

The Determinants of Pension funds' Allocation to Private Equity

Antonia López-Villavicencio* Sandra Rigot**

November 30, 2013

Abstract

This paper investigates the main determinants of pension funds investment in private equity funds, and particularly in venture capital and leverage buyouts in the US and Canada over the 1996-2011 period. Our results, based on a Tobit model, show some important differences between pension funds allocating to private equity and more traditional assets (i.e. equity). The first ones are bigger, mainly diversified private funds. They do not consider the age of their members when deciding this type of allocation and they present a higher discount rate. Furthermore, they specially take into account their private equity returns in comparison to management costs. We also show that pension funds investing in private equity do not distinguish between venture capital and leverage buyouts.

JEL Classification: G23.

Keywords : pension funds, private equity, asset allocation, long term investors

*CEPN-CNRS, University of Paris Nord, 99 avenue Jean-Baptiste Clement, 93430 Villetaneuse, France. E-mail: lopezvillavicencio@univ-paris13.fr

**CEPN-CNRS, University of Paris Nord, 99 avenue Jean-Baptiste Clement, 93430 Villetaneuse, France. E-mail: sandra.rigot@univ-paris13.fr

1 Introduction

If pension funds could theoretically hedge their retirement liabilities by investing their portfolio entirely in bonds (Bodie, 1990), in reality, they invest a substantial part of it in equities, in compliance with the theory of portfolio diversification. According to OECD (2012), pension asset allocation to equities is from 0% to 50% with the highest allocations in the United States, Australia, Finland and Netherlands.

During the market crash of 2001-2002, pension funds registered huge losses and to compensate them, they have been seeking exposure to a high performing asset class. Consequently, they try to better diversify their portfolios and enhance their long-term asset-liability management (Sharpe and Tint, 1990) with alternatives assets like hedge funds and private equity investments. This structure is known to be an efficient strategy for portfolio diversification through active management (Amenc et al., 2009). It consists of defining a strategic asset allocation and dividing assets between two components: core and satellites (Amenc et al. 2004).

The objective of the first one is to avoid risks related to the variability of the assets of pension funds.¹ The core is generally invested in traditional asset classes in liquid markets (large caps, bonds, etc.). The component satellite looks for higher performance (by generating positive alpha returns) and a better diversification of risk (by improving beta).² Among these satellites, private equities are the most significant alternative asset class in term of average allocation of pension funds. Due to the risk of illiquid private equity, pension funds could expect a higher return than traditional asset classes.

Over the past two decades, private equity funds have become responsible for an enormous amount of investment in the economy. According to Mac Kinsey (2007), private equity funds accounted for 0.7 trillion dollars in 2006 before the crisis. In 2009, worldwide private equity funds managed approximately \$1 trillion of capital (Metrick et al., 2010). A driving force of this change was the increasing interest of institutional investors for private equity. According to Preqin (2013), public and private pension funds made up 43% of capital invested by private equity funds during 2001-2011.

1 The “core” component represents 75% to 90% of portfolio and it aims to match the liabilities of pension funds via immunization techniques.

2 The second component (10%-25%) the “satellites” is almost exclusively invested in alternative assets (real estate, hedge funds, private equity, infrastructure, etc.).

The first objective of this paper is to investigate the main characteristics of pension funds investing in private equity funds related to their liabilities profile and their mode of management.

However, if private equity investment may be attractive for pension funds to catch higher returns and to diversify their portfolio, they are also related to the funding of companies and their long term investment. Indeed, the private equity universe is very large. These funds undertake investment in companies (supply in equity) at different stages of their evolution with different structures of funding.³ The two main strategies targeted by investors are venture capital and leverage buyouts (Prequin, 2013). In this line, the second objective of this paper is to investigate the differences between pension funds investing in venture capital funds versus leverage buyouts funds.

According to Metrick and Yasuda (2010), venture capital funds are financial intermediaries which take the investors' capital and invest it only in private companies (i.e. it cannot be traded on public exchange). They often invest in businesses that are early in their life cycle (start-ups) and in high technology companies. In that way, they participate to the funding of innovation. These funds take an active role in monitoring and helping the companies in its portfolio (for example, a position on the board of directors to provide advice and support at the highest level of the company). They invest in companies with negative cash flow and which need capital for expansion. The aim of these funds is to maximize their financial return by exiting investments through sale or an initial public offering. High technological business offers the potential of high growth and high exit. This is a high risk business.

Metrick and Yasuda (2010) find sharp differences between venture capital (VC) and leverage buyout funds (LBO). LBO funds bring money from at least two sources: investors (like for venture capital) and senior debt, provided generally by banks. They have a high financial risk (leveraged balance sheet). In many cases, there is a mezzanine layer of subordinated debt in addition to the senior debt and equity. They almost always acquire mature business with excess cash flow and they rarely invest high technology companies but medium ones. LBO firms usually acquire companies with excess cash flow that need little or no capital for expansion. Therefore LBO managers build on their prior

³ Many of the features of private equity funds can be understood as responses to agency problems (Lerner, 2001). A large literature has pointed out that these information gaps inherent to publicly owned companies are due the separation of ownership (dispersed shareholders) and control (managers). Management may not act in the best interests of shareholders. Because a private equity fund buys 100 percent of the company and controls it, it has often been argued that the arrangement will reduce these agency problems (Jensen, 1989; Shleifer and Vishny, 1997).

experience by increasing the size of their funds faster than VC managers do. This leads to significantly higher revenue per partner and per professional in later LBO funds.

Venture capital funds raised nearly \$160 billion of capital during the boom years of 1999 and 2000, and made early investments in recent successes like Google (in the United States), Skype (in Europe) (Metrick and Yasuda, 2010). About two thirds of the worldwide private equity of this capital is managed by leverage buyout funds, where leverage can multiply the investment size by three or four times the base capital. In the peak years of the early 21st century cycle, these buyout funds were responsible for about one-quarter of all global mergers and acquisitions activity.

To the extent that venture capital funds always invest in businesses that are much earlier in their life cycle (start-ups) and high technology companies that have some difficulties to find funding, we can suppose that pension funds which allocate to these funds participate indirectly to the financing of innovation. Venture capital seems to be more innovation oriented than LBO funds which seem to be more short term profitability oriented.

Both venture capital and leverage buyouts funds are organized as closed-end, finite-life limited partnerships, with fund managers serving as general partners and large institutional investors and wealthy individuals providing the bulk of the capital as limited partners.⁴ The general partners make investment decisions and receive a substantial share of the profits. The limited partnerships last typically between 5 and 10 years.

Private equity funds benefit from light regulation and their specific governance raises issues beyond those posed by traditional investments. These issues include company risks and financial challenges related to valuation, leverage, liquidity and the operational risk of private equity investments (US GAO, 2012). The particularity of private equity investments implies that many pension funds do not have the necessary abilities or incentives to invest in this category of alternative assets. Investments in private equity should, for example, be made by those with the skills required to select managers and have sufficient bargaining power to negotiate contractual terms related to fees and information disclosure (Rigot and Tadjeddine, 2012).

Attention has been increasingly focused on the governance and investment performance of pension funds (Brinson and al., 1997; Hinz and al. 2012; Aglietta and al., 2013.). A massive amount of literature has also developed with the goal of

⁴ Partnership agreements signed at the funds' inception clearly define the expected payments to the general partner. If all goes well, the venture capital fund eventually sells its stake in the portfolio company, returns the money to its limited partners, and then starts the process all over again with a different company.

understanding the financing of corporate investments, performance of firms and performance of private equity funds (Gomers and al. 2006; Phalippou and al.2009; Hege and al., 2009; Bottazzi and al., 2010). However, the literature that analyses specifically pension funds allocation to private equity funds is very scarce⁵, mostly due to data limitations. This paper aims to fill that gap by using an original and representative database. This adds important value because it is difficult to get reliable figures on private equity, venture capital and leverage buyouts funds. To our knowledge, the information provided by the CEM benchmarking database concerning allocations to private equity has not been used in related pension fund studies. This article is in line with Bouvatier and Rigot (2013), which determines the archetypal profile of pension funds that allocate assets to hedge funds. However, we use the updated database which provides more detailed data with new variables about liabilities of pension funds. These variables are crucial in the construction of pension funds' portfolios (Yermo, 2012). Moreover, we study a longer term horizon, which takes into account the recent crisis years.

The remainder of the paper is organized as follows. Section 2 presents the data and descriptive statistics. Section 3 presents the methodology and assesses the characteristics of the pension funds allocating to private equity, venture capital and leverage buyouts. Section 4 concludes the paper.

2 Data and descriptive statistics

Our analysis is based on CEM Benchmarking data. This unique international database provides information for 535 defined benefits (DB) pension funds in the US and 218 funds in Canada over the 1990-2011 period. However, we restricted our study to start in 1996, the first year for which we have reliable information and observations on private equity funds' allocation. This implies that our sample contains 464 and 183 funds in the US and Canada, respectively, over 15 years. Given that not all the funds appear in the data for all of the years, our final sample contains 3968 observations over the period.

As we further investigated the characteristics of pension funds allocating in venture capital and leverage buyout, our analysis in this case starts in 2006, the first year with positive allocations for leverage buyout.⁶

⁵ See Della Croce (2012) about pension allocation to infrastructures.

⁶ Pension funds might have allocated to leverage buyouts funds before 2006 but the reports are not reliable before this date.

The database is quite representative. It contains, on average, information of about less half of the assets under management of US DB pension funds and 80% of Canadian DB pension funds.⁷ Moreover, the quality of data is good because the answers to the questionnaire are anonymous and, therefore, there is no self-reporting bias (Bauer et al. 2010; French, 2008).

This database provides the following detailed information about DB pension funds by year and country: their sponsorship (private versus public pension fund), their strategic annual and actual asset allocations at a very detailed level, the fund's costs and returns by asset class and by the nature of their delegation (active/passive and external/internal), the annual discount rates used to discount the liabilities, the maturity of the fund, the percentage of liabilities associated with retired members, etc.

Total assets are disaggregated into six classes: equity, fixed income, real assets, hedge funds, private equity and other assets. Real assets are divided into real estate and infrastructures. Others assets are compounded of cash and Tactical Asset Allocation (TAA). In addition, private equity assets are also disaggregated into venture capital, leverage buyouts, diversified private equity and "other" private equity.

Table 1 presents the summary statistics over the 1996-2011 period for our final sample. The sample consists of funds in the US and Canada distinguishing corporate and public funds.

–TABLE 1 ABOUT HERE–

As seen in table 1, private pension funds are more numerous than public pension funds. However, the latter are larger in terms of assets under management. They accounted for more than 68% of US pension funds and about 80% of Canadian pension funds' assets in the final sample. Moreover, the total mean assets of Canadian pension funds are four times smaller than in the US.

Table 2 displays asset allocation for our sample of US and Canadian defined benefit pension funds over the period. As can be seen, on average, pension funds invest, 56.3% in equity, about 33.3% in fixed income, 3.9% in real assets, 2.3% in private equity and 1.1% in hedge funds. The table also shows that there are differences between the private and public pension funds of our sample regarding asset allocation. Indeed, public pension funds allocate less in equity than private pension funds (54.5% against 57.5%) but

⁷ Indeed, according to the OECD (2012), in 2011, the share of DB pension funds in US (Canada) pension funds' assets is around 40% (95%) and total assets-to-GDP ratios for US and Canada pension were 70.5% (around 4197 565 mil. \$) and 63.7% (1 094 227 mil. \$), respectively. By 2011, the total assets managed by US (Canada) DB pension funds in the database were 3,259,860 mil. dollars (861,233 \$ mil.) Therefore, the database represent more than 70% of US DB pension funds and more than 80% of Canadian DB pension funds the same year.

relatively more in fixed income (34.5% against 32.5%) and alternative assets like real assets (4.8% against 3.3%), private equity (2.4% against 2.2%) – except in hedge funds. We observe the same trend in both countries for private and public pension funds for equity, fixed income and real assets with allocations being lower in Canada, except in the case of fixed income. In the US, the statistics show the opposite trend: private pensions allocate more to private equity (3.1% against 2.8%) and hedge funds. In Canada, public pensions allocate considerably more to private equity than private funds (1.5% against 0.5%) and hedge funds (0.7% against 0.3%).

–TABLE 2 ABOUT HERE–

We further investigated the characteristics of pension funds by splitting our sample in two sub-samples. The first one includes pension funds which invest in private equity. The second sub-sample incorporates pension funds which did not allocate to private equity (see table 3).

–TABLE 3 ABOUT HERE–

As seen in table 3, on average, there is roughly the same number of pensions which allocate as do not allocate to private equity. More precisely, about half pension funds in the US invest in private equity. On the contrary, in Canada only one third of funds invest in private equity. However, in terms of assets under management, assets invested in private equity are seven times higher. This implies that, on average, pension funds which allocate to private equity are larger. In addition, most of the pension funds which invest in private equity are private, particularly in the US. In Canada, the proportion of private and public pension funds investing in private equity are relatively the same. Therefore, we can presume that pension funds which invest in private equity are larger. The relationship with sponsorship is, however, less evident in Canada but more relevant for US pension funds.

Regarding the distribution of asset allocation, pension funds which do not allocate to private equity have, on average, a higher allocation to equities than pension funds which do allocate in private equity. This difference seems similar for the US and for Canada. Similarly, pension funds not investing in private equity allocate more to fixed income, on average, in both countries. On the contrary, funds which do not invest in private equity, invest on average, nearly half in real assets. This trend is the same for the US and it is three times less for Canada. Moreover, note that the sum of alternative assets (private equity, real assets and hedge funds) is 11.7% for the first sub-sample and only 2.8% for the sub-sample of funds not investing in private equity. Equally, pension funds which do not allocate to private equity do not seem interested in hedge funds either. One could infer from this pattern that there is an arbitrage between private equity

allocation and real asset classes: the decrease of equity and fixed income can be made in profit of alternative assets, in general, and private equity, in particular.

In the first sub-sample, the mean allocation to private equity is 4.5% in the whole sample, 5% in US pension funds and 2.6% in Canadian funds. This allocation is almost as high and volatile as real asset allocation. Finally, there is no really difference between both sub-samples related to others assets and between both countries.

Regarding the liabilities profile of pension funds, two variables are provided by the database. First, the discount rate, which is the rate from which pension funds have to discount their liabilities vis-à-vis their final investors. The discount rate is central to the accounting of pension obligations. It is used to estimate at the balance sheet date the amount (i.e. the present value commonly referred to as present value) of pension obligations which will be paid to beneficiaries in future periods.⁸ Moreover, this indicator is important to compute the funding ratio that pension funds have to respect. The higher the value of this variable, the more the liabilities are low and vice versa. Equally, the more it is volatile, the more the liabilities are volatile. Therefore, pension funds managers have to carefully take into account the discount rate for asset allocation (Montperrus, 2009; Yermo, 2012).

CEM also provides information about the number of retired and active members from which we derived the maturity of pension funds (i.e. the ratio between inactive or retired to active members). A higher value for this ratio implies that the fund is more mature. Highly mature funds, in turn, must deliver retirement benefits to more retired people. As a result, pension funds have incentives to perform a more conservative asset allocation basically because they have to make sure to pay benefits. Therefore, we should expect that a higher degree of maturity decreases the allocation to risky assets, such as equity (Severinson et al., 2012).

At this respect, table 3 shows that, on average, pension funds have about the same discount rate independently of whether they allocate or not to private equity (7.1 against 6.8 percent). There is, however, an important difference in terms of maturity. Indeed, pension

8

In particular, the concept of time value of money states that a sum of money to be received today is worth more than if received tomorrow because of uncertainty about future outcomes and opportunity cost (Brealey, Myers and Allen, 2006).

funds which allocate to private equity have a lower maturity ratio (1.3 compared to 4.3), mainly due to a high maturity index in Canada for funds not investing in private equity.

The database also provides information about the way assets are managed and the degree of sophistication of pension funds. Firstly, we computed a variable related to the degree of concentration. This is assessed by the sum of the square of the percentage of asset allocations (calculated in terms of a Herfindahl index) with a higher value implying a more concentrated pension fund. Secondly, we calculated the percentage of assets actively managed. Thirdly, we used a proxy for international diversification, computed as the share of foreign equity to total equity. De Dreu and Bikker (2009) suggest that the home bias in asset allocation reveals the “degree of short-sightedness” of investors. International diversification in investment allocation could, therefore, be positively associated with the degree of sophistication of pension funds. We anticipate that sophisticated funds allocate more to private equity. Fourthly, we calculate the percentage of assets externally managed in all asset classes.

The statistics show that pension funds which allocate to private equity have a relatively lower concentration ratio compared to those not allocating (in the US and Canada). This indicates that, pension funds pursuing a higher portfolio diversification in terms of number of asset classes invest more in private equity. We also observe that pension funds which allocate to private equity manage rather less actively equities and fixed income than pension funds which do not follow this type of management in the whole sample, both in the US and Canada. However, the descriptive statistics do not show a difference between both sub-samples regarding international diversification, which represents about 40% of total equities in each case, a percentage that is considerably lower in the United States. The percentage of assets externally managed is 82.5% for the first sub-sample versus 91.8% for pension funds which do not invest in private equity. We find the same trend for US and Canada.

The number of funds in the sub-sample of private sponsorship which is allocating to private equity is 55% (56% in the US and 51% in Canada). However, as far as assets under management are concerned, public pension funds invest more in private equity on average: 70% in the US and 88% in Canada.

Finally, regarding costs and returns, Table 3 shows that, on average, pension funds which invest in private equity have slightly higher global performance than those not investing in these assets (8.3% against 7.9%). However, the standard deviation is very high. For example, the average return was 15.2% (14.3%) in 1996 for funds allocating (or not allocating) to private equity, this reached up to 20.9% (resp. 18.6%) in 2003 and then fell to -19.5% (-20.7%) in 2008, 16%, (17%) in 2009 12.5%, (11.5%) in 2010. The under-performance of private equity allocations is mainly explained by the

turbulence of the sub-primes' crisis which crashed in the summer of 2007. By 2011, the global average return in assets was only 2.8% for funds investing in private equity and 1.4% for the rest of the funds (see figure 1).⁹ The private equity mean performance is higher than the global performance, but also more volatile (10.7 over the period, with a high standard deviation of 26.5). This performance is considerably higher and more volatile in the US than in Canada (11.7% and 6.6% respectively).

We observe that, on average, equity return is higher in the sub-sample not allocating in private equity (8.3% versus 8.7%) with a lower standard deviation and a lower return both in the US and in Canada. Equity costs are equivalent in both sub-samples. On average, private equity performance is higher and more volatile than equity. We observe the same trend in the US but not in Canada where private equity return is lower (6.6% against 7.9%) with a higher deviation standard.

However in the US, this additional performance is more than compensated by the cost. Indeed, private equity costs are on average ten times higher than equity costs. These prohibitive costs, which are delegation costs, can be explained by the specific governance of private equity funds within a double structure of fees, of partnership agreements: management fees (2% on average) and carried interest (20% on average) contrary to traditional asset classes managers who only touch management fees.

As a result, we observe that the archetypal pension which invests in private equity is a large, mainly private pension fund which makes arbitrage between private equity allocation and real asset classes. It has a higher discount rate and is a relatively immature fund. It diversifies its portfolio in terms of numbers of asset classes but not worldwide. It manages less actively equities and fixed income than pension funds. It has a better global performance but is also more volatile.

Regarding the components of private equity, table 7 reports the descriptive statistics for defined benefits pension funds investing in venture capital and/or leverage buyouts for the 2006-2011 period¹⁰. We can see that there are more pension funds which allocate to venture capital than to leverage buyouts. A similar trend is observed in the US and Canada. US pension funds are six times more numerous. In terms of assets under management,

9 This performance is very low in comparison with Dutch, Australian, Danish pension funds performances in 2011 respectively (4.3%, 5.1% and 12.1%) according to OCDE (2013).

10 Private equity allocation corresponds at the sum of venture capital, leverage buyout, diversified funds and "other" type of private equity.

pension funds which allocate to venture capital are smaller in average than pension funds which allocate to LBO.

–TABLE 4 ABOUT HERE–

Most pension funds which allocate to VC are public (about 85%). Private and public pension funds investing in VC are more or less the same in number but the proportion of public funds investing in LBO is higher than private pension funds. However, in terms of assets, private funds in both VC and LBO represent a smaller proportion.

Concerning asset allocation, on average, pension funds which allocate to VC have about the same allocation to equity (50.9 versus 49.4%) as pension funds which allocate to LBO, with a higher rate for Canada. There is no real difference between both sub-samples for fixed income which is on average 29%. Pension funds which invest in VC invest the same share in real estate, around 6%. Canada pension funds invest much more in real estate (7.6% against 9.9%). Pension funds which invest in VC invest as much as in hedge funds (4.5% against 4.6%). This allocation is very low in comparison with US one (1% against 0.5%). Pension funds which invest in VC allocate less to others assets, on average (2.6% against 3.1%).

Concerning variables related to liabilities of pension funds, we observe that pension funds which invest in VC have a relatively lower discount rate than pension funds which invest in LBO (6.8% against 7.1%). This is the same for US and Canada. On average, pension funds which invest in VC and LBO have about the same maturity ratio (1) as is the case for US. But this ratio is higher for Canada (1.5 against 1).

Concerning management variables, we observe that on average the concentration ratio is the same for both sub-samples as in the US. It is higher in Canada for pension funds which invest in VC. Both subsamples manage actively and in the same proportion their equities and fixed income asset classes. This is the same for the US and Canada. There is no difference between both sub-samples related to foreign diversification (about 0,45%) in the US and in Canada.

Pension funds in the US and Canada which invest in VC have a better global performance on average (5.2% against 4.6%). However, on average, the VC mean performance (4.7%) is higher than LBO mean performance (3.3%). In the US, the gap is the same (4.7% versus 3.5%). In Canada, LBO mean performance (2.1%) is twice lower than the VC one (4.7%).

Pension funds in the US and Canada which invest in VC have a lower global cost of management (1.2% against 1.4%). Once again, however, we observe that on average, VC mean costs (4.8%) are higher than LBO ones (3.3%). In Canada, VC means performance is higher but VC means costs are higher.

We summarise that there are no real differences between VC and LBO sub-samples, in terms of equity, fixed income, real assets and hedge funds allocations, diversification (international and number of asset classes) and in terms of liabilities profile. We only observe differences for global performance in favour of the first VC sub-sample and for global management cost, which are less important for the first VC sub-sample.

3 Methodology

This section develops the Tobit model that we implemented in the next section. We rely on this methodology because numerous pension funds do not invest in private equity and its components, and therefore the dependent variable, is incompletely observed. To acknowledge this potential censoring of investments, a Tobit model of the following form is employed for the following:

$$y_{it}^* = \alpha_i + \gamma_{jt} + \beta_m X'_{it} + \beta_r Z'_{it} + \beta_d V'_{it} + \beta_s \text{Size} + \beta_p \text{Public} + \varepsilon_{it} \quad (1)$$

$$y_{it} = \begin{cases} y_{it}^* & \text{if } y_{it}^* > 0; \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

Where y_{it}^* is the latent (unobserved) allocation, y_{it} is also the observed allocation (i.e. the share of assets in each category), that indicates the pension funds, t indexes the years and j indexes the country. Equation (2) indicates that the latent variable y_{it}^* is only observed if $y_{it}^* > 0$. That is, the observable dependent variable y_{it}^* is defined to be equal to the latent variable whenever the latent variable is over and above zero

With respect to the explanatory variables, other than the (log) size and a dummy variable indicating if the Fund is publicly owned, we include four types of explanatory variables. Firstly, X_{it} is a regress vector that contains variables related to the management of the fund, such as the share of foreign assets over total assets, a concentration index, which is the sum of the square of the percentage asset allocations, and the share of equities and fixed income assets actively managed. Secondly, Z_{it} , which represents the liabilities, contains a maturity index, which is the proportion of retired

over active members, and proxies the risk taken by the fund and the liability discount rate that captures the actuarial assumptions of each fund. Finally, in vector \mathbf{V}_{it} we include costs and returns in equity and in each allocation (i.e. private equity, venture capital and leverage buyout).

We estimate equation (2) by the maximum likelihood of random-effects estimation for the whole sample and for four allocations: i) the share of the Pension Fund's assets held in Equities (E), ii) the share of Private Equity in the total assets (P E), iii) The share of Venture Capital in total assets (V C) and iv) the share of total assets allocated in Leverage Buyout (LBO). We split the sample further into Canadian and American funds and investigated first, the determinants of equity and private equity allocation¹¹ and second, whether pension funds which allocate to venture capital have the same profile than those which allocate to LBO.

4 Results

The marginal effects of the independent variable on the latent variable of the Tobit model are presented in table 5. The estimated coefficients are related to the latent variable y^* in Equation (1). They show the effects of change in a given explanatory variable on the expected value of the latent variable, holding on the other hand all right side variables constant.

If we consider first the variables related to the management of the portfolio, the results show that there is no significant relation between foreign equity (over total equity) and allocation to private equity. However, we note the negative and significant coefficient of the foreign diversification in equity allocation, implying that whereas this type of diversification has no effect on the allocation to private equity it reduces the probability to allocate in equity. The same pattern holds when we split the sample into Canadian and American funds, except that in this case, foreign diversification has no significant effect on equity allocation for Canadian funds (see table ?? in the Appendix). This result confirms descriptive statistics. This variable is not relevant to explain private equity allocation.

–TABLE 5 ABOUT HERE–

Similarly, pension funds which tend to manage more actively their traditional asset classes (equity and fixed income) have lower a probability of investments in equity.

11 Ideally, we would also split the sample for the cases of venture capital and LBO, but the resulting sample size would be too small to draw any robust conclusion.

Nevertheless, this variable has no significant effects on the allocation to private equity in the whole sample but a negative and significant effect on allocation to private equity for funds in the US. Given the previous results, we can presume that pension funds which invest in private equity prefer to use external managers for alternative investments more than traditional ones. In the latter, given that there is a market benchmark, it is easier to do this 'in house'.

On the contrary, there is a significant and positive effect between concentration and allocation to equity. The opposite effect is observed for the allocation to private equity in the whole sample and for both countries. This is an important result that indicates that the less the portfolio of a pension fund is diversified, the more it allocates to equities. However, the probability of allocating to private equity is higher for less concentrated funds. This result corresponds with the descriptive statistics and with Bouvatier and Rigot (2013) for the case of hedge funds which have similarities with private equity funds (Aglietta and Rigot, 2009).

With regard to how liabilities influence the probability of allocation and in accordance with the previous literature¹² (Bikker et al. 2011), we observe that pension funds take into account the age of their members for equity allocation. In particular, a higher proportion of retired members with respect to active members leads to a significant reduction of equity allocation by around 0.02% (i.e. an additional 0.01 percent decrease in equity allocation is associated with retired members in respect to active members).

Surprisingly, the results show no maturity effect for private equity allocation, a consistent result in the whole sample as well as in each country. Contrary to what we might expect the fact that maturity is not significant for private equity allocation is contrary to previous literature that supports the life cycle theory.

As far as the discount rate is concerned, the Tobit model estimates show a significant and positive relation with both equities and private equity exposure (basically due to the positive effect in the USA). More precisely, the estimated marginal effects for specification show that a 1% increase in the discount rate leads to a 0.7% increase in equity and a lower but also significant 0.2% allocation to private equity. There is no difference between both samples: the discount rate is relevant for private equity allocation decisions.

The higher the discount rate is, the higher the probability of investing in private equity. In other words, an increase in discount rate induces an increase in risky assets. This result is

¹² Bikker et al. (2011) find a positive and significant relationship between risk taking and the share of active employees in the pension plan.

in line with Pennachi and Rastad¹³ (2011) and Andonov et al. (2013). For investment in private equity, this is the only liabilities variable which is at stake. Moreover, discount rate belongs to regulatory factors which can have a large and significant impact on risky asset allocation¹⁴.

In addition to this, we find no relation between equity cost and equity exposure. However, higher costs in equity do affect positively the allocation to private equity: a 1% increase in costs related to equity management increases by 0.02% the probability of allocating to private equity. From these results, we can deduce that there is an arbitrage between equity and private equity related to cost. Contrary to this, returns on equity investments are not significant, neither in equity nor in private equity allocation. This implies that this variable is not relevant for the decision to allocate to private equity. In terms of costs and returns specific to private equity, the results show that when deciding the allocation of funds, the performance both in terms of returns and costs is considered. This implies that on average, contrary to the equity return, private equity return is relevant to the decision to allocate to private equity.

Remarkably, there is an important difference between Canada and the United States in this case: in the first country, the probability to invest in private equity is independent of the returns. But contrary to this in the USA, higher returns increase the probability to allocate, and the amount of assets allocated to private equity.

In Canada, the cost is even more important if we consider that they registered the highest management cost in private equity and the lowest in private equity return. We can deduce that Canadian pension funds do not succeed in selecting the best private equity funds nor in monitoring them. This does not seem to be the case for US pension funds which registered the highest return in private equity allocation with the lowest cost. This is probably why they are encouraged to allocate more to private equity.

Our results also show a positive and significant relationship between the size of the pension fund and allocation to private equity but not to equity. This means that bigger –but less concentrated– funds have a higher probability to invest in private equity. More precisely, a 1% increase in the proportion of assets leads to an increase of 0.01% of private equity allocation. We find a significant and positive (at 10%) effect of private sponsorship in private equity allocation.

¹³ Pennachi and Rastad (2011) find that public funds that select high rate of returns (to discount their liabilities) have riskier portfolios.

¹⁴ US public funds, US private and Canadian funds face much tighter rules concerning their liability discount rates.

To summarise, we can deduce that pension funds which allocate to private equity have the following profile: i) they do not use foreign diversification or active management; 2) they are big funds, mainly private that diversify their portfolio in terms of the number of asset classes; iii) they do not take into account the maturity of the members; iv) they have a high discount rate; v) they arbitrate with equity asset classes in term of cost but not in returns and vi) they consider cost and returns originated from private equity.

With respect to VC and LBO allocation, and considering first the variables related to the management of the portfolio, the Tobit model results show just a few differences between the determinants for allocating these funds. Indeed, there is no significant relation between the variable foreign equity over total equity and the allocation to either VC or LBO allocation. Therefore, in general, we can infer that foreign diversification in equities has no effect on the allocation to private equity and in its components.

–TABLE 6 ABOUT HERE–

Similarly, we find no significant relation between the variable of active management in traditional asset classes and allocation to VC. However, we find a negative effect of this variable, though only significant at 10%, on the allocation to leverage buyout. This implies that pension funds which tend to manage their equity and fixed income more actively, invest relatively less in LBO.

Moreover, as is the case for private equity, there is a significant and negative effect between concentration and allocation to both VC and LBO. This implies that the less the portfolio of a pension fund is concentrated, in terms of the number of asset classes, the more its probability is to allocate to these type of assets. More precisely, a 1% increase in the concentration leads to a 0.02% (0.07) decrease in the probability to allocate to VC (LBO). In other words, less concentrated funds turn to private equity (either VC or LBO) rather than equity allocation.

Concerning how liabilities influence allocation to VC and LBO, the Tobit model estimates show no maturity effect for venture capital or leverage buyout. Similarly, the discount rate is not significant in either case.

With respect to costs and returns, we find no relation between equity management cost and exposure in VC. The results show, however, that higher costs derived from equity management increase the probability to allocate in LBO. Equally, pension funds which invest in VC and LBO do not take equity returns into account for their

allocation decision in VC or LBO. As expected, higher returns in venture capital and/or LBO, increases their exposure. In other words, the performance seems relevant to the allocation to VC and LBO.

This result suggests that costs have a positive effect for allocations to both VC and LBO. These results can be rationalized by the fact that pension funds managers seem to believe that performance compensates these high private equity costs, and as such pension funds keep on allocating in private equity regardless of the costs. Bouvatier and Rigot (2013) find the opposite results related to allocation to hedge funds: past performance does not seem relevant but costs negatively affect allocations to hedge funds.

Our results show no relationship between the size of the fund and allocation to venture capital. However, bigger funds have a higher probability to invest in LBO. This result might be explained by the fact that monitoring increases the cost of allocating to LBO. Indeed, the amount of LBO deals is generally bigger than venture capital. Finally, we find no effect of sponsorship in either type of investment.

We can presume that pension funds which allocate to venture capital have the following profile: they do not use foreign diversification, they do not manage equities and fixed income so actively, they have a diversified portfolio in terms of the number of asset classes; they do not take into account either the maturity or the discount rate, they take positively into account for allocations to VC past performance and costs. Most of these characteristics are shared by pension funds which allocate to LBO. However, when these pension funds are larger, they negatively consider active equity management and they take into account costs derived from traditional assets (i.e. equity).

5 Final Remarks

For pension funds, private equity investments may enhance long-term asset-liability management, providing a way to diversify portfolios and to reach higher performance. Moreover, they may have a more general benefit for the general economy. They can be seen as long term investment because they undertake investment in real companies, supplying equity at different stages of their evolution with different structures of funding. However, regardless of its increasing importance, the literature that analyses private equity allocation is very scarce. Based on a reliable, confidential database, we contribute to this limited literature by investigating the main determinants of pension funds investment in

private equity funds, particularly in venture capital and leverage buyouts in Canada and the United States over the 1996-2011 period.

Our results, based on a Tobit model for allocation to private equity, show some important differences with respect to allocation to more traditional assets (i.e. equity). Indeed, defined benefit plans allocating to private equity are bigger, more diversified, mainly private funds. However, even if these funds are diversified in terms of assets, they are not international. They do not consider the age of their members when deciding this type of allocation. This last result is important because it is not in accordance with the life cycle theory, contrary to what we might expect. Furthermore, in accordance with the literature, they present high discount rates, implying an incentive to allocate to more risky assets like private equity. Finally, they arbitrate with equity asset classes and they take into account their own costs and returns which are, in both cases, considerably higher than in equity.

Even though private equity can be distinguished from venture capital and LBO, pension funds investing in one or other may have the main characteristics but quite different objectives that might affect the economy in different ways. This implies that pension funds investing in private equity do not distinguish between these two types of assets, even though funds allocating to venture capital have higher returns and lower costs than LBO, which are, in turn, bigger funds.

Finally, DB pension funds do not give more importance to more innovation oriented venture capital with respect to the more short-term profitability derived from LBO. Therefore, they do not seem to participate in the funding of the economy via illiquid investments (like private equity), whereas they have long term liabilities that give them a strategic advantage to take risks and immobilize capital.

TABLES

Table 1: Number of Funds and total assets under management (thousands and percentage over total assets) by type of Fund and country. 1996-2011

Country	Sponsorship	Number of of Funds	Assets		
			Thousands over the period	% over total	Mean (s.d)
Canada	Private	118	1,690,101.8	19.6%	2,058.59 (2,707.458)
	Public	65	6,949,540.5	80.4%	14,538.79 (28,730.04)
	Total	183	8,639,642.4	100.0%	6,650.99 (18,552.99)
USA	Private	297	10,127,638	31.1%	6,724.86 (12,061.24)
	Public	167	22,457,413	68.9%	19,343.16 (34,264.5)
	Total	464	32,585,051	100.0%	12,263.45 (25,263.19)
Total	Private	415	11,817,739.8	28.7%	5,078.53 (10,083.87)
	Public	232	2,9406,953.5	71.3%	17,942.01 (32,811.33)
	Total	647	41,224,693.3	100%	1,0426.11 (23,426.57)

Table 2: Allocations (in percentage of total assets) by type of Fund and country. 1996-2011

Country	Sponsorship	Equity	Fixed Income	Real Assets	Private Equity	Hedge Fund	Other assets
Canada	Private	56.03%	37.00%	2.58%	0.54%	0.31%	3.54%
	Public	51.17%	38.74%	4.84%	1.49%	0.68%	3.07%
	Total	54.41%	37.58%	3.34%	0.85%	0.43%	3.38%
USA	Private	58.31%	29.80%	3.74%	3.14%	1.59%	3.41%
	Public	55.86%	32.74%	4.77%	2.77%	1.07%	2.77%
	Total	57.28	31.02	4.18%	2.99%	1.37%	3.14%
Total	Private	57.46%	32.48%	3.31%	2.17%	1.11%	3.45%
	Public	54.49%	34.51%	4.80%	2.39%	0.96%	2.85%
	Total	56.30%	33.26%	3.89%	2.26%	1.05%	3.22%

Table 3: Further descriptive statistics by country. Funds allocating and not allocating in Private Equity. 1996-2011

	Allocating in PE			Not allocating in PE		
	Canada	USA	Total	Canada	in USA	Total
Number of funds	77	303	380	153	237	390
Of which private sponsorship (%)	51.04	56.01	55.01	69.24	57.33	63.08
Total assets period	6,658,121.2	29,204,727	35,862,848.2	1,981,521.2	3,526,419.9	5,507,941.1
Of which private sponsorship (%)	11.81	30.61	27.12	45.61	33.73	38.00
Mean assets	15,448.08	16,784.33	16,519.05	2,282.86	3,795.93	3,065.08
in private funds	3,574.6	9,176.7	8,144.5	1,503.6	2,235.9	1,847.5
in public funds	27,828.0	26,303.6	26,633.1	4,036.8	5,896.9	5,147.8
Allocations (%)						
in Equity	53.22 (9.94)	55.87 (12.76)	55.35 (12.29)	57.77 (9.19)	61.08 (12.35)	59.48 (11.06)
in Fixed Income	34.47 (7.50)	29.09 (9.81)	30.16 (9.64)	37.86 (9.15)	32.88 (12.04)	35.29 (11.02)
in Real Assets	5.69 (5.60)	5.06 (4.01)	5.19 (4.38)	1.92 (3.28)	2.76 (3.47)	2.35 (3.40)
in Private Equity	2.57 (3.24)	4.98 (4.29)	4.50 (4.22)	–	–	–
in Hedge Funds	1.11 (3.63)	2.31 (5.15)	2.08 (4.91)	0.30 (1.74)	0.51 (2.32)	0.41 (2.07)
in Other	2.92 (3.90)	2.68 (4.06)	2.72 (4.03)	2.15 (3.26)	2.76 (6.28)	2.47 (5.06)
Mean global performance	7.80 (8.49)	8.48 (12.65)	8.34 (11.94)	7.90 (8.78)	8.05 (12.87)	7.97 (11.10)
Mean equity performance	7.86 (15.53)	8.45 (22.06)	8.33 (20.93)	8.06 (14.82)	9.31 (20.65)	8.69 (18.01)
Mean private equity performance	6.62 (17.86)	11.71 (26.10)	10.70 (26.47)	–	–	–
Mean global costs	0.77 (0.71)	0.89 (1.22)	0.87 (1.00)	0.30 (0.17)	0.41 (0.22)	0.35 (0.20)
Mean equity costs	0.34 (0.28)	0.38 (0.18)	0.37 (0.20)	0.32 (0.13)	0.40 (0.19)	0.36 (0.16)
Mean private equity costs	3.47 (6.15)	3.64 (7.38)	3.61 (7.15)	–	–	–
Discount rate	6.70 (0.79)	7.23 (1.25)	7.12 (1.19)	6.56 (0.99)	7.10 (1.21)	6.84 (1.14)
Maturity	0.95 (0.93)	1.46 (10.81)	1.37 (9.73)	7.44 (44.62)	1.41 (10.00)	4.34 (32.06)
Concentration	0.43 (0.07)	0.44 (0.09)	0.43 (0.09)	0.49 (0.06)	0.52 (0.08)	0.51 (0.07)
Equity and FI in active management	0.70 (0.21)	0.66 (0.18)	0.67 (0.19)	0.75 (0.19)	0.71 (0.23)	0.72 (0.22)
Foreign equities/equities	0.49 (0.12)	0.33 (0.14)	0.37 (0.15)	0.49 (0.14)	0.25 (0.13)	0.36 (0.18)

Notes: (1) Standard deviations are in parenthesis

Table 4: Further descriptive statistics by country. Funds allocating in Private Equity either in Venture capital or/and in Leverage Buy-out. 2006-2011

	Allocating in VC			Allocating in LBO		
	Canada	USA	Total	Canada	in USA	Total
Number of funds	6	42	48	4	30	34
Of which private sponsorship (%)	33.33	54.76	52.08	25.00	40.00	38.23
Total assets	556,795.1	3,384,674.7	3,941,469.8	47,683.4	2,685,041.8	2,732,725.2
Of which private sponsorship (%)	3.92	13.80	12.40	27.39	11.03	11.32
Mean assets	21,415.2	26,237.8	25,428.8	3,178.9	31,221.4	27,056.7
in private funds	2,729.6	6,970.9	6,518.5	2,611.8	8,711.2	7,929.2
in public funds	29,719.9	47,058.4	43,157.2	3,462.4	45,939.6	39,088.4
Allocations (%)						
in Equity	51.99 (11.52)	50.66 (14.92)	50.93 (14.29)	47.29 (6.04)	49.94 (15.60)	49.45 (14.34)
in Fixed Income	34.38 (7.82)	28.13 (11.94)	29.40 (11.49)	33.58 (5.72)	28.21 (12.37)	29.20 (11.60)
in Real Assets	7.68 (8.53)	5.91 (4.55)	6.27 (5.62)	9.95 (4.57)	5.60 (4.72)	6.41 (4.97)
in Private Equity	5.20 (4.87)	6.57 (4.26)	6.29 (4.42)	6.92 (5.02)	7.23 (4.37)	7.18 (4.48)
in Hedge Funds	1.00 (2.25)	5.40 (8.57)	4.50 (7.91)	0.49 (0.71)	5.61 (8.73)	4.66 (8.13)
in Other	0.02 (6.57)	3.33 (4.31)	2.61 (5.05)	1.76 (1.97)	3.40 (4.92)	3.09 (4.56)
Mean global performance	2.81 (7.51)	5.72 (14.51)	5.23 (13.62)	3.25 (7.42)	4.80 (14.42)	4.57 (13.59)
Mean equity performance	1.93 (18.95)	3.33 (27.71)	3.10 (26.40)	-0.15 (19.57)	2.27 (27.97)	1.91 (26.82)
Mean private equity performance	2.49 (13.27)	8.85 (17.52)	7.79 (17.01)	-	-	-
Mean global costs	1.10 (0.54)	1.23 (0.81)	1.22 (0.77)	1.42 (0.50)	1.43 (0.95)	1.43 (0.89)
Mean equity costs	0.31 (0.19)	0.37 (0.18)	0.36 (0.18)	0.40 (0.18)	0.36 (0.17)	0.36 (0.17)
Mean VC/LBO costs	4.74 (3.11)	4.77 (8.74)	4.76 (7.76)	2.14 (1.99)	3.51 (4.57)	3.31 (4.31)
Discount rate	6.12 (0.56)	6.90 (1.28)	6.78 (1.16)	6.20 (0.29)	7.15 (1.12)	7.01 (1.09)
Maturity	1.54 (1.14)	1.03 (0.90)	1.12 (0.97)	1.00 (0.41)	0.99 (0.96)	0.99 (0.90)
Concentration	0.41 (0.08)	0.37 (0.09)	0.38 (0.10)	0.37 (0.06)	0.37 (0.11)	0.37 (0.10)
Equity and FI in active management	0.41 (0.30)	0.60 (0.17)	0.56 (0.22)	0.50 (0.35)	0.63 (0.16)	0.60 (0.21)
Foreign equities/equities	0.54 (0.12)	0.42 (0.17)	0.45 (0.17)	0.54 (0.07)	0.43 (0.19)	0.45 (0.18)

Notes: (1) Standard deviations are in parenthesis

Table 5: Estimated coefficients^a in the Tobit model for Equity, Private Equity (1996-2011) and Venture Capital and LBO (2006-2011). Full sample.

Variable	Equity		Private Equity		Venture capital		LBO	
	Coeff.	z-stat	Coeff.	z-stat	Coeff.	z-stat	Coeff.	z-stat
Management								
Foreign eq./eq	-0.020	-1.41	0.000	0.00	-0.004	-0.65	0.003	0.18
Concentration	0.748	34.54	-0.171	-18.93	-0.022	-1.96	-0.067	-2.04
Equity and FI in active	-0.007	-0.72	-0.009	-2.02	-0.007	-1.29	-0.021	-1.79
Liabilities								
Maturity	-0.015	-2.65	-0.004	-0.89	-0.018	-0.45	-0.093	-0.57
Discount rate	0.806	5.43	0.175	3.06	-0.054	-0.64	0.217	1.14
Costs and returns								
Returns equity	0.029	1.37	-0.018	-2.13	-0.007	-0.71	0.009	0.34
Cost equity	0.024	2.81	0.014	1.80	-0.002	-0.37	0.016	1.99
Returns PE	–	–	0.008	3.55	–	–	–	–
Cost PE	–	–	0.014	1.80	–	–	–	–
Returns VC	–	–	–	–	0.019	3.98	–	–
Cost VC	–	–	–	–	0.038	3.56	–	–
Returns LBO	–	–	–	–	–	–	0.037	2.49
Cost LBO	–	–	–	–	–	–	0.257	5.50
Other								
(log) size	0.001	0.42	0.011	8.35	0.000	-0.03	0.005	1.94
Public ^b	-0.009	-1.65	-0.613	-1.85	0.202	0.64	0.983	1.37

Notes: (a) The estimated coefficients measure the marginal effect of the independent variable on the latent variable.

Table 6: Estimated coefficients^a in the Tobit model for Equity and Private Equity. 1996-2011. Canada and United States _____

Variable	Equity				Private Equity			
	Canada		United States		Canada		United States	
	Coeff.	z-stat	Coeff.	z-stat	Coeff.	z-stat	Coeff.	z-stat
Management								
Foreign eq./eq	-0.016	-0.92	-0.042	-2.06	-0.007	-0.69	0.000	0.06
Concentration	1.010	29.50	0.692	24.93	-0.146	-7.97	-0.169	-16.26
Equity and FI in active	-0.016	-1.44	-0.006	-0.48	0.010	1.43	-0.017	-3.20
Liabilities								
Maturity	-0.010	-2.12	-0.039	-2.78	-0.059	-0.72	-0.003	-0.65
Discount rate	0.730	3.26	0.834	4.43	-0.022	-0.16	0.216	3.42
Costs and returns								
Returns equities	0.033	1.21	0.026	0.92	-0.009	-0.55	-0.018	-1.90
Cost equity	0.001	0.11	0.041	3.02	0.019	5.26	0.022	4.76
Returns PE	–	–	–	–	-0.003	-0.57	0.009	3.79
Cost PE	–	–	–	–	0.050	3.03	0.006	0.74
Other								
(log) size	0.004	1.38	0.002	0.57	0.009	4.87	0.010	6.48
Public ^b	-0.004	-0.68	-0.010	-1.30	-0.142	-0.38	-0.937	-1.90

Notes: (a) The estimated coefficients measure the marginal effect of the independent variable on the latent variable; (b)

Table 7: Further descriptive statistics by country. Funds allocating in Private Equity either in Venture capital or/and in Leverage Buy-out. 2006-2011

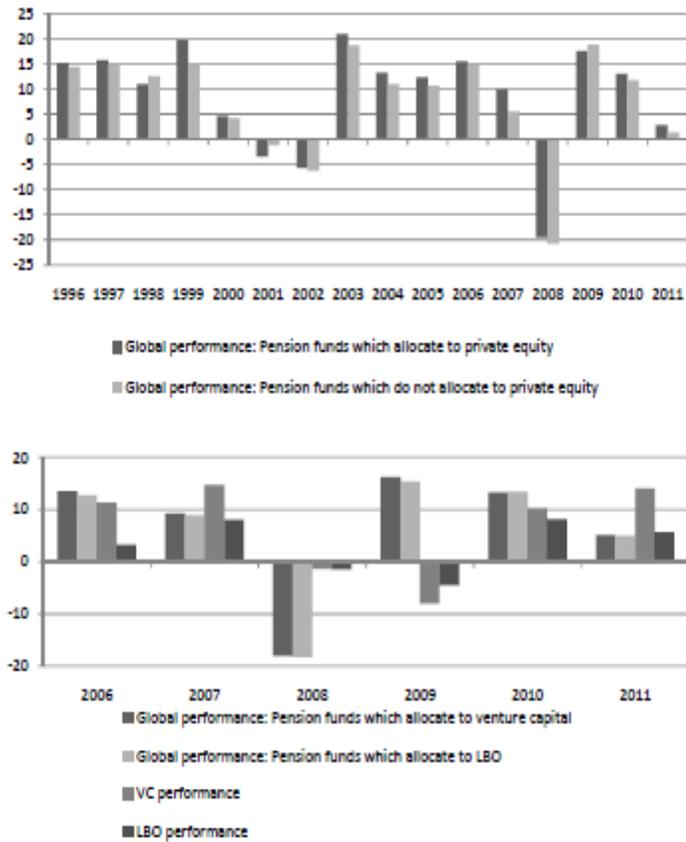
	Allocating in VC			Allocating in LBO		
	Canada	USA	Total	Canada	in USA	Total
Mean private equity performance	2.49 (13.27)	8.85 (17.52)	7.79 (17.01)	3.02 (11.81)	7.87 (19.66)	7.14 (18.74)
Mean VC/LBO performance	2.10 (12.51)	6.75 (16.59)	5.97 (19.04)	0.66 (7.10)	5.74 (12.35)	4.99 (11.83)
Mean private equity costs	3.88 (2.66)	3.69 (2.43)	3.73 (2.46)	5.74 (3.76)	4.44 (4.80)	4.63 (4.66)
Mean VC/LBO costs	4.74 (3.11)	4.76 (8.74)	4.76 (8.07)	4.70 (4.10)	4.08 (5.01)	4.17 (4.87)

Notes: (1) Standard deviations in parenthesis

6 Appendix

–TABLE 6 ABOUT HERE–

Figure 1: Performance Pension Funds



7 References

- Aglietta, M. & Rigot, S. 2009a. *Crise et rénovation de la finance*. Paris: Odile Jacob.
- Aglietta, M. & Rigot, S. 2009b. The Regulation of Hedge Funds under the Prism of the Financial Crisis: Policy Implications. *Louvain Economic Review* 75(1): 5-34.
- Aglietta, M., Brière, M., Rigot, S., & Signori, O. 2012. "Rehabilitating the role of active management for pension funds", *Journal of Banking & Finance*, 36(9), 2565-2574.
- Amenc N., Malaise, P., Martellini, L. 2004. Revisiting Core-Satellite Investing. *Journal of Portfolio Management* 31(1): 64-75.
- Amenc N., Martellini L., Ziemann V. 2009. "Alternative Investments for Institutional Investors, Risk Budgeting Techniques in Asset Management and Asset-Liability Management", *The Journal of Portfolio Management*, 35(4), 94-110.
- Andonov A., Bauer R., Cremers M. 2013. "Fund Asset Allocation and Liability Discount Rates: Camouflage and Reckless Risk Taking by U.S. Public Plans?", Working Paper.
- Bauer R., Cremers, M. and Frehen R. 2010. Pension Fund Performance and Costs: Small is Beautiful. MPRA Paper No. 23556.
- Bikker J.A., Broeders D.W.G.A., Holanders D.A., Ponds E.H.M. 2011. "Pension Funds' Asset Allocation and Participant Age: A Test of the Life-Cycle Model", *The Journal of Risk and Insurance*, 79(3), 595-618.
- Bodie, Z. 1990. "Pensions as Retirement Income Insurance," *Journal of Economic Literature*, American Economic Association, 28(1), 28-49.

Bottazzi, L. & Da Rin, M., Hellmann, T., 2010. "The Importance of Trust for Investment: Evidence From Venture Capital", Discussion Paper 2010-49, Tilburg University, Center for Economic Research.

Bouvatier V., Rigot S. 2013. Pension Funds' Allocation in Hedge Funds: an Analysis of US Defined Benefit Plans, *Applied Economics* , 45 (6): 3701-3710.

Brealey, R., Myers, S., Allen, F. 2006. *Corporate finance*. Eighth edition. New York, NY: McGraw Hill/Irvin

Brinson, G., Singer B., Beebower G. 1991. "Determinants of Portfolio Performance II: An Update", *Financial Analysts Journal* 47(3): 40–48.

De Dreu, J. and Bikker, J. 2009. Pension Fund Sophistication and Investment Policy. DNB, Working Paper 211.

Della Croce, R. 2012., "Trends in Large Pension Fund Investment in Infrastructure", *OECD Working Papers on Finance, Insurance and Private Pensions*, No.29, OECD Publishing.

French, K. 2008. Presidential address: The Cost of Active Investing. *The Journal of Finance* 63(4), 1537-1573.

Gompers P. & Kovner A., Lerner J. & Scharfstein D., 2006. "Skill vs. Luck in Entrepreneurship and Venture Capital: Evidence from Serial Entrepreneurs," NBER Working Papers 12592, National Bureau of Economic Research, Inc.

Hege U., Palomino F., Schwienbacher A., 2009. "Venture capital performance: the disparity between Europe and the United States," MPRA Paper 39551, University Library of Munich, Germany.

Hinz R., Heinz P. R., Antolín P., Yermo J., 2012. Evaluating the financial performance of pension funds. World Bank , Directions in development.

Jensen M. C., 1989. "Active Investors, LBOs, and the Privatization of Bankruptcy," Journal of Applied Corporate Finance, Morgan Stanley, vol. 2(1), 35-44.

Lerner J., 2001. "Venture capital and private equity: a course overview", Harvard business school Working Paper.

Mac Kinsey Global Institute Report. 2007. *"The new power brokers: how oil, Asia, hedge funds, and Private equity are shaping Global capital markets?"*, October

Metrick M., Yasuda A., 2010. "Venture Capital and Other Private Equity: A Survey," NBER Working Papers 16652, National Bureau of Economic Research, Inc.

Monperrus-Veroni, P. 2009. Les fonds de pension dans la crise. *Revue de l'OFCE* 110: 221-254.

OECD, 2013. Pension Markets in Focus.

OECD, 2012. Pension Markets in Focus.

Pennachi G. and M. Rastad. 2011. "Portfolio allocation for public pension funds", Journal of Pension Economics and Finance, 10 (2), p 221-245.

Phalippou L., Gottschalg O., 2009. "The Performance of Private Equity Funds," *Review of Financial Studies*, Society for Financial Studies, vol. 22(4), 1747-1776.

Preqin Investor Network. 2013. Global Alternatives Report

Rauh, J. 2009. "Risk Shifting versus Risk Management: Investment Policy in Corporate Pension Plans", *Review of Financial Studies*, 22, 2687-2733

Rigot, S. & Tadjeddine, Y. 2011. Emergence of a New Regulation: Informational Disclosure Modalities in The Hedge Fund Opacity World. *International Economics*, 123 (3): 161-194

Severinson, C., Yermo J. 2012. "The Effect of Solvency Regulations and Accounting Standards on Long- Term Investing: Implications for Insurers and Pension Funds", *OECD Working Papers on Finance, Insurance and Private Pensions*, No. 30, OECD Publishing.

Sharpe, W. & Tint, L. 1990. Liabilities: a New Approach. *Journal of Portfolio management* 16(2): 5-10.

Shleifer A., Vishny R.W., 1997. " A Survey of Corporate Governance," *Journal of Finance*, American Finance Association, vol. 52(2), 737-83, June.

U.S. Government Accountability Office (GAO). 2012. Defined Benefit Pension Plans : Recent Developments Highlight Challenges Of Hedge Fund And Private Equity Investing GAO-12-324 Report.

Yermo, J. (2007), "Reforming the Valuation and Funding of Pension Promises: are Occupational pension Plans Safer?", *OECD Working Papers on Insurance and Private Pensions*, No. 13, OECD Publishing.