectional deal entry price. Standard errors are reported in parentheses. * significant at 10%, ** significant at 5%, and *** significant at 1%.

	Deal Investment Year >=Vintage year + 4					
	1	2	3	4	5	6
DP	-2.213**	-2.005**	-2.183**	-2.323**	-1.329	
	(0.865)	(0.852)	(0.853)	(0.877)	(0.809)	
Fund Size		-0.079	-0.067	-0.117	-0.100	-0.196
		(0.140)	(0.139)	(0.155)	(0.138)	(0.156)
GP Experience		0.168**	0.172**	0.167**	0.144**	0.159**
		(0.075)	(0.074)	(0.075)	(0.067)	(0.073)
GP Fundraising 2			-0.478	-0.578*	-0.413	-0.563*
			(0.315)	(0.344)	(0.308)	(0.336)
GP Past Perf.				0.152	0.854	0.134
				(0.209)	(0.186)	(0.205)
Deal Size					- 0.624***	
					(0.134)	
DP x High Deal Size						-3.046***
						(0.918)
DP x Low Deal Size						-1.089
						(1.026)
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Investment Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
N	105	105	105	105	105	105
R-Squared	0.2784	0.3244	0.3436	0.3480	0.3130	0.3864

Table 10: Dry powder and deal size.
This table displays the results of the OLS regressions corresponding to Equation 15. The dependent variable is the deal size as measured by the log of the deal entry price. The dry powder (DP) is measured one quarter before the deal is executed. We consider 230 deals from sample 1.2 that are executed at least four years after the vintage year. Standard errors are reported in parentheses. * significant at 10%, ** significant at 5%, and *** significant at 1%.

	Deal Investment Year >=Vintage year + 4			
	1	2	3	4
DP	0.526	0.954**	0.976**	1.706**
	(0.527)	(0.445)	(0.446)	(0.758)
Fund size		0.769***	0.765***	0.787***
		(0.085)	(0.087)	(0.132)
GP Experience		-0.067*	-0.070*	-0.088
		(0.040)	(0.040)	(0.057)
GP Fundraising 2			0.178	0.018
			(0.212)	(0.311)
GP Past Perf.				-0.104
				(0.285)
Industry Fixed Effect	Yes	Yes	Yes	Yes
Investment Year Fixed Effect	Yes	Yes	Yes	Yes
N	230	230	230	230
R-Squared	0.1058	0.3775	0.3797	0.4651

Table 11: Dry powder and deal pricing.
This table displays the results of the OLS regressions corresponding to Equation 16. The dependent variable is Entry EBITDA multiple. The dry powder (DP) is measured one quarter before the deal is executed. We consider 120 deals from sample 1.2 that are executed at least four years after the vintage year. Deal size is measured as the log of the entry price. High Deal Size (resp. Low Deal size) takes the value of 1 should the deal entry price be above the median cross-sectional deal entry price. Standard errors are reported in parentheses. * significant at 10%, ** significant at 5%, and *** significant at 1%.

	Deals >=Vintage year +4					
	1	2	3	4	5	6
DP	3.771	4.047	4.418	3.900	3.858	
	(3.612)	(3.525)	(3.552)	(3.691)	(3.725)	
Fund size		-1.559*	-1.506*	-1.046	-1.373	-1.207
		(0.853)	(0.855)	(0.871)	(0.972)	(0.910)
GP experience		0.895**	0.919**	0.989**	0.990**	0.959**
		(0.367)	(0.369)	(0.392)	(0.394)	(0.394)
GP Fundraising 2			-1.862	-1.709	-1.643	-1.614
			(2.050)	(2.077)	(2.147)	(2.089)
GP Past Perf.				-0.507	-0.498	-0.494
				(0.933)	(0.941)	(0.935)
Deal Size					-0.099	
					(0.757)	
DP x High Deal Size						8.122
						(6.174)
DP x Low Deal Size						3.786
						(3.699)
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Investment Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
N	120	120	120	120	120	120
R-Squared	0.1620	0.2290	0.2358	0.2383	0.2384	0.2444

Table 12: Dry powder and leverage.
This table displays the results of the OLS regressions corresponding to Equation 17. The dependent variables is the deal leverage. The dry powder (DP) is measured one quarter before the deal is executed. We consider 127 deals from sample 2.2 that are executed at least four years after the vintage year. Deal size is measured as the log of the entry price. High Deal Size (resp. Low Deal size) takes the value of 1 should the deal entry price be above the median cross-sectional deal entry price. Standard errors are reported in parentheses. * significant at 10%, ** significant at 5%, and *** significant at 1%.

	Deal Investment Year >=Vintage year + 4					
	1	2	3	4	5	6
DP	-16.834**	-18.041**	-19.872***	-20.396**	-22.579***	
	(7.173)	(7.335)	(7.480)	(7.798)	(7.936)	
Fund size		-1.634	-1.441	-1.565	-3.147	-1.438
		(1.471)	(0.714)	(1.564)	(1.957)	(1.592)
GP Experience		0.219	0.389	0.344	0.552	0.311
		(0.701)	(0.714)	(0.739)	(0.752)	(0.745)
GP Fundraising 2			-4.208	-4.458	-5.289	-4.421
			(3.529)	(3.683)	(3.721)	(3.669)
GP Past Perf.				0.477	0.575	0.488
				(1.892)	(1.886)	(1.900)
Deal Size					2.124	
					(1.590)	
DP x High Deal Size						-24.153**
						(10.989)
DP x Low Deal Size						-19.319**
						(8.135)
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Investment Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
N	127	127	127	127	127	127
R-Squared	0.3379	0.3470	0.3565	0.3569	0.3689	0.3585

Table 13: Dry powder and deal syndication.
This table displays the results of the OLS regressions corresponding to Equation 18. The dependent variables is the *Deal club*, i.e. the number of LBO funds involved in the purchase of the target company. The dry powder (DP) is measured one quarter before the deal is executed. We consider 230 deals from sample 1.2 that are executed at least four years after the vintage year. Deal size is measured as the log of the entry price. Standard errors are reported in parentheses. * significant at 10%, ** significant at 5%, and *** significant at 1%.

	Deal Investment Year >=Vintage year + 4				
	1	2	3	4	5
DP	-0.211	-0.239*	-0.248*	-0.248*	-0.242*
	(0.144)	(0.143)	(0.145)	(0.145)	(0.145)
Fund size		-0.074***	-0.074***	-0.009***	-0.070**
		(0.027)	(0.027)	(0.028)	(0.028)
GP Experience		0.008	0.009	0.009	0.009
		(0.014)	(0.014)	(0.015)	(0.015)
GP Fundraising 1			-0.033	-0.035	-0.035
			(0.076)	(0.078)	(0.078)
GP Past Perf.				0.004	0.002
				(0.035)	(0.034)
Deal Size					0.047**
					(0.021)
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes
Investment Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
N	230	230	230	230	230
R-Squared	0.1155	0.1286	0.1289	0.1289	0.1364

Table A.1: Fund sponsor variables - Definitions.

Variable	Definition
Beta_1	*Beta_1* is computed by assigning to each PE fund the beta of the industry in which they mainly invest in. Each industry has been assigned to one of the 48 industry groups and the corresponding beta for publicly traded companies in the same industry was allocated. PE funds that are classified as diversified display a beta equals to one.
Beta_2	*Beta_2* is estimated by computing the weighted average of the beta's portfolio companies in which the fund has invested in and for which we have the information. Each company has been assigned to one of the 48 industry groups and the corresponding beta for publicly traded companies in the same industry was allocated.
Beta deviation	*Beta deviation* is the difference between *Beta_2* and *Beta_1*.
Carried interest	*Carried interest* is in percentage and is the performance-based component of the profit-sharing agreement between GP and LPs.
Dry powder Y4 (resp. Y5, Y6)	*Dry powder* is 1 minus the ratio of the invested capital to the total committed capital of the fund and represents the level of dry powder at the fourth (resp. fifth, sixth) year of the life of the fund (Vintage year of the fund + 4, resp. +5, +6).
Dry powder change (Y4 to Y6)	*Dry powder* change is the difference in dry powder between year 4 (Vintage year of the fund + 4) and year 6 (Vintage year of the fund + 6).
Experienced funds	*Experienced funds* are funds that are at least the fourth fund of a PE firm.
First fund	*First fund* is a variable for funds that are the first fund of a PE company.
GP Fundraising phase 1	*GP Fundraising 1* is a variable equals to one if vintage year + 4 falls within the period of fundraising of a follow up fund. We compute fundraising period as the fundraising starting date of the follow up fund + 3years or when not provided, as its vintage year minus two years (to account for roadshows) up to the vintage year plus one year to account for LPs entering the fund the first year of investment.
GP Fundraising phase 2	*GP Fundraising 2* is a variable equals to one if the investment year of the deal falls within the period of fundraising of a follow up fund. We compute fundraising period as the fundraising starting date of the follow up fund + 3years or when not provided, as its vintage year minus two years (to account for roadshows) up to the vintage year plus one year to account for LPs entering the fund the first year of investment.
GP experience	*GP experience* is the number of fund series for the same private equity firm.
Fund size	*Fund size* represents the total committed capital of the fund (in millions USD).
HHI	*HHI* (Herfindahl-Hirschman Index) measure the deals concentration of the fund.
Infrequent fundraiser	*Infrequent fundraiser* is a variable equal to one if a fund is launched by a PE firm later than 3 years after the launch of the previous fund.
KSPME	*KSPME* (Kaplan Schoar PME) incorporates the performance contribution of a public market index by compounding each fund cash flow (capital calls and distributions) based on index performance. The index we used is the S&P500. Index performance is measured between the date of the cash flow and the valuation date.
Management fees	*Management fees* is in percentage and is the fixed component of the profit-sharing agreement that the GP received for their services (deal generation , selection, structuring, value adding, exiting).
Mid-experienced funds	*Mid-experienced funds* are funds that are the second or the third fund of a PE firm.
GP Past Performance (TVPI/KSPME)	*Past perf. (TVPI/KSPME)* is the *TVPI/KSPME* of the previous fund launched by the PE firm.
TVPI	*TVPI* (Total Value Paid In Capital) is the sum of the cash flows distributed and the residual value and this sum is divided by the invested capital; we compute it at the end of the fund life. height

Table A.2: Deal variables - Definitions.

Variable	Definition
Cash on Cash Return (cash multiple)	*Cash on cash return* (or cash multiple) is the ratio of total cash (the sum of equity market value of the target company valued at the exit price and the pre-deal net debt) received from the investment to the total cash invested (the sum of equity market value of the target company valued at the offer price and the pre-deal net debt).
Deal club	*Deal club* is the number of LBO buyer funds that are involved in the purchase of a target company.
Dry powder	*Dry powder* is 1 minus the ratio of the invested capital to the total committed capital of the fund and represents the level of dry powder one quarter before the deal.
Entry EBITDA Multiple	*Entry EBITDA Multiple* is the ratio between the entry price and the latest available annual EBITDA for the target firm at the time of the LBO.
Entry price (in million USD)	*Entry Price* represents the enterprise value of the target company, that is, the sum of equity market value (valued at the offer price) and the target's pre-deal net debt (financial debt minus cash and marketable securities).
Entry Revenue Multiple	*Entry Revenue Multiple* is the ratio between the entry price and the latest available annual revenue for the target firm at the time of the LBO.
Exit multiple	*Exit multiple* is the ratio between the exit price and the latest available annual revenue for the target firm at the time of the exit.
Exit price(in million USD)	*Exit price* represents the enterprise value of the target company, that is, the sum of equity market (valued at the exit price) and the target's pre-deal net debt (financial debt minus cash and marketable securities).
Investment duration	*Investment duration* is the number of years between the investment initiation date and the investment exit.
Leverage of the deal (in %)	*Leverage of the deal* is the ratio of the total net debt to the enterprise value of the target company.
Number of funds	*Number of funds* is the amount of LBO buyer funds that are involved in the purchase of a target company.
Target EBITDA margin (in percent)	*Target EBITDA margin* is the latest available annual EBITDA over the annual revenues for the target firm at the time of the LBO.
Target revenue (in million USD)	*Target revenue* is the latest available annual revenue for the target firm at the time of the LBO.
Target total asset (in million USD)	Target total asset is the latest available annual total assets for the target firm at the time of the LBO.

Table A.3: Contract features and dry powder.
This table displays the results of the probit regressions corresponding to Equation 12 in which the dependent variable is an indicator equal to 1 if the level of dry powder at the 4th year (vintage year+4) of the fund is above the median of the sample. The sample is composed of all PE (closed) funds retrieved from Preqin database. * significant at 10%, ** significant at 5%, and *** significant at 1%.

	1	2	3	4
Infrequent fundraiser	-0.221***	0.135	0.145	0.123
	(0.074)	(0.241)	(0.251)	(0.254)
Fund Size	-0.132***	-0.107	-0.207	-0.202
	(0.070)	(0.108)	(0.128)	(0.129)
GP Experience	0.026*	-0.100*	-0.120	-0.135**
	(0.014)	(0.058)	(0.062)	(0.064)
GP Fundraising 1	-0.443***	-0.428	-0.296	-0.194
	(0.088)	(0.353)	(0.367)	(0.375)
Management Fees			-1.006**	-1.085****
			(0.511)	(0.532)
Carried Interest			-0.012	-0.003
			(0.047)	(0.049)
GP Past Perf.				-0.251
				(0.189)
Beta_1				0.881
				(0.660)
Vintage Year Fixed Effect	Yes	Yes	Yes	Yes
N	1374	142	142	142
Pseudo R-Squared	0.0697	0.1452	0.1860	0.2021

Sample: All closed PE funds (Preqin).

Table A.4: Contract features and dry powder.
This table displays the results of an OLS regressions corresponding to Equation 12 in which the dependent variable is the level of dry powder at the 4th year (vintage year+4) of the fund. This sample is composed of funds that are involved in deals from sample 1.2. * significant at 10%, ** significant at 5%, and *** significant at 1%.

	1	2	3	4
Infrequent fundraiser	0.006	0.033	0.021	0.033
	(0.021)	(0.047)	(0.050)	(0.046)
Fund Size	-0.010	-0.014	-0.030	-0.042*
	(0.009)	(0.021)	(0.024)	(0.224)
GP Experience	-0.003	-0.027**	-0.027**	-0.024**
	(0.004)	(0.011)	(0.011)	(0.010)
GP Fundraising 1	-0.091***	-0.211***	-0.203**	-0.187**
	(0.024)	(0.071)	(0.078)	(0.072)
Management Fees			-0.144	-0.164*
			(0.098)	(0.090)
Carried Interest			0.001	0.006
			(0.011)	(0.011)
GP Past Perf.				-0.135***
				(0.037)
Beta_1				0.118
				(0.124)
Vintage Year Fixed Effect	Yes	Yes	Yes	Yes
N	372	72	72	72
Pseudo R-Squared	0.1458	0.3957	0.4176	0.5310

Table A.5: Dry powder and fund sponsor performance.
This table displays the results of the OLS regressions corresponding to Equation 13. The dependent variable is the TVPI (Total Value Paid in Capital) at the closing of the fund for specifications (1) to (2). The dependent variable is the KSPME (Kaplan Schoar PME) at the closing of the fund in specifications (3) to (4). DP is the level of dry powder at vintage year + 4. The sample is composed of all closed PE funds retrieved from Preqin database. Standard errors are reported in parentheses. * significant at 10%, ** significant at 5%, and *** significant at 1%.

	TVPI		KSPME	
	1	2	3	4
Dry powder Y4		-0.253**		-0.159**
		(0.106)		(0.069)
Fund size	-0.014	-0.020	-0.003	-0.001
	(0.016)	(0.016)	(0.010)	(0.010)
GP Experience	0.016**	0.017**	0.008*	0.008*
	(0.007)	(0.007)	(0.004)	(0.005)
GP Past Perf.	0.384***	0.375***	0.381***	0.373
	(0.028)	(0.028)	(0.025)	(0.026)
Vintage year fixed effect	Yes	Yes	Yes	Yes
N	893	893	893	893
R-Squared	0.2129	0.2179	0.2204	0.2243

Table A.6: Dry powder and Cash on cash return.
This table displays the results of the OLS regressions corresponding to Equation 14. The dependent variables is the deal cash multiple. The dry powder (DP) is measured one quarter before the deal is executed. We consider all deals from Preqin Deal database that could be matched with the PE fund sponsor database and that are executed at least four years after the vintage year. Deal size is measured as the log of the entry price. High Deal Size (resp. Low Deal size) takes the value of 1 should the deal entry price be above the median cross-sectional deal entry price. Standard errors are reported in parentheses. * significant at 10%, ** significant at 5%, and *** significant at 1%.

	Deals >=Vintage year +4					
	1	2	3	4	5	6
DP	-5.477**	-5.872***	-5.937***	-5.997***	-4.599***	
	(2.107)	(2.071)	(1.659)	(1.716)	(1.608)	
Fund size		-1.002**	-0.736**	-0.749**	-0.027	-0.589*
		(0.394)	(0.324)	(0.388)	(0.358)	(0.336)
GP experience		-0.034	-0.058	-0.059	-0.098	-0.071
		(0.179)	(0.143)	(0.144)	(0.133)	(0.140)
GP Fundraising 2			-2.295***	-2.314***	-2.099***	-2.559***
			(0.724)	(0.738)	(0.680)	(0.727)
GP Past Perf.				0.052	-0.176	0.109
				(0.357)	(0.333)	(0.349)
Deal Size					- 0.953***	
					(0.218)	
DP x High Deal Size						-7.662***
						(1.803)
DP x Low Deal Size						-3.253
						(2.008)
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Investment Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
N	166	166	123	123	123	123
R-Squared	0.1271	0.1787	0.3335	0.3336	0.4435	0.3734

List of figures

Figure 1: Dry powder and performance fees.

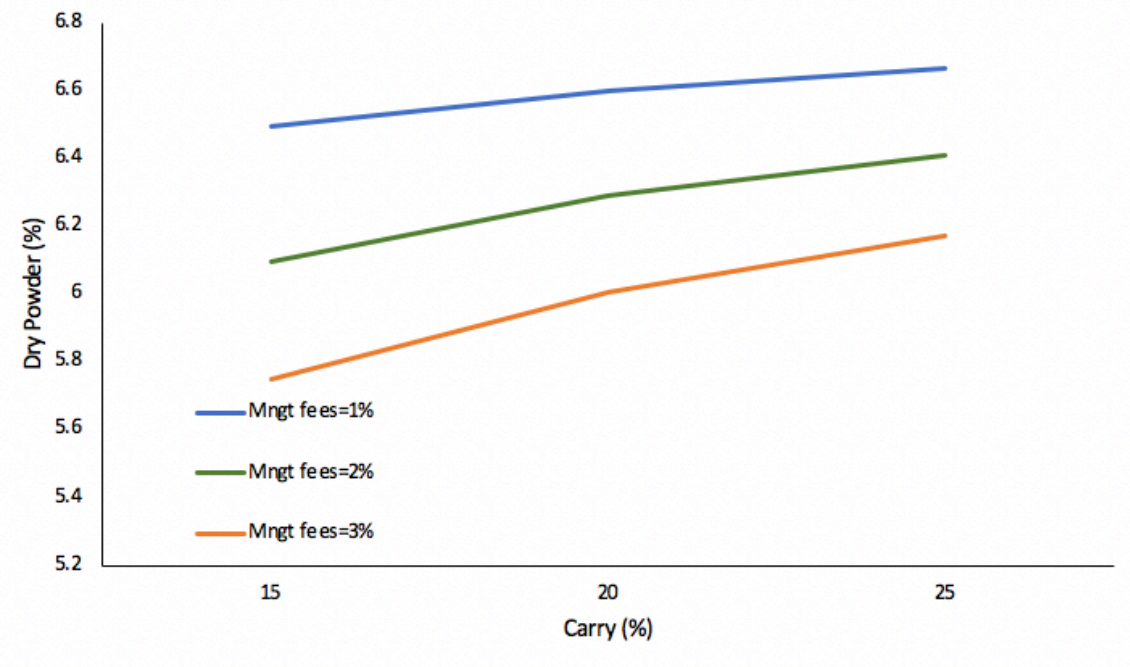


Figure 1 displays the relationship between performance fee (in %) and dry powder when there is a change in the basis of the computation of management fees. *Where* R = expected return = 20%, e = LP hurdle rate =8%, *x* = exit rate = 25%, D = duration of deal = 3, T2 = exit time = 7, b = incremental return due to the option to delay investments = 5%.

Figure 2: Dry powder and expected returns.

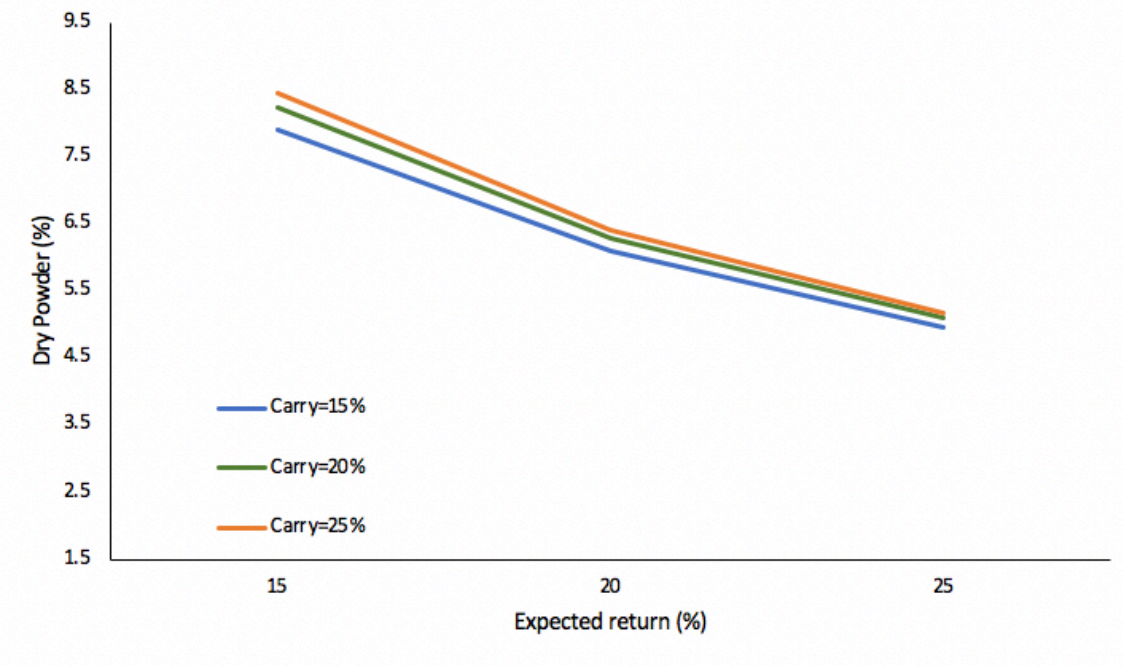
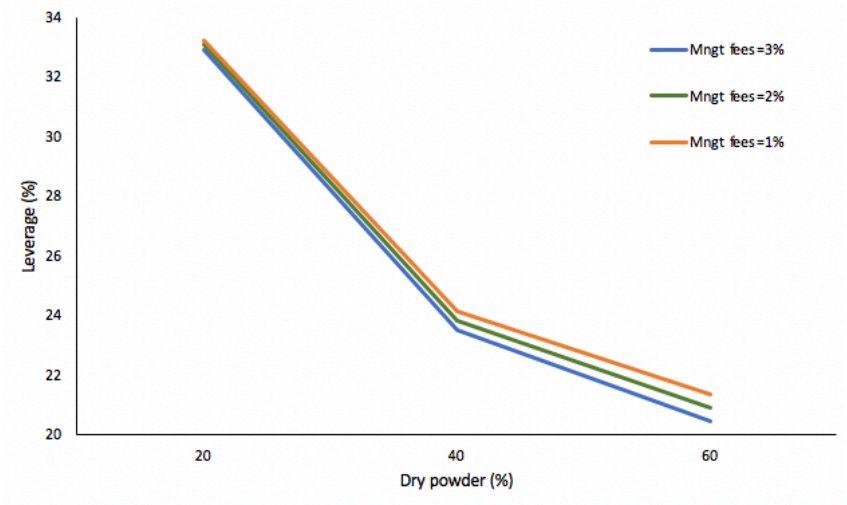


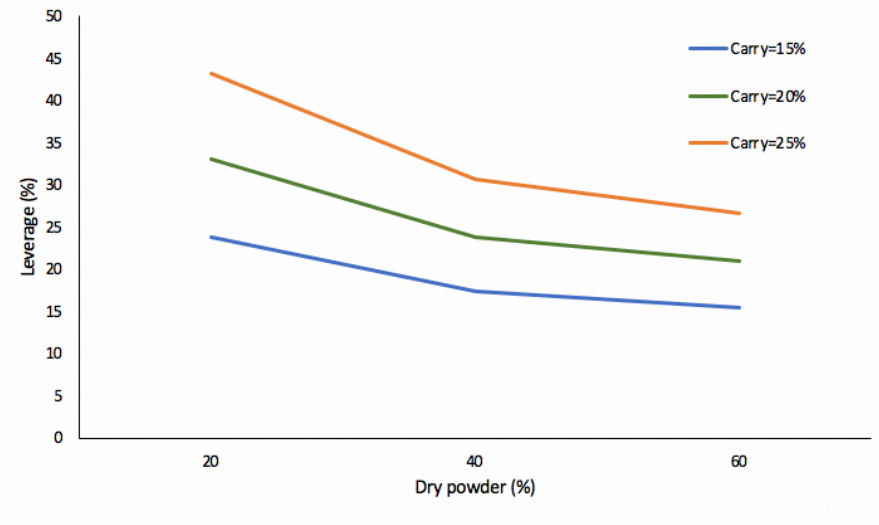
Figure 2 displays the relationship between expected return and dry powder when there is a change in the basis of the computation of management fees. *Where* α_0 = mngt fee = 2%, e = LP hurdle rate = 8%, *x*= exit rate = 25%, D = duration of deal = 3, T2 = exit time = 7, b = incremental return due to the option to delay investments = 5%.

Figure 3: Leverage and dry powder

Panel A



Panel B



Panel C

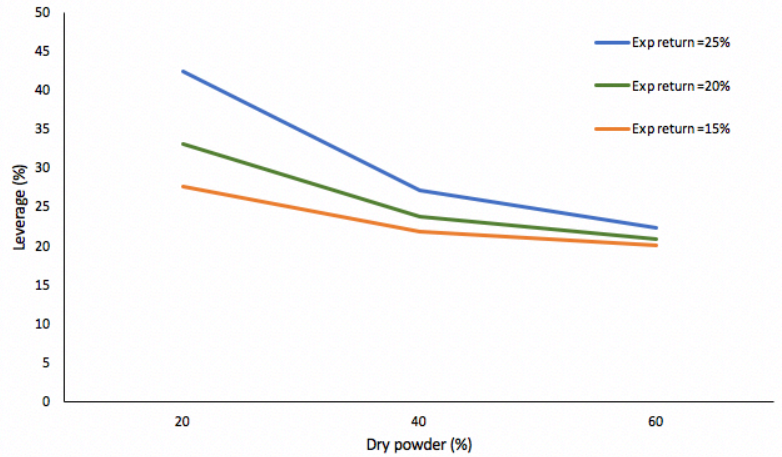


Figure 3 displays the relationship between leverage ratio and the dry powder when there is a change in the basis of the computation of management fees. *Where* $\alpha_0 = 2\%$, $\alpha_1 = 20\%$, R = 20%, e = 8%, $x = 25\%$, D = 3, T2= 5, b = 5%, r0 = 4%. Panel A tests the impact of a variation in management fees on the dry powder-leverage relation, Panel B tests the implication of dry powder on leverage when considering different levels of carry interests, Panel C tests the impact of expected return on the relation between the dry powder and the leverage.