Private equity across the credit cycle: A cross-sectional approach

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Abstract

We document how borrowing, investment and subsequent performance are different among buyout firms and how these differences evolve over the credit cycle. Much of the response to credit conditions is driven by the most experienced firms. More experienced firms ramp up investments by almost twice as much as less experienced firms in booming credit conditions. We use deal-level returns data to document that this cyclical response to credit conditions is correlated with a decrease in average equity returns. This relation holds even after controlling for leverage, which is positively related to returns. For a one standard deviation decrease in credit spreads, returns are 5% lower. However, the decrease is no larger for the most experienced private equity firms, compared to their inexperienced competitors.

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Introduction

A large literature in macro finance examines the nature of credit cycles in the aggregate (e.g., Kiyotaki and Moore, 1996, Gorton and He, 2005, Myerson, 2011, Greenwood and Hanson, 2011). In this paper we ask whether there is cross-sectional heterogeneity in the use of credit by leveraged buyout (LBO) firms. We analyze how borrowing, investment and subsequent performance are different among buyout firms and, most importantly, how these differences evolve over the credit cycle.

LBO firms are uniquely interesting entities through which to study borrowing behavior over the credit cycle. They are arguably among the most sophisticated investors in the market. They represent an important slice of the high yield market: at its most recent peak in 2007, LBO firms sponsored more than 35% of junk debt issuance. Given their reliance on leverage to finance acquisitions, these firms are highly exposed to the credit cycle. Indeed, the leverage ratio of buyout deals varies systematically across the cycle (Axelson et al., 2011, Kaplan and Stein 1993) and LBO firms have responded to innovations such as collateralized loan funds by issuing more debt (Shivdasani and Wang 2012). Moreover, while there is debate about the extent to which corporations manage their capital structure, the general partners (GPs) of buyout funds are explicitly implementing a new capital structure for each company they acquire, and thus are a particularly interesting segment of the market through which to study the response to credit cycles.

We use a large sample of 1,718 worldwide buyout deals over the period 1987 to 2005 with information on the number of investments made by each GP, leverage at the time of the initial investment and subsequent equity return. We find substantial cross-sectional heterogeneity across buyout firms over the credit cycle. Not surprisingly, we find that without conditioning on credit conditions, more experienced firms complete more transactions, where we measure experience as the cumulative number of deals invested in prior to that year, relative to the average firm in that same year. When

credit spreads are low, experienced firms ramp up the number of investments considerably more than inexperienced firms. However, the experienced firms do not disproportionately increase leverage. Rather, all GPs increase leverage similarly when credit spreads are low. A distinguishing feature of our dataset compared to the extant literature, is the availability of deal-level returns to the GP. Credit booms are associated with lower equity returns for all investments, with a one standard deviation in credit spreads associated with a 5% decrease in equity returns. This relationship holds after controlling for leverage, which we find to be positively correlated with deal-level returns. However, we find no statistically significant difference in the gross equity returns of deals by experienced GPs relative to less experienced firms in credit booms, even though they execute many more deals.

What can we learn from these findings, beyond documenting how the most sophisticated producers of risky debt act during credit booms and busts? Experience serves as a proxy for multiple factors. First, more experienced GPs are likely to face lower information asymmetry costs with debt investors, since they are repeat players in these markets (Demiroglu and James (2010), Ivashina and Kovner (2011)). They have more capital to invest (larger funds) as well as better access to limited partners to raise more capital. Second, GPs with longer track records may have greater ability either to select good investments or to improve the operations of their investments, as less talented GPs may not have survived.

While it is difficult to distinguish among these factors, we look at patterns within LBO firms to see if these results are driven by firm specific factors, such as ability or investment approach, that may be fixed over time. Indeed, we find that 17% of the variation in leverage is explained by firm fixed effects alone. However, within a firm, the response to credit cycles is even stronger. The most experienced PE firms vary the number of deals that they execute in a given year from about three in high credit spread periods to around seven in low credit spread times. PE firm-level heterogeneity is particularly important when considering the relationship between leverage and returns, since more experienced firms may

have differential access to leverage. Controlling for fixed effects for PE firms, we find a strong positive relationship between leverage and returns, with each additional 10% of leverage adding 2.8% to equity returns, all else equal. This is different from the finding of Axelson et al. (2010) who regress fund-level IRR on individual deal leverage and find a negative relationship, consistent with the literature on public firms (for example, Dichev (1998), Griffin and Lemmon (2002), and Campbell et al. (2008)).[1]

Despite cross sectional differences among PE firms in their response to credit cycles, we do not find evidence that the type of target companies selected to be LBOs are significantly different across the cycle. While we lack detailed financial information on LBO portfolio companies, we look at median characteristics of comparable public companies in the same industry. There are no statistically significant patterns in the leverage or pricing (market-to-book) of industries with LBOs across cycles. This is similar to Axelson et al. (2010) who document in that LBO deal capital structure is not related to the characteristics of the target firm. We do find that deal size is larger when credit spreads are low, even after controlling for the increase in deal size over the sample, particularly for experienced firms.

Our paper is related to two strands of the literature. First, the credit cycle literature. This literature considers mostly aggregate movements in credit cycles, considering possible drivers such as: changes in borrower characteristics (most notably net worth), changes in bank capital (Bernanke and Gertler (1989), Kashyap, Stein, and Wilcox (1993), Holmstrom and Tirole (1997), and Kiyotaki and Moore (1997)), time-varying financial frictions, or time-varying investor beliefs or tastes (Greenwood and Hanson, 2012). Jermann and Quadrini (2012) show that debt payout is countercyclical and model debt and equity financing to explore how the dynamics of real and financial variables are affected by

[1] Axelson et al. (2010) do not have data on the investment equity returns, and instead attribute fund-level returns to each investment in that fund, effectively assuming that leverage is similar for all deals in a particular fund. Their median fund has only one investment covered in their database. We calculate that the median standard deviation of leverage in a fund is 0.171, with a median leverage of 0.675, showing a non-negligible variation in leverage within a fund. Similarly there is substantial variation in returns of individual deals within a fund.

"financial shocks." A number of studies examine the cross-section of publicly traded firms across the business cycle. Korajczyk and Levy (2003) show that target leverage is counter-cyclical for financially unconstrained firms, whereas it is pro-cyclical for constrained firms. Korteweg (2010) argues that while observed leverage ratios are counter-cyclical, target leverage is pro-cyclical. Covas and Den Haan (2011) examine debt and equity issuance by public firms and find that issuance by all but the largest firms is pro-cyclical. Other studies explore the effects of credit supply shocks on publicly traded firms (Leary (2006) and Faulkender and Petersen (2006)).

Second, the paper relates to the literature on private equity and LBOs. On the leverage side, recent LBO research has analyzed the determinants of debt pricing, structure and level (Axelson et al. (2011), Ivashina and Kovner (2011), and Demiroglu and James (2010)). Our paper is unique in its consideration of the cross-section of LBO funds and in the deal-level returns data. Other papers using deal level data have often been limited to proxies for equity returns derived from US reverse LBOs (Kaplan, 1989, Hotchkiss et al. (2010)). Axelson et al. (2011) relate deal-level leverage to fund level returns. An exception is Lopez-de-Silanes et al. (2011) who use data assembled from the fund-raising prospectuses of private equity firms to understand the drivers of deal-level equity returns, but they do not look at leverage.[2] Acharya et al. (2011) have very detailed data including accounting information, leverage and equity returns on a sample of 395 private equity transactions in Western Europe . They assess the part of the return that is mechanically related to leverage, assuming that Modigliani-Miller Proposition 2 holds. They, however, do not look at the cross-sectional relation between return and leverage, or the role of credit cycles.

The two papers that are closest to ours are Demiroglu and James (2011) and Colla, Ippolito and Wagner (2009). Demiroglu and James consider a sample of 180 public-to-private LBOs between 1997 and 2007.

[2] Returns to debt investors have been investigated by Shivdasani and Wang (2011) and Warga and Welch (1999).

They find that more reputable GPs tend to have higher leverage, and use a lower proportion of bank debt relative to public debt, with lower bank loan spreads. They do not explore the interaction between credit cycles and reputation. Similarly, Colla et al. (2009) show that in hot credit markets, PE sponsors use more leverage at lower spreads. However, neither paper examines subsequent equity returns.

The paper proceeds in four parts. Section 1 reviews the data compiled for the project, which combines information for private and public sources. Section 2 presents empirical results detailing our findings about investments, leverage and equity returns. In section 3 we offer interpretations of the empirical findings and address robustness concerns. Section 4 discusses sample selection and robustness, and section 5 concludes.

1. Data

A. Data Sources and Collection

We begin with a large dataset of investments made by more than 300 private equity firms.[3] This dataset is compiled from fund-raising prospectuses usually referred to as private placement memorandums (PPMs).[4] It differs from earlier commercial and academic datasets in that it contains information about the returns of individual investments. Although not all PPMs come in the same format, the following information for all investments made as of the date of the document can be found: (1) month and year of the initiation of the investment; (2) month and year of exit (if realized); (3) industry of the investment;

[3] Private equity firms are organizations that manage private equity funds. A firm may have several funds running at each point in time. Funds have a finite life lasting ten to fourteen years. The typical firm launches a new fund every two to four years. When a firm raises a new fund, it gives a fund-raising prospectus to potential investors. Investors commit capital at fund inception and cannot add or withdraw capital during the fund's life. Several investors gave us access to their prospectuses, but under signed confidentiality agreements, which bar us from disclosing information about the identity of the PE firms and their investments.

[4] These prospectuses have been collected over the years, starting from 2001, by Oliver Gottschalg and Ludovic Phalippou and come from several investors in private equity from both the US and Europe. See Lopez-de-Silanes, Phalippou and Gottschalg (2010) for a detailed discussion of this data.

(4) country where the investment is located; (5) total amount invested (often labeled "cost" in PPMs); (6) total amount distributed (realized value); (7) multiple (total amount distributed plus valuation of unrealized stake if any, all divided by amount invested); (8) gross IRR. This dataset represents a comprehensive list of all of the firms' investments. Appendix 1 shows an example of a PPM track record.

We collect leverage data from a collection of sources. Our first source is a set of due-diligence documents of large LPs. On these documents, the LP requested information on leverage for all of the investments in the offering memorandum, where leverage is defined as the book value of total debt divided by total enterprise value (*TEV*). *TEV* is calculated as the market value of equity plus the book value of debt.[5] In some cases, the leverage ratio is given directly. In other cases, full details on each investment are given and we have the detailed capital structure from which we calculate leverage. In yet other cases, we take advantage of case-studies presented by LBO firms which include leverage information. These case studies represent about 20% of the leverage information coming from PPM/due-diligence documents (referred together as 'private source').

In addition to this private source of leverage data, we use public sources that have been used in the literature (e.g. Axelson et al., 2011). This consists of LPC's Dealscan database of syndicated loans, Mergent's public bond database and Capital IQ. This may underestimate debt since it misses real estate debt, capital leases, assumed debt and debt that is neither syndicated nor publicly traded (e.g., debt provided by mezzanine funds). More importantly, we do not know from LPC how much of the revolving credit is drawn down at the time of the transaction. We follow Axelson et al. (2011) and assume that no revolving credit is drawn down. This too likely underestimates leverage. We eliminate matches where the syndicated loan or bond issuance is not within one year of the date of initial investment, and where

[5] We use the book value of debt because the market value is typically not available. Market value of debt at issuance is typically very close to par.

the purpose of the syndicated loan is a refinancing.[6] In addition, when evaluating returns, we drop all observations for which the investment is too recent (i.e. excluding all investments made two years or less before the date of the PPMs, following Lopez-de-Silanes et al. (2011)). Finally, we check in Capital IQ whether the target firm has balance sheet information at the time of LBO. Typically this information is available for companies with public bonds issued after 1996. If so, we use the debt as of the quarter ended immediately after the deal. Using the Capital IQ debt figure avoids the potential undercounting of non-syndicated, non-public debt, but adds the problem that leverage levels can change between the effective date of the deal and the first financial reporting quarter.

The result is a dataset of 1,718 observations with information on equity returns, leverage, industry and geographic region at the time of investment. Of the 1,465 observations for which we have leverage information, 1,057 observations come from private sources, 584 from public sources, with information from both for 176 observations. When we have both sources, we keep the private source. Comparing the leverage levels from public sources to those reported in the private source for observations for which we have leverage from both sources, we find that the public source leverage is lower by 18.5 percentage points on average. Raising all the leverage ratios from the public data by this amount does not change our empirical results.

In order to reduce the impact of extremely high values we winsorise the leverage and return data at the 97% level**.** Because some firms include growth and venture capital investments in their comprehensive list of previous investments, we exclude investments where leverage is less than 21.85% (the median leverage of public companies in similar industries) from the deal level analyses.

[6] We keep loans whose purpose is M&A, and LBO.

B. Descriptive statistics

Panel A of Table 1 presents summary statistics at the PE firm-year level, and at the individual investment level. Overall, the sample is consistent with that of other studies of private equity. The majority (69%) of the observations are in the US or UK. Deals are seen in almost all industries, with the greatest representation of Business Services (11%), followed by Food (7%) and Household goods (6%). The median investment in the sample has an enterprise value of $189 million. As expected, the sample is very highly levered, with mean (median) leverage of 0.67 (0.68), with similar numbers if averaged across firms in a year, or pooled across investments. This is similar to the levels estimated in Axelson et al (2011). There is substantial variation in leverage both across and within firms. Firm fixed effects alone explain 17.2% of the variation in leverage, and the average within-firm standard deviation of leverage is 0.15 (results not tabulated). Average within-year standard deviation of leverage is 0.16 (not shown).

Our main variable for generating cross-sectional variation across GPs is adjusted experience. Adjusted experience is calculated as the number of investments to date made by a PE firm in a given year, divided by the average number of investments to date across all firms in that year. We define firms as being active in a year if they make an investment in that year or if they invest both before and after that year. In this way we avoid having a measure of experience that is mechanically correlated with time (similar to Gompers et al., 2008). By construction, the average of adjusted experience is 1, although it rises to 1.23 in the deal level statistics, since experienced firms do more deals. The standard deviation of adjusted experience is 1.47, confirming substantial cross-sectional variation in experience.

[TABLE 1: SUMMARY STATISTICS]

The average firm does three deals in each year (median is two deals). There is significant variation in the number of deals, with an inter-quartile range between one and four deals, with a long right tail. In the next section we look more closely at the cross-sectional and time-series variation in this variable.

We match the target companies in our sample to a set of publicly traded companies in the same 48 Fama-French industries. We collect data items for US public companies from the Compustat and CRSP databases, using the median value of companies in the same industry, calculated as of the quarter ended closest to the LBO. At the median, LBOs in the sample have leverage ratios immediately after the buyout that are more than three times as high as publicly traded companies in the same industry. In addition, the LBO companies are larger than the median public company in their industry. Comparing the median statistics of industries with LBOs to the S&P 500, we find that LBO industries are equally levered, and have similar proportions of tangible assets. LBO industries had less volatile earnings than did companies in the S&P 500, and public companies in these industries traded at lower multiples of cash flow (TEV/EBITDA).

Our main metric for return to the GP is the gross internal rate of return (*IRR*), which is the measure of rate of return used in the industry and reported in PPMs. It is reported gross of all fees and expenses. In order to reduce the impact of extreme values we winsorise the returns data at the 97% level. The resulting mean (median) IRR across deals is 0.41 (0.31), which is higher than that of Axelson et al. (2010), given the success bias of the PPM data discussed below. The average (median) IRR at the firm-year level, weighted by invested capital, is 0.30 (0.24).

In addition, we calculate Public Market Equivalent (*PME*), which measures total value created in excess of the CRSP US stock index (as in Kaplan and Schoar, 2005) (mean of 2.0) and multiple of capital realized (*Multiple*) (mean of 2.2x). Results are similar when we examine value created in excess of the S&P 500. We are limited, however, in our calculation of PME by the fact that we do not have detailed information on the cash flows of the underlying investments. In order to calculate PME, we calculated the duration of the investment implied by the multiple of capital and the IRR. We then assume that all of the equity is invested at the initial investment date and all of the capital is returned as of the exit date implied by the

weighted average duration. Since the timing of investment and return of capital may differ significantly from these assumptions, the results may be noisy.

2. Empirical Results

In this section we present our main findings, postponing any interpretation in light of theory until the next section. First, we consider the relation between buyout activity and the credit cycle in the aggregate, confirming that our deal-level observations match the stylized facts that have previously been documented using aggregate and fund-level data. We then turn to the cross-sectional differences in GP behavior across the cycle and consider deal-level returns and leverage.

A. Aggregate LBO activity and credit cycles

Figure 1 shows the time-series of the average number of buyout deals per GP, based on the year in which the buyout was concluded. Consistent with statistics shown in Kaplan and Stromberg (2009), and Axelson et al. (2012), we see peaks in the number of deals in the late eighties, the late nineties and rising again in the pre-financial crisis boom of the mid 2000s. We also plot the credit cycle as measured by the Baa credit spread over the 10 year Treasury rate as of year-end the previous year. There is substantial variation in the mean number of deals done by each firm over time, and an inverse relationship between spreads and the number of investments made, similar to that observed in the aggregate industry. In other words, we observe a strong margin of adjustment at the firm level, not just by the addition of new private equity sponsors to the industry in response to favorable credit conditions. This pattern is similar if we look at the total number of deals, or the total value of deals done. We consider other measures of the credit cycle in the robustness section.

FIGURE 1: Mean Annual Deals and Credit Spread

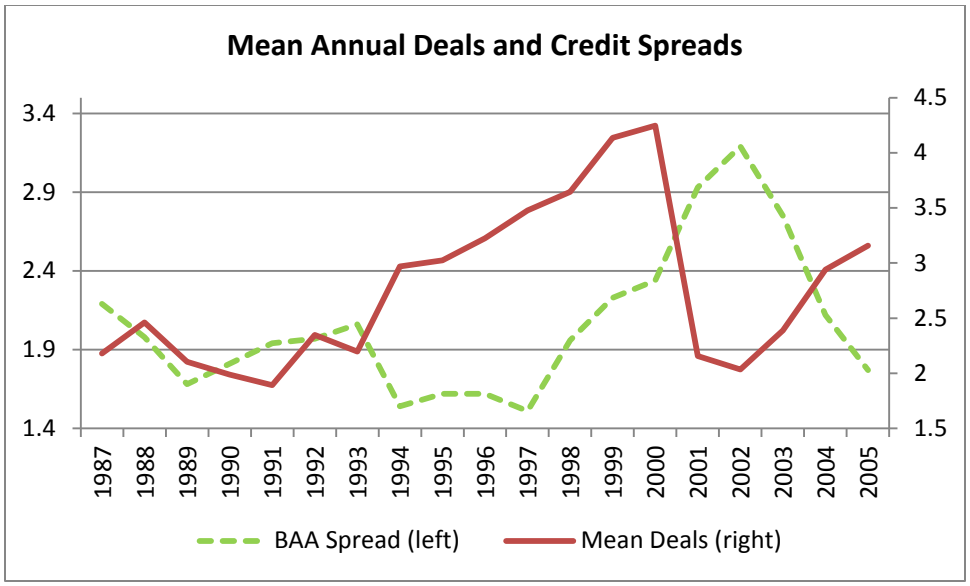
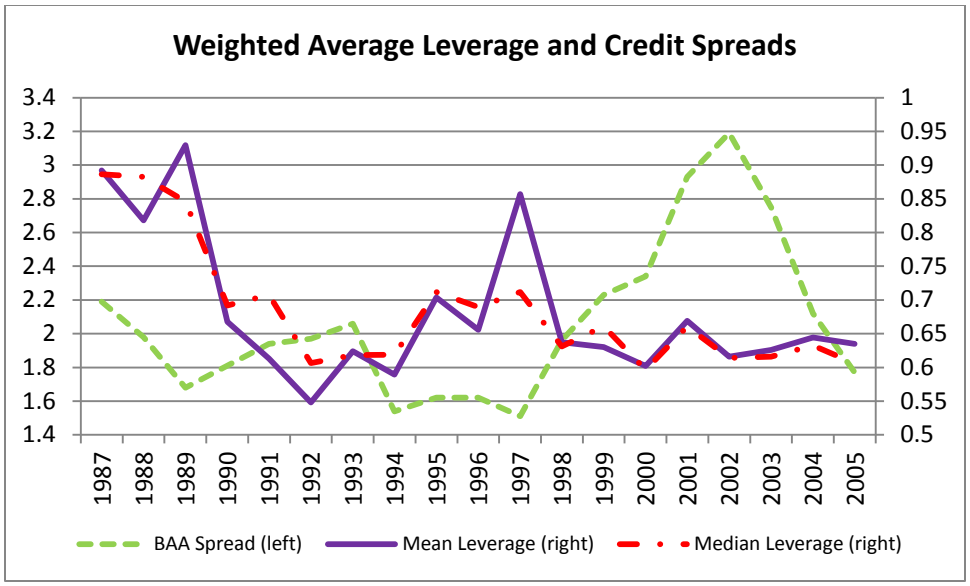


Figure 2 plots equal-weighted and value-weighted average leverage across LBO deals over the credit cycle. Other than the very high leverage witnessed in the late 1980s with the advent of junk bonds, highly levered LBOs tend to coincide with low Baa spreads. Table 3 confirms this negative relation in a regression of leverage on spreads. The pro-cyclicality of both the number of deals and leverage implies that the aggregate *quantity* of credit varies substantially over the cycle. This evidence is consistent with Axelson et al. (2011), and with the relationship between aggregate credit cycles and LBOs first documented by Kaplan and Stein (1993).

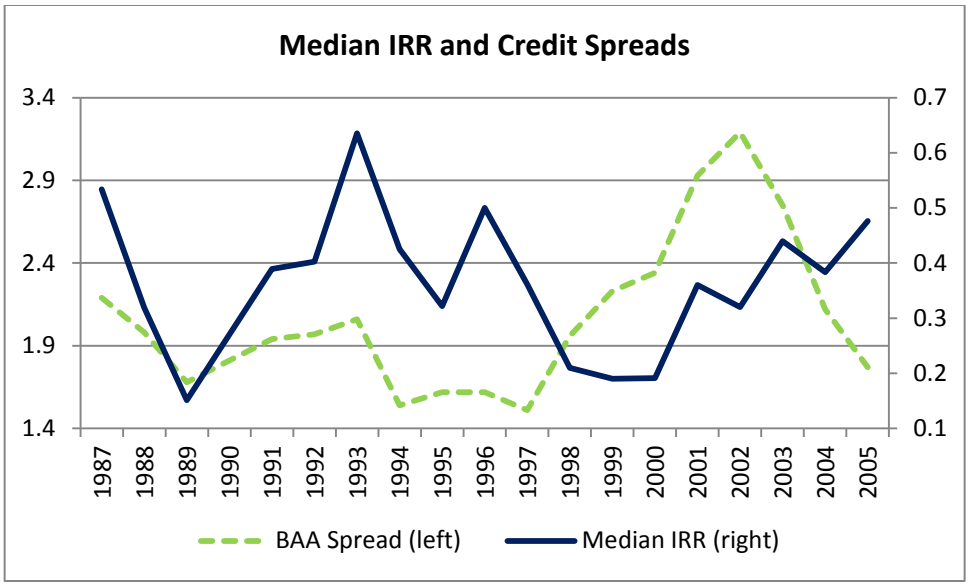
FIGURE 2: Leverage and Credit Spreads



We next consider the relationship between credit spreads and performance. Previous studies of this question are limited by having fund-level returns only, which are typically invested over three to five years through varying credit conditions. Our deal-level returns have more statistical power. Figure 3 suggests a positive relationship between aggregate gross IRR and credit spreads, where the IRRs are medians over the deals that were initiated in the given year. Table 5 shows that this relationship holds after controlling for the return on the S&P 500, leverage and the LBO fundraising environment. For each one standard deviation increase in credit spreads, returns are 5.0% higher.[7] We find similar results when considering returns within firms. This finding is consistent with Greenwood and Hanson (2012), who document a negative relation between excess junk bond returns and the credit cycle.

FIGURE 3: LBO Returns and Credit Spreads

[7] As discussed above, we do not have quarterly cash flow information and thus the return on the S&P is calculated based on the weighted duration implied by the reported multiple of capital invested and the IRR.



However, when we use PME as the performance measure, the sign of the relationship flips from positive to negative, both with and without firm fixed effects. This result may be due to the (implicit) assumption in the PME calculation that the investment's beta equals one. Since the stock market tends to perform poorly going forward when credit spreads are high, if beta is above unity (as for example suggested by the loading on the market in our IRR regressions), using a beta that is too low will mechanically lower the coefficient on credit spreads in the PME regressions. This underscores the problem in the private equity literature that it is difficult to control for risk given the nature and paucity of data.

To summarize, the patterns in this private dataset are consistent with prior studies based on public data: In the aggregate, buyout firms do more deals and use more leverage when credit spreads are low. This increase in deals is associated with lower median returns to equity investors.

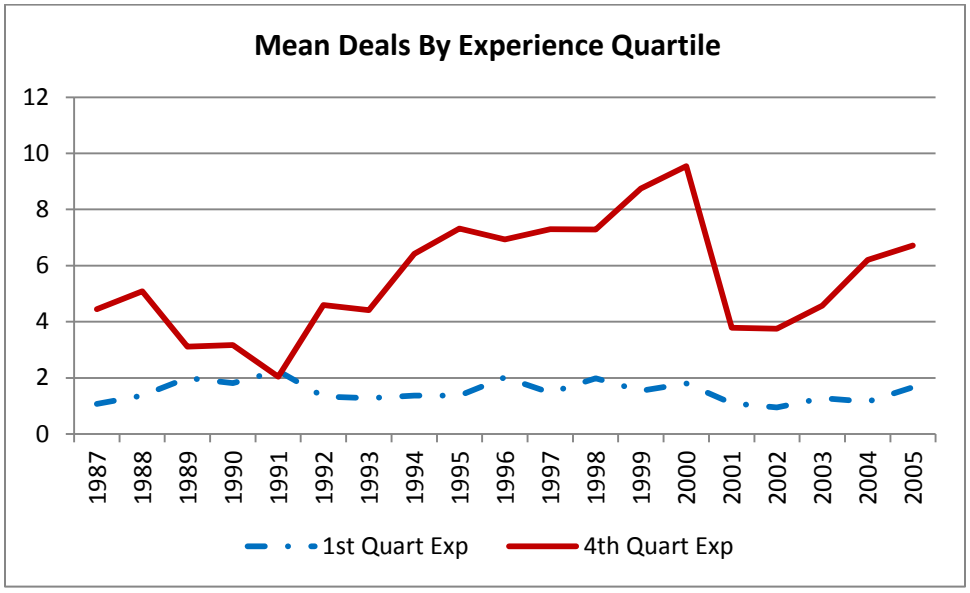
B. Cross-sectional GP behavior over the credit cycle

The behavior of GPs over the credit cycle varies substantially in the cross-section. Figure 4 plots the time series of the mean number of deals per buyout firm in the top versus the bottom quartile of GPs by

adjusted experience. The Figure shows that, with the exception of the year 1991, the more experienced firms do more deals than the less experienced GPs. This is not surprising given that the more experienced firms operate larger funds. What is more striking is that deal frequency varies strongly across the credit cycle only for the experienced GPs: when spreads are low, the more experienced firms increase the number of deals from two or three deals per year up to six to eight deals, while they cut back towards the level of the inexperienced firms when spreads are high. Inexperienced firms exhibit only limited variation, doing between one and two deals per year across all time periods in our sample.

Table 2 confirms this result in regressions of the mean number of deals: the loading on experience is positive, and the interaction between adjusted experience and the credit spread is negative and significant at the 1% level. We should note that even for the most inexperienced firms, the number of deals still varies with the credit cycle in a statistically significant way, but not nearly as much as the experienced firms. The rightmost four columns of Table 2 show that this result also holds within firms, when adding firm fixed effects to the regressions.

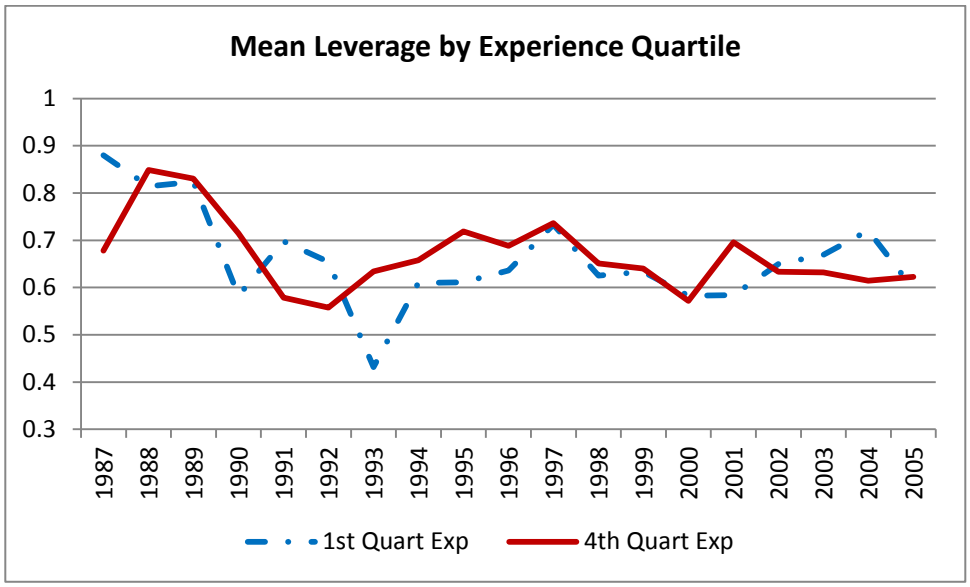
FIGURE 4: Deals by Experience Quartile



[TABLE 2: NUMBER OF INVESTMENTS]

While we see cross sectional differences in the number of deals done, Figure 5 shows that the time series of average deal-level leverage looks very similar for the top and bottom quartiles of experience. There is no systematic difference amongst the two groups across the credit cycle. The regressions with firm fixed effects in Table 3 confirm that this result also holds within PE firms.

FIGURE 5: Leverage and Experience



[TABLE 3: LEVERAGE]

We do not find any statistically significant differences in the types of LBO industries or the financial characteristics of LBO industries (market/book, tangible assets etc.) either across experience or across the credit cycle. Table 4 shows that we do find differences in the size of deals. When spreads are high, the average enterprise value of deals is higher, even after controlling for a linear increase over time in the size of deals. This effect is found both cross-sectionally and within PE firms. The effect is not as

strong (and not statistically significant) when we use equity invested as the dependent variable, rather than total enterprise value, suggesting that firms may try to reduce risk by investing in club deals, using less of their own equity to buy bigger companies. There does not seem to be a differential size response to spreads by more experienced firms. We control for the size of the target company (in logs) in our later specifications, to make sure that our results are not driven by differences in deal size.

[TABLE 4: DEAL SIZE]

We do not find economically or statistically significant differences in returns across experience, whether returns are measured by IRR or PME. Like the buyout industry as a whole, the returns of experienced firms are lower when spreads are lower, but they perform no worse than their peers, despite the higher number of investments.

[TABLE 5: RETURNS]

We find a strong positive relationship between leverage and returns. For each additional 10 percentage points of leverage, gross IRRs are 2.81 percentage points higher. This number is large, especially when compared to estimates of alpha in the industry that range from negative to +1 percent per year. Moreover, this result is in contrast with the public equity market, where many papers document a negative relation between leverage (or distress risk) and returns (for example, Dichev (1998), Griffin and Lemmon (2002), and Campbell et al. (2008)).

In order to get a different perspective on risk and return to LBO investments, we examine bankruptcy rates through the credit cycle. Table 6 shows that the relation between bankruptcies and the credit spread is negative across all specifications. This is consistent with the IRR result, although the coefficients are not statistically significant. Controlling for leverage, a one standard deviation lower credit spread (50 basis points) is associated with a 1.4% higher bankruptcy rate. This is an economically

large result, given that the average bankruptcy rate across all deals is 8.5%. Across the sample, more highly levered deals are more likely to go bankrupt, with a 10 percentage point increase in leverage associated with a 1.1% higher bankruptcy rate. However, the result is not statistically significant after controlling for firm fixed effects. There is some evidence that experience is associated with a lower probability of bankruptcy in general, and mitigates the relationship between credit booms and bankruptcy when controlling for leverage, but the result is not statistically significant.

[TABLE 6: BANKRUPTCY]

In future work we intend to examine some additional cross-sectional effects such as whether the LBO firm is affiliated with a bank, the importance of funds under management and whether the success record of experienced firms makes a difference.

3. Interpretation

The finding that buyout firms execute more deals when credit spreads are low is consistent with a better opportunity set of potential buyout deals during low spread times, whether through a cash flow or a cost of capital channel, or both.[8] The cost of capital channel is also consistent with the lower subsequent IRRs for deals that are consummated in times of lower spreads.

It is noteworthy that the experienced firms are very flexible in the sheer number of deals that they can take on, varying between two and eight deals per firm in a given year, depending on credit conditions. The differential response of more experienced firms implies that these drivers are more important to larger funds. It is also interesting that the experienced firms scale back the number of buyout deals when spreads increase. Apart from a poorer pool of potential deals, reputation concerns may play a role

[8] There is a sizeable literature that documents that credit spreads have predictive power for future economic activity, see for example, Gertler and Lown (1999), Mody and Taylor (2004), King et al. (2007), Mueller (2007), Gilchrist et al. (2009), Philippon (2009), Faust et al. (2010), and Gilchrist and Zakrajsek (2010).

here as well. Absent reputation, a fund may have incentives to overinvest to maximize fees and carry from the present fund.[9]

While it is perhaps not surprising that inexperienced GPs do few deals when credit spreads are high, it is less clear why they are unable or unwilling to scale up when spreads are low. One might expect that when credit is easy, inexperienced firms enjoy high demand from LPs, and scale up significantly, especially if the top GPs restrict access to their funds, for example out of reputation or disclosure concerns (e.g., Metrick and Yasuda (2010)). Moreover, if GP compensation is largely derived from operating larger funds (Chung, Sensoy, Stern and Weisbach (2012)), then one would expect the inexperienced GPs to quickly scale up the size of their funds when spreads are low. We do not see this in the data, and a key question is whether this is optimizing behavior on the part of the inexperienced GPs that are focused on building a reputation, or whether this is driven by external financial constraints.

The financial constraints explanation is that inexperienced GPs are constrained in raising capital, and therefore unable to ramp up the number of deals as much in response to favorable market conditions as do the more experienced GPs, even when credit is easy. These financial constraints may stem, for example, from asymmetric information about the unobserved ability of GPs, which is particularly important for PE firms that have do not have a rich history of completed deals.

More importantly, for this explanation to hold, the nature of financial constraints must vary with the business cycle, as predicted, for example, by the classic bank credit channel of the credit cycle (Bernanke and Gertler (1989), Holmstrom and Tirole (1997), Kiyotaki and Moore (1997), and Kashyap, Stein, and Wilcox (1993)). When spreads are low, the financial constraints for inexperienced GPs are less stringent, allowing them to do more deals, but the experienced GPs must see a greater relaxation of constraints. Anecdotally, another important source of constraint for inexperienced PE firms is attracting new human

[9] One possibility is that funds that are near the end of the investment cycle (roughly five years into the fund's life) have more incentive to keep investing even if investment opportunities have deteriorated, relative to newly raised funds. We intend to look at the interaction between fund age and credit spreads in a future version of this paper.

capital. Even if financial capital is available to these firms, they may not be able to take full advantage of the opportunity set of deals because it is difficult to attract new GPs to the firm.

An alternative explanation for the observed pattern in deal frequency is that the inexperienced GPs deliberately turn down raising more equity (i.e., bigger funds) from LPs, or refrain from using higher leverage to execute more deals when spreads are low. One reason for such behavior is that, even though there are more profitable deals, the experienced GPs soak up most of the deal flow, and so the expansion of the opportunity set for the inexperienced GPs is not as great as it is for the experienced firms. Additionally, inexperienced GPs may act conservatively in order to build a reputation with both lenders and LPs. As far as we can observe, we see no cross-sectional differences in the types of industries that PE firms invest in. Still, we should note that it is difficult to control for the relevant deal characteristics, and our test may have low power.

Another key question that our cross-sectional findings on investment behavior raises, is whether experienced firms rationally do more deals in good times, as documented in venture capital by Gompers et al (2008), or whether the experienced LBO firms contribute to cyclicality in credit markets because they overinvest when pricing of risky debt is low? Given that the experienced buyout firms still generate positive returns that do not differ from the inexperienced firms across the cycle, the answer appears to be the former. However, it should be noted that it is difficult to control for risk in these regressions.

Finally, to our knowledge this is the first paper to document the positive relation between leverage and returns in the PE literature. To the extent that more experienced firms can access more leverage (as in Demiroglu and James (2010), who use experience and fund size as proxies for reputation), the returns result may be driven by more experienced firms using both more leverage and having higher returns (by

virtue of being more talented on average, through survivorship). If talent is fixed over time, however, the fact that we find a similar, statistically significant and economically large relationship between leverage and returns within firms, suggests that survivorship is not the full story. More strongly, this result is driven by the firms with longer track records, who are more likely to have been lucky in the early funds, even though those used lower leverage, going against the survivorship story. Still, it is possible that the result is driven by lower asymmetric information for experienced firms, if both the quantity and price of credit move favorably (to the buyout firm) with reputation, as measured by experience. Other explanations, such as PE firms overpaying when credit is easy or if riskier target firms take less leverage, would work against finding a positive leverage-return relationship.

4. **Sample Selection and Robustness**

There are a number of concerns with the data we use in our analysis, many of which are endemic to academic work in private equity. As mentioned earlier in the paper, the data used in this paper represent a substantial innovation relative to other work, due to the large number of observations, and the fact that we have information on the complete track record of the LBO firms. However, the data are success biased, geography biased and size biased. In this section we document several exercises to confirm that our results are robust.

A. Sample Selection

There are two types of potential bias in the data we have collected. First, there is a success bias in the PPM data. Although all investments of a firm (good and bad) are included in the PPM, only successful firms are likely to write a PPM for the purpose of raising subsequent funds, and equity returns for these

investments are likely to be more successful than those of the LBO industry as a whole. The mean (median) return of investments gross of fees in the whole data set is 0.25 (0.22). In addition, investments for which leverage comes from selected case studies are usually selected for their higher returns. The mean (median) return of investments gross of fees for which we have leverage data is 0.41 (0.31). This compares to estimates of fund IRRs, net of fees, ranging from 0.11 to 0.21 (Harris et al 2012). We tackle this selection bias in two ways. First, we repeat the analysis without the selected-leverage investments, and second, using data from Dealscan and Mergent that represents a comprehensive sample of all LBOs with syndicated loans and public bonds, respectively.

We compare our results to those found when using a comprehensive sample from Dealscan and from Reuters Mergent bond issuance database. This work is complicated by the fact that while Dealscan lists sponsors, these sponsors are not all LBO firms, and these sponsors lack unique IDs. The Mergent bond data is even less informative, because it both lacks identifiers to indicate LBOs as well as lacks information on sponsors, which must be hand researched. When complete analysis of these databases is finished, we will have a dataset with comprehensive information on all deals with syndicated loans or public bonds from which to replicate the key findings. This work is currently in progress.

The second potential bias is that for the observations with leverage data from public information, there is a size and geography bias, which is common to the literature. Only investments above a certain size will have syndicated loans or public bonds, and coverage is much better in the U.S. and U.K. 57% of investments with public leverage data are in the U.S. and 16% in the U.K. In our private sample, these numbers are 49% and 19% respectively. Regarding size, transaction value for investments in the public sample is larger than in the private sample (result not shown). The size bias is present only for deals with leverage from public sources, and not at all present for specifications that examine the number of investments.

We can say more to see how the size/geography bias may work maybe: In good credit times, firms can re-finance and thus increase the leverage level. In good economic times, leverage will go down as companies repay debt. The debt to be repaid is the A-tranche and the fraction of that tranche in the total debt is also time varying: It is low in good times. Special dividends are also expected to be there mainly in good economic times…. Companies have a line of credit which they are more likely to draw if bad times hit thereby increasing leverage. So on the one hand, in good times, we will tend to underestimate the actual subsequent leverage compared to bad times (because of less repayment, and refinancing). On the other hand, in bad times, repayment is higher but may be more difficult and debt may be renegotiated. Overall it seems that we will under-estimate the cycle effect?

B. Measurement Issues

There are several other possible measures of credit cycles besides Baa credit spread: junk bond issuance, CLO issuance or macroeconomic conditions (as measured by a dummy for whether the year was classified as a recession by the NBER). Many of these measures are not available for the complete time period (CLO issuance), or create endogenity issues of their own (junk bond issuance). Our main results are directionally robust to considering these alternative measures of credit cycles, although the results are not always statistically significant.

Since different regions may be in a different phase of the credit cycle, we also consider the US, Europe and other regions separately. Finally, we consider the results using only our private measure of leverage, and only our public measure of leverage. Results are substantively similar, although this work is currently still in progress.

As shown by Demiroglu and James (2010), various measures of reputation are closely correlated (around 0.8 for most measures) to the cumulative number of deals.

Another issue we face is that private equity firms may make substantial changes to the capital structure of their investments in the months or years that follow the acquisition of a business. Our analysis considers only the initial leverage, and does not account for subsequent changes in leverage. As far as the relationship between leverage and returns is concerned, any mismeasurement of this nature should work against finding a positive relationship.

For robustness we also look at MIRR (modified internal rate of return), which alleviates potential problems with the re-investment assumption used to compute IRR (Ljungqvist et al. 2007).

5. Conclusions

While there is a large body of academic research about cycles in equity markets and how companies may, or may not, time the equity markets, there has been relatively less progress in understanding cross-sectional variation in borrower behavior across the credit cycles. We examine a large panel dataset of private equity firms, financial intermediaries which sponsor a substantial amount of debt issuance, and show how these firms vary debt issuance over the credit cycle.

There is a strong relation between the activity in the buyout industry and credit market cycles. This paper presents new evidence about significant differences in the cross-section of GPs in credit booms. The change in the number of investments appears to be particularly strong for the most experienced firms. During times of low spreads, the average experienced GP completes as many as eight deals per year, while consummating only three deals per year when spreads are high. The inexperienced GPs show much variation, doing one deal when spreads are high, increasing to two when spreads are low.

A decrease in spreads and the correspondent increase in investments is associated with lower gross returns – A one standard deviation decrease in spreads reduces returns by 5.04%, all else equal. But the more experienced firms, despite having ramped up their number of investments, do not suffer lower returns in relative terms.

It is important to note that unlike the negative (or zero) relationship between leverage and returns documented in public markets, we find a strong, statistically significant relationship between leverage and returns, with a 10 percentage point increase in leverage associated with a 2.81% increase in returns, although also a 1.14% increase in bankruptcy rates. This relationship also holds across deals within the same PE firm.

A key question that this paper raises is whether the observed relationships are the result of a rational response of experienced firms to invest in highly leveraged companies in good times, as documented in venture capital by Gompers et al (2008), or whether LBO firms, and particularly experienced LBO firms contribute to cyclicality in credit markets by overinvesting when credit spreads are low? This paper raises a tip of the veil and suggest that the answer is more likely to be the former, given that the experienced buyout firms still generate positive, albeit lower, returns. More work is needed on this important question.

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Table 1, Panel A: Summary Statistics

	Mean	S.D.	p25	p50	p75	N
One Observation per firm / year						
Number of Deals	2.926	4.510	1	2	4	3248
VW Average Leverage	0.670	0.246	0.556	0.654	0.759	654
VW IRR	0.297	0.487	0.0224	0.237	0.506	1960
Moody's Baa-10yr Treasury spread	2.137	0.503	1.680	2.060	2.340	3248
Adjusted Experience	1	1.468	0.174	0.550	1.211	3248
Experience	18.82	32.51	3	9	22	3248
Ln(Fundraising)	10.44	1.078	9.772	10.74	11.16	3248
One Observation per firm-investment (with leverage data)						
Gross IRR	0.413	0.755	0.0480	0.306	0.633	1377
Leverage	0.665	0.171	0.550	0.675	0.780	1461
Leverage / Median Industry Leverage	11.70	103.9	1.995	3.016	4.719	1406
PME	2.135	1.912	0.929	1.614	2.796	1392
Moody's Baa-10yr Treasury spread	2.063	0.511	1.620	1.960	2.340	1461
TEV ($M)	516.7	1215	75.75	188.5	510.2	1392
Median Industry TEV ($M)	205.1	271.6	76.19	124.7	220.6	1417
Total Multiple	2.823	13.43	1.080	2.200	3.700	1401
Adjusted Experience	1.232	1.544	0.207	0.717	1.483	1440
Experience	41.47	65.77	5	18.50	52	1440
Industry Market to book	2.180	2.232	1.398	1.770	2.389	1417
Industry profitability (EBITDA/Assets)	0.0623	0.0479	0.0258	0.0653	0.0938	1417
Industry Leverage	0.229	0.131	0.145	0.219	0.304	1417
Ln(Fundraising)	10.44	1.173	10.09	10.92	11.16	1461
Bankrupt	0.0876	0.283	0	0	0	1461
One Observation per firm-investment (all observations)						
Gross IRR	0.25	0.70	0.00	0.22	1	6669
Total Multiple	2.57	2.44	1.00	1.94	3.35	6669
PME	1.51	1.38	0.49	1.13	2.09	6669
Bankrupt						

Table 1, Panel B: Summary Statistics by Quartile

	N	Adjusted Experience Mean	S.D.	Leverage Mean	S.D.	Gross IRR Mean	S.D.	Moody's BAA-AAA spread Mean	S.D.
Experience Quartile (Within Year)									
1	419	0.0595	0.0826	0.6893	0.1657	0.3938	0.7735	2.0219	0.4540
2	306	0.3848	0.1363	0.6469	0.1785	0.5346	0.8014	2.1126	0.5068
3	414	0.8868	0.2359	0.6693	0.1616	0.3340	0.7278	2.0819	0.4793
4	550	2.9666	1.7942	0.6537	0.1774	0.3915	0.7073	2.1426	0.5069
Spread Quartile									
1	478	1.1435	1.4152	0.6831	0.1681	0.3657	0.8373	1.5702	0.0515
2	386	1.1863	1.7122	0.6573	0.1582	0.3612	0.6544	1.9116	0.0948
3	496	1.3670	1.6861	0.6611	0.1783	0.4051	0.7576	2.1777	0.1055
4	329	1.3949	1.5470	0.6552	0.1778	0.4954	0.6946	2.9388	0.1942

Note: The sample consists of observations from between 1987 and 2005. Observations are either one observation per firm-investment (232 private equity firms, 1718 observations), or one observation per firm-year (292 private equity firms, 3,248 observations). *Number of deals* is the number of investments made by a private equity firm in a year, and 0 if no investments are made. *Leverage* is the amount of total debt at book value divided by the total enterprise value of the company at market value at the time of the investment. *Gross IRR* is the internal rate of return of the investment calculated gross of all fees and expenses. *Experience* is the number of investments of the PE firm from inception through the year preceding the investment. *Adjusted experience* is the experience of the firm divided by the average experience of all firms active in that year. *PME* is the public market equivalent return, the ratio of the return on the investment to the return on the stock market at the same time period. *Moody's Baa spread* is the average difference in yields between Moody's BAA rated bonds and benchmark 10 year Treasury bonds at the end of the calendar year. *TEV* is the total enterprise value of the company, the sum of the market value of equity and the book value of debt, calculated in millions at the time of the investment. Median Industry measures are calculated as medians of all public companies in the same Fama-French industry as the investment as of the quarter closest to the investment date, including: *Leverage,* the median total debt to TEV, *Market-to-book*, the market value of equity divided by the book value of assets, and *Profitability*, EBITDA divided by assets.

Table 2: Number of Investments

	(1)	(2)	(3)	(4)	(5)	(6)
Baa Spread	-0.108***		-0.0627**	-0.0804***		-0.0350
	(0.026)		(0.026)	(0.021)		(0.023)
Adjusted Experience (# Deals)		0.245***	0.344***		0.0679***	0.222***
		(0.010)	(0.036)		(0.016)	(0.034)
Adjusted Experience * Baa Spreads			-0.0450***			-0.0622***
			(0.016)			(0.012)
Constant	1.269***	0.794***	0.925***	1.389***	1.129***	1.168***
	(0.057)	(0.015)	(0.059)	(0.16)	(0.16)	(0.17)
Observations	3248	3248	3248	3248	3248	3248
Adjusted R-Squared	0.00473	0.223	0.229	0.461	0.462	0.470
Firm Fixed Effects	no	no	no	yes	yes	yes

Note: The sample consists of 3,248 observations from 292 private equity firms making investments from 1987 to 2005, where observations have the full complement of covariates. The dependent variable is *Number of investments*, the log of the number of investments made by the firm in that year plus one. *Adjusted experience* is the experience of the firm (number of deals) divided by the average experience of all firms active in that year. *Baa spread* is the average difference in yields between Moody's BAA rated bonds and benchmark 10 year Treasury bonds at the end of the calendar year. Robust standard errors clustered by year are in parentheses. Fixed effects for private equity firm are included in specifications (4) through (6). ***, **, and * indicate significance at the 1%, 5%, and 10% levels of significance, respectively.

Table 3: Leverage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Baa Spread	-0.0210*		-0.0139	-0.0187		-0.0275	-0.0301**	-0.00412
	(0.011)		(0.015)	(0.014)		(0.019)	(0.012)	(0.015)
Adjusted Experience (# Deals)		-0.00477**	0.00213		-0.0182**	-0.0211*	-0.0194	-0.00410
		(0.0020)	(0.0098)		(0.0072)	(0.013)	(0.014)	(0.016)
Adjusted Experience * Baa Spread			-0.00278			0.00221	0.00323	-0.00386
			(0.0042)			(0.0048)	(0.0066)	(0.0079)
Ln(Total Enterprise Value)							0.00388	0.00192
							(0.0038)	(0.0047)
Constant	0.698***	0.661***	0.689***	0.579***	0.558***	0.627***	0.728***	0.542***
	(0.024)	(0.0074)	(0.032)	(0.096)	(0.088)	(0.10)	(0.030)	(0.090)
Observations	700	654	654	700	654	654	1375	1375
Adjusted R-squared	0.00331	0.00383	0.00517	0.123	0.119	0.120	0.0158	0.168
Firm FEs	no	no	no	yes	yes	yes	no	yes

Note: Specifications (1) through (6) consist of 700 observations from 232 private equity firms from 1987 to 2005 for investments for which we have leverage information. Specifications (7) and (8) consist of 1,375 observations from 292 private equity firms from 1987 to 2005 for investments in years for which the firm made at least on investment for which we have leverage information. Specifications (1) through (6) are one observation per firm-investment. Specifications (7) and (8) are one observation per firm-year. The dependent variable is *Leverage*, the amount of total debt at book value divided by the total enterprise value of the company at market value at the time of the investment. In specifications (7) and (8), leverage is an average within firm-years weighted by equity invested. *Baa spread* is the average difference in yields between Moody's BAA rated bonds and benchmark 10 year Treasury bonds at the end of the calendar year. *Adjusted experience* is the experience of the firm (number of deals) divided by the average experience of all firms active in that year. *ln(Total Enterprise Value)* is the natural log of the sum of the market value of equity and the book value of debt, calculated in millions of dollars at the time of the investment. Robust standard errors clustered by year are in parentheses. Fixed effects for private equity firm are included in specifications (4) through (6) and (8). ***, **, and * indicate significance at the 1%, 5%, and 10% levels of significance, respectively.

Table 4: Investment Size

	Equity Invested						TEV of Investment					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Baa Spread	0.118		0.164	0.0709		0.0823	0.272***		0.315***	0.258***		0.319***
	(0.089)		(0.11)	(0.085)		(0.11)	(0.082)		(0.10)	(0.074)		(0.096)
Adjusted Experience		0.205***	0.330***		-0.107**	-0.0558		0.116***	0.172*		-0.132***	0.0132
		(0.024)	(0.12)		(0.052)	(0.11)		(0.023)	(0.10)		(0.049)	(0.092)
Adjusted Experience			-0.0595			-0.0243			-0.0285			-0.0639
* Baa Spreads			(0.054)			(0.054)			(0.049)			(0.045)
Year	0.115***	0.124***	0.120***	0.126***	0.130***	0.128***	0.0778***	0.0933***	0.0807***	0.0873***	0.0996***	0.0894***
	(0.0097)	(0.0086)	(0.0095)	(0.010)	(0.0095)	(0.010)	(0.0094)	(0.0083)	(0.0093)	(0.0098)	(0.0089)	(0.010)
Constant	-225.0***	-243.7***	-236.6***	-249.8***	-257.1***	-252.6***	-150.7***	-181.2***	-156.8***	-171.4***	-195.4***	-175.7***
	(19.3)	(17.3)	(18.9)	(20.8)	(19.1)	(20.8)	(18.6)	(16.6)	(18.5)	(19.6)	(17.9)	(20.1)
Observations	1344	1324	1324	1344	1324	1324	1439	1418	1418	1439	1418	1418
Adjusted R-squared	0.141	0.190	0.190	0.451	0.453	0.452	0.0999	0.116	0.122	0.453	0.449	0.453
Firm FEs	no	no	no	yes	yes	yes	no	no	no	yes	yes	yes

Note: The sample consists of observations from 232 private equity firms on 1,718 investments made between 1987 and 2005 for which full covariates are available.
The dependent variables in specifications (1) through (6) are *ln(Equity Invested at Entry)*, the log of the equity invested by the private equity firm in the leveraged buyout, and in specifications (7) through (12) are *Size*, the log of the sum of the market value of equity and the book value of debt, calculated in millions of dollars at the time of the investment. *Baa spread* is the average difference in yields between Moody's BAA rated bonds and benchmark 10 year Treasury bonds at the end of the calendar year. *Adjusted experience* is the experience of the firm (number of deals) divided by the average experience of all firms active in that year. *Year* is a linear control for calendar year of the investment. Robust standard errors clustered by year are in parentheses. Fixed effects for private equity firm are included in specifications (4) through (6) and (10) through (12). ***, **, and * indicate significance at the 1%, 5%, and 10% levels of significance, respectively.

Table 5: Returns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Baa Spread	0.142***				0.128**	0.118**	0.231***	0.111**				0.105	0.110	0.188***	-0.226*	-0.376**
	(0.041)				(0.054)	(0.054)	(0.020)	(0.050)				(0.068)	(0.069)	(0.021)	(0.13)	(0.17)
Adj. Experience		-0.00685			-0.0179	-0.0240	-0.005***		-0.0650**			0.0136	0.0289	0.0005	-0.0822	-0.0336
		(0.011)			(0.052)	(0.052)	(0.002)		(0.030)			(0.059)	(0.060)	(0.002)	(0.11)	(0.15)
Leverage			0.281*		0.213	0.241*				0.407**		0.317*	0.298*		1.182***	1.220***
			(0.15)		(0.15)	(0.14)				(0.17)		(0.16)	(0.16)		(0.37)	(0.42)
Ln(Fundraising)				-0.0739***	-0.0699***	-0.0654**	0.026***				-0.110***	-0.0989***	-0.0988***	0.0103	-0.0580	-0.102
				(0.024)	(0.025)	(0.029)	(0.009)				(0.029)	(0.033)	(0.035)	(0.010)	(0.065)	(0.082)
Adjusted Exp. *					0.00433	0.00759	0.000***					-0.0111	-0.0183	0.000	0.0164	0.0185
Baa Spreads					(0.025)	(0.025)	(0.000)					(0.030)	(0.031)	(0.000)	(0.049)	(0.074)
Annualized Return						0.636**	1.65579062						0.744***	1.669		
Of S&P 500						(0.26)	(0.091)						(0.28)	(0.091)		
Ln(Total	0.0178	0.0335**	0.0272	0.0398**	0.0292	0.0298	-0.010	0.0394*	0.0474**	0.0432*	0.0684***	0.0557**	0.0585**	-0.0145	0.0461	0.0717
Ent. Value)	(0.017)	(0.017)	(0.017)	(0.018)	(0.018)	(0.019)	(0.006)	(0.023)	(0.023)	(0.023)	(0.023)	(0.025)	(0.025)	(0.007)	(0.048)	(0.064)
Constant	0.0268	0.248***	0.0814	0.975***	0.590**	0.500	-0.659***	-0.0264	0.314	0.0695	1.384***	0.853*	0.791*	-0.359***	2.265***	3.010***
	(0.11)	(0.093)	(0.13)	(0.25)	(0.29)	(0.33)	(0.111)	(0.25)	(0.23)	(0.24)	(0.37)	(0.44)	(0.46)	(0.125)	(0.74)	(1.05)
Observations	1357	1339	1314	1357	1296	1259	6669	1357	1339	1314	1357	1296	1259	6669	1310	1310
Adj. R-squared	0.0101	0.00228	0.005	0.0146	0.0204	0.0329	0.0535	0.0372	0.0297	0.0368	0.0557	0.0480	0.0455	0.0862	0.0139	0.0274
Firm FEs	no	no	no	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	no	yes

Note: The sample consists of observations from 232 private equity firms on 1,718 investments made between 1987 and 2005, except for columns (7) and (14) which include observations for 6,669 investments, and are not limited to those observations for which leverage data is available.

The dependent variable in specifications (1) through (14) is *gross IRR,* the internal rate of return of the investment calculated gross of all fees and expenses. The dependent variable in specifications (15) and (16) is *PME*, the public market equivalent return, defined as the ratio of the return on the investment to the return on the stock market at the same time period. *Baa spread* is the average difference in yields between Moody's BAA rated bonds and benchmark 10 year Treasury bonds at the end of the calendar year. *Adjusted experience* is the experience of the firm (number of deals) divided by the average experience of all firms active in that year. *Leverage* is the amount of total debt at book value divided by the total enterprise value of the company at market value at the time of the investment. *Annualized Return of S&P 500 over investment* is the annualized return of the S&P 500 over the duration of the investment. *Size* is the natural log of the sum of the market value of equity and the book value of debt, calculated in millions of dollars at the time of the investment. Robust standard errors clustered by year are in parentheses. Fixed effects for private equity firm are included in specifications (6) through (10) and (12). ***, **, and * indicate significance at the 1%, 5%, and 10% levels of significance, respectively.

Table 6: Bankruptcy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Baa Spread	-0.0281*			-0.0414**	-0.00262			-0.0256
	(0.016)			(0.020)	(0.020)			(0.026)
Adjusted Experience (# Deals)		-0.00340		-0.0317*		0.00248		-0.0350
		(0.0040)		(0.019)		(0.0075)		(0.022)
Leverage			0.114***	0.107**			0.0162	0.0185
			(0.043)	(0.044)			(0.054)	(0.054)
Adjusted Experience * Baa Spreads				0.0143				0.0220*
				(0.0088)				(0.011)
Size	-0.0106*	-0.0128**	-0.0145**	-0.0130**	-0.0251***	-0.0254***	-0.0267***	-0.0264***
	(0.0062)	(0.0061)	(0.0061)	(0.0064)	(0.0087)	(0.0086)	(0.0088)	(0.0090)
Constant	0.205***	0.163***	0.0904**	0.177***	0.113*	0.105***	0.104**	0.152*
	(0.042)	(0.034)	(0.042)	(0.060)	(0.058)	(0.038)	(0.047)	(0.081)
Observations	1439	1418	1396	1375	1439	1418	1396	1375
Adjusted R-squared	0.00479	0.00319	0.00828	0.00922	-0.00272	-0.000704	0.00214	0.00393
Firm FEs	no	no	no	no	yes	yes	yes	yes

Note: The sample consists of observations from 232 private equity firms on 1,439 investments made between 1987 and 2005 where observations have the full complement of covariates. The dependent variable is *bankruptcy*, an indicator variable equal to one if the investment went bankrupt. *Baa spread* is the average difference in yields between Moody's BAA rated bonds and benchmark 10 year Treasury bonds at the end of the calendar year. *Adjusted experience* is the experience of the firm (number of deals) divided by the average experience of all firms active in that year. *Leverage* is the amount of total debt at book value divided by the total enterprise value of the company at market value at the time of the investment. *Size* is the natural log of the sum of the market value of equity and the book value of debt, calculated in millions of dollars at the time of the investment. Robust standard errors clustered by year are in parentheses. Fixed effects for private equity firm are included in specifications (5) through (8). ***, **, and * indicate significance at the 1%, 5%, and 10% levels of significance, respectively.

Appendix 1: Example of a PPM

Fund IV Track record Status as at June 30, 2007, In millions of Euro

Company	Date of investment	Date realized	Sector	Country	Cost	Realized value	Unrealized Value	Total value	Multiple	IRR	Exit
Realized investments											
X1	Apr-00	Apr-06	Healthcare	France	60	_	_	0	0.0	n.m.	
X2	May-01	May-06	Industrial	UK	140	120	_	120	0.9	n.m.	Trade sale
X3	Mar-01	Jun-03	Consumer	Germany	115	950	_	850	7.4	100%	IPO
X4	Mar-01	Jul-06	Chemicals	Germany	60	85	_	85	1.4	25%	Trade sale
Total Realized					375	1155		1055	2.8	51%	_
Partly realized investments											
X5	Oct-00	_	Healthcare	France	500	130	300	430	0.9	n.m.	
X6	Apr-04	_	Industrial	UK	200	150	190	340	1.7	100%	
X7	Feb-03	_	Healthcare	France	179	444	43	487	2.7	51%	
Total Partly Realized					879	724	533	1257	1.4	31%	
Unrealized investments											
X8	Dec-05	_	Healthcare	France	140	_	280	280	2.0	25%	
X9	Jul-02	_	Industrial	UK	450	_	450	450	1.0	n.m.	
Total Unrealized					590	_	730	730	1.2	10%	
Total					1844	1879	1283	3042	1.6	40%	