Corporate risk and the asset allocation of corporate pension funds

United States

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Abstract

This paper describes the relationship between corporate risk and the asset allocation of corporate pension funds in the United States using panel data analysis for the period 2002 - 2010. Measures of corporate risk as well as the proportions invested in equity and bonds are collected from the balance sheet and annual report of all the companies which are included in the S&P 500. For the approximation of the asset allocation, solely the investment in equities has been used, where the investment in equities can be seen as an aggressive investment strategy and the investment in bonds as a conservative investment strategy. The corporate risk factors are used according to the corporate balance sheet view, where pension funds can be seen as a part of the sponsoring company. This means, that the state of the sponsoring company affects the asset allocation of the corporate pension fund. In order to analyze this relationship several corporate risk factors have been used, namely a firm's: Income volatility, Profitability, Corporate Gearing, Tax Paying Status and the Size of the Pension Scheme as well as the Size of the Firm. Besides corporate risk factors, two traditional risk factors have been used, namely: Maturity and Funding Ratio. The final results indicate that only the profitability of the sponsoring company as a corporate risk factor and both maturity and funding ratio affect the investment decisions of corporate pension funds in the United States during the period 2002 - 2010. During the period 2008 - 2010 which stand for the credit crisis, the corporate pension funds adopt a more conservative investment strategy. This means that in a period of economic instability there are additional risk factors which causes the corporate pension funds to adopt a certain investment strategy.

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1 Introduction

The U.S. pension system can be characterized as a combination of social insurance, private pensions and personal savings. This system is often called the three-legged stool (Aaron (2009)). The first pillar consist of The Social Security, which handles the largest part of the income from pensions of both the vast majority of households with a modal income and all the households with an income below modal. The second pillar consists of the pensions provided by employers and the third pillar consists of individual savings besides the pensions provided by the employers. There is also a fourth leg, namely public assistance, that serves income for the elderly, blind, and disabled. Since 1980, significant changes have occurred in the kind of employment-based retirement plan that workers participate in; Defined benefit (so called traditional pension) plans have declined, while defined contribution (401(k)-type) plans have grown (Mosisa and Hipple (2006)). The age of retirement will rise from the age of 65 to the age of 67. Therefore employees who want to quit before their age of retirement, can expect a lower payment. A second innovation, is that the benefits in the first pillar will get taxed, because the threshold where benefits get taxed does not rise along with inflation. This will result, that in the near future the first pillar will become smaller and the second pillar will become even more important, so therefore the task of Social Security will become less important. The second pillar is somewhat different from the same pillar in The Netherlands. According to Ambachtsheer (2007) the pension funds in The Netherlands are independent entities with their own board and are not dedicated and dependent on the actual profitability and riskiness of the sponsoring company. This is a contradiction to the pension fund setup in the United States. Under the second pillar the pension funds are a part of an individual company. This means, that for instance Microsoft owns a pension fund, which results in the fact that pension fund managers will act in the interest of the sponsoring company itself. The investment decisions that pension funds make are therefore issued by the sponsoring company itself. The defined contribution plans (401(k)-type) were launched during the 80's. During this period these schemes were seen as a complement of the already existing collective pension schemes. Since the launch of these pension schemes, the United States pension market has been changed remarkably.

According to Aaron (2009) the United States was one of the last nations who developed a national social insurance pension. Until the year 1950 the Social Security covered barely half the labor force. A complementary system of private pensions and tax-favored private saving plans grew, which enabled workers to retire earlier. An increase in the proportion of workers lifetimes spent in retirement was an explicit objective of the United States. The number of active participants in U.S. DB plans was essentially flat from about the mid-1970's through the mid -1980's, while the number of DC participants grew rapidly. By 2004, about 65 million workers were covered by DC plans compared to 25 million in DB

plans. Similarly the size of assets in DC plans has shown considerable growth. According to data in the U.S. Flow of Funds Accounts, in 1985, private-sector DB plans held about US$800 billion in total financial assets, while private-sector DC accounts contained around US$425 billion.

In this paper an analysis is made in order to investigate the investment decisions of corporate pension funds in the United States (US). Several factors are analyzed in order to capture the relationship between the corporate pension fund's investment strategy of US companies which are included in the S&P 500 and several corporate and pension related factors, which are accounted on the balance sheet or annual report of these companies. The added value of this analysis is the use of panel data analysis for the period 2002 - 2010, where most researchers used cross-section instead. The advantages of using panel data analysis will be discussed briefly in Section 4.1. There are different perspectives in describing risk which is contributed to the investment decisions of corporate pension funds. Eventually this paper aims at describing the effect of corporate risk on the asset allocation of pension funds, in the form of investment in equities using panel data analysis. The investment in equities is used to be able to describe the risk attitude of corporate pension funds and since the investment in bonds and equities within the US are negatively correlated (will be further explained in Section 5), the investment in bonds can be excluded. When corporate pension funds lower their investment in equities, the investment in bonds will rise. Since bonds and equity differ in riskiness, it is possible to analyze whether a pension fund adopts a more conservative or aggressive investment strategy. The main result of this paper is, that corporate risk only describes a part of the total risk attitude of corporate pension funds. Profitability which stands for a corporate risk factor and both the maturity and funding ratio affects the investment decisions of corporate pension funds in the United States during the period 2002 - 2010. This is in line with the corporate perspective, where the assets and liabilities of a corporate pension fund can be seen as part of the total assets and liabilities of the sponsoring company, but this literature is only partially supported by the results. The credit crisis affected the corporate pension funds investment decisions. During the period 2008 - 2010 it can be seen that the corporate pension funds adopt a more conservative investment strategy. Therefore the risk of a pension fund is not solely the risk the sponsoring company it wishes to offset.

The remainder of this paper is structured as follows. In Section 2 the pension system itself as well as the US pension system is characterized. Section 3 points out the literature behind earlier research concerning the corporate risk factors. In this section it is explained, why a particular risk factor is used in the analysis and which effect is expected. Section 4 continues with the methodology that is used in order to analyze the risk appetite of corporate pension funds within the US. The data that is used in order to investigate several relationships between corporate factors and the pension asset allocation is described in Section 5. Finally in Sections 6, 7 and 8 respectively the results are analyzed, discussed and concluded.

2 Literature Review

This section reflects the literature which concerns the pension market as a whole and the characteristics of the corporate pension market within the United States. It starts with an overview of the characteristics of the pension plan itself, so the main attributes of a pension scheme and a pension fund. Next the literature behind different perspectives concerning the asset allocation of pension funds is described. The main purpose of these perspectives is to get an overview of the most useful methods to analyze a pension fund and which risk attitudes are relevant for this paper to investigate and which are not.

2.1 Pension Plans

A pension plan in the United States can be characterized by an employee benefit plan which is established by an employer or by an employee organization, that provides retirement income. There are a number of types of retirement plans, including the 401(k) plan and the traditional pension plan, known as a defined benefit plan. Retirement plans may be classified either as a defined benefit or as a defined contribution. This classification is made according to the determination of the benefits. A defined benefit plan guarantees a certain payout at retirement according to a fixed formula which usually depends on the members related salary and the number of years of membership participating in the plan. A defined contribution plan will provide a payout at retirement that depends on the amount of income contributed and the performance of the investment vehicles utilized. Some types of retirement plans, such as cash balance plans combine features of both defined benefit and defined contribution plans. These plans are often referred as hybrid plans. Such plan designs have become increasingly popular in the US since 1990. Examples include Cash Balance and Pension Equity plans.

2.1.1 Defined Benefit

According to Broadbent et al. (2006) the promised payout in a traditional Defined Benefit (DB) plan, is commonly based on a formula linked to the wage or salary of an employee. Employees are promised a monthly payment from the date of retirement until their death. The formula is most of the time expressed as a percentage of nominal earnings for each year of his/her participation. The structure of the payments, is that in final salary plans the expected benefit is designed to replace a percentage of final salary. The replacement rate varies across retirement plans, but on average the most DB plans provide a replacement ratio between 60-70 percent of an employees' final salary. The DB plan is imposed for several reasons. One important implication of a DB plan is that retirees should be able to enjoy a similar living standard to that which they had when they were employed. Thus, pension benefits should be linked to employees' salary at or near their retirement to ensure an expected standard of life (Blake (2003)). The other important implication is that, in a DB plan, the pension benefits are independent of both income from the pension fund investment and the amount of contribution made into the plan. Although employees do usually make a contribution into the plan, it is the employer's obligation to make a sufficient payment to cover the risk if the scheme is under-funded. Therefore, the obligations of a DB plan show similar characteristics as the long-term liabilities of the employing companies, where the employer faces the risk that the costs of pension benefits may exceed the amount that was expected.

The setup of the DB plan imposes different types of risk on employers and employees. The employer bears the risk that DB plan assets may fall short of what is required to meet this obligation at the time of the retirement of the employee, which is expressed as the replacement rate of the employees final salary. Employers also face longevity risk, because they are obliged to offer DB benefits as a deferred life annuity. Longevity risk is the risk, that the participators of the DB plan on average will live longer than expected, this will increase the time period for paying the benefits. Employees on the other hand bear the risk of inflation, but perhaps the biggest risk is accrual risk. This can be seen as the fact that benefits have traditionally been loaded towards long-tenured employment relationships. Any changes which affects the benefits that occur towards the final years of work (including changes to the defined formula) may result in the fact that accrual benefits fall short of a employee's expectation.

2.1.2 Defined Contribution

Besides the Defined Benefit plan there is an enormous rise in Defined Contribution plans (DC), where the amount of contributions in a DC plan made by both employees and employer is defined as a specific fraction of salary (e.g. 10%). Compared to a DB plan,

the contributions are generally a fixed percentage of earnings in stead of the benefits. The retirement income that a DC plan will provide is unknown. For a DB plan it is the other way around, the benefits to the employee are fixed instead of the contribution. The benefits to the employees during their working career depends on the contributions during the period of work and the investment returns earned. In a DC plan this generally means that the DC plan assets are controlled by the worker. A worker may be able to leave the plan assets under the administration of a previous employer, transfer the assets to a new employers' plan or transfer the assets to an individual retirement savings account. Similar to DB plans, DC plan benefits must be vested. If the plan is terminated prior to the vesting date, only employee's contributions and interest are returned. The most common type of defined contribution plan is a savings and thrift plan. Under this type of plan, the employee contributes a predetermined portion of his or her earnings to an individual account, all or part of which is matched by the employer. The United States specifies a defined contribution plan as a plan which provides for an individual account for each participant and for benefits based solely on the amount contributed to the participants account, and any income, expenses, gains and losses, and any forfeitures of accounts of other participants which may be allocated to such participants account.

2.1.3 Hybrid Pension Plan

According to Broadbent et al. (2006) recently there has been a development in the United States, with quite a number of DB plans converting to a hybrid plan that combines the features of both DB and DC plans. This hybrid plan is treated as a traditional DB plan for tax, accounting and regulatory purposes, but the benefits are expressed in terms of notional account balances. The pension benefit is expressed as a lump sum amount that can be expired upon retirement, at plan-termination, or if a worker changes employers. The most popular hybrid plan is the so-called cash balance (CB) plan which was introduced in the US. Pension benefits in CB plans typically accrue much more evenly over time compared with the traditional DB benefits. Thus, like DC plans, CB plans allow workers to avoid the accrual risk associated with traditional DB plans, thereby providing more value to workers who might anticipate changing employers or moving in and out of the labor force over their career. Employers bear the responsibility to maintain funding for benefits accrued under CB plans, so workers also avoid investment risk.

2.2 Pension asset allocation strategy (Investment strategy)

There is extensive literature concerning the most useful pension asset allocation strategy. But the question remains, which one is the most useful. The theory concerning pension asset allocation mainly differs in the way risk is analyzed. Risk can be seen as the risk

concerning the asset allocation of the pension fund, but also the associated risk concerning the sponsoring company. The main differences in both perspectives will be analyzed in this section, where a distinction will be made between the traditional and the corporate perspective as well as the literature concerning asset liability management.

2.2.1 The traditional perspective

According to the "traditional perspective", pension funds are entirely separated from the corporation itself and its shareholders and should be managed without the interest of the corporation and its shareholders. Within this context funding decisions should be based only on the expected future stream of employee pension liabilities and despite of the corporate financial condition and/or policy. For this reason, investment decisions within the fund should be made only in the best interests of the beneficiaries. It is quite unclear what asset allocation policy would be the best for beneficiaries. For example, if the defined benefit liabilities are really fixed, so beneficiaries would not and could not share in any surplus of pension assets over liabilities, then the beneficiaries would want a well-funded plan to be invested in the least risky assets, presumably fixed income securities. If, on the other hand, the beneficiaries are able to participate in the ownership of such a surplus, as Miller and Scholes (1981) and Bulow and Scholes (1983) have argued, then the optimal asset allocation would be much less clear and, in principle, could include virtually any mix of stocks and bonds.

There are however a number of criticisms of this traditional view of the pension fund asset allocation. At first, according to Bulow and Scholes (1983) this view is not consistent with the current accounting standards (FRS 17 and IAS 19). Under both accounting standards a recognition of net assets or liabilities of DB and DC plans on the corporate balance sheet is required. Secondly, the pension fund's performance on average affects the performance of firms more than it affects the scheme members. Thirdly, many sponsoring companies appoint the trustees. This results in the fact, that the trustee is not able to ignore the interests of the employer nor the financial condition of the sponsoring company. Generally a firm is operating primarily for the best interest of the shareholders, and therefore, the asset allocation of a pension fund should be recognized as an integral part of the overall corporate financial policy.

2.2.2 Asset Liability Management (ALM)

According to Ito (1995), besides pension funds' incentive of providing funding for the pension liabilities, the pension fund's sponsor also has a secondary goal. This goal is the achievement of an earnings-spread, since this earnings-spread is capable of reducing the

requirement for future contributions. Ito (1995) implies that asset and liability management reduces risk and can save the sponsor money. To be able to meet the long-term future obligation, Chernoff (2003) suggests that pension fund management should all be based on the view of asset liability management. In this research it was also suggests that pension fund managers should avoid under-performances and asset/liability mismatches every year, in order to follow an appropriate ALM. The popularity of ALM in pension funds seems to have risen in recent years. For a pension scheme, an ALM strategy can be constructed by investing pension assets in securities that would generate a future cash flow which is positively correlated with the accrued pension liabilities and benefits. The underlying objectives are to gradually smooth the volatility of surpluses and deficits and to stabilize the employer contributions over time.

According to Feinberg (2002), ALM should be the basis of any pension fund's investment policy. This research reports that many pension funds are now conducting more asset/liability studies mainly due to their funded status. Many pension fund managers were interviewed by Feinberg (2002) to learn the reason for the recent increase in the popularity of the asset/liability studies. The demand for these asset/liability studies has occurred due to various reasons, including: market conditions; switching from defined benefit funds to defined contribution funds; additional contributions; increased liabilities due to the baby boomers retirement and changes in the future benefits structure.

2.2.3 The corporate perspective

The literature concerning the corporate perspective (augmented balance sheet view) was introduced by Bagehot (1972) who argued that the pension liabilities of a DB and DC plan can be viewed as a part of overall corporate financial policy. In this view pension liabilities are just one more set of corporate liabilities and the pension assets as the collateral for those liabilities are just one more type of corporate assets. This perspective concerns how to manage the firms' extended balance sheet, including both the normal assets and liabilities and the pension related assets and liabilities in the best interest of the shareholders. From the corporate financial perspective, the beneficiaries are protected by the government and the corporate pension decisions become a game between the corporation and various government agencies and interests, a game that can be and should be thought of as an integral part of corporate financial policy.

Pension funds are a part of the balance sheet. This means, that pension liabilities and pension assets do not only affect the pension asset allocation, but also the value of the sponsoring firm. The supporting theory is an extension of the proposition of Modigliani and Miller (1958) developed for pension funds by Black (1980), where it is stated that a firm can restructure its corporate balance sheet to offset the changes in pension investment

strategy. A firm can reduce the ratio of pension assets invested in equity to bonds for example, but buy back its corporate equities by issuing more bonds. So, although the pension fund is less risky, the corporate balance sheet is more geared, and therefore the whole risk profile of the firm remains unchanged. Concerning the firm's shareholders, it is always possible to restructure their own investment portfolio to offset risks if they think the risk involved in pension asset allocation is not optimal. Hence, the equity risk of a pension fund, the gearing risk of a corporate balance sheet and the personal portfolio risk can all be adjusted. It, therefore, suggests that the pension assets allocation is irrelevant in determining investment strategy, and the capital structure of a firm as a whole should be considered.

3 Theoretical framework: Corporate Perspective and Pension Asset Allocation

The literature concerning the corporate risk indicators which all affect the pension asset allocation over time according to the corporate perspective, will be described in this section. These factors are all part of the final analysis. How these factors are used in order to find a relationship between for instance the pension scheme maturity and the investments in equities can be found in Section 4. Based on the literature several hypotheses are formulated, which are tested with the use of panel data regression analysis. These hypotheses describe the relationship between the risk factors and the investment in equities, which gives an indication of the risk appetite of corporate pension funds.

3.1 Choice between asset classes

The investment decisions of pension funds are decisions which are made in order to finance a stream of consumption over a worker's lifetime. According to Campbell and Viceira (2002) long-term inflation-indexed bonds are risk-less assets for long-term investors and stocks can be safer assets for long-term investors than for short-term investors. A long-term investor may be willing to hold a higher proportion of stocks and inflation-linked bonds and less cash compared to a short-term investor. There have been many surveys on the asset allocation of pension funds in several countries. Papke (1991) analyzed the asset allocations of US private pension funds, both for defined benefit and defined contribution plans. This research found, that the large single employer plan allocates 60% of their pension assets to fixed income and 20% of their pension assets to equities. Smaller single employers allocate 50% of their pension assets in fixed income and 20% in equities.

Healey and Rozenov (2004) analyzed the trend in asset allocation within the defined benefit funds in the United States. This research found, that during the period 1991 - 2001, the equity allocation increased from 48% in 1991 to 57% in 2001.

There are also considerable researches within the United Kingdom. Blake et al. (1999) analyzed the asset allocation of more than 300 U.K. pension funds. This research found a high percentage invested in equities (78%) compared to the percentage invested in fixed income (14%). This research differs from the rest, since it analyzes the performance, rather than the asset allocation.

The main focus of this paper is concluding why pension funds allocate their assets over different asset classes. The following sections describe the literature concerning the decisions of corporate pension funds. Why do pension funds allocate their assets the way they do.

3.2 Maximizing expected returns

A wide excepted method to manage pension funds is referred as "Maximizing Expected Returns". The liability structure of both DB and DC plans are assumed to be very long. Therefore investment decisions need to be made on the long-term and the short-term may for the same reason be seen as less important. So a high return is important on the long run. From the view of both employee and employer a higher long-term return can bring them substantial benefits. For example, the resulting surpluses (which resulted from the higher long-term return) can be used by employers in order to improve the retirement benefits of employees (Booth (2005)).

As a general rule, it is accepted that the return on equities is higher compared to the return on fixed income as a instrument for pension fund investment. To follow up the strategy "maximizing expected returns", pension funds should invest their assets substantially in equities, rather than investing in bonds. The theory behind this phenomenon is called the "equity risk premium". This theory explains, that on the long-run returns from investing in equities are higher than those invested in bonds. According to Benartzi and Thaler (1993) the difference between the returns of both equities and bonds is roughly 4% on average. However in earlier research done by Booth (2005) it was found, that the equity returns are highly volatile. These high volatilities results in risk effects which are not desired by the pension fund. On the short-term it is accepted, that investing in equities is riskier compared with investing in bonds. For this research however it is more interesting to analyze the pattern in risk on the long-term, since pension asset allocation results in decisions for a lifetime. On a short-term period it has been argued that equities would provide unfavorable return over a short-term period. However when the length of

investment rises, equity returns tend to revert to a long-run upward trend. This theory suggest; the longer the time period, the larger the risk reduction. According to Kritzman (2002), the standard deviation of equity returns will decrease when the duration of investment increases. The theories behind mean reversion of stock prices has been analyzed by several authors, which results in many contradicting results. There is both evidence for and against the hypothesis of mean reverting stock prices. The conclusion from these contradictory results is that mean reversion is theory, which is still used in many debates. There is no strong evidence for or against the statement.

Moreover the investment horizon is the most important aspect of this theory. According to Sutcliffe (2005) the duration of a pension scheme has an important implication for the asset allocation between bonds and equities. Particularly, if most beneficiaries are pensioners or a scheme is closed to new entrants, the length of pension investment is relatively short. Therefore fully adopting the equity risk premium is not suitable, so fund managers may look further to find a compromise between maximizing expected return and assets liability matching.

3.2.1 Investment horizon

The length of horizon is an important factor in the willingness to take equity risk. This statement is further approved by Campbell and Viceira (2002). This research found, that when planning their asset management, long-term institutional investors take the investment horizon into account. They compared the investment horizon with a demographic structure. A pension fund with a younger demographic structure should have a positive influence on the percentage invested in equity. The explanation behind this is, that when people believe in the mean reversion of stock prices, meaning that on the long-run returns on equity will revert to a long-run upward trend, investors with a younger demographic structure are willing to take advantage of the equity premium puzzle and therefore invest more in equity. On the other hand a more mature demographic structure has a shorter investment horizon, this will result that they cannot take advantage of the equity premium in the long run. This will result, that the more mature demographic structure will invest a higher percentage in bonds. Another argument is that an older age structure results in higher benefit payments to the employees, therefore pension funds require a liquid asset structure and invest in less volatile assets.

A younger age structure implies a longer investment duration, a young individual has a longer investment horizon compared with an old individual. This results in the fact, that a younger age structure means a large proportion of liabilities which are final salary related. The idea behind this relationship lies in the field of behavioral finance. The paper written by Taylor and Allen (1992) describes a model with two individuals, namely old and young. It suggests: labor income when young and consumption when old. Young people invest in the more risky asset, namely equities and the old consume using bonds. Being young there is a longer horizon, so the investment strategy is therefore less risky. Equity is closely correlated with salary increases as well as price inflation, and therefore firms have the incentive to march the assets and liabilities by investing more in equities and less in bonds. On the other hand, a pension plan with an older age structure should consist of a larger proportion of retired pensioners. Since the liabilities for pensions in payment are less salary linked, matching the assets and liabilities means investing more pension related assets in bonds. Despite of research by Bodie et al. (1987), most empirical evidence present a relatively consistent result. Pension schemes are willing to take more equity risk when they have a younger scheme age structure reflecting a longer investment horizon. The aging of pension schemes leads to increased risk aversion when fund managers make investment decision, so less engagement in equities.

Alestalo and Puttonen (2006) analyzed the Finnish pension funds. Their results illustrated a significant negative relationship between holdings of equities and the aging of pension schemes measured by the level of benefits payout.

In the United Kingdom the Pension Protection Fund and the Pension Regulator used the current pension liabilities as a percentage of total liability to capture the pension schemes' age structure. This resulted in a significant positive relationship between average age of scheme members and proportion of bond investment as well as a significant negative correlation between average year and proportion of equity investment.

Hypothesis 1; A pension plan with a longer investment duration (low maturity) tends to invest more in equities and less in bonds.

3.2.2 Pension scheme solvency

Besides maturity, the solvency of a pension scheme is also a measure of risk concerning the pension scheme itself. Pension schemes solvency captures the riskiness which the pension scheme bears on the sponsoring company. The funding ratio is usually used as the measure which is capable of capturing the pension schemes solvency. According to Friedman (1984) pension funds with a high funding ratio, so a high scheme solvency level, are willing to take more equity risk in their portfolio. Friedman (1984) stated that as long as the solvency

level maintains high, pension fund managers, who usually like outperforming investments, tend to feel secure to take more equity risk. On the other hand, fund managers would offset the risk of low scheme solvency by adopting a more conservative investment strategy, therefore investing more in bonds. In addition, a low pension scheme solvency could be generally due to the bad performance in stock markets in recent years. Therefore, schemes with a low solvency level tend to match their assets and liabilities by shifting to invest more pension assets in bonds.

This relationship is an extension of the traditional perspective discussed in Section 2.2.1, where the performance of the sponsoring company does not affect the choices and limitations of the fund managers. The performance of the fund managers is the only factor which affects the solvency of the pension fund. However the results from this analysis showed no significant effect on the pension asset allocation. In a later research, Bodie et al. (1987) did capture this effect for the pension funds in the United States. This research found, that the funding level of a pension fund has a significant effect on the pension investment strategy. Pension funds with a lower funding ratio (i.e. lower scheme solvency) tend to invest a higher percentage in bonds, compared to equities. This means, that when a pension fund faces a low funding ratio, it is less willing to take equity risk.

In the United Kingdom, the Pension Protection Fund analyzed the same relationship. This research found, that firms with a well funded pension scheme invest a higher percentage in equities, compared to less well funded schemes. However this research focused primarily on the investment in equities, in stead of the asset allocation in both equities and bonds. So it is not clear, whether the less well funded schemes invest more in bonds.

Hypothesis 2; A pension plan with a high level of solvency will invest a higher percentage of their pension assets in equities and less in bonds.

3.3 Corporate risk

Since the view of the pension scheme's demographics is based on the traditional independent balance sheet view, this view alone cannot explain the attitude of a firm towards risk. Since this view ignores the position of the sponsoring company and the interest of shareholders, other factors need to be analyzed as well. As explained in Section 2.2.3 the corporate balance sheet view takes the liabilities, profits and firm-specific risk into consideration. The idea is, that since pension fund managers are employed by a sponsoring company and as long as the deficits of the pension scheme are reported on a corporate balance sheet, fund managers need to take the risk-tolerance of a firm towards the volatility of equity into account. The risk offsetting effect, which is a theory described by Friedman (1984) argues that firms want to offset corporate risk by following a more conservative

strategy. This means investing more in bonds, compared to equity. In the following section the literature behind the corporate risk factors are explained. This research uses corporate gearing, income volatility, profitability and the size of the firm and the size of the pension scheme.

3.3.1 Corporate Gearing

Corporate gearing stands for a general term describing a financial ratio that compares some form of owner's equity (or capital) to borrowed funds. Corporate gearing is a measure of financial leverage, demonstrating the degree to which a firm's activities are funded by owner's funds or creditor's funds. The higher a company's degree of leverage, the more the company is considered risky. As for most ratios, an acceptable level is determined by its comparison to ratios of companies in the same industry. A company with a relatively high gearing (high leverage) is more vulnerable to downturns in the business cycle, because the company must continue to service its debt regardless of how bad sales are. A greater proportion of equity provides a cushion and is seen as a measure of financial strength. A highly geared firm is therefore expected to offset some of their gearing risk and therefore invests a higher proportion in bonds, relative to equity.

Corporate gearing is a factor which in theory is capable of affecting the asset allocation of pension funds. It is in line with the corporate balance sheet view. Friedman (1984) found a negative relationship between the corporate gearing and the percentage invested in equities. So firms with a greater corporate gearing tend to invest less in equities and more in bonds. The main reason behind this lies in the fact, that highly geared firms tend to offset some of the risk associated with their gearing position. Highly geared firms will be more eager to take a more conservative strategy.

Amir and Benartzi (1998) analyzed the relationship between the corporate gearing after a stock market decline and the pension asset allocation. The results confirm that firms whose reported gearing are more sensitive to pension deficits acts in a more conservative manner, which results in a bigger interest in the bond market instead of the equity market.

Hypothesis 3; Firms with a relatively high gearing tend to invest more in bonds and less in equities.

3.3.2 Income Volatility

Income volatility is often used as a measure for corporate risk. According to Friedman (1984) firms with a high income volatility which results in higher risk (i.e. corporate risk) will try to offset their risk by allocating more pension assets to less risky assets,

therefore they are expected to allocate a higher percentage in bonds, relative to equity. In this research by Friedman (1984) the variance of the earnings to book value of corporate equity has been used. The results support a significant positive relationship. Amir and Benartzi (1998) used the variance of the operating cash flow as a measure for income volatility. This research also found a significant positive relationship between the income volatility and the pension asset allocation. Firms with a more stable cash flow on average invest a higher percentage in equities compared to bonds.

Hypothesis 4; Firms whose income is highly volatile tend to invest less in equities and more in bonds.

3.3.3 Profitability

The theory behind the profitability of the sponsoring company describes that firms which are highly profitable will be able to invest aggressively. This means, that they are willing to take equity risk. Friedman (1984) uses this factor in his analysis. The ratio of earnings to book value of equity and the ratio of earnings to assets as the measure for profitability has been used. A significant positive relationship between a firm's profitability and the investment in equities was found.

Since corporate pension funds in the United States are no individual entities like the pension funds in the Netherlands, it is expected that highly profitable firms will be financially able to take equity risk in their pension fund. This means, that their profitability makes the pension fund less risk averse. Bodie et al. (1987) did investigate this relationship as well. This research used the ratio of earnings to book value of equity and the ratio of earnings to assets to measure a firm's profitability. This research resulted in the fact, that highly profitable firms tend to invest a higher percentage of their pension assets in equity and less in bonds, which is consistent with the hypothesis.

Hypothesis 5; A highly profitable firm tends to invest a higher percentage in equities compared to bonds.

3.3.4 Size of the firm and Pension Fund

The size of a pension scheme or the size of the firm can be seen as a measurement of risk. When a firm is large, it is more capable to diversify and have more financial resources to take equity risk, compared to small firms with small pension funds. This hypothesis is also tested by Amir and Benartzi (1998). In this research it was found, that larger firms who are expected to be less risky, take more equity risk in their pension fund. Furthermore, the bigger the firm and size of the pension scheme, the more a corporate pension fund

invests in equity, compared to bonds.

In the United Kingdom, the Pension Protection Fund and the Pension Regulator have analyzed the relationship between the pension asset allocation and the scheme size. In this research the scheme size was measured by the value of assets. A significant negative relationship between the scheme size and percentage invested in bonds was found. In addition, it was concluded that larger pension schemes hold more equities than smaller schemes do. However this relationship does not appear so clear if the scheme sizes of selected samples are in general very large.

Hypothesis 6; Larger firms and firms with larger pension schemes tend to invest more in equities and less in bonds.

3.3.5 Firms tax paying status

The tax paying status is mentioned by Papke (1991). This research suggested that the special tax status of pension funds creates the same incentive for both DB and DC plans to tilt their asset mix towards assets with the largest spread between the pre-tax and the after-tax rate of return. To exploit the tax shelter, a pension fund needs to invest in assets with the highest spread for a given risk level.

The problem is, that there is no empirical test yet which definitive concluded the significance of this theory. There is small evidence of a link between profitability, tax-paying status and fixed income investment, but it has only little economic significance. The literature is in line with the paper by Tepper (1981). This research proposed that firms can effectively earn a pre-tax rate of return on any assets held in the pension fund and pass these returns through to shareholders, the comparative advantage of a pension fund lies in its ability to be invested in the most heavily taxed assets. Presumably this means that pension funds should be invested entirely in taxable bonds, as opposed to common stock.

It is assumed that corporate bonds can deliver the biggest spread to pension funds. This means, if pension funds want to exploit the tax paying status, they will invest a higher percentage in bonds and less in equity.

Hypothesis 7; Firms with a higher tax paying status will invest a higher percentage of their pension assets in bonds and less in equities.

3.4 Credit crisis

The asset allocation of corporate pension funds after the credit crisis has been changed from investing a higher proportion in equities in the period 2004 - 2007 to a lower proportion in equities in the period 2008 - 2010. According to Eling and Schmeiser (2010) a warning sign could already have been seen during the period 2006 - 2007, with a period of low interest rates and increasing US housing prices. Eventually the subprime crisis in the US housing market started in the summer of 2007. One of the first visible events in respect to the financial crisis was the bank run on Northern Rock in September 2007 and the consequent support from the Bank of England.

According to Orlowski (2010) the credit crisis has stemmed from a combination of macro-economic events and micro-level institutional factors, which gave a boost to the crisis. These factors include: monetary expansion in the US, large capital inflows to US securities market from high-savings countries, the US housing boom and the mounting indebtedness of US households. The institutional characteristics include: rapidly growing asset securitization coupled with financial innovations, development of new structured financial products, the emergence of hedge funds, flawed credit risk assessment and asset valuation models and inadequate financial supervisory and regulatory frameworks. The credit crisis resulted in the fact, that companies as well as pension funds are reluctant to bear more risk. The expectation is that the corporate pension funds within the S&P 500 become even more risk averse after 2007. This will result in the fact that US corporate pension funds invest less in equity during the period 2008 - 2010, and therefore invest more in bonds.

Hypothesis 8; During the period 2008 - 2010 the investment of US corporate pension funds falls, therefore the investment in bonds rises.

4 Methodology

This section describes the methods used in order to analyze the relationship between several corporate risk factors (the variables which indicate the risk profile of companies) and two risk factors concerning the pension scheme (maturity and pension scheme solvency) as explained in Section 3.2 on one hand and on the other hand the asset allocation of corporate pension funds. The pension asset allocation stands for either investing in equity or bonds, since these asset classes can describe the risk attitude of pension funds the best. The relationships between the asset allocation and corporate risk factors are used in order to be able to monitor whether pension funds adopt the risk preferences of the sponsoring corporation. This research uses mainly quantitative analysis and less qualitative elements. There are some factors which cannot be examined in a quantitative way. For instance risk preferences and risk tolerance. With the use of interviews and focus groups for example it becomes possible to collect the data in a qualitative way. Still in this paper the focus is on the quantitative manner in order to reduce time. This section elaborates on the existing literature and the hypotheses discussed in Section 3. Next the hypotheses discussed in Section 3 will be tested through econometric regressions. The relationship between the dependent variable (i.e. corporate pension asset allocation) and independent variables (i.e. firms' corporate financial position and their pension scheme's financial position) can be examined with the use of these regressions. The relationships are tested according to statistical relevance in stead of economic relevance. This means that the statistical significance is tested rather than the magnitude of the relationship. As earlier mentioned in Section 3.2 there are many factors which can affect the pension scheme's asset allocation of the companies which are included in the S&P 500. In this section the different factors as well as the implementation to test the hypotheses will be discussed in detail. This paper uses the methods imposed by the papers from both Alestalo and Puttonen (2006) and He (2008). Just as these authors several regressions where different effects are tested on the corporate pension scheme's asset allocation of the sample of companies are implemented. As independent variables the corporate financial position and pension fund's financial position are used.

4.1 Regression analysis

The regressions used in this research are based on panel data analysis. Most previous empirical studies (introduced in Section 3) were done by cross-sectional analysis, which however, only describe the asset allocation changes at a point in time rather than a period of time. The panel data analysis can bring a number of additional advantages. Firstly, the overall variation in a panel dataset can be decomposed into variation between firms and variation through time, it enables to have more variability, more degrees of freedom, infor-

mative data, and more efficiency than simple time-series or cross-sectional data. Secondly, the techniques (fixed effect or random effect model) of panel data estimation can take heterogeneity explicitly into account by allowing for individual-specific variables (Greene and Zhang (2003)). In addition, the panel dataset can also control for omitted variable bias and, to some extent, can reduce the problem of endogenity and multicollinearity, thus improving the accuracy of the parameter estimates (Hsiao (2003)).

4.1.1 The fixed effect model

According to Brooks (2008), perhaps the easiest method to handle panel data is using a pooled regression, where a single equation will be estimated on all the data together. With this method the dataset for instance for y is stacked up into a single column with all the cross-section and time-series observations, and where all the observations for the independent variables would be stacked in one single column. Still this method has several limitations. Pooling the data in this way assumes that the average values of the parameters and the relationships between them are constant over time and across all of the cross-sectional units in the sample. For this reason this paper focuses on two panel estimator approaches, namely the fixed effects model and the random effects model. The fixed effects model allows each parameter in Equation 1 to change for each individual in each time period (Hill et al. (2008)).

$$y_{it} = \beta_{1it} + \beta_{2it}x_{2it} + \beta_{3it}x_{3it} + \epsilon_{it} \tag{1}$$

But the paramters are hard to estimate when there are many observations involved, for that reason the fixed model uses a simplification, where it restricts the slope parameters to be constant across all firms and time periods, namely β_{1it}=β_{1i}, β_{2it}=β_2, β_{3it}=β_3. Within this model only the intercept parameter varies, the slope parameters and the intercept varies only across individuals and not over time. This finally results in the following Equation:

$$y_{it} = \beta_{1i} + \beta_2 x_{2it} + \beta_3 x_{3it} + \epsilon_{it}, \tag{2}$$

where all the behavioral differences between the individual firms and over time are captured by the intercept.

4.1.2 The random effect model

In the fixed effect model it is assumed that all individual differences are captured by the intercept. The slope parameters are expected to be rather fixed. With the use of the

random effects model it is again assumed that all the differences between individual firms are captured by the intercept, but the main difference with the fixed effect model, is that the random effect model treats the firms, like they were randomly selected. For this reason the individual differences is treated as random, rather than fixed. The random differences which are introduced in the model can be separated by the intercept parameter β_{1i} in a fixed part which represents the population average, $\bar{\beta}_1$ and random individual differences from this population average, u_i. This can be seen in Equation 3

$$\beta_{1i} = \bar{\beta}_1 + u_i, \tag{3}$$

where these u_i's capture the individual differences, they are called the random effects. These random effects have zero mean, are uncorrelated across individuals and have constant variance σ_u^2. If Equation 3 is plotted in Equation 2 the following equation is obtained:

$$\begin{aligned} y_{it} &= \beta_{1i} + \beta_2 x_{2it} + \beta_3 x_{3it} + \epsilon_{it} && (4) \\ &= (\bar{\beta}_1 + u_i) + \beta_2 x_{2it} + \beta_3 x_{3it} + \epsilon_{it}, && (5) \end{aligned}$$

where $\bar{\beta}_1$ is a fixed population parameter, and u_i is a random effect. If we rewrite this regression, to make it a familiar regression we obtain:

$$\begin{aligned} y_{it} &= \bar{\beta}_1 + \beta_2 x_{2it} + \beta_3 x_{3it} + (\epsilon_{it} + u_i) && (6) \\ &= \bar{\beta}_1 + \beta_2 x_{2it} + \beta_3 x_{3it} + v_{it}, && (7) \end{aligned}$$

where $\bar{\beta}_1$ is the intercept parameter and the error term v_{it} consists of a component u_i, which represents a random individual effect and the component ϵ_{it}, which is the usual regression random error. The combined error is:

$$v_{it} = u_i + \epsilon_{it} \tag{8}$$

Because Equation 8 consists of two components, one for the individual and one for the regression, this model is often called, the error components model.

4.1.3 Choice of regression technique

Now the three methods have been described; pooled regression, fixed effect and random effect, the question arises which one to use for the dataset used in this paper. To distinguish between the three models the regressions are tested, which technique bests fits the data. The choice of the appropriate panel data regression techniques will be made trough the use of the Redundant Fixed Effects Test and the Hausman-Taylor Estimation. In the first step, the Pooled OLS and fixed/random effect are compared by using the Redundant Fixed

Effects Test. If the firms heterogeneity has been proved in the above test, as the second step we investigate whether the unobserved effects are random (regressor-uncorrelated) or fixed (regressor-correlated) by using Hausman-Taylor Estimation, the result will indicate whether we should use fixed effect regression or random effect regression.

Since the pension asset allocation of firms is determined by many factors, all of those factors should be controlled in order to isolate the specific contribution of the target variables (e.g. maturity, scheme solvency, et cetera). However, not all factors are observable. Firms' heterogeneities are those unobserved factors which are a persistent difference over time. Because they are unobserved, they are treated as a part of the error term, e.g. fund managers risk preference, skills, corporate objectives and policies, etc. Failure to control for them will create systematic errors across firms and pooled model estimated by OLS will be invalid. The existence of heterogeneity in our analysis will be tested by the Redundant Fixed Effect Test. If the null hypothesis is rejected, random or fixed effect model which account for unobserved, time-constant individual heterogeneity will be adopted to overcome the firms heterogeneity. Otherwise the simple pooled OLS regression will be used.

Not only firms heterogeneity could affect firms pension asset allocation, but also there is a possibility that heterogeneity is correlated with other explanatory variables. According to Mundlak (1978), individual heterogeneity is suggested to be randomly distributed across the population as a whole. However, it could be possible that in one country, firms specific effects might be correlated with the regressors and thus cause error-regressor correlation and parameter estimates to be biased. The existence of heterogeneity-regressor correlation will be tested by employing Hausman-Taylor Estimation. If the null hypothesis in is rejected, the existence of endogeneity problem can be proved. The empirical results should be based on fixed effect regression. Otherwise the random effect model will be used.

5 Data

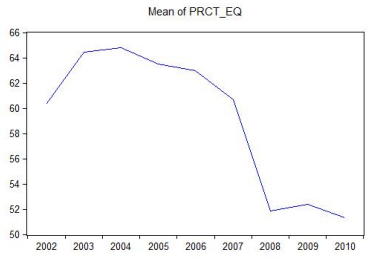
To test the hypotheses formulated in Section 3 the data from the 2002 - 2010 annual accounts of companies which are included in the S&P 500 at March 2012 are used. The data collected mainly covers the financial position of their pension schemes as well as the financial corporate position. The figures concerning the data of the pension schemes are reported in the section of the firms' annual report and accounts that set out of the information on their pension schemes. The corporate financial data are collected from the firms' balance sheet, income statement and cash flow statements.[1] A limitation of the total sample is, that the S&P 500 mainly covers the large-cap stock market. It systematically excludes small sized firms from the sample. Therefore some variables, e.g. firm size and pension scheme size, might generate biased or inconsistent estimators. The results could be improved if further research include other indices or unlisted firms in the sample as well. The descriptive statistics concerning the pension asset allocation can be found in Table 5, where the percentages invested in respectively equities, bonds, properties and "other" assets are described. This paper aims at describing the pension asset allocation of corporate US pension funds. To do so, this paper uses only the investment in equity, since the investment in equity and bonds are negatively correlated. The investment in bonds and equity are the best asset classes to use modeling the risk appetite of an individual investor, besides these asset classes are by far the most used. An other reason why this distinction has been made, is that the database (Thomson One Banker) does not define the asset class "other". This asset class can be any asset class there is. Since it is not clear, it is not possible to make a statement when a pension fund invests more in the asset class "other" compared to for instance equity. Therefore this paper only considers equity and bonds.

The pension asset allocation of the corporate pension funds in the sample can be found in Figure 1. As is clear from both the Figure and Table 1, the percentages invested in equities and bonds are negatively correlated. When the percentage invested in equities drop in 2004, the percentages invested in bonds on the other hand rises. Therefore it becomes not necessary to analyze both the dependent variables; equity and bonds. Since they are negatively correlated and the percentages investment in "other" and property respectively are on average low, this paper only aims at investment in equity. The investment in bonds is used for the sense of robustness. Within this paper the aim is to analyze the investing behavior and analyze which factors influences this behavior. With the use of regressions, several relationships are analyzed between these changing asset allocations over time and several corporate risk factors. In the following section, the set of dependent variables and

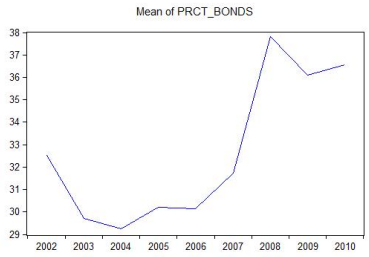
[1] These data are collected from Thomson One Banker and Worldscope. These databases are chosen instead of data from databases like FORM 5500, because the data from Thomson Banker and Worldscope are on fund level. The data from FORM 5500 on the other hand is on pension plan level and analyzes the yearly pension market for the United States.

Figure 1: Corporate pension asset allocation 2002 - 2010

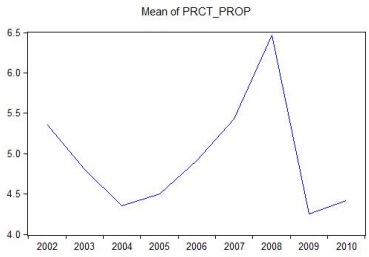
(a) Equities



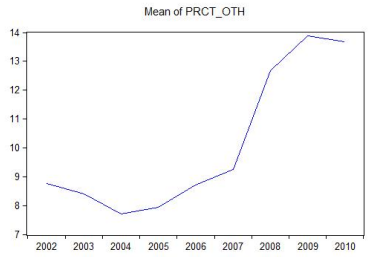
(b) Bonds



(c) Properties



(d) Other



Resulting mean of the asset allocations of the corporate pension funds included in the S&P 500 in percentages for the period 2002 - 2010 . From left to right the figure shows the allocation in respectively equities, bond, properties and other assets of the corporate pension funds included in the S&P 500.

Table 1: Correlation dependent variables

	Bonds	Equity
Bonds	1.000.000	-0.668388
Equity	-0.668388	1.000.000

This table represents the correlation between the dependent variables; investment in bonds and investment in equities.

independent variables are explained. A short overview of why it is included in the analyzes as well as how it actually is measured is described.

5.1 Summary of dependent variables

The dependent variables, which are used in this research capture the status of firms' pension asset allocation. Since the investment in equities and bonds are highly correlated, solely the investment in equities is used. Since these two asset classes are highly correlated, the investment in bonds is used for the robustness test. The following dependent variables are used:

- The percentage of pension assets invested in equities
- The percentage of pension assets invested in bonds (used to test the robustness of the results)

5.2 Summary of independent variables

To analyze the changing pension asset allocations over time, several independent variables are collected to test several relationships. There are two pension scheme's risk related variables and several corporate risk related variables which have been used in this paper. As independent variables several characteristics earlier mentioned in Section 3 are used .

- Scheme's maturity

  The age structure of a pension scheme is not a variable which a company is required to brief on their annual report. In order to come up with a variable which would still be able to describe the age affect, the ratio of the benefits payment to the total funded pension liabilities is used as an approximation.

- Scheme's solvency

  A pension scheme's funding level is a main ratio to measure the solvency of the pension scheme and then to capture the risk bearing on the sponsoring company. The scheme's solvency level can be approximated using the funding ratio. The funding ratio stands for the relative value of a scheme's assets and liabilities, usually expressed as a percentage.

- Firms' corporate gearing

  It has been argued that the pension asset allocation may also be affected by the firms' basic gearing. Corporate gearing describes how a company finances its operations. It is a fundamental analysis ratio of a company's level of long-term debt compared to its equity capital. For the robustness test a substitute has been used, namely the ratio of total liabilities divided by total assets.

- Credit crisis

  The credit crisis started at a point in time in 2007. This event has an expected negative effect on the risk preferences of a pension fund. The data has been analyzed for individual years (cross-section) and a break. The data has been divided in two datasets, one for the period 2004 - 2007 and one for the period 2008 - 2010. This can be done with dummy variables.

- Firms' income volatility

  A firm's risk, which is measured by income volatility, is suggested to be associated with the firm's pension asset allocation. As described in the paper by He (2008) a firm's income volatility measures the expected riskiness of the sponsoring company. Two ratios are adopted to measure a firm's income volatility. These are; the volatility of operating cash flow (OCF) and the volatility of turnover.

- Firms' profitability

  Highly profitable firms will be financially strong to aggressively take equity risk in their pension funds. In other word, the risk of short term equity volatility can be compensated by their profit generating ability. To analyze the profitability of a particular firm two measures are used, including return on equity (ROE) and net profit margin (NPM). ROE is measured by the profit after tax divided by the total shareholders fund and NPM is measured by the profit after tax divided by the total turnover

- Firm's size and pension scheme's size

  The size of a firm and its pension fund is another measurement of risk. In order to come up with a variable which indicates the size of the firm, the log value of total assets and turnover is being used. For the size of a pension scheme, the log value of the total funded pension liabilities rather than the log value of total pension assets have been used. The reason is that since the asset allocation could have a significant effect upon the value of total pension assets, the pension asset allocation and the value of the assets could be simultaneously determined and therefore it might lead to endogenous problems. In addition, the correlation between the size of the firm and the size of the scheme will be examined.

- Firms' tax paying status

  Tepper (1981) mentioned that the comparative advantage of a pension fund lies in its ability to be invested in the most heavily taxed assets. This means that pension funds should be invested entirely in taxable bonds, as opposed to common stock, real estate or other assets that are in effect taxed at lower marginal tax rates for most shareholders. To measure the tax-paying status the firm's total reported taxes minus the change in deferred taxes over the previous year is used. Subtracting the change

in deferred tax liabilities provides an approximate adjustment for such practices as using straight-line depreciation for reporting purposes and accelerated depreciation for tax purposes.

6 Results

In this section the expectations as a result from the literature review will be tested and discussed. It starts with analyzing the relationships between the dependent variable; the investment in equity and the list of independent variables which are discussed in Sections 5.1 and 5.2. For the panel data analysis different regressions have been used. Since the variables "firm size" and "scheme size" are highly correlated (which can be seen in Table 2), there has been used a full regression (including both variables) and excluding regressions, where one of the two variables are excluded. The following Section starts with testing the formulated hypotheses using panel data regression. The results from the panel data analysis can be found in Table 3, where besides the different corporate risk factors an additional dummy variable has been used for the period 2008 - 2010 to indicate the effect of the credit crisis on the pension asset allocation of corporate pension funds in the United States.

As becomes clear from Table 3 only three out of the eight relationships which are discussed briefly in Section 3 appear in the data as well. Especially the effect of the maturity, funding ratio and the return on equity seem to significantly have the expected effect. On the other hand the results do not support the literature concerning the corporate gearing, tax paying status, income volatility and the size of the firm and scheme respectively.

The panel data analysis indicates that the results support *hypothesis 1*. This means that a pension plan with a longer investment duration, which results in a low maturity tends to invest more of their pension assets in equities and less in bonds. Analyzing the results for the regression analysis including all independent variables, it becomes clear that a pension fund invests a higher percentage in bonds when the maturity increases. The relationship becomes even stronger when the size of the firm is excluded. For this relationship it does not matter which regression is used, all coefficients support the hypothesis. From the results it can be seen that corporate pension funds do take their investment horizon in consideration when planning their investment strategy.

The results from the panel data analysis support *hypothesis 2*. This means that a pension plan with a high level of solvency will invest a higher percentage of their assets in equities and less in bonds. All panel regressions indicate the same significant relationship. When the level of solvency remains high, investors tend to feel more secure to take more equity risk. Therefore pension schemes with a lower solvency level tend to invest a higher percentage in bonds, compared to equities. This is consistent with the data and therefore in line with the theory described by Friedman (1984).

According to *hypothesis 3* corporate gearing has a negative effect on the investment in equity. The results from the panel data analysis reveal that this relationship is not

significant. From this perspective it is difficult to conclude the sign of the the coefficient since the effect is not that strong. The results from the data do not confirm, that a highly geared firm tends to invest more in bonds and less in equity. This weak relationship suggests that the risk offsetting theory by Friedman (1984) has not been generally applied by firms to balance their gearing and pension investment strategy.

hypothesis 4 states that firms whose income is highly volatile tend to invest less in equities and more in bonds. The results from the panel data analysis show that the turnover volatility has no effect on the investment in equity, since the effect is not significant. Therefore it cannot be concluded that the income volatility of the sponsoring company affects the investment decision of corporate pension funds.

According to *hypothesis 5* a highly profitable firm tends to invest more pension assets in equities and less in bonds. The results from the panel data analysis support the hypothesis. This means that, the return on equity does have a significant positive effect on the relative investment in equity. The effect is strong, this means that profitability is a variable which has a strong effect on the corporate pension asset allocation. The more profitable a company becomes, the more risk it is willing to bear, this affects the riskiness of the particular corporate pension fund.

The results from the panel data analysis does not support *hypothesis 6*. According to this hypothesis larger firms and firms with a larger pension scheme tend to invest more in equities and less in bonds. This means, that according to the literature the size of the firm and the pension scheme needs to have a positive effect on the investment in equities. The results are in fact disappointing. Both the size of the firm and the size of the pension scheme have a negative effect on the investment in equity. The effect of both the size of the pension scheme and the size of the firm are significant and therefore consistent. In general, the bigger the firm, the more of the pension assets are invested in equities. The results are inconsistent with the hypotheses. In addition, they are also contradictory with previous empirical studies (Bodie et al. (1987)) as well as the risk offsetting theory of Friedman (1984). The results cannot be explained either by financial theory or by corporate strategic theory.

Hypothesis 7 states that firms with a higher tax paying status will invest a higher percentage of their pension assets in bonds and less in equities. According to the results from the panel data analysis this relationship doest not appear in the data at all. The effect is in fact even for some regressions the reverse, but more important the effect is not significant for any regression. The hypothesis states that the comparative advantage of a pension fund lies in its ability to be invested in the most heavily taxed assets. This means that pension funds should be invested entirely in taxable bonds as opposed to common stock, real estate or other assets that are taxed at lower marginal tax rates for most

shareholders. According to the data it is not clear whether the investors identify the tax paying status.

Besides testing the effect of an independent variable on the investment in equity, it is interesting to analyze whether the credit crisis which started in the late summer of 2007 has an effect on the investment in equities and bonds. This can already be seen in Figure 1. The event has an expected negative effect on the risk preferences of a pension fund. As can be seen in Table 3 the credit crisis did cause the corporate pension funds to adopt a more conservative investment strategy. The investment in equities fell during this period, where the investment in bonds has risen. This is in line with *Hypothesis 8*.

6.1 Robustness

To test whether the results mentioned above are robust, several changes have been made in the regressions to test whether the effect appears using other variables as well. In Table 4 changes have been made in the composition of both the dependent and independent variables. For the robustness this paper could have used substitutes for all the independent variables, however since the substitutes measure exactly the same this is not necessary. In this case there has been used two substitutes to test the robustness. As can be seen in the table, it does not matter which measure for gearing is used. Both measures indicate the same phenomenon. As for the gearing measured in Table 3 the effect of the second gearing variable is not significant, which makes it hard to conclude the relationship between this variable and the investment in equity. Net profit margin on the other hand reverses the support for *Hypothesis 5*. The effect becomes negative and is is not significant anymore. Since there are several measures for profitability, NPM is perhaps not the best approximation of the profitability of a corporation.

Since the investment in equity has been used as the dependent variable, the investment in bonds can be used to test whether the negative relationship between these two asset classes perfectly holds in the data. Since these two dependent variables are significantly negatively correlated (Table 1), the investment in bonds can be used in the robustness test. What becomes clear, is that all the relationships supported for the investment in equity holds for the investment in bonds. Using the investment in equity or bonds does not affect the results which are discussed above, which indicates that the results are robust.

Table 2: Correlation independent variables

	F size	Funding	Gearing	Maturity	NPM	ROE	S Size	Tax	Vol
F Size	1.000.000	0.092867	0.112014	-0.006819	0.070864	0.018183	0.761799	0.421159	0.012004
Funding	0.092867	1.000.000	-0.008871	-0.069570	0.099630	0.000934	0.125868	-0.025167	-0.105460
Gearing	0.112014	-0.008871	1.000.000	0.024994	-0.056154	-0.036175	0.192735	-0.099585	0.004625
Maturity	-0.006819	-0.069570	0.024994	1.000.000	-0.044940	0.008970	-0.165712	-0.002354	0.038397
NPM	0.070864	0.099630	-0.056154	-0.044940	1.000.000	-0.014299	-0.028081	0.026321	-0.073529
ROE	0.018183	0.000934	-0.036175	0.008970	-0.014299	1.000.000	0.037770	0.012246	-0.016116
S Size	0.761799	0.125868	0.192735	-0.165712	-0.028081	0.037770	1.000.000	0.305077	-0.103214
Tax	0.421159	-0.025167	-0.099585	-0.002354	0.026321	0.012246	0.305077	1.000.000	0.022304
Vol	0.012004	-0.105460	0.004625	0.038397	-0.073529	-0.016116	-0.103214	0.022304	1.000.000

This table represents the correlation between all the independent variables, in order to lower the change of spurious effects. This resulted in a table where the F ratio stands for Funding Ratio, S Size for Scheme Size, Vol for Income Volatility, Tax for Tax Paying Status and F size for Firm Size.

Table 3: Panel data analysis

		Total		**Ex S Size**		**Ex F Size**	
	Exp	**Coof**	**P-value**	**Coof**	**P-value**	**Coof**	**P-value**
Maturity	−	**-0.049814**	**0.0030**	**-0.039846**	**0.0108**	**-0.082376**	**0.0000**
F ratio	+	**0.113803**	**0.0000**	**0.124563**	**0.0000**	**0.090659**	**0.0001**
Gearing	−	-0.020235	0.5764	-0.030238	0.4018	0.036100	0.3566
ROE	+	**1.43E-05**	**0.0002**	**1.53E-05**	**0.0002**	**1.23E-05**	**0.0009**
S size	+	**-0.038863**	**0.0070**			**-0.094941**	**0.0000**
Vol	−	-0.002655	0.9348	0.004109	0.8984	-0.030446	0.3772
Tax	−	1.49E-06	0.3385	1.52E-06	0.3382	-1.52E-08	0.9926
F size	+	**-0.084778**	**0.0000**	**-0.108475**	**0.0000**		
2008 - 2010	−	**-0.103759**	**0.0000**	**-0.103789**	**0.0000**	**-0.106594**	**0.0000**

This table represents the results from the panel data analysis for the effect on the percentage invested in equities. For the analysis three regressions have been made. One full regression with all independent variables and two regressions where firm size or scheme size respectively is left out of the regression. In this table the F ratio stands for Funding Ratio, S Size for Scheme Size, Vol for Income Volatility, Tax for Tax Paying Status and F size for Firm Size.

Table 4: Robustness Test

Panel A: Gearing 2							
		Total			**Ex S Size**		**Ex F Size**
	Exp	**Coof**	**P-value**	**Coof**	**P-value**	**Coof**	**P-value**
Maturity	−	**-0.052863**	**0.0021**	**-0.043141**	**0.0069**	**-0.082979**	**0.0000**
F ratio	+	**0.116299**	**0.0000**	**0.128620**	**0.0000**	**0.085883**	**0.0002**
Gearing 2	−	-3.80E-05	0.3385	-4.08E-05	0.3192	-2.77E-05	0.4418
ROE	+	**1.45E-05**	**0.0001**	**1.55E-05**	**0.0001**	**1.19E-05**	**0.0009**
S size	+	**-0.039687**	**0.0062**			**-0.096785**	**0.0000**
Vol	−	-0.012929	0.6978	-0.006243	0.8498	-0.039473	0.2653
Tax	−	1.51E-06	0.3305	1.54E-06	0.3302	-3.58E-08	0.9826
F size	+	**-0.085584**	**0.0000**	**-0.109083**	**0.0000**		

Panel B: NPM							
		Total			**Ex S Size**		**Ex F Size**
	Exp	**Coof**	**P-value**	**Coof**	**P-value**	**Coof**	**P-value**
Maturity	−	**-0.045525**	**0.0062**	**-0.034982**	**0.0238**	**-0.078724**	**0.0000**
F ratio	+	**0.112070**	**0.0000**	**0.123246**	**0.0000**	**0.087847**	**0.0002**
Gearing	−	-0.037869	0.2973	-0.050385	0.1656	0.020661	0.6032
NPM	+	-0.000602	0.2985	-0.000601	0.2902	-0.000645	0.3020
S size	+	**-0.040743**	**0.0054**			**-0.099592**	**0.0000**
Vol	−	0.003174	0.9211	0.009691	0.7610	-0.025543	0.4491
Tax	−	1.58E-06	0.3425	1.50E-06	0.3760	1.88E-07	0.9159
F size	+	**-0.086386**	**0.0000**	**-0.111409**	**0.0000**		

Panel C: Bonds							
		Total			**Ex S Size**		**Ex F Size**
	Exp	**Coof**	**P-value**	**Coof**	**P-value**	**Coof**	**P-value**
Maturity	+	**0.038626**	**0.0115**	**0.038773**	**0.0120**	**0.047714**	**0.0013**
F ratio	−	**-0.101534**	**0.0000**	**-0.101385**	**0.0000**	**-0.094976**	**0.0000**
Gearing	+	0.021035	0.6225	0.020909	0.6272	0.004422	0.9194
ROE	−	**-9.76E-06**	**0.0037**	**-9.75E-06**	**0.0043**	**-9.12E-06**	**0.0069**
S size	−	-0.000573	0.9724			0.016800	0.2550
Vol	+	-0.032167	0.3578	-0.032074	0.3595	-0.024575	0.4793
Tax	+	2.05E-06	0.2223	2.06E-06	0.2227	2.53E-06	0.1406
F size	−	**0.026808**	**0.0198**	**0.026426**	**0.0258**		

This table represents the robustness test to indicate the robustness of the relationships. To test the independent variables; the NPM and Gearing 2 have been used. For the dependent variable; the investment in bonds have been used. With this test the effects proven earlier are further analyzed to test whether different proxies for a certain variable capture the same effect. In this table the F ratio stands for Funding Ratio, S Size for Scheme Size, Vol for Income Volatility, Tax for Tax Paying Status and F size for Firm Size.

7 Discussion

In this section the main findings of this paper are discussed in detail. In this paper the risk factors are divided in firm specific and in pension fund specific factors. As made clear in the results the factors which describe the state of the pension fund do have the expected significant effect on the investment decision of corporate pension funds. Maturity is an important factor, which affects the investment decisions of corporate pension funds. The overall results, suggest that pension funds do recognize the long run equity risk premium together with time diversification and therefore invest more in equity when facing a longer investment horizon. When they have a younger demographic structure pension funds believe in the mean-reversion of stock prices, so stock prices will revert to a long-run upward trend. Investors with a younger demographic structure are therefore more willing to take advantage of the equity premium puzzle. But on the short-run investing in bonds is more attractive compared with investing in equities, because a more mature demographic structure has a shorter investment horizon, so they cannot take advantage of the equity premium puzzle and therefore invest more in bonds.

The funding ratio which has been used as an indicator of the solvency level has a significant positive effect on the investment in equity. When the level of solvency remains high, investors tend to feel secure to take more equity risk in their portfolio. Therefore pension schemes with a low level of solvency tend to invest a higher percentage in bonds compared to equities. This is in line with the literature described by Friedman (1984). When the the solvency level is low, the pension fund wants to off-set this risk or diversify it away by adopting a more conservative investment strategy. On the other hand, when the solvency level is high the pension fund becomes overconfident and is willing to take more equity risk in their pension fund portfolio resulting in a more aggressive investment strategy. Still this relationship must be treated with absolute care. It could be that the funding ratio on the other hand describes the state of the sponsoring company. Which means that using the pension fund's funding ratio as the level of solvency, the current state of the sponsoring company can be determined. For this reason it is important to understand the direction of this relationship. With the causality in mind it is hard to conclude that the state of the sponsoring company affects the funding ratio of the pension scheme (since it is not observable) and therefore affects the pension asset allocation.

Not all corporate factors have the expected significant effect on the asset allocation of pension funds. Corporate gearing has the expected effect, but as has been made clear in the results, the effect is not significant. This means, that it is hard to conclude that corporate pension funds take the state of the gearing of the sponsoring company into account. According to Friedman (1984) firms with a relatively high gearing tend to invest more in bonds and less in equities. Since the expected relationship is not significant it

cannot be concluded that the risk offsetting theory by Friedman (1984) has been generally applied by firms to balance their gearing and therefore adopt a certain pension investment strategy. This means that it is not clear that highly leveraged firms in the United States try to offset their risk and use the pension funds for this purpose.

There are several ways to use an indication of the income volatility of a company. In this paper the volatility of the total turnover has been used. The effect on the corporate pension funds' asset allocation is not significant. When the income volatility of the sponsoring company is high, which results in high uncertainty, it is not clear whether the pension fund tries to off-set this risk. It was expected that corporate pension funds in the United States adopt a more conservative investment strategy when the volatility of the total turnover of the sponsoring company rises. However this relationship between a firm's turnover volatility and its asset allocation is not supported by the results and therefore there is no evidence to support Friedman (1984)'s risk offsetting theory. A possible explanation why the corporate gearing and the income volatility is not significant could be, that since both corporate gearing and income volatility do not measure an absolute profit or a loss, the pension fund does not feel the need to offset this risk, since it is not measured in an absolute dollar amount. Therefore pension funds do not act more risk averse, but still apply their most rewarding investment strategy.

The profitability of the sponsoring company has a positive effect on the aggressive investment strategy. The higher the return on equity of the sponsoring company, the more aggressive the corporate pension fund invests. A corporate pension fund is more willing to take equity risk in her portfolio when the sponsoring company is more profitable. Corporate pension funds in the United States are less risk averse when the sponsoring company is highly profitable. The risks which then can be taken using the pension fund's asset allocation can be off-set by the profit the sponsoring company creates.

According to other researches the size of the pension scheme and firm respectively affect the pension fund investment decisions. This relationship is not supported in this paper, but the reversed effect which is found in the results is highly significant. The bigger the firm or pension scheme, does not result in a more aggressive investment strategy in the United States for corporate pension funds. Large firms with large pension funds are able to diversify more than smaller companies with smaller pension funds. A possible reason, why the effect is not present, is that the companies which are included in the S&P 500 are used. These companies are relatively big, since the S&P 500 mainly covers the large-cap stock market. It systematically excludes small sized firms from the sample. Therefore the results are biased. For further analysis other companies, which are for instance not listed could be used to indicate the effect.

The final corporate factor which is analyzed in this paper is the tax paying status of the sponsoring company. This effect was found by Tepper (1981). The corporate pension funds do not adopt a more conservative strategy when the sponsoring company has a higher tax paying status. It is assumed that the corporate bonds can deliver the biggest spread to pension funds, resulting in pension funds investing in bonds. This is not the case since the effect is not significant. It could be that there has been changes in the tax-ability of bonds compared with other asset classes and therefore are not attractive for this reason. Since this effect was found around 1980 it could be that the spread between the pre-tax and after-tax rate of return for bonds and equities move closer together during the period 2002 - 2010.

During the period 2002 - 2010 the credit crisis was an extreme event, it is interesting to analyze whether the credit crisis which started in the late summer of 2007 affects the investment decisions of corporate pension funds. The credit crisis resulted in the fact that US corporate pension funds adopt a more conservative investment strategy. This means that besides the risk factor of the sponsoring company, the credit crisis brought an additional risk factor, which brought the corporate pension funds additional risk to control.

Besides the effect of the credit crisis the drop in investment in equities in 2006 could additionally be triggered by the new pension accounting standard (SFAS 158) issued by the Financial Accounting Standard Board (FASB) in September 2006. The new standard, which is effective for annual financial statements issued in December 2006, requires immediate recognition of all actuarial gains/losses and prior service cost through other comprehensive income and the full recognition of the pension surplus/deficit, similar to FRS 17 and IAS 19. SFAS 158 also requires measurement of the funded status of a plan as of the end of the fiscal year. By requiring recognition of net pension surplus/deficit on the balance sheet and the immediate recognition of actuarial gains/losses in comprehensive income, FRS 17 introduces material volatility to companies' balance sheets, especially if pension assets are mostly invested in equity securities. Firstly, reporting actual, rather than smoothed, pension returns injects volatility into shareholders equity. Furthermore, the recognized net pension asset/liability could be a significant portion of a company's book value and market capitalization. Amir et al. (2010) analyzed the effect of this new pension disclosure and they found that prior to the adoption of SFAS 158, US companies maintained a stable asset allocation. However, there is a shift from equity to debt securities since the adoption period. This means that besides the credit crisis the new pension accounting standard triggers the incentive of corporate pension funds to adopt a more conservative investment strategy after 2006.

To summarize, it becomes clear that the sponsoring company does not fully define the investment decisions of corporate pension funds in the United States in the period 2002 - 2010. The risk a sponsoring company bears can be off-set by the related pension fund, however still only a part of the risk offsetting theory by Friedman (1984) is supported by the data in this paper. The profitability of the sponsoring company in the United States contributes to the investment strategy of the corporate pension fund which has been made clear with the relative investment in equities. During the period 2002 - 2010 which has been used as the horizon in this paper, the investment strategy of the US corporate pension funds can be explained due to the profitability of the sponsoring company and the characteristics of the pension scheme. When the sponsoring company is for instance highly profitable, the corporate pension fund will adopt a more aggressive investment strategy. The corporate pension fund adopts the conservative investment strategy when the reversed effects appear. Besides this corporate risk factor, when the pension scheme is characterized by a high maturity and high funding ratio, this will affect the conservative investment strategy positively and negatively respectively. Besides these influences the results supported the view that during a period of economic instability (the credit crisis, which started in the late 2007 (bear market)) the corporate pension funds adopt a more conservative investment strategy. This means, that besides all the influences on the investment decision, a period of economic instability brings an additional risk factor, which the corporate pension fund needs to bear. So when the market can be characterized as a bear market, the risk factors a corporate pension fund need to keep in mind are more diverse.

7.1 Future Research

This paper captured several factors which were found by other researchers as well. Still this paper has got several limitations as well. Since the companies, which are included in the S&P 500, have been used are large cap stocks, small companies have not been considered. For further analysis, it will be interesting to implement other indices and companies which are not listed. Therefore the size of the firm can be re-investigated, since this factor analyzes the effect between the relative size of the firm and or pension scheme. Besides this problem concerning the companies, there is also the limitation of the dependent variable. In this paper the relative investment in equity has been used, since the investment in bonds and equity were highly negatively correlated. For further analysis however it will be interesting to include other asset classes as well. This means for instance the commodities, real estate, private equity. When these asset classes are included, probably a more detailed risk analysis can be performed, since all asset classes have its own risk and the effect of diversifying can be obtained. What cannot be seen as a limitation, but as an expansion of the impact of the credit crisis, is whether a pension fund's asset allocation can be explained during an extreme event such as the credit crisis. During the results in this paper, it became clear, that the US pension funds adopted a more conservative investment strategy during the period 2008 - 2010. What could be an expansion of this paper, is to analyze which factors can explain the riskiness of corporate pension funds during such an event. This means testing whether the asset allocation of a corporate pension fund can be explained and which factors contribute to the total risk the corporate pension fund bears. The analysis will then concentrate on the economic relevance, rather than the statistical relevance.

8 Summary and Conclusions

The main findings of this research only partially contribute to the existing literature on the investment decisions of corporate pension funds. The main purpose of this paper was to find whether risk on a corporate level contributes to the investment decisions of corporate pension funds in the United States. In order to analyze whether the corporate risk factors create more or less aggressive investment opportunities, the investment in equity has been used, since it is highly negatively correlated with the investment in bonds. With this measure it becomes clear when a pension fund is willing to take more risk (equity risk) and invest in equity or when a pension fund wants to off-set this risk of the sponsoring company and invest in the more safe asset, namely bonds.

Where other researchers used cross-sectional analysis, this paper used panel data regressions. The factors which are used in order to describe the investment decisions of pension funds are divided in two groups. The first group consists of factors which are on the pension fund level itself. These factors include the maturity, scheme solvency and the size of the scheme. The other factors are on the corporate level. These measures describe the current state of the sponsoring company, namely: corporate gearing, income volatility, profitability, size of the firm and the tax-paying status. Besides the analysis of a relationship between a particular factor and the pension investment decision, an additional analysis have been made in order to capture whether the US corporate pension funds adopted a more conservative investment strategy during a period of economic instability.

Within the United States the corporate pension funds partially depend on the sponsoring company. This aspect is in line with the corporate perspective, where the assets and liabilities of the pension fund are just one set of the total assets and liabilities of the sponsoring company, but not all the affects appeared as the literature suggested. When a pension fund acts according to the corporate perspective, the state of the sponsoring company affects the investment decisions of the pension fund. Not all the factors which are supported by theory are supported by the data in this paper. According to the data the size of the firm, the size of the pension scheme, corporate gearing and corporate income volatility respectively do not influence the investment strategy of the related pension fund. The factors which describe the current financial state of the sponsoring company (profitability) and pension scheme related characteristics (maturity and funding ratio) on the other hand influence the asset allocation of their related pension fund. During a period of economic instability corporate pension funds bear an additional risk factor. Which means, that besides the pension scheme's related risk factors and the corporate risk factors the state of the economy contributes to the investment strategy of the corporate pension funds.

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9 Appendix

Table 5: Descriptive Statistics

Descriptive statistics									
	2002	2003	2004	2005	2006	2007	2008	2009	2010
Panel A: Bonds									
Mean	32,52	29,70	29,24	30,20	30,15	31,73	37,82	36,10	36,56
Median	31,80	28,00	29,00	29,00	29,00	30,00	36,15	34,80	34,09
Maximum	74,30	97,90	99,00	98,00	68,00	100,00	99,00	99,00	92,20
Minimum	0,40	0,30	0,30	0,30	0,30	0,30	4,00	0,00	0,30
Skewness	0,46	1,92	1,46	1,32	0,57	1,26	0,57	0,90	0,88
Kurtosis	4,46	12,22	11,75	9,90	4,66	8,11	4,71	5,32	4,76
Observations	153	270	300	317	323	324	322	323	324
Panel B: Equities									
Mean	60,38	64,41	64,78	63,49	62,97	60,69	51,88	52,37	51,32
Median	60,00	65,00	65,55	64,00	64,00	62,00	53,00	55,10	54,00
Maximum	98,00	97,00	98,00	98,00	99,00	97,00	97,00	96,70	98,00
Minimum	12,40	15,10	19,00	12,60	24,00	14,00	6,60	3,00	2,00
Skewness	-0,52	-0,67	-0,76	-0,92	-0,57	-0,73	-0,33	-0,77	-0,57
Kurtosis	5,00	6,14	5,97	6,29	4,67	4,86	3,92	3,79	3,46
Observations	159	275	306	319	327	326	323	324	324
Panel C: Other									
Mean	8,75	8,41	7,70	7,95	8,71	9,25	12,67	13,88	13,68
Median	4,27	4,50	4,00	5,00	5,00	5,60	8,00	9,00	8,00
Maximum	65,00	88,10	100,00	100,00	100,00	100,00	100,00	100,00	100,00
Minimum	0,00	0,00	0,20	0,10	0,10	0,00	0,00	0,00	0,00
Skewness	2,66	3,24	4,42	4,45	4,62	3,66	2,73	2,63	2,64
Kurtosis	10,91	18,38	32,81	32,16	29,38	21,04	13,14	10,98	10,99
Observations	114	196	218	240	245	243	246	272	279
Panel D: Properties									
Mean	5,36	4,81	4,35	4,50	4,92	5,43	6,47	4,25	4,42
Median	5,00	4,00	4,00	4,00	4,00	5,00	5,50	4,00	4,00
Maximum	16,90	42,60	14,00	16,00	16,00	19,00	24,80	18,00	17,00
Minimum	0,00	0,00	0,00	0,00	0,00	0,24	0,26	0,00	0,00
Skewness	0,81	4,79	0,72	1,03	1,00	1,13	1,17	1,49	1,31
Kurtosis	3,45	38,14	2,84	3,74	3,90	4,53	4,50	6,18	5,36
Observations	61	108	121	126	129	127	131	141	136

This table represents the descriptive statistics of the pension asset allocation. The mean, median, maximum and minimum are in percentages invested in particular asset.