The Return to Pension Funds' Private Equity Investments:

New Evidence on the Private Equity Premium Puzzle

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Job market paper

Abstract

This paper provides new evidence on the private equity premium puzzle suggested by Moskowitz and Vissing-Jørgensen (2002); Even professional investors like pension funds seem to get a poor risk-return tradeoff from investing in private equity. Contrary to previous studies of the return to entrepreneurial and venture capital investments, this paper uses novel data from the population of pension funds (in Denmark). Unique properties of these data allow us to examine why investors accept the poor risk-return tradeoff of investments in private equity. We argue that the ability to derive pecuniary and non-pecuniary benefits is almost negligible for pension funds and that a preference for skewed returns is inconsistent with previous research showing that pension funds are prudent investors. We further show that the poor returns cannot be explained by politically motivated investments—pension funds with politically influenced boards perform no differently. This points to a systematic overestimation of the probability of success of private equity investments as a possible explanation. We investigate the source of this apparent misjudgment by comparing the operating performance of the portfolio held by pension funds to a matched sample of similar firms. The evidence suggests that mispricing and the consequent low capital gains explain the gap in returns to private equity investments.

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1 Introduction

Asset pricing and investment theory have long studied the risk and return characteristics of public equity. As pointed out by Moskowitz and Vissing-Jørgensen (2002), the private equity market is as important as the public equity market in terms of size and growth. Despite its relative importance, little is known about the risk-return tradeoff in private equity investments.

Two recent strings of literature have estimated the return to private equity investments. One has focused on entrepreneurial investments, while the other has analyzed the return to investments made by private equity funds.

The first string of literature emerged from the question of why people become entrepreneurs. Hamilton (2000) examines the wage differentials in self-employment and paid employment and finds that most entrepreneurs enter and remain in business despite the fact that both the initial level and the growth of earnings are lower. This gap suggests that non-pecuniary benefits are an important motivation for self-employment. Using data on entrepreneurial households, Moskowitz and Vissing-Jørgensen (2002) document that entrepreneurial investments are extremely concentrated and that the returns, despite this poor diversification, are no higher than the returns to public equity.[1] This finding has caused the emergence of the *private equity premium puzzle*: Why do households willingly invest a substantial fraction of their wealth in a single firm without a compensatory return on the investment? Moskowitz and Vissing-Jørgensen suggest, among other things, that non-pecuniary benefits compensate for this gap.

A similar conclusion emerges from another string of literature that estimates the return to private equity investments made by private equity funds. In a recent survey, Denis (2004) summarizes this literature. *Although much progress has been made, our knowledge of the dynamics of private equity returns remains incomplete. Analysis of these phenomena are complicated by the lack of data and the potential selection biases in available datasets. It remains unclear whether private equity returns are different from those of public equity.* Using the most comprehensive sample of private equity funds to date, Phalippou and Zollo (2005a) show that over the prior 25

[1] Moskowitz and Vissing-Jørgensen find that households with private equity investments on average have more than 70 percent of their private holdings in a single company.

years, the return to private equity funds has underperformed the S&P500 Index by more than 3 percentage points per year.

Collectively, both strings of literature show that private equity offers a poor risk-return tradeoff to the average investor. This observation begs the question of why investors, given the large public equity premium, allocate substantial capital into this asset class.

This paper examines pension fund investments in private equity to present new evidence on this puzzle. The advantage of focusing on investments by pension funds is twofold. First, we utilize the fact that the Danish Financial Statement Act has, since 1995, obligated pension funds in Denmark to disclose the returns on different types of assets. This creates a novel opportunity to estimate the *net* return to private equity. These data are less exposed to the measurement problems inherent in prior studies on the return to private equity that use data on households or private equity funds. We find that the return to private equity for pension funds has been significantly *lower* than the return to public equity. Our most conservative estimate shows that private equity has underperformed public equity by 5 percentage points *per annum*. This economically and statistically significant underperformance suggests that even pension funds accept a poor risk-return tradeoff when investing in private equity.

Second, the novelty of these data allows us to examine potential explanations to this puzzle. The existing literature has listed high risk tolerance, preference for risk, pecuniary or non-pecuniary benefits, over-optimism, misperceived risk, and politically motivated preferences as possible explanations to why investors choose private equity. Whereas these potential explanations have been discussed in the literature, they have not, to our knowledge, been subject to rigorous scrutiny.[2] This paper fills this gap. From pension fund annual reports, we identify their portfolios of privately held firms. We link these to a unique dataset that comprises *all* privately held firms in Denmark. We thereby obtain data that allow us to test potential explanations to the puzzle.

We begin by stressing that previous research has documented that pension funds are prudent

[2]This is primarily due to the difficulty of obtaining firm-level data on private equity as noted by Fenn, Liang and Prowse (1997).

investors (Del Guercio, 1996 and Gompers and Metrick, 2001). Thus, unlike entrepreneurs and individuals, pension funds do not have a high risk tolerance or a preference for skewed returns. We further show that pension fund investments in private equity have not been driven by self-interested managers. We document that the managers and board members of pension funds are rarely appointed to the boards of portfolio companies subsequent to investment. We thereby reject, using a very direct measure, that pension fund investments to any great extent are driven by pecuniary or non-pecuniary benefits accruing to fund managers. We further reject anecdotal evidence suggesting that pension fund investments in private equity are politically motivated. We show that private equity investments by pension funds with politically influenced boards perform no differently than pension funds without board seats occupied by representatives of political organizations. Finally, we disentangle the sources of poor return to pension funds' private equity investments by showing that their portfolio companies have performed significantly worse than a matched sample of non-portfolio companies. However, the documented underperformance is insufficient to explain the size of the gap in performance. This points to a systematic overestimation of the probability of success of private equity investments.

Our findings strongly suggest that the private equity premium puzzle also extends to professional investors like pension funds. Using a novel dataset of private equity investments that allows us to narrow the list of potential explanations, we present evidence suggesting that even professional investors systematically overestimate the probability of success of private equity investments. We thereby present new evidence on the private equity premium puzzle.

This paper proceeds as follows: In the next section we survey the literature on returns to private equity investments. Section 3 describes the data. Section 4 estimates the returns to private equity investments. In Section 5, we assess the risk characteristics of private equity. Section 6 scrutinizes potential explanations as to why pension funds willingly invest in private equity despite poor returns. Finally, Section 7 offers some concluding remarks.

2 A Survey of the Literature Estimating Return to Private Equity Investments

The literature estimating the return to private equity investments has primarily employed two sources of data. One has used surveys of households and consumer finance, whereas the other has used data on private equity funds from specialized agencies such as Venture Economics. As a result, the first approach estimates the return to investments by entrepreneurs, whereas the second estimates the return to investments by equity funds with an active management role.

Using survey data on US individuals, Hamilton (2000) compares the wage differential between self-employed and paid employees. He finds that the self-employed earn a significantly smaller stream of future earnings. This finding suggests that entrepreneurs are willing to sacrifice substantial earnings in exchange for non-pecuniary benefits, such as the value of 'being your own boss'. In a related study, Moskowitz and Vissing-Jørgensen (2002) estimate the return on investments in privately held firms by US households. They find that the return to private equity is no higher than the return to public equity and that entrepreneurial investments are extremely concentrated and poorly diversified. This finding has initiated awareness of the private equity premium puzzle: why do households willingly invest substantial amounts in assets with such a poor risk-return trade-off. The private equity premium puzzle suggests that entrepreneurs receive large non-pecuniary benefits from the ownership of closely held firms - otherwise they should invest in the public equity market. In short, the literature on the return to private equity that employs survey data on investments by entrepreneurs shows evidence of a poor risk-return tradeoff.

In the literature, entrepreneurial financing has been nearly synonymous with venture capital. The initial studies of venture capital investments have used data on publicly traded funds to estimate returns. Martin and Pretty (1983) provide evidence of a positive excess return to private equity using a small sample of publicly traded venture funds in the US from 1974 to 1979. Gompers and Lerner (1997) study the risk-adjusted performance of a single publicly traded venture capital group and find an excess return of 8 percent per annum. A number of

more recent studies have used data on private equity funds provided by specialized agencies such as Venture Economics.

Using data on the performance of individual venture capital investments, a number of studies have attempted to build a private equity index (Peng 2001, Quigley and Woodward 2003, Woodward and Hall 2003) or to estimate the return on individual venture capital projects (Cochrane 2005). Kaplan and Schoar (2005) point out an inherent problem with these studies, namely that the return can be observed only if there is some sort of transaction involving the investment. This creates sample selection bias, which Cochrane (2005) addresses by employing a maximum likelihood procedure to estimate the probability of success.

To circumvent this potential problem, other studies have focused on the cash-flow stream between private equity funds and their limited partners. Kaplan and Schoar (2005) use a large sample of private equity funds between 1970 and 2001 and find that the return, net of fees, does not exceed the return on public equity. However, they point out that there is substantial cross-sectional variation and some persistence over time in the return on the funds.[3] In a sample almost identical to that used in Kaplan and Schoar (2005), Jones and Rhodes-Kropf (2003) examine the effect of idiosyncratic risk on the pricing of private equity investments. Consistent with Kaplan and Schoar (2005), they find no excess return even though the average fund alpha is positive (but small).

Using the most comprehensive data to date, Phalippou and Zollo (2005a) show that the performance results in Kaplan and Schoar (2005) are significantly biased. Adjusting for sample selection and writing off the residual value of "living dead" funds, Phalippou and Zollo (2005a) find significant underperformance for private equity funds. Their return lags the S&P500 return by as much as 3.3 percent per annum. In particular, Phalippou and Zollo (2005a) show that a significant number of private equity funds are reported as "active" in the Venture Economics data, even though they have not reported any signs of activity in the prior 4 years. Assuming that the residual value of these funds' investments is equal to half of that reported is sufficient

[3]Similarly, Lerner, Schoar and Wong (2005) report significant heterogeneity in the return to institutional investors' private equity investments. In particular, they find that endowments have outperformed the average institution, whereas banks have underperformed.

to reach the conclusion that private equity funds on average have underperformed the S&P500.

Ljungqvist and Richardson (2003) raise two important methodological concerns that are specific to the evaluation of the return to venture capital funds. Based on the observation that venture capital funds are organized as partnerships, Ljungqvist and Richardson (2003) argue that prior studies do not take into account the timing of the contributions to the funds and the risk profile of the portfolio companies. Ljungqvist and Richardson (2003) have obtained data from a large anonymous institutional investor to shed light on these concerns. They find that it takes 6 years for funds to invest more than 90 percent of invested capital and 8 years before the internal rate of return becomes positive. Taking these measurement problems into account, Ljungqvist and Richardson (2003) find evidence of a positive risk-adjusted return to private equity investments. While this finding contrasts with the results of the prior literature, their study suffers from a relatively modest sample size. The limited sample size is a particular concern if there is persistence in fund performance over time (Kaplan and Schoar, 2005 and Phalippou and Zollo, 2005a) or large heterogeneity in the performance of investor classes (Lerner, Schoar and Wong, 2005).

A survey of the literature highlights the presence of a general private equity premium puzzle: why do investors seemingly accept the poor risk-return tradeoff offered by private equity? This paper seeks to uncover new evidence on this puzzle by scrutinizing the potential explanations. In addition, this study complements the existing literature by providing an estimate of the return to pension funds' private equity investments using data that is be less exposed to the measurement and data problems of prior studies. The use of data from surveys of households could create a negative bias to the estimate of the return to private equity, since consumption within the firm is likely to be unreported. Similarly, data on private equity funds can suffer from survivorship bias, sample selection problems, and backfilling. To circumvent these potential measurement problems, we make use of a 10-year panel of returns to private equity investments by the *entire population* of pension funds in Denmark. These returns are reported and externally audited according to government guidelines in the Financial Statement Act, which induces fairly coherent reporting practices across funds and which prevents backfilling. Additionally, our data include

returns to public equity investments in the same period, which enables us to benchmark the return to private equity against the same pension funds' return on public equity. One potential drawback of our approach relates to the general applicability of the estimated returns to private equity, as Lerner, Schoar and Wong (2005) have documented large heterogeneity in the performance of investor classes. However, since our main focus is to scrutinize potential explanations to the puzzle, it is sufficient for the current analysis to document the underperformance of pension funds' private equity investments. We proceed by presenting the data in detail.

3 Data on Pension Funds' Investments in Private Equity

The Financial Statements Act of 1995 (the Act) obligates Danish pension funds to specify return on investment by asset class in their annual reports. The Act specifies 6 categories of assets; real estate, subsidiaries, equity, bonds, loans and other. In addition, it partitions equity into 4 subcategories: publicly and privately held firms, and domestic and foreign firms. For each category (as well as for subcategories), pension funds must report market value (at both the beginning and end of the year) and returns. The Act provides a guideline for the specification of assets and returns. The yearly return, r_T, should be calculated using a time- and value-weighted formula:

$$r_T = \prod_{t=1}^{T}(1 + r_t) - 1$$

where r_t, the value-weighted return in sub-period t within year T, is given by

$$r_t = \frac{MV_t - MV_{t-1} - CF_{t-1,t}}{MV_{t-1} + W\dot{C}F_{t-1,t}}$$

and MV_t and MV_{t-1} are the market values of the asset class at time t and $t-1$, respectively. $CF_{t-1,t}$ is net cash flow within period t and W is the relative number of days each cash flow has been included in the portfolio. If multiple cash flows occur within the period, each cash flow is weighted with its own relative weight. The length of each time-period is, in principle, determined by flows into and out of the portfolio of the particular asset. However, it is customary among pension funds to use monthly sub-periods.

The reported returns are therefore not biased by new investments within the year and are, thus, comparable across years and among different asset classes. The reported returns, then, are not subject to the criticism of Ljungqvist and Richardson (2003), since they take the timing of the investments and cash flows into account.

Whereas market values for publicly held firms are easily observed, the "market" values of privately held firms are only observable when there is some sort of "exit". Thus, the observed returns to private equity are therefore a mix of current and stale returns, which necessitates evaluation of the returns over a longer period. This is a problem shared with the prior literature on return to private equity.[4]

If no exit occurs, the Act states that market values for privately held firms should be based on intrinsic value with reference to the latest accounting. The Act further specifies that the market values of private equity should be adjusted whenever the changes are "permanent". If pension funds are conservative they might refrain from marking the value of the portfolio investments to market and base the reported market values on book values. Whereas a more conservative accounting practice would produce an upward (downward) bias on positive (negative) returns, the aggregate effect on the reported return is ambiguous. However, this potential bias will diminish if the evaluation period increases. The observed returns to private equity are therefore a mix of current and stale returns, which necessitates the evaluation of the returns over a longer time period.

From exhibits in the pension funds' annual reports, we manually collect the market value of investments in public and private equity and the return on these investments for each year. These data enable us to estimate the return to private equity investments using a panel of all pension funds in Denmark from 1995 to 2004.[5]

[4]Gompers and Lerner (2001) highlight that venture capitalists often refrain from marking portfolio company values to market to present a conservative assessment of the portfolio valuation. Similarly, Woodward (2004, p. 11) emphasizes that the return to venture capital funds are a mix of current and stale returns; *Each quarter, the general partners in the VC fund report the value of each company in which the fund invests to the limited partners. These values are nearly always based on each company's most recent round of financing.*

[5]Throughout this paper we only use domestic investments and refer to them as public and private equity. We have chosen to exclude foreign private equity investments, since these firms are not included in our firm-level dataset. Furthermore, most foreign private equity investments by Danish pension funds took place towards the very end of the sample period.

In addition, the Act obligates pension funds to provide a list in their annual reports of any investments in firms where either their cash flow or voting stake exceeds 5 percent. This list provides us with information on the investments that have generated the private equity returns. Given that ownership of privately held firms is extremely concentrated, this list is likely to include most private equity investments.[6] We link this data to the *population* of privately held corporations in Denmark. These data are from the firms' filing of annual account statements with the Danish Ministry of Economic and Business Affairs, which all limited liability companies in Denmark are obligated to do by law. This data includes items from income statements and balance sheets as well as the identities of the CEO and board members. These detailed data enable us to investigate the sources of the private equity returns.

Table 1 shows descriptive statistics on the number and the size of pension funds in Denmark from 1995 to 2004. The population of pension funds in Denmark in the sample period has consisted of between 54 and 60 funds.[7]

The average pension fund had assets of EUR 1.5 billion in 1995, increasing by 2004 to EUR 3.3 billion.[8] Funds with investments in the particular type of equity, had on average EUR 214 million invested in firms quoted on the Copenhagen Stock Exchange and EUR 25.2 million in privately held firms in 1995. By 2004 this had risen to EUR 251 million and 34.9 million, respectively. In 2004, the total investment assets of pension funds in Denmark equaled EUR 179 billion - equivalent to 92 percent of GDP. The total market value of investments in public and private equity was EUR 12.0 billion and 1.5 billion, respectively.

Table 1 further shows the number of pension funds with investments in private equity from 1995 to 2004. The number of pension funds with private equity investments has remained fairly constant, but with a slight decrease until 1999 followed by a larger increase until 2004. The pension funds' private equity investments' average share of total domestic equity investments

[6]The within-sample mean (median) investment by individual pension funds measured by share of cash flow is 17.9 (12.5) percent, well above the 5 percent reporting cut-off level.

[7]The number of pension funds increased in 1998 and 1999 due to entry of foreign-owned pension funds and the creation of two temporary public pension funds. It decreases subsequently due to mergers of funds.

[8]Note that figures are reported in million Danish kroner (DKR) in the tables, whereas we report these in euro (EUR) in the text. The exchange rate of DKR to EUR is 7.45.

decreased from 15.9 percent in 1995 to 8.7 percent in 2000, but then increased to 26.5 percent in 2004. Table 1 also reports the average number of private equity investments reported in pension funds' annual reports. Throughout this paper we will refer to these as *portfolio investments*. The average number of reported portfolio investments per pension fund with private equity investments is around 10. However, as the reported investments include both direct investments and indirect investments through funds, the total number of portfolio companies is higher.

Table 2 reports descriptive statistics on the composition of pension funds' private equity portfolios. We identify the private equity funds among the reported portfolio investments and utilize our rich firm-level data to identify each fund's portfolio. When we include fund investments in the pension funds' private equity portfolios, the total number of portfolio companies increases substantially. In 1995, the average pension fund's portfolio consisted of 24 companies (12 direct and 12 indirect investments through 1 private equity fund), whereas the median pension fund portfolio included only 13 companies.

Perhaps more interestingly, Table 2 reveals that the bulk of investments by pension funds in Denmark is directly rather than indirectly held through funds.[9] To measure the relative weight on direct versus indirect investments, we calculate the share of the book value of assets and book value of equity that are ultimately owned by pension funds.[10] Direct investment's share of private equity portfolios is surprisingly high throughout the period, although the average share of book value of assets (equity) declined from 94 (90) to 79 (76) percent from 1995 to 2004. Direct investments are even more dominant in the median portfolio, where only a small fraction is allocated into indirect investments through funds.

In summary, Danish pension funds have invested substantial funds in privately held firms. We proceed by evaluating the return on these investments.

[9]Direct investments by pension funds are not specific to Denmark, as recent coverage in the business media reports evidence of direct investment by some of the largest institutional investors in Australia, Canada, Germany, the Netherlands, Switzerland, Turkey and the UK. See Financial Times, November 7, 2005, "*Pension Funds Bypass Private Equity Houses*" and FT Mandate, February 2006 Issue, "*Boost for Private Route*". There are few studies of pension funds' direct investments in private equity. The main exception is Nielsen (2006).

[10]Market values on individual investments are not reported in the data. We therefore rely on book values to assess the total value of the portfolio. We calculate the share of book value of assets (equity) by multiplying the pension fund's share of ownership with each portfolio company's book value of assets (equity). We thereby estimate the relative weights on direct versus indirect investments.

4 The Return to Private Equity Investments

In the previous section, we described the data on pension fund investments in equity from 1995 to 2004. In this section, we use this data to estimate the return to private equity. Table 3 summarizes the yearly return to pension fund equity investments. We have provided the total number of pension funds, the average return and the standard deviation on the return across pension funds for both public and private equity. Figure 1 shows yearly average return to pension funds of their investments in public and private equity from 1995 to 2004. In years with a high stock market return, the return to private equity investments has been substantially lower. Likewise, in years with a high negative return on public equity, the return to private equity has been less negative. The correlation coefficient between the average yearly return to public and private equity is 0.41. Thus, there seems to be a positive correlation between the average return to public and private equity.

Table 3 also reports the standard deviation on the return to public and private equity investments. In all years, the variation in private equity returns is substantially larger than for public equity. In fact, in all years, variation on yearly private equity returns is at least *twice* as high as the standard deviation of public equity returns. Thus, at first glance, private equity returns seem much more volatile compared to public equity returns.

Panel A in Table 4 summarizes the insight shown in Figure 1—putting equal weight on each pension fund. The average return to public equity within the period 1995 to 2004 was 12.89 percent compared with 4.70 percent for private equity investments. Using a standard F-test to test whether the returns on public and private equity are identical, we reject the null hypothesis at the 1-percent level.[11] Thus, the return to private equity has been significantly *lower* than the return to public equity.

A major concern when estimating the return to private equity is whether the sample period is sufficiently long to observe the realization of the return. Private equity investments can be long-term investments in the sense that several years may pass before *any* return is realized. Table 1

[11] We perform a simple F-test of comparable means.

shows that after the turn of the millennium, there was a small increase in the number of pension funds with private equity investments. This might provide a negative bias to our estimate of return simply because these investments have not matured yet. To address this potential bias, Table 4 reports the return for the sub-sample of firms with private equity investments for the period 1995 to 2004. For these pension funds, the average return to their public and private equity investment was 13.35 and 5.52 percent, respectively. Again, we strongly reject the null hypothesis of comparable means. Consequently, pension funds realized a significantly lower return from their private equity investments.

Panel A in Table 4 reports the estimated return to pension fund investments using equal-weighted averages. Clearly, the pension funds and their investments in private equity vary in terms of size. We therefore proceed by checking the robustness of the results using value-weighted averages. Panel B reports the estimated return to public and private equity using the average market value for each type within that year to weight the returns. Increasing the weight on pension funds with the largest investments in the respective equities increases the estimated average return to private equity to 8.19 percent, whereas the return to public equity remains above 13 percent. Even though the difference between the return to private and public equity decreases to 5.44 percent, the difference is still statistically significant at the 1-percent level. We see similar results when we restrict the sample to pension funds with private equity investments throughout the 10-year period.

In summary, we provide strong evidence that the return to private equity investments has been significantly lower than the return to public equity within the 10-year period 1995 to 2004. The difference is large both economically and statistically. Our most conservative estimate shows that private equity investments have provided a 5.3 percent lower return *per annum*.

5 The Risk of Private Equity Investments

The previous section demonstrates that return to private equity has been significantly lower than return to public equity. This finding begs the question of whether the private equity premium puzzle extends to investments by professional investors, since even pension funds seemingly

accept a worse risk-return trade-off than offered by the public equity markets. Inherent in the puzzle is the premise that private equity is *at least* as risky as public equity.

To open the discussion of risk, we characterize the total risk of private equity as an asset class. We then document the risk-level of individual pension funds' private equity portfolios, a more relevant measurement for pension fund decision-making.

To examine the total risk of private equity as an asset class, we estimate beta by using results derived in the previous section. Figure 1 reveals a positive correlation of 0.41 between the average yearly returns to public and to private equity. At first glance, the return to private equity seems weakly correlated with the public equity market. However, Gompers and Lerner (2001) point out that the use of conservative valuation practices provides a negative bias to this correlation, since the fact that market values of private equity are unobservable induces a lack of synchronicity between "actual" and reported returns. As a result, the correlation coefficient is downward biased. Using data on a single publicly traded venture capital fund, Gompers and Lerner (1997) find that the correlation between venture capital and public equity prices increases substantially when the underlying portfolio of private equity firms is marked to market prices.

Other studies have estimated the correlation using data that are less affected by the lack of synchronicity—Moskowitz and Vissing-Jørgensen (2002) find a correlation of 0.7 between the book equity return of public and private equity from 1963 to 1999. Similarly, Phalippou and Zollo (2005b) find that the performance of private equity funds co-varies positively with both business cycles and stock market returns. These studies provide evidence showing a high correlation between returns to private and to public equity. This is clearly an unattractive property given the low returns to private equity.

Despite such problems, we proceed to estimate the beta of risk even though the negative bias is carried over. Table 5 reports the beta estimate from the regression of the return premium on private equity on the market premium on public equity. We obtain a beta coefficient of 0.207, which is significant at the 10 percent level. The private equity alpha is negative and statistically insignificant, hence, at first glance, we find no difference in the risk-adjusted return. As mentioned above, a caveat to this approach is that the observed return to private equity is a

mix of current and stale values, which provides a negative bias to the beta estimate. This bias arises because the period over which private equity returns are measured is not the same as the period over which the stock market is measured. This problem is equivalent to the problem of measuring risk and performance for thinly traded stocks in the public equity markets. Recognizing this potential problem, Scholes and Williams (1977) include lead and lagged values of the market return to adjust for the downward bias. In a recent paper, Woodward (2004) applies this technique to quarterly venture capital returns and finds that the estimated beta increases dramatically, from 0.6 to 2.0. Our estimate of beta also increases, but less dramatically, when we include the lagged market return.[12] The beta measure of risk increases from .207 to .473 when we apply this technique where the estimated beta is the sum of the estimated coefficients on the current and lagged market premium. Alpha remains negative and insignificant. Economically, the private equity alpha is quite large (-2.2 percent), even though the short sample period makes it difficult to estimate standard errors with precision. In a recent paper, Phalippou and Zollo (2005b) estimate the average beta at the fund level for European and U.S. private equity funds. Using the reported accounting returns, they find an average fund level beta of between 0.5 and 0.65. However, when they use the average industry beta for each portfolio firm to calculate the average beta at the fund level, they find a beta of 1.6. Thus, if the private equity investments were continuously traded in the market they would have relatively high betas.

In summary, we find that return to private equity has a low correlation with return to public equity, which induces a relatively low beta. As mentioned above, there are some crucial data issues that might provide a negative bias to this estimate; we have few data points and we know from the prior literature that the mix of current and stale returns provides a large negative bias on the estimated beta.

We proceed with analysis of the risk of individual pension fund portfolios, which is more directly related to pension fund decision making. We quantify the risk of individual pension fund portfolios by comparing the cross-fund standard deviation of private equity returns to

[12] A potential explanation as to why our estimate increases less drastically is that we apply the technique to yearly returns, whereas Woodward (2004) uses quarterly returns.

public equity returns over the 10-year period. The difference in returns implies that EUR 1 invested in public equity in 1995 would, in 2004, be worth EUR 3.05 for the average fund, whereas an identical investment in private equity on average would be worth only EUR 1.78. The standard deviation on the compounded return to public equity between funds is 0.27 and an astonishing 1.24 for private equity. Thus, for the individual pension fund, the return to private equity is much more volatile over time than the return to public equity. The distribution of compounded returns shows that either the private equity portfolios a) have more idiosyncratic risk, b) are less diversified than public equity portfolios or c) have a combination of higher idiosyncratic risk and poor diversification. We now attempt to disentangle whether the different cross-fund standard deviations are driven by worse diversification of private equity portfolios, higher idiosyncratic risk, or both.

Table 2 shows that the median number of companies in pension fund private equity portfolios is fairly small. The median private equity portfolio consists of around 15 portfolio companies.[13] Thus, due to the widespread use of indexing by pension funds, the number of portfolio investments in pension fund private equity portfolios is substantially lower than in their public equity portfolios.

To describe the idiosyncratic risk of pension fund private equity portfolio companies, we will focus on firm characteristics related to risk. The literature on asset pricing of both public and private equity highlights that small firms are expected to have higher risk, in particular firms operating within high-tech industries and firms with high levels of leverage (Fama and French 1993, Phalippou and Zollo 2005b, among others). Similarly, young firms are associated with higher risk due to the high probability of bankruptcy or failure in early stages of the business life cycle. Moskowitz and Vissing-Jørgensen (2002) document that only 35 percent of all firms survive for 10 years. Other studies have provided even *lower* survival rates for newly established firms.[14] We therefore proceed by analyzing the characteristics of pension

[13]Note that we include indirect investments through funds in the total number of portfolio companies. The median portfolio consisted of 10.5 directly and 0 indirectly held portfolio companies in 1995. In 2004, the median was 6.5 and 5 companies for directly and indirectly held portfolio companies, respectively.

[14]See references in Moskowitz and Vissing-Jørgensen (2002).

fund portfolio companies and compare these characteristics to the population of publicly and privately held firms.

Table 6 provides statistics for publicly and privately held firms and pension fund portfolio companies distributed on 3 firm characteristics: firm size (book-value of assets), firm age, and leverage. The distribution of the 3 samples is shown by percentile grouping of these 3 firm characteristics. Not surprisingly, publicly held firms tend to be larger, older and more leveraged than privately held firms. Portfolio companies are larger and slightly older than all privately held firms, but significantly smaller and younger than publicly held firms. Thus, Table 6 provides evidence suggesting that pension fund private equity portfolio companies have substantial idiosyncratic risk compared to publicly traded firms.

To summarize, we have shown a significant measurement problem in evaluating the total risk of private equity as an asset class. More precisely, with respect to pension fund decision making, we show that the variation in the 10-year accumulated return on private equity across pension funds is significantly larger than the variation in returns on public equity. The different cross-fund standard deviations appear to be engendered by poorer diversification of private equity portfolios, and higher idiosyncratic risk in private equity portfolio companies. Thus, the evidence seems to suggest that pension fund private equity portfolios are at least as risky as their portfolios of public equity.

6 Potential Explanations for the Poor Risk-Return Trade-off

This section analyzes potential explanations suggested in the prior literature as to why investors invest substantial capital in private equity despite a poor risk-return tradeoff. In a seminal paper, Moskowitz and Vissing-Jørgensen (2002) list a number of potential explanations as to why entrepreneurs willingly invest a substantial fraction of their wealth in a single private firm. Entrepreneurs might have a high risk tolerance (i.e. low risk aversion), which will reduce the disutility from poor diversification. Likewise, entrepreneurs might have a preference for skewed returns and therefore accept a lower mean return in exchange for the large potential upside—in other words entrepreneurs are participating in a tournament. Entrepreneurial activity could

also be encouraged by the ability to derive pecuniary and non-pecuniary benefits. Pecuniary benefits take the form of consumption through the firm (e.g. perks), whereas non-pecuniary benefits are prestige, reputation, and the value of being your own boss, among others. Finally, Moskowitz and Vissing-Jørgensen point to over-optimism and misperceived risk as explanations for entrepreneurial investments in private equity.

One advantageous and novel feature of our data on pension fund investments is that they allow us to test the possible explanations of why this particular type of investor invests in private equity. In the case of pension funds, the previous section shows that their investments in private equity have provided a lower return relative to their own investments in public equity. Thus, any potential explanation as to why pension funds invest in private equity should explain this gap in relative return.

A. Risk Tolerance and Preference for Skewness

Previous research on institutional investors and their investment preferences has shown that institutions and in particular pension funds tend to be prudent (see Del Guercio 1996, and Gompers and Metrick 2001, among others). Prudent investors invest in less risky stocks, which is inconsistent with having a high risk tolerance and/or a preference for skewed returns. Thus, unlike entrepreneurs and individuals, pension funds are unlikely to have a high risk tolerance or a preference for skewed returns.

B. Pecuniary and Non-pecuniary Benefits to Pension Managers

Pecuniary and non-pecuniary benefits have been suggested by both Hamilton (2000) and Moskowitz and Vissing-Jørgensen (2002) as explanations for why people become entrepreneurs. Pecuniary benefits usually take the form of consumption through the firm. In essence, these benefits are measurement errors when we evaluate the return to private equity using survey data, since these benefits are unreported. Non-pecuniary benefits, on the other hand, include prestige, reputation and the value of 'being your own boss', which are difficult to quantify.

We argue that pension funds are less likely than individuals to obtain pecuniary or non-

pecuniary benefits from their investments in private equity. Nevertheless, pension funds are run by managers who might have a self-interest in deriving private benefits from investments in private equity. To address this potential explanation of poor return by pension funds on private equity, we evaluate the accumulation of board seats by pension fund managers. Our rich data allow us to investigate the relationship between the managers of a pension fund and the appointment of new board members in portfolio companies subsequent to investment. Within the period 1995 to 2004, 39 pension funds reported having at least 1 investment in a private firm where either the cash flow or the voting stake exceeded 5 percent. In the course of this 10-year period, pension funds invested directly in 333 portfolio companies and indirectly in 749 companies through 33 private equity funds. To complete the analysis, we identify new board members in both portfolio companies and private equity funds. In total, the sample consists of 4355 firm-year observations and, with this dataset, we identify all new board members subsequent to an investment by a pension fund.

Table 7 shows that a total of 2514 new board members were appointed in portfolio companies and private equity funds subsequent to an investment by a pension fund. Of these 2514 new board members, only 26 (1 percent) were directors in the pension fund at the time the investment decision was taken. Similarly, 24 (1.0 percent) of the newly appointed board members were members of the board of the investing pension fund. Table 7 conditions the timing of the appointment of new board members. Evidently, most appointments to portfolio company boards of managers of the investing pension funds took place while such pension fund was an owner. The lack of a significant accumulation of board seats by the management of pension funds is inconsistent with the idea that these investments are driven by self-interested managers. Thus, using a very direct measure of pecuniary and non-pecuniary benefit, we do not find significant evidence of this as the driving force behind the investments. Arguably, there are many other more indirect ways to obtain private benefit from portfolio companies than by joining the board. These are difficult to quantify and to measure.

We argue that if private benefits are important to the management of pension funds, one of its most likely manifestations would be board representation. We base this belief on the

positive motive for board representation - monitoring of the investment. Monitoring of portfolio companies would be a perfect blind for managers to join a board and at the same time to receive private benefit. Still, we find little evidence backing this explanation for pension fund investment in private equity.

C. Over-optimism and Misperceived Risk

The previous sections showed that the return to pension fund private equity investments, despite a seemingly higher risk, was lower than the return to public equity. In this section, we scrutinize the source of this low return. We make use of firm-level data to disentangle whether poor performance of the underlying portfolio of privately held firms, missing capital gains, or both are the driving forces behind the low returns.

In a recent paper, Lerner, Schoar and Wong (2005) find wide heterogeneity in the return to the limited partners of private equity funds. They attribute this heterogeneity to differences in skills. Thus, one explanation for our finding of poor risk-return tradeoff could be that the average pension fund lacks the skills needed to invest in private equity and thereby misprices the asset class.

Our empirical strategy is to test whether underlying performance has been lower in pension fund portfolio companies.[15] We use a matching procedure for each portfolio company that is conditioned on industry and firm size to form a matched sample of non-portfolio companies. We construct matched samples using both 2-digit and 3-digit NACE industry codes. The matched sample consists of the 10 (5) firms within the 2-digit (3-digit) industry code with the closest proximity measured by firm size (book value of assets) to each portfolio company in each year. This match is repeated for all portfolio companies to form a fairly homogeneous sample of control firms within the period from 1995 to 2004.

Table 8 shows the results of the regression of return on assets (defined as EBIT over assets) on a portfolio company dummy and 2 control variables. We include firm age and leverage as

[15] Note that we only focus on portfolio companies. We therefore exclude private equity funds, as their portfolios are included in the sample of portfolio companies. See Section 3.1 for details.

control variables to ensure that our results are not driven by observable characteristics unrelated to size. To examine whether portfolio companies performed any differently than the matched control sample, we include a random effect (dummy) for each portfolio company and matched firm pair. Our approach thereby controls for industry- and size-specific effects.

In the left panel of Table 8, the matching procedure is based on 2-digit industry codes, whereas the right panel is based on 3-digit industry codes. We start by estimating the 10 yearly cross-sectional models separately and continue by pooling the data. We find a negative coefficient on the portfolio company dummy in all 10 cross-sectional models. The portfolio company effect is negative and significant at the 5 percent level in 5 out of 10 cross sectional models. Consistent with this, the effect is negative and significant in the pooled sample. These results are robust with respect to the level of industry matching, since we find similar results when we match within 3-digit industry codes. On average, pension fund portfolio companies have 2.0 to 2.2 percentage points lower earnings performance than the matched control sample.

A valid concern in the above analysis of the relative performance of portfolio companies to the matched control sample is that the earnings performance of firms with large investments in research and development might be negatively biased. In particular, the relatively lower performance of portfolio companies might be a pure selection effect if pension funds tend to invest in companies with high R&D spending (e.g., biotechnology). We therefore repeat the analysis on the sub-sample of manufacturing firms where this selection problem should be less severe.[16] Panel B of Table 8 shows similar results when we restrict the sample to firms operating within manufacturing industries. On average, pension fund portfolio companies have lower earnings performance than the matched sample of control firms. Interestingly, on average, pension fund portfolio companies have 2.7 to 3.9 percentage points lower earnings performance than the matched control sample, which is around 1 percentage point lower than for all industries. Thus, our general result, that pension fund portfolio companies have underperformed the matched sample, seems to be strongest for manufacturing firms where the selection bias should be less

[16] We classify NACE industry codes lower than 45 as manufacturing" industries.

severe.

However, it is worth emphasizing that the significantly poorer earnings performance of pension fund portfolio companies could be driven by higher investment into research and development and other cash draining activities. The lower earnings performance could also be an outcome of selection bias if pension funds tend to invest in firms that are restructuring. The above exercise is not conclusive on these factors, rather it is suggestive evidence in favor of over-optimism and misperceived risk as the driving forces behind the poor realized return. We find significantly lower earnings performance, but on a scale that cannot explain the poor realized return on private equity investments. This points toward missing capital gains due to initial over-optimism and misperceived risk as important sources of the disappointing returns in the case of pension funds. We thereby gain new evidence on the private equity premium puzzle which highlights that over-optimism and misperceived risk are important in explaining the puzzle. This could indicate that the much cited non-pecuniary benefits do not stand alone in explaining the private equity premium puzzle for other types of investors. Over-optimism and misperceived risk contribute as well.

D. Other Explanations Related to Pensions Funds

In this section, we discuss a number of other explanations as to why pension funds might invest in private equity despite poor returns.

Pension funds manage large portfolios of assets and therefore it might be sensible to hold a small fraction of private equity if the return is sufficiently uncorrelated with the return on other assets. In fact, using U.S. data, Hwang, Quigley and Woodward (2005) show that a mean-variance investor would want to invest a positive fraction in private equity despite the lack of a return premium. This result relies on two important assumptions: i) the mean-variance investor can invest in an index of private equity; and ii) a low correlation between returns to private and public equity.

Both assumptions appear highly contestable. First, in previous sections we show that pension funds have, on average, invested in approximately 15 privately held firms, representing a tiny

fraction of the total private equity market. As a result, the cross-fund standard deviation of returns over the 10-year period is *five* times higher for private than for public equity. Thus, the assumption that investors can index the private equity market is not backed by the data. Second, using the data from Hwang, Quigley and Woodward (2005), Woodward (2004) shows that the correlation coefficient is significantly negatively biased by the stale pricing problem; as a result, the covariance between private and public equity returns triples.[17] In a similar vein, Moskowitz and Vissing-Jørgensen (2002) and Phalippou and Zollo (2005b) have shown that private equity does not appear to have particularly attractive hedging properties. Finally, it should be noted that even though Hwang, Quigley and Woodward (2005) find a positive portfolio weight on private equity, the inclusion of private equity does not change the efficient portfolio frontier significantly. Thus, even under contestable assumptions which make private equity appear much more attractive from a portfolio perspective, the inclusion of private equity does not yield a higher portfolio return.

We acknowledge that a more thorough and extensive analysis is needed to completely rule out that it can be rational for a mean-variance investor to invest in private equity despite the poor risk-return tradeoff. Our data show that pension funds with private equity investments on average have allocated 2.3 percent of their total portfolio to private equity. Even though this appears to be a tiny fraction of the total portfolio - it corresponds to 17.7 percent of all domestic investments in equity. Thus, pension funds have allocated a significant fraction of their equity investment into private firms. To answer the question of whether it is rational for a mean-variance investor to put this particular weighting on private equity, we need to further improve our understanding of the risk and return characteristics of private equity. This is left for future research.

Other studies have emphasized that pension funds might be committed to the development of the local economy and therefore invest in private equity to stimulate growth and innovation. Phalippou and Zollo (2005b) cite causal evidence of this behavior among pension managers

[17]Woodward (2004) reports that the beta of risk increases from 0.6 to 2.0 when correcting for the stale pricing problem. See section 5 for further details.

in the U.S. and Europe when they choose to back venture capital funds. Similarly, pension funds have historically been integrated with unions and therefore investment decisions might be influenced by political concerns. Political investments to sustain employment in unprofitable industries might have induced pension funds to invest in private equity. Again, it is hard to argue that this political preference should affect private equity investments significantly differently than investments in public firms. Further, as these politically motivated investments tend to attract significant media attention, there seem to be too few examples to explain the large underperformance. Nevertheless, to quantify the influence of political investments, we use another novel feature of our data; our sample of pension funds consists of two types, one managed by labor market parties (unions and employers' organizations) and one managed by financial intermediaries. As pension funds managed by unions and employers' organizations are more prone to invest politically, we should expect a lower return to private equity for this group, if political motives are important.

Panel A in Table 9 shows the return to private equity for pension funds managed by labor market parties and those managed by financial intermediaries, respectively. On average, pension funds managed by labor market parties realized an annual return of 8.5 percent compared to 7.7 for funds managed by financial intermediaries. The difference of 0.7 percent is highly insignificant.

To further examine the impact of politically motivated investments, we examine election rules in the pension fund bylaws that grant board seats to political organizations (defined as unions and associations of local governments).[18] If political organizations are granted the right to appoint board members, they can indirectly influence pension fund investment policy. In particular, we are interested in board seats granted to unions and associations of local governments. Unions tend to elect their leaders, whereas associations of local governments tend to elect local politicians. Thus, by measuring the number of board seats granted to political organizations, we obtain a measure of the political influence on pension fund investment policy.

[18]Local governments are actively involved in pension funds managed by labor market parties due to the fact that local governments are employers in a wide range of professions (e.g., education, child care, health care, etc.)

Panel B in Table 9 shows the return to private equity for pension funds as a function of the degree of political influence on the boards. We use two measures: in Panel B (I) we divide the pension funds based on whether at least 1 board seat is granted to a political organization, whereas we in Panel B (II) divide them based on whether the majority of board seats are granted to political organizations. Using both measures, we find no significant difference in the return to private equity of politically influenced boards. Thus, politically motivated investments do not seem to explain why pension funds invest in private equity despite the poor return. Otherwise, we should have found a significantly lower return to politically influenced pension fund private equity investments.

To conclude, we acknowledge that in the case where all pension funds' investments in private equity are politically motivated, our test would fail to recognize this. Rather, we used the within-sample variation to show that the return to pension funds' private equity investments is unrelated to the organization of the pension fund and to the number of board seats granted to political organizations. We thereby find no evidence suggesting that political preferences can explain why pension funds invest in private equity.

7 Conclusion

Prior studies of return to private equity investments have used survey data on entrepreneurial investments or data on investments by private equity funds. Collectively, these studies have found that the return to private equity is no higher than the return to public equity. This paper makes use of a novel dataset of private equity investments by a completely different set of investors—the population of pension funds in Denmark. We argue that these data are less exposed to the measurement problems inherent in previous studies of return to private equity. An additional novel feature of our data is that we have access to the portfolio companies that have generated the returns and the entire population of privately held firms. This allows us to evaluate potential explanations for the realized return.

We show that private equity has dramatically underperformed public equity. Our most conservative estimate shows that pension fund private equity return is 5 percentage points lower

per annum. We further assess the risk of private equity and conclude that private equity is at least as risky as public equity. Thus, pension funds seem to invest in private equity despite a poor risk-return tradeoff. This finding provides new evidence on the private equity premium puzzle raised by Moskowitz and Vissing-Jørgensen (2002).

We further exploit the fact that our data on pension funds allows us to narrow the list of potential explanations suggested in the literature as to why people invest in private equity despite poor return. We find that even though pension fund portfolio companies have underperformed a matched sample of similar companies, this underperformance cannot fully explain the low realized returns. Thus, even investments in private equity by professional investors like pension funds seem to have been driven by over-optimism and misperceived risk. We thereby substantiate the claim that initial over-optimism and misperceived risk are important explanations for the private equity puzzle.

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Table 1. Pension Fund Investment Assets from 1995 to 2004

This table provides descriptive statistics on the size of pension fund investment assets. The sample consists of all pension funds in Denmark from 1995 to 2004. We report the number of pension funds, the mean and median market value of all investment assets, as well as domestic investments in public and private equity. In addition, we report the average and median share of total equity investments allocated to private equity and the number of reported portfolio investments (See Section 3.1 for details). All figures are in million DKR. The exchange rate of DKR to EUR is 7.45.

Year	Pension Fund Investment Assets							
	All		Public Equity		Private Equity			
	N	Market value	N	Market value	N	Market value	% total equity allocation	Number of reported portfolio investments
Mean (Median)								
1995	55	11139.1 (2750.6)	49	1594.5 (429.2)	39	188.0 (79.0)	15.9 (13.7)	10.2 (5.0)
1996	55	12561.0 (2991.4)	51	1729.8 (464.0)	38	186.7 (85.6)	14.4 (12.1)	9.9 (4.0)
1997	55	14357.9 (3489.3)	52	2252.6 (569.9)	38	174.3 (74.8)	13.6 (9.5)	9.6 (3.0)
1998	57	15931.9 (4241.2)	56	2828.5 (699.1)	36	211.4 (95.1)	12.6 (7.2)	10.4 (5.5)
1999	60	16455.0 (4232.2)	53	2978.7 (840.9)	36	206.6 (105.0)	10.9 (6.9)	9.9 (7.0)
2000	60	18923.1 (5568.9)	53	3433.8 (959.8)	38	242.8 (72.2)	8.7 (7.5)	9.4 (7.0)
2001	60	20325.1 (6743.2)	54	3292.4 (1019.6)	44	259.8 (60.1)	15.4 (8.2)	8.0 (3.5)
2002	59	20842.1 (6796.0)	54	2594.4 (837.3)	45	253.1 (87.2)	22.5 (11.0)	8.3 (4.0)
2003	58	20905.7 (6940.5)	51	1663.1 (456.1)	43	268.4 (79.0)	28.1 (16.4)	8.0 (5.0)
2004	54	24663.8 (8806.4)	48	1871.2 (565.0)	43	260.3 (95.5)	26.5 (15.4)	9.7 (5.0)

Table 2. Pension Fund Private Equity Portfolios from 1995 to 2004

This table provides descriptive statistics on the size of pension fund private equity portfolios. The sample consists of the population of pension funds with private equity investments within the period from 1995 to 2004. We distinguish between direct and indirect investment through private equity funds. We report the number of direct investments, whereas for indirect investments we report the number of funds and number of fund investments. The total number of portfolio companies is the number of direct investments plus the number of fund investments. We measure the relative size of each type by aggregating the share of book value of assets and the share of book value equity that ultimately are owned by pension funds.

Year	Direct Investments			Indirect Investments through Private Equity Funds				Total number of portfolio companies
	Number of investments	% of total assets	% of total equity	Number of funds	Number of fund investments	% of total assets	% of total equity	
Mean (Median)								
1995	12.2 (10.5)	94.3 (100.0)	90.4 (100.0)	1.1 (0.0)	11.8 (0.0)	5.7 (0.0)	9.6 (0.0)	24.0 (13.0)
1996	11.6 (11.0)	93.4 (100.0)	89.0 (100.0)	1.1 (0.0)	14.4 (0.0)	6.6 (0.0)	11.0 (0.0)	26.0 (14.0)
1997	10.8 (8.0)	91.4 (100.0)	86.5 (100.0)	1.1 (0.0)	17.6 (0.0)	8.6 (0.0)	13.5 (0.0)	28.4 (16.0)
1998	10.2 (7.0)	89.1 (99.7)	84.0 (98.4)	1.5 (1.0)	18.3 (0.0)	10.9 (0.0)	16.0 (0.0)	28.5 (16.0)
1999	9.1 (7.0)	85.9 (98.9)	80.5 (92.6)	1.9 (2.0)	21.8 (3.0)	14.1 (0.0)	19.5 (0.1)	30.9 (16.0)
2000	9.1 (7.5)	84.3 (99.0)	77.9 (94.9)	2.3 (2.0)	22.5 (5.0)	15.7 (0.0)	22.1 (0.1)	31.6 (12.5)
2001	8.9 (7.0)	82.2 (99.2)	75.5 (95.6)	2.3 (1.0)	24.4 (9.0)	17.8 (0.8)	24.5 (4.4)	33.3 (15.0)
2002	8.5 (6.5)	80.8 (98.1)	73.8 (91.0)	2.5 (1.5)	28.8 (12.0)	19.2 (1.9)	26.2 (9.0)	37.3 (18.0)
2003	7.1 (5.0)	81.8 (98.7)	76.4 (97.2)	2.3 (1.0)	23.1 (4.0)	18.2 (1.3)	23.6 (2.8)	30.2 (14.0)
2004	8.0 (6.5)	79.2 (97.9)	75.8 (96.2)	1.8 (1.0)	20.0 (5.0)	20.8 (2.1)	24.2 (3.8)	28.0 (12.5)

Table 3. Average Yearly Return on Pension Fund Equity Investments from 1995 to 2004.

This table summarizes the average yearly return (in percent) of pension fund equity investments from 1995 to 2004. We report the following for both public and private equity investments, respectively: the number of pension funds, the average return, and the standard deviation on pension fund returns.

Year	Return to Public Equity (%)			Return to Private Equity (%)		
	N	Mean	Std. dev.	N	Mean	Std. dev.
1995	49	7.438	3.302	39	-0.405	10.363
1996	51	31.188	7.133	38	1.024	12.047
1997	52	33.88	11.074	38	16.242	22.359
1998	56	-3.6911	6.168	36	12.148	31.336
1999	53	22.714	7.127	36	1.778	14.982
2000	53	20.195	10.048	38	27.266	40.662
2001	54	-13.944	5.780	44	-5.535	24.847
2002	54	-20.509	6.369	45	-6.089	14.993
2003	51	30.396	11.156	43	-0.590	19.925
2004	48	25.298	5.633	43	5.151	9.148

Table 4. Return to Private Equity Investments by Pension Funds

This table reports the average annual return to public and private equity investments by pension funds in Denmark from 1995 to 2004. Panel A uses equal weights, whereas Panel B reports value-weighted returns. We report the average annual return for all pension funds, and for pension funds with private equity investments for all years within the period. We use a standard mean comparison test to evaluate whether public and private equity provided identical returns. We report the difference and the *p*-value that emerge from the test of comparable means.

	Average Annual Return (%)					
	Public Equity		Private Equity		Difference	
	N	Mean (std.dev)	N	Mean (std.dev)		*P*-value
Panel A: Equal weighted						
All	520	12.890 (20.45)	401	4.698 (23.52)	**-8.192*****	[0.000]
All with private equity investments in all years within period	340	13.350 (20.20)	340	5.523 (22.74)	**-7.827*****	[0.000]
Panel B: Value weighted with average market value						
All	520	13.628 (20.39)	401	8.185 (21.69)	**-5.442*****	[0.000]
All with private equity investments in all years within period	340	13.645 (20.39)	340	8.328 (21.32)	**-5.316*****	[0.001]

Table 5. Estimation of the Beta Measure of Risk

This table reports estimates of the beta measure of risk. The dependent variable is the return premium on private equity. Following Scholes and Williams (1977) and Woodward (2004), Model (2) includes the *lagged market return premium*, whereby the estimated beta is the sum of the coefficient on the current and lagged market return premiums.

	Model (1)		Model (2)	
	Coefficient	*t*-statistics	Coefficient	*t*-statistics
Intercept, alpha	-0.545	(-0.18)	-2.154	(-0.98)
Market return premium	0.207*	(1.77)	0.182*	(1.86)
Lagged market return premium			0.291***	(3.20)
Beta	**0.207**		**0.473**	
R^2	0.171		0.526	
N (years)	10		10	

Table 6. Distributional Characteristics of Publicly and Privately held firms and Pension Fund Portfolio Companies in 1999

This table reports the distribution of publicly and privately held firms and pension fund portfolio companies on different firm characteristics. We report the 10th, 25th, 50th, 75th and 90th percentiles of the distribution book-value of assets, firm age and leverage.

	Assets			Firm age			Leverage		
	Public equity	Private equity		Public equity	Private equity		Public equity	Private equity	
		All	Portfolio companies		All	Portfolio companies		All	Portfolio companies
10th Percentile	57.6	0.3	4.6	12	1	2	0.281	0.046	0.013
25th Percentile	213.7	0.8	27.6	25	3	6	0.478	0.241	0.071
50th Percentile	680.5	2.3	91.6	35	9	11	0.615	0.594	0.521
75th Percentile	2692.8	6.5	300.0	93	17	19	0.809	0.823	0.690
90th Percentile	8024.7	20.0	747.8	118	25	35	0.893	0.960	0.836

Table 7. Private Benefits to the Management of Pension Funds: Board Seat Accumulation in Portfolio Companies by Management of Pension Funds

This table shows the number of new board members in pension fund portfolio companies subsequent to the investment by a pension fund. We include direct investments, private equity funds and private equity fund portfolios in the sample of portfolio companies. We report the number of new board members and the number of managers and board members of the pension fund. We further partition on whether the new members joined the board while the pension fund was still an owner and after the fund sold out, respectively.

	New board members in portfolio companies	Number of managers and board members of pension funds among new board members of portfolio companies			
		Pension Fund Managers		Pension Fund Board members	
	N	N	%	N	%
All new boards members after investment by a pension fund	2514	26	1.0	24	1.0
- New board members while pension fund is an owner	1774	22	1.2	19	1.1
- New board members after the pension fund sold out	740	4	0.5	5	0.7

Table 8. Return on Assets in Pension Fund Portfolio Companies Relative to a Matched Sample of Companies within the Industry

This table shows the operating performance of pension fund portfolio companies relative to a sample of matched firms. We construct a matched sample of similar sized firms within the industry. On the left side of the table, the matched sample consists of the 10 firms within the 2-digit industry code with the closest proximity in firm size to the portfolio company, whereas on the right side, the matched sample consists of the 5 firms within the 3-digit industry code. We use Return on Assets defined as EBIT/Assets to measure earnings performance. We report the average coefficient, the number of positive, negative, and significant from the 9 cross-section regressions, whereas we report the coefficient and the *t*-statistics from the pooled model. Panel A makes use of all industries, whereas Panel B focuses on manufacturing industries by excluding firms operating in 2-digit NACE codes higher than 65. Significance is based on White's robust variance estimator.

	Matched sample based on 2-digit NACE			Matched sample based on 3-digit NACE		
	(1)		(2)	(3)		(4)
Model specification	Cross-section		Pooled	Cross-section		Pooled
	Average coefficient	Number of positive / negative [significant]	Coefficient (*t*-stat)	Average coefficient	Number of positive / negative [significant]	Coefficient (*t*-stat)
Panel A: All industries						
Portfolio company dummy	-0.0284	0/10 [0/5]	-0.0287 (-6.31)	-0.0211	0/9 [0/4]	-0.0212 (-5.36)
Control variables	YES		YES	YES		YES
Size and industry effects	YES		YES	YES		YES
Panel B: Manufacturing industries						
Portfolio company dummy	-0.0325	0/10 [0/4]	-0.0391 (-4.86)	-0.0328	0/9 [0/3]	-0.0345 (-4.82)
Control variables	YES		YES	YES		YES
Size and industry effects	YES		YES	YES		YES

Table 9. Politically Motivated Investments and the Return to Private Equity Investments

This table reports the value-weighted average annual return to private equity investments by pension funds with private equity investments in all years from 1995 to 2004. Panel A splits the pension funds into funds managed by labor market parties (unions and employers' organizations) and financial intermediaries, respectively. Panel B splits the pension funds according to the composition of board members: from pension fund by-laws, we identify election rules that grant board seats to political organizations (defined as unions and associations of local governments). In Panel B, I we split the sample of pension funds on whether at least one board seat is granted to a political organization, whereas in Panel B, II we split the sample on whether a majority of the board seats is granted to political organizations. We use a standard mean comparison test to evaluate whether the two groups have identical returns to private equity according to the split. We report the difference and the *p*-value that emerge from the test of comparable means.

	Average Annual Return (%)			Difference	
	N	Mean	(std. dev)		*P*-value
Panel A: Organization of pension funds					
Managed by labor market parties	220	8.520	(19.44)	**0.708**	[0.769]
Managed by financial intermediaries	120	7.722	(26.50)		
Panel B: Board seats granted to political organizations					
(I)					
At least one board seat granted to a political organization	250	8.107	(18.842)	**-1.356**	[0.666]
No board seats granted to political organizations	90	9.463	(31.18)		
(II)					
Majority of board seats granted to political organizations	160	8.512	(18.49)	**-0.499**	[0.833]
Minority of board seats granted to political organizations	180	8.003	(25.64)		

Figure 1. Average Yearly Return to Pension Fund Equity Investments 1995-2004

This figure shows the average yearly return to pension fund public and private equity investments. The average is computed using equal weights on each pension fund's return.