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JEL Classification: D86, G12, G31, G32, G34

Keywords: private equity, buyouts, incentives, general partner, ownership, Risk Taking, Wealth

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Ownership, wealth, and risk taking: Evidence on private equity fund managers*

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We examine the incentive effects of private equity (PE) professionals' ownership in the funds they manage. In a simple model, we show that managers select less risky firms and use more debt financing the higher their ownership. We test these predictions for a sample of PE funds in Norway, where the professionals' private wealth is public. Consistent with the model, firm risk decreases and leverage increases with the manager's ownership in the fund, but largely only when scaled with her wealth. Moreover, the higher the ownership, the smaller is each individual investment, increasing fund diversification. Our results suggest that wealth is of first order importance when designing incentive contracts requiring PE fund managers to coinvest.

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1 Introduction

Following the 2008 financial crises, the wide-spread use of variable pay in the financial services industry came under fire. Critiques claim that option awards and bonus payments induced short-termism, which led to excessive risk taking at the expense of long-term value maximization (Blinder, 2009; Thanassoulis, 2012). As a response, politicians imposed limits on bonus payments in financial institutions, requiring incentive pay to have clawback features and vest over several years (European Commission, 2013). Such deferral of payout is tantamount to a buildup of equity in the firm, effectively giving managers a long-term "skin in the game".

There is a large body of evidence on the relation between equity-based incentives and risk taking in firms and financial institutions.[1] Using a unique sample of private equity (PE) investment professionals and portfolio companies in Norway, we contribute to this literature in several ways. First, PE funds are raised and managed by investment professionals of a general partner (GP) that are required to invest in the fund. We provide new evidence on the effect of GP ownership on the choice of portfolio company risk and leverage.

Second, it is commonly accepted that risk aversion is declining in wealth (Becker, 2006; Holt and Laury, 2002). The Norwegian setting allows us to scale GP ownership with the private wealth of its investment professionals, which we use as a proxy for the manager's risk-aversion. We show that the effect of GP ownership on risk taking is significant largely only after controlling for wealth.

Third, GP ownership is determined *ex-ante*, when the fund is raised, while the decisions to acquire portfolio companies are made *ex-post*, as the fund's committed capital is invested over the subsequent five to six years. This sequencing mitigates endogeneity

[1] See, e.g., Guay (1999), Knopf, Nam, and John H. Thornton (2002), Rajgopal and Shevlin (2002), and Coles, Daniel, and Naveen (2006) for effects of incentive-based pay on investment policy, Tchistyi, Yermack, and Yun (2011) for effects on financial policies, Fahlenbrach and Stulz (2011) for effects on the stock-return volatility of banks, and Driessen, Cremers, Maenhout, and Weinbaum (2009) for the performance of equity mutual funds.

concerns typically plaguing the literature, similar to the approach of Shue and Townsend (2017).[2] Such concerns are mitigated further as we scale GP ownership with the manager's wealth at the time of investment, which is likely to have changed since fund inception.

GPs (also known as PE firms) are typically compensated with an annual management fee of two percent of the fund's capital and 20% carried interest on the profits above a certain threshold (Metrick and Yasuda, 2010).[3] The carry creates an option-like payoff, with little downside to the fund manager. Since the performance of the current fund also affects subsequent fund raising, the GP's incentive to generate high returns is even stronger than that provided by the carry alone (Chung, Sensoy, Stern, and Weisbach, 2012).

To mitigate potential adverse incentives for excessive risk taking, GPs are generally required to invest in the fund. Robinson and Sensoy (2013) report that US' GPs on average contribute 2.4% (median 1.0%) of the buyout fund's capital.[4] However, they find no relation between the dollar amount of GP ownership and fund performance net of fees—as if the GP's ownership itself does not systematically affect risk taking.

We start by developing a simple theoretical model, in which the GP simultaneously selects a target firm and decides how much debt to use in the acquisition, contributing the equity from the fund. The GP can choose between firms with different risk, where high-risk firms have relatively high expected cash flow and high probability of default, and vice versa. The GP invests a fraction β of the equity and receives a performance-based carried interest α on the cash flow above a threshold. Because debt increases the payoff to equity in good states, managers use more debt the higher is the carry α.

[2]Shue and Townsend (2017) study effects of CEO option grants that vest over several years. See also Chava and Purnanandam (2010) and Coles, Lemmon, and Meschke (2012) for other approaches to address endogeneity concerns.

[3]Many GPs charge transaction fees and monitoring fees to their portfolio companies. Phalippou (2009) and Phalippou, Rauch, and Umber (2018) estimate these fees to on average 6%-7% of invested capital.

[4]An ownership of 1% or more also allows the GP to tax the carry as capital gains (Gompers and Lerner, 2001).

The GP is risk averse and derives negative utility from downside risk. It follows that GP ownership has direct implications for the portfolio company choice. In particular, the GP selects the firm by trading off the expected cash flow against the downside risk. *Ceteris paribus*, managers with a relatively high β invest in less risky firms. Since lower-risk firms have greater debt capacity, GP ownership also has an indirect effect on leverage. That is, for a given α, the higher her ownership, the more debt the GP uses to finance the firm. Moreover, allowing risk aversion to be declining in wealth, the effect of β on firm risk and leverage is attenuated by the GP's private wealth.

We then take these model predictions to the data, using a unique sample of 62 firms acquired by 20 Nordic PE funds between 2000 and 2010. We limit the analysis to Norway, where the investment professionals' taxable wealth is public, as are the portfolio companies' financial statements after going private. By hand-collecting private wealth data, we are able to estimate the incentive effects of GP ownership, not only in percent and dollars, but also as a proportion of wealth. This is an important empirical contribution of our paper. As shown below, the effect of GP ownership on portfolio company risk and leverage is significant (in most cases) only after controlling for the investment professionals' wealth.

The GP ownership varies substantially across the PE funds in our sample, with an average of 3.7% (median 1.5%), ranging from zero to 15% of the fund's capital. Importantly, we show that investment professionals in Norway generally are required to invest a large fraction of their private wealth in the funds they manage. In our sample, the PE partners' ownership in the fund averages as much as 93% (median 48%) of their taxable wealth.

Our empirical tests confirm the model predictions. Funds in which GP ownership is relatively high tend to acquire firms with lower asset beta and return volatility, and hence lower cash-flow risk. Moreover, these fund use more debt to finance their acquisitions. Axelson, Jenkinson, Stromberg, and Weisbach (2013) document that debt levels

in buyouts are determined primarily by economy-wide credit conditions. We add to their evidence by showing that portfolio company leverage increases with GP ownership.[5]

We further show that the PE fund's overall risk is lower the higher the GP's ownership. Specifically, portfolio companies' equity beta declines in GP ownership, suggesting that the reduction in cash flow risk dominates the increased default risk from higher leverage. Moreover, as an alternative measure of portfolio risk, we introduce "ticket size", defined as the ratio of the fund's equity investment in the firm to the fund's total capital. The smaller this ratio, the more diversified is the PE fund's portfolio. Consistent with our results on target firm equity beta, we document that ticket size is decreasing in GP ownership. This evidence suggests that the incentive effect of the GP's ownership is not limited to characteristics of the individual target firms, but has a broader impact on the overall design of the fund portfolio.

Importantly, the relation between GP ownership and portfolio company asset beta, equity beta, leverage, and ticket size is significant only when the GP's ownership in the fund is scaled by the private wealth of the investment professionals. Neither the percent of the fund nor the dollar amount invested is related to portfolio company systematic risk and portfolio diversification, consistent with Robinson and Sensoy (2013). Thus, an important contribution of this paper is to show the importance of controlling for the investment professionals' private wealth to properly assess the incentive effect of GP ownership.

In our setting, the GP's ownership is determined upfront, at fund raising, whereas the target companies are selected several years later, when the private wealth of the investment professionals may have changed. This suggests that causality runs from the incentives created by GP ownership to the selection of portfolio company risk. Reverse causality would require that limited partners (LPs), when investing in the fund, correctly anticipate both the future investment decisions and the subsequent development in GP

[5]See also Colla and Wagner (2012), who find that buyout leverage increases with firm profitability and decreases with cash flow volatility.

wealth—something that is highly unlikely.

Another potential concern is that unobservable characteristics of the fund manager generate a spurious correlation between GP ownership and target firm risk. For example, risk-averse and low-ability GPs could select both lower ownership in the fund and less risky firms. We argue, however, that our setting mitigates such endogeneity concerns for two reasons. First, LPs often negotiate the partnership agreements (Robinson and Sensoy, 2013). Thus, the GP's ownership is likely influenced by the LP's risk preferences as well. Second, latent GP characteristics, such as risk preference and ability, imply that GP ownership should be positively associated with risk taking. Our empirical analysis shows instead that GP ownership is negatively related to risk taking, rejecting this notion.

Overall, our evidence suggests that LPs effectively reduce PE fund managers' incentives to take risk by requiring them to invest in the fund. Whether this reduction in risk appetite is optimal or not goes beyond the scope of this paper. LPs ultimately care for the risk-adjusted return net of fees, something we leave for future research.[6]

The paper proceeds as follows. Section 2 sets up and discusses our theoretical model and its predictions. Section 3 describes the data, while Section 4 presents the empirical results. Section 5 concludes.

2 Model

In this section, we develop a simple model showing how the GP's ownership and wealth affect her choice of target company risk and leverage.

[6]For evidence on PE fund returns, see, e.g., Kaplan and Schoar (2005), Phallipou and Gottschalg (2009), Groh and Gottschalg (2011), Driessen, Lin, and Phalippou (2012), Harris, Jenkinson, and Kaplan (2014), Higson and Stucke (2012), Phalippou (2014), Braun, Jenkinson, and Stoff (2017), and Phalippou, Ang, Goetzmann, and Chen (2018).

2.1 Model set-up

The model has three agents: a GP raising and managing a PE fund, risk-neutral investors (LPs) contributing capital to the fund, and a bank providing debt. At time $t = 0$, the GP selects risk through the choice of target company and the amount of debt financing. At time $t = 1$, the target firm realizes a cash flow that is shared by the bank, investors, and the GP.

The firm's realized cash flow x is $R + \Delta$ (high), R (medium), or $R - \rho$ (low) with probability $0.5q$, $1 - q$, and $0.5q$, respectively. Firms vary in the likelihood of the tail outcomes and hence in the risk q of their cash flows. We assume $\Delta > \rho$ and zero discount rate, so the expected value of the firm $V(q) = R + 0.5q(\Delta - \rho)$ is increasing in q.

After selecting a firm with a certain q, the GP approaches the bank for debt financing. The GP finances the purchase price I by borrowing D against the firm's cash flow, using equity from the PE fund for the remaining amount $I - D$. The bank charges an interest rate r and receives $D(1 + r)$ at $t = 1$ as long as the realized cash flow $x > D(1 + r)$. We let $R > D(1 + r) > R - \rho$, so the firm defaults and the bank receives $R - \rho$ and investors zero in the low outcome.

We let cash flow risk be contractible and the bank sets the loan rate r accounting for q. With a competitive loan market, the bank will require a rate r that allows it to break even:

$$0.5qD(1 + r) + (1 - q)D(1 + r) + 0.5q(R - \rho) = D. \tag{1}$$

The cash flow to equity, left after the bank is paid off, is shared between investors and the GP. We ignore potential benefits from leverage, such as tax shield (Modigliani and Miller, 1958) and reduced agency costs (Jensen, 1986), and let firm value $V(q)$ be independent of leverage.

2.2 The GP's incentive scheme

The GP is compensated through a performance-based carried interest α received at $t = 1$.[7] Investors cannot observe GP risk-aversion and use a standard rate for $\alpha \in (0, 1)$. The carry pays the GP a fraction of the cash flow to equity exceeding a return e. We assume that e is a non-risk adjusted exogenous rate, with $e > r$.[8] The carried interest is thus $\alpha(x - C) > 0$, where C is the sum of the debt payments to the bank and the hurdle amount paid to investors:

$$C(D) = D(1 + r) + (I - D)(1 + e) = I(1 + e) - D(e - r). \tag{2}$$

Combining Eq. (2) with the bank's participation constraint in Eq. (1) yields

$$C(D) = I(1 + e) - De + \frac{0.5qD}{1 - 0.5q} - \frac{0.5q(R - \rho)}{1 - 0.5q}. \tag{3}$$

To make debt financing attractive, we assume that $\Delta + \rho - R > D(1 + e)$. That is, the difference in cash flow between the high and low outcome net of that of the medium outcome exceeds the reduction in the hurdle payout due to debt financing. For simplicity, we also let $R = I(1 + e)$, so the cash flow in the medium outcome equals the hurdle payout for an all-equity firm. These assumptions ensure that the all-equity firm has positive NPV.[9] Moreover, in the medium outcome and with debt financing, $x - C = D(e - r) > 0$ and the GP receives carry.

The carry is zero in the low state. Hence, it is option-like with no downside risk. To release this limited-liability constraint, investors require the GP to invest in the fund. The GP contributes a fraction $\beta \in (0, 1)$ of the fund's equity investment at $t = 0$ and receives β of the realized equity value $V(q)$ at $t = 1$. For a leveraged firm, the equity

[7] In reality, GPs also charge a management fee, expressed as a percentage of the fund's capital. Such fixed fee has no impact on the GP's investment decision and is therefore ignored in the analysis below.

[8] This maps industry practice, where the hurdle rate is set when the fund is raised, well before the fund manager starts select target companies.

[9] The NPV of the all-equity firm is $V(q) - I$. With $R = I(1 + e)$, $V - I = Ie + 0.5q(\Delta - \rho) > 0$.

value is:

$$V^D(q, D) = 0.5q[R + \Delta - D(1 + r)] + (1 - q)[R - D(1 + r)] \tag{4}$$

While debt funding increases the payoff to equity in the high and medium outcomes, it comes with a cost to the GP in the low state. In case of default, the GP incurs a reputational loss that may hamper future fund raising efforts. We let the GP's personal cost of default B be increasing in the bank's loss and convex in D. Moreover, we rely on the notion that the failure of a low-risk firm causes greater reputational loss than that of a high-risk firm. Hence, we let $B(q, D) = \lambda D^2/q$, where $\lambda \in (0, 1)$.

We further assume that the GP is risk averse and derives negative utility from downside risk. This negative utility $k(q) = 0.5cq^2$, where $c \in (0, 1)$ captures the GP's risk aversion and $\partial k/\partial q > 0$. Since the GP is exposed to downside risk through her ownership in the firm, we let this cost be proportional to β (see Bolton, Mehran, and Shapiro (2011) for a related approach). Moreover, we let c be decreasing in the GP's private wealth w (i.e., $c(w)$ with $\partial c/\partial w < 0$), implying that wealthier GPs are less risk averse (Holt and Laury, 2002; Rabin, 2000).

2.3 GP ownership and risk taking

Proposition 1 summarizes the effect of the GP's equity ownership on her choice of project risk and leverage.

Proposition 1: *The GP's incentive to select riskier firms and use less debt financing is decreasing in her ownership β.*

To see this, the objective function of the fund manager is:[10]

$$\begin{aligned} V^{GP}(q,D) &= \beta(V^D(q,D)-(I-D))+\alpha(V^D(q,D)-C(D)|x>C) \\ &\quad -0.5qB(q,D)-\beta k(q)+M. \end{aligned} \tag{5}$$

Combining Eq. (5) with the banks participation constraint in Eq. (1) and the equity value of the leveraged firm in Eq. (4), and substituting for the functions of C in Eq. (3), B and k, the GP's objective function can be rewritten as:

$$\begin{aligned} V^{GP}(q,D) &= \beta(0.5q(R+\Delta)+(1-q)R+0.5q(R-\rho)-0.5cq^2-I)) \\ &\quad +\alpha[0.5q(R+\Delta-C+(1-q)(R-C)]-0.5\lambda D^2+M \end{aligned} \tag{6}$$

When choosing the level of project risk q and debt financing D, the GP faces two opposing effects that she has to trade off against each other. Higher q is associated with, on the one hand, larger expected cash flows and, on the other hand, greater negative utility k related to risk aversion. Similarly, higher debt D is accompanied by higher expected carry, as cheaper debt replaces more expensive equity, but also greater expected default cost B.

Since, from Eq. (2), $\partial C/\partial D = -(e-r)$, the first-order condition for the GP's choice of risk is:

$$\frac{dV^{GP}}{dq} = \beta(0.5(\Delta-\rho)-cq)+0.5\alpha(\Delta+\rho-D(1+e)-R)=0 \tag{7}$$

and the first-order condition for her choice of debt is:

$$\frac{dV^{GP}}{dD} = -\lambda D+\alpha((1-0.5q)e-0.5q)=0. \tag{8}$$

[10]For tractability, we ignore the portion of the carry that the GP has to pay from his ownership stake β in the target firm. With $\alpha = 0.20$ and $\beta = 0.01$, this portion will be small in comparison with the other components of the GP's payoff and can safely be ignored without altering the results.

Solving these two equations yields:

$$q(D, \beta, \alpha) = \frac{(\Delta - \rho)}{2c} + \frac{\alpha(\Delta + \rho - D(1+e) - R)}{2c\beta} \tag{9}$$

and

$$D(q, \alpha) = \frac{\alpha((1 - 0.5q)e - 0.5q)}{\lambda}. \tag{10}$$

Note that project risk and leverage are complements to each other. That is, q is a function of D in Eq. (9) and D is a function of q in Eq. (10). Notice also that the two dimensions of risk, q and D, operate in opposite directions. Higher project risk leads the GP to optimally choose lower leverage and vice versa.[11] Our two choice variables are in this sense risk-substitutes. This tradeoff between project risk and leverage, which can be seen in the first-order conditions, is a key mechanism in our model.

An important consequence of this complementarity is that exogenous parameters may affect the choice of risk and leverage directly, via the respective first-order condition, as well as indirectly, through the other choice variable. For example, the carry α affects both q and D directly, and therefore also indirectly. In contrast, the GP's equity ownership β has a direct effect on q only and hence an indirect effect only on the leverage choice.

We derive the comparative static effects of the GP's ownership by totally differentiating the first-order conditions. From Eqs. and (7) and (8), we get:

$$\frac{dq}{d\beta} = \frac{-\lambda(cq - 0.5(\Delta - \rho))}{\Gamma} < 0 \tag{11}$$

and

$$\frac{dD}{d\beta} = \frac{(cq - 0.5(\Delta - \rho))(0.5(1+e))}{\Gamma} > 0, \tag{12}$$

where $\Gamma > 0$ is the determinant of the Hessian matrix of the two endogenous variables.[12]

[11] This follows from $\frac{dD}{dq} = -\frac{\alpha e - 1}{2\lambda} < 0$ and $\frac{dq}{dD} = -\frac{\alpha(1+e)}{2c\beta} < 0$.

[12] Γ is the determinant of the D-q matrix of the second derivatives stemming from Eqs. (9) and (10). Since the direct second-order conditions are negative, a positive Γ is a necessary and sufficient condition

Recall from above that we let $\Delta + \rho - R > D(1+e)$, so debt financing increases the cash flow to equity in the good states. For the first-order condition of V^{GP} with respect to q in Eq. (7) to be satisfied, it follows that $cq > 0.5(\Delta - \rho)$. Consequently, at the optimum, from the risk-averse GP's point of view, the marginal cost of an increase in project risk is higher than the marginal benefit. Thus, an increase in β has a negative effect on q and a positive effect on D. The economic intuition is that the bigger equity stake (higher β) induces the risk-averse GP to select a less risky firm (lower q), which, in turn, is financed with more debt (higher D).

The impact of the GP's private wealth on the incentive effect of her equity ownership is summarized in our second proposition.

Proposition 2: *An increase in the GP's wealth w attenuates the incentive effect of the GP ownership on the choice of firm risk and leverage.*

To see this, we totally differentiate Eqs. (7) and (8) with respect to the two dimensions of risk (q and D), taking the negative relation between c and w into account:

$$\frac{dq}{dw} = \frac{-\beta q \lambda (\partial c / \partial w)}{\Gamma} > 0 \tag{13}$$

and

$$\frac{dD}{dw} = \frac{(0.5\beta q(1+e)(\partial c / \partial w)}{\Gamma} < 0. \tag{14}$$

An increase in wealth hence has opposite effects on the two risk measures. Wealthier GPs are less risk averse and therefore select riskier firms (Eq. 13), which they finance with less debt (Eq. 14).

In sum, our model generates three testable predictions. As stated in Proposition 1, the GP's incentive to select risky portfolio companies is declining in her ownership β.

for the Hessian matrix to be negative definite, implying that the optimal solution D^* and q^* resulting from Eqs. (11) and (12) are maxima.

Moreover, having chosen a less risky firm, a higher ownership β induces the GP to use more debt financing. Furthermore, as stated in Proposition 2, since wealth lowers the negative utility associated with risk, the incentive effects on GP ownership are attenuated by GP wealth. In the following, we test Propositions 1 and 2 by scaling the GP's ownership with the total wealth of its investment professionals and partners.

3 Sample selection and description

3.1 Sample selection and data sources

We start with a list of all buyout transactions in Norway between 1991 and 2010, provided by the Argentum Centre for Private Equity at the Norwegian School of Economics (NHH). Comparing this list with the web pages of Nordic PE funds, we are able to identify 142 acquisitions of 134 unique Norwegian firms. By manually matching on company name and year, we successfully identify 117 of the target firms in the Brønnøysund Register Centre database, provided by Mjøs, Berner, and Olving (2016). We retrieve financial statement and ownership data for the period 1997–2012 for these firms.

Norwegian corporate law prevents acquirers from servicing acquisition debt with the target firm's cash flow.[13] To circumvent this rule, buyout transactions are typically executed in two steps. First, the PE fund raises debt against an empty holding company used to acquire the target. Second, about a year later, the holding company merges with the portfolio company. To account for this practice, we consolidate the debt of the target firm and its Norwegian holding companies.[14]

Information on the GP's ownership in the fund is typically confidential. However, from a large LP that wants to remain anonymous, we are able to get this information for 20 PE funds. The 20 funds, which are raised by 11 Nordic GPs, acquire 62 of the

[13] "Aksjeloven §8-10. Kreditt til erverv av aksjer mv".

[14] For tax reasons, it is attractive to domicile the holding companies in Norway. In our sample, only 32% of the firms are owned directly by the PE fund.

117 target firms between 2000 and 2010. While not tabulated, the 62 firms in our final sample are on average larger and acquired by older, higher-sequence funds than the 55 firms with missing GP ownership information. Other firm and fund characteristics are, however, similar across the two groups.

To retrieve data on wealth, we first identify all investment professionals from the GPs' websites. We drop professionals that join a GP after the fund's investment phase and do Google searches for those that have left. Discussions with LPs and GPs confirm that local investment professionals typically are responsible for the local deals. Thus, we limit our analysis to the 120 investment professionals residing in Norway, eliminating 123 professionals that live elsewhere.

For the 120 investment professionals in the sample, we obtain the history of tax records from the Norwegian tax authorities. These records disclose their taxable wealth, used below to adjust the GP's ownership in the fund. The caveat with this wealth data is that, whereas listed securities are marked-to-market, the assessed value of real estate is typically far below its market value. Thus, our wealth measure will underestimate the true wealth of the investment professionals. That notwithstanding, it does allow us to control for differences in wealth in the cross-section, providing a proxy for their relative risk aversion.

We cannot identify the exact deal team and assume that the GP's investment professionals in Norway share responsibility for the fund's local investments. While this assumption introduces noise in the wealth estimate, such noise works against us finding any results and is therefore of limited concern. Moreover, because the wealth largely depends on the success of earlier funds, there is likely a high correlation in wealth between the investment professionals' of a GP. Thus, averaging wealth within a GP may actually reduce some of the noise in the wealth estimate.

3.2 Sample description

Panel A of Table 1 presents summary statistics for the 20 PE funds in the sample. All variables are defined in Table 2. The average fund has a committed capital of $942 million (median $325 million), is number 3.6 (median 3) in sequence, and has 3.1 (median 3) sample firms in its portfolio. The average GP is 10 (median 8) years old when the fund acquires its first sample firm. Moreover, it has 16.6 (median 10) investment professionals in Norway, of which 8.4 (median 7) are partners. Panel A further shows that the taxable wealth of the average investment professional and partner is $1.9 million (median $1.3 million) and $3.2 million (median $1.5 million), respectively, in the year of the sample firm acquisition.

For a subset of funds, we have information on the management fee (14 funds), carry (11 funds), and equity hurdle rate (12 funds).[15] The average fund has a management fee of 2.0% (median 2.0%), carry of 18% (median 20%), and hurdle rate of 8.0% (median 8.0%). Since there is almost no variation in these rates across funds, we ignore them in the empirical analysis below. It is worth noting that, unlike US funds, Nordic PE funds do not charge transaction and management fees from their portfolio companies. Moreover, there is typically a clawback, requiring the GP to return any carry previously paid out if the fund subsequently underperforms.

In Panel B, we report summary statistics for the 62 portfolio companies in the sample. At the end of the fiscal year of the acquisition, the average firm has total assets of $120 million (median $67 million), total sales of $100 million (median $54 million), and book leverage, defined as total liabilities/total assets, of 62% (median 64%). The return on assets (EBITDA/total assets) averages 3% (median 7%) and asset tangibility (property, plant and equipment/total asset) averages 8% (median 0.4%). Most of the sample firms are in the services (42%), transportation (24%) and retail and wholesale (16%) industries, as defined by the European Nomenclature of Economic Activities (NACE) codes 70-75,

[15]The fee information is from the LP providing GP ownership data.

62-65, and 51-52, respectively.

An empirical test of our model requires a measure for firm risk. Since the target firms are private, we estimate their asset and equity betas from a matched sample of public firms. We run a propensity score estimator that finds the best fit among the approximately 250 firms listed on the Oslo Stock Exchange (OSE) in a given year. The estimator matches on profitability, return on assets, size, asset tangibility, and industry (at the NACE one-digit level). We use nearest neighbor matching with replacement and assign five matches to each sample firm.

We first estimate the equity beta of each matched firm over a 24-month rolling window against the Oslo Main Index, using monthly stock return data from NHH's "Børsprosjektet".[16] We then delever the matched firm's equity beta to obtain asset beta, assuming a debt beta of zero. The sample firm's asset beta is the average asset beta of the five public matches. We compute the sample firm's equity beta by relevering its asset beta at the year-end debt ratio. Because asset book values are written up in connection with the acquisition, this book leverage is close to the market leverage. As shown in Panel B, the average sample firm has an asset beta of 0.47 (median 0.46) and an equity beta of 0.69 (median 0.59). These betas are consistent with the relatively low betas estimated by Driessen, Lin, and Phalippou (2012) for portfolio companies in US buyout funds.

As an alternative risk measure, we estimate the return volatility from the five matched firms. Specifically, $Volatility$ is the standard deviation of the daily stock return over the eight months preceding the month of the acquisition, averaged across the five matched firms. The average firm in our sample has a volatility of 0.030, with a median of 0.031. The last row of the panel shows *Ticket size*, defined as the sample firm's book value of equity divided by the committed capital of the fund. Again, because asset book values are generally written up to reflect the purchase price, book equity is a fair approximation

[16] http://mora.rente.nhh.no/borsprosjektet.

of fund's investment in the target company. We use this variable as a proxy for fund diversification. The larger the ticket size, the greater proportion of the fund's capital is invested in the firm. In our sample, the average ticket size is 0.10, with a median of 0.05.

Finally, Panel C of Table 1 presents summary statistics for the GP ownership across the 62 sample firms. The average GP in our sample is required to invest 3.7% (median 1.5%) of the fund's capital, ranging from a low of zero to a high of 15%. This GP ownership is somewhat higher than the average of 2.4% (median 1.0%) reported for US buyout funds (Robinson and Sensoy, 2013). To compute the total dollar amount owned by the investment professionals, we assume that the proportion of the fund invested in Norway equals the fraction of the GP's professionals that reside in Norway. With this assumption, the GP ownership averages $13.0 million (median $5.9 million) per fund.

The relative ownership is defined as the ratio of the GP's dollar ownership in the fund to the total wealth of the GP's investment professionals or partners, averaged over the three years prior to the acquisition.[17] We smooth wealth to avoid large variations in the wealth estimate from year to year. Since the GP's risk aversion is determined by the total amount at risk, we use the GP's ownership in the fund—and not in the individual target firms—in the empirical analysis below. As shown in Panel C, the GP professionals invest on average 89% (median 47%) of their taxable wealth in the fund. It is possible, however, that the requirement to invest is limited to the PE firm's partners. Restricting the GP's investment in the fund to its partners, the average GP ownership is 93% (median 48%) of the partners' private wealth. In the empirical analysis below, we scale the GP ownership with the wealth of all investment professionals as well as that of partners for robustness.

[17]We winsorize two observations with a ratio above five.

4 Empirical analysis

4.1 GP ownership and firm cash flow risk

In this section, we perform cross-sectional tests of our model predictions. According to Proposition 1, the incentive to invest in risky firms is decreasing in GP ownership. We first use the target firm's asset beta as a proxy for portfolio company cash flow risk. Table 3 shows the coefficient estimates from ordinary least squares (OLS) regressions of asset beta. Standard errors are clustered by GP (using robust standard errors do not alter the inferences).

The regressions control for fund and firm characteristics that may drive portfolio company risk. The fund characteristics are *GP_age* (number of years since the GP was founded when the firm is acquired), *Fund_size* (log of the fund's committed capital) and *Fund_sequence*. The firm characteristics are (log of) total sales, *Tangibility*, and *ROA* (return on assets). The even-numbered columns include dummies for the three largest industry groups (services, transportation, and retail and wholesale), examining GP risk-taking within a given target industry, whereas the odd-numbered columns do not, allowing the GP to select portfolio company risk through the industry choice. All regression models include deal year dummies to control for time-varying economy-wide conditions, such as the credit market spread. As shown in Table 3, of the control variables, only GP age and fund sequence generate significant coefficients. Specifically, portfolio company asset beta is decreasing in GP age and increasing in fund sequence.

Our main variable of interest is GP ownership. The regressions include the percent (columns 1-2) and the dollar amount (columns 3-4) of GP ownership in the fund. As shown in the table, however, the coefficient estimates for *%_ownership* and *$_ownership* are all insignificant. That is, GP ownership measured neither in percent of the fund's capital nor in absolute dollar amount can explain the GP's choice of portfolio company systematic cash flow risk.

Proposition 2 states that the incentive effect of GP ownership is attenuated by wealth. To test this, we scale the GP's ownership with the total wealth of its investment professionals and partners. This variable, which we label *Rel_ownership*, allows us to control for the relative risk aversion in examining the incentive effect of the GP's ownership. Importantly, as shown in the last four columns of Table 3, asset beta is decreasing in *Rel_ownership*. That is, GPs with a relatively high proportion of their private wealth invested in the fund tend to select less risky firms, as predicted by our model.

The coefficient estimates for *Rel_ownership* are negative and significant at the 5% level when adjusting with the wealth of all of the GP's investment professionals (columns 5-6). Adjusting for the partners' wealth only, the coefficient is significant at the 5% level when including industry dummies (column 8) and otherwise at the 10% level (column 7). Thus, if anything, it appears that the selection of lower systematic cash flow risk is more pronounced within the target firm's industry. To gauge the economic impact of GP ownership on asset beta, we note that the average asset beta is 0.47, while the coefficient estimate is -0.043 (column 6). A one standard deviation increase in the GP wealth invested in the fund reduces asset beta from 0.47 to 0.41.

We next use return volatility as a measure for the firm's idiosyncratic cash flow risk. While a well-diversified investor should care about systematic risk only, PE funds have a limited number of firms in the portfolio, so much of the idiosyncratic risk cannot be diversified away. Table 4 reports the coefficient estimates from OLS regressions of $Volatility$, using the same control variables as in Table 3 and clustering standard errors by GP. As shown in columns (1)-(4), *%_ownership* and *$_ownership* now generate negative and highly significant ($p<0.01$) coefficients. The higher the GP's percentage and dollar ownership in the fund, the lower the return volatility of the acquired firms, consistent with Proposition 1. However, there is no discernible effect of GP ownership when scaled with wealth, whether that of all investment professionals or partners (columns 5-8).

Overall, the evidence in Tables 3 and 4 suggests that GPs tend to choose portfolio companies with less risky cash flows the higher their ownership in the fund, consistent with our model.

4.2 GP ownership and leverage

The second implication of Proposition 1 is that the GP's incentive to finance acquisitions with debt is increasing in her ownership in the fund. To test this, Table 5 reports the coefficient estimates from OLS regressions for portfolio company leverage. Starting with the control variables, there is some evidence that leverage decreases with firm profitability and increases with fund size and asset tangibility.

Turning to the GP ownership, $\%\_ownership$ and $\$\_ownership$ are again insignificant (columns 1-4). That is, there is no evidence that the percent or the dollar amount ownership in the fund affect the GP's decision to finance the acquisition with debt. More importantly, *Rel_ownership_all* and *Rel_ownership_partners* both generate positive coefficients, significant at the 5% level (columns 6) and 1% level (column 8), respectively, when including industry dummies. That is, consistent with Propositions 1 and 2, the higher the proportion of the GP's wealth invested in the fund, the more debt is used to finance the target firm relative to other target firms in the same industry.

Thus, similar to the above results for asset beta, while GP ownership in itself does not affect the choice of portfolio company leverage, it does so when adjusted for the wealth of the GP's investment professionals and partners. To gauge the economic impact of the wealth-adjusted GP ownership on leverage, note from Table 1 that the average leverage in the sample is 0.62. From column (6), a one standard deviation increase in the GP's ownership relative to her wealth increases the leverage ratio from 0.62 to 0.71.

4.3 PE fund portfolio risk

Our analysis so far shows that GPs with a relatively high fraction of their wealth invested in the fund tend to, on the one hand, select firms with less risky cash flow and, on the other hand, use more debt to finance the firm. These results both follow from Propositions 1 and 2. Our model, however, stays silent on the combined effect of a lower asset beta and higher leverage. That is, whether or not the reduced cash-flow risk associated with higher GP ownership dominates the increased default risk from taking on more debt. We next examine the effect of GP ownership on the systematic risk of the fund's equity investment in the target firm, capturing the net impact of the fund manager's investment decision.

Table 6 shows the coefficient estimates from OLS regressions for the sample firms' equity beta, using the same model specifications as above. Again, $\%\_ownership$ and $\$\_ownership$ enter the regressions with insignificant coefficient estimates. This is consistent with Robinson and Sensoy (2013), who fail to find any effect of GP ownership on fund returns net of fees. However, as shown in columns (5)-(8), *Rel_ownership_all* and *Rel_ownership_partners* both generate negative and highly significant coefficients ($p<0.01$). That is, the higher the proportion of the GP's wealth invested in the fund, the lower the systematic risk of the fund's equity investments. The economic effect is large: A one standard deviation increase in the GP's ownership scaled by wealth decreases the portfolio company equity beta from on average 0.69 to about 0.50 (column 6).

Another way to reduce risk is to lower the idiosyncratic risk of the PE fund's equity investments. This could be achieved by increasing the number of portfolio companies, investing a smaller amount in each individual firm. While fewer companies in the portfolio increases the amount of time the GP can monitor each firm, it leaves the GP more vulnerable to random exogenous shocks that may reduce company performance. The decision is again the result of a tradeoff, where higher leverage increases equity risk,

while at the same time reducing the size of the equity investment from the fund. Thus, to the extent a higher ownership makes the GP more risk averse, this could further manifest itself in a greater number of portfolio companies.

In table 7, we examine the cross-sectional determinants of *Ticket_size* (the fund's equity investment in the target firm divided by fund size). Again the coefficients for *%_ownership* and *$_ownership* are statistically insignificant, while *Rel_ownership_all* and *Rel_ownership_partners* generate negative and significant coefficients ($p<0.05$). It appears that GPs with a relatively high fraction of their wealth invested in the fund not only select target firms with lower systematic equity risk (beta), but further diversify idiosyncratic fund risk by investing a smaller fraction of the fund's capital in each portfolio firm. Indeed, a one standard deviation increases in the proportion of the GP's wealth invested in the fund reduces the fraction of the fund invested in the average target firm from 0.10 to 0.06 (column 6).

In sum, GP ownership appears to fundamentally influence the selection of individual portfolio companies with respect to their cash-flow risk and leverage, as well as the overall portfolio risk and diversification. However, our empirical results show that this incentive effect is typically not discernable unless adjusting for the private wealth of the GP's investment professionals or partners, capturing their relative risk aversion. This suggests that it is critical to control for wealth to appropriately assess the impact of GPs' ownership on their appetite for risk taking in the funds they manage.

5 Conclusion

GPs are required to invest in the PE funds that they manage. In this paper, we examine how this ownership affects the GP's investment decision. Since the GP ownership is determined *ex-ante*, when the fund is raised, and the fund's investment decisions are typically made several years later, this setting reduces concerns about endogeneity and

reverse causality.

We first develop a simple model, which shows that higher ownership incentivizes the GP to select less risky target firms and use more debt to fund the acquisitions. Moreover, allowing GP risk aversion to be decreasing in wealth, the incentive effect of GP ownership is attenuated by GP wealth. We then take the model predictions to the data, using a unique sample of 62 Norwegian PE transactions. We use hand-collected data on the private wealth of the investment professionals as a proxy for differences in risk aversion across GPs.

The empirical evidence supports the predictions of the model. Portfolio company asset beta and stock return volatility decreases and leverage increases in GP ownership. Moreover, GPs with relatively high ownership tend to reduce the overall risk of the fund's portfolio, both in terms of target company equity beta and ticket size, defined as the fraction of the fund's committed capital invested in each target firm. Importantly, GP ownership is a significant determinant of investment risk primarily when adjusted for the wealth of the investment professionals or partners. This suggests that wealth is of first-order importance when assessing the incentive effect of GP ownership.

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Table 1: **Summary statistics**

The table shows summary statistics for the sample of 20 PE funds (Panel A) and 62 portfolio companies (Panel B), as well as the GP ownership in the fund (Panel C). All variables are defined in Table 2. Firm characteristics are from year 1. We use an exchange ratio of 6 NOK/USD (the time-series average across the sample period).

Variable	Num.	Mean	Median	Std. Dev.	Min	Max
	(1)	(2)	(3)	(4)	(5)	(6)
A: GP and fund characteristics						
Fund size ($ million)	20	942	325	1700	53	5883
Fund sequence number	20	3.65	3	2.35	1	8
# of sample firms in portfolio	20	3.1	3	1.619	1	7
GP age when fund acquires first firm	20	9.65	8.5	6.53	1	20
# of professionals in Norway	20	16.6	10	17.95	4	83
# of partners in Norway	20	8.45	7	4.25	3	21
Avg. wealth professionals ($ million)	20	1.92	1.31	2.05	0.02	6.82
Avg. wealth partners ($ million)	20	3.22	1.53	4.27	0.03	17.33
Management fee	14	0.020	0.020	0.000	0.013	0.023
Carry	11	0.180	0.200	0.050	0.020	0.200
Hurdle rate	12	0.080	0.080	0.000	0.070	0.080
B: Firm characteristics						
Total assets ($ million)	62	119.7	67	223	2.10	1717
Sales ($ million)	62	100	54	116	0	628
Leverage	62	0.618	0.641	0.276	0.02	1.325
ROA	62	0.030	0.072	0.243	-1.66	0.315
Tangibility	62	0.080	0.004	0.149	0	0.554
Asset beta	62	0.473	0.459	0.298	-0.29	1.237
Equity beta	62	0.691	0.586	0.538	-0.47	2.747
Volatility	62	0.030	0.031	0.016	0.011	0.078
Ticket size	62	0.105	0.055	0.153	-0.051	0.796
C: GP ownership						
Ownership in %	62	3.7	1.5	4.9	0	15.0
Ownership (in $ million)	62	13.02	5.90	20.67	0	88.33
Relative ownership all	62	0.893	0.427	1.32	0	5.00
Relative ownership partners	62	0.932	0.476	1.33	0	5.00

Table 2: **Variable definitions**

The table defines variables used in the empirical analyses. Year 0 is the year in which the PE fund acquires the sample firm. The financial information is from year 0. Only investment professionals in Norway are considered.

Variable name	Definition
A: GP ownership and private wealth	
%_ownership	GP ownership in the fund in percentage points.
$_ownership	GP ownership in the fund in billion NOK.
Rel_ownership_all	*$_ownership/ Wealth_all.*
Rel_ownership_partners	*$_ownership/ Wealth_partners.*
Wealth_all	The GP investment professionals' total wealth in billion NOK, averaged over years -2, -1, and 0.
Wealth_partners	The GP partners' total wealth in billion NOK, averaged over years -2, -1, and 0.
Wealth_ch_all	Change in GP investment professionals' wealth, year -2 to -1.
Wealth_ch_partners	Change in GP partner wealth, year -2 to -1.
B: GP and fund characteristics	
GP Age	Number of years since GP was founded at acquisition.
Fund sequence	Order of succession of the fund for the GP.
Fund size	Natural logarithm of fund size in billion NOK.
C: Firm characteristics	
Asset_beta	We estimate equity beta against the Oslo Main Index for the five matched firms, using monthly returns over the 24 month ending in year 0. *Asset_beta* is the average asset beta of the five matched firms, computed as their equity beta*(1-market leverage), where market leverage is (total liabilities)/(market value of equity + total liabilities).
Equity_beta	Computed as *Asset_beta*/(1-*Leverage*).
Volatility	The standard deviation of the daily stock return over the eight months preceding the month of the acquisition, averaged across the five matched firms.
Ticket_size	The firm's book value of equity/fund size.
Sales	Natural logarithm of total sales in thousand NOK.
Leverage	Total liabilities/total assets.
Tangibility	Property, plant and equipment (PPE)/total assets.
ROA	Earnings before interest, taxes, depreciation and amortization (EBITDA)/total assets.

Table 3: **Cross-sectional determinants of asset beta**

The table shows coefficient estimates from ordinary least squares (OLS) regressions of portfolio company asset beta, estimated from five matched public firms. *Rel_ownership* is the GP's ownership in the fund scaled by the total wealth of its' investment professionals and partners. The sample is 62 Norwegian firms acquired by Nordic PE funds between 2000 and 2010. All variables are defined in Table 2. Standard errors are clustered by GP and shown in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GP ownership:								
%_ownership	-0.041	-0.001						
	(1.041)	(1.072)						
$_ownership			0.084	-0.047				
			(0.402)	(0.448)				
Rel_ownership_all					-0.044**	-0.043**		
					(0.019)	(0.017)		
Rel_ownership_partners							-0.040*	-0.040**
							(0.021)	(0.018)
Fund characteristics:								
GP_age	-0.026**	-0.028***	-0.026***	-0.027***	-0.023**	-0.025**	-0.023**	-0.025**
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
Fund_size	-0.033	-0.039	-0.040	-0.035	-0.019	-0.025	-0.019	-0.025
	(0.030)	(0.032)	(0.048)	(0.058)	(0.027)	(0.028)	(0.027)	(0.028)
Fund_sequence	0.072**	0.076**	0.071**	0.077**	0.076**	0.081**	0.076**	0.081**
	(0.033)	(0.035)	(0.032)	(0.033)	(0.029)	(0.033)	(0.030)	(0.033)
Firm characteristics:								
Sales	-0.007	0.000	-0.007	0.000	-0.001	0.007	-0.002	0.006
	(0.010)	(0.010)	(0.011)	(0.011)	(0.010)	(0.010)	(0.009)	(0.010)
Tangilibity	0.236	0.148	0.234	0.147	0.245	0.168	0.246	0.167
	(0.397)	(0.384)	(0.392)	(0.369)	(0.399)	(0.376)	(0.398)	(0.376)
ROA	-0.180	-0.197	-0.173	-0.199	-0.247	-0.267	-0.239	-0.259
	(0.205)	(0.183)	(0.228)	(0.209)	(0.219)	(0.215)	(0.219)	(0.214)
Constant	1.051	1.141	1.186	1.055	0.656	0.742	0.672	0.757
	(0.628)	(0.688)	(0.946)	(1.163)	(0.511)	(0.583)	(0.507)	(0.583)
Industry dummies	No	Yes	No	Yes	No	Yes	No	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	62	62	62	62	62	62	62	62
R-squared	0.311	0.354	0.312	0.354	0.336	0.376	0.331	0.372

Table 4: **Cross-sectional determinants of volatility**

The table shows coefficient estimates from ordinary least squares (OLS) regressions of portfolio company cash flow volatility, estimated as the average standard deviation of daily stock returns of five matched public firms over eight months prior to the acquisition. *Rel_ownership* is the GP's ownership in the fund scaled by the total wealth of its' investment professionals and partners. The sample is 62 Norwegian firms acquired by Nordic PE funds between 2000 and 2010. All variables are defined in Table 2. Standard errors are clustered by GP and shown in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GP ownership:								
%_ownership	-0.077***	-0.078***						
	(0.024)	(0.025)						
$_ownership			-0.044***	-0.046***				
			(0.013)	(0.012)				
Rel_ownership_all					-0.000	0.000		
					(0.001)	(0.001)		
Rel_ownership_partners							-0.000	0.000
							(0.001)	(0.001)
Fund characteristics:								
GP_age	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fund_size	-0.002	-0.002	0.004**	0.004**	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Fund_sequence	-0.000	-0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm characteristics:								
Sales	-0.001**	-0.001*	-0.001**	-0.001*	-0.001**	-0.001*	-0.001**	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tangilibity	0.027*	0.029*	0.027*	0.025	0.026*	0.026	0.026*	0.026
	(0.015)	(0.016)	(0.015)	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)
ROA	-0.002	-0.002	0.000	0.000	0.003	0.003	0.003	0.003
	(0.005)	(0.005)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)	(0.006)
Constant	0.093***	0.093***	-0.020	-0.023	0.059**	0.061**	0.059**	0.062**
	(0.025)	(0.025)	(0.029)	(0.026)	(0.026)	(0.028)	(0.026)	(0.028)
Industry dummies	No	Yes	No	Yes	No	Yes	No	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	62	62	62	62	62	62	62	62
R-squared	0.676	0.678	0.689	0.692	0.651	0.652	0.651	0.652

Table 5: **Cross-sectional determinants of leverage**

The table shows coefficient estimates from ordinary least squares (OLS) regressions of portfolio company leverage, defined as liabilities/total assets. *Rel_ownership* is the GP's ownership in the fund scaled by the wealth of its' investment professionals and partners. The sample is 62 Norwegian firms acquired by Nordic PE funds between 2000 and 2010. All variables are defined in Table 2. Standard errors are clustered by GP and shown in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GP ownership:								
%_ownership	-1.527	-1.512						
	(1.185)	(1.098)						
$_ownership			-0.798	-0.771				
			(0.569)	(0.538)				
Rel_ownership_all					0.072*	0.100**		
					(0.036)	(0.035)		
Rel_ownership_partners							0.071*	0.100***
							(0.035)	(0.035)
Fund characteristics:								
GP_age	0.003	0.003	0.006	0.005	-0.003	-0.005	-0.003	-0.005
	(0.009)	(0.009)	(0.009)	(0.009)	(0.007)	(0.007)	(0.007)	(0.006)
Fund_size	0.035	0.029	0.134**	0.125**	0.038	0.022	0.036	0.018
	(0.056)	(0.060)	(0.061)	(0.060)	(0.054)	(0.047)	(0.055)	(0.047)
Fund_sequence	-0.020	-0.019	-0.025	-0.023	-0.036*	-0.038*	-0.037*	-0.039*
	(0.024)	(0.026)	(0.020)	(0.022)	(0.019)	(0.019)	(0.019)	(0.019)
Firm characteristics:								
Sales	0.022	0.022	0.018	0.019	0.008	0.003	0.009	0.003
	(0.022)	(0.021)	(0.019)	(0.019)	(0.013)	(0.012)	(0.013)	(0.012)
Tangilibity	0.360*	0.370*	0.356*	0.311**	0.321	0.279	0.317	0.276
	(0.192)	(0.198)	(0.178)	(0.142)	(0.191)	(0.172)	(0.191)	(0.175)
ROA	-0.549*	-0.565*	-0.498*	-0.507**	-0.342	-0.307	-0.347	-0.311
	(0.309)	(0.284)	(0.264)	(0.240)	(0.241)	(0.181)	(0.241)	(0.182)
Constant	-0.121	-0.060	-2.221*	-2.073*	-0.157	0.221	-0.126	0.273
	(1.080)	(1.120)	(1.221)	(1.173)	(1.013)	(0.833)	(1.032)	(0.840)
Industry dummies	No	Yes	No	Yes	No	Yes	No	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	62	62	62	62	62	62	62	62
R-squared	0.385	0.426	0.394	0.430	0.428	0.525	0.427	0.525

Table 6: **Cross-sectional determinants of equity beta**

The table shows coefficient estimates from ordinary least squares (OLS) regressions of portfolio company equity beta, estimated by relevering asset beta of five matched public companies. *Rel_ownership* is the GP's ownership in the fund scaled by the wealth of its' investment professionals and partners. The sample is 62 Norwegian firms acquired by Nordic PE funds between 2000 and 2010. All variables are defined in Table 2. Standard errors are clustered by GP and shown in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GP ownership:								
%_ownership	1.143	1.177						
	(2.312)	(2.312)						
$_ownership			1.072	0.786				
			(0.818)	(0.875)				
Rel_ownership_all					-0.141***	-0.164***		
					(0.033)	(0.037)		
Rel_ownership_partners							-0.133***	-0.158***
							(0.035)	(0.038)
Fund characteristics:								
GP_age	-0.039**	-0.042**	-0.043**	-0.045**	-0.029*	-0.031	-0.030*	-0.032*
	(0.018)	(0.018)	(0.017)	(0.017)	(0.015)	(0.018)	(0.015)	(0.018)
Fund_size	-0.011	-0.020	-0.129*	-0.112	0.012	0.013	0.014	0.017
	(0.080)	(0.084)	(0.068)	(0.085)	(0.059)	(0.054)	(0.061)	(0.056)
Fund_sequence	0.132**	0.141**	0.133**	0.142**	0.153***	0.164***	0.154***	0.166***
	(0.058)	(0.064)	(0.055)	(0.059)	(0.038)	(0.055)	(0.040)	(0.056)
Firm characteristics:								
Sales	-0.029	-0.014	-0.025	-0.012	-0.006	0.015	-0.008	0.013
	(0.029)	(0.028)	(0.028)	(0.028)	(0.019)	(0.023)	(0.019)	(0.023)
Tangilibity	0.182	0.023	0.174	0.073	0.230	0.133	0.237	0.135
	(0.664)	(0.641)	(0.653)	(0.604)	(0.668)	(0.602)	(0.667)	(0.602)
ROA	-0.009	-0.043	-0.022	-0.079	-0.301	-0.383	-0.283	-0.367
	(0.351)	(0.341)	(0.372)	(0.371)	(0.325)	(0.323)	(0.323)	(0.319)
Constant	0.793	0.923	3.222**	2.822	0.073	-0.083	0.066	-0.114
	(1.662)	(1.733)	(1.342)	(1.685)	(1.095)	(1.091)	(1.133)	(1.131)
Industry dummies	No	Yes	No	Yes	No	Yes	No	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	62	62	62	62	62	62	62	62
R-squared	0.326	0.372	0.341	0.377	0.398	0.460	0.391	0.454

Table 7: **Cross-sectional determinants of ticket size**

The table shows coefficient estimates from ordinary least squares (OLS) regressions of portfolio company ticket size, defined as the ratio of book value of equity to fund size. *Rel_ownership* is the GP's ownership in the fund scaled by the wealth of its' investment professionals and partners. The sample is 62 Norwegian firms acquired by Nordic PE funds between 2000 and 2010. All variables are defined in Table 2. Standard errors are clustered by GP and shown in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GP ownership:								
%_ownership	1.020**	1.045**						
	(0.440)	(0.425)						
$_ownership			-0.265**	-0.271**				
			(0.096)	(0.097)				
Rel_ownership_all					-0.031*	-0.030*		
					(0.015)	(0.015)		
Rel_ownership_partners							-0.030**	-0.030*
							(0.014)	(0.014)
Fund characteristics:								
GP_age	0.002	0.002	0.004	0.004	0.005	0.005	0.005	0.005
	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Fund_sequence	0.001	0.001	0.008	0.008	0.009	0.009	0.009	0.009
	(0.020)	(0.020)	(0.015)	(0.015)	(0.013)	(0.014)	(0.014)	(0.014)
Firm characteristics:								
Sales	0.008	0.008	0.010	0.010	0.015	0.014	0.014	0.014
	(0.010)	(0.010)	(0.010)	(0.011)	(0.014)	(0.015)	(0.014)	(0.015)
Tangilibity	0.047	0.049	0.062	0.070	0.077	0.101	0.078	0.101
	(0.117)	(0.081)	(0.095)	(0.066)	(0.103)	(0.072)	(0.103)	(0.072)
ROA	0.037	0.035	-0.036	-0.044	-0.078	-0.085	-0.076	-0.083
	(0.073)	(0.076)	(0.071)	(0.074)	(0.096)	(0.096)	(0.095)	(0.095)
Constant	0.287*	0.274*	0.380**	0.358**	0.313	0.289	0.316	0.291
	(0.151)	(0.157)	(0.159)	(0.159)	(0.214)	(0.207)	(0.212)	(0.206)
Industry dummies	No	Yes	No	Yes	No	Yes	No	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	62	62	62	62	62	62	62	62
R-squared	0.474	0.486	0.451	0.461	0.462	0.465	0.462	0.465