# The Risk Attitude in the German Pension Market

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## Abstract

This paper is devoted to research the risk attitude in the German pension market. During a five year period (2007-2011) pension data is gathered on 58 companies listed on the German stock exchanges and summarised in a panel dataset. Three regressions are conducted in order to find changes in the equity share and therefore risk attitude. Were the size of the pensions' liabilities or assets and the funding or maturity ratios do not appear to have significant influence, the data does present differences between specific sectors. Moreover, the funding and maturity ratios have different effects in each sector. Clearly the lower equity share in the financial sector presents less risk compared to all other sectors. With the recent financial crisis in mind, high amounts of regulation and policy implementations by governments or regulators could cause the lower equity share. However, regardless of the low equity share in the financial sector, other sectors appear to be too exposed to market volatility finding themselves incorporating too much risk.

## List of Abbreviations

PAYGO: Pay-As-You-Go

EPS: Earnings per Share

ROE: Return on Equity

GRV: Gesetzliche Rentenversicherung

DC: Defined Contribution Plan

DB: Defined Benefit Plan

PPS: Pension Plan Size

Prob.: Probability

FV: Fair Value

BaFin: Bundesanstalt für Finanzdienstleistungsaufsicht

## Definitions

Child dependency ratio: the ratio of the population under 15 to that between 15 and 64

Elder dependency ratio: the ratio of the population older than 65 to that between 15 and 64

Fully Funded: A pension plan that has sufficient assets to provide for all future accrued benefits

Replacement Rate: The percentage of a worker's pre-retirement income that is paid out by a pension program upon retirement.

Gesetzliche Rentenversicherung: German Public Pension Insurance

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## 1. Introduction

Pension funds are at the foundation of all societies. They offer a future 'safe haven' for the domestic populations and more importantly current employees, through the endless support and financial security. Traditional (public) pension funds in Germany have the problematic factor that the second generation pays for the first generation, the so called pay-as-you-go (PAYGO) system. This worked brilliantly for the 'baby boomers' but sketches more problematic scenarios for future generations. Currently, company pension funds (second pillar), which are set up as fully funded defined contribution (DC) or defined benefits (DB) plans, are gaining market share within the pension markets. With respect to the earlier mentioned 'safe haven', how company pension funds realise these safe havens is currently being scrutinised. For instance, these fund managers made rational investments in the past but, moral incentives are becoming more influential. Fund managers are investing other people's money; how should they be managed, which policies are required? More importantly, how much risk is accepted or allowed and when?

The risk of pension funds has been a wide spoken topic. Economists speak of a growing global trend towards an ageing world and the possible consequences of this trend towards retirement benefits. Companies with high benefit payments compared to total pension liabilities have more immediate pressure, resulting in a demand for higher returns in the short run accompanied by higher risk. Brinson et al. (1991) found that within US companies higher returns were not related to the absolute activity of fund managers. So, fund managers can never guarantee higher returns and their investments in equity, which could provide higher returns, are accompanied by higher amounts of risk. Furthermore, large pension plans could potentially take on more risk since their cash 'buffers' are more profound. There are many more pressures within all societies towards the performance of pension funds and their 'benefit production'. These problems are global issues; however, this research focuses on previously mentioned factors and more and specifically their effect on the risk of occupational (company) pension funds in Germany.

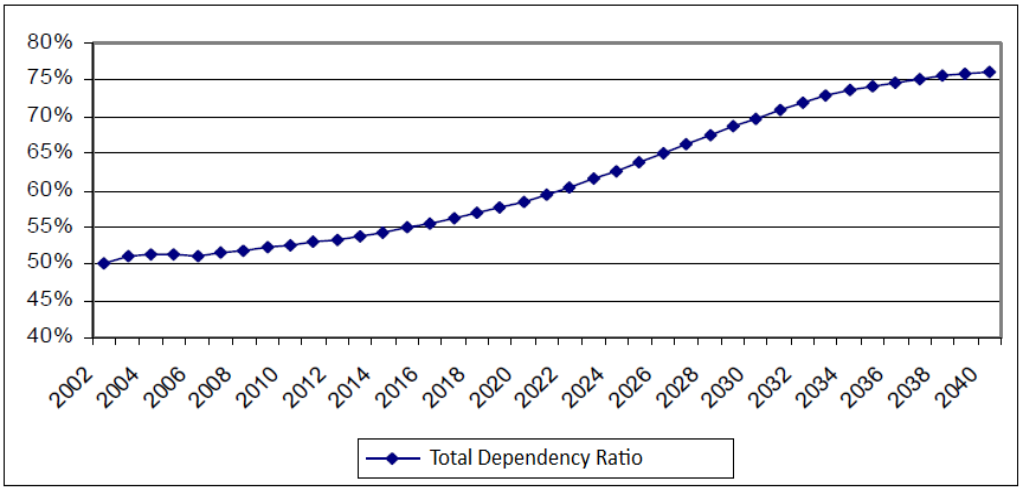
The rest of this paper is constructed in the following order. Section 2 presents a theoretical background on Germany. Section 3 presents the German pension markets including reforms. Section 4 contains the literature review. Sections 5 states the research questions followed by section 6 with the data and methodology. Section 7 present the results and section 8 the conclusion with future pitfalls and opportunities for Germany.

## 2. Theoretical Background

As one of the pillars of society, problems within the pension market automatically affect all layers and therefore all individuals. First this research will present a short introduction in the movements of the German domestic market both on a demographic scale as for its global pension funds.

### 2.1 Demographic Situation in Germany

For the past decade Germany realised an ageing problem was present within their civilisation, which is a growing concern for politicians, economists and the general population. The Statistisches Bundesamt and the European Commission obtained several statistics regarding the demographic variables such as: age -, gender distribution, population growth etc., from these they concluded an alarming scenario. In 2011 there were approximately 81.75 million people living in Germany. The sex ratio was 96.33 males to 100 females. In the last 22 years from 1990 to 2012 the percentage of elderly (65+) has grown from respectively 14.9% to 20.6% (Figure 1, Appendix). According to the Federal Statistics bureau of Germany this pattern will continue and by 2030 the percentage of the 'old population' will be 22.9%; in 2050 even 36%. Furthermore, the child and elderly dependency ratios also experienced a strong change. The elderly and child dependency ratio together form the total 'dependency ratio' (Graph 1). From graph 1 we can see that pension funds will become extremely important in the future.




Graph 1: Total Dependency Ratio between 2002-2040, Source: Börsch-Supan & Wilke, 2004

The elderly dependency ratio in 1990 was 0.21 (21 people aged 65 and older versus 100 people aged between 25 and 64) and in 2011 0.31. Germany predicts[1] that this trend will skyrocket

[1] Federal Statistical Office Germany

to 0.52 in 2030 and even 0.64 in 2050. (Figure 2, Appendix) Finally, Germany also experienced a birth deficit since 1972 which was initially offset by a positive migration balance. However, this low birth rate (figure 3,4; Appendix) could be a future negative spiral since the low birth rate has a compounding effect, which introduces a future decline for the total population of Germany (Börsch-Supan, Wilke 2004).

The growing population of elderly in Germany is an alarming factor. Recently, there has been a global financial crisis but, it must be noted that previous to the crisis, problems were already present in the market. Börsch-Supan and Schnabel already made a critical note on the generosity of the German pension system in their paper (May 1998). In their view the German pension system is a textbook example of possible negative effects such a generous system could have on plan participation (see section 3). Furthermore, according to the OECD Germany spends a high amount of its GDP on pensions compared to other countries, namely 11.4%[2]. However, Germany has issued several pension market reforms to cope with the changing environment. Specifically the introduction of the multi-pillar system through the Riester reform (2001) (see section 3).

## 2.2 Occupational Pensions

The German occupational pension plans are available as DC or DB pension plan. Besides this specification, German companies can choose between five occupational pension vehicles in which they set up their pension plans for employees. These five are direct pension promise, direct insurance, pensionkasse, pension fund and the support fund. These vehicles give rise to a more funded approach in German pensions and therefore the government provide supports through tax advantages and subsidies. Were all pensions vehicles mentioned above are independent of their sponsoring company[3], contributors do choose their own pension funds managers. Since pension funds are independent, they can make their own decision regarding their portfolios and investments. However, the equity share is limited to 35% for direct insurance, pensionkasse and pension fund[4].

### *2.2.1 Defined Benefit Pension Plan (DB)*

The German DB comprises of two key characteristics, the first holds that future retirement benefits are known in advance. The calculation of future retirement benefits of employees is based on two variables namely, the employees working history and its past contributions. Since these are the only influences, an increase in retirement benefits can only incur when contributions rise. The second key characteristics states that retirees should have the same living condition in retirement as

[2] *OECD (2011), Pensions at a Glance 2011: Retirement-Income Systems in OECD and G20 Countries (www.oecd.org/els/social/pensions/PAG)*
[3] Stewart and Yermo (2008)
[4] Pensionfundsonline.co.uk

during their life as employee. Therefore, contribution rates are linked to salaries through a relative amount. However, the Riester reform bounded these to maximum levels of 20% in order to stimulate participation among the 'next generation'.

### *2.2.2 Defined contribution Pension Plan (DC)*

The DC comprises of three key characteristics, the first being that the contribution made to the pension plan are split between employee and employer. These contributions are linked to the salary through a relative amount, as with the DB plan. The second key characteristics is that retirement benefits of a DC plan are not known in advance but dependent on contributions and investment returns or returns on assets. From the previous a DC plan can never be underfunded and liabilities should not exceed the assets (O'Brien, 2007). The third key characteristic is that employers do not bear the risk of investments; this burden is for the employees. Therefore, the retirement amount could be less than expected.

So, were DB plans have a formula to calculate the future benefit payments based on contributions and employee history, a DC plan's benefit payments depend on investment returns. In addition, DC's future benefit payments are not related to past contributions but past investment returns (bonds, equity, property and other), which is a significant difference when retirement payments increase or investments have disappointing returns.

## 3. The German Pension Market

The German pension system was known for its retirement's income and strong coherence with the market. The German government spoke about the public pension not as social benefit but pension insurance. Through this cunning inspiration Germany inspired employees to arrange their own future safe haven. This section will make a sketch of the German pension system and its major reforms.

The introduction of the old age pension plan in Germany (Otto van Bismarck, 1889), which was subsidised by the state, was designed to support workers in the industrial, agrarian, artisan (craftsmen) and servant sector. Since its origin the German pension plan survived the first and second world war and in between the great depression. Therefore, the German pension plan is well known and praised for its past performance. Moreover, the German pension plan's key characteristic was to extend living standards acquired during employees working lives. Taking the average of the salary employees earned during their employment, made public pensions dependent on their salaries. The previous stimulated the growth of the German economy since workers strived for high retirements and in effect high paying high level jobs. Contributions were proportional to employees'

income which presented a sound base. Founded as a fully funded pension plan German citizens obtained the security they needed. From the previous Germany named its pension plan a "retirement insurance" contrary to "social security" since employees had the prosperity or insurance of their retirement in their own hands.

During the three decades after its foundation minor reforms passed. The German pension plan was first characterised by a mandatory retirement age of 70, when the average male life expectancy was 45. Later on this was decreased from a retirement age of 70 to 65, for disabled employees. Today male life expectancy is 75 but average retirement age is 60 (Börsch-Supan, Wilke 2004). Due to World War II, the German pension plan was changed to a PAYGO system in 1957, which severely eroded the capital stock. With a strong growth in population (baby boomers) the PAYGO system became a sound and promising option. In the decade following this reform the remainder of the capital stock was spent and regulations required only a very small reserve fund, which covered only 14 days of benefit expenditures in 1957 (Börsch-Supan and Wilke 2004).

The next significant reform in 1972 introduced changes in policy. Firstly, replacement rates increased to 70 percent in pre-retirement incomes for workers with a 45 year earnings track record. Secondly, a flexible retirement age was implemented; employees who had employment track records of 35 years could retire at age 63. Thirdly, the pension age of disabled employees was decreased to 60 (Börsch-Supan and Jurges 2011). These reforms had significant consequences for the contribution rates of younger employees.

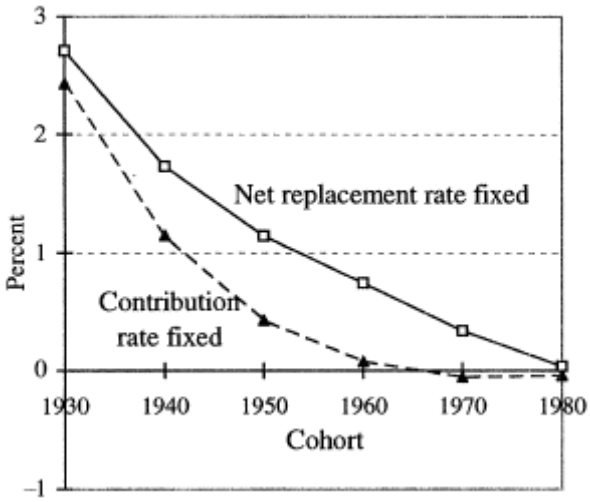



Figure 5: Real rate of Return on the German PAYGO system

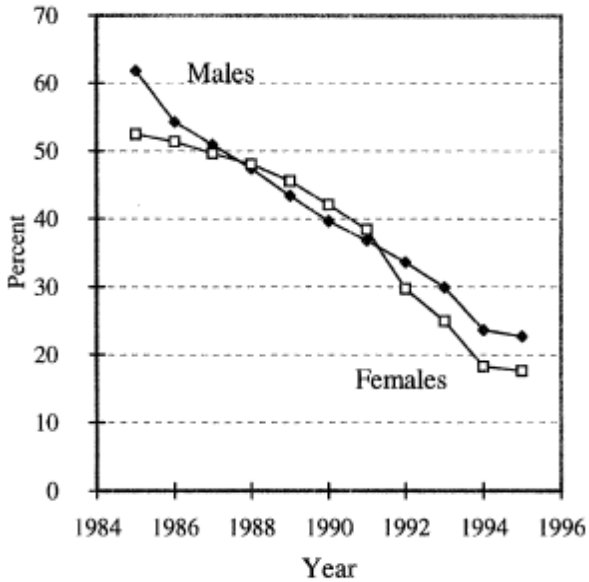



Figure 6: Active participation in the German Public Pension Plan among self employed Individuals

With previous reforms in mind Schnabel concluded that the rate of return will decrease (figure 5, Source: Schnabel, 1997) regardless of possible future policies (shift in retirement age or

decrease in benefit payments). Therefore, the 'young' generation was not stimulated to join the public pension plan (figure 6, Source: Schnabel, 1997). Many self employed Germans, who could choose between market based pensions and the public pension plan, chose the market based pension plan (Schnabel, 1997). In effect, during these years the PAYGO pension plans lost many contributors. Regardless of the generosity which characterised the German pension system (high replacement rates), the pension system was threatened at the roots through these social achievements and the aging society.

During 1984 and 1986 the German government implement even more reforms which made early retirement more attractive. Jüges and Börsch-Supan (2011) stated that: "*Early retirement was further extended by creating a bridge to retirement.*" This reform consisted of an increase of replacement rate for retirees aged 55 to 59 to respectively 63% and 68% of former gross wages. Moreover, retirees aged between 55 - 59 were not required to actively search for a new jobs. In addition, severance pay presented tax advantages for employers. Obviously, the previous resulted in a decline in employment and the German pension market saw a changing pathway to retirement (figure 7). A growing amount of unemployed stopped job searching and applied for retirement.

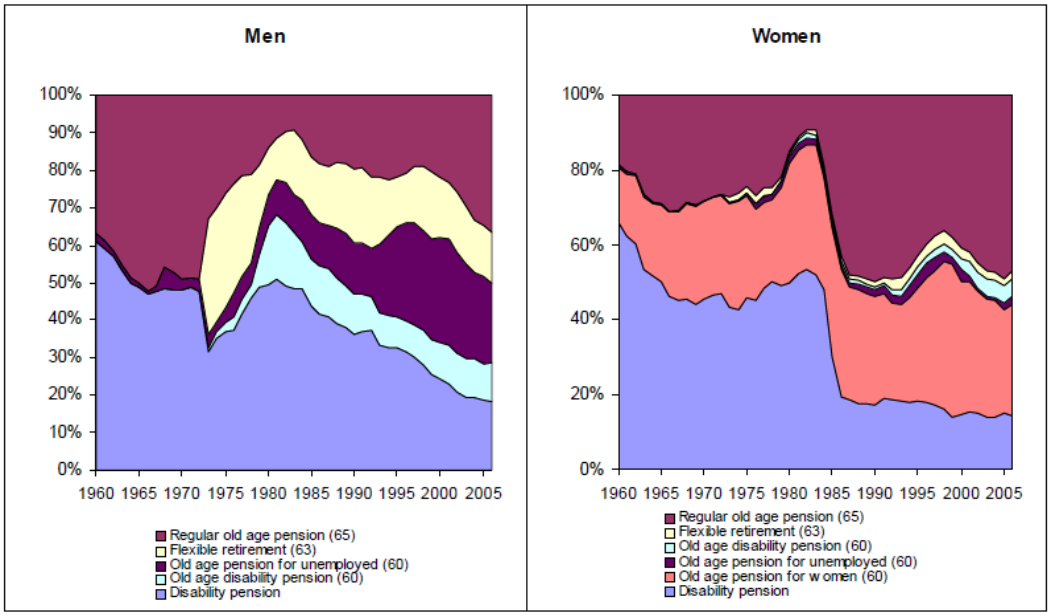


Figure 7: different routes to retirement in Germany, Source: Deutsche Rentenversicherung Bund

The previous reforms were implemented when the German population flourished. The 'babyboom' generation assured a strong and large working population which supported the PAYGO system. However, born in 1942 means retired in 2007, resulting in extreme amounts of future benefit payments; let alone the early retirement arrangements and high replacements rates.

Threatened by the previous problems and demographic influences the German government started a long line of reforms[5] with the first in 1992. With the impact of high replacement rates the government propagated the need to reduce them. Step 1 of the 1992 reform was to change the gross wage to net wage for the calculation of retirement benefits. Börsch-Supan and Jürges noted an important change: *"This removed an odd mechanism that would have created a vicious cycle of increasing pension benefits in response to increasing contribution rates."*

Step 2 involved the cancellation of the 'retirement window' and early retirements became less desirable through lower incomes. Unfortunately retirements are strongly influenced by emotional feelings and population sentiment. Therefore, a critical note on the increase of mandatory retirement age should be made and is displayed in its slow implementation. Recently the European Union (EU) stated an increase to 67, however this will be implemented through monthly increases per year.

Through the years the well regarded German pension system developed itself in a robust but rigid system. 2001 presented the pensions with Walter Riester, the labor minister at the time, who ratified and enforced the Rietser reform. Its major change was the introduction of the multi-pillar system or three pillar pension system. Currently the three pillars are: social security, occupational pensions and individual retirement investments. The first pillar, social/public security, has been the dominant system in the past. Currently the first pillar, public retirement insurance (*Gesetzliche Rentenversicherung*, GRV), contains 63% of the total employees in Germany[6]. However, with the ageing society in retrospect, the German government is decreasing the dominance of this pillar through time.

The second pillar, Riester's occupational pensions (company pension plans) introduced as a DC plan[7], is growing in importance supported by many reforms (i.e. decreasing replacement rate). Regardless of the minor role in the past (Blaich, 2010) more employees are turning to companies and their retirement plans. Currently, besides the Riester DC plan companies also offer DB pension plans. In addition, the third pillar, private insurance, is slowly growing in size. Both the second and third pillar are being supported by lower taxes and subsidies. With the government stimulation for company pension funds, the second pillar will become a more prominent pension fund for the future.

In addition to changing the core of the system from a purely PAYGO to a multi-pillar fully funded part and PAYGO part, this reform aimed at three more major changes. First, contribution rates should become stable. Moreover, an intergenerational aspect was introduced to encourage young employees to join. By limiting the contribution rates to 20% until 2020 and 22% until 2030, the

[5] Börsch-Supan et al. 2007
[6] Deutsche Renteversicherung Bund
[7] Börsch-Supan, Coppola, and Reil Held (2012)

government ensured the young generation that they would not be hold accountable for the benefits of the 'babyboom' generation. Second, the earlier mentioned fully funded was accompanied by tax advantages or subsidies to encourage contributions. Third, the PAYGO pillar received less benefits during the year following this reform in order to promote the new pillar and stimulate a shift towards company pension funds.

Introduced as the solution, the Riester reform was characterized by some flaws for instance, the funding deficit in the public pension system was not the responsibility of the population but the government. There was a constant shortage in the pension budget and employee contributions were not enough to supply all future benefit payments, this resulted in tremendous amount of liquidity from the government to secure future benefits payments. The German government realized that the cost reductions of the Riester reform were not enough to meet the retirement payments with a replacements rate of 67%. Future changes were needed and to discover and implement these policies the *"Commission for Sustainability in Financing the German Social Insurance System"* (Börsch-Supan & Jürges, 2011) was created. This commission became responsible for the stabilisation of the pension market and they tried to relieve the public pension system through an increase in market share for the second pillar. Were the company pension funds should become the prominent pension vehicle, employees should manage part of their own pensions and not solely rely on the public pension plan. Another reform which supported the previous actions was the German retirement saving act (2001), which presented the pension market with individual pension accounts (IPA). Contributions to IPA's are voluntary and pre-tax which should compensate employees for the earlier cut in pension payments. The dominance of the public pension system was further decreased through the linkage of retirement age to average life expectancy. In addition, pension benefits were related to the dependency ratio through the so called sustainability factor (Bonin, 2009). The German government subsidised the second and third pillar in order to shift the focus of the pension market.

Finally, another major change was the recent implementation of a higher retirement age, namely from 65 to 67. However, this new age becomes final in 2035 and is introduced on a monthly bases each year. With the option of early retirement around the corner this retirement age was increased as well, to prohibit an increase in the latter. Regardless of heavy protests and possible retaliations of unions the previous was implemented and furthermore, in 2007 the implementation of the different retirement age was accelerated and the age limit for old age pension for disabled changed to 65.

Naturally there were many more reforms which are not mentioned above; therefore a more elaborate list with a short explanation is presented in table 1.

| Table 1: The evolution of the German Public Retirement Insurance | | |
|---|---|---|
| **1889** | Introduction of the old age pension by Otto van Bismarck | Introduced for the support of industrial, agrarian and artisan employees<br>Mandatory Retirement Age 70 (Life Expectancy of 45)<br>fully Funded system, shared contributions between employee and employer |
| **1913**<br>**1916**<br><br>**1923**<br>**1957** | Retirement age for white collar workers 65<br>Retirement age for disabled pensions decreased to 65<br>Retirement age for blue collar workers 65<br>Introduction of PAYGO | Pension benefits linked to contribution rates<br>Purpose: securing future pensions and extending the standard of living through old age retirement<br>Retirement age set at 65<br>Dynamic benefits, indexed to gross wages and salaries<br>Reduction of the reserve fund; final marker in 1957 with only 14 days of reserves |
| **1972** | Public Retirement Insurance for entire domestic population | Increase of replacement rates to 70%<br>Flexible retirement age<br>Decrease of retirement age for disabled |
| **1977**<br><br>**1978**<br><br>**1984** | Pension splitting option for divorced couples<br>Minimum reserves are reduced to one month<br>Bridge to retirement | Increase of replacement rates of retirees aged 55 & 59 to respectively 63% and 68%<br>No active Job search required after age 55<br>Severance pay presented tax advantages |
| **1992** | Integration of the Germany Democratic Republic | Retirement calculation were based on net wages instead of gross wages<br>cancellation of retirement income<br>Increase in mandatory retirement age (monthly bases) |
| **1999** | Early Retirement alterations | Early retirement options for women and unemployed are restricted<br>Early retirement only for the long-insured and with benefit adjustments<br>Exceptions for disabled persons |
| **2001** | Riester Reform | Introduction of a Multi-Pillar System, by combining PAYGO and a fully funded part<br>Objective 1: Stabilization of contribution rates |

| | | |
|---|---|---|
| | | Limiting the contribution rates to 20% until 2020 and 22% until 2030<br>Introduction of a multigenerational character<br>Objective 2: Introduction of fully funded part<br>The new pillar (fully funded) was accompanied by tax advantages, to stimulate its prosperity<br>Objective 3: Reduction of the PAYGO system<br>PAYGO system received less benefits and government support |
| **2001**<br><br><br>**2002** | German Retirement Saving Act<br><br><br>Origin Commission for Sustainability in Financing the German Social Insurance System | Introduction of IPA's to compensate employees and their fall back in pension payments<br><br>Objective: Providing sufficient contributions in a sustainable manner |
| **2004**<br>**2007** | Introduction of the Sustainability Factor<br>Increase Retirement age to 67 | Objective: Decreasing the pressure on contribution rates by replacement rates |

*Source: Holzman & Palmer (2006), Author's compilation*

## 4. Literature Review

With the introduction of occupational pension funds by the Riester reform, the German pension market was pushed in a new direction with a PAYGO part and a fully funded part (second and third pillar). With the focus on the entire pension market this section discusses the logic behind a fully funded system, the new occupational pension funds and the asset management.

### 4.1 Fully funded pension funds

The German pension system was founded as a fully funded system and changed to a PAYGO system. Unfortunately, due to the changing markets, the PAYGO system could no longer meet the necessary requirements for pension funds today. Researchers (Sinn, 1997, Feldstein 1997) stated that since PAYGO systems' contribution rates, which are relative amounts, are dependent on wage increases, the previous will only increase when wages increase; in effect when GDP increases. Therefore, returns of the PAYGO system will never exceed the rate of interest, since this will result in an inefficient domestic market (Sinn, 1997). However, Feldstein (1995) and Börsch-Supan (1997) argue that a switch to a fully funded pension system will immediately increase welfare since the equity market provides higher returns, which are then accumulated through time until retirement. Contrary, Sinn (2000) states that the risk premium in the stock market which results in higher returns does not provide enough support to switch between PAYGO and fully funded. Unless the government and company pension funds have better risk mechanisms which provide excess returns or at least more reliable returns, the possible higher returns in the stock market provide no reason to switch.

However, both Sinn (1997, 2000) and Breyer (1989) argue that the value of all contributions equals the value of all pensions. Therefore, an attempt to increase benefits for one generation will decrease benefits for another. Breyer states: "*There is not a Pareto improving transition to a funded system.*" Following the previous notion, Breyer (2001) argues that redistributing future consumption or a welfare increase for the latter generation are both unfunded arguments for switching to a fully funded system. Were an intergenerational aspect is lacking in fully funded systems; a better approach would simply be to increase savings and bestow high inheritances. An additional problem lies in the transition phase. Were the first generation was contributing to the PAYGO system, the latter partly fund their own pension in fully funded plans. The net losses incurred during the transition period should be smoothened by the government.

With no direct (Pareto) efficiency gains researchers propose a hybrid system. The latter generation will incur a double burden but this is diminishable in the long run. This paper argues that the reasoning behind a switch to a partly fully funded system is implemented to relieve the pressure

from the public insurance plan. Were the entire domestic population has a mandatory PAYGO public insurance pension, the secondary pillar offers an extra voluntary fully funded occupational pension within companies. This occupational (company) pension fund is implemented to transfer part of the responsibility of pension and investment decisions to employers and employees. By relieving the public insurance and placing responsibility with the employees, public pension funds could possibly cope with the increasing amount of retires and decreasing amount of contributors.

## 4.2 Occupational pension funds

Were the German first pillar (mandatory) public insurance is very generous for old age retirement, the participation in occupational (voluntarily) pension funds is relatively low compared to other EU countries. (Haverland, 2007) However, the market share of occupational pension plan is steadily increasing through the support of the government, by subsidies and tax advantages.

Regardless of government support the occupational pension plans are exposed to several risk factors. Srinivas et al. (2000) noted that there is systematic undiversifiable risk, systematic risk and agency risk. The first being an intergenerational part since a crisis only reflects on the returns of one generation and the latter generation experiences no consequences. The second systematic risk relates to bank solvability, political stability and more factors which the public is unable to influence. Agency risk comprises a moral hazard where some investors have asymmetrical information compared to the market.

In order to control for these risks, Germany maintains both a prudent person rule (PP Rule) and qualitative restrictions (Haverland, 2007). The PP Rule is defined as: “Pension fund regulations rely on the (prudential) quality of fund managers.” Where qualitative restriction imply which financial instruments may be applied, such as bond, loans etc. So, the policy regulations specifically guide and control company pension funds in the asset allocation and performance. In effect the risk attitude is controlled for to a certain amount, since opportunistic funds manager could otherwise become too aggressive. However, regardless of certain limits the share of equity within portfolios diverges between all companies which could be influenced by pension fund size, funding, pension fund maturity etc. (Guardiancich, 2010) By keeping their limits in order fund managers try to maximise their return. The following section will discuss the asset distribution.

## 4.3 Portfolio asset management

German pension funds have a qualitative restriction, which restricts the fund’s allocation. With respect to risk attitude the main question is: “How are the investments then allocated between assets?” The asset allocation of funds is characterised by tactical and strategic allocation. Where the first focuses on the short run and draws its profit and losses from ‘market timing’, the latter is

influenced by portfolio distortion with respect to the long term strategy. All institutions want to maximise returns with low amounts of risk, in order to obtain these results they use several models such as a mean-variance model to choose their asset allocations. Davis (2001) noted that the risk return trade of the portfolio must be in balance, with the pre-condition that the portfolio's frontier is efficient.

Several researchers found that the return on equity in the previous 100 years has been 6% higher than the return on treasury bills (Kocherlakota, 1996). The previous is the well-known equity premium[8]. Since equity has a higher risk fund managers and investors state that a risk premium is necessary. However, were that premium should be 0.35% this significantly diverges from the realised excess return of 6% (Dimson, Marsh, Staunton, 2006). So, equity has more risk (e.g. shortfall risk) but more importantly a higher return.

Occasionally higher returns are required or requested which raises the second question: "What influences an increase in the equity (risky) share of funds?" Blake et al. (1999) researched pension funds in the UK were they tried to explain a shift from bonds to equity. They found that strategic allocation and short run incentives have little influence contrary, long run returns and expectations explain the bulk of the asset distributions. In addition, pension funds are strongly influenced by their funding and maturity. Davis et al (2001) argued that funding consideration must be made since shortfall risk, which is an incidental negative stock market event on the short term, could have a significant effect when investing in equity. With respect to maturity, a different ratio between retired and current employees can significantly change the demand for equity.

Were asset allocations influence future returns, investment strategies play an important role between short and long run incentives. Booth et al. (2004) noted that market volatility will result in short term surpluses or deficits; however, these are insignificant in the long run. Were a pure stock strategy has statistically higher returns in the long run[9] it poses more risk on the short run. A pure bond strategy secures the required benefit payments and other liabilities through low risk low return bond investments, but might succumb to an increasing inflation. A long term strategy diverges between young and old members. Were old members are more conservative and risk averse, young members can be risk seeking. Moreover, young participants have the luxury of time should equity investments give disappointing returns; the previous is called the life cycle strategy[10]. From the latter, Maurer and Schlag (2002) argue that the asset allocation should change with age, since short falls are difficult to compensate in the short run.

[8] Dimon et al. 2006
[9] Maurer and Schlag (2002)
[10] Michaelides and Gomes (2005)

The risk attitudes and simultaneously the investment strategies of pension funds are influenced by several factors. Should managers follow the maturity fluctuations by adopting the life cycle strategy (section 4.3) when maximising the expected returns? Or, should managers only focus on a long term investment plan (He, 2008). Since both political situations and pension characteristics influence risk and return, the choice of an investment strategy is difficult.

In addition, there is an intergenerational part in pensions which binds the retirees benefit requirements to the employees' contributions. When employees face tremendous benefit payments they will not participate in pension funds. Therefore, the younger generations must be given incentives in order to provide a healthy pension fund.

## 5. Research Question

There is a growing amount of pressure on the pension system in Germany. The government has increased contribution rates (2001 reform) and the retirement age has been set higher (2003 reform). Unfortunately, both measures are not sufficient to cope with the increasing demand for benefit payments of future retirees. Therefore, some researchers believe Germany should return to a fully funded system, since previous presents possible efficiency improvements (Sinn, 1997, Feldstein 1997). However, Sinn (2000) stated that the public pension system, a PAYGO system, is a zero sum game between generation which hold no simple inefficiencies or simple improvements with respect to a fully funded system). However, through the changes of the Rietser reform (public and occupational pension system) the German government presented a clear incentive for employers and employees to individually manage part of their own pension funds; thereby, relieving pressure from the public pension fund.

The implementation of this new hybrid pension system raises an important question: "What is the investment strategy of this new pension system?" The turbulent equity market[11] and also the turmoil present in politics resulting in possible unstable bonds (Greece), present a dangerous scenario for pension funds. The portfolios of German pension funds consist of bonds, equity, property and other investments. Earlier research states that bonds have a longer maturity and more stable returns (relatively safe), contrary to equity (section 3.3) which are relatively short term and their returns are more volatile (relatively risky). Therefore, the equity portfolio will define the risk attitude of these pension portfolios. How does the portfolio share of equity relate to the age differentiation within companies and what about large pension funds or financial companies? The

[11] Kocherlakota, 1996

amount of risk could be influenced by many factors such as demographic variables, pension characteristics and different market sectors.

What influences the equity share and therefore risk within company pension plan? Are there significant changes caused by pension plan characteristics? With respect to the previous the research question of this paper becomes:

**Research Question:** "What influences the risk attitude (equity share) of German pension funds?"

## 6. Data and Methodology

### 6.1 Data

The OECD and The Statistisches Bundesamt of Germany provide the demographic variables, such as: age and gender distribution and forecast, population growth and forecast, vital statistics (births and deaths), fertility and mortality rate by gender. All and more are used to describe the German market and present an insight in the behaviour of the German population.

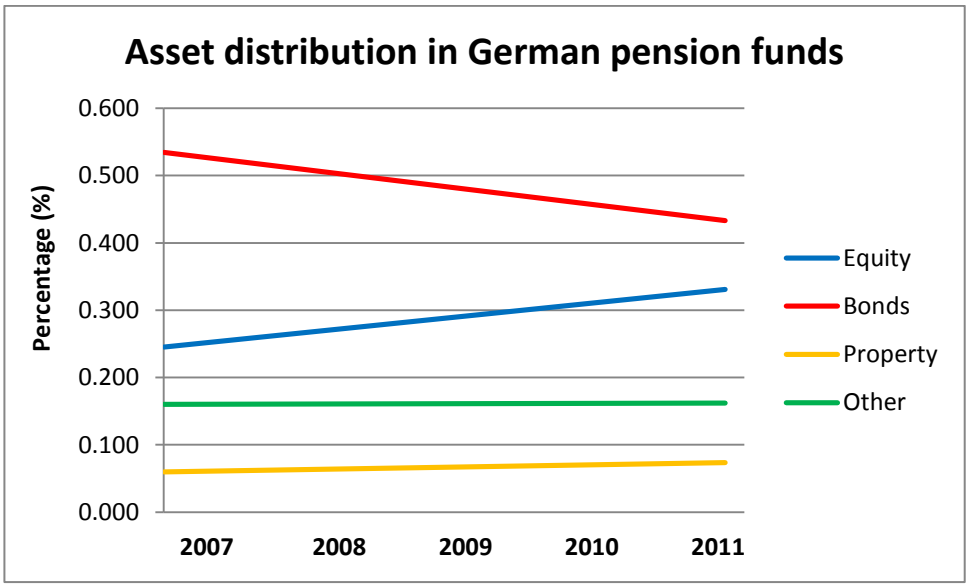
The asset or portfolio distribution of pension funds will be gathered for companies listed on the German stock exchange. The composition of the DAX contains 30 companies, MDAX 50, SDAX 50 and the TecDAX 30. From this total sample of 160 companies 58 companies report their portfolio distribution (equity, bonds, property, others) for the last 5 years (2007-2011). This data set is obtained through the annual reports of these companies and Thompson one beaker (world scope section). Since it is not clarified which assets are covered in the 'other' section these data point will be excluded from the dataset. The final dataset contains the pension funds' portfolio distributions of 58 companies ranging from 2007 to 2011. The risk attitude is tests are based on the equity share.

The pension size (assets and liabilities) and pension payments are also found on annual reports of all companies for the years 2007-2011. Since all companies are listed either on the DAX, SDAX, MDAX, TecDAX the annual reports can be found on their websites. Finally, the market sector in which the company is active is found in Thompson one banker, characterised by GCIS code, and added to the data set. The portfolio distribution, the demographic variable and financial and market data together form the panel dataset on which this research is conducted.

#### *6.1.1 First impression*

The asset distribution has changed with respect to the bond and equity shares however; all movements (Graph 2) are logical results from recent market turmoil. It is interesting to see that the bond portfolio was partly substituted for equity, between 2007 and 2011, since bonds decreased and property remained relatively equal. The previous could stimulate a stabilisation of the market in

general, where large investors (i.e. pension funds) are becoming more active in the equity market. Where the trust in equity was severely damaged during 2006 and 2007, due to the financial crises, this trust is now slowly recovering. Furthermore, the share of bonds could become a discussion point since Greece presented the financial world with a government on the brink of bankruptcy. Maurer and Schlag (2002) and Bader (2003) argued that future funded pension payments should be largely offset by the bond portfolio. With respect to the decreasing bonds portfolio share, it could be argued that and payments are covered and the immediate risk for pension funds is minimal; which is a soothing thought.




Graph 2: Asset distribution in German pension funds (2007 - 2011)

## 6.2 Methodology

This section will first discuss the different variables in the regression followed by a description of the regressions. From section 4.3 it follows that an increase in the relative amount of equity present in a pension fund will be seen as an indicator of more risk taken by the pension fund. Equity is therefore taken as the dependent variable in all regressions.

### *6.2.1 Dependent Variables Equity*

From the descriptive statistics on the dependent variable equity in table 2 the equity portfolio share is slowly increasing from 25.3% to 34.0%. Due to a stock market crash in 2008 it can be argued that the pension funds are slowly redistributing their funds towards a pre-crisis distribution.

| Table 2: Descriptive Statistics on Dependent Variable (Equity) | | | | | |
|---|---|---|---|---|---|
| | **2007** | **2008** | **2009** | **2010** | **2011** |
| **Equity Share** | 0.255 | 0.277 | 0.288 | 0.272 | 0.340 |

### *6.2.2 Independent Variables*

In the following sub chapters several possible influences, ranging from demographic characteristics to pension characteristics, are presented. The sub chapters are constructed in the following way. First, the reasoning behind the variables is presented. Secondly, the descriptive statistics are given (more elaborately in the appendix). Thirdly the expectation and hypothesis are stated.

#### 6.2.2.1 Pension Plan Size (PPS)

Within a hybrid pension plan Maurer and Schlag (2002) argued that future funded liabilities should be largely offset by a bond portfolio to secure benefits. Therefore high liabilities could result in a lower equity share and a higher bond share. However, high amount of liabilities could also lure fund managers in to riskier investments, since large amounts of liabilities could present problems for fund managers in the short run. Since pension plan are risk averse by nature this paper holds to the first argument were liabilities are offset by bond portfolios. This research uses the present value (PV) of funded pension liabilities since these represent the retired employees and therefore future benefit payments. In order to make values comparable between companies and time, log values are taken.

- **PPS Liabilities**

$$PPS\ Liabilities = Log(PV\ Funded\ Liabilities)$$

| Table 3: Descriptive Statistics on Pension Plan Size | | | | | |
|---|---|---|---|---|---|
| | **2007** | **2008** | **2009** | **2010** | **2011** |
| **Log(Assets)** | 2.858 | 2.829 | 2.772 | 2.722 | 2.761 |
| **Log(Liabilities)** | 2.990 | 2.940 | 2.880 | 2.821 | 2.823 |

Table 3 presents a slightly decreasing amount of funded pension liabilities during the five year period. In addition, Table 4 (appendix) states that the sample is slightly skewed (positively). This indicates that the sample is concentrated even more towards lower liabilities. However, relatively high standard deviations could indicate that this sample is sensitive to extreme outliers, due to the relatively low number of companies.

Lower amounts of liabilities could originate from the implementation of occupational pension fund. Regardless, they are remarkable stable since the government bond interest rates, on

which the discount factor is based, has dropped during the sample period; which should increase liabilities. From the previous the following expectation are formulated: High amounts of funded liabilities are expected to decrease the equity share. Concluding, the equity share has a contradictory movement compared to PPS Liabilities. This results in the following hypothesis:

**Hypothesis 1 (PPS Liabilities): High amounts of pension funded liabilities will decrease the equity share**

He (2008) states that the asset allocation could have a significant distorting effect on its value. However, the pension asset allocation (or asset amount) should be closely affiliated to future pension liabilities in order to fulfil retirement obligations. Were future pension liabilities are based on demographic firm characteristics and financial assumptions the asset allocation will follow suit in order to cope with these predictions. Therefore, regardless of He, pension's assets are a sound representation of the risk attitude of fund managers. In addition, the fair value (FV) of the plan assets is taken which incorporates all assumptions.

Large amount of pension assets could provide a false security since these assets provide a theoretical safe guard in the shape of a cash buffer, should investments go wrong. Rauh (2009) found results with respect to the size of companies in the US, were large companies (with more liquidity) tend to have bigger equity positions. Concluding, employees have a large base from which their pensions are guaranteed, which could lure fund managers in to riskier investments. In order to make values comparable between companies log values are taken.

- **PPS Assets**

$$PPS\ Assets = Log(FV\ Plan\ Assets)$$

Table 3 presented a slightly decreasing amount of assets between 2007 and 2011. In addition, table 5 (appendix) states that the sample is slightly skewed (positively) and relatively high standard deviations. The latter could indicate that these values are slightly biased since within this small sample, extreme values can have a large impact. Also, this decreasing number of assets within pension plans could be explained from a rumoured second dip which is focused on the stock market and lowering equity values. In addition, the uncertainty in the bond market could also lower the return. Since pension fund will only invest in safe bonds (Germany, Dutch) and avoid weak bonds (Greece, Spain) with high returns. Therefore, both equity and bond could be lowering the plan's asset value.

Concluding, with respect to the expectations for the equity share this research states the following. The independent variable PPS Assets are expected to have a positive, or coherent, effect on the equity portfolio share. This results in the following hypothesis:

**Hypothesis 2 (PPS Assets): High amounts of pension assets will increase the share of equity**

#### 6.2.2.2 Age Distribution Within Companies

Since the retirement for younger employees is further away, equity becomes more attractive because it has higher returns and the risk can be diversified through the years. Contrary, older employees are at the brink of retirement and want security of their pension, thus low risk. The previous is called the life cycle strategy. However, fund managers could also reason that many employees (i.e. baby boom generation) on the brink of retirement pressure the demand for high liquidity in the short run. However, it all depends on the maturity of employees (Davis, 2001). Since higher returns, through more equity investments, cannot be guaranteed this research holds to the life cycle strategy.

Unfortunately German companies do not publish the age distribution within companies. Therefore, instead of the age distribution this research looks at the ratio pension payments to pension funded liabilities for each company, which represents the amount of retirees within a pension fund. With the baby boom generation at the brink of retirement and a decreasing birth rate, pension payments could experience a tremendous increase. So, were pension contributors are decreasing and pension consumers are increasing, this ratio could prove to be an interesting variable for the future.

- **Maturity Variable**

$$Maturity = \frac{Pension\ Payments}{PV\ Funded\ Liabilities}$$

**Table 6: Descriptive Statistics on the Maturity Ratio**

| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| **Maturity** | 0.072 | 0.087 | 0.089 | 0.096 | 0.094 |

Table 6 presents an increasing ratio which could indicates that the amount of retirees is rising. However, section 6.2.2.1 showed a decreasing amount of funded liabilities which could also cause the increasing maturity ratio. Either way the maturity ratio is, compared to other nations, relatively sound; which is a positive sign for German companies. Nevertheless, this increasing ratio should be closely looked after, to prevent a further increase.

Table 7 (appendix) shows that the sample is extremely positively skewed with high standard deviations. This is a comforting thought since positive skewness indicates that the sample is largely situated in low maturity values but severely biased by extreme outliers.

With the life cycle strategy in mind the expectation become the following. A high ratio will have a negative effect on the equity portfolio share. The equity share is negatively related to the maturity ratio. This results in the following hypothesis

**Hypothesis 3 (Maturity): High maturity ratios will decrease the equity portfolio share**

#### 6.2.2.3 Pension Funding Variable

Funding stands for the creditworthiness of pension funds. Pensions with relatively high amounts of debt, or low funding ratio's, tend to invest more in bonds, since retirement payments are mounting. In addition, possible investment losses through equity would leave the pension highly unfunded and therefore bring too much risk. Finally, Bader (2003) mentioned that pensions' funded liabilities should be offset by a bond portfolio in order to secure future benefits and limit the risk. Davis (2001) also mentioned the negative influence of low funding ratios on investment 'freedom', were low funding meant more safe investments.

Contrary, extreme high funding ratios, resulting from e.g. excess returns, boasts fund managers confidence and are likely to increase the equity share. In addition, Friedman's (1982) risk offsetting theory, predicted a positive correlation between funding level and equity proportion.

Since pension assets and pension liabilities can fluctuate through time, due to crisis periods, baby boom generations and changing interest rates, a ratio will be used to compare the funding of companies between years.

- **Pension Funding Ratio**

$$\text{Pension Funding Ratio } = \frac{FV\ Plan\ Assets}{PV\ Funded\ Liabilities}$$

**Table 8: Descriptive Statistics on the Pension Funding Ratio**

| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| **Funding** | 0.763 | 0.792 | 0.801 | 0.822 | 0.892 |

Table 8 states funding ratios between 0,763 and 0,892 which are steadily increasing during the sample period towards acceptable levels, compared to pension funds in Europe (Dutch). Table 9 (appendix) states standard deviations between 0.15 and 0.18. Furthermore, the pension funding ratio is highly negatively skewed which indicates that this sample mainly consists of high funding

ratios but is biased by extreme values; this is a comforting thought. Finally, the German pension market has been reforming their pension system in a hybrid system and it must be noted that this has temporary consequences for the funding ratio.

Pensions funding ratios are expected to have a positive effect on the equity portfolio share since overfunded pension funds could invest without losing the ability to pay all benefits. When all benefits are covered investments in bonds will be minimises and equity investments are increase. Our expectation become that the equity share is coherent with the funding ratio, if funding increases the equity share will increase. This results in the following hypothesis:

**Hypothesis 4 (Pension Funding): High funding ratios will increase the equity share in pension fund portfolios**

#### 6.2.2.4 Sector Dummy Variables

Since, all companies are operating in different sectors this could have an effect on their share of equity in their pension funds. These companies are categorised in specific sectors through their GICS scores. Developed by MSCI the GICS aims to enhance several researches by categorising companies worldwide in different sectors[12].

This data set comprises of the following sectors: Materials, Industrials, Utilities, Consumer Discretionary, Consumer Staples, Health Care, Financials, Information Technology and Telecommunication Services. Were industrials and utilities are combined in one dummy named industry since utilities only consists of two companies and is closest affiliated to industrials. Similarly, consumer staples and consumer discretionary are combined in one dummy: consumer goods, in order to enlarge the dummy's sample and increase the statistical power. Finally, information technology and telecommunation services are combined in one dummy IT in order to enlarge the dummy's sample as well. So, the following dummy variables are created: D_Materials, D_Industry, D_Consumer Goods, D_ Health Care, D_IT, D_Finance. In the rest of this research the sector dummies are indicated as $d_sectors_j$. Were this variable has the following order:

$d_sectors_j$ D_Materials,
D_Industry
D_Consumer Goods
D_ Health Care,
D_IT
D_Finance

[12] More information on the GICS: http://www.msci.com/products/indices/sector/gics/

From these different sectors the finance sector is used as the benchmark. It is expected that their risk attitude is relatively lower compared to other sectors. Firtsly, Borio and Zhu (2009) stated that the since the regulations in the financial sectors have become more restricted, they could incur severe negative consequences when certain thresholds are crossed; hence they are more risk averse. Secondly, in Germany BaFin supervises many financial and insurance companies which are obliged by BaFin's new regulation criteria to frequently run stress tests and report the results (Stewart 2007). Breaching certain thresholds (i.e. funding ratio, underfunding) can be extremely costly for a bank, since it could trigger more restrictive regulatory actions. Thirdly, investment managers of pension funds can incur significant reputational damage. This results in the following hypothesis:

**Hypothesis 5: The financial sector has a lower equity share in their pension funds compared to other sectors**

Finally, the equity shares of each sector are stated below.

**Table 10: Equity shares between sectors**

| Sector | Equity (%) |
|---|---|
| **Materials** | 4.77 |
| **Industry** | 7.18 |
| **Consumer Goods** | 6.25 |
| **Health Care** | 4.03 |
| **IT** | 3.51 |
| **Finance** | 2.89 |

#### 6.2.2.5 Interaction Dummy Variables

Were each sector could have various ideas for the share of equity in their pension portfolios, the maturity and funding ratios also create unique differences between sectors. In order to find these relations interaction dummies are formulated. This research focusses on the funding and maturity variables. Firstly, since funding is a key representation of the 'health' of a pension fund, investment managers are sensitive to its value and movements. Secondly, the age differentiation within companies and sectors is a key factor for pension funds. As mentioned in section 4.3 the life cycle strategy states opposite investment strategies when the maturity variable changes.

So, how much does a 1% change in the funding or maturity variable influence the equity share in different markets? Is there a difference in magnitude? The following interaction dummy variables are formulated:

| | |
|---|---|
| d_Materials*funding | d_Materials*maturity |
| d_Industry*funding | d_Industry*maturity |
| d_Consumer_Goods*funding | d_Consumer_Goods*maturity |
| d_Health_Care*funding | d_Health_Care*maturity |
| d_IT*funding | d_IT*maturity |
| d_Finance*funding | d_Finance*maturity |

For the remainder of this paper interaction dummies are indicated $d_sectors_j$*funding and $d_sectors_j$*maturity.

Section 6.2.2.4 stated that financial companies are expected to have a lower equity share and therefore these pension funds have a lower exposure to the volatility of the equity market. Contrary, pension funds in other sectors have relatively higher equity shares, resulting in a higher sensitivity to market fluctuations. Pino and Yermo (2010) stated that during the financial crisis, which is also present in our sample, European pension funds incurred significant asset losses. Where funding ratios are expected to be stable, the previously suggested fluctuations are not desirable which could results in alterations in their asset allocations

Furthermore, Borch-Supan et. al. (2009) stated that savings rates and wealth levels are influenced by three main factors: cohort effect, life cycle effect and time effect. With respect to the life cycle effect (section 3.3) they found that the savings rate of households increased for all birth cohorts. In relation to the maturity ratio the SAVE analyses described a similar saving behaviour for the whole market. In sum, the funding ratio is expected to have an impact on our sample, were the maturity ratio could be diversified through the saving behaviour. Finally, the maturity ratio must also account for an intergenerational risk attitude, thereby complementing the effect of the life cycle strategy.

### 6.2.3 Regressions

In our research three regressions are conducted on the pension characteristics, different sectors and possible interaction effects. Also, each new regression will be tested for its significance.

#### 6.2.3.1 Pension Characteristics

Through the first regression the hypotheses (section 6.2.2.1 - 6.2.2.3) are tested and either accepted or rejected.

| Dependent Variable: | = | Independent variables: |
|---|---|---|
| **Equity Share** | | **$\alpha$** |
| | | **$\beta_1$*PPS Liabilities** |
| | | **$\beta_2$*PPS Assets** |
| | | **$\beta_3$*Funding** |
| | | **$\beta_4$*Maturity** |

#### 6.2.3.2 Sector Differences

In addition, the second regression test if there are differences in the portfolio's equity shares between sectors. Therefore, D_Finance is taken as the benchmark compared to the other sectors. This form the following regression:

| Dependent Variable: | = | Independent variables: |
|---|---|---|
| **Equity Share** | | **$\alpha$** |
| | | **$\beta_1$*PPS Liabilities** |
| | | **$\beta_2$*PPS Assets** |
| | | **$\beta_3$*Funding** |
| | | **$\beta_4$*Maturity** |
| | | **$\gamma_i$*d_sectors$_j$** |

Since the benchmark is an arbitrary choice the hypothesis $H_0 = \gamma_i = 0$ (i = 1 tot 5) of no partial effect is tested through an incremental Sum-of-Squares[13] approach. Here $R_u$ is R-squared of the uncontrained model. $R_c$ is R squared of the contrained model since 5 variables are restricted to zero. Furthermore, n is the sample size, k represent the explanatory variables of the constrained model and q represent the explanatory variables of the unconstrained model

$$F_{(q,n-k-1)} = \frac{n-k-1}{q} \times \frac{R_u^2 - R_c^2}{1 - R_u^2}$$

#### 6.2.3.3 Interaction dummy variable

The third and final regression tests if there are different reactions between sectors, to changes in funding and maturity. Similarly to the first regression the finance sector is used as a benchmark. It must be noted that in this regression the β coefficients of maturity and funding and the γ coefficients for each sector cannot be seen as unique partial effects or differences. γ presents the difference between sectors at the origin (funding and maturity equal zero). β states part of the

[13] John Fox, Lecture Slide 17

effect of maturity and funding in each sector, were the interaction dummy displays another part of the effect.

Finally, β combined with θ (δ) states the effect of funding (maturity) in a specific sector. The interaction model show how two variables interact and combine to affect the dependent variable. Contrary to correlation, this describes the relation between two independent variables.

| Dependent Variable: | = | Independent variables: |
|---|---|---|
| **Equity Share** | | **α** |
| | | **$\beta_1$*Funding** |
| | | **$\beta_2$*Maturity** |
| | | **$\gamma_i$*d_sectors$_j$** |
| | | **$\theta_i$*d_sectors$_j$*funding** |
| | | **$\delta_i$*d_sectors$_j$*maturity** |

Again an incremental F test is conducted, for both funding and maturity, in order to test the hypothesis $H_0 = \boldsymbol{\theta}_{\mathrm{i}} = 0$ $(\mathrm{i} = 1 \text{ tot } 5)$ and $H_0 = \boldsymbol{\delta}_{\mathrm{i}} = 0$ $(\mathrm{i} = 1 \text{ tot } 5)$ of no interaction effect. In order to find the total effect within each sector an individual regression for each sector could be formulated. Variables that are not significant should not be included in this regression since this contradicts with the principle of marginality. The regressions are be constructed accordingly (i = 1 – 5; j = D_Materials, D_Industry, D_Consumer Goods, D_ Health Care, D_IT):

$$equity = (\alpha + \gamma_i) + (\beta_1 + \theta_i) * d_sector_j * funding + (\beta_2 + \delta_i) * d_sector_j * Maturity + \varepsilon_i$$

The equity share of pension is influenced by more variables but this research focuses on the maturity and funding ratios. Therefore, only the individual interaction effects for each sector are discussed and the individual regression can simple be calculated with the given values.

## 7. Results

This section will present the results of the research which contains an explanation regarding the hypothesis, differences between sectors and a discussion of the interaction between pension variables and sectors. First the table and possibly an incremental F-test are presented, followed by a discussion of the results.

### 7.1 Pension characteristics

Table 10 below presents the results of the first regression, with respect to the dependent variable equity. In this table values significant at a 10%, 5% or 1% level are marked respectively with one (*), two (**) or three (***) stars.

**Table 11: Time Series Regression (dependent variable equity)**

| Independent Variable | Exp. | Coefficient | Std. Error |
|---|---|---|---|
| C | | 0.483738** | 0.229966 |
| PPS_ASSETS | + | -0.005334 | 0.355749 |
| PPS_LIABILITIES | - | -0.002406 | 0.356245 |
| MATURITY | - | 0.025615 | 0.126657 |
| FUNDING | + | -0.218701 | 0.233331 |

With respect to the pension funds characteristics no significant influences are found, that is the coefficients are not significantly deviating from zero. Therefore, no conclusive description can be given for our hypothesis one to four. The transition phase from the PAYGO system to the hybrid system, initiated by the Riester reform, could explain part of this insignificance. Börch-Supan, Coppola and Reil-Held (2012) found that the acceptance of these new pensions was concentrated in younger generations with children, while elderly (55+) did not switch, causing a bias between generations. With respect to the funding and maturity ratios, these pension fund characteristics are dependent on different variables, i.e. asset allocation and future payments. These characteristics have experienced recent shocks which could cause a bias between years. For instance, due to the recent crisis equity prices significantly decreased combined with a decrease in governments bonds (i.e. Greece). Antolin and Stewart (2009) stated that the previous causes a shift in asset allocation changing the pension's fair value of assets biasing the funding ratio. The maturity ratio is dependent on the pension liabilities. This discount factor, which is based on the interest rates of government bonds, has decreased in our sample period and therefore increases the future liabilities. This shock in the interest rates could bias the maturity ratio. Finally, a larger sample size could be taken, for example 10 years, or the time period should be altered preceding the Riester reform. Both reasons could be ideas for future research.

### 7.2 Sector Differences

Table 10 below presents the results of the first regression, with respect to the dependent variable equity. In this table values significant at a 10%, 5% or 1% level are marked respectively with one (*), two (**) or three (***) stars.

| Table 12: Time Series Regression (dependent variable equity) | | | |
|---|---|---|---|
| **Independent Variable** | **Exp.** | **Coefficient** | **Std. Error** |
| **C** | | 0.513563** | 0.225363 |
| **PPS_ASSETS** | + | 0.132157 | 0.351940 |
| **PPS_LIABILITIES** | - | -0.143356 | 0.352476 |
| **FUNDING** | - | -0.318226 | 0.229976 |
| **MATURITY** | + | -0.078045 | 0.125529 |
| **D_MATERIALS** | + | 0.114892*** | 0.034139 |
| **D_INDUSTRY** | + | 0.058209* | 0.030294 |
| **D_CONSUMER_GOODS** | + | 0.132748*** | 0.032414 |
| **D_HEALTH_CARE** | + | 0.124215*** | 0.036949 |
| **D_IT** | + | 0.085212** | 0.036362 |

In order to formulate our results first the hypothesis of no partial effect or $H_0 = \boldsymbol{\gamma_i} = 0\ (\mathrm{i} = 1 \text{ tot } 5)$ is tested. The incremental F-test rejects the hypothesis at 1%, which makes our new model and the coefficients significant.

### *7.2.1 Discussion Sector Differences*

Where our expectations are that investment managers in the financial sector are risk averse, our results confirm these expectations. Compared to the benchmark (finance sector), all sectors present significantly higher amounts of equity in their portfolios; ranging from 5.8% to even 13.3%. Recent turmoil in the financial sector has caused regulatory agencies to intensely monitor (i.e. stress tests) financial entities (Stewart 2007). In addition, public criticism and reputational damage could have made investment managers in the finance sector reluctant or reserved in their equity investment.

With respect to individual sectors, companies in the materials, industry, consumer goods, health care and IT sector have respectively 11.5% (significant at 1%), 5.8% (significant 10%), 13.3% (significant 1%), 12.4% (significant 1%) and 8.5% (significant 5%) more equity in their pension fund portfolios. What is interesting is that the mature sectors: consumer goods, materials and health care have significantly higher equity shares than the relatively new IT sector. Where the IT sector could be characterised as relatively more opportunistic, they are expected to have higher equity shares. In addition, the health care sector or insurance sector also endured much scrutiny; however, their equity share remains significantly higher. This might present interesting results in the funding and maturity ratios.

### 7.3. Interaction effects

Table 11 below presents the results of the second regression, with respect to the dependent variable equity. In this table values significant at a 10%, 5% or 1% level are marked respectively with one (*), two (**) or three (***) stars.

| Table 13: Time Series Regression (dependent variable equity) | | | |
|---|---|---|---|
| **Independent Variable** | **Exp.** | **Coefficient** | **Std. Error** |
| **C** | | 0.834*** | 0.126 |
| **FUNDING** | + | -0.655*** | 0.162 |
| **MATURITY** | - | -1.393*** | 0.453 |
| **D_MATERIALS** | + | -0.571*** | 0.189 |
| **D_INDUSTRY** | + | -0.389** | 0.155 |
| **D_CONSUMER_GOODS** | + | -0.285* | 0.171 |
| **D_HEALTH_CARE** | + | -0.301* | 0.155 |
| **D_IT** | + | -0.52*** | 0.181 |
| **D_MATERIALS*FUNDING** | | 0.622*** | 0.224 |
| **D_INDUSTRY*FUNDING** | | 0.465** | 0.186 |
| **D_CONSUMER_GOODS*FUNDING** | | 0.368* | 0.216 |
| **D_HEALTH_CARE*FUNDING** | | 0.366* | 0.199 |
| **D_IT*FUNDING** | | 0.645*** | 0.216 |
| **D_MATERIALS*MATURITY** | | 2.102*** | 0.517 |
| **D_INDUSTRY*MATURITY** | | 0.967 | 0.634 |
| **D_CONSUMER_GOODS*MATURITY** | | 1.601*** | 0.572 |
| **D_HEALTH_CARE*MATURITY** | | 1.575*** | 0.519 |
| **D_IT*MATURITY** | | 1.222** | 0.514 |

In order to formulate our results first the hypothesis of no interaction effect or $H_0 = \boldsymbol{\theta}_{\mathrm{i}} = 0\ (\mathrm{i} = 1 \text{ tot } 5)$ and $H_0 = \boldsymbol{\delta}_{\mathrm{i}} = 0\ (\mathrm{i} = 1 \text{ tot } 5)$ are tested. The incremental F-test rejects the funding hypothesis of no effect at 5% and maturity hypothesis of no effect at 1%, which makes our new model and the coefficients significant.

### *7.3.1. Discussion Interaction effects*

Again the coefficients behave as expected and are significant at various levels. Moreover, when funding ratios change the consequences or resulting changes are of significant higher magnitude in other sectors than in the finance sector. Therefore, our hypothesis is accepted.

Specifically for the IT sector, which is describes as entrepreneurial and relatively more risk seeking compared to other markets, the funding ratio has a strong influence. Therefore, the equity share changes with the funding ratio making the pension fund more risk seeking and risk averse contradictory to our expectations for the funding ratio. The mature materials sector also displays a high effect similarly to IT. Since both sectors initially have a relatively high equity share this requires alterations when the market or pension characteristics change. The strategy of these sectors could be focused on a recalibration based on the funding ratio, thereby adjusting their equity share to a more accepted level. Ebbinghaus and WiB (2011) argued that higher rates of bonds, risk averse investment products, resulted in more stable funding ratios. However, in light of the negative coefficient for funding this research argues that the pension funds are more focused on the short term. Baker (1998) argued that more (stress) tests leads to more pressure for fund managers in order to perform on the short term, therefore increasing their risk attitude.

Furthermore, the funding level of pension funds present an indication to the wealth present in the pension fund. Gollier (2007) researched the intergenerational aspect of risk in pension fund. Since this is difficult to quantify between generations and therefore calibrate in a formula, due to unforeseen shocks and market movements, Gollier stated that: "*A certain amount of wealth in pension funds is needed in order to smooth financial shocks between nations.*" In pension fund portfolios the amount of risk should depend on the health or funding of a portfolio. From Gollier's perspective this research argues that our sector's pension funds, compared to the finance sector, change to more risky portfolios when funding ratios drop, which is disturbing thought. Furthermore, the argument could be extended to the financial sector since they are already being monitored, therefore explaining the high coefficient between the other sectors.

Second the interaction effect between sectors and the maturity ratio. Four of the five interaction dummies present very significant coefficients. Therefore, from these coefficients it is obvious that all sectors experience a much stronger effect, compared to the benchmark, from the maturity ratio. Our hypothesis is accepted.

Since the maturity ratio is negative (as expected), these significant interaction effect mark that the sectors will decrease (increase) their equity share when the age structure increases (decreases). Therefore, the asset allocations of pension funds in these sectors are in line with the life cycle strategy, which is comforting for retirees. In addition, the SAVE study of German household

(Börsch-Supan, et.al. 2007) found that individuals from all cohorts continue to safe, invest relatively more in bonds, in periods before, close to and in retirement; which supports our results and is complementary to the life cycle strategy.

Fiona Stewart (2007) found that many new stress tests have recently been conducted, especially in the financial sector decreasing their equity share hence, their market exposure. The previous results in a lower exposure to market fluctuations compared to other sectors, therefore the maturity ratio will have a stronger effect in these sectors, resulting in higher coefficients.

## 8. Conclusions

The financial crisis influenced the pension asset's fair value tremendously. Where the equity market experienced an extreme drop (Pino and Yermo, 2010), the bond market was struck as well, both combined resulted in heavy losses for pension funds. In addition, based on research of the Statistisches Bundesamt, the German demographic market could be characterised as aging, with a growing elderly population and an increasing birth deficit. These arguments present a dangerous scenario for the German Pension market. Therefore, analysing the risk attitude in German pension funds is a key interest of current and future retirees.

Pension funds have different strategies within their portfolios, hence the diversity in their asset allocation and more specifically their equity share. This research mentions the life cycle strategy and intergenerational risk sharing but a cohort effect and time effect could also explain part of the risk attitudes. A brief summary of the results; firstly, the pension characteristics do not appear to have a significant effect on the equity share of pension funds in our sample. Secondly, focusing on the sector differences, all sectors present a significantly higher equity share then the financial sector. Thirdly, changes in the funding and maturity ratio create significantly different effects in other sectors compared to the finance sector.

Firstly, the pension characteristics will be discussed. The initial approach of this research was to find the influences or effects of various pension characteristics on the equity share. However, these do not appear to be significant; what could cause their insignificance? First, our sample is influenced by a financial crisis, therefore it is suggested to change or extend the time period. Second, the Riester reform implemented several changes (hybrid system) which are still being implemented and more importantly accepted by the general public. Although insignificance is unfortunate, this research would like note that all pension characteristics should have a minor influence, since highly volatile asset allocations are not preferred.

Secondly, what of the significance of the differences between sectors. The first explanation has been mentioned many times before and is based on the research of Stewart (2007), which stated

that financial companies were increasingly under supervision through more stress tests and more frequent reporting responsibility. Therefore, they decreased their equity share which could explain the higher sensitivity of other sectors. Furthermore, where the market was already moving towards generally more supervision (baker, 1998) this could have been spiked by the crisis resulting in market wide stress tests.

Thirdly, the interaction effects between sectors. Researchers mentioned that higher stress test and more supervision resulted in fund managers who are evaluated on their performance and thus more focused on the short term; hence, the unexpected negative relation in the funding ratio. Also, the maturity interaction dummy shows strong movements for all sectors when the ratio changes. Previous research (SAVE) presented an initial change in the behaviour towards savings, where the older generations is saving as usual; the younger generations are saving as well and the intergenerational risk is diminished. Therefore, the maturity ratio is strengthened by the overall savings attitude which results in a larger impact on the asset allocation when the maturity ratio changes. Where this research is pleased that the life cycle strategy can be accepted for German pension funds, the magnitude of changes in the maturity ratio can create too much volatility in the pension funds' asset allocations which is unwanted.

It is clear that differences are present between sectors. In addition, the finance sector appears to be less risk seeking compared to other sectors. It is mentioned, that since financial companies were hold accountable for the crisis their actions were scrutinised and they reduced possible risks. The question which is present now is: Who holds the correct amount of equity in their portfolios? This research argues that governments and policy makers should mind their regulatory roles. Antolin and Stewart (2009) argued that governments and regulatory bodies should not over regulate specifically for the finance sector since these short term consequences do not: "*strike the right balance between stability and growth and could have severe consequences for the long term.*" Furthermore, both the maturity and funding ratio should remain fairly stable with respect to their influence in the equity share and risk attitude. Since pension funds are risk averse by nature and their current asset allocation gives way for too much volatility a drop in equity share is preferred, specifically for the significant influence of several ratios. This would adjust the equity shares to that present in the financial sector and diminishes the risk. However, since markets change, so does the attitude or behaviour for risk and saving change. What should happen is that pension funds' asset value become less volatile and simultaneously minimising the risk.

## 8.1 Future research

Since our sample includes a financial crisis which stimulates much supervision in specific sectors, it is interesting to conduct our analyses on a data period both before and after such a crisis. In addition, it might also be interesting to look at the risk attitude before the introduction of the Rietser reform. Finally, it is also recommended that more years are added when conducting this research however, this depend on the availability of the data.

As mentioned in the conclusion, markets are constantly changing along with the behaviour of the individuals which are operating within. Therefore, the risk and savings attitudes of individuals must be monitored in order to adjust the asset allocation for the future. A final word for future research is that this kind of research should be conducted multiple times in a decade, in order to optimise the asset allocation and amount of risk within pension funds.

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# Appendix

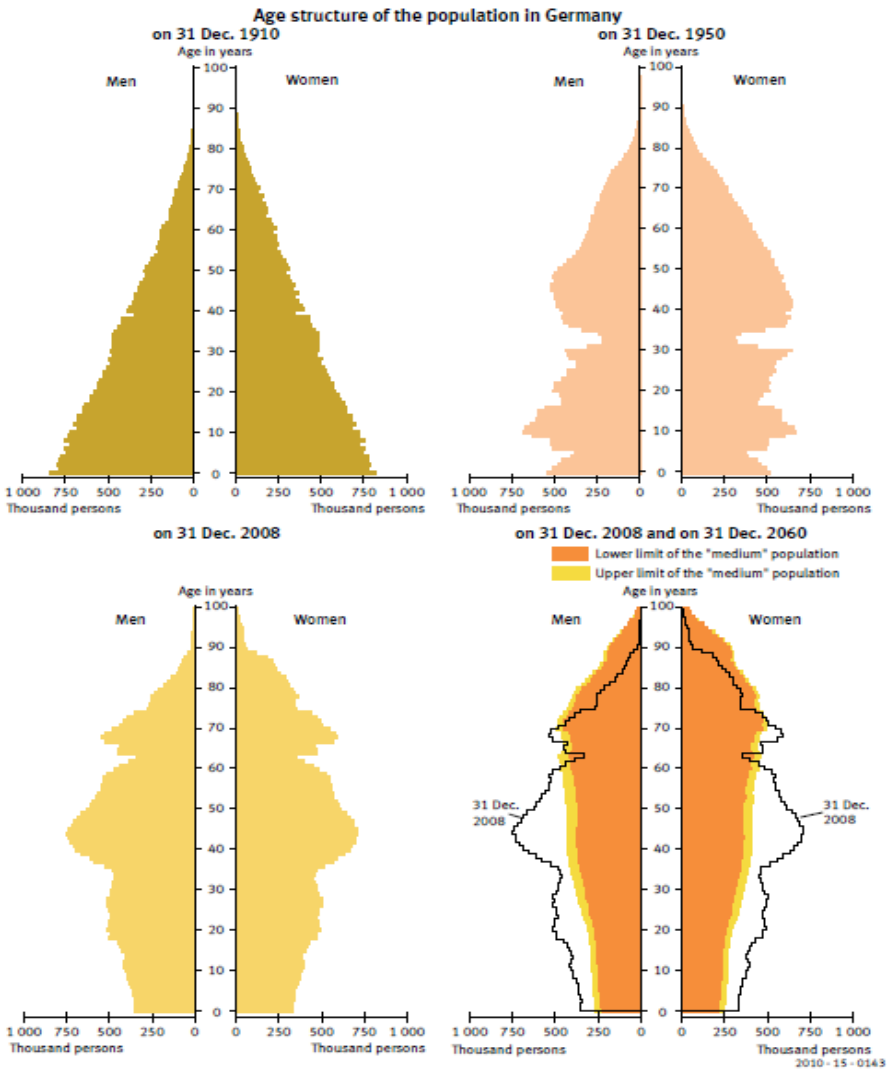


Figure 1: Age Structure in Germany, Source: Statisches Bundesamt, Germany's population By 2060

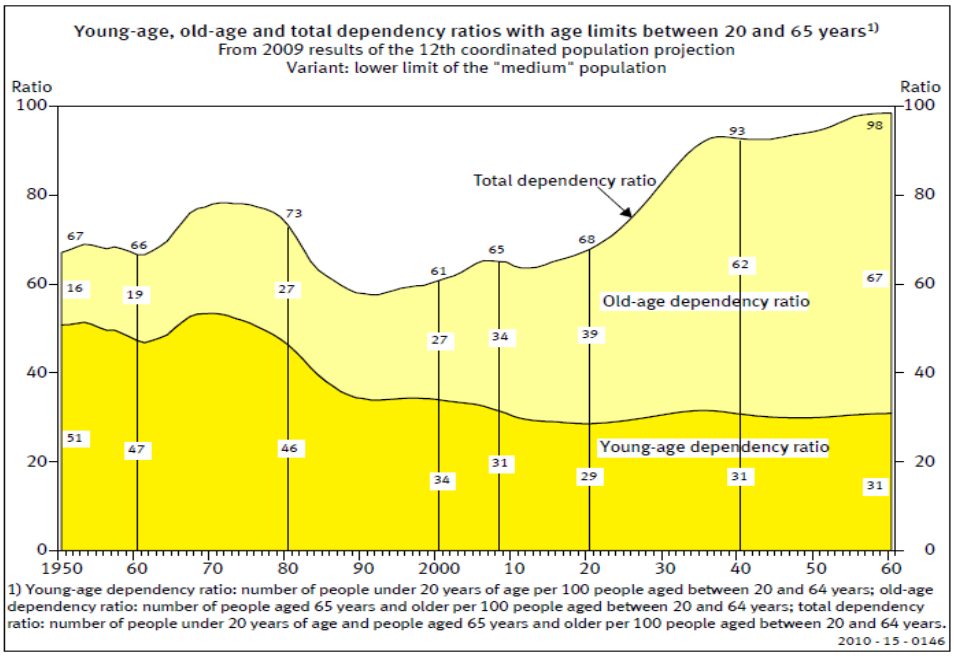


Figure 2: Dependency ratio's young and old in Germany between 1950 and 2060 (forecast), Source: Statisches Bundesamt, Germany's Population By 2060

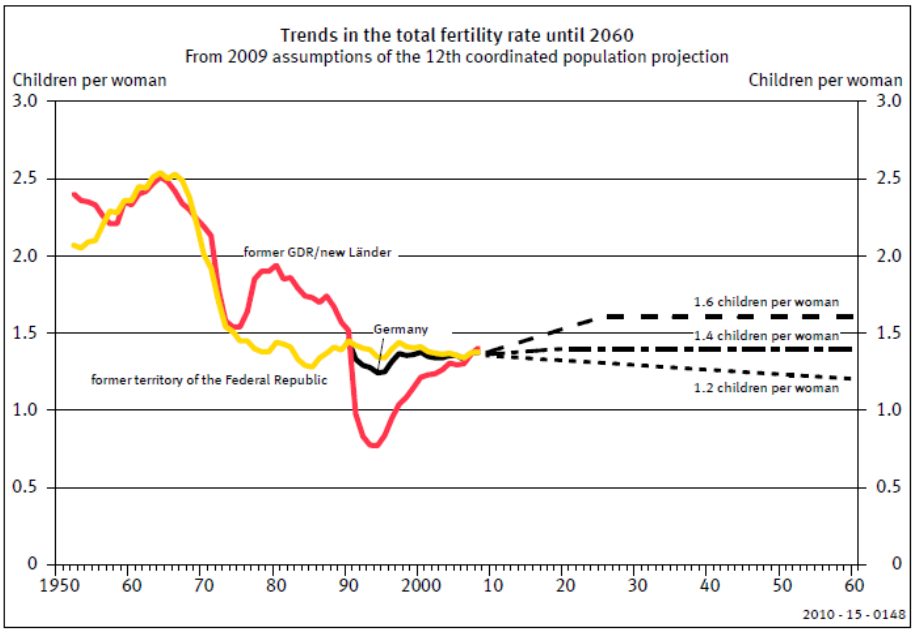


Figure 3: Trends in the Total Fertility Rate, Source: Statisches Bundesamt, Germany's Population By 2060

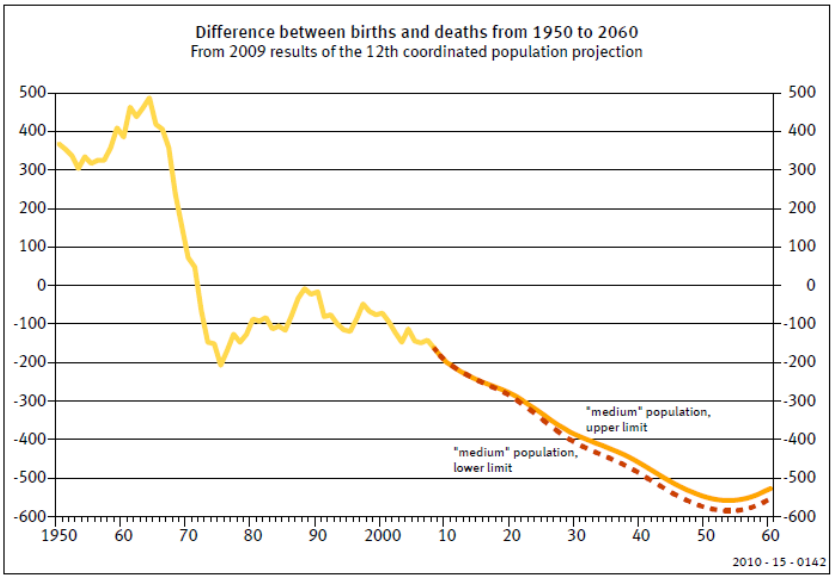


Figure 4: Difference Between Birth and Deaths, Source: Statisches Bundesamt, Germany's Population By 2060

**Table 4: Descriptive Statistics on log(liabilities), Pension Plan Size**

| | Companies | Mean | Maximum | Minimum | Std. Dev. | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| **2007** | 58 | 2.990 | 5.547 | 1.173 | 0.968 | 0.114 | 2.297 |
| **2008** | 58 | 2.940 | 5.451 | 1.098 | 0.965 | 0.138 | 2.325 |
| **2009** | 58 | 2.880 | 5.417 | 1.050 | 0.976 | 0.130 | 2.317 |
| **2010** | 58 | 2.821 | 5.389 | 1.003 | 0.976 | 0.112 | 2.386 |
| **2011** | 58 | 2,823 | 5.338 | 0.926 | 1.032 | 0.093 | 2.310 |

**Table 5: Descriptive Statistics on log(Assets), Pension Plan Size**

| | Companies | Mean | Maximum | Minimum | Std. Dev. | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| **2007** | 58 | 2.858 | 5.340424 | 1.061641 | 0.976764 | 0.101532 | 2.20197 |
| **2008** | 58 | 2.829 | 5.366096 | 1.019698 | 0.983416 | 0.123136 | 2.25316 |
| **2009** | 58 | 2.772 | 5.374075 | 0.969276 | 0.990243 | 0.14744 | 2.30184 |
| **2010** | 58 | 2.722 | 5.331662 | 0.848251 | 0.989201 | 0.119956 | 2.33445 |
| **2011** | 58 | 2.761 | 5.35904 | 0.971832 | 0.999105 | 0.159115 | 2.27304 |

| Table 7: Descriptive Statistics on Age distribution (Maturity) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Companies** | **Mean** | **Maximum** | **Minimum** | **Std. Dev.** | **Skewness** | **Kurtosis** |
| **2007** | 58 | 0.072 | 0.298254 | 0.011561 | 0.052894 | 2.216727 | 8.55295 |
| **2008** | 58 | 0.087 | 0.467758 | 0.021968 | 0.081404 | 2.726816 | 11.3479 |
| **2009** | 58 | 0.089 | 0.463739 | 0.012692 | 0.082097 | 2.512192 | 10.069 |
| **2010** | 58 | 0.096 | 0.353736 | 0.020033 | 0.076705 | 1.801514 | 5.68227 |
| **2011** | 58 | 0.094 | 0.38256 | 0.011978 | 0.079839 | 1.83258 | 6.06011 |

| Table 9: Descriptive Statistics on Pension Funding Ratio | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Companies** | **Mean** | **Maximum** | **Minimum** | **Std. Dev.** | **Skewness** | **Kurtosis** |
| **2007** | 58 | 0.763 | 0.994251 | 0.171691 | 0.171458 | -1.014606 | 4.16005 |
| **2008** | 58 | 0.792 | 1.010405 | 0.330853 | 0.156203 | -0.804159 | 3.1348 |
| **2009** | 58 | 0.801 | 1.058015 | 0.313581 | 0.165739 | -0.840614 | 3.3375 |
| **2010** | 58 | 0.822 | 1.177239 | 0.270443 | 0.18014 | -0.77258 | 3.6188 |
| **2011** | 58 | 0.892 | 1.156607 | 0.211337 | 0.18207 | -1.326095 | 5.36325 |