Strategic Asset Allocation Considerations for German Pension Insurance Funds: Theoretical Analysis and Empirical Evidence

Applying Stochastic Time-Series Simulations and Dynamic, Multiperiod Investment Strategies to Determine Optimal Portfolio Structures

Research Project

No. 04/2011

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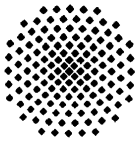
Stuttgart, in October 2011

ISSN: 1864 0125



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Abstract

Our research project analyses the suitability of social responsible investments (SRI) and alternative asset classes (in particular commodities, hedge fund investments, high-yield bonds) for the portfolio management of German Pension Insurance Funds *(Pensionskassen)*, the largest external occupational pension scheme in Germany. The research objective is to determine optimal portfolio allocations for varying asset classes and investment strategies. The empirical methodology applied in our analysis will consist of stochastic time series simulations in combination with dynamic, multi-period asset allocation strategies. To our knowledge, our research proposal is to date the first of its kind and will provide valuable results to the academic research community as well as represent a useful reference for finance practitioners.

Keywords: Pensionskasse, Pension Insurance Fund, Germany, Social Responsible Investment, SRI, alternative asset class, ocupational pension scheme, stochastic time series, dynamic asset allocation.

JEL Classification: C01, C32, C53, G11, G23.

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Abbreviations

Abbreviation	Description
AltZertG	Certification of Retirement Pension Contracts Act
AnlV	Anlageverordnung
AR	Autoregressive
AuM	Assets under Management
AVmG	Altersvermoegensgesetz
BaFin	Bundesanstalt fuer Finanzdienstleistungsaufsicht
BetrAVG	Gesetz zur Verbesserung der Altersvorsorge or Betriebsrentengesetz
CAGR	Compounded annual growth rate
CPPI	Constant proportion portfolio insurance
DCCG	Defined Contributions with Capital Guarantee
ESG	Ecological, ethical and governance
ETF	Exchange traded fund
GDP	Gross Domestic Product
HY	High-yield
IVG	Investmentgrade
MA	Moving average
OBPI	Option based portfolio insurance
para.	Paragraph
PAYG	Pay-As-You-Go
PIF	Pension Insurance Fund
PRI	Principles of Responsible Investing
SGB	Sozialgesetzbuch
SME	Small and medium
SRI	Social Responsible Investment
VAG	Versicherungsaufsichtsgesetz
VAR	Vector autoregressive
VEC	Vector error correction
VVG	Versicherungsvertragsgesetz

Translation of Key Terms

Term	Translation into German
Capital funding principle	Kapitaldeckungsverfahren
Mutual insurance company	Versicherungsverein auf Gegenseitigkeit (VVaG)
Public limited company (plc)	Aktiengesellschaft (AG)
Collective labour agreement	Tarifvertrag
Pay-As-You-Go	Umlageverfahren
Direct Pension Commitment	Direktzusage
Support Fund	Unterstuetzungskasse
Direct Insurance	Direktversicherung
Pension Insurance Fund	Pensionskasse
Pension Fund	Pensionsfond
Insurance Supervision Act	Versicherungsaufsichtsgesetz (VAG)
Defined Benefits	Leistungszusage
Contribution-based Defined Benefits	Beitragsorientierte Leistungszusage
Defined Contributions with Capital Guarantee	Beitragszusage mit Mindestleistung
Covering Funds	Deckungsmittel
Insurance Contract Law	Versicherungsvertragsgesetz (VVG)
Investment Ordinance	Anlageverordnung
Guarantee Assets	Sicherungsvermoegen
Actuarial Provision	Deckunsrueckstellung
Tied Asset Base	Gebundenes Vermoegen
Promissory Note	Schuldscheindarlehen
Registered Bond	Namensschuldverschreibung
Certification of Retirement Pension Contracts Act	Gesetz ueber die Zertifizierung von Altersvorsorge- und Basisrentenvertraege (ALtZertG)
Deferred Compensation Payment	Entgeltumwandlung
Social Security Code	Sozialgesetzbuch
Law for the Improvement of the Company Pension Scheme	Betriebsrentengesetz

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1. Introduction

The occupational pension scheme in Germany, despite representing only approximately 5% of pension benefits[1] and 3% of income[2] for German pensioners, is widely spread in society and has a long history, going back to the early 19th century when the first pension plans were introduced. On average, 51% of German corporates offer occupational pension plans to their employees, for large corporations[3] this proportion is as high as 97%.[4] With 12.3m pension members, 15.1% of Germany's total population is currently covered to a certain degree by an occupational pension plan.[5]

By law, there are five occupational pension plan alternatives that can be offered to employees. Amongst those, *Pensionskassen* (subsequently referred to as Pension Insurance Funds in our text) represent the largest external occupational pension scheme with more than 4.5m[6] pension members and €107.1bln[7] assets under management (AuM). The currently 151[8] regulated Pension Insurance Funds in Germany also benefit from the largest growth in terms of members.[9]

The role and relevance of Germany's Pension Insurance Funds are expected to increase in coming years, triggered primarily by important demographic changes in society: an aging population as well as a decreasing workforce (-34.4% until 2060)[10] is jeopardizing the funding of the pay-as-you-go (PAYG) state pension system. It is estimated, that by 2030, the ratio of pensioners to contributors in Germany will increase significantly from currently 65:100 to 110:100.[11] Capital funded pension schemes, both occupational as well as private solutions, are

[1] See Frankfurter Allgemeine Zeitung (2005).
[2] See Statistisches Bundesamt (2007), p.594.
[3] Defined as corporates with more than 1,000 employees.
[4] See Bundesministerium fuer Arbeit und Soziales (2008), p. 32.
[5] See Bundesministerium fuer Arbeit und Soziales (2008), p. 22. For the current population, we have used the 2010 figure of 81.5m inhabitants as reported by Statistisches Bundesamt (2011).
[6] See Bundesministerium fuer Arbeit und Soziales (2008), p. 110.
[7] See aba (2011).
[8] See BaFin (2011, a).
[9] See Bundesministerium fuer Arbeit und Soziales (2008), p. 110.
[10] See Statistisches Bundesamt (2009), p. 39 and p. 44.
[11] See Deutsche Bank Research (2010, a), p. 2.

expected to counterbalance the funding gap of the state system. In other European countries, the shift towards occupational and private pension solutions has already occurred. In the Netherlands, for example, occupational pension schemes represent already 40% of pension benefits, while in the UK that rate is 25% and in Switzerland 32%.[12]

One interesting observation about the investment allocation of European pension funds is their high and increasing involvement in Social Responsible Investments (SRI), in particular in the UK and the Netherlands. At current, 83% of Dutch pension funds have already some form of SRI policy in place.[13] In Germany, on the other hand, SRI investments by occupational pension schemes remain negligible, although we see various drivers that may potentially lead to a change in investment attitude in the future. First, there is evidence for increasing pressure by pension clients to include SRIs in the investment process.[14] Moreover, recent interpretation of fiduciary duty seems to imply that pension fund managers should be obliged to include SRI strategies in their portfolios.[15] Also, legal and regulatory requirements implemented in the last few years in Germany are expected to foster a more 'SRI-friendly' investment environment.[16] Besides, various academic studies have proved that SRIs achieve at least a similar financial performance than equivalent traditional investment strategies do.[17]

Asset allocation by German Pension Insurance Funds remains very conservative from a risk-return perspective. On average, 68% of assets under management are invested in (highly-rated) fixed-income bonds, only 28% in equities and 3% in real estate.[18] Recent legal and regulatory amendments, however, have introduced more flexibility in the asset allocation, in particular with respect to alternative asset classes, like hedge fund investments, commodities and high-yield bonds.

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[12] See Frankfurter Allgemeine Zeitung (2005).
[13] See VBDO (2011), p. 7.
[14] See WestLB Research (2010), p. 3.
[15] See Freshfields Bruckhaus Deringer (2005).
[16] See Preu, Richardson (2011), pp. 882-884.
[17] See UNEP, Mercer (2007), p. 36 or Margolis (2007), p. 2.
[18] See Bafin (2011, c).

Our research dissertation will focus on analysing the suitability of SRIs across asset classes (with special emphasis on corporate bonds) as well as alternative investments for the asset management of German Pension Insurance Funds from a legal, regulatory and economic point of view. A significant effort will be dedicated to the empirical analysis, which will be conducted using advanced stochastic time series simulations and dynamic asset allocation strategies. To our knowledge, no academic research studies have been published to date that concentrate on these topics. We expect therefore our research results to represent a significant contribution to the research community as well as to finance practitioners. The research project will be carried out as a doctoral dissertation at the Department of Corporate Finance of the University of Stuttgart (Germany) under the supervision of Prof. Dr. Henry Schaefer. This document introduces the detailed framework of our research project, defines the research proposal and the methodology that will be used.

2. Research Project Framework

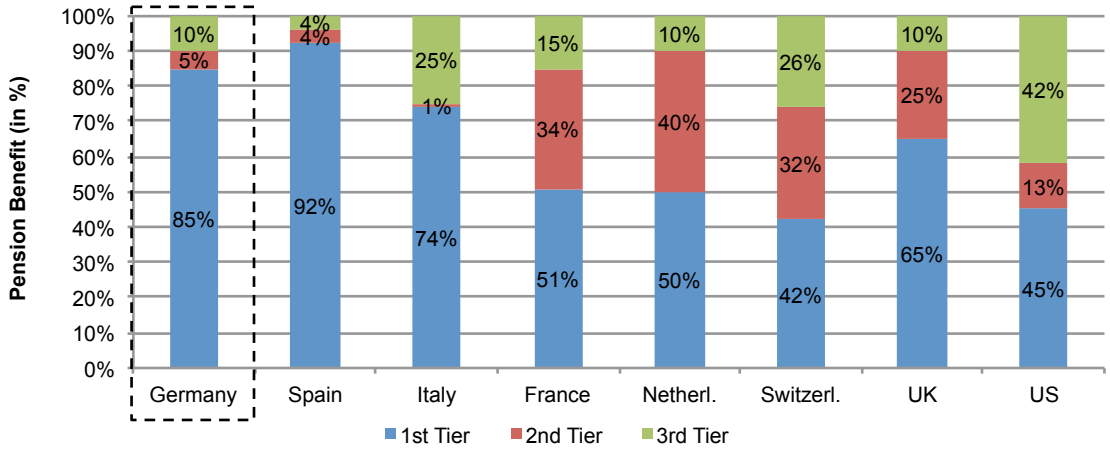
2.1 The German Pension Insurance Fund as Integral Part of the Occupational Pension Scheme

2.1.1 Occupational Pension Schemes in Context

A. Overview

Germany's pension system is structured similarly to the majority of pension schemes in industrialized countries. Retirement provisions are thereby primarily offered via three (separate) alternatives: (1) a statutory public pension scheme (first tier), (2) occupational pension schemes (tier 2) and private pension plans (tier 3).[19] The rationale for promoting additional tiers to the public (basic) system is primarily to improve retirement provisions for pensioners, as it is becoming increasingly evident that for citizens in industrialised countries public pension provisions are not sufficient anymore to guarantee an acceptable means of existence.[20] Comparing the distribution of pension benefits amongst the three tiers in various pension systems in Europe and the US visualises the predominant role of the statutory pension plan in Germany (85% of total pension benefits) in contrast to neighbouring countries like France (51%), Switzerland (42%) or the Anglo-Saxon system (US 45%, UK 65%).

Figure 1: Origin of Pension Benefits in Europe and the US (2005, in % of total pension benefits for a two-people household)



Source: Frankfurter Allgemeine Zeitung (2005).

[19] See Schmaehl (2003), p. 118 et seq.
[20] See Duenn, Fasshauer (2009), p. 111.

B. Statutory Pension Scheme (First Tier)

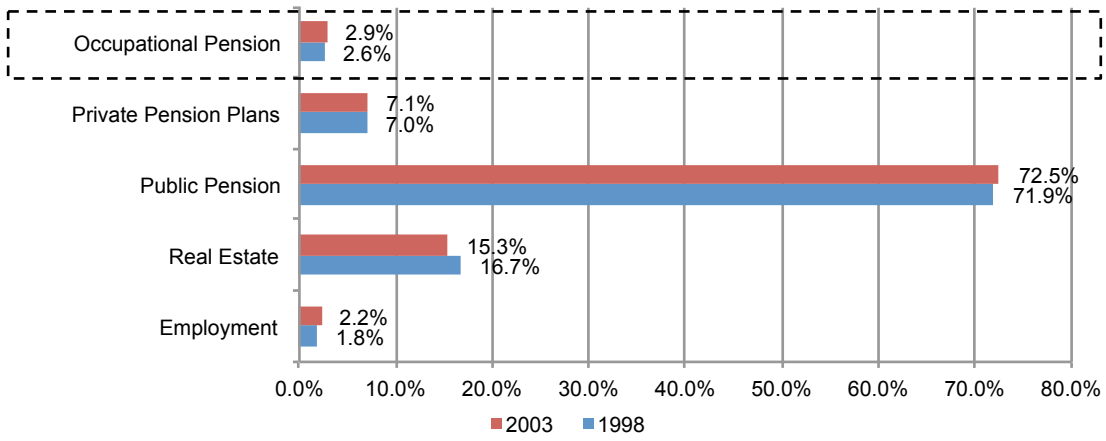
The statutory pension scheme represents the core of the German pension system in terms of economic relevance, population coverage and magnitude of pension financing: as we have seen, approximately 85%[21] of German pension benefits are paid out from the first tier and close to 80% of all employees are affiliated to it. Its economic importance is reflected in the fact that around 10% of the German GDP runs through the public pension system.[22]

With 52.2m members and €230.7bln of pension benefits paid out in 2010, the first tier is doubtlessly the dominant element of the German pension system.[23] Based on research studies by the German Federal Statistical Office, 73% of the income of German pensioners is originated by the public pension system; occupational pension schemes (around 3%) and private pension plans (7%) play currently a minor role.[24] Figure 2 summarises these findings.

An important element of the German state pension system is its funding structure, as it is financed via the Pay-As-You-Go (PAYG) principle (as stated in §153 para.1 SGB VI). This means that current contributions by paying members are transferred directly to current pension beneficiaries. Pension contributions in Germany are paid equally between employer and employee.[25] Major financing risks of PAYG financing structure are changing demographics, in particular aging societies in industrialised countries, as contributions become increasingly insufficient to cover benefit payments.

[21] See Frankfurter Allgemeine Zeitung (2005).
[22] See Duenn, Fasshauer (2009), p. 112.
[23] See Deutsche Rentenversicherung Bund (2011), p. 1 et seq.
[24] See Statistisches Bundesamt (2007), p. 594.
[25] See Sabrowski (2007), p. 5.

Figure 2: Income Distribution of German Pensioners (in % of Gross Income)



Note: Data shows distribution of gross income of German pensioners in 1998 and 2003 for a one-person pensioner household. Numbers are an average for West and East Germany.

Source: Own figure, based on Statistisches Bundesamt (2007), p. 594.

C. Occupational Pension Scheme (Second Tier)

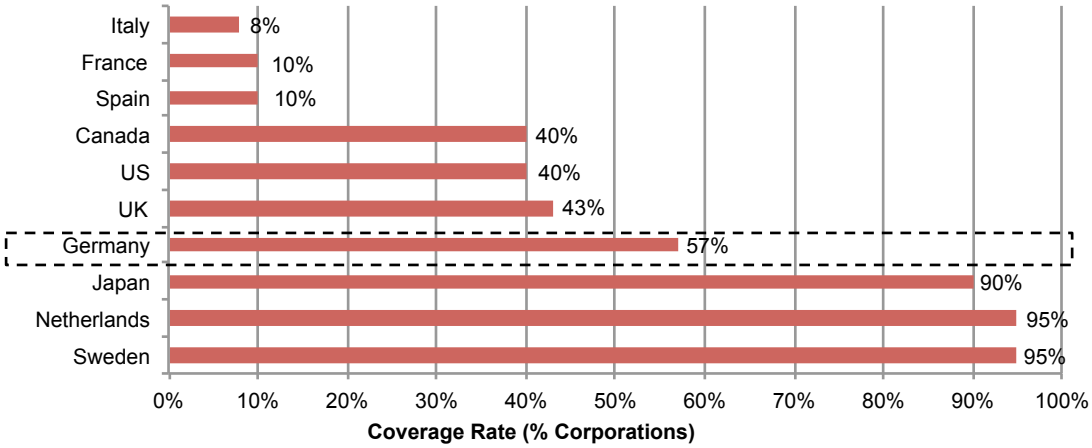
Germany's occupational pension scheme, despite its current relatively low importance in terms of source of income for pensioners, has a long history and was in fact introduced prior to the state pension system. Early examples of large industrial companies offering their employees protection against death and disability are Gutehoffnungshuette in 1832 and Siemens in 1872.[26] Retirement provisions followed shortly after. It is important to highlight that the implementation of these pension schemes by caring and paternalistic company founders occurred purely on a voluntary basis.[27]

Nowadays, occupation pension schemes have been introduced in both public and private sectors. Within the public sector, in general, all civil servants are covered by some form of supplementary pension plan (normally in the form of collective agreements), primarily in defined benefit structures.[28] In the private sector, approximately 57% of employees are members of an occupational pension scheme in Germany, a coverage level that diverges significantly amongst industrialised countries, as figure 3 shows. While Northern European countries generally have a very high coverage (Sweden 95%, Netherlands 95%), South-

[26] See Sabrowski (2007), p. 11.
[27] See Gieg (2008), p. 19.
[28] See Schmaehl (2003), pp. 119-121.

ern European companies have a much lower penetration rate (Italy 8%, Spain 10%).[29]

Figure 3: Proportion of Workforce with Occupational Pension Plan (2005)



Source: Own figure, based on The Pensions Board (2005), p. 139.

The German occupational pension scheme is regulated within the legal framework of the BetrAVG (*Gesetz zur Verbesserung der betrieblichen Altersversorgung*, also called *Betriebsrentengesetz*) and the VAG (*Versicherungsaufsichtsgesetz*). In §1 para. 1 sec. 1, the BetrAVG defines a pension plan as an arrangement by an employer to offer benefits to his employees to protect him against financial shortfalls caused by retirement, death or disability. Benefits become legal entitlement as soon as one of the risk events occurs and the affected employee is unable to continue to pursue his work obligations.[30] The BetrAVG offers employers five major implementation alternatives: Direct Pension Commitments (*Direktzusage*), Support Funds (*Unterstuetzungskasse*), Direct Insurances (*Direktversicherung*), the Pension Insurance Fund (*Pensionskasse*) and Pension Funds (*Pensionsfonds*).[31] The funding of Pension Insurance Funds, Pension Funds as well as Direct Insurances occurs via the capital funding principle (§1 para. 2 BetrAVG).

D. Private Pension Plans (Third Tier)

Private pension plans are offered in many different ways in Germany, the most common ones being savings plans, real estate investments and investment

[29] See The Pensions Board (2005), p. 139.
[30] See Foerster, Rechtenwald (2008), p.138.
[31] See Rohde, Kuesters (2007), p.18 et seq.

funds. It is difficult, however, to attribute investments in these asset categories directly to retirement provisions, making an analysis of the exact asset distribution within the third tier challenging.[32] Some more recently implemented private pension plans are subsidised via tax incentives by the German Government (the most relevant pension plan being the 'Riester Rente' introduced in 2002, and the 'Ruerup-Rente').[33] Private pension plans are the second most relevant tier of the German pension system in terms of size, and they also benefit from the largest growth rates, mostly amongst younger generations of employees.[34]

2.1.2 Key Elements of the German Pension Insurance Fund

A clear understanding of the legal, regulatory and economic requirements for Pension Insurance Funds as defined in the BetrAVG and the VAG as well as the regulatory environment of the BaFin, under which this form of occupational pension scheme operates, will enable us to define the framework for our empirical analysis and help us to analyse the feasibility of including new asset classes into the investment portfolio. The detailed considerations on the investment framework for Pension Insurance Funds will be discussed separately in section 2.2, given its relevance for our research project.

A. Definition

The BetrAVG defines in §1b para. 3 a Pension Insurance Fund as an independent insurance institution, which offers employees (or surviving dependents) a legal claim on benefits originated by an occupational pension arrangement. Furthermore, based on VAG §118a, Pension Insurance Funds are legally independent life insurance companies that offer insurance protection to their members for the risk events of retirement[35], death or disability. The VAGs states further that (1) the insurance business should be realised via the capital funding principle, (2) in case of death only surviving dependents have a legal claim on the benefits and (3) the insured person has a direct legal claim versus the Pen-

[32] See Gieg (2008), p. 21 et seq.
[33] See Duenn, Fasshauer (2009), p. 113.
[34] See Deutsche Rentenversicherung Bund (2005), p. 7.
[35] When referring to 'retirement' risk, risk refers to the 'threat' a pensioner faces of not being able to maintain a lifestyle based on his savings only or pension entitlements he may receive from the public pension system. The benefits from the occupational pension scheme are seen as a risk cushion against such possible shortfalls upon retirement.

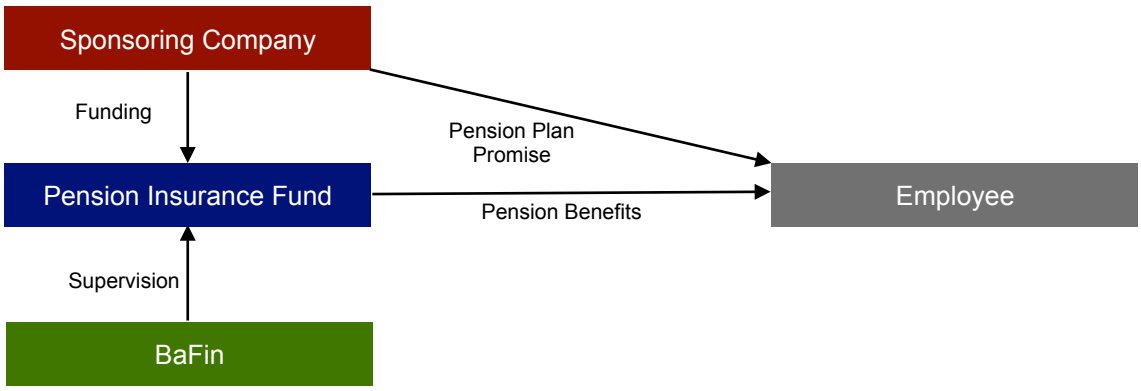
sion Insurance Fund.[36] Due to the insurance character of Pension Insurance Funds, the VAG allows only a few legal forms: either as a mutual insurance company or alternatively as a public limited company (plc).[37]

Distinguishing a Pension Insurance Fund from a traditional life insurance is, despite the similarities of the risk categories covered, relatively unproblematic: the former offers pension insurance services exclusively to employees of a company and is therefore not accessible to everybody, while the latter insures the general public. The classic Pension Insurance Fund offers occupational pension arrangements for employees of a specific company only. However, there are also alternative structures for large corporate groups, industry sectors or collective labour agreements and even comprehensive funds not associated to any sector or company.[38]

B. Relationships Company-Employee-Pension Insurance Fund-Regulator

The various explicit and implicit relationships between sponsoring company, the Pension Insurance Fund, the employer as well as the German regulator are depicted in figure 4.

Figure 4: Relationships amongst Involved Parties in a Pension Insurance Fund



Source: Own figure, on the basis of Doetsch et al (2010), p.21 and Hanau et al. (2006), p.159.

The Sponsoring Company is responsible for an adequate funding of the Pension Insurance Fund, so that the investment objectives can be sufficiently met, in particular with regards to the regulatory requirements of the VAG. Once a company decides to offer this type of occupational pension scheme to its em-

[36] See Hanau et al (2006), pp. 158-159.
[37] See Klatt (2003), p. 67.
[38] See Klatt (2003), pp. 68-69.

ployees, they obtain a legally enforceable claim against the company (§1 para. 1 BetrAVG). The pension benefits themselves are paid out directly from the Pension Insurance Fund to the employees. The German regulator BaFin supervises Pension Insurance Funds to ensure that the rules of the VAG with respect to investment guidelines are complied with and to avoid potential insolvencies.

C. Pension Benefits and Contributions

Pension benefits and contributions linked to a Pension Insurance Fund determine the cash flows that are involved during the life of the insurance contract. Under BetrAVG, there are three main forms of employer-financed benefit alternatives for German occupational pension schemes: (1) defined benefits (*Leistungszusage*), (2) contribution-based defined benefits (*Beitragsorientierte Leistungszusage*) and (3) defined contributions with capital guarantee (*Beitragszusage mit Mindestleistung*). All three alternatives are feasible for Pension Insurance Funds.[39]

Pension plans with defined benefit structures represent the basic form of pension schemes for employees in Germany.[40] Regulated in §1 para.1 BetrAVG, defined benefits guarantee an insured person a certain benefit level once one of the three insured risk events (retirement as compulsory element, with disability and death as optional contractually covered events) occurs. Benefits are usually paid out as a percentage of last salary or as a fixed amount, although there can also be mixed combinations.[41] The exact amount that the pensioner will receive is time-dependent (years of affiliation to the scheme, §2 BetrAVG) and contribution-dependent.[42] For defined benefit plans, there are no regular contributions that are paid into the respective pension scheme, rather a promise by the employer of a fixed pension level at retirement.

For contribution-based defined benefits (defined in §1 para. 2 no. 1 BetrAVG), on the other hand, the employer commits to contribute a fixed amount into a pension scheme during the investment period. These contributions are trans-

[39] See Rohe, Kuesters (2007), p. 17.
[40] See Roth (2009), p.22.
[41] See Doetsch et al. (2010), p. 24.
[42] See Hanau et al. (2006), p. 161.

formed via an actuarial formula into benefit entitlements for the employee. This formula enables the company to determine the required contributions to the pension scheme to obtain the agreed pension contributions upon retirement.[43]

Defined contributions with capital guarantee (DCCG) are the latest benefit alternative that was introduced in Germany in 2002 when the AVmG (*Altersvermoegensgesetz*) law bill came into effect. §1 para. 2 no. 2 BetrAVG states that in a DCCG plan, the employer commits to pay regular contributions to a pension scheme. Once an insured risk event occurs, the claimant is entitled to receive the sum of all contributions accumulated until that moment plus any excess returns the invested capital has achieved. Any costs related to hedging the biometric risk of death and disability has to be deducted from this gross pension capital.[44] It is important to emphasize that this capital guarantee only applies to the sum of all contributions made less the costs for biometric risks (net pension capital).[45]

The German legislator has the authority to fix a maximum guaranteed return on the pension contributions that a Pension Insurance Fund can offer to its clients (§65 VAG). Today, this interest rate is capped at 2.25%, although the Federal Ministry of Finance announced that the rate would be decreased to 1.75% for any new members from 2012 onwards.[46]

From an investment management point of view, defined contributions with capital guarantee represent the most challenging benefit structure, as the employer is obliged to guarantee the net pension capital accumulated during the investment period. Any shortfall to this amount has to be funded by the company. The claimant, on the other hand, bears full inflation risk on the invested capital, as the net pension capital is understood to be in nominal terms.[47] As the company is legally not obliged to provide a guaranteed return on the contributions over

[43] See Veit (2009), p. 439.
[44] See Ruland, Ruerup (2008), p. 148.
[45] See Doetsch et al. (2010), p. 25 et seq.
[46] See Hagen, Riedel (2011).
[47] See Hanau et al. (2006), pp. 168-170.

time other than the backstop on the net pension capital in nominal terms, DCCG are also called “Zero-Return-Guarantee” plans.[48]

2.1.3 Economic Relevance and Outlook

A. Economic Relevance

Based on statistics published by the BaFin, there were 151 regulated Pension Insurance Funds active in Germany by mid-2011.[49] Using underlying covering funds (assets under management) as a reference, Pension Insurance Funds had a total asset base of €107.0bln under management, what represents the second largest occupational pension scheme after Direct Pension Commitments, with €245.1bln of assets. Table 1 illustrates the split of total AuM by German pension schemes.[50]

Table 1: Covered Funds of German Occupational Pension Schemes (2008)

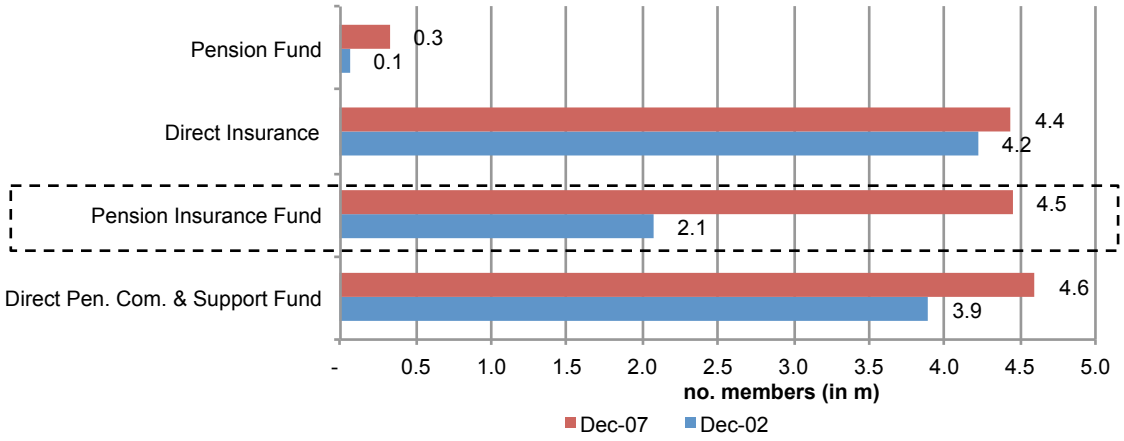
Occupational Pension Scheme	Assets under Management	
	In % of Total	**In €bln**
Direct Pension Commitment	54.0%	245.1
Pension Insurance Fund	23.6%	107.1
Direct Insurance	11.0%	49.9
Support Fund	8.2%	37.2
Pension Fund	3.2%	14.5
TOTAL	**100.0%**	**453.8**

Source: On the basis of aba (2011).

Taking as reference the number of insured pension scheme members, the relative position of each occupational pension scheme remains unchanged.

[48] See Langohr-Plato, Teslau (2003), p. 661.
[49] See BaFin (2011, a).
[50] See aba (2011).

Figure 5: Pension Members by Occupational Pension Scheme (Dec-2002 to Dec-2007, in million people)



Source: Own figure, on the basis of Bundesministerium fuer Arbeit und Soziales (2008), p. 110.

B. Outlook

Forecasted demographic changes for the next 50 years will pose a real threat to the funding and viability of the state pension system in Germany. The German Federal Statistical Office estimates that by 2030 Germany's population will shrink from currently 81.5m people (2010 data) to 77.4m in 2030 and then further to 64.6m in 2060 (-20.7%).[51] In the same time period, the proportion of the 'employable' population will decrease from 49.7m people in 2008 to 32.6m by 2060 (-34.4%).[52] Furthermore, if in 2010 the ratio of German pensioners to contributors for the state pension system was 65:100, this proportion is expected to shift dramatically to 110:100 by 2030 (+69.2%).[53]

Important pension reforms have been passed in the last 10 years to address the issues that the pension system faces in terms of demographic changes, in particular the 2002 pension reform (AltZertG or *Altersvermoegensgesetz*) and the 2005 *Alterseinkuenftegesetz* (AltEinkG). Main objective of these measures was to foster the penetration of occupational pension schemes as well as achieve a higher acceptance of private pension solutions. Recent developments are showing that Germany's employees are reacting to the potential financial threat caused by the statutory pension system and hence are diversifying their future pension income sources into private sector solutions. While at the end of 2001

[51] See Statistisches Bundesamt (2011).
[52] See Statistisches Bundesamt (2009), p. 39 and p. 44.
[53] See Deutsche Bank Research (2010, a), p. 2.

approximately 31% of German corporations offered occupational pension schemes, this rate increased considerably to 51% by the end of 2007 (+64.5%). For large corporations (> 1,000 employees) this rate is as high as 97%.[54] In the same time period, the overall number of employees that were members of an occupational pension scheme grew from 9.4m people to 12.3m (+31.0%), what represents a 15.1%[55] of the total population in Germany. [56]

Pension Insurance Funds benefited particularly from this high demand for private sector pension solutions: from 2002-2007, the number of members with pension entitlements grew by 114.3% from 2.1m members up to 4.5m, representing the largest growth of all five occupational pension schemes under BetrAVG for the time period considered (see previous figure 5).[57] These recent developments in the penetration of occupational pension schemes indicate that pension funds in general will potentially play an increasing role in the coming years.

2.2 The Investment Framework for Pension Insurance Funds

2.2.1 Legal and Regulatory Framework

A. Overview

The legal and regulatory framework for the investment management of German Pension Insurance Funds is primarily defined in the Insurance Supervision Act VAG, the Investment Ordinance (AnlV or *Anlageverordnung*) and the various circular letters of the BaFin (particularly the latest R 4/2011).[58]

The prime objective of these regulations is to ensure that pension promises by companies made to pension scheme beneficiaries will be fulfilled when benefits are claimed in the future. For that purpose, the asset-liability-management of Pension Insurance Funds requires to be monitored and regulated. As stated by the BaFin, “insurance companies must invest the Guarantee Assets and the Other Restricted Assets in a way that ensures maximum security and profitabil-

[54] See Bundesministerium fuer Arbeit und Soziales (2008), p. 32.
[55] Based on 81.5m inhabitants in 2010. See Statistisches Bundesamt (2011).
[56] See Bundesministerium fuer Arbeit und Soziales (2008), p. 22.
[57] See Bundesministerium fuer Arbeit und Soziales (2008), pp. 64-66.
[58] See Frere et al (2009), p. 64.

ity, while maintaining the insurance undertaking's liquidity at all times, maintaining an adequate diversification and spread".[59] For so-called primary insurers, to which Pension insurance Funds belong, the Investment Ordinance AnlV defines allowable assets for investing, diversification requirements for the investment portfolio, "spread thresholds, matching and location requirements" as well as a qualitative framework of how the internal investment management has to be implemented.[60]

Rules and regulations for the investment management of Pension Insurance Funds can be grouped into 3 categories: (1) Balance sheet aspects, (2) qualitative investment management guidance and (3) quantitative asset class specifications and limitations. While §§54 to 54d VAG define in generic terms the requirements for the fund allocation, §§65 to 79 VAG refers to balance sheet aspects (in particular terms and conditions of the Guarantee Assets), the Investment Ordinance AnlV and BaFin's circular letters specify concrete asset allocation limitations as well as investment standards with respect to diversification and risk spreading.

B. Balance Sheet Aspects

As defined by VAG, the asset side of the balance sheet is composed of the Guarantee Assets, Other Restricted Assets and Free Assets (§66 VAG). The sum of Guarantee Assets and Other Restricted Assets is called the Tied Assets Base. The liabilities side can be grouped into the Actuarial Provision and Other Liabilities (§65 VAG). VAG requires that the Tied Assets (Guarantee Assets plus Other Restricted Assets) equals the Actuarial Provision base to avoid an ALM mismatch that would result in a financial shortfall.

Figure 6: Balance Sheet of a Pension Insurance Fund as defined by §§65 and 66 VAG

	Assets	Liabilities
Tied Asset Base	Guarantee Assets	Actuarial Provision
	Other Restricted Assets	
	Free Assets	Other Liabilities

[59] Bafin (2011, b). Citation based on §54 para.1 VAG.
[60] See Bafin (2011, b).

C. Qualitative Investment Management Guidance

§54 para.1 VAG outlines that the asset selection for the Tied Asset Base of a Pension Insurance Fund should be guided by prudence, profitability, liquidity, diversification and risk spreading.[61] The prudence principle is thereby the predominating factor that guarantees that the pension scheme can fulfil its contractual obligations with its members. Assets selected should provide profitability, although the VAG does not state that a specific asset should achieve a certain guaranteed return. Moreover, the entire asset side of the pension fund should offer sufficient liquidity to be able to redeem its on-going and regular benefit payments. Adequate diversification, a basic principle in modern portfolio theory, should deliver risk reduction for the unsystematic risk exposure of the portfolio. Within risk spreading, a conservative investment approach has to limit the exposure to single counterparties to avoid default risk.[62]

Recent BaFin circulars R3/2009 as well as R4/2011 specify how the asset management of insurers has to be structured. With regards to the internal risk management, BaFin names five main risk categories for insurers: (1) market risk, (2) credit risk, (3) concentration risk, (4) liquidity risk and (5) legal risk for the proceeds invested within the Tied Asset Base. The board of the pension fund has to define a strategic and tactical asset management policy that takes into account such portfolio risks. In addition, one board member has to be made responsible for all risk management aspects of the portfolio (following the so-called 'prudent-person principle'). Moreover, an appropriate front and back office has to be put in place to execute the investment guidance of the board.[63]

All relevant asset management rules and recommendations have to be written down in an internal asset management policy book.[64] Furthermore, as part of a satisfactory risk management system, the insurer has to run stress tests on his portfolio on a quarterly basis.[65] Based on R4/2011, section B.2.3, insurers have the possibility to outsource all risk management aspects of the fund to an exter-

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[61] See Franz (2011, b), p. 1027.
[62] See Klatt (2003), pp. 87-89.
[63] See R/4 2011 (2011), section B.2.1.
[64] See R4/2011 (2011), section B.2.2.
[65] See R4/2011 (2011), section B.2.3.

nal counterparty. Also, insurance companies are obliged to provide BaFin on an annual basis a description of (1) the expected or targeted asset allocation for the coming year, (2) the internal asset-liability system in place and (3) risk exposures of the current asset portfolio.[66]

Circular letter R4/2011 has gained significant importance in the German insurance sector as it is considered a first step towards Solvency II, which will come into effect in Jan-2013 and is expected to have a meaningful impact on the asset-liability management of insurers (and therefore also Pension Insurance Funds), especially with regards to risk capital adequacy.[67]

D. Quantitative Asset Class Specifications and Limitations

For the purpose of our empirical analysis, the quantitative rules and regulations for the asset management of Pension Insurance Fund are of fundamental importance. The allocation flexibility is thereby worded in the VAG, the AnlV as well as the latest BaFin circulars: while §54 para. 2 VAG determines into which asset classes it is possible to invest in general, §§2, 3 and 4 AnlV provide further details on these asset categories as well as maximum allocation caps, BaFin circular R 4/2011 offers a more practical orientated guidance for the day-to-day investment business.

Table 2 summarises all investible asset classes, the allocation caps imposed by the regulator as well as requirements for risk diversification and risk spreading. It is important to highlight that these investment restrictions refer exclusively to the Tied Asset Base of Pension Insurance Funds. Within the Free Assets, the fund has practically no investment restrictions.

[66] See R4/2011 (2011), section B.2.5.
[67] See Franz (2011, b), p. 1030 et seq.

Table 2: Summary of Investment Restrictions as Defined by VAG, AnIV and R4/2011

Asset Class	Maximum Allocation	Comments
Risk Capital	35%	• Includes shares, subordinated debt, participation rights, loans backed by shares or cash, investment funds
Real Estate	25%	• Direct or indirect investments allowed (i.e. REITs or real estate funds)
Bonds/Mortgages/Loans	50% each	• Investment grade with rating, two ratings recommended • Max. 12 years to maturity and NPV of at least 50%. If longer than 12 years, than minimum return of current actuarial interest rate (currently 2.25%) or minimum coupon of 2.25% • For assets that drop below B- or B3: if direct investment or fund participation is more than 3% of the total fund volume, disposal or swap into free assets within 6 months, if less than 3% you have 6 months to see if rating improves and then another 6 months for disposal or swap into free assets
Indirect Investments	1%	• Indirect investments, i.e. private equity funds, into one single entity cannot exceed 1% of Tied Asset Base
ABS, CLN	7.5%	• Max. maturity of 12 years, NPV of capital guarantee at least 50% as for bonds • Stricter rules than for bonds/mortgages/loans: requires IVG rating, in case of downgrade no possibility to allocate as high yield, disposal threshold is already reached at rating of BB+ or Ba1
High Yield	5%	• If at least B- / B3, then allocation to Tied Asset Base possible
Commodities	5%	• No physical delivery of underlying commodities allowed
Maximum Allocation Single Asset Class	50%	• 50%, unless specified otherwise for asset classes within Tied Asset Base
Maximum Exposure Single Counterparty	5%	• Exposure to any counterparty is limited to 5% of the Tied Asset Base
Single Portfolio Manager	20%	• If Tied Asset Base is in the hands of one single portfolio manager, in one single company only 1% allowed
Low-Risk Loans	30%	• Loans issued by governments, supranational and regional issuing entities
Secured Debt Instrument by Single Financial Institutions	15%	• Refers to plain-vanilla secured bonds, covered bonds, for which there is protection on the collateral via law or regulation
Sponsoring Company	5% / 15%	• Limit for one sponsoring company 5% • Sum of all existing companies (if 3 or more) to not exceed 15%
Subordinate Debt	1%	• For same issuer
Equity	1%	• For same issuer
Hedge Funds	5%	• Either via fund-of-funds or direct investments

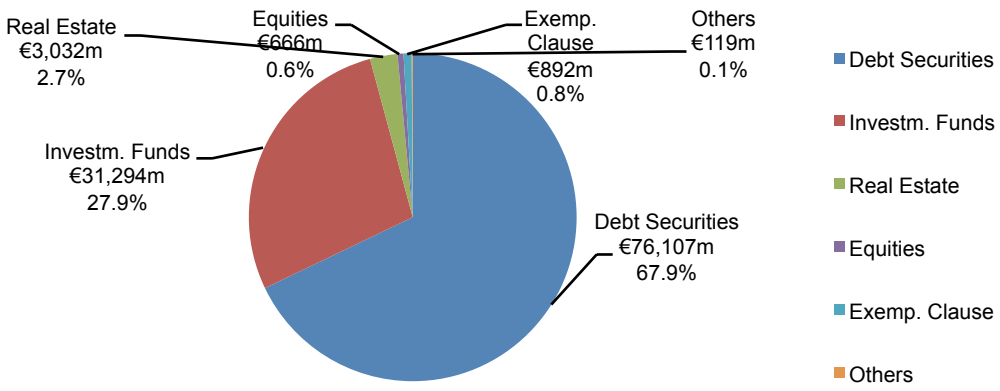
Exemption Clause	5% / 10%	• Assets under the exemption clause can only represent up to 5% of the Tied Asset Base. The BaFin can allow an increase to up to 10% under special circumstances
Exchange Rates	70%	• A maximum of 30% of the Tied Asset Base can be invested in a currency that is not the currency of the liabilities of the pension scheme • Real estate is denominated in the currency of the respective country in which the object is located, for shares the reference point is the stock exchange
Minimum Return Assets	> 0%	• Minimum not required, although zero return assets are not allowed

Source: Own summary, based on §54 para. 1-2 VAG, §§2-4 AnlV and R4/2011.

2.2.2 Investment Strategies and Asset Allocation

While section 2.2.1 summarises the legal and regulatory requirements that insurers have to fulfil within their Tied Asset Base, figure 7 shows how German Pension Insurance Funds are actually invested. This asset allocation represents the 'average sector' allocation of all 151 regulated Pension Insurance Funds in Germany that are under the supervision of the BaFin.

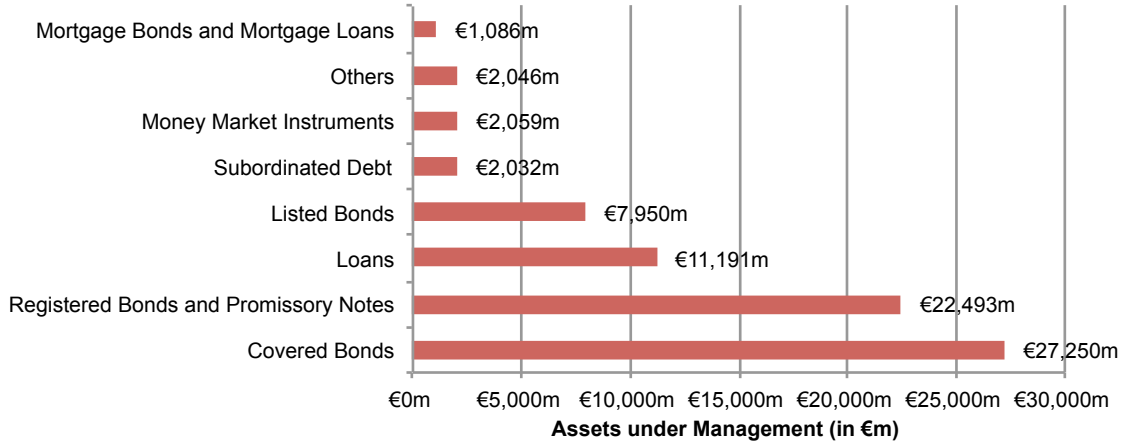
Figure 7: Asset Allocation for German Pension Insurance Funds (Q2 2011, in €m)



Source: Own figure, on the basis of BaFin (2011, c).

Due to the relevance and weight of fixed-income securities within the portfolios of Pension Insurance Funds, we have provided a more detailed description of this category in figure 8:

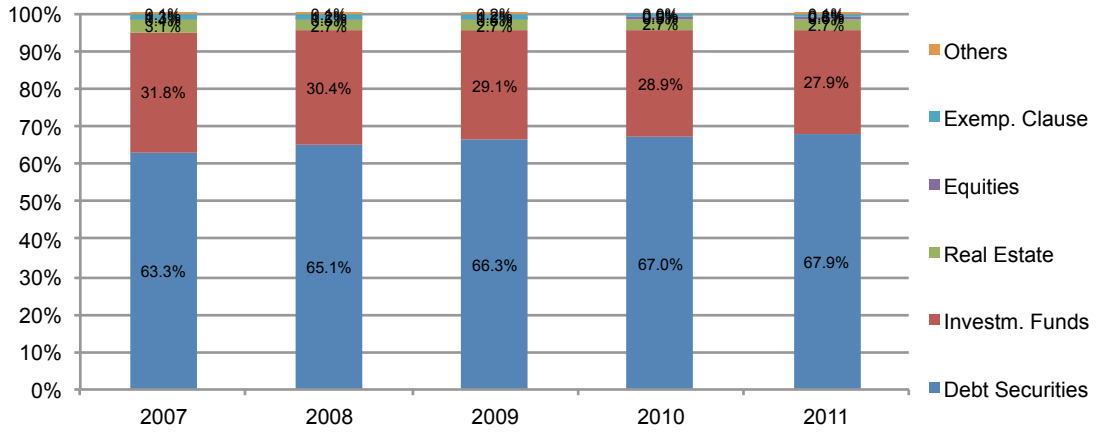
Figure 8: Investments in Debt Instruments by German Pension Insurance Funds (Q2 2011, in €m)



Source: Own figure, on the basis of BaFin (2011, c).

To ensure that our analysis remains representative and uses time-persistent references, we have plotted the 'average sector' asset allocation for German Pension Insurance Funds for the last 5 years.

Figure 9: Historic Asset Allocation for German Pension Insurance Funds (since 2007, using as reference respective Q2 numbers)



Source: Own figure, on the basis of BaFin (2011, c).

The main conclusions that can be drawn from this data is as follows:

- Clear overweight of fixed-income securities in the portfolios (67.9% of assets under management)
- Direct equity investments play a minor role with only 0.6% of the assets, while the majority of equity exposure is obtained via investment fund allocations (27.9%). At this point, we assume that the vast majority of these funds are invested in equities.
- Real estate remains a relatively small proportion of the asset allocation with only 2.7% of weight.

- The Exemption Clause, which allows Pension Insurance Funds to invest up to 5% of the Tied Asset Base into assets not permitted under AnlV, only plays a minor role with 0.8% of the assets.
- Alternative investments, hedge funds and commodities, in particular, are not yet meaningfully represented, although asset allocation for each asset could be up to 5% each. Also high-yield debt does not seem to be of interest to the respective portfolio managers.
- With regards to the market share of sovereign debt within the debt securities category, we estimate that approximately 40-50% (€29-38bln) is invested in such instruments. This number is based on the following assumptions: (1) Covered bonds, which are by definition highly rated instruments (average spread to German Bunds of 20bps pre-credit crisis and 60-80bps since then)[68], have about 50-75% market share in public sector issued paper,[69] (2) loans, as defined by §2 para.1 no. 3-5 AnlV, are primarily issued by sovereign entities (German government, German regions or communities), (3) for listed bonds, no further disclosure is available, but due to the requirements on highly-rated instruments, we have to assume that the proportion of government paper is relatively high (50-75% assumption). It is difficult to make a precise estimation for the 'Registered Bonds and Promissory Notes', but given their nature, we assume that these securities have not been issued by government entities.
- The average asset allocation remains constant over time. For the last 5 years, the portfolios of German Pension Insurance Funds have remained almost unchanged, despite the turmoil financial markets have experienced during this time period. Fixed-income securities have had an allocation range of 63.3 – 67.9%, while equities (investment fund participations) obtained on average 28.9 - 31.8% of total AuM.

[68] See Verband Deutscher Pfandbriefbanken (2011), p. 30.
[69] See Verband Deutscher Pfandbriefbanken (2011), p. 28.

2.3 Considerations on Social Responsible Investments

2.3.1 Definition and Investment Strategies

A. Definition Social Responsible Investments (SRIs)

A precise definition of social responsible investments (SRI) remains a challenging task, as the concept of 'sustainability' cannot be measured by purely quantitative methods or parameters. A widely accepted academic classification therefore does not exist to date, rather various valid definitions and methodologies in parallel.[70] In common terms, SRIs are considered an umbrella term for investments and investment strategies that include considerations "to create positive social change, minimise environmental damage and incorporate religious or ethical beliefs."[71] For Schaefer (2009, a), all those asset classes that in addition to traditional investment criteria (risk, return, liquidity) include ethical or moral principles can be considered in general as social responsible investments.[72]

Leading social investment forums have worded their own respective definitions for social responsible investments or strategies. The US Social Investment Forum (USSIF), for example, defines SRIs as an investment process that considers "both the investor's financial needs and an investment's impact on society". SRI investing assumes that both "corporate responsibility and societal concerns are valid parts of investment decisions. SRI investors encourage corporations to improve their practices on environmental, social and governance issues".[73] Its UK counterpart, the UK Social Investment Forum, sees social responsible investments as "motivated by both a social or environmental purpose and a financial objective, i.e. a mixed motive rather than purely a philanthropic one."[74] Eurosif states that "sustainable and responsible investing (SRI) is a generic term covering any type of investment process that combines investors' financial ob-

[70] See Schaefer, Schroeder (2009, b), p. 22.
[71] Fung et al. (2010), p. 1.
[72] See Schaefer (2009, a), p. 64.
[73] See USSIF (2011).
[74] See UKSIF (2011).

jectives with their concerns about Environmental, Social and Governance (ESG) issues."[75]

In a more 'classical' definition, SRIs are described as investments that include ecological, ethical and social values (also referred to as ESG factors), with the objective to contribute to sustainable development. Sustainable development is generally understood as an inter-generational economic activity that focuses on conservation of nature rather than exclusively on profit maximization.[76] Economic activity should thereby not be conducted based on usual financial- or business-reasonable time horizons, but rather in a sustainable manner over various generations to conserve nature and guarantee human livelihood.[77] The emphasize of the 'classical' definition is therefore more centred on the concept of sustainable impact rather than financial returns.

In recent years, the concept of SRIs has slightly changed as it is considered a practice of increasingly integrating ESG factors into the financial investment process. Conventional financial criteria as well as social or environmental objectives or constraints play together a role in the decision process over the acquisition or disposal of an investment.[78] This definition puts equal balance between return optimization and social/environmental objectives.

One of the currently widespread methodologies of defining the concept of SRIs is to differentiate amongst 'Sustainable Investing', 'Socially Responsible Investing' and 'Impact Investing'. With reference to, 'Sustainable Investing', SRIs are understood to integrate long-term ESG criteria into the investment process with the objective of achieving "superior risk-adjusted financial returns" in comparison to conventional benchmarks or investment methods for the same asset class. ESG criteria are used in the decision process alongside traditional financial aspects (for example cash flow analysis or relative valuation matrices). The focus on obtaining superior risk-adjusted returns is a clear differentiating factor

[75] See Eurosif (2010), p. 8.
[76] Sustainable development is a term originated during the UN-conference in Rio de Janeiro in 1992. See also Schaefer, Schroeder (2009, b), p. 22.
[77] See Schaefer, Schroeder (2009, b), p. 22.
[78] See Sandberg (2010), p. 143.

to the notions of ‘Socially Responsible Investing’ or ‘Impact Investing’, in which lower financial returns may be tolerated for achieving ESG requirements.[79]

‘Social Responsible Investing’ includes investments in companies that have strong ESG policies in place and avoids investments in assets that are involved in ‘undesirable’ business activities, like for example alcohol, weapons and others.[80] Negative screening as well as positive screening methods (Best-in-Class, thematic approaches) are typically associated with such investments.[81] In-line with this definition, Schoenheit (2005) describes SRIs as investments that are targeted towards those companies that exhibit particular ecological and/or social characteristics or behaviours in the view of the investor.[82]

‘Impact Investing’, on the other hand, has emerged more recently as an alternative asset class. Impact investments are investments that aim at creating a positive impact beyond pure financial returns by improving the “lives of poor and vulnerable people or to provide environmental benefits at large. (…) They can either expand the access to basic services for people in need or through production processes that benefit society”. The expected financial returns are thereby at least the repayment of the nominal principal amount, while market rates are also feasible.[83]

For our empirical analysis, we will assume that SRI assets target obtaining competitive returns in comparison to similar traditional asset classes both in the short and long term, while simultaneously recognizing corporate social responsibility as well as ESG concerns as a valid part of the investment decision process.[84] Due to the fiduciary duty that the asset manager of a Pension Insurance Fund is committed to, only SRI assets that achieve comparable risk-adjusted returns to current asset allocations can be justified.

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[79] See World Economic Forum (2011), p. 10.
[80] See JP Morgan Global Research (2010), p. 79.
[81] See Eurosif (2010), p. 8.
[82] See Schoenheit (2005), p. 77.
[83] See JP Morgan Global Research (2010), p. 7 et seq.
[84] See Fung et al. (2010), p. 6.

B. SRI Investment Strategies

Engineering SRI-friendly portfolios requires the same standards of practise than the construction of conventional asset portfolios does, namely defining an investment policy, fixing short-term and long-term goals and estimating adequate and observable risk parameters. In the traditional process of asset selection, the investors' investment objectives can be thought of as a well-balanced system of risk, return and investment horizon. For SRI-investments, however, a fourth element, sustainability, is included.[85] Schaefer and Lindenmayer (2007, b) describe the SRI investment process as a "magic rectangle" that includes risk, return, liquidity and sustainability.[86]

In academic research, there are primarily two categories of SRI investment approaches: active SRI investments and passive strategies. Within active methodologies, investors use their voting rights (also called voice-option) to achieve social, ecological and economic impacts at the company level, whereas passive SRI strategies are characterised by the absence of any active involvement with management. A further distinction can be drawn between pre- and post-phase SRI investment strategies. In the pre-phase, investors decide on certain screening or filter criteria (positive and/or negative screening) which are then applied to select a target pool of assets out of the total universe of available investments. In the post-investment period, once the target portfolio has been allocated, investors have the option to pursue shareholder activism[87] strategies.[88]

Investor strategies employed in the pre-investment period are either exclusionary (negative screening) or inclusionary (positive screening, Best-in-Class).[89]

Negative Screening

Companies, industry sectors or sovereign issuers (governments) are analysed to determine whether they fulfil certain criteria for social responsibility as defined

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[85] See Fung et al. (2010), p. 27.
[86] See Schaefer, Lindenmayer (2007, b), p. 8.
[87] Academic research on this topic is predominantly equities focused, as the first asset class considered for SRI investments has been historically shares. Moreover, only stocks enable investors to actively participate in AGMs and vote.
[88] See Schaefer, Lindenmayer (2007, a), p. 1083.
[89] See McLachlan, Gardner (2004), p. 13.

by the investor. These screenings are in practise usually conducted by specialised rating agencies. Based on Schaefer et al. (2006), there are globally more than 70 rating agencies focused on this type of rating service.[90] Finally, those investment targets that do not fulfil the predefined screening criteria are excluded for investing.[91]

Negative screening is considered the most basic form of choosing SRI investments, as investors often simply exclude entire industry sectors from the portfolio selection process (traditional examples for such exclusions being tobacco or defence industries).[92] Historically, negative screening methods have been popular investment strategies amongst pension funds as well as charities and churches.[93]

Positive Screening

Positive screening is an inclusionary strategy, as investors select actively assets that meet certain 'SRI-friendly' investment criteria. These criteria should proof that a company is managed and is acting in a social-responsible or sustainable way.[94] The stocks chosen tend to be from companies that are regarded as innovators in their respective sector for social and/or ecological achievements (also denominated pioneers or innovators, while the activity itself can be called 'pioneer-screening').[95]

Positive screening is considered a more difficult task than negative screening, as some social or ecological criteria are very difficult to quantify. As a consequence, positive screening has a certain degree of subjectivity by the rating agency or the investors that define the criteria for the inclusion of target companies.[96]

[90] See Schaefer et al. (2006), appendix, table 2.
[91] See Schaefer, Lindenmayer (2007, a), p. 1083.
[92] See Fung et al. (2010), p. 28.
[93] See Eurosif (2005), p. 19.
[94] See Fung et al. (2010), p. 28.
[95] See Schaefer, Lindenmayer (2007, a), p. 1083.
[96] See Fung et al. (2010), p. 28.

Best-in-Class (BiC)

Best-in-Class (BiC) represents a special form of positive screening, in which a company's environmental and ecological performance is rated and measured against an industry standard. Only the best companies in their respective industry qualify for the target portfolio.[97]

BiC is useful for company targets that do not fall into either positive or negative screening criteria, in particular for corporations that have multiple business lines corresponding to different industry sectors.[98]

Shareholder Activism

Shareholder activism can be divided into 3 phases of active SRI management. Phase 1 refers to the simple exercise of voting rights by an investor at the AGM of the invested company. Phase 2, on the other hand, includes an active dialogue with managers to discuss specific social responsible aspects of the operations of the company. Finally, phase 3 is centred on the concept of shareholder advocacy, in which investors remain in constant dialogue with management. Shareholder advocacy is exercised in particular by large pension funds in the US and the UK.[99]

In practise, SRI-focused investors tend to combine various SRI strategies at once. For the purpose of our research project, we will focus primarily on passive SRI strategies in the pre-investment period (negative/positive screening, BiC).

2.3.2 Relevance of SRIs for Capital-Funded Pension Schemes in Europe

A. European SRI Market

The European SRI market continues to grow, despite the adverse economic effects since the credit crisis in 2007/2008. At the end of 2009, assets worth almost €5trn were invested in SRIs, up from €2.7trn in 2007 (including Core and

[97] See Deutsche Bank Research (2010, b), p. 10.
[98] See Fung et al. (2010), p. 29.
[99] See Schaefer, Lindenmayer (2007, a), p. 1084.

Broad SRI strategies[100]). Adjusting for the EU expansion to 14 countries, this represents an 87% growth rate over two years and a CAGR of 37%. Out of these €5trn, €1.2trn (24%) are invested in Core SRI and €3.8trn (76%) in Broad SRI.[101] Based on estimates by EFAMA, the Core SRI segment would therefore represent approximately 10% of the total European asset management industry.[102]

The European SRI market remains predominantly an institutional market, with 92% of AuM in the hands of professional investors. A split by assets classes shows an overweight of fixed-income instruments (53% of total SRI assets), while equities represent 33% of the asset pool.[103] Recent trends suggest that fixed-income securities as well as monetary funds are becoming more relevant in the SRI space, (33% and 114% AuM growth rate respectively between 2007 – 2009), while equities have declined by 7% in the same time period. These numbers compare to lower growth rates for AuM for bonds and monetary funds in the traditional asset management space (-5% for fixed-income funds, +4% for monetary funds, -14% for equities).[104]

B. German SRI Market

The precise size of the German SRI market is difficult to estimate, as assets are invested across various asset categories, predominantly in mutual funds, thematic or specialised funds, certificates, account deposits at cooperative banks or social and ecological financial institutions.

Based on Eurosif estimates, by the end of 2009, approximately €12.9bln SRI AuM were invested in Germany via mutual funds, out of which 94% were allocated towards Core SRI strategies. With €1,706bln total AuM invested in the German asset management industry, SRI assets in mutual funds obtain 0.8% of total market share, considerably below the European average of 10%. Nonethe-

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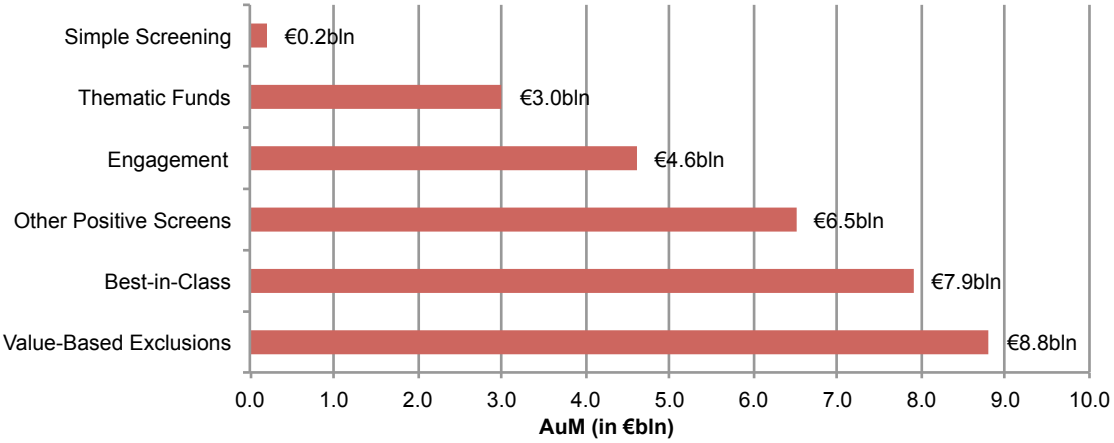
[100] Core defined as: norms- and value-based exclusion criteria, Best-in-Class, thematic funds and others. Broad includes primarily: simple exclusions, engagement and integration (inclusion of ESG risks into traditional financial analysis). See Eurosif (2011) p. 13.
[101] See Eurosif (2010), p. 11.
[102] Using as reference €12.4trn of assets under management at the end of 2009, as reported by EFAMA (2010), p. 2.
[103] See Eurosif (2010) p. 7.
[104] See Eurosif (2010), p. 11.

less, the German SRI fund market has expanded by 16% since 2007 pre-crisis levels and, is expected to grow by 56% between 2010-2013.[105] As figure 10 illustrates, the investment strategies used by investors in the SRI mutual fund space have been dominated by value-based exclusion strategies (€8.8bln AuM) and Best-in-Class methods (€7.9bln).

Figure 10: Investment Strategies for SRI Mutual Fund Investments in Germany (2009, in €bln)



Note: Double-counting possible, therefore sum of all strategies exceeds €12.9bln of total German SRI funds.

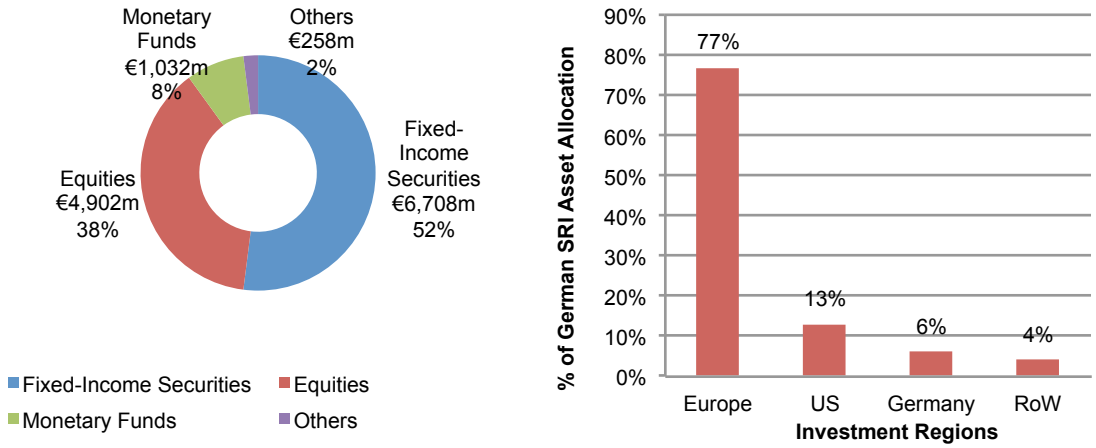
Source: Own figure, on the basis of Eurosif (2010), p. 35.

The investor structure of the German SRI market for mutual fund investments also differs from the average European SRI asset allocation: by the end of 2009, 55% of the AuM were in the possession of institutional investors (down from 63% in 2007), with the remaining 45% of assets held by retail investors. Religious institutions as well as charities represent the most important investor groups, followed by NGOs foundations and occupational pension schemes.[106]

The asset structure of German SRI fund investments reflects the European average, as bonds represent more than half of the allocation (52%), with equities 38% of AuM. 66% of assets were allocated towards SME companies and 34% to large cap targets.[107] Figure 11 summarises asset allocation by asset classes and regions.

[105] See Eurosif, p. 35 et seq.
[106] See Eurosif, p. 36.
[107] See FNG (2010), p. 20.

Figure 11: German SRI Asset Allocation by Asset Class and Region (2009, mutual funds only)



Source: Own figure, on the basis Eurosif (2010), p. 35 for allocation by asset class and FNG (2010), p.20 for allocation by region.

The product range for SRI mutual fund investments has expanded considerably in the last few years: at the end of 2009, 313 funds across asset classes (equities, fixed-income, fund of funds, microfinance funds and ETFs) were approved for distribution in German speaking countries (Germany, Austria, Switzerland), up from 112 funds in 2004 (+180% growth).[108]

Taking into consideration sustainable investments owned outside the German mutual fund sector, the actual size of the SRI market is considerably larger. Based on estimates of strategy consulting firm Funds@Work, the total asset base of social responsible investments in Germany could be as large as €250bln, or 19x the size of German SRI mutual fund investments.[109] While this number is based on a survey of asset managers and does therefore reflect only part of the German investment universe, it indicates that the commonly used market size of €12.9bln is doubtlessly too low. A very recent study by Union Investment, for example, supports the view that the actual market size in Ger-

[108] See Deutsche Bank Research (2010, b), p. 5.

[109] See Funds@Work (2010), p. 1. This sum includes fund investments in mutual funds as well as the sum of SRI assets in specialised funds in Germany. The €250bln are calculated as follows: assuming a total asset base of €736bln AuM for all investors that participated in the survey conducted by Funds@Work in 2010, 69% were invested in Germany, 29% in Switzerland and 2% in Austria. The sum of assets reported to be managed using some sustainable criteria was approximately €360bln in total. The €250bln for German SRI assets are calculated as 69% out of €360bln. For the survey, a total of 120 institutional investors in Germany participated, with a total asset under management base of €736bln.

many is in the few hundreds of billions of assets under management.[110] An important amount of these additional funds is invested in direct investment mandates and special funds and are therefore not publicly available to external investors. Apart from mutual and special funds, there exist non-conventional SRI investment alternatives in Germany, which are achieving sizeable asset bases and enjoying robust growth rates.

Certificates

Certificates replicating sustainable investment strategies account for approximately €8.7bln of additional sustainable investments in Germany. Historically, certificates have been a relatively popular investment class for German retail clients. Investors can to date choose amongst almost 250 different sustainable certificates from 30 issuers, primarily banks and investment funds.[111]

Social and Ecological Banks

Social and ecological banks in Germany have benefited in the last couple of years from solid growth. Their business objectives include, amongst others, the commitment to reinvest clients' deposits to finance exclusively sustainable projects. Approximately €3bln of sustainable financing are currently committed by German social and ecological banks.[112]

Clerical Banks

Similar to Germany's social and ecological financial institutions, clerical banks have strict ESG filters in place for any loans that are conceded to their clients. By 2010, there were a total of €15.3bln deposits at these institutions.[113]

Microfinance Investments

Another pool of SRI investments outside the scope of traditional mutual fund investments are microfinance assets. While this asset class is currently still in a

[110] See Union Investment (2011), p. 2. The survey included investors with total AUM of €1,030bln. 64% of these investors indictated that they consider some form of sustainable criteria in their investment process.
[111] See Deutscher Derivate Verband (2009), pp. 6-8.
[112] See Schneeweiss (2010), p. 13.
[113] See Schneeweiss (2010), p. 14.

developing stage in Germany, between €300-400m of investments have been already committed.[114]

C. Role of European Pension Funds in the SRI Market

65.3% of European SRI assets are in the hands of pension funds, although 98.1% (or €3,161bln) of these investments are held by public pension funds and only 1.9% (€61bln) by occupational pension schemes. There are, however, clear signs that corporate pension funds are intending or already have expanded their SRI allocation within their investment portfolios.[115] The significance of pension funds in the SRI space is also evident if you analyse the global composition of the 764 signatories (asset owners and investment managers only) of the UN Principles for Responsible Investment (PRI): 49% are institutional investors categorised as 'non-corporate' pension funds, while 24% of signatories are corporate pension schemes. Using as reference 387 European asset owners and investment managers that appear as signatories, there are currently a total of 283 institutional pension scheme investors (73.1%) in Europe committed to various degrees to SRI investments, with 93 funds (24.0%) belonging to occupational pension schemes only. The distribution of these investors by country is however very unequal. In the UK alone, there are 98 (34.6%) investors as signatories, 51 (18.0%) in the Netherlands and 37 (13.1%) in Switzerland.[116]

A more detailed analysis of the two leading countries in terms of SRI investments by pension funds, the UK and the Netherlands, provides evidence that Germany remains at a relatively early stage of sustainable investing by pension schemes.

United Kingdom

The UK is "acknowledged as a global leader in sustainable and responsible finance".[117] With more than £939bln assets invested in SRIs (84x the total size of

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[114] See Schneeweiss (2010), p. 17. The assets under management refer exclusively to the investments made by German investors. To date, there are only two foreign providers of microfinance investments in Germany: Dutch clerical bank Oikocredit and Swiss special bank ResponsAbility.
[115] See Eurosif (2010), p. 16.
[116] See PRI (2010), p. 6 and PRI (2011).
[117] Eurosif (2010), p. 53.

the German mutual fund SRI market) at the end of 2009, occupational pension schemes are undoubtedly a driving force of sustainable investing. Furthermore, almost all of the 98 British signatories of the UN PRI are pension funds. In addition, the UK is the first country in the world to introduce back in 2000 disclosure requirements regarding SRI policies for occupational pension schemes.[118]

Netherlands

The Dutch SRI market has total SRI AuM of €396bln and more than €743bln of pension assets (end 2009). The two largest pension funds in the country, APG and PGGM, represent almost 50% of pension fund assets and are regarded as 'avant-garde' for SRI investments and initiatives in the country and worldwide.[119] Based on a study by VBDO in 2010, 83% of Dutch Pension Funds have SRI policies in place. Out of these, 65% apply exclusions in investment process and 33% have integrated ESG criteria into their investment process.[120]

D. SRI Investments in the German Pension Market

Obtaining reliable data on SRI investments by German pension schemes remains a challenging task. As we have identified, pension funds in neighbouring European countries tend to have significant investments in SRI assets and represent the largest group of UN PRI signatories. Germany, on the other hand, has only 13 signatories (3.4% of European signatories) and is therefore considerably underrepresented, particularly taking into account its economic position in Europe. Moreover, there is only one public entity (the *Bayerische Versorgungskammer*) that is involved in pension fund management, but to date there is no single occupational pension scheme at all.[121]

Nevertheless, recent events are indicating that the low involvement of German pension funds in SRI assets is potentially changing. Based on research findings by WestLB Research (2010), for example, large German listed corporations are getting under increasing pressure to include sustainability considerations into the investment management of their respective occupational pension schemes.

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[118] See Eurosif (2010), p. 53.
[119] See Eurosif (2010), p. 41 et seq.
[120] See VBDO (2011), p. 7.
[121] See PRI (2010), p. 6 and PRI (2011).

The authors draw the conclusion that while sustainability has been often implemented on the operational side of the businesses, pension investing has been considerably neglected.[122] Schaefer (2005) states that occupational pension schemes were deemed to be the precursors of SRI investing in Germany, but had so far disappointed, largely due to a limited product range for non-equity products and the restrictive investment rules set by the German regulator.[123]

Scoris conducted a representative survey amongst German Pension Insurance Funds and Pension Funds that focused primarily on the existence of SRI investments in the asset portfolio of the pension schemes. The result was rather disillusioning: for up to 70% of the funds, SRI investing did not play a relevant role. On the positive side, however, the survey also revealed the significant growth potential of SRI investments for pension funds in Germany.[124]

A study commissioned by the German Federal Environmental Ministry and Fortis Investments in 2008 established that "although the Germans are seen internationally to be leaders in the area of environmental protection and 86% of occupational pension clients request that their pension schemes do not invest in companies making environmentally damaging products, German occupational pension schemes are deemed unprogressive when it comes to comprehensive integration of sustainability aspects. The largest barrier cited was the lack of active, sustainability leaders among institutional investors. The fiduciary duties in Germany do not represent a barrier."[125]

2.3.3 Justification of SRIs for German Occupational Pension Schemes

A crucial question in the context of SRI investing by German pension funds is to ask what the rationale and driver behind their investment decision to allocate assets into this asset class could be. There are various aspects that need to be considered and that may also play an important role for German occupational pension schemes and their asset allocation policy. The most relevant ones are thereby:

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[122] See WestLB Research (2010), p. 3.
[123] See Schaefer (2005), p. 560.
[124] See Scoris (2005), p. 4 and p. 25.
[125] Federal Environmental Ministry of Germany, Fortis Investment (2008), p. 8.

A. Fiduciary Duty

One of the most impactful documents to justify the obligation by institutional investment managers to include ESG issues into their asset allocation process is certainly the 'Freshfields Report' published in 2005. This report, commissioned to the law firm Freshfields Bruckhaus Deringer, analysed whether the integration of ESG factors by asset owners was a "voluntary, legally required or hampered by law and regulation"[126] for a total of nine jurisdictions[127], including Germany. The conclusion was clear: "…integrating ESG considerations into an investment analysis in order to more reliably predict financial performance is clearly permissible and is arguably required in all jurisdictions."[128] As stated in a follow-up study by UNEP, the results of this study have enabled pension funds in the respective jurisdictions to "clarify the legality behind the considerations of ESG issues".[129]

B. Legal and Regulatory Requirements

Currently there are eight European countries that have specific national SRI regulations for their pension system in place: UK (implemented 2000), Germany (2001), Sweden (2001), Belgium (2004), Norway (2004), Austria (2005), Italy (2005) and Spain (in process).[130]

Recent German legislation relating to the disclosure of investment strategies and non-financial information is expected to encourage more SRI investments by occupational pension schemes in the future.[131] The two most relevant legal acts in this context are the Certification of Retirement Pension Contracts Act (AltZertG) and, particularly for Pension Insurance Funds, §115 para. 4 of the VAG. The AltZertG requires a mandatory reporting duty of pension plans to communicate on an annual basis how ESG issues have been considered in the allocation of pension contributions.[132] §115 VAG, on the other hand, stipulates in similar manner that German occupational pension schemes shall inform their

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[126] Freshfields (2005), p. 6.
[127] Australia, Canada, France, Germany, Italy, Japan, Spain, UK and US.
[128] Freshfields (2005), p. 13.
[129] UNEP (2009), p. 18.
[130] See Eurosif (2010), p. 19.
[131] See Preu, Richardson (2011), p. 884.
[132] See Preu, Richardson (2011), p. 882.

members of the integration of ESG factors in the employment of contributions paid.[133] On this aspect, German legislation goes beyond the precedent set by UK legislation, which requires UK pension plans merely to publish if they have a SRI policy in place, not specifying, however, to what degree such policy has been implemented.[134]

Besides, large German corporations are required by law to integrate non-financial performance indicators (i.e. environmental issues) into management reports. These measures may also encourage more SRI investing in Germany by facilitating pension fund managers an evaluation of corporate environmental performance.[135] Nonetheless, as of today, the issue remains as to why the majority of institutional investors, in particular occupational pension funds, continue to ignore to a large degree ESG issues in their investment decisions.[136]

C. SRI Investment Performance

Justifying SRI investing over traditional asset classes based on pure asset performance remains a complicated task. Numerous academic research studies have been published with regard to this topic (focused primarily on equity investments). The overall results are mixed. Schroeder (2004) summarised several studies that analyse SRI performance and concluded that the majority of the studies proof that SRI investments obtain similar performances to conventional funds, but no statistically significant out-performance.[137] A joint report by UNEP Finance Initiative and Mercer (2007) reviewed 20 recent academic research papers (all published since 2000): 10 papers showed statistical evidence of an outperformance, 7 obtained neutral effects and 3 an underperformance.[138] Margolis et al. (2007), in one of the most ambitious research studies to date, compared 192 statements in as many as 167 previous academic research studies on the relationship between so-called “corporate social performance” and

[133] See Deutsche Bank Research (2010, b), p. 6.
[134] See Preu, Richardson (2011), p. 882.
[135] See Preu, Richardson (2011), p. 882.
[136] See Sandberg (2010), p. 144.
[137] See Schroeder (2004), p. 124.
[138] See UNEP, Mercer (2007), p. 36.

"corporate financial performance". The outcome of their study is that the association is "positive but small".[139]

In summary, the empirical conclusions based on academic research testify largely a neutral or slightly positive link between SRI investments and traditional asset performances. German occupational pension schemes, consequently, do not break fiduciary duty by investing into SRI assets, as these investments do generate on average as high returns as traditional asset classes do.

2.4 Inclusion of Alternative Investments

2.4.1 Rationale

In the last 10 years, large institutional investors have diversified away from traditional, liquid assets like bonds and equities into alternative asset classes, particularly hedge funds, real estate, commodities and infrastructure. New risk-return constellations as well as a wider product range have been the predominant drivers of this investment shift.[140]

By investor type, pension funds have been the predominant force in the alternative investment space, with estimated AuM of $817.1bln globally, which represent approximately 41% of the market share of total alternative investments.[141] A split by asset classes shows an overweight in real estate (52%), followed by private equity investments (21%), hedge funds (13%) infrastructure (12%) and commodities (2%). It is important to highlight that some of these investments have actually been realised via fund of funds investments, in particular private equity and hedge fund type of investments.[142] A total of $278bln (34%) of alternative pension assets are held by European pension funds with the following asset class allocation:

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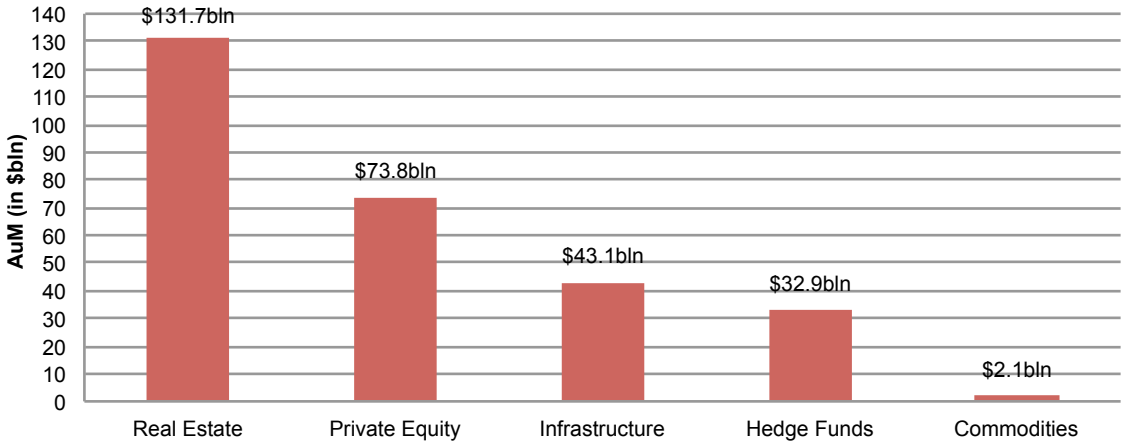
[139] See Margolis et al. (2007), p. 2.
[140] See WestLB Research (2011), p. 33.
[141] These numbers are based on the top 100 alternative managers managing alternative investment assets on behalf of pension funds as of 31-Dec-2009. The survey included the largest 149 asset managers in the industry, but the top 100 already represent 91% of total AuM.
[142] See Towers Watson (2010), p. 7.

Figure 12: Alternative Investments by European Pension Funds (in $bln, 2009)



Source: Own figure, on the basis of Towers Watson (2010), pp. 6-8.

The large proportion of real estate and infrastructure assets is not surprising given the steady cash flows and long-term investment horizon such investments offer to pension funds. Private equity can be considered a medium-term asset class as invested capital tend to be locked-up at a private equity fund for up to 10yrs. The allocations into hedge fund assets (12% of total alternative AuM) as well as commodities (0.7%) still remain relatively low. This can be partly explained by the high volatility of hedge fund returns and the relatively recent product offering into commodities in form of ETFs and indices.

2.4.2 Portfolio Effect

As we have seen in section 2.2.1, German Pension Insurance Funds have the possibility to allocate a proportion of their investment portfolio into alternative asset classes. The limits as defined by the regulator are: (1) real estate 25%, (2) high-yield debt 5%, (3) commodities 5% and (4) hedge fund investments 5%. Moreover, section 2.2.2 ‘Current Investment Allocation’ enabled us to determine that currently German Pension Insurance Funds have a very low allocation into alternative asset classes. Asset allocation is predominantly invested in traditional asset classes, with a strong weight in fixed-income securities (67.7% on average).

Adding alternative asset classes to the existing portfolio of Pension Insurance Funds could potentially have many advantageous effects, namely risk diversification into low-correlated assets, return enhancements and more flexibility in the asset allocation, while maintaining the legal requirements as stated by the VAG and the AnlV. Grouping traditional asset classes with corresponding alter-

native asset classes and plotting the performances in a chart can give an indication as to whether the asset classes perform in-line or have low correlations, what would contribute to risk diversification in the Markowitz portfolio context.[143] Table 3 shows the correlation coefficients amongst the respective asset classes:

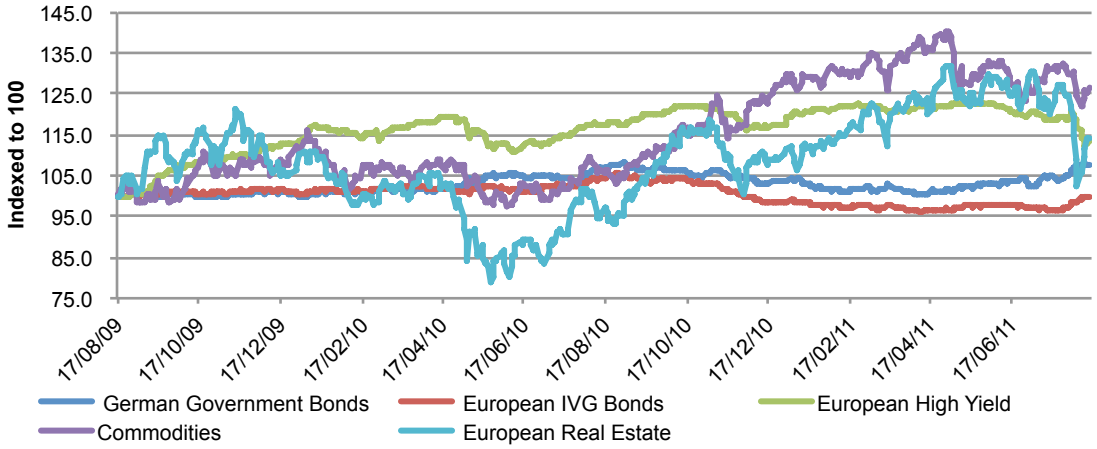
Table 3: Correlation Coefficients between Traditional Asset Classes and Alternative Investments (last 2 years)

	European High Yield	Commodities	European Real Estate
German Gov. Bonds	0.37	0.01	-0.26
European IVG Bonds	-0.27	-0.79	-0.67
European Equities	0.61	0.58	0.49

Due to the fact that German Pension Insurance Funds have 2/3 of their AuM in either Government bonds or corporates (investment grade bonds), adding alternative asset classes appear (based on a simple correlation coefficient analysis) a good fit, as the close to zero and negative coefficients indicate (green highlighted cells in table 3), in particular between European bonds and commodities (-0.79 correlation coefficient) as well as to real estate assets (-0.67 correlation coefficient). Plotting the corresponding assets with low correlation coefficients in a chart visualises the 'decoupled' performance of the assets.

[143] Based on the variance of a portfolio P as defined by $Var(P)=a^2Var(X)+b^2Var(Y)+2abr_{xy}\sigma_x\sigma_y$ with r_{xy} as correlation coefficients between 2 assets. For correlation coefficients lower than 1, the resulting variance of a portfolio will be lower than the simple weighted average variance of the two assets. Correlation coefficients of 0 indicate that the two assets move independently to each other (no structure recognizable), while negative correlation coefficients indicate that assets are moving in inverse directions. From a risk reduction perspective, correlation of 0 would be ideal, however such occurences happen very rarely in practise. See Copeland et al. (2005), pp. 115-121.

Figure 13: Comparison of European Investment Grade Bonds and German Government Bonds to the Performance of European Real Estate, European High Yield Bonds and Commodities (last 2 years, performance indexed to 100)



Source: Own figure, data provided by VWD Data Provider. German Government Bonds are represented by the ML German Federal Governments 5-10yrs Index, European Investment Grade Bonds by the ML EMU Large Cap Investment Grade 5-10yrs index, European High Yield Bonds by the ML Euro High Yield BB-B Index, Commodities by the DJ AIG Commodities Index and European Real Estate by the MSCI Real Estate Europe index.

3. Research Proposal

3.1 Problem Definition

As the analysis of the regulatory investment framework for German Pension Insurance Funds as well as the actual allocation in section 2.2 has revealed, the average pension portfolio is predominantly invested in highly rated fixed-income securities and liquid stocks and represents therefore a very conservative investment profile from a risk-return perspective.

Moreover, we have identified that social responsible investments are already playing an important role for pension funds in other European countries, in particular the UK and the Netherlands. Expected growth rates for the asset class as well as the increasing number of UN PRI signatories from the pension fund sector indicate that the importance of SRIs will increase in coming years. In Germany, conversely, SRIs remain rather a niche asset class, for traditional asset managers in general and for occupational pensions schemes in particular. The outlook, nonetheless, appears promising: growth rates for SRI investments in Germany have been considerably higher than for traditional asset classes even during the financial crisis and the forecasted +56% growth for the time period 2010-2013 is encouraging.

Increasing pressure by stakeholders for Germany's management boards to consider sustainability not only for the operational business but also for occupational pension schemes may trigger a change in the investment behaviour of Germany's pension funds. Furthermore, fiduciary duty (discussed in 2.3.3, A), as well as legal and regulatory requirements (2.3.3, B) support the view that occupational pension schemes should reconsider their investment practises and shift at least part of their asset allocation into SRI investments in coming years. A further argument could also be the excepted risk-return profile of SRI investments (2.3.3, C), as it does not represent a disadvantage in comparison to traditional asset classes.

Due to the fact that German Pension Insurance Funds remain heavily invested in bond securities, a practicable SRI investment strategies should include also fixed-income instruments. The interest by finance practitioners in general to in-

clude ESG criteria into the investment process for fixed-income securities has risen considerably in the past couple of years in Germany, a trend that will also play a dominant role for Pension Insurance Fund managers due to their traditionally large exposure to this asset class.[144] Academic research on this topic, in particular for German occupational pension schemes, does however not exist to date.

In addition, we determined that Pension Insurance Funds have certain flexibility in including alternative investments into their asset portfolios. While their allowable allocation by law is rather small, their peculiar risk-return profile could potentially be beneficial for the investment management of pension schemes. As we have alluded to, the majority of feasible alternative asset classes have a low to negative correlation with traditional asset classes and could consequently be interesting investments from a portfolio risk diversification perspective. This is a research area for which there has not been published any empirical academic studies so far.

Any modification to the average asset allocation of German Pension Insurance Funds needs to guarantee that the investment objectives, as defined by VAG, AnlV and the circulars of the BaFin, remain unchanged. Downside risk minimisation, liquidity and profitability have to be central drivers of a viable investment management policy that tries to include SRI or alternative investments (or both).

3.2 Research Objectives

Considering the points debated in preceding chapter 3.1, several questions have come up that will be analysed as part of our doctoral dissertation and that are of academic interest. We will focus our research on very specific aspects that have not been covered yet by the research community. The main questions targeted are thereby:

[144] See Oekom Research (2011), p. 4.

A. Should German Pension Insurance Funds invest in Social Responsible Investments (SRIs)?

We provided evidence that European pension funds are allocating considerable proportions of their investment portfolio into SRI assets. For traditional German asset managers, SRIs are playing an increasingly important role. We will analyse if and how German Pension Insurance Funds should invest into SRI assets. More specific questions arise in this context.

A.1 Do Social Responsible Investments fit into the legal and regulatory framework of Pension Insurance Funds?

Any modification of the asset portfolio of Pension Insurance Funds is only feasible if it fulfils the strict investment rules as defined by the VAG, AnlV and circular letters of the BaFin. We will also suggest potential reforms to the current system that would potentially promote SRI investments in the future and increase their appeal for the investment management of Pension Insurance Funds.

A.2 Are there potentially legal or fiduciary requirements to invest in SRIs?

We have already suggested that fiduciary duty and/or legal requirements may make SRI investments compulsory for pension schemes in general. We will analyse this aspect for German Pension Insurance Funds in particular. Further emphasis will be put in determining additional factors that may make SRI investments for occupational pension schemes a proper fit.

A.3 How can Pension Insurance Funds invest in SRI-friendly manner, in particular with respect to fixed-income securities?

So far we have only discussed if Pension Insurance Funds should consider SRI investments in general. Our research will provide details on how such investments can be executed in practise. This part of the analysis ranges from suitable asset classes to adequate investment strategies. A very important issue will be how to obtain SRI-friendly investments for fixed-income portfolios, a major focus of our dissertation. This point has not been covered by academic research to date as the vast majority of studies focus exclusively on equities.

A.4 How will risk-return distributions of SRI-friendly investment strategies differ from traditional portfolios?

A shift from traditional asset classes to SRIs can only be justified, if at least similar risk-return distributions are achievable. Should the performance be deteriorated by SRI investments, they may not be suitable for Pension Insurance Funds as capital guarantee is a determinant factor of the investment management. For this analysis, we will first determine an appropriate econometrical (time series) model that enables us to run simulations on risk-return distributions for traditional asset classes, which will then be used as inputs for dynamic allocation strategies. The results for traditional asset classes will then be compared to the results we will obtain for a 'SRI-friendly' portfolio that fulfils all legal and regulatory requirements and intends to replicate a traditional asset allocation.

B. Are alternative investments a suitable asset class for German Pension Insurance Funds?

The German regulator allows insurance companies to invest up to a certain degree into alternative investments, an aspect we have discussed in section 2.2.1. So far, though, Pension Insurance Funds have not made great use of such asset classes. A section of our research project will be dedicated to determine whether alternative investments should be added to the portfolio mix and how that may impact expected risk-return aspects.

B.1 How well do alternative investments fit into the legal and regulatory framework of Pension Insurance Funds?

Similar to the analysis we need to run for SRI investments, we have to determine first how well alternative investments fit into the regulatory and legal framework that determine how Pension Insurance Funds can invest. We have already presented in this research paper some evidence that recent developments by the regulators have loosened the investment flexibility available. Moreover, our dissertation will provide suitable propositions to modify the status quo with the final objective of improving the penetration of alternative asset classes for occupational pension schemes in Germany, in particular for Pension Insurance Funds.

B.2 Amongst the available alternative investments, which are more suitable from a risk-return perspective?

We have to evaluate, by using econometrical analysis, simulation and adequate portfolio allocation methods, which of the legally possible alternative assets are more suitable for Pension Insurance Funds.

B.3 Can alternative investments also be replicated in socially responsible manner?

An academic challenging issue that will be debated in our dissertation is, under the assumption that (at least some) alternative assets are suitable investments for German Pension Insurance Funds, which of them can also be replicated in a socially-responsible manner, therefore adding on the advantages that SRI assets may offer to occupational pension schemes.

3.3 Expected Contributions

Our research dissertation is expected to provide the following contributions to the academic research community:

A. Determine if SRIs are a suitable asset class for German Pension Insurance Funds from a legal, financial and risk management point of view.
B. Establish a methodology of how to invest in fixed-income securities (corporates and sovereigns) in SRI-friendly way.
C. Provide empirical evidence of how well such SRI fixed-income portfolios perform versus traditional fixed-income portfolios.
D. Offer evidence whether alternative investments are appropriate assets for Pension Insurance Funds, focusing again on risk-return considerations and legal aspects.
E. Present an analysis of how alternative asset classes can be replicated as social responsible investments and how such assets would perform versus conventional alternative investments.

3.4 Restrictions

There are several restrictions that will be imposed on our research project. These constraints will be necessary to guarantee that our methodology remains

representative, clearly understandable, replicable by interested researchers and implementable by practitioners.

A. The benchmark portfolio used for our empirical analysis will have an asset allocation similar to the average allocation of German Pension Insurance Funds as published by the BaFin (see also section 2.2.2). As such, it will be representative for all German Pension Insurance Funds currently approved by the German regulator.
B. The respective asset classes used in our empirical section will be replicated primarily by adequate indices. This applies to equities, corporate bonds, government bonds as well as alternative investments. Also for SRI assets we will try to use indices where available. An issue will be SRI indices for fixed-income securities as well as alternative investments; to date such products are not being offered yet by leading index providers. For these assets, we may have to define and calculate our own SRI-friendly index. In general, using indices has the advantage that they represent a transparent methodology to select a portfolio of assets following known index rules. Moreover, historical data available tend to be extensive, what is an important pre-requisite for our empirical analysis as advanced time series models require historical prices that go back in time many years to be able to capture long-term cointegration effects (see also section 4.)
C. Statistical models used for the empirical section will be established time series models (VEC models primarily) as well as portfolio allocation techniques. We are committed to provide representative and reproducible results applying proven and tested methodologies.
D. Our quantitative analysis will focus exclusively on the asset side of German Pension Insurance Funds. Liabilities incurred due to the commitment of paying future benefits to pension members will not be considered in this study. This is an aspect that can be of interest for further future studies once the results of our research have been obtained. However, no asset management consideration in the context of pension schemes can be run ignoring completely existing liabilities. Our empirical model will focus to a large extend to determine an asset allocation mix that offers Pension Insurance Funds capital guarantee and downside risk minimization. A considera-

tion on the liabilities side for our study may be the inclusion of the maximum guaranteed return of currently 2.25% allowed by the German regulator.

3.5 Existing Research Studies

Our research project can be regarded as expanding or redirecting previously obtained results and conclusions by other research studies. Both for our theoretical considerations on why Pension Insurance Funds should consider SRI investments and (potentially) also alternative assets in their asset allocation process as well as for the quantitative section of our project, we have been able to make use of valuable research results already available in the academic research community. We have adequately referenced any external contribution. Both theoretical as well as empirical studies have contributed to the definition of our own research proposal. The most relevant studies by third parties have been summarised in this section.

3.5.1 Theoretical Studies

Table 4: Summary of Theoretical Research Studies

Author	Title	Year	Format	Major Contributions for our Research Project
Freshfields Bruckhaus Deringer	A legal framework for the integration of environmental, social and governance issues into institutional investment	2005	RP	- Asset managers have legal obligation to invest in SRIs to fulfil their fiduciary duty - Applies also to German asset managers
Schaefer, H. and Mayer, N.	Nachhaltige Geldanlagen fuer betriebliche Altersvorsorgeeinrichtungen	2010	RP	- SRIs offer pension occupational pension schemes in Germany the possibility to fulfil their fiduciary duty - Almost any asset class is in theory replicable in SRI-friendly manner - Need for further studies in particular with respect to SRI-friendly fixed-income assets - Demand by occupational pension schemes for SRI investments expected to grow in coming years
Schumacher-Hummel	Die Rolle von Pensionskassen im Bereich Socially Responsible Investments	2004	PhD	- Focused on determining if there are internal or external factors that may influence pension funds to invest in SRI - Survey-based analysis for Swiss pension funds

RP: Research Paper, PhD: Doctoral Dissertation

3.5.2 Empirical Studies

Table 5: Summary of Empirical Research Studies

Author	Title	Year	Format	Major Relevant Contributions for our Research Project
Eberts, E	Strategische stochastische Investmentmodelle fuer den deutschen Kapitalmarkt	2002	PhD	- Applies stochastic investment models, in particular time series methodologies, to run simulations on various asset classes - Includes cointegrated model approaches as well as VARs
Frere, E., Reuse, S. and Schmitt, S.	Asset Liability Management in Pensionskassen – Einfluss aktueller Problemstellungen und Auswahl von geeigneten Assetklassen	2009	RP	- ALM model for German Pension Insurance Funds using traditional asset classes - Portfolio composition using simple weighted average returns and simple portfolio variance calculations - Quantitative analysis applies exclusively historical data for risk return distributions, no advanced econometrical methodology - Inclusion of alternative asset classes, primarily hedge funds, private equity, commodities and high yields bonds
Ohlms, C.	Aktives Investmentportfolio Management – Optimierung von Portfolios aus derivatebasierten dynamischen Investmentstrategien	2006	PhD	- Optimization of asset portfolios applying multiperiod investment models - Inclusion of derivatives in the optimization process
Reinschmidt, T.	Dynamische Steuerung von Portfoliorisiken	2005	PhD	- Econometrical analysis to determine portfolio optimization strategy - Focus on volatility-varying methodologies - Includes intra-day data for the empirical analysis
Scherer, H.	Anlagestrategien fuer Schweizer Pensionskassen	1995	PhD	- Time-series based simulation analysis to analyse portfolio allocation for Swiss pension funds - Mean-variance-based approach, using stochastic dominance
Schroeder, M.	Die Eignung nachhaltiger Geldanlagen fuer die Vermoegensanlage von Stiftungen	2010	HBL	- Analysed the suitability of SRIs for German foundations - Used time series models as well as portfolio allocation techniques to obtain risk-return distributions and determine optimal asset allocation - SRI investments entirely focused on equities
Skaanes, S.	Einflussfaktoren auf die strategische Asset Allo-	2004	PhD	- Analysed the factors that determine the asset allocation of Swiss pension funds

	cation Schweizer Pensionskassen			
Stephan, T.	Strategische Asset Allocation in Lebensversicherungsunternehmen	1995	PhD	- Early-stage research study combining time series analysis and portfolio optimization for the asset management of German insurance businesses
UNEP and Mercer	Demystifying Responsible Investment Performance	2007	RP	- Summary of 20 major research studies that analysed the performance of SRI investments versus traditional asset classes - Concluded that relationship between ESG factors and performance is at least neutral, suggesting there is no performance disadvantage for investing in SRI assets

RP: Research Paper, HBL: Habilitation Thesis, PhD: Doctoral Dissertation

4. Research Methodology

4.1 Overview

The research objectives of our dissertation as defined in section 3.2 can be divided into questions of qualitative and quantitative nature. While the major attention of our research will be focused on the empirical analysis that is required to answer some of our questions, there are some important issues that need to be analysed from a different angle. From the seven questions outlined in 3.2, two have an exclusively empirical structure, while the remaining five demand either legal/regulatory analysis or a more practical orientated methodology. Table 6 summarises our main research questions by categories:

Table 6: Research Questions by Type and Expected Research Commitment

	Research Question	Section	Research Type	Expt. Research Commitment
1	Do Social Responsible Investments fit into the legal and regulatory framework of Pension Insurance Funds?	3.2, A.1	Legal Regulatory	
2	Are there potentially legal or fiduciary requirements to invest in SRIs?	3.2, A.2	Legal	
3	How can Pension Insurance Funds invest in SRI-friendly manner, in particular with respect to fixed-income securities?	3.2, A.3	Legal, Regulatory Practical	
4	How will risk-return distributions of SRI-friendly investment strategies differ from traditional portfolios?	3.2, A.4	Empirical	

5	How well do alternative investments fit into the legal and regulatory framework of Pension Insurance Funds?	3.2, B.1	Legal Regulatory	
6	Amongst the available alternative investments, which are more suitable from a risk-return perspective?	3.2, B.2	Empirical	
7	Can alternative investments also be replicated in socially responsible manner?	3.2, B.3	Legal, Regulatory Practical	

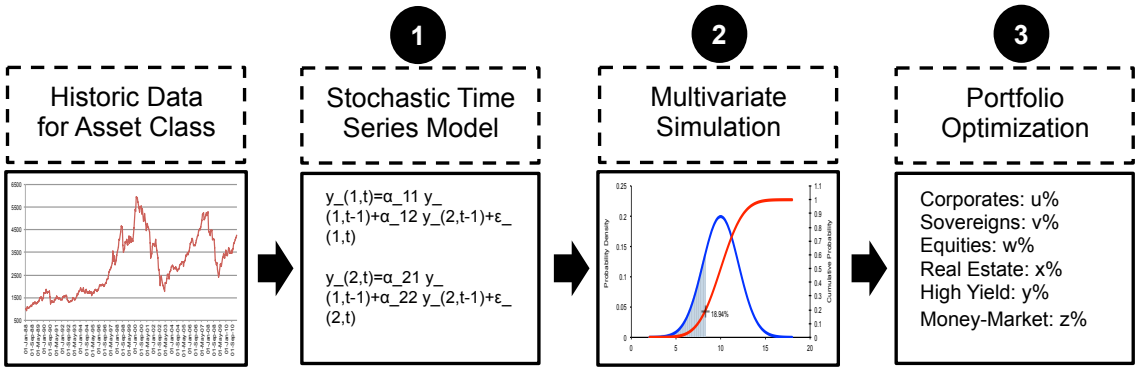
 *Main,*  *Medium,*  *Low Commitment*

Depending on the type of qualitative question under consideration, we will use available legal law texts, regulatory documents, existing research publications or 'practical' methods that are in use in the finance world. The predominant effort and required commitment of our research project will be doubtlessly on the empirical analysis, in which we will define an adequate econometrical time-series model as well as appropriate portfolio allocation strategies.

Our empirical methodology will be composed of a 3-step process, as depicted in figure 14. In step 1, once we have determined the asset classes that will be used for the portfolio allocation, we will have to estimate an appropriate stochastic time series model that is statistically satisfactory and that is appropriate for simulation purposes. The model should be suitable to describe the data generation process (DGP) of the underlying time series, as will be discussed in more detail in section 4.2.2. Subsequently (step 2), the estimated group of time series formula is used to run multi-period, stochastic bootstrap simulations and thus replicate possible future paths the assets can take. The obtained returns will enable us to analyse the riskiness of the simulated asset class using the entire return distribution (expected mean, variance, skewness and curtosis) given the dispersion of the results. In step 3, we will select several allocation strategies and compare the expected mean-variance distributions of portfolios composed of varying asset classes. As input for these portfolio models we will us the simulated return distributions. This will enable us to determine the optimal portfolio composition that achieves the most attractive mean-variance combinations but, more importantly, that simultaneously fulfils all legal and regulatory requirements of VAG, AnlV and the circulars of the BaFin.

The empirical approach we are using in our analysis has been applied to a similar degree in Schroeder's habilitation (2010)[145] or in Dynamic Financial Analysis, an insurance risk management technique that has become relatively popular in the insurance sector in recent years.[146] However, the (relatively basic) first research projects in Germany combining time series analysis and Monte-Carlo simulation to obtain mean-variance input distributions for portfolio optimization strategies go back to as early as 1995 (Stephan, 1995).[147] While in the meantime modelling techniques have developed significantly and are considerably more complex, the basic concept remains similar.

Figure 14: 3-Step Empirical Model for Portfolio Optimization

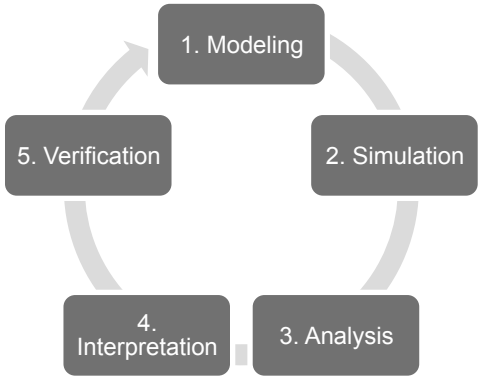


Source: Own figure.

In conclusion, suitable simulation models should follow a predetermined sequence of process steps to ensure that the results obtained are reliable and replicable. After an adequate model that captures the statistical characteristics of the asset classes in question has been estimated using historical data, future return paths using a simulation procedure are generated. Subsequently, the results are analysed to identify possible skewness or extreme events in the distributions. In the interpretation stage, the investment strategies based on the simulated results can be adjusted to circumvent such extreme events. The verification stage is used to compare simulated outcomes to real-world results. The feedback obtained from this comparison is then used to re-adjust the modelling process and start the development loop again (see figure 15).[148]

[145] See Schroeder (2010), section C2, especially pp. 73-74.
[146] See Eling, Parnitzke (2007).
[147] See Stephan (1995), p. 207 et seq, p. 266.
[148] See Eling, Parnitzke (2007), p. 38 et seq.

Figure 15: General Conception of a Development Loop for Simulation Analysis



Source: Own figure, on the basis of Eling, Parnitzke (2007), p. 38.

Further details on the stochastic time series model (step 1) have been summarised in section 4.2 and for the portfolio strategies (step 3) in 4.4.

An important aspect of our analysis will be to determine adequate risk measurements for our portfolio management. Due to the (mandatory) conservative investment approach by German Pension Insurance Funds, we will focus on risk measures that consider the downside risk of the respective investment strategies as only those strategies are appropriate for Pension Insurance Funds that offer the highest probability of capital guarantee (more details in 4.4.2, F).

4.2 Stochastic Time Series Model

4.2.1 Introduction

A. Structural vs. Time Series Models

The most common econometrical models traditionally used in economics are structural models, which include multiple variables to quantity movements in the dependent variable Y_t. Changes in Y_t are thereby explained by movements in current or past values of the explanatory variables. While structural models are usually based on economic theory to establish the relationship between dependent variable and explanatory variables, time series models are considered a-theoretical. This means that their construction is not based on any underlying theoretical model that attempts to explain the behaviour of the dependent variable.[149] For structural models to avoid misspecifications and therefore provide false or biased results, all relevant explanatory variables that have in theory a

[149] See Brooks (2008), p. 206.

meaningful impact on Y_t need to be included in the model. This requires from researchers sufficiently profound economic knowledge about interdependencies of the dependent variable.[150] Another major difference between the two model concepts is that structural models use cross-section data (i.e. data from various economic units at a specific point in time), whereas time series models collect data over time for a given economic unit.[151]

There are specific scenarios when time series methods should be preferred to structural approaches: the former should be used when either (1) there is no adequate data available or (2) no appropriate structural model to explain the target variable Y_t. A good example for (1) could be that the dependent variable is measured in daily returns while one of the explanatory variables is published in monthly time intervals (inadequacy of data).[152] Moreover, especially for research on financial markets, data may be available (and for many asset classes there is plenty data available), but no reasonable theory that can explain future price movements. A representative example for (2) could be the German equities index DAX. While data availability is guaranteed (up to high-frequency time intervals), there is no theoretical model that can explain what explanatory variables have an impact on the current value of the index and to which extend.[153]

B. ARMA Processes as Basic Time Series Models

The starting point of modern time series analysis is considered Box and Jenkins' published book "Time Series Analysis: Forecasting and Control" (1976), which introduced the family of ARMA models (AutoRegressive Moving Average models).[154] The family of ARMA-type models comprehend MA(q) (Moving Average) models, AR(p) (AutoRegressive) models and the ARMA(p,q) models themselves (combination of AR(p) and MA(q) models). MA(q) models are the simplest time series model available as they are merely a linear combination of

[150] See Buscher (2002), p. 133.
[151] See Hill et al. (2008), p. 227.
[152] See Brooks (2008), p. 207.
[153] See Buscher (2002), p.133.
[154] See Brooks (2008), p. 206.

q white noise processes.[155] Y_t depends thereby exclusively on the current as well as previous values of white noise disturbance terms:

$$(4.1)\ Y_t = u_t + \beta_1 u_{t-1} + \cdots + \beta_q u_{t-q}$$

with u_t being a white noise process with $E(u_t)=0$ and $var(u_t)=\sigma^2$.[156] For AR(p) models, the current value of Y_t is a linear function of its p-lagged values of the following type:

$$(4.2)\ Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \cdots . + \beta_p Y_{t-p} + u_t$$

where $E(u_t|Y_{t-1},Y_{t-2},\ldots)=0$.[157] ARMA (p,q) models are combinations of MA(q) and AR(p) models and accordingly Y_t is determined by a linear combination of its own p previous values (AR(p)-component) as well as q white noise terms (MA(q)-component).[158]

The main models that will be used in our empirical analysis are more advanced time series methods derived from ARMA techniques (and their various sub-models just discussed), namely VAR models (Vector Autoregressive Models) in general, and VEC models (Vector Error Correction Models) in particular. VAR/VEC models are considered a good and logical alternative to structural models that are composed of large and complex simultaneous equation systems.[159]

4.2.2 VEC Model

A. VAR Process as Base Model

VAR processes allow for the inclusion of dynamic, intertemporal features that could exist amongst the variables used in the model, a flexibility not available in traditional structural models.[160] VARs are defined as a vector autoregression (VAR) of "a set of k time series regressions, in which the regressors are lagged

[155] White noise terms have an expected mean of zero and constant variance. Each of the white noise terms is completely independent from previous white noise term.
[156] See Brooks (2008), p. 211.
[157] See Stock, Watson (2011), p. 572.
[158] See Brooks (2008), p. 223.
[159] See Brooks (2008), p. 290.
[160] See Luetkepohl (2004), p. 86.

values of all k series."[161] For equation systems with an equal number p of lags in each equation, the system is called a VAR(p). For k=2 (i.e. two time series involved), the VAR(p) is described as:

$$(4.3)\ Y_t = \beta_{10} + \beta_{11}Y_{t-1} + \ldots + \beta_{1p}Y_{t-p} + \gamma_{11}X_{t-1} + \cdots + \gamma_{1p}X_{t-p} + u_{1t}$$

$$(4.4)\ X_t = \beta_{20} + \beta_{21}Y_{t-1} + \ldots + \beta_{2p}Y_{t-p} + \gamma_{21}X_{t-1} + \cdots + \gamma_{2p}X_{t-p} + u_{2t}$$

with β and γ as the respective coefficients and u_{1t} and u_{2t} as the error terms of the VAR system.[162] As formula 4.3 states, the current value of Y_t will be estimated based on lagged values of the same variable, lagged values of X_t and a stochastic error term u. The same logic applies to X_t in formula 4.4. Now the explanatory variable has become the dependent variable. All the coefficients of the VAR model will be estimated using OLS (Ordinary-Least-Squares) regression.[163]

B. Specifications on VECMs

VEC processes (VECMs) are more suitable than VARs if the variables used in the equation system have a cointegrated relation to each other. Cointegration can occur when several variables are driven by a common stochastic trend in the long run. This means, that the time series used in the model appear to move together. Such occurrences are relatively frequent in financial data; consequently we have to assume that our empirical analysis will need to at least consider VECMs for our data generation process.[164] A typical capital markets example for cointegration could be the relationship between short term and long-term interest rates. The theory of the term structure of interest rates states that there is a long-run relationship between the two interest rates. Should at some point in time this gap widen more than the long-run equilibrium, an adjustment is ex-

[161] Stock, Watson (2011), p. 674.
[162] See Stock, Watson (2011), p. 674.
[163] A number of conditions need to be fulfilled before OLS can be applied, in particular that the random variables Y and X are stationary, large outliers are unlikely, there is no perfect multicollinearity and that $E(ut|Y_{t-1}, Y_{t-p},\ldots,X_{t-1}, X_{t-p})=0$. For further details see Stock, Watson (2011), p. 579.
[164] See Luetkepohl (2004), p. 86 et seq.

pected to occur. As Enders (2010) defines it, “the short-run dynamics must be influenced by the deviation from the long-run relationship”.[165]

VECMs are defined as:[166]

$$(4.5)\ \Delta Y_t = \beta_{10} + \beta_{11}\Delta Y_{t-1} + \ldots + \beta_{1p}\Delta Y_{t-p} + \gamma_{11}\Delta X_{t-1} + \cdots + \gamma_{1p}\Delta X_{t-p} + \boldsymbol{\alpha_1(Y_{t-1} - \theta X_{t-1})} + u_{1t}$$

$$(4.6)\ \Delta X_t = \beta_{20} + \beta_{21}\Delta Y_{t-1} + \ldots + \beta_{2p}\Delta Y_{t-p} + \gamma_{21}\Delta X_{t-1} + \cdots + \gamma_{2p}\Delta X_{t-p} + \boldsymbol{\alpha_2(Y_{t-1} - \theta X_{t-1})} + u_{2t}$$

The red highlighted terms are called the error correction terms.[167] Error correction terms play a crucial role when cointegration exists amongst the random variables. In the VECM, the current value of the target variable (in our example Y_t) is not simply dependent on lagged values of the same variable as well as past values of the dependent variables (here ΔX_t) in the equation system, but also on the response of Y_t to the deviation from the long-run equilibrium between Y and X. This adjustment is regulated via the error correction terms. Parameters α_1 and α_2 in formulas 4.5 and 4.6 of the correction terms are thereby responsible for the speed of adjustment to the long-run-equilibrium. The larger their values are, the faster the respective target variable will react now to the deviation to the long-run equilibrium in the previous period.[168]

4.2.3 Rationale

There are various reasons, why we opine that VAR/VEC models are appropriate processes for our research project to capture the data generation process.

A. Despite ARMA models generating good forecasting results that generally outperform structural models, they lack any theoretical (economic) founda-

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[165] Enders (2010), p. 366.

[166] In comparison to the VAR model, the variables are all represented in their first differences. The reason for this is related to the concept of stationarity, wich will be explained in depth in our dissertation project. For the purposes of this paper, though, it is sufficient to mention that in a VECM, what is actually modelled are the first differences ΔY_t and ΔX_t and not the absolute values of the time series, as it was the case for the VAR (for which we assumed stationarity for the random variables).

[167] See Stock, Watson (2011), p. 693.

[168] See Enders (2010), p. 366 et seq.

tion. As a consequence, they are not suitable for the validation of economic theories. VAR/VECM models, on the other hand, enable researcher to benefit from the precision of ARMA forecasting results while enabling for some economic foundation, without the necessity though to have the same in-depth theoretical knowledge as is required for structural models. For VAR/VEMCs, it is sufficient to know which variables may have an impact on the explanatory variable. Statistical tests will help to determine the exact relationships amongst them.[169]

B. In VAR/VECMs, it is not conditional to specify which of the variables used are endogenous or exogenous, as all of them are assumed to be endogenous.[170]

C. VAR/VECMs are considered to be more suitable for forecasting purposes, in particular with regards to out-of-sample forecasting accuracy in comparison to structural models.[171]

D. VECMs offer a self-correction mechanism that ensures that for cointegrated variables any deviations from the long-run equilibrium in the data generation process reverts back. Moreover, impulse-response functions can be applied to see how each variable of the equation system reacts to external shocks and recalibrates over time. For portfolio management purposes, in particular, such dynamic features make VECMs very appealing.[172]

E. Cointegration can be used in portfolio management in particular for allocations in long-only positions and for long-term investment horizons, therefore being a powerful tool for asset allocation considerations for Pension Insurance Funds. Due to the long investment horizon of occupational pension schemes, it makes sense to base investment decisions on common long-term trends in asset prices. As such, costly portfolio rebalancing can be decreased considerably. Moreover, should the investment policy target tracking a benchmark index, as it is frequently the case in pension asset management, then the pension portfolio should be cointegrated with the bench-

[169] See Winker (2002), pp. 214-217.
[170] See Brooks (2008), p. 291.
[171] See Brooks (2008), p. 292.
[172] See Alexander (2008), p. 251.

mark, so that in the long-run, both portfolio and index are tied together via their cointegration.[173]

4.3 Multiperiod, Multivariate Simulation

4.3.1 Pre-Step: Forecasting Methodologies

Once we have obtained a robust VEC model that estimates the data generation process of the underlying time series, we will use "out-of-sample" forecasting techniques to estimate how reliable and precise our VEC model actually is to replicate the underlying data. As Brooks (2008) defines it, "determining the forecasting accuracy of a model is an important test of its adequacy. …the statistical adequacy of a model is largely irrelevant if the model produces accurate forecasts."[174]

The idea behind "out-of-sample" forecasting is to use the existing data of a time series less the more recent data points (what is denominated the "in-sample estimation period"), estimate the VEC model based on these numbers and then forecasts its values for the "out-of-sample forecast evaluation period" in either one-step forecasts or multi-step forecasts. Comparing the numbers generated by the forecast to the real data of the "out-of-sample" period enables us to determine the forecasting quality and precision of our VEC process.[175]

4.3.2 Bootstrap Simulation Technique

Bootstrap simulation techniques have become very popular in finance and econometric applications have increased significantly in recent years.

While in traditional simulation techniques (Monte-Carlo simulation in particular) future simulated prices are constructed via an entirely artificial process, bootstrap (simulation) techniques on the other hand involve sampling recurrently (with replacement) from the actual time series data that is available. Consecutive applications of this process, using so-called loop-techniques (up to 50,000 repetitions, depending on computational processing capabilities), should then

[173] See Alexander (2008), p. 252.
[174] See Brooks (2008), p. 244.
[175] See Schroeder (2002), p. 406 et seq.

generate a series of data with the same distributional properties than the original data from the time series.[176] The quality of the results will be improved by increasing the number of simulation cycles, so that the full outcome distribution of the data generation process can be obtained.[177] The simulated stochastic returns are then used as input for the portfolio strategies that will be applied in our research project (see section 4.4 for more details).

For the purpose of running our simulations, we will use market standard econometrical software applications that allow for such advanced calculations. Our analysis will be realised using EViews, RATS and CATS software packages. While many time series applications and statistical tests are already included in these applications, bootstrap simulations require proper programming in the respective programming language of these softwares.

4.4 Dynamic Portfolio Allocation Strategies

4.4.1 Objectives

Using the results from the multiperiod stochastic time series simulation as input parameters, we can replicate dynamic asset allocation strategies which are appropriate for Pension Insurance Funds.

An important aspect to highlight is that our allocation strategies do not represent an optimization process in the classical way, as investment choices are not ranked according to a single utility criterion.[178] Nevertheless, running simulations on investment strategies will "provide detailed and accurate answers to questions about future return distributions and future investment policies".[179] An optimization element is included in our analysis given the regulatory and legal prerequisites an investment strategie has to fulfill, in particular taking into consideration the intertemporal character of our empirical analysis. The final results should enable us to give precise anwers as to which strategies and asset class mixes are preferable from a risk-return standpoint that simultaneously also satisfy the imposed model constraints.

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[176] See Brooks (2008), p. 553 et seq.
[177] See Eling, Parnitzke (2007), p. 39.
[178] See Elton et al. (2011), p. 270 et seq.
[179] Elton et al. (2011), p. 270.

4.4.2 Description

A. Main Assumptions

Our analysis lies on some assumptions that are required to make the simulations feasible: (1) The replication of asset classes will be performed using suitable indices. The rationale for that is that Pension Insurance Funds follow (in general) passive investment strategies, which can be easily imitated using indices. The pension fund invests therefore in the respective index and does not exercise any stock or single asset picking. (2) The investor will not follow any market timing investment strategies in our analysis.[180] (3) We will focus on investment strategies that have become market standard and have been validated both from an academic angle as well as in real-world situations. These strategies will be: Buy-and-hold, constant mix strategy, put option strategies and the CPPI method. (4) Two investment horizons will be simulated (one year and five years). A one-year time horizon is apt as German Pension Insurance Funds have an annual mandatory reporting duty on ESG issues imposed by the AltZertG and the VAG. Moreover, as detailed in R4/2011, section B.2.5, Pension Insurance Funds have to provide the BaFin each year a description of the targeted asset allocation for the coming year as well as the prevailing risk exposure of the investment assets. Five-year investment horizons, on the other hand, are adequate to capture long-term dynamics that can occur amongst the variables chosen. In addition, due to the long investment horizon that Pension Insurance Funds have, including a five-year scenario seems adequate.

B. Buy-and-Hold Strategy

In a buy-and-hold strategy, the Pension Insurance Fund invests into an initial mix of assets that fulfils the legal and regulatory investment requirements. Once the investment portfolio is bought, it is held over time. No further adjustments will be conducted. Such portfolio strategies are also called ‘do-nothing’ investment methods and act frequently as anchor points for more complex models.[181] Depending on the performance of the respective asset classes included in the portfolio, initial weightings in value terms will change over time. For the one-

[180] See Schroeder (2010), p.69.
[181] See Perold, Sharpe (1995), p. 149 et seq.

year investment horizon in our analysis, there will be no adjustment during the year, whereas for the five-year investment period, we will re-adjust at the beginning of every year to the initial portfolio weights.[182]

C. Constant Mix Strategies

A constant mix strategy maintains a constant exposure to the initial underlying proportions of wealth in a multi-asset portfolio. In practise, a portfolio manager would predetermine what percentages of his portfolio should be designated to each asset class and rebalance over time as market price movements distortion the initial wealth proportions. Due to transaction costs and market risk exposure, rebalancing should occur within certain fixed boundaries or 'level of tolerance'. This means that the underlying asset class has to move by a certain percentage before a rebalancing actually occurs or after a certain period of time has passed. In our simulation exercise, we will rebalance the portfolio to the initial proportions on a monthly basis.[183]

D. Option Based Portfolio Insurance (OBPI)

Option based portfolio insurance (OBPI) is a popular portfolio insurance strategy that should be considered as part of an adequate investment strategy for Pension Insurance Funds. OBPI methods were introduced first by Leland and Rubinstein in 1976. They consist of acquiring a risky asset and simultaneously writing a put on it (also called 'protective put'). The value of the overall portfolio at maturity (in our case end of the one- or five-year investment horizon) is thereby always greater than the strike of the put, independently of market price fluctuations. The strike of the put represents the insured amount of the portfolio.[184] In our empirical analysis, the option-based strategy will be applied only on the equities portion of the portfolio. At inception of the investment horizon, the equities portfolio is protected with ATM put options that have a one-year maturity. After one year, the then prevailing value of the equities portfolio will be protected again for another year with a new ATM put until the end of the five-year

[182] See Schroeder (2010), p. 112, where a similar approach has been used.
[183] See Perold, Sharpe (1995), pp. 151-154.
[184] See Bertrand, Prigent (2003), p. 462.

investment period. Using protective put strategies will allow the portfolio manager to protect the nominal value of his equities investments.[185]

E. Constant-Proportion Portfolio Insurance (CPPI)

Constant Proportion Portfolio Insurance (CPPI) enables Pension Insurance Funds to limit downside risk on the investment portfolio while maintaining some upside potential due to investments in risky assets (in general equities or liquid corporate bonds).[186] First introduced in 1987 by Black and Jones, CPPI "attempts to maintain a highly leveraged exposure in risky assets while assuring principal protection at any point in time".[187] To achieve this, the portfolio manager has to regularly shift allocations between the risky asset and some risk-free assets (in academic papers replicated by zero-coupon government bonds) to avoid that the capital guarantee threshold is not breached. At maturity of the investment horizon, the strategy should return the initially fixed capital guaranteed level.[188] To obtain a capital guarantee at the end of the investment period, CPPI strategies require frequent portfolio rebalancing. Due to transaction costs, such frequent shifts are not feasible though and therefore CPPI methods implicitly have gap risk. In our analysis, we will run simulations on a monthly basis, so that any market disruptions in between rebalancing dates will deter the desired investment outcome.[189]

4.4.3 Risk Measurement Methods

An important part of our portfolio strategy will be centred on selecting adequate risk measurements that are aligned with the investment objectives defined for German Pension Insurance Funds. Due to the conservative investment approach that is primarily focused on capital guarantee over time, our empirical section will comprise methods like shortfall risk measures and Lower Partial

[185] See Schroeder (2010), p. 120.
[186] See Cont, Tankov (2009), p. 379.
[187] Yueh (2010), p. 22.
[188] See Zimmerer (2006), p. 101 et seq.
[189] See Schroeder (2010), p. 137.

Moments (LPM).[190] Further suitable risk methods could also include traditional Sharpe ratios[191] as well as Sortino ratios.[192]

Which risk measurement methodologies are more appropriate for Pension Insurance Funds will depend on the type of distribution we will obtain and the exact definition of our investment policy.

[190] See Gast (1998), pp. 62-69. Given a certain return distribution for a portfolio, LPMs measure the likelihood that a certain predetermined minimum return will not be achieved.

[191] See Sharpe (1966), p. 122. Sharpe ratios are defined as $SR = (\mu - r_f)/\sigma$, in which μ is the expected return of the portfolio, r_f the riskfree rate and σ the standard deviation of the portfolio returns.

[192] See Sortino, van der Meer (1991), pp. 29-31. Sortino ratios make use of both LPMs and Sharpe ratios. It is defined as $SOR = (\mu - z)/\mathrm{sqrt}(LPM_2(z))$, in which μ is the expected return of the portfolio, z the minimum threshold return and LPM_2 the variance of the distribution below z.

5. Expected Timetable

The expected timetable for our research project is depicted in table 7. From submission of this research project to the submission of the final version of the research dissertation, we estimate that the required time of completion will be around 9-12 months.

Table 7: Expected Timetable for Research Project

Event	Expected Date of Completion
Publication Research Proposal	01-Oct-2011
Doctoral Colloquium	21-Oct-2011
Completion Empirical Analysis	End of December 2011
Completion First Draft Doctoral Thesis	01-Apr-2012
Submission First Draft	01-Apr-2012
Process Comments from First Draft	01-May until 31-May-2012
Submission Final Version	01-Jun-2012
Rigorosum	Between Sep-2012 and Dec-2013

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