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**ALTERNATIVE INVESTMENTS IN SELECTED  
EUROPEAN PENSION FUNDS**

Master's Thesis

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## TABLE OF CONTENTS

ABSTRACT .....	4
INTRODUCTION .....	5
1. PENSION SYSTEMS AND ALTERNATIVE ASSETS .....	8
1.1. European population and pension market.....	8
1.2. Pension systems in selected European countries .....	14
1.2.1. Finland .....	14
1.2.2. Denmark.....	16
1.2.3. The Netherlands .....	17
1.2.4. Switzerland.....	19
1.2.5. Estonia .....	20
1.3. Pension fund investment restrictions.....	21
1.4. Alternative asset classes .....	24
2. DATA AND RESEARCH METHODS.....	30
2.1. Description of selected pension funds.....	30
2.2. Description of data .....	34
2.3. Empirical research methods.....	37
2.3.1. Scenario analysis .....	37
2.3.2. Correlation analysis .....	42
2.3.3. Interviews with Estonian pension funds .....	44
3. RESEARCH RESULTS.....	45
3.1. Results of the scenario- and correlation analysis.....	45
3.1.1. Results of the scenario analysis.....	45
3.1.2. Results of the correlation analysis .....	56
3.1.3. Summary of the interviews .....	60
3.2. Comparison to Estonian pension funds .....	63
CONCLUSION.....	68
LIST OF REFERENCES .....	72
APPENDICES .....	77

Appendix 1. Interview questions provided to pension funds .....	77
Appendix 2. Interview transcript, Pension fund A .....	78
Appendix 3. Interview transcript, Pension fund B.....	80
Appendix 4. Interview transcript, Pension fund C.....	81
Appendix 5. Interview transcript, Pension fund D .....	83
Appendix 6. Example of scenario analysis.....	84
Appendix 6 Continued .....	85

## **ABSTRACT**

The master's thesis in hand carries out research on the asset allocation of selected European pension funds. The purpose of this thesis is to find out how alternative asset classes have affected the risk and return metrics of the pension funds. The thesis gives a general view of the European pension fund market, but thoroughly investigates four countries – Finland, Denmark, the Netherlands, and Switzerland. The alternative asset classes included in the research are real estate, private equity, hedge funds, commodities, and infrastructure.

The methods of research are both qualitative and quantitative. The former include research on pension systems and alternative assets (document analysis), as well as interviews. The quantitative methods applied are scenario analysis and correlation analysis. Among significant results of the research is the fact that the foreign pension funds researched allocate significantly more of their assets into alternative asset classes than Estonian pension funds. Also, alternative investments provide diversification benefits and in some scenarios improve the pension funds' risk-return profile. However, there are various risks involved with valuing the alternative investments and with the reporting of their investment returns.

As the master's thesis takes a very practical research approach, it enables Estonian pension fund managers to obtain useful information from the experience of the funds operating in more developed markets.

Keywords: pension funds, pension systems, alternative assets, real estate, private equity, hedge funds, commodities, infrastructure, scenario analysis, correlation analysis

## **INTRODUCTION**

It is widely known that the population in Europe, and in developed countries in general, is aging and the number of pensioners is increasing. At the same time, the working age population that provides pension benefits for the elderly is decreasing. This strains the national pension systems and the governments alone are not capable of providing adequate living standards for the pensioners. Therefore, the importance of private pension schemes is increasing. The private pension funds need to earn sufficient investment returns to cover the future pension liabilities, while also keeping risk at a reasonable level.

In order to achieve the return and risk targets, pension fund managers allocate their investments into various asset classes. Traditionally, these include equities, fixed income instruments, and cash and deposits. However, pension funds are increasingly investing into other asset classes – the so-called alternative assets. The reasoning behind this is that the return, volatility, and correlation profiles of alternative investments potentially improve the portfolio's risk-return profile when combined with traditional asset classes. The assets considered as alternative include real estate, private equity, hedge funds, commodities, infrastructure, and others.

Considering the pension funds' need to achieve sufficient investment returns and the increasing investments into alternative asset classes, the author is interested in finding out in what way have alternative investments affected the pension funds' risk and return. As the Estonian pension fund market is still developing and the funds' investments into alternative asset classes are relatively small, Estonian pension fund managers may benefit from the experience of more developed pension fund markets. Therefore, the author has decided to take a very practical approach to the research and through this provide useful information to Estonian fund managers. This approach also includes discussing the matter with the fund managers themselves in order to find out their opinion and practices regarding alternative investments.

The objective of the research conducted in the master's thesis is to find out in what way have investments into alternative asset classes affected the return and risk of various European pension funds. It should be noted that the research has a very practical approach and the goal is

not to model the optimal asset allocation based on historical data. In order to research this problem, the author has established the following research questions:

1. What are the major characteristics of the pension systems in selected European countries?
2. Which asset classes are considered “alternative” and what are their main features?
3. How have the pension funds in selected European countries allocated their investments among various asset classes?
4. How have alternative investments affected the risk and return metrics of those pension funds?
5. Do alternative investments provide portfolio diversification possibilities?
6. How do Estonian pension fund managers view alternative asset classes?

To achieve the research objective and find answers to the questions above, there are several research tasks:

- Describe the current situation regarding European demographics and pension fund market.
- Provide an overview of pension systems in selected European countries.
- Provide the key features of various alternative asset classes.
- Analyse the asset allocation, risk, and return of selected European pension funds.
- Interview Estonian pension fund managers regarding their opinion of alternative asset classes.
- Make conclusions on how the alternative investments have affected the funds’ results.

There are various research methods used to carry out these tasks. The quantitative methods applied include scenario analysis, which is the most significant part of the empirical research, as well as correlation analysis. The qualitative methods include working through information on the European pension funds market in general, pension systems in selected countries, and alternative asset classes. An additional qualitative research method is the interviews carried out with Estonian pension fund managers.

The master’s thesis begins with a chapter describing the environment in which European pension funds operate. First, the demographics and pension fund market are described, followed by an overview of pension systems in selected European countries – Finland, Denmark, the Netherlands, and Switzerland. Next, an overview of the investment restrictions that apply to the

pension funds in the countries mentioned previously. Finally, various alternative asset classes are introduced. These include real estate, private equity, hedge funds, commodities, and infrastructure.

The second chapter starts out with giving a brief overview of the individual pension funds that were selected for the empirical research. This is followed by a description of the data used in the quantitative research. Finally, a description of the research methods used for empirical research purposes – scenario analysis, correlation analysis, and interviews with pension fund managers.

The third and final chapter of the master's thesis primarily presents the empirical research results. Also, a comparison of these results compared to Estonian pension funds is provided in order to completely understand the opinions expressed by Estonian pension fund managers in the interviews carried out.

The author wishes to thank her supervisor for the useful comments, and also the pension fund managers whose responses to the interviews provided valuable insights regarding fund management and alternative asset classes.

# **1. PENSION SYSTEMS AND ALTERNATIVE ASSETS**

The first chapter of the master's thesis in hand presents key information on and describes the demographics and pension markets in Europe, the pension systems in selected European countries, and alternative asset classes in order to fully understand the empirical research described in the later chapters.

Chapter 1.1 presents past information and future expectations for the European population with regard to age groups. The chapter also provides statistical information on the European OECD countries' pension markets and describes various types of pension plans available. Chapter 1.2 of the master's thesis gives an overview of the pension systems in the countries selected for research – Finland, Denmark, the Netherlands and Switzerland. In chapter 1.3, the investment restrictions applying to each country's pension funds are described in order to give the reader some insight into how the pension funds are allowed to invest and how this may affect their results. Finally, chapter 1.4 describes the asset classes widely considered as alternative investments.

## **1.1. European population and pension market**

It is already common knowledge that the population in Europe, and in the developed world in general, is ageing and the number of pensioners is constantly increasing. This process poses significant challenges for the economy as a whole and in particular for pension systems. The ageing of the population is driven partly by declines in fertility rates from the high levels following the post-World War II generations (OECD 2014a, 18) and rising life expectancy, a pattern that has been apparent for several decades (Eurostat 2014).

As a result of these processes, the proportion of working age people in the European Union countries is shrinking while the relative number of those retired is expanding. The share of people aged 65 and over of the total population is expected to increase significantly in the coming decades. This will most likely lead to an increased burden on those who provide for the social expenditure required by the ageing population. (Ibid.) As it may be seen on figure 1



below, the proportion of people aged 15-64 is expected to decrease by almost 10% over the next 40 years. At the same time, the population of elderly is likely to increase by the same amount.

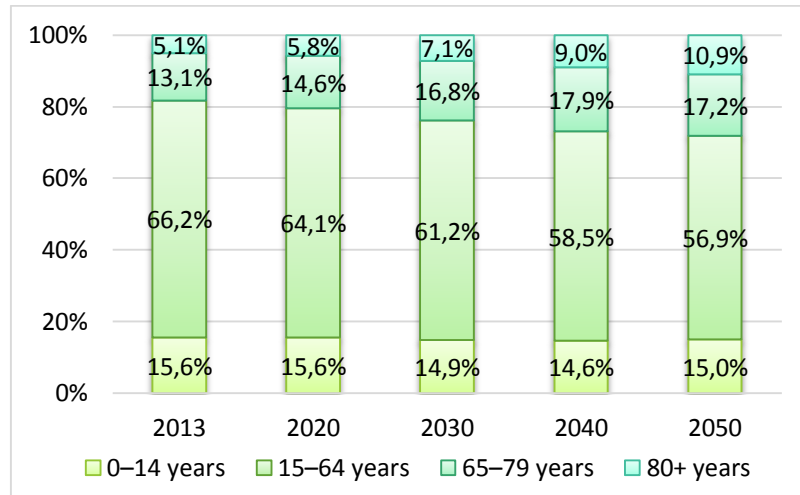


Figure 1. EU-28 population structure by major age groups  
Source: (Eurostat 2014)

The median age of the European Union population was 41.9 years at the beginning of 2013. The increase in median age has been, on average, 0.3 years per year during 2002-2013. The share of elderly as a percentage of total population has increased by 1.9 percentage points during the same period. (Eurostat 2014)

The public pension funds are not able to provide sufficient living standards to the elderly and thus the pension systems are relying increasingly on occupational and personal pension plans. Following is a short overview of the major characteristics of the private pension markets in European countries that are also members of the OECD. The OECD Global Pensions Statistics database provides comprehensive data, which enables gaining a general picture of the private pension situation as of year-end 2013.

The market value of accumulated assets relative to the size of a country's economy is considered a key indicator for measuring the scale of pension funds' activity. As it may be seen on figure 2 below, only four European countries had the ratio of assets-to-GDP higher than 100% at the end of 2013 – the Netherlands, Iceland, Switzerland and the United Kingdom. It is worth noting that 17 of the European countries have assets-to-GDP ratio below 20%, which is the minimum level for meeting the OECD's definition of a mature pension fund market (OECD 2014b, 11).

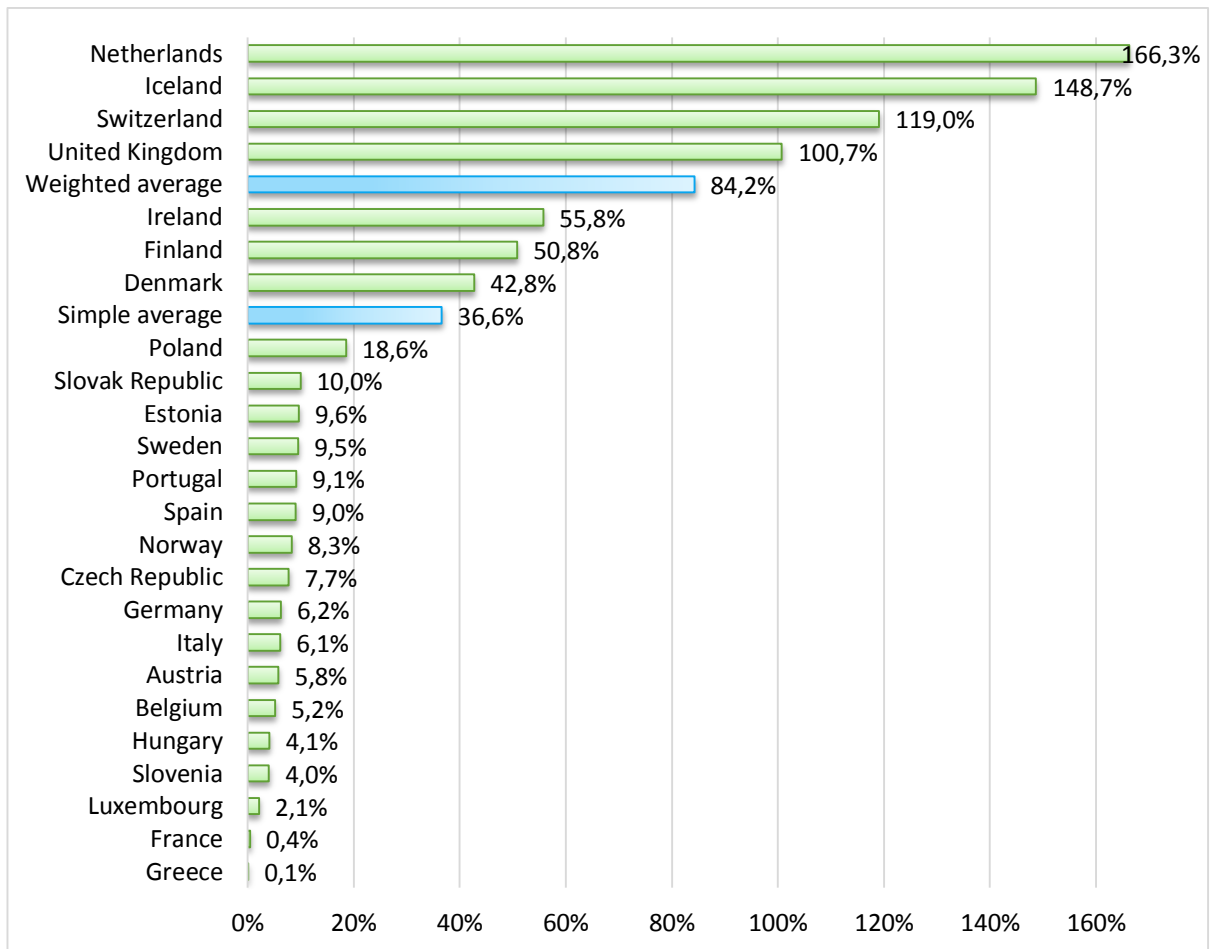


Figure 2. Pension fund assets as a percentage of GDP, 2013  
Source: (OECD Global Pension Statistics 2015)

There are two major types of pension plans in Europe – occupational and personal pension plans. The occupational pension plans are linked to an employment or professional relationship between the plan member and the entity that establishes the pension plan (the sponsor). Occupational plans may be established by employers and labour or professional associations, jointly or separately. The plan may be administered directly by the plan sponsor or by an independent entity, such as a pension fund or a financial institution acting as pension provider. The personal pension plans do not have to be linked to an employment relationship. These plans are established and administered directly by a pension fund or another financial institution without any intervention of employers. Individuals independently purchase and select material aspects of the arrangements, but the employer may nonetheless make contributions to personal pension plans. (OECD 2005, 47-49)

Figure 3 provides an overview of the types of private pension plans currently in use in European OECD countries for which the OECD provided data. There are only five countries in

the selection that apply primarily personal pension plans, while twelve of the countries only allow occupational pension plans.

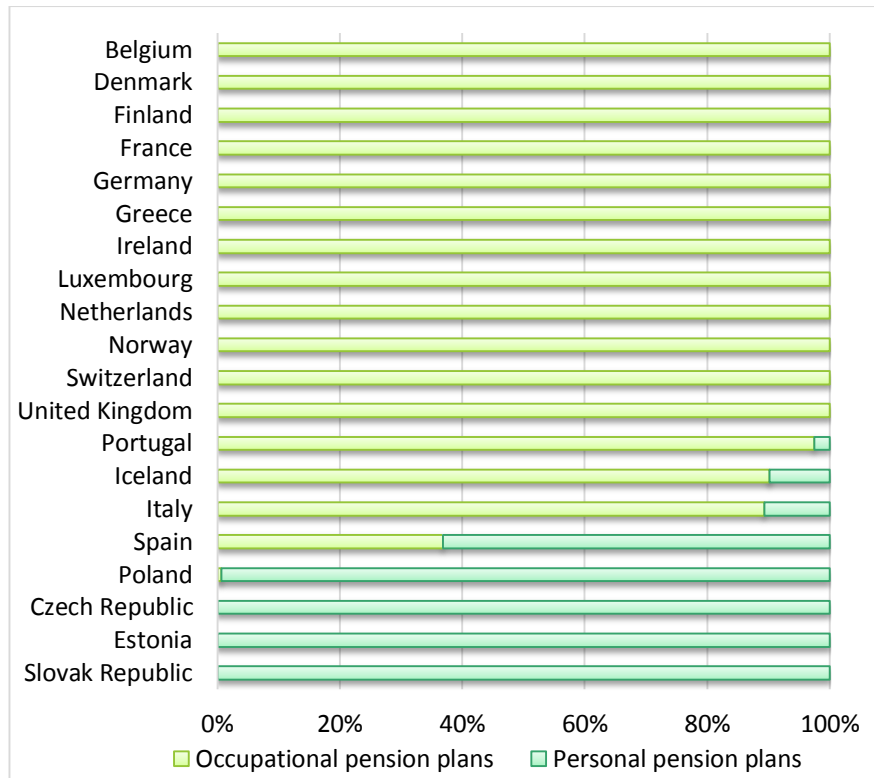


Figure 3. Pension funds' assets by pension plan type, 2013  
Source: (OECD Global Pension Statistics 2015)

In addition to classifying pension plans by the type of benefit provider, the plans may also be identified according to the contribution method. There are largely two types – defined benefit and defined contribution plans, but some hybrids also exist. Following is a short explanation of the two options (CFA Institute 2013a, 443):

- Defined benefit pension plan (DB) – a plan in which the company promises to pay a certain annual amount (defined benefit) to the employee after retirement. The company bears the investment risk of the plan assets.
- Defined contribution plan (DC) – individual accounts to which an employee and typically the employer make contributions. The amounts of contributions are defined at the outset, but the future value of the benefit is unknown. The employee bears the investment risk of the plan assets.

Figure 4 below depicts the split between defined benefit and defined contribution plans in the European OECD countries for which the split of investments could be measured. As we

may see, investments in the defined contribution plans outweighed those in defined benefit plans. In nine of the countries only defined contribution plans are offered and in three only defined benefit plans are available. A shift from defined benefit to defined contribution plans is evidenced in some countries by the closing of defined benefit pension funds to new members, for example in Italy since 1993. Defined benefit plans, however, still play an important role largely due to their historical prominence as the favoured arrangement for occupational pension plans in many countries. (OECD 2014b, 15)

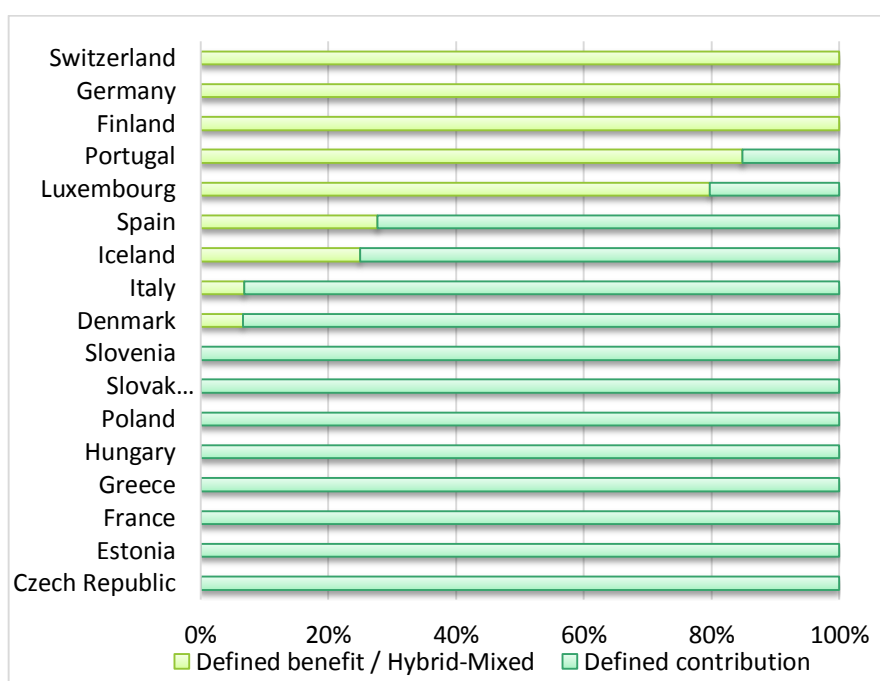


Figure 4. Relative shares of DB and DC pension fund assets, 2013  
 Source: (OECD Global Pension Statistics 2015)

Following is a short overview of the asset allocation in the pension funds of European OECD countries. At the end of 2013, similarly to previous years, the dominant asset classes were fixed income and equities. As may be seen on figure 5, nine of the countries’ pension funds have invested over 60% of their assets into fixed income. None of the countries’ pension funds (measured as the average of all pension funds in the country) invested more than 50% of assets into equities. Poland, Belgium, and Finland had the largest allocation to equities – 41.5%, 39.0%, and 38.2% respectively. The largest holders of cash and deposits were Greece (24.6%), Slovakia (23.1%), and Estonia (17.4%).

According to the OECD Survey of Large Pension Funds 2014, institutional investors have diversified their portfolios by adding allocations to alternative investments such as private

equity, real estate, infrastructure, and hedge funds. However, despite the increasing interest in alternative investments, official data is scarce. This is mostly due to the fact that alternative investments are usually not publicly quoted, thus the availability of data is sometimes deliberately kept private. National statistical agencies do not currently collect separate data on these investments and the different forms available to investors. (OECD 2014c, 6)

The “Other” segment provided in the OECD Global Pension Statistics database includes real estate, hedge funds, private equity, structured products, other mutual funds (i.e. not invested in cash, fixed income, or equities), and other investments. United Kingdom pension funds have the largest allocation to “other” (42%), followed by Germany with 40%. Estonia was among the countries with the smallest allocation to “Other” – below 1%. However, as it was mentioned earlier, there may be some issues with the reporting of alternative asset allocations.

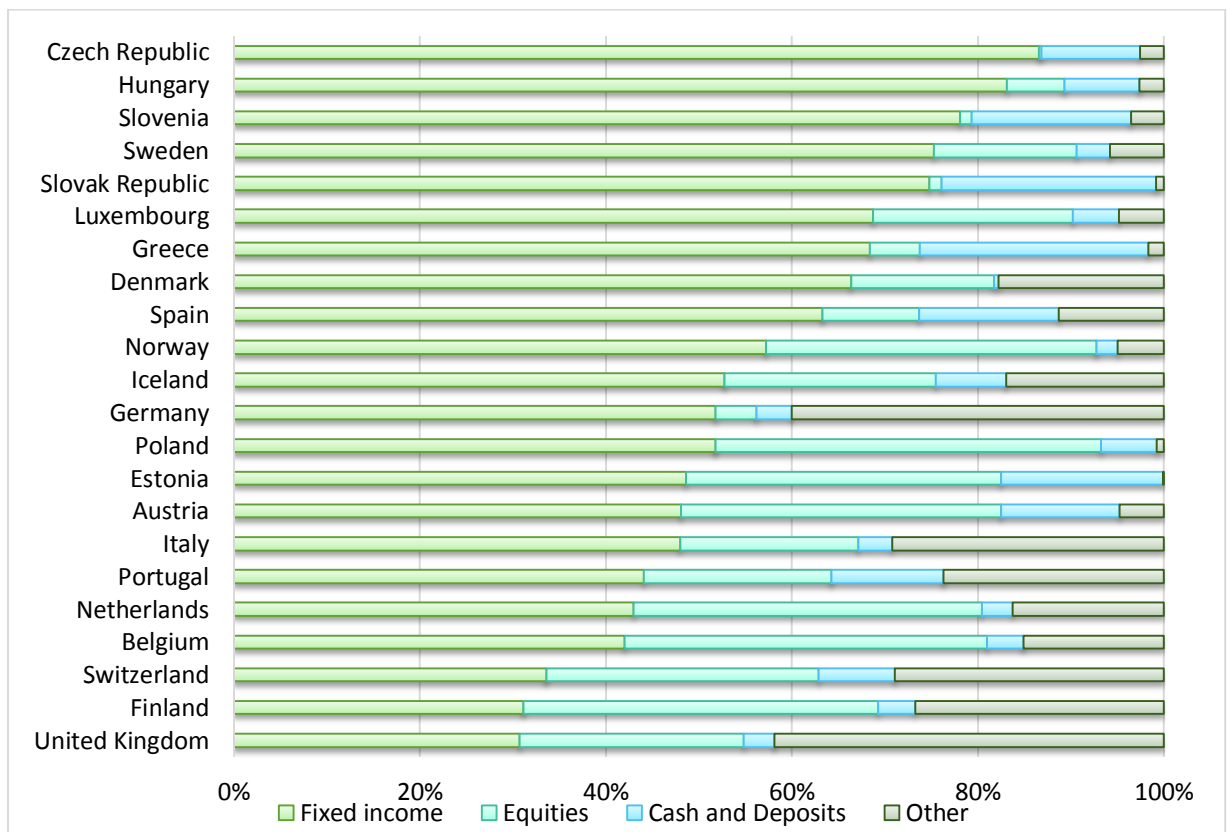


Figure 5. Pension fund asset allocation 2013  
Source: (OECD Global Pension Statistics, 2015)

Largely based on the 2013 year-end data provided by OECD, the author chose certain countries for further and more thorough research. As the master’s thesis in hand is focused on alternative asset classes, the countries with at least 15% allocation to “other” were chosen.

These include the United Kingdom, Germany, Italy, Switzerland, Finland, Portugal, Denmark, Iceland, and the Netherlands. Once the author researched the OECD data more thoroughly, it appeared that in the case of Italy the “other” group amounted only to 5% of total assets. Also, the amounts allocated to various asset classes did not add up to 100% of the total assets under management. It may be suspected that the portion missing was falsely allocated to the “other” segment. Italy was excluded from further the research. There were also some other minor discrepancies found regarding the data of other countries.

Afterwards, the largest private pension funds in the countries mentioned above were looked at more closely. The countries where pension funds report the data necessary for the scenario analysis described in Chapter 2 are Switzerland, Finland, Denmark, and the Netherlands. Therefore, the largest pension funds in these four countries were chosen for further research. In order to understand how the pension funds operate and allocate their investments, the following chapter provides the description of the pension systems in Switzerland, Finland, Denmark, and the Netherlands. Also, for comparison, the chapter includes a short overview of the pension system and investment restrictions in Estonia. This is for the purpose to understand the answers provided to the interviews carried out with four Estonian pension fund managers in chapter 3.1.

## **1.2. Pension systems in selected European countries**

### **1.2.1. Finland**

Finland has a pension system that combines a compulsory legislative basis, similar defined benefits for all, partial funding and private organisation of the pension provision. (Ambachtsheer 2013, 3) The statutory pensions in Finland provide security for old age, in the event of disability, and the death of the breadwinner in the family (Finnish Centre for Pensions 2015). The statutory pension security consists of three components (Finnish Ministry of Social Affairs and Health 2015):

- Earnings-related pension: pension accrued from wages or self-employed earnings;
- National pension: minimum pension security for those who have not accrued an earnings-related pension, or if it is small;

- Guarantee pension: pension benefit guaranteeing everyone a minimum pension larger than the national pension.

In the private sector, earnings-related pensions are provided by pension insurance companies, company pension funds, and industry-wide pension funds. The pension provision of people working in the public sector has been arranged collectively by Keva, which will be introduced in a later chapter. (The Finnish Pension Alliance TELA 2015) The pension insurance companies compete for employer business, but jointly guarantee each other's liabilities in case a fund proves insolvent. (Ambachtsheer 2013). Figure 6 presents the total Finnish pension assets during the years 2007-2013.

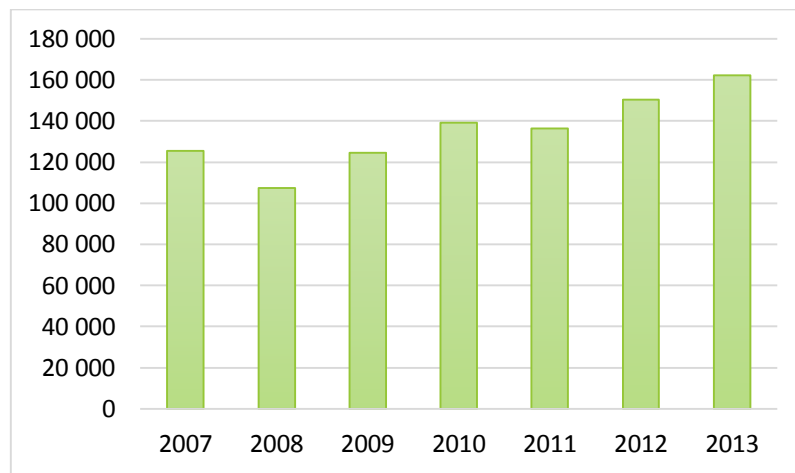


Figure 6. Finland total pension assets 2007-2013 (EUR million)  
Source: (Finnish Centre for Pensions Statistical Database 2015)

Finnish statutory pensions are partially financed (about 75%) by pay-as-you-go (PAYG) contributions, and partially by pre-funding (about 25%) contributions. The former flow directly into current pension payments and the latter are invested, and paid out as pensions later. (Ambachtsheer 2013, 11) The average pension insurance contribution is 22-23% of the worker's salary, with 17% paid by the employer, 5-6% by employees. Additionally, employers need to contribute to a disability scheme, where contribution rates range between 0.09% and 4.95%. (OECD 2014d, 55)

The voluntary pension, essentially the third pillar, consists of individual private pension or life insurance schemes. However, it is not well developed, as wide coverage, relatively high replacement rates and the absence of a ceiling on contributions in the compulsory system make it unattractive. (OECD 2014d, 29)

The beginning of old-age pensions in Finland varies. The national pension usually begins at age 65 and the earnings-related pension payments may be received starting from age 63. (Finnish Centre for Pensions 2015) The average effective age of retirement is lower than the official retirement age (61.8 years for men and 61.9 for women). (OECD 2014d, 56)

### **1.2.2. Denmark**

The Danish pension system essentially has three pillars with some differences to the classical three-pillar system (Rhode, Densgoe 2010, 22):

- The first pillar includes a state-funded pension benefit financed by general tax revenue and paid to all old-aged residents, as well as the benefits provided through ATP.
- Labour market pensions form the second pillar. They are collective insurance-based multi- or single-employer schemes providing the target income replacement rate.
- Private individual pensions are the third pillar. They either supplement pensions from a labour market scheme, or fund pensions based on personal preferences.

The first pillar in turn consists of two tiers. A residence-based national pension, which is composed of a basic amount, which is flat-rate and tied to length of residence, and an income-tested pension supplement. This is a PAYG and tax-financed from general budget revenues. The first pillar's second tier consists of the Supplementary Labour Market Pension Fund (ATP), which is meant for all employees whose working time exceeds nine hours a week. ATP is financed through fixed-sum contributions paid by both employers (2/3 of total) and employees (1/3). (Guardiancich 2010, 2)

Participation in the Danish second pillar labour market pension funds is technically voluntary. In reality, however, collective bargaining agreements have made participation mandatory for both employers and employees. (International Organization of Pension Supervisors 2011, 4) Typical contribution rates are 9% for blue-collar workers, 15% for white-collar workers, and 12% for public-sector employees. In the private sector, employees pay one-third of contributions and employers two-thirds. The government bears full contribution costs for public sector employees. (International Organization of Pension Supervisors 2011, 4) Figure 7 presents the total assets of Danish second pillar pension funds during 2004 – 2013.



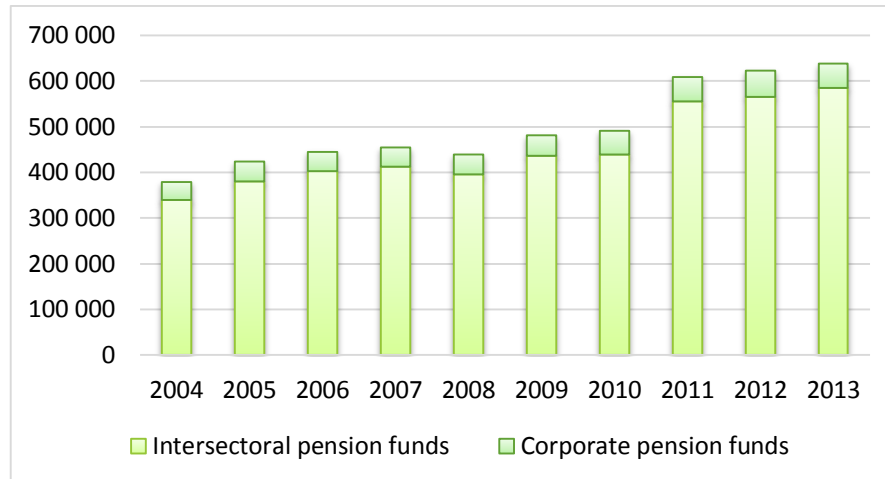


Figure 7. Danish pension funds' total assets, DKK million  
 Source: (Statistics Denmark 2015)

The third pillar consists of voluntary, supplementary pension schemes, managed by banks or insurance companies (International Organization of Pension Supervisors 2011, 4).

The official retirement age is 65 years for both men and women, but will increase to 67 during the period of 2024-2027 or possibly sooner, by half a year each year. (International Organization of Pension Supervisors 2011, 3) Contributions to pension are exempt from income taxation, while pension benefits are taxed as regular income when they are paid out. In addition, investment returns are also taxed, as they accrue in the pension funds. (OECD 2008, 184)

### 1.2.3. The Netherlands

The Dutch pension system has two main pillars, consisting of a flat-rate public pension scheme and earnings-related occupational plans. (OECD 2010) The first pillar is the state PAYG pension system that provides a basic income, the level of which is linked to the statutory minimum wage. Everyone who has lived or worked in the Netherlands between the age of 15 and 65 has the right to receive the state pension from age 65. (Pensioen Federatie 2010, 9)

The occupational pension system has three types of pension funds, which are mainly organised in the form of defined benefit plans (Broeders et al. 2014, 46). The industry-wide funds are organised for industries such as construction, health care, transport, etc. The second type is company pension funds, where a sponsor runs its own pension plan for the employees. In both cases, worker participation is mandatory and governed by collective labour agreements. The third type is the professional group pension funds, which organise pension schemes for specific groups of professionals (physicians, notaries, etc.). (OECD 2010, 69) The second pillar

pensions are financed from the scheme member contributions paid in the past and from the investment return on these contributions (Pensioen Federatie 2010, 9). Figure 8 presents the total assets of Dutch pension funds from 2005 to 2014.

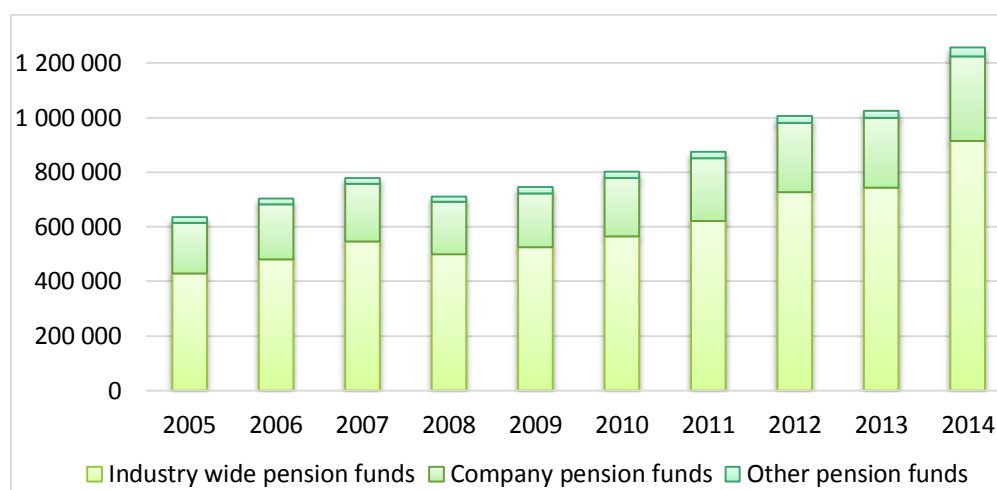


Figure 8. Dutch pension funds' total assets, EUR million  
Source: (De Nederlandsche Bank 2015)

The third pillar of the Dutch pension system is made up of private retirement savings accounts, in which individuals participate on their own initiative (Broeders et al. 2014, 46). This option is mainly used by the self-employed and employees in sectors without a collective pension scheme (Pensioen Federatie 2010, 13).

The Dutch regulatory authorities have defined nominal funding ratios that need to be met in order to ensure that pension funds are able to finance their future pension commitments. The minimum coverage ratio is 105%, but the pension funds also must hold equity buffers. On average, the required coverage ratio including the buffers is 125%. (Ibid.) If funds fall below this ratio, it is mandatory for them to submit a recovery plan with a three-year time horizon (presently temporarily extended to five years). (OECD 2010, 48) The pension funds have various options to restore their coverage ratio after a financial shock. For example they may raise contributions or call for one-off sponsor commitments, cut back on indexation, and reduce their risk profiles by adjusting their investment policies. (Broeders, Rijsbergen 2010, 53)

The pension accumulation period is stimulated through taxation measures – no tax is levied on pension contributions and the pension funds' investment performance is also not taxed. Pension benefit is only taxed when it is received. (Pensioen Federatie 2010, 28)

#### **1.2.4. Switzerland**

The Swiss pension system, similarly to many others in Europe, consists of three pillars. The first pillar provides all retirees with a minimum income. Together with the means-tested pension supplement, this guarantees an income at or above the poverty line. The scheme is financed by PAYG contributions: 4.2% of salary for both employees and employers. (Bonoli et al. 2013, 5) Any person living or working in Switzerland is insured and has to contribute from age 21, or from age 17 if already working (Durand, Gaille 2013, 1). It is a redistributive scheme, since there is no contribution ceiling. The amount of pension benefit, however, may vary between a floor and a ceiling that is twice as high as the floor. A full pension is paid at age 64 for women and 65 for men. (Bonoli et al. 2013, 5)

The second pillar represents the occupational pension plans financed through employer-specific pension funds. Participation is mandatory by law, assuming that salaries are above an inflation-linked threshold level. The monthly contributions are split between the employee and the plan's sponsor (employer). The sponsors may freely choose their pension plan model; either defined benefit or defined contribution. The employers may also decide whether to manage the pension fund themselves or hand the task to collective institutions. (Real 2014, 21) The occupational pension law prescribes a minimum nominal interest rate for the second pillar pension funds (Bonoli et al. 2013, 22). Investment returns earned above the minimum required return are distributed to the insureds in the long term (Real 2014, 22). Since January 1<sup>st</sup> 2014 the required nominal interest rate is 1.75% (Credit Suisse AG Global Custody Solutions 2015). Although the law does not mention a specific target, the sum of the first and second pillar retirement benefits should amount to approximately 60% of the last income before retirement (Durand, Gaille 2013, 2). Figure 9 presents the total amount of pension assets in Switzerland during the period 2005-2013.

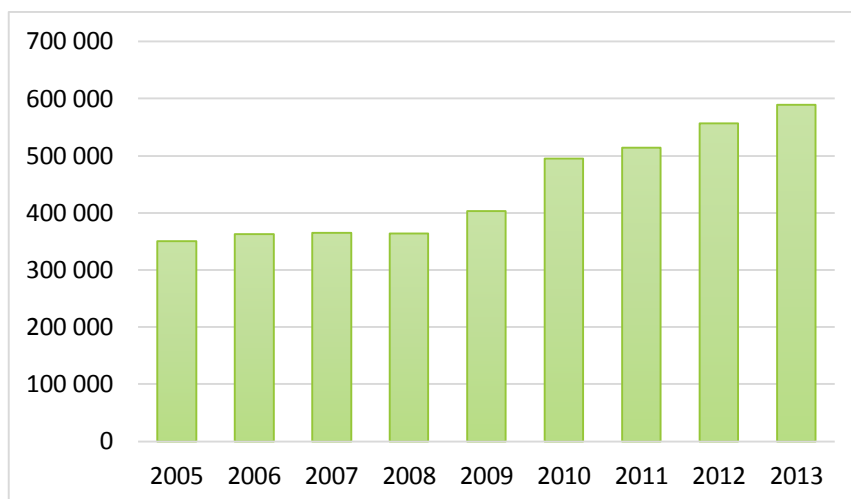


Figure 9. Swiss pension funds' total assets, CHF million  
 Source: (OECD Global Pension Statistics)

The third pillar consists of voluntary private individual pensions, which are encouraged through tax deductions. Funds invested in a third pillar pension plan may be withdrawn earlier in order to buy accommodation to be occupied by the insured person. (Bonoli et al. 2013, 7)

The pensioners' income in 2013 consisted mainly of the first pillar benefits (39% of total) and occupational pensions (22%). There are also other income sources, such as social transfers, income from work, and income from assets. (Ibid.)

### 1.2.5. Estonia

The Estonian pension system consists of three pillars – state pension, mandatory funded pension, and supplementary funded pension. A person is entitled to state old age-pension at age 63 and if their length of employment in Estonia has been at least 15 years. The state pension is a PAYG system, which is collected through the social tax calculated from salaries. Employers pay 33% of the salary of each employee for social tax, of which 13% is for health insurance and 20% is for pensions. (Pensionikeskus 2015)

The second pillar, defined contribution funded pension, is based on preliminary financing as a working person saves for their pension paying 2% of the gross salary into a chosen pension fund. The state adds 4% from the social tax paid on the employee's salary. (Pensionikeskus 2015) There are no occupational pension schemes in Estonia. The pension funds into which the employees contribute are administered by private asset management companies. The management companies offer different investment options, varying by their

equity allocation from 0% to 75%. (OECD 2011) Participating in the second pillar pension plans is mandatory for the persons born in 1983 and later. Persons born before 1983 had the option to voluntarily subscribe to the funded pension system in 2010. There is no possibility to unsubscribe from the funded pension. (Pensionikeskus 2015)

Participation in the third pillar is voluntary and is meant as a supplement for the benefits received from the first and second pillars. There is an income tax advantage applied to supplementary pension contributions. (Ibid.) In addition to the risk of old age, the voluntary plans cover also long-term disability (OECD 2011, 7) Figure 10 presents the total assets of Estonian private pension funds from 2005 to 2014.

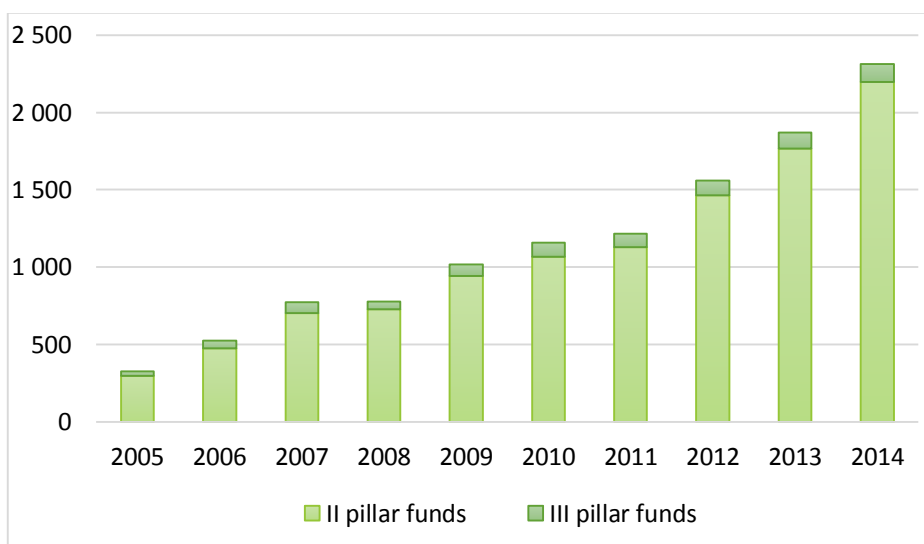


Figure 10. Estonian pension funds' total assets, EUR million  
Source: (Pensionikeskus 2015)

### 1.3. Pension fund investment restrictions

The chapter provides a brief overview of the most significant investment restrictions applying to pension funds in Denmark, Finland, the Netherlands, Switzerland, and Estonia. Table 1 describes the limits on the amount of total assets pension funds are allowed to invest in certain asset classes. The table does not include information on voluntary third pillar pension funds, but only on second pillar mandatory pension funds.

Table 1. Pension fund investment restrictions: portfolio ceilings in 2013

Country	Equities	Real Estate	Bonds	Investment funds	Private funds	Bank deposits
Finland	No limit for listed, 15% for non-listed.	No limit	No limit for listed, 15% for non-listed	No limit	15%	No limit
Denmark	70%	No limit	No limit	70% (no limit if UCITS with listed bonds as underlying assets)	10%: hedge funds, private equity and other	No limit
Netherlands	No limit	No limit	No limit	No limit	No limit	No limit
Switzerland	50%, may increase if certain criteria are met	30%, may increase if certain criteria are met	No limit	Limit applies, but no specification	Limit applies, but no specification	No limit, 10% per bank
Estonia	75%, depending on fund	40%	Listed: no limit Unlisted: 10%	No limit	No limit	No limit

Source: (OECD 2014e)

It should be noted that none of the countries, except Finland, have any limits on investments into foreign assets. For the Finnish statutory pension plans there applies a restriction to invest no more than 20 per cent of assets into non-OECD countries. The following is the description of other significant quantitative investment restrictions in each country, which are likely to affect the pension funds' risk and return levels. All of the information below is compiled from the OECD Annual Survey of Investment Regulation of Pension Funds 2014 (OECD 2014e):

### **Finland**

Investments in single issuer: max 10% in real estate regarded as one object; max 5% of equities, bonds of a single corporation; max 10% in debt obligations secured by a single corporation.

Ownership concentration limits: max 50% in other than insurance companies unless a company is directly linked to pension industry; max 10% in banks or other credit institutions; max 10% of the sponsoring employer.

Other: max 10% of assets may be invested in the sponsoring employer; max 20% in other currencies than EUR.

### **Denmark**

Investments in single issuer: max 3% in securities issued by a single issuer; max 40% in mortgage bonds by a single issuer; max 5% investment in a single property.

Ownership concentration limits: ownership is limited to carry out activities ancillary to the activities licenced (though it is allowed to carry out other financial activities); it is allowed to carry out the establishment, ownership and operation of real property as a long-term placing of funds.

### **Netherlands**

Investments in single issuer: diversification is required, but no quantitative rules.

Ownership concentration limits: none.

Other: max 5% may be invested in shares of the sponsoring employer.

### **Switzerland**

Investments in single issuer: max 10% in debt instruments by a single issuer; max 5% in equities of a single company or single real estate.

Ownership concentration limits: none.

Other: max 5% may be invested in the sponsoring employer (extensions possible); investment in derivatives is allowed for hedging purposes only (no leverage).

### **Estonia**

Investment limit in single issuer: 5% in securities issued by a single issuer; 20% securities issued by a single group; 10% securities issued by a single fund; 2% investment in a single property; 35% in one state security.

Ownership concentration limits: a management company may acquire no more than: 10% of the non-voting shares/debt securities/money market instruments of any single body; 25% of the units of another investment fund.

Other: it is prohibited to issue securities, short-sell, give a loan; overall net open foreign exchange position may not exceed 50%; at least 50% of the investments made in bonds must have a credit rating higher than A2 (Moody's).

#### **1.4. Alternative asset classes**

Alternative investments are perceived to behave differently from traditional investments. They fall outside of the definition of long-only investments in stocks, bonds, and cash. (CFA Institute 2013b) The approach to investing may involve holding both long and short positions in securities, and holding private securities instead of publicly traded investments. Also, there may be derivatives and hedging strategies for achieving the desired level of return. (Baird Private Wealth Management 2013, 1) Alternative investments, particularly investments through special vehicles, are often characterised by high fees, low diversification of managers and investments within the portfolio, high use of leverage, and restrictions to fund redemptions. (CFA Institute 2013b)

There are several characteristics common to many alternative asset classes (Ibid.):

- Illiquidity of underlying investments;
- Narrow manager specialisation;
- Low correlation with traditional investments;
- Low level of regulation and less transparency;
- Limited and potentially problematic historical risk and return data;
- Unique legal and tax considerations.

Given the historical return, volatility, and correlation profiles of alternative investments, combining them with traditional asset classes potentially improves the risk/return profile of the overall portfolio. (Ibid.)

Despite an absolute return objective, alternative investments are not free of risk and may be correlated with other investments, especially in periods of financial crisis (CFA Institute 2013b, 209). Also, due to the complex nature and lower transparency compared to traditional investments, alternative assets may prove difficult to understand for untrained investors. The successful implementation of an alternative investment strategy relies largely on the investment manager's skills. (Baird Private Wealth Management 2013, 3) Investors should be careful in evaluating the historical record of alternative investments, as some investments, such as direct



real estate and private equity, are usually valued using estimated values rather than actual market prices. As a result, the volatility of returns as well as the correlation of returns with traditional asset classes will tend to be underestimated. (CFA Institute 2013b, 211)

The following subchapters provide an introduction of the assets widely considered as alternative investments: real estate, private equity, hedge funds, commodities, and as a more recent addition, infrastructure.

### **Real estate**

Real estate investing is often thought of as direct or indirect ownership in real estate property such as land and buildings. Key reasons for investing in real estate include the following (CFA Institute 2013b, 245):

- Potential for competitive long-term total returns driven by both income generation and capital appreciation.
- Prospect that multiple-year leases with fixed rents for some property types may lessen cash flow impact from economic shocks.
- Likelihood that diversification benefits may be provided by less than perfect correlation with other asset classes.

Andonov et al. consider the main reason for adding real estate into investment portfolios as: 1) diversification, 2) hedging against inflation, and 3) delivering steady cash flows to the portfolio (i.e. rental income). (2013, 34)

The first choice an investor has to make regarding real estate investments is whether to gain direct exposure to properties or to build it up indirectly through listed property companies (Ibid.). The direct investments into equity occur in the private markets. Public investments into real estate are usually done through real estate investment trusts (REITs), which sell their shares to raise funds for property purchases. (CFA Institute 2013b, 247) In the case of direct investments into properties, the investor may keep administrative responsibilities concerned with the property. When investors acquire shares in various investment vehicles, the aim is to pass all property management responsibilities to an outside institution. (Theurillat et al. 2010)

However, it may happen that real estate investments fail to perform in accordance with expectations. Property values are subject to variability based on national and global economic conditions, local real estate market situation, and interest rate levels. The size of investment may have to be large and the investment may also be relatively illiquid, if the investment occurs in private markets. Other real estate investment risks include the ability of fund management to

select and manage the properties, and changes in regulations. Also, many real estate funds pursue leverage to potentially increase returns, which magnifies the impact of gains and losses. To value a real estate investment, appraisals are carried out periodically by experts, but may still be subjective. (CFA Institute 2013b)

### **Private equity**

Private equity investment is a strategy that seeks to participate in the growth of private (usually small- or medium size) companies through long term investments in private securities (Baird Private Wealth Management 2013, 2). This means investing in either privately owned companies or in public companies with the intent to take them private (CFA Institution 2013b, 235). Investors seek to gain access to equity returns that are potentially in excess of those available in public markets, however, at the expense of liquidity (Cumming et al. 2011, 595). Investments in private equity funds can add diversity to a portfolio comprised of publicly traded stocks and bonds, as they may have less than perfect correlation with those investments. (CFA Institute 2013b, 241)

The European Venture Capital and Private Equity Association (EVCA) identifies various types of funds, which are considered as private equity. These include early-stage funds that make majority of their investments in companies that already have a product, and later-stage funds that make investments to help sell that product. Balanced funds invest in all stages of venture capital, while generalist funds invest in all stages of private equity. Buyout funds make leveraged or management buyout investments, and mezzanine funds invest using a type of debt financing with intermediate priority. (EVCA 2014a, 25):

Figure 11 presents the amounts invested into various stages of private equity in European countries during the years 2007- 2014. As it may be seen, private equity investments were popular before the latest financial crisis, but dropped to a quarter of previous volumes as the crisis hit Europe. There has been some recovery in recent years, but the investments have still not reached the pre-crisis levels.

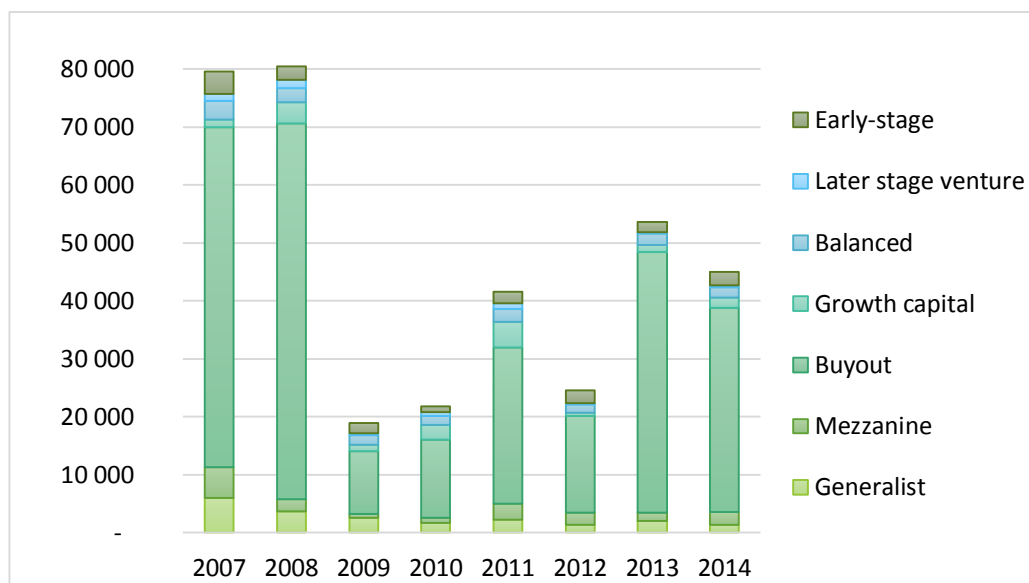


Figure 11. Investments into European private equity funds 2007-2013, EUR million  
 Source: (EVCA European Private Equity Activity Data 2015)

According to the historical standard deviations of annual returns, private equity investments, including venture capital, are riskier than investing in common stocks. Therefore, investors should require a higher return from accepting a higher risk, including illiquidity and leverage risks. Also, private equity funds rely heavily on the fund manager’s experience and skills, which may pose an additional risk. Similarly to other alternative investments, private equity historical performance data is subject to survivorship, backfill and other biases. This may lead to an overstatement of published returns and an understatement of measures of volatility and correlations with other investments. (CFA Institute 2013b, 242)

### Hedge funds

Shortly described, a hedge fund is a managed portfolio of investments that uses advanced investment strategies such as leveraged, long, short and derivative positions in both domestic and international markets. The goal is to generate strong absolute returns, reduce volatility, or both. Hedge funds are generally available to only higher net worth individuals or qualified institutional investors (Baird Private Wealth Management 2013, 2) The CFA Institute adds that hedge funds are aggressively managed and have few, if any, investment restrictions. The funds are generally set up as private investment partnerships and the investors should be willing and able to make a large initial investment. Restrictions on redemptions are often imposed, for example investors may be required to keep their money in the fund for a minimum period (referred to as lockup period) or they may be required to give early notice of their intent to

redeem shares. The willingness of investors to invest in hedge funds, despite the various restrictions, is largely because of the reported higher returns and the perceived low correlation with traditional investments. (2013b, 219)

Given the broad range of strategies across hedge funds, general statements about hedge fund performance are often not entirely meaningful. Also, there has been noticed a general lack of performance persistence: hedge fund strategies that generate the highest returns in some years may perform the poorest in subsequent years. It is also important to consider a hedge fund's fee structure prior to making an investment. A common fee structure is "2 and 20", which reflects a 2% management fee and a 20% incentive fee. (CFA Institute 2013b)

### **Commodities**

Commodities are physical products, which investment returns are based on changes in price rather than on an income stream such as interest, dividends, or rent. Holding the physical products incurs costs of transportation and storage. Thus, most investors do not trade actual physical commodities, but rather their derivatives. (CFA Institute 2013b, 253) Historically, indirect investments such as equity ownership in firms specialising in commodity production, have been the principal means for pension funds to obtain exposure. However, in the last decade the number of investible commodity indices and commodity-linked investments has increased significantly. (Schneeweis 2012, 3) The commodities asset class largely includes precious and base metals, energy products, and agricultural products (CFA Institute 2013b, 254).

Commodity derivatives may be attractive to investors not only for the potential profits, but also because of the perception that commodities are effective hedges against inflation and enable portfolio diversification. (Ibid.) According to Scheenweis, commodity investments have been shown to provide return enhancement as well as risk reduction opportunities (2012, 3).

Commodity indices typically use the price of futures contracts on the commodities included in them rather than the prices of the commodities themselves. As a result, the performance of a commodity index can be quite different from the performance of the underlying commodities. The commodity spot prices are a function of supply and demand, costs of production and storage, value to users, and global economic conditions. The supply cannot be altered quickly by producers as there exist extended lead times. The inability of suppliers to quickly respond to changes in demand levels may result in supply levels that are too low in times of economic growth and too high in times of economic slowing. (CFA Institute 2013b)

## **Infrastructure**

Investing in infrastructure has become increasingly popular with institutional investors in recent years. Infrastructure is presented as one of the new alternative asset classes and is expected to provide new sources of return and better diversification of risk. (Inderst 2010, 89) Among other benefits named are capital protection and long-term growth with a hedge against inflation. Also, infrastructure investments have been more resilient to volatility than investments on listed markets. (Thao, 2012, 3)

Widely defined, infrastructure investments cover “services essential to society”, which typically includes infrastructure such as transport (ports, roads), utilities (energy, water), communication (cable networks, towers), as well as social infrastructure (schools, hospitals). The common aspect of these is the possibility to capture excess returns resulting from limited competition due to natural monopolies, government regulation, or concessions. (Inderst 2010, 90) Infrastructure investments may be made via buying the shares or debt of publicly listed infrastructure companies or through private equity type infrastructure funds. There is a vast need for long-term investments. For example, Europe’s infrastructure financing needs for transport, energy and the fight against climate change are estimated to be more than EUR 2000 billion by 2020. (Mareuse 2011, 84) Western Europe continues to attract most investments, however, increasingly, there is more appetite to deploy capital outside of Europe to emerging markets (Deloitte LLP 2013, 15).

Infrastructure investments are often classified as private equity or real estate, the investments into listed companies are not separate from the general equity or fixed income portfolios. The data regarding private infrastructure investments is often proprietary and not made public. Also as there is much diversity among unlisted infrastructure funds, there are no agreed performance and risk reporting standards. Another major concern is regulatory risk as there may be disadvantageous regulation changes, which may even be applied retrospectively. (Deloitte LLP 2013, 2)

The following chapter of the master’s thesis provides descriptions of the data and methods used to carry out the empirical research. Also, as majority of the data is obtained from selected pension funds’ annual reports, there is a brief introduction of those pension funds.

## **2. DATA AND RESEARCH METHODS**

The second chapter of the master's thesis begins with a brief overview of the 20 pension funds selected for empirical research and explains the reasoning behind the choice. Chapter 2.2 provides a description of data used for empirical research purposes. This includes selected data from pension fund annual reports for the scenario analysis and price data of various indexes used as benchmarks in the correlation analysis. Chapter 2.3 provides information on the methods used in conducting the empirical research. The major part of the research consists of scenario analysis carried out on the pension funds described. This is followed by the description of correlation analysis. The third research method used in the thesis is interviews with Estonian pension fund managers.

### **2.1. Description of selected pension funds**

The selection of funds is based on the Pensions & Investments/Towers Watson World 300: Largest retirement funds (2014). Not all of the funds subsequently described were included in the list, as the assets under management were not sufficiently large. Also, some of the largest funds are not part of the research as there was no necessary data available. The first five pension funds described operate in Finland, followed by the five in Denmark, the Netherlands and Switzerland. Lastly, a short overview of four Estonian pension funds.

**Keva.** At the end of 2014 the Finnish pension fund Keva served altogether 974 member organizations with approximately 1.3 million insured employees. The persons working for the state and local governments, and the Evangelical Lutheran Church of Finland are members of the Keva pension fund. At the end of December 2014, Keva's pension liability fund, i.e. the amount of funds invested had a market value of about EUR 41.5 billion. (Keva 2015)

**Varma Mutual Pension Insurance Company (Varma).** The second largest pension fund by assets under management in Finland, which provides pension insurance for work carried out in Finland. The pension fund covers private sector employees and also self-employed persons. There are approximately 66,000 self-employed and organizations covered

with a total of 862,000 people. At the end of 2014 Varma's investment assets amounted to EUR 40.1 billion. (Varma Mutual Pension Insurance Company 2015)

**Ilmarinen Mutual Pension Insurance Company (Ilmarinen).** Similarly to Varma, Ilmarinen provides pension insurance for private sector employees and is owned by its policyholders. As of year-end 2014 about 38,200 companies have insured their employees with Ilmarinen and the company is responsible for the pension provision of over 900,000 people. Ilmarinen had assets under management of EUR 34.2 billion at the end of 2014, which makes it the third largest pension provider in Finland. (Ilmarinen Mutual Pension Insurance Company 2015)

**Etera Mutual Pension Insurance Company (Etera).** Etera offers private sector companies, private households, and self-employed persons statutory earnings-related pension insurance. Etera was established in 2003 to continue the activities of the LEL Employment Pension fund. As of year-end 2014 there were approximately 203,000 persons insured with Etera and the assets under management totalled EUR 5.8 billion. (Etera Mutual Pension Insurance Company 2015)

**Veritas Pension Insurance (Veritas).** The smallest of the Finnish pension funds included in the research, which similarly to others provides pension insurance for employees of private companies and self-employed persons. The clients of Veritas are mainly small- and medium sized companies. At the end of 2014 Veritas provided pension insurance for approximately 93,000 persons and managed pension assets amounting to EUR 2.6 billion. (Veritas Pension Insurance 2014)

**PFA Pension (PFA).** PFA is the largest privately owned non-profit pension insurance company in Denmark that insures private companies' employees. As of year-end PFA serviced approximately 1 million individual customers and had assets under management of DKK 246.1 billion (c. EUR 33 billion). (PFA Pension 2015)

**Danica Pension (Danica).** The company is among the largest pension providers in Denmark and provides pensions to privately employed persons. There were approximately 600,000 customers at the end of 2014. As the company offers several pension plans and the largest of those, Danica Balance, was chosen for further research. The plan allows the customers to choose their own risk level. Total assets under management in this pension plan were DKK 176.5 billion (c. EUR 23.6 billion) as of December 2014. (Danica Pension 2015)

**Pension Danmark (Danmark).** Pension Danmark is the fourth largest pension fund in Denmark. It is a not-for-profit organisation, which offers a defined contribution pension plan. The products are offered based on collective agreements with approximately 24,800 companies. Danmark covers more than 660,000 individuals within both the private and public sector. Assets under management were DKK 155.9 billion (c. EUR 20.9 billion) as of year-end 2014. (Pension Danmark 2015)

**Industriens Pensionsforsikring (Industriens).** Administrates the pension scheme for the employees of Denmark's industrials sector. The agreement is negotiated by the Central Organisation of Industrial Employees in Denmark, which represents seven different unions. Approximately 8000 companies with a total of 400,000 members are covered by Industriens's defined contribution pension plan. The pension fund had assets under management of DKK 128.1 billion (c. EUR 17.2 billion) at the end of 2014. (Industriens Pensionsforsikring 2015)

**Sampension KP Livsforsikring (Sampension).** Sampension administers industry-wide pension plans of customers mainly employed within the municipal and state sector, but also some private sector employees through employers' pension agreements. The company is essentially non-profit. As of year-end 2014 nearly 300,000 Danes are members of Sampension's pension plans and have total assets of DKK 86.9 billion (c. EUR 11.63 billion). (Sampension KP Livsforsikring 2015)

**Stichting Pensioenfonds ABP (ABP).** The not-for-profit pension fund for employees in the Dutch government, public, and education sectors. ABP is the largest pension fund by assets under management in the Netherlands and the third largest in the world according to the P&I/Towers Watson World 300 largest retirement funds list. The fund had approximately 2.8 million beneficiaries and had invested capital of EUR 344 billion as of year-end 2014. (Stichting Pensioenfonds ABP 2015)

**Pensioenfonds Zorg & Welzijn (PFZW).** The second largest pension fund in the Netherlands providing the compulsory collective pension scheme for employees of the care and welfare sector. As of the end of 2014 the pension fund had more than 2 million members and assets under management of EUR 161.7 billion. (Pensioenfonds Zorg & Welzijn 2015)

**Stichting Bedrijfstakpensioenfonds voor de Bouwnijverheid (BpfBOUW).** The pension fund represents employers and workers in the Dutch construction industry. As of 2014 there were approximately 11,600 member companies with a total of 860,000 persons covered



by the pension fund. Invested capital at the end of 2014 amounted to EUR 47.6 billion. (Stichting Bedrijfstakpensioenfonds voor de Bouwnijverheid 2015)

**Pensioenfonds van de Metalelektro (PME).** The pension fund administers the pensions in the Dutch metal and electrical engineering industries. The fund is controlled by both the employers' organisations and trade unions. PME has more than 1200 member companies and covers nearly 300,000 employees in the industry. As of year-end 2014 PME had assets under management of EUR 39.5 billion. (Pensioenfonds van de Metalelektro 2015)

**Pensioenfonds voor de Grafische Bedrijven (PGB).** PGB is the pension fund for employees in the more general processing industry, such as graphic media, cardboard- and flexible packaging, painting and printing, publishing, etc. The PGB pension fund covers approximately 2200 companies with a total of over 230,000 current and former industry employees. At the end of 2014 the pension fund had assets under management of EUR 19.3 billion. (Pensioenfonds voor de Grafische Bedrijven 2015)

**Pensionskasse des Bundes Publica (Publica).** Also known as Bundes Pensionskasse, Publica is the largest private pension fund in Switzerland with assets under management of CHF 38.1 billion (c. EUR 36.5 billion). Publica has approximately 105,000 pension customers from the Federal Administration, the ETH Domain, and other various decentralised federal enterprises. (Pensionskasse des Bundes Publica 2015)

**BVK des Kantons Zurich (BVK).** The pension fund for the employees of the canton of Zurich. Also, several municipalities, schools, churches, and public institutions related with the canton have joined BVK. The pension fund covers approximately 114,000 members and as of year-end 2014 had invested assets of CHF 26.2 billion (c. EUR 25.1 billion). (BVK des Kantons Zurich 2015)

**Migros-Pensionskasse (MPK).** The occupational pension fund for the employees of Switzerland's largest retail company Migros Group. As of the end of 2014 the pension fund had almost 82,000 members and the assets under management amounted to CHF 20.9 billion (c. EUR 19.8 billion). (Migros-Pensionskasse 2015)

**Pensionskasse Post (Post).** The pension fund for the majority of Swiss postal workers, mainly catering to the employees of Schweizerischen Post AG, but also some related companies. At the end of 2014 the pension fund had approximately 74,000 members with assets under management of CHF 15.4 billion (c. EUR 14.7 billion). (Pensionskasse Post 2015)

**GastroSocial Pensionskasse (GastroSocial).** The GastroSocial pension fund's customers are the employees of the hotel and catering industry by a collective labour agreement. At the end of 2014 there were approximately 20,000 member companies with over 152,000 persons insured. The assets under management amounted to CHF 5.6 billion (c. EUR 5.4 billion). (GastroSocial Pensionskasse 2015)

The Estonian pension funds researched include the four largest funds in Estonia. All of the funds have an equity risk limit of 50%. Since the Estonian pension system is fully personal, all of the funds cater to the whole working-age population and compete for market share. The largest pension fund is Swedbank Pension Fund K3, which at year-end 2014 had assets under management of EUR 542.2 million. K3 is followed by SEB's Progressive Pension Fund with EUR 356.9 million worth of assets and LHV Pension Fund L with EUR 289.2 million of assets. The fourth largest fund is actually Swedbank's K2, however, this fund may only have 25% equity risk and therefore is excluded from the research. Instead, Danske Pension 50 fund with EUR 192.9 million of assets under management is included.

## **2.2. Description of data**

There are mainly two types of data gathered for the purposes of the empirical research of the master's thesis. The majority of data is gathered from the annual reports of the pension funds described in the previous chapter, which is used to conduct the scenario analysis. The second type of data is obtained from the Bloomberg Terminal and consists of monthly price data for various indexes used in the correlation analysis.

As mentioned, the data for the scenario analysis comes from the annual reports of 20 selected pension funds. Instead of using asset class benchmarks, the author decided to take a very practical approach by using the actual asset allocations and returns of the pension funds. As the funds chosen for research are among the largest in each country, the author believes the results may be generalised to the country's whole pension market.

The research period is ten years from 2005 to 2014, which means that altogether 200 annual reports were researched for the necessary data. From each annual report the asset allocation into various asset classes was obtained and also the nominal annual returns for each of those asset classes. In addition, the pension funds' total annual returns were gathered from the reports. In general, the pension funds already publish their asset allocation in percentage

terms. For those that published the amount allocated to each asset class in currency, the author made the conversion into percentage terms. It should be noted, that the asset allocations published are year-end values and may have been slightly different during the course of the year. However, the author does not consider this to be a significant issue. Rushing slightly ahead to the research results, there have been no drastic asset allocation changes in any of the pension funds from one year to another. Perhaps only in 2008, when the amount of equities decreased and was replaced by a larger allocation into fixed income and cash. However, this did not occur in all of the pension funds researched.

The Estonian pension funds mentioned in the previous chapter do not provide all of the necessary data for carrying out the scenario analysis. The funds only publish their asset allocation and the total return, which is enough to compare them to the actual results of the more mature European pension funds. Therefore, the asset allocation and total return data was also gathered for the four Estonian pension funds, which brings the total number of annual reports researched to 240.

As it was mentioned earlier, the correlation analysis is carried out on the asset class benchmark level. During the pension fund asset allocation data gathering phase, the author noticed some similar tendencies among all of the pension funds, which formed the basis for choosing the appropriate benchmarks. After also consulting the CFA Institute materials (CFA Institute 2013b, 212), the benchmarks were selected. It should be kept in mind that there exist some biases in evaluating the returns of some asset classes (for example time lag in the case of private equity and real estate) as explained in chapter 1.4. The price data used for the correlation analysis is monthly and all of it is gathered from the Bloomberg Terminal on 06.06.2015. From the price data, the author calculated the monthly returns, on which the correlation analysis is carried out. The period covered, similarly to the scenario analysis, is from the beginning of 2005 until the end of 2014. The benchmarks chosen for the correlation analysis are briefly described below.

Due to the fact that pension funds invest globally, the MSCI All Country World Index was chosen to represent the equities asset class in the correlation analysis. The index represents companies with both large and medium market capitalisation across 23 developed markets and 23 emerging markets countries. The index covers approximately 85% of the global investable equities and has 2,466 constituents as of 30.04.2015. The MSCI AWCI was launched in May 1990. (MSCI Inc. 2015)

Pension funds also invest globally into various fixed income instruments, but as the author noticed during the data gathering phase, pension funds strongly prefer investment grade bonds, both government and corporate. Therefore, the Barclays Global Aggregate Index was chosen as a benchmark for fixed income investments. The index created in the year 2000 includes investment grade debt issued in 24 different local currency markets. It represents fixed-rate treasury, government-related, corporate, and securitized bonds from both developed and emerging markets issuers. (Barclays Bank PLC 2014)

As the pension funds mostly invest in local real estate in their country or in European REITs, the chosen benchmark is the STOXX Europe 600 Real Estate Cap Index, which broadly represents the European publicly traded real estate securities. The index has altogether 25 components, which are either real estate companies, REITs, Listed Property Trusts, or real estate holding and development stocks. The index was launched in the year 2001. (STOXX Limited 2015)

Similarly to real estate investments, European pension funds prefer investing into European private equity funds. For this reason the LPX Europe Index was chosen to represent the private equity asset class, instead of, for example, the S&P Listed Private Equity Index, which includes companies in the USA. The LPX Europe covers all private equity companies listed in European markets that fulfil certain liquidity criteria. The index is diversified across private equity investment styles such as buyout, venture capital, and growth capital described in chapter 1.4. (LPX Group 2015)

To represent hedge funds in the correlation analysis, the HFRX Global Hedge Fund Index was chosen. It is designed to be representative of the overall hedge fund universe and comprises of all eligible hedge fund strategies. These include convertible arbitrage, distressed securities, equity market neutral, event driven, macro, and other strategies. The allocation to the strategies is asset weighted on the distribution of assets in the general hedge fund industry. (Hedge Fund Research, Inc. 2015)

As the commodities universe is very large, an index with a wide coverage of different commodities was chosen as a benchmark. The Goldman Sachs Commodity Index is a composite index of commodity returns that has an unleveraged, long-only investment approach in commodity futures. The commodity sectors represented include energy, non-energy, industrial metals, precious metals, agriculture, and livestock. The various commodities are weighted in the index by their respective world production quantities. (Goldman, Sachs & Co. 2015)

Finally, as an infrastructure investment benchmark, the STOXX Global Broad Infrastructure Index was chosen, which offers the opportunity to access the infrastructure sector on a global scale. It represents the largest companies according to market capitalisation that earn at least 50% of revenue from the infrastructure industry. The index is well diversified as the geographic and supersector concentrations are decreased by capping country allocations at 40% and supersectors at 30%. (STOXX Limited 2015)

The following chapter describes in detail the methods of empirical research carried out on the data presented above. In addition to the scenario- and correlation analysis, the third research method presented is interviews with Estonian pension fund managers. This enables better understanding of why and how Estonian pension funds have allocated their investments into alternative asset classes.

## **2.3. Empirical research methods**

### **2.3.1. Scenario analysis**

The central part of the empirical research in this master's thesis is scenario analysis. The input data used to construct the scenarios was described in the previous chapter. The choice of countries and pension funds included in the empirical research was already described in chapters 1.1 and 2.1.

The goal of the scenario analysis was to find out how investments into alternative asset classes have affected the pension funds' risk and return metrics during the 10-year period. Instead of using asset class benchmarks, a practical approach is taken, using the actual asset allocations and returns of pension funds. There are altogether three scenarios, which are first played out for each pension fund separately and compared to the funds' actual results. Next, the scenarios are taken to the country level, with a simple average including all five pension funds. As the funds chosen are all among the largest in their respective countries, the results are most likely applicable for the whole pension fund management industry in that country. Lastly, all of the scenario analysis results are merged and the overall indicators are found for the group of four countries. The last step, however, should only be taken as a reference point or general background information, as the investment restrictions are different in each country and affect the allocation of money to various asset classes.

The first scenario (Scenario 1) consists of simply removing the amount allocated to different alternative assets altogether and replacing this with a deposit. This scenario is expected to show whether the alternative assets as a whole have contributed positively or negatively to the pension fund's risk and return over the time period. The interest rates used to simulate the deposit return are obtained from each country's national bank statistics database. For each of the years, that specific year's average deposit interest rate is used. As pension funds may need to maintain some liquidity, it would not be reasonable to allocate free funds to a deposit for longer than one year. Therefore, the deposit interest rates used in calculations are for a period of less than one year.

The second scenario (Scenario 2) consists of removing all alternative assets, except for real estate, and depositing what is left. Again, the same deposit interest rates are used as in Scenario 1. The intuition behind constructing this scenario is that while gathering the data, the author noticed that none of the pension funds consider real estate as an alternative asset class. Rather, it is presented separately and in almost all cases had a relatively larger allocation than any of the other asset classed described as "alternative". In addition, during the data gathering, the author noticed that the returns on real estate assets were more stable as, for example, in the case of equities or commodities. Therefore the results of Scenario 2 provides insight into: 1) whether real estate as an asset class has contributed positively or negatively to the funds' performance, and 2) how the rest of the alternative assets have impacted the funds' results.

The third scenario (Scenario 3) involves again removing all of the alternative investments from the portfolio and replacing them with the traditional investments of fixed income and equities. The allocations to fixed income and equities are proportionally increased with respect to each year's allocation to these equities, as so that the fund is fully invested. While calculating the proportionately increased allocations, the author was careful to make sure that the new allocations do not cross the funds' regulated investment limits described in chapter 1.3. This happened only on one occasion as in some years the Swiss pension fund BVK's simulated portfolio crossed the maximum allowed equity allocation limit of 50%. Therefore, the BVK portfolio in Scenario 3 has an equal allocation of 50% into equities and fixed income in the years 2006, 2007, 2010 and 2012. Naturally, this scenario of fully invested assets is not likely in reality, as the funds probably have liquidity needs. However, the goal is to find out whether investing as much of the assets as possible into fixed income and equities would improve or diminish the funds' risk and return metrics. The intuition would be to assume that

during rising markets the results of Scenario 3 are better than the funds' actual results or Scenario 1 and Scenario 2. During falling markets and volatile times, Scenario 3 should have worse results than the others, as being fully invested and little diversified among asset classes may leverage the portfolio's losses.

As it was mentioned earlier, various risk and return metrics were found regarding the actual historical results of the pension funds and the simulated results of Scenarios 1, 2, and 3. These include the standard deviation of the portfolio return, geometric mean return, median return, and the Sharpe ratio. Following is a short description of these metrics and also the reasoning behind choosing these exact metrics.

The standard deviation is often considered to be synonymous with risk as it reflects the volatility of the asset or portfolio returns. It measures the average deviation from the portfolio's mean return during the selected time period. A higher standard deviation suggests less predictable returns and therefore a more risky investment. The standard deviation of returns of an asset is the square root of the variance of returns. Standard deviation is often preferred to variance, as the result is presented in percentage terms, rather than as an arbitrary figure. (CFA Institute 2013a) Another reason for choosing standard deviation to measure the pension funds' risk is the fact that most of Estonian pension funds report this metric in their monthly fund overviews. The formula used for calculating the standard deviation of portfolio returns (Ibid.):

$$\sigma = \sqrt{\frac{\sum_{t=1}^T (R_t - \mu)^2}{T}} \quad (1)$$

where

- $\sigma$  – standard deviation
- $R_t$  – return in period  $t$
- $T$  – total number of periods
- $\mu$  - mean of  $T$  returns

The geometric mean return, rather than the arithmetic mean return was chosen because the arithmetic mean is the average of the returns earned on a unit of investment at the beginning of each holding period. “It assumes that the amount invested at the beginning of each period is the same, similar to the concept of calculating simple interest” (Ibid.). However, it would be unreasonable to expect that a pension fund's assets under management remain constant over the years. Rather, the previous year's earnings should be added to the beginning value of the investment. (Ibid.) As the geometric mean return assumes that the investment amount is not

reset at the beginning of each year, and should provide a more accurate representation of the growth in portfolio value, it was chosen as a metric that would provide sufficient information on the pension funds' annual returns. The following equation, provided by the CFA Institute, was used for calculating the geometric mean returns (Ibid.):

$$\begin{aligned}
 R_{Gi} &= \sqrt[T]{(1 + R_{i1}) \times (1 + R_{i2}) \times \dots \times (1 + R_{i,T-1}) \times (1 + R_{iT})} - 1 = \\
 &= \sqrt[T]{\prod_{t=1}^T (1 + R_{it})} - 1
 \end{aligned} \tag{2}$$

where

$R_{Gi}$  – geometric mean return

$i$  – the asset (or portfolio)

$R_{it}$  – return in period  $t$

The median of a series of portfolio returns is the value of the middle item of a set of items that has been sorted into ascending or descending order. In an odd-numbered sample of  $n$  items, the median occupies the  $(n + 1)/2$  position. In an even-numbered sample, the median is defined as the mean of the values of items occupying the  $n/2$  and  $(n + 2)/2$  positions. The advantage of the median is that, unlike the mean, extreme values do not affect it. (CFA Institute 2013c, 357) Therefore, it may be reasoned that the geometric mean return and the mean complement each other. The first provides the average return over the period, taking into account the whole magnitude of the pension fund's returns and the median provides a narrower picture, which is not affected by the large return swings that occurred during the last financial crisis.

Finally, the Sharpe ratio, which combines both risk and return, and essentially measures the compensation for higher risk that the investors should receive in the form of higher returns. The Sharpe ratio result is a figure that by itself does not provide much information, but should rather be compared to the Sharpe ratios of other portfolios. The portfolio with the highest Sharpe ratio has the best performance, and the one with the lowest ratio has the worst performance. This reasoning only applies if the numerator is positive for all comparison portfolios. If the numerator is negative, the ratio will be less negative for riskier portfolios, resulting in incorrect rankings. The Sharpe ratio formula is as follows (CFA Institute 2013a, 374):



$$\text{Sharpe ratio} = \frac{R_p - R_f}{\sigma_p} \quad (3)$$

where

$R_p$  – portfolio return

$R_f$  – risk-free rate

$\sigma_p$  – portfolio standard deviation

As noted above, the Sharpe ratio formula contains the risk-free interest rate. It is not specifically defined, which interest rate should be used in the calculation as there are many options depending on the portfolio for which the ratio is calculated. After discussing the matter of choosing the right risk-free interest rate with a fund management industry professional<sup>1</sup>, the author decided to use each country's 10-year government bond yield. For the Finnish pension funds the rate of 0.30% was used, which was obtained from the Bloomberg Terminal on 02.04.2015. The rates for the Netherlands, Switzerland, and Denmark used are 0.36%, -0.11% and 0.32%, respectively. All of the yields are as of the date 04.04.2015 and again gathered from the Bloomberg Terminal. The case of Switzerland is rather interesting as the bond yield is negative. Again, after discussing the matter, it was decided to keep the yield as it is, instead of using, for example, a 0% yield, as it reflects the current reality of extremely low investment grade government bond yields. Therefore, the 0.11% was added back to the portfolio return, not subtracted.

Regarding Estonian pension funds, there were similar data acquiring problems as in all of the countries dropped from research earlier – the funds publish their asset allocation, but not the investment returns for each asset class. Therefore, there is no scenario analysis carried out with Estonian pension fund data. However, to still enable comparison to peers from Finland, Denmark, the Netherlands and Switzerland, the risk and return metrics described above are calculated for the Estonian funds as well. Concerning the Sharpe ratio, as Estonia does not have any government bonds, there were various options considered for representing the risk-free rate. First, the bonds of Latvia and Lithuania, and the Estonian ten-year CDS were considered. However, the other Baltic countries have a lower credit rating than Estonia and the CDS is not liquid enough. Therefore, it was decided to use the yield of the Czech Republic 10-year government bond. Similarly to Estonia, the Czech Republic has a credit ratings of A1, AA-

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<sup>1</sup> Fixed income fund manager, investment experience since 1998

and A+ from Moody's, Standard and Poor's, and Fitch respectively. The yield of 0.38% was obtained from the Bloomberg Terminal on 28.04.2015.

The risk and return measures for each scenario are compared to the pension funds' actual results. This enables making conclusions on whether investing into alternative asset classes has improved or diminished the funds' return and risks, the latter measured as standard deviation. An example of how the scenario analysis was conducted is available in Appendix 6. As diversification among asset classes is an important concept, the next chapter describes the method of correlation analysis.

### **2.3.2. Correlation analysis**

One of the major benefits of investing into alternative asset classes pointed out in chapter 1.4 is their potential ability to provide portfolio diversification benefits. Adding assets with less than perfect correlations to a portfolio reduces the portfolio's risk. Correlation is defined as a measure of the consistency or tendency for two investments to act in a similar way. The correlation coefficient may be either positive or negative and it ranges from -1 to +1. (CFA Institute 2013a) A correlation above 0.90 is considered high because the investments do not provide a significant opportunity for diversification of risk. Correlations below 0.30 are usually considered attractive for portfolio diversification. (Baird Private Wealth Management 2013, 3) Therefore, the pension fund manager should include either individual investments or asset classes with a correlation coefficient significantly less than 1. Investments that have negative correlations move in opposite directions and finding such assets would be an even greater addition to portfolio diversification.

In order to conduct research on how the asset classes, into which pension funds allocate their customers' funds, act in relation to one another, a quite simple correlation analysis was carried out. The pension funds studied invest into equities and fixed income instruments in all regions of the world. The private equity and real estate investments are more concentrated in the pension fund's country of origin or more generally in Europe. In some cases, where hedge fund investments were presented in detail, they are managed from either the USA or Europe. However, the hedge funds may invest in all regions. The commodities investments, where specified, included precious metals, oil and gas, and several other commodities. Considering that the pension funds have these similar tendencies mentioned above, it was decided to carry out the correlation analysis on the asset class benchmark level, as described in chapter 2.2. The

correlation analysis, like the scenario analysis, covers the period from 2005 to 2014. Due to the reasons mentioned above, the MSCI All Country World Index was chosen to represent the equities asset class. To represent fixed income assets in the correlation analysis, another index with a wide coverage was chosen – the Barclays Global Aggregate Index. As the pension funds researched prefer to invest in European real estate and private equity, the STOXX Europe 600 Real Estate Cap Index and the LPX Europe Index were chosen to represent real estate and private equity, respectively. For hedge funds the benchmark is the HFRX Global Hedge Fund Index. The commodity benchmark chosen is again an index with wide coverage of different commodities – the Goldman Sachs Commodity Index. Finally, the STOXX Global Broad Infrastructure Index was chosen to represent the infrastructure investments.

With these benchmarks, the correlation analysis was carried out for three time periods. First, for the whole period of research in the thesis – the ten years from 2005 to 2014. The second time period researched is 2005-2009 and the third set of correlations was found for the five-year period of 2010- 2014. The reasoning behind the second and third set of correlation analysis is that various media articles and also the latest International Monetary Fund Global Financial Stability Report (IMF 2015, 34) have mentioned higher correlations among asset classes after the financial crisis. Therefore, it may happen, that as governments continue with quantitative easing programmes, some of the diversification benefits of different asset classes may decrease further.

The correlation coefficients are found between all asset class benchmarks described above, but more attention is dedicated to correlations of traditional investments to alternative investments. The goal is to find out whether any of the alternative asset class benchmarks provide diversification possibilities and whether that possibility has changed during the three time periods under investigation. The results of the correlation analysis should be considered as background information of the portfolio diversification abilities of alternative asset classes, as the pension funds researched seem to prefer not to invest only into benchmarks.

To gain a deeper knowledge of pension fund managers' preferences and general views on alternative investments, the next chapter describes the interviews carried out with the managers of largest Estonian pension funds.

### **2.3.3. Interviews with Estonian pension funds**

Despite of investment restrictions set by the regulators and internal policies set by the asset management companies themselves, pension fund managers have discretion to choose the asset allocation and individual investments they deem appropriate. The master's thesis in hand aims to have a very practical approach to the topic of asset allocation and alternative investments. Due to this, there were interviews carried out with the fund managers (or other persons involved in the management) of four of the largest pension asset management companies in Estonia. With respect to the fund managers' privacy wishes, the names of the asset management companies and the fund managers will not be presented. Instead, notations such as "Pension fund A" and "Fund manager A" will be used while presenting the results of the interviews.

The interviews were conducted via e-mail during the period of 24.04.2015- 06.05.2015. There were altogether nine open-ended questions regarding the pension funds' asset allocation, risk management, and the fund managers' personal view on the topic of alternative assets. The interview questions were composed based on the theoretical approaches and alternative asset background information presented in former chapters. The interview questions and transcripts are provided in Appendices 1 to 5.

### **3. RESEARCH RESULTS**

The third chapter of the master's thesis in hand provides the results of the research conducted and finally also conclusions and recommendations. Chapter 3.1. presents the outcomes of the scenario analysis described in the previous chapter. The results are presented on the country level i.e. combined results of individual pension funds. Also, the results of asset class benchmark correlation analysis are included, which provides insight into the diversification abilities of alternative investments. This is followed by an overview of the interviews conducted with Estonian pension fund managers. Chapter 3.2. compares the asset allocation and risk-return metrics of Estonian pension funds to peers from Finland, Denmark, the Netherlands, and Switzerland. Combined with the interview results, this comparison enables gaining insight into how the Estonian pension fund managers' strategies have performed compared to the funds from more developed pension markets.

#### **3.1. Results of the scenario- and correlation analysis, and interviews**

##### **3.1.1. Results of the scenario analysis**

The scenario analysis is the most significant part of the empirical research conducted and enables to conclude how alternative investments have contributed to pension funds' risk and return metrics over a ten-year period. The scenario analysis results are combined from the metrics of each pension fund introduced in chapter 2.1 to the country level. As the pension funds selected are among the largest in each country, the author believes the combined results are representative of the situation in the whole country. The description of results will begin with Finland, followed by Denmark, the Netherlands, and Switzerland.

For the Finnish funds as a whole, the asset allocation has not gone through any drastic changes. Only in 2008 was the allocation to fixed income increased and to equities decreased by approximately 10 percentage points. Again in 2011, likely due to the problems in Greece, the fixed income allocation was increased again. However, the general tendency noticeable over the ten-year time period is that the asset allocation into alternative investments has steadily

increased on the account of traditional assets. The amount invested into alternative assets has risen from 15.4% in 2005 to 27.1% of total assets by 2014. These developments may be seen on figure 12. Regarding the division of assets between the alternative investments, commodities are the least favoured with a below 1% allocation during the whole period. As may be seen on the figure below, real estate is the most popular alternative asset class. The reason for this may be that the Finnish pension funds are allowed to directly own all kinds of real estate, which they gain rent from. In the recent years, allocation to hedge funds and private equity has also increased noticeably.

As presented on the figure below, Finnish combined pension funds' returns on investment have been relatively stable, but have fluctuated during periods of financial distress.

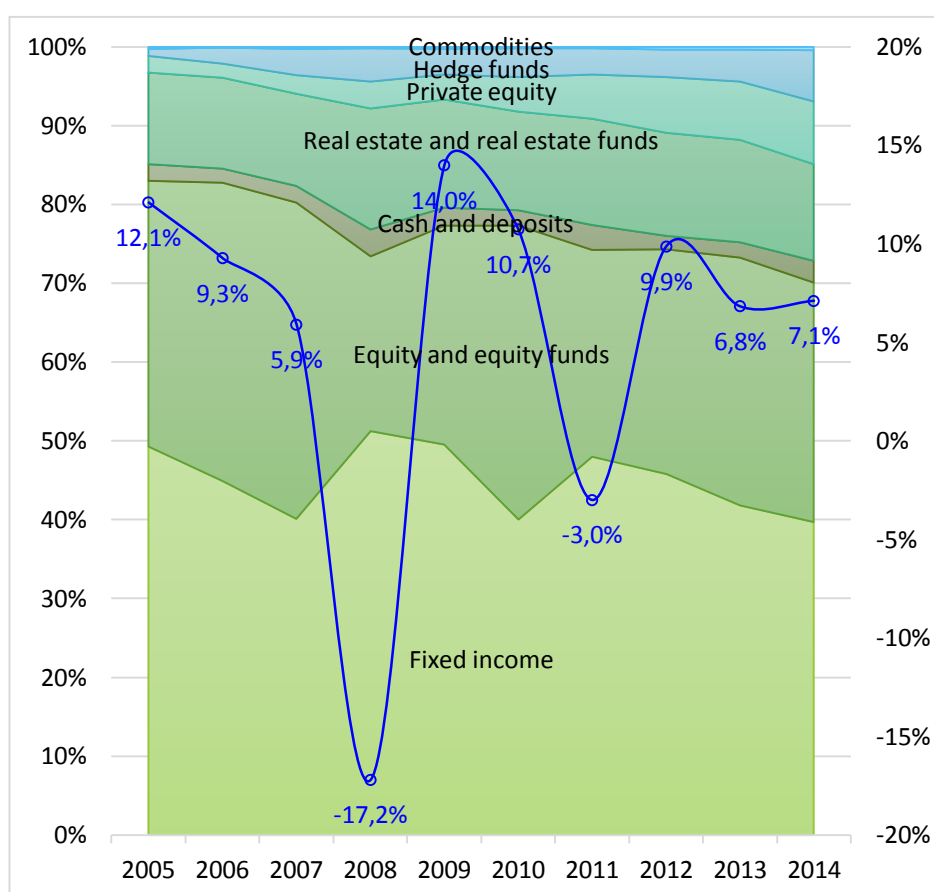


Figure 12. Finland, pension funds asset allocation and returns, 2005-2014  
 Source: Prepared by the author based on the data from pension funds' annual reports

Presented in table 2 below are the results of the combined scenario analysis compared to the actual results of the pension funds. As may be seen, the standard deviation is lower for Scenarios 1 and 2, which is a quite natural result – the pension funds have quite large allocations

into alternative asset classes, with more volatile than deposit interest rates. In the case of Scenario 3, the standard deviation metric is slightly higher than for the actual fund portfolios, which is likely due to the large simulated allocation to equities. During the ten-year period, the equities, into which Finnish pension funds had invested, had a standard deviation of 21.9%, compared to real estate's 2.8%, private equity's 10.2% and hedge funds' 6.9%.

Regarding the return metrics, Scenario 1 and 2 underperformed the funds' actual returns. This implies that all of the alternative assets have contributed positively to the funds' performance. However, Scenario 3 had better return metrics than the actual pension funds. Being fully invested into fixed income and equities yielded higher returns in most of the years. Therefore, in the case of Finnish pension funds' historical data, sacrificing diversification for returns would have grown the pension assets by on average 6.9% a year instead of 5.6% per year. This may imply that the Finnish pension fund managers are strong in picking stocks and bonds or have weak skills when it comes to choosing alternative investments.

Concerning the Sharpe ratio, Scenarios 1 and 2 again performed worse than the actual pension funds. It appears that the lower standard deviation did not compensate for the lower returns. However, the Sharpe ratio is better for Scenario 3 as the higher returns compensated for the slightly higher standard deviation. Therefore, in conclusion, for the Finnish pension funds in general it would have been more profitable, and also provided a better risk-return relationship, to have been fully invested into equities and fixed income instruments.

Table 2. Finland, results of scenario analysis compared to actual results

<b>Scenario/metric</b>	<b>Std. dev</b>	<b>Median</b>	<b>G.mean</b>	<b>Sharpe</b>
Actual	9.45%	8.58%	5.64%	0.548
Scenario 1	8.76%	6.90%	4.23%	0.425
Scenario 2	8.83%	7.59%	4.79%	0.487
Scenario 3	9.72%	9.53%	6.89%	0.652

Source: Prepared by the author based on the data from pension funds' annual reports

The scenario analysis results of Denmark are presented next, but first the asset allocation of the combined Danish funds is discussed. Visual representation of the Danish pension funds is available on figure 13. Similarly to Finland, there have been no large changes in the funds' asset allocation. Except for in 2008 when the amount of fixed income instruments increased

from 61% to 69% of total assets. In the case of Denmark it is also noteworthy that the allocation to fixed income assets has been relatively large, ranging between 60% and 70% during the ten-year period. The allocation to various alternative asset classes has been steadily increasing on the account of fixed income. The preferred alternative asset classes are real estate with 7% and private equity with 5% allocations at year-end 2014. Two of the Danish pension funds, Industriens and Pension Danmark present their infrastructure investments as a separate asset class. Industriens began with its infrastructure investments in 2008 and Pension Danmark in 2007, both have steadily increased the allocation. The “other” segment includes various investments such as total return funds, special strategies, and simply “other”, which the pension funds have not provided any details on.

The combined returns of the Danish pension funds have been relatively stable with very small losses in 2008, which likely due to the large allocation into fixed income instruments.

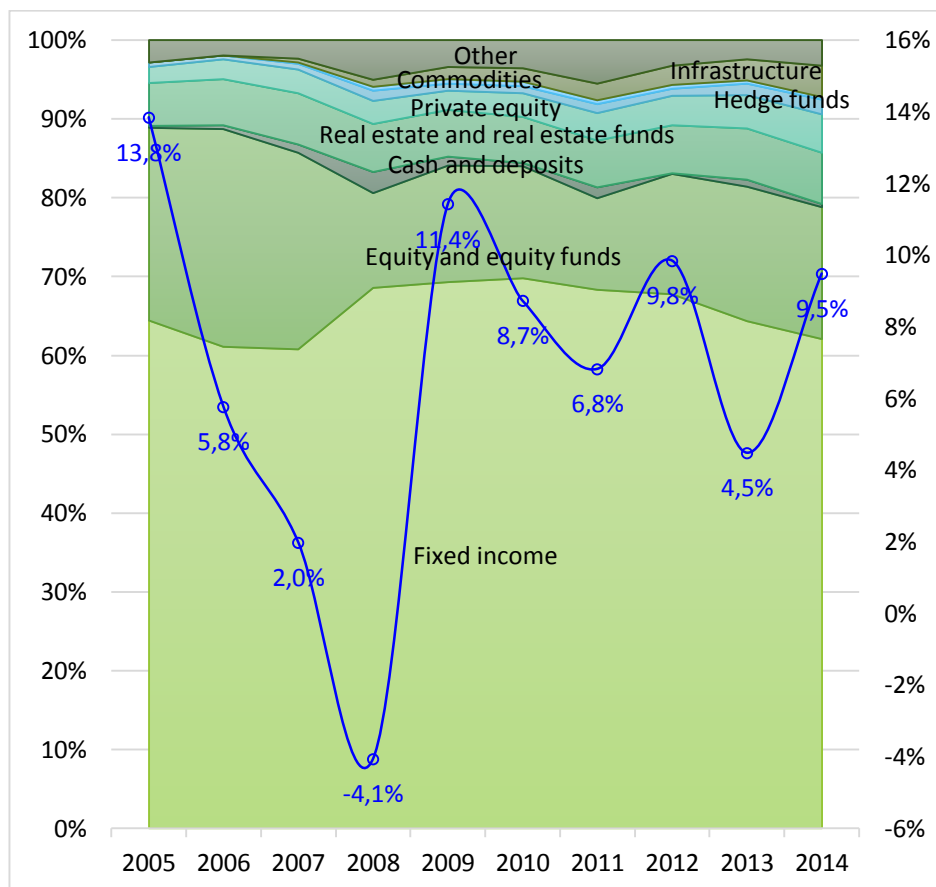


Figure 13. Denmark, pension funds' asset allocation and returns, 2005-2014  
 Source: Prepared by the author based on the data from pension funds' annual reports



Presented in table 3 are the results of the scenario analysis of the Danish pension funds. Beginning with standard deviation, the metric is slightly lower for Scenarios 1 and 2 compared to the actual result. Similarly to Finland, this is a rather logical outcome, as deposit interest rates clearly have smaller standard deviations than the alternative assets. In the case of Scenario 3, the standard deviation is higher than the funds' actual metric. This is again a logical result as the share of equities of the portfolio was increased. The equities into which the Danish pension funds invested had an average standard deviation of 22.3%. For comparison, real estate, private equity, and infrastructure had standard deviations of 11.9%, 12.1% and 3.0%, respectively.

Concerning the median and geometric mean returns, all scenarios underperformed the pension funds' actual result. In the case of Scenario 3 this is a somewhat surprising outcome, which may again be due to the high allocation into fixed income assets. The combined geometric mean returns for equities and fixed income were 8.5% and 7.1%, respectively. Private equity had a mean return of 8.7%, real estate 5.0%, while commodities had a negative return of -1.5% over the period researched. Therefore, it may be concluded that in Denmark's case allocating funds into alternative assets has paid off in terms of investment returns.

Finally, the Sharpe ratio of Scenario 2 was slightly higher than for the actual portfolio. As the standard deviation was lower, it may be assumed that the alternative assets, except for real estate, did not contribute positively to the risk-return relationship. As for Scenario 1 the Sharpe ratio was lower, if real estate was removed from the portfolio along with all other alternatives. In the case of Scenario 3, the Sharpe ratio is significantly lower than in other scenarios and also for the actual result. This is due to the fact that being fully invested into stocks and bonds did not provide higher returns and also increased the volatility of portfolio returns. Therefore, it may be concluded that the actual asset allocation of the pension funds proved to be the best option. Also, alternative investments, especially real estate, contributed positively to the pension funds' results. It may be speculated that if the allocation to alternative assets had been larger on the account of fixed income, the portfolio returns would have also been higher. However, the risk metrics would have suffered and the losses in 2008 would probably have been larger.

Table 3. Denmark, results of scenario analysis compared to actual results

<b>Scenario/metric</b>	<b>Std. dev</b>	<b>Median</b>	<b>G.mean</b>	<b>Sharpe</b>
Actual	5.88%	7.79%	6.65%	1.220
Scenario 1	5.52%	6.59%	6.04%	1.192
Scenario 2	5.58%	7.05%	6.48%	1.237
Scenario 3	6.75%	6.98%	6.08%	0.936

Source: Prepared by the author based on the data from pension funds' annual reports

Next, the asset allocation of Dutch pension funds and the results of the scenario analysis carried out on those funds. While the Finnish and Danish funds report the allocations and returns of all asset classes, some of the Dutch funds report separately only fixed income, equities, real estate and “alternatives”. In the selection there are two funds, PME and BpfBOUW that include all their private equity, hedge fund, commodity, and other investments under “alternatives”. Moreover, it is not fully specified which assets the group consists of. However, even if the data is not as comprehensive as the author would have wished, the scenario analysis could still be carried out. Figure 14 below presents the asset allocation and returns for the combined data of Dutch pension funds. As it may be seen, similarly to other countries, there have been no sudden asset composition changes, not even in 2008 – 2009. The average allocation to fixed income instruments has been 43.7% over the years and equities have been allocated 33.8% on average. Also noteworthy is the fact that the allocation to both real estate and alternative assets in general has slightly decreased in recent years. On the other hand, the portion of equities has increased from 27.5% in 2013 to 34.8% of total assets in 2014. The latter development seems reasonable as equities have been doing reasonably well over the last few years. Regarding the alternative investments of ABP and PFZW, which were presented separately, the preferred asset classes were hedge funds and private equity. For example, at year-end 2014 private equity accounted for 4.9% and hedge funds for 2.6% of the portfolio of ABP. However, while in 2013 3% of PFZW's portfolio was allocated to hedge funds, the amount had decreased to 0.2% by the end of 2014. Both ABP and PFZW have also invested approximately 2% of their assets into infrastructure as of 2014.

Regarding the investment returns, similarly to Finland, they have been rather stable, but the geometric mean return is higher by about two percentage points. As the asset allocation overall is very similar to that of the Finnish pension funds, it may be speculated that the Dutch

pension fund managers are more skilled in picking investments. However, as described in chapter 1.3, the Dutch pension funds have significantly less restrictions on how to allocate their investments. This may also play a role in achieving higher returns. On the other hand, the standard deviation of Dutch pension funds is higher than of the funds in Finland.

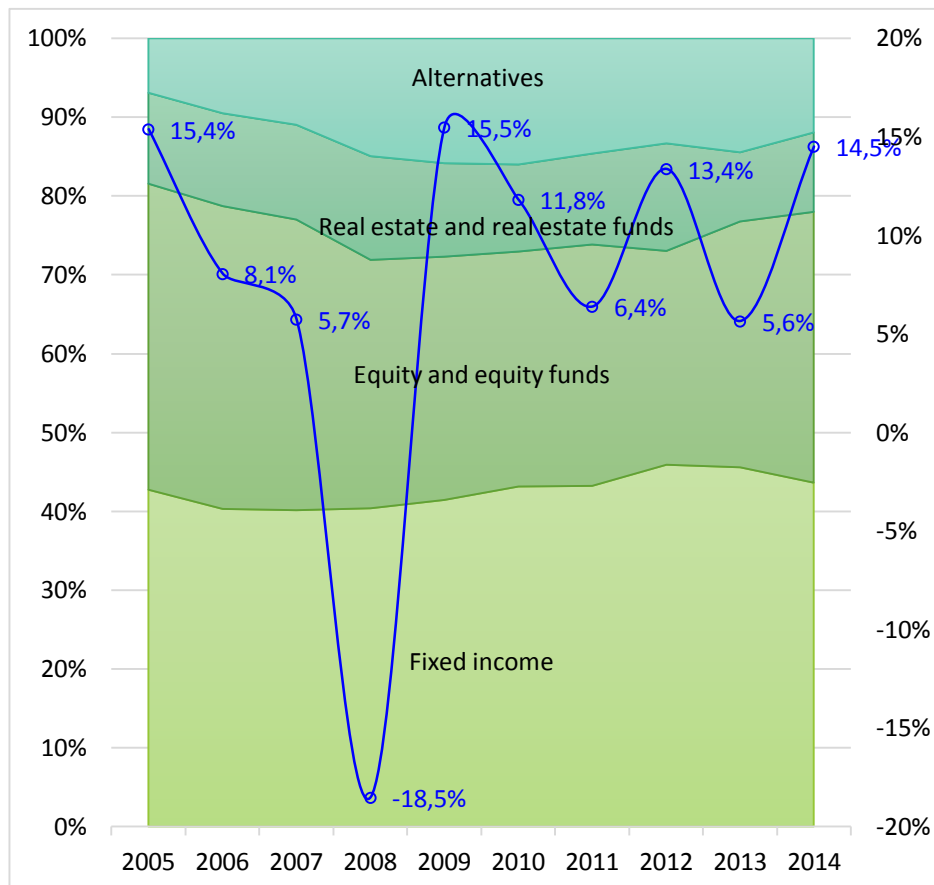


Figure 14. The Netherlands, pension funds' asset allocation and returns, 2005-2014  
Source: Prepared by the author based on the data from pension funds' annual reports

The results of the Dutch pension funds' scenario analysis are presented in table 4. Beginning with the standard deviation, naturally the metric is lower than the actual result for Scenarios 1 and 2 as deposit interest rates are less volatile than the returns of alternative assets. For Scenario 3, which presumes being fully invested into equities and fixed income instruments, the standard deviation was higher by almost one percentage point. This is likely due to the standard deviation of 20.5% for equities compared to, for example, 9.9% for real estate and 5.2% for private equity.

Regarding the median and geometric average returns, the actual results were better than those of any of the three scenarios. This is a somewhat surprising result for Scenario 3, but it

may be assumed that the strongly negative return of 2008 affected the overall geometric mean return. Concerning Scenario 2, the returns are very similar to those of the actual portfolio. This implies that real estate investments have contributed the most of the alternative assets to the portfolio return. However, overall, the results of the scenario analysis show that all alternative investments in general have enabled the Dutch pension funds to gain higher investment returns.

Finally, concerning the Sharpe ratio, it is higher for Scenarios 1 and 2. Therefore, the lower standard deviation of those scenarios has compensated for the lower returns. For Scenario 3, the Sharpe ratio is the lowest of all four options. As a conclusion, it appears that alternative assets have positively contributed to the Dutch pension funds' returns. However, better risk metrics have been sacrificed for the higher returns.

Table 4. The Netherlands, results of scenario analysis compared to actual results

<b>Scenario/metric</b>	<b>Std. dev</b>	<b>Median</b>	<b>G.mean</b>	<b>Sharpe</b>
Actual	10.28%	10.94%	7.42%	0.698
Scenario 1	8.50%	8.74%	6.58%	0.746
Scenario 2	9.27%	10.08%	7.27%	0.759
Scenario 3	11.26%	9.14%	6.84%	0.593

Source: Prepared by the author based on the data from pension funds' annual reports

Finally, the asset allocation and scenario analysis results are presented for the pension funds of Switzerland. Similarly to some of the Dutch funds, three of the Swiss pension funds report all of their alternative investments as one asset class. Such funds are Gastrosocial, Post, and MPK. However, the data still enables the scenario analysis to be carried out. Presented on Figure 15 is the combined asset allocation of the Swiss pension funds. Similarly to other countries, there have not been any large changes to the asset allocation over the ten-year period. The allocation to "alternatives", real estate and equities has been steadily increasing on the account of fixed income instruments and cash. Among the funds which provided the specific allocations to alternative assets, commodities seem to be the preferred asset class with approximately 4% allocation in both Publica and BVK as of 2014.

Regarding the returns of the Swiss pension funds, they have fluctuated less than the returns of Finnish and Dutch funds. However, the returns are also lower. This may imply a more conservative investment approach in the Swiss funds. The Swiss pension funds seem to have

an overall preference for local government and corporate bonds instead of foreign assets. Also, the allocation to real estate is slightly larger than in Finland, Denmark, and the Netherlands. However, the allocation to commodities, which tend to be more volatile than other assets, should result in the opposite.

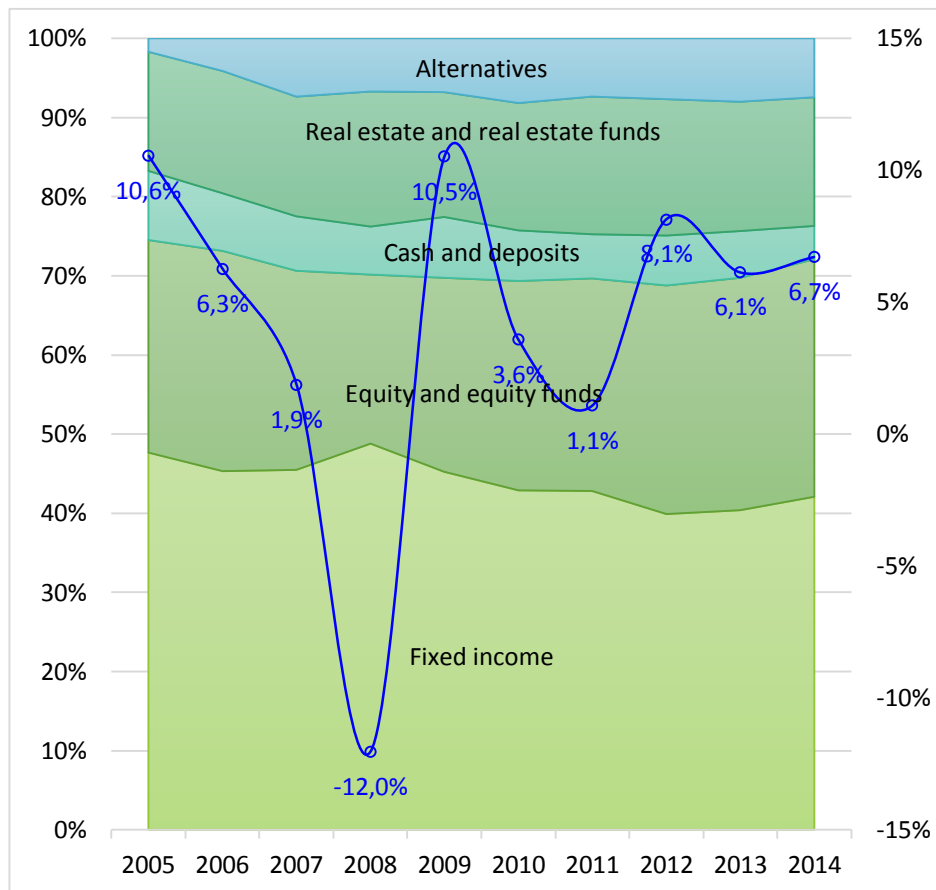


Figure 15. Switzerland, pension funds' asset allocation and returns, 2005-2014  
 Source: Prepared by the author based on the data from pension funds' annual reports

The results of the Swiss pension funds' scenario analysis are presented in table 5. As it may be seen, the results of the simulated scenarios are largely better than the funds' actual results. Starting with the standard deviation, the scenario analysis outcome is rather logical – Scenarios 1 and 2 have lower standard deviation, and Scenario 3 has a higher standard deviation.

Moving on to the median and geometric returns, only Scenario 1 underperformed the actual pension funds. This implies that all the alternative assets as a group provided higher returns for the funds. However, when separating real estate from the other alternative investments, Scenario 2 outperforms. Therefore, it may be concluded that real estate surely

affected the pension funds' return positively, however all other alternative assets contributed negatively. Results of Scenario 3 imply that being fully invested into only fixed income and equities would have provided the highest returns, but resulted in higher standard deviation. Considering this, it may turn out that the Swiss fund managers are highly skilled in choosing equity and fixed income investments, but have not performed so well in picking alternative investments.

Regarding the Sharpe ratio, it is higher for all scenarios compared to the pension funds' actual Sharpe ratio. Therefore, the low standard deviation compensated for the lower returns in Scenario 1 and the higher returns compensated for the higher standard deviation in Scenario 3. As it appears, Scenario 2 provided the best results, only by a small margin though. So, the Swiss pension funds would have achieved the best results combining only equities, fixed income, real estate, and deposits.

Table 5. Switzerland, results of scenario analysis compared to actual results

<b>Scenario/metric</b>	<b>Std. dev</b>	<b>Median</b>	<b>G.mean</b>	<b>Sharpe</b>
Actual	6.45%	6.01%	4.10%	0.671
Scenario 1	5.62%	5.16%	3.74%	0.708
Scenario 2	6.19%	6.26%	4.51%	0.760
Scenario 3	7.70%	6.63%	4.96%	0.704

Source: Prepared by the author based on the data from pension funds' annual reports

The final step of the scenario analysis process was to combine the results of all four countries. This should be taken as a general background information since the pension funds are regulated differently and also clearly have different investment strategies. Figure 16 presents the combined asset allocation of the Finnish, Danish, Dutch, and Swiss pension funds. As may be seen, the alternative asset classes amount to 23% of total pension funds' assets as of year-end 2014. The allocation to the group "Alternatives" has increased from 4% in 2005 to 12% in 2014, while the allocation to real estate has remained relatively stable. The increased allocation into alternative asset classes has taken place on the account of equities and since 2012 also on the account of fixed income investments.

The combined returns have been relatively stable over time with fluctuations in 2008-2009, which was more thoroughly explained in the previous paragraphs.

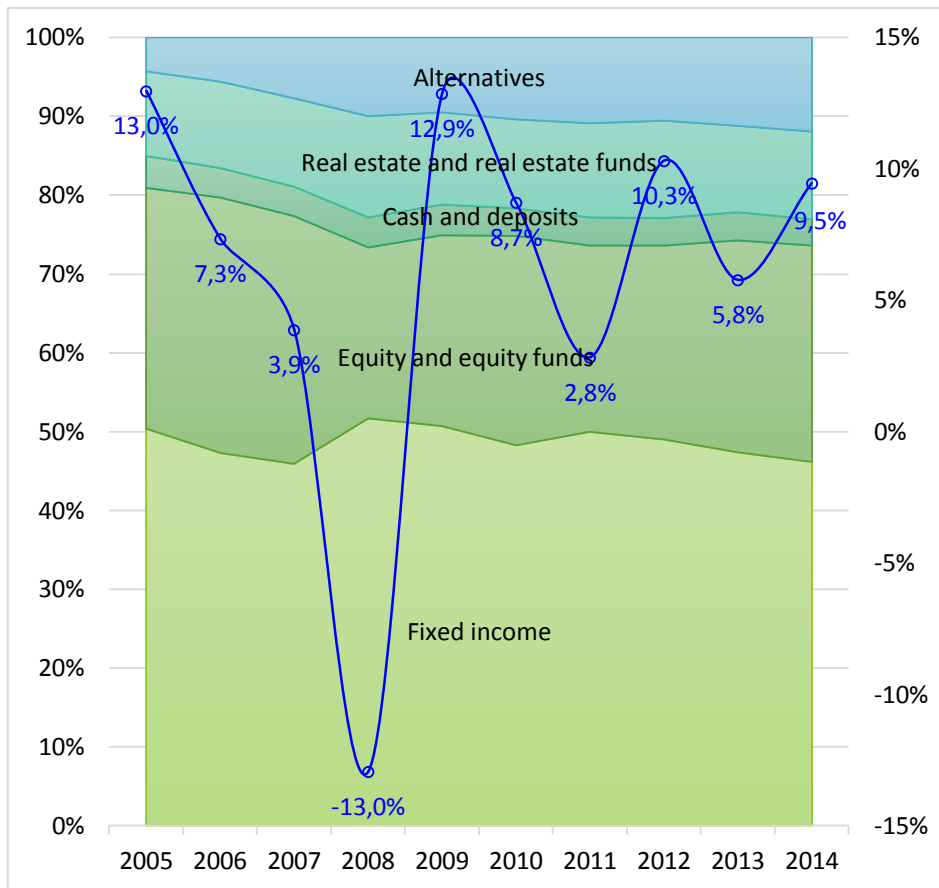


Figure 16. Finnish, Danish, Dutch, and Swiss pension funds' asset allocation and returns, 2005-2014

Source: Prepared by the author based on the data from pension funds' annual reports

The combined risk and return metrics are presented in table 6 below. Regarding standard deviation, only Scenario 1 has a lower standard deviation than the pension funds' actual result. Which, again, is natural as deposit interest rates are less volatile than alternative investments. Concerning the median return and the geometric mean return, only Scenario 3 has higher returns than the actual pension funds. However, the Scenario 3 returns are only slightly higher, while the standard deviation is higher by 1.34 percentage points. Therefore, being fully invested into equities and bonds, increases risk more than returns. This is also reflected in the Sharpe ratio, which is lower for Scenario 3 than for the pension funds in reality. The only scenario with a higher Sharpe ratio is Scenario 2. This may imply that real estate investments contribute positively for both risk and return.

Table 6. Switzerland, results of scenario analysis compared to actual results

<b>Scenario/metric</b>	<b>Std. dev</b>	<b>Median</b>	<b>G.mean</b>	<b>Sharpe</b>
Actual	7.52%	8.03%	5.85%	0.784
Scenario 1	7.09%	6.85%	5.14%	0.767
Scenario 2	7.47%	7.75%	5.76%	0.811
Scenario 3	8.86%	8.06%	6.19%	0.721

Source: Prepared by the author based on the data from pension funds' annual reports

Overall, considering all of the scenario analyses of each country, there were some mixed results. In some cases, the funds would have been better off investing only into fixed income and equities, while in other cases investing into alternative assets improved both risk and return metrics. The diversification abilities of various asset classes are also considered important in the context of portfolio management. Therefore, the following chapter presents the results of the correlation analysis carried out on the asset class benchmark level.

### **3.1.2. Results of the correlation analysis**

As described in chapter 2.3, the correlation analysis was carried out with benchmarks representing the asset classes over three time periods: 2005-2014, 2005-2009, and 2010-2014. Following is a description of the main points from the correlation analysis results.

First, the correlations between the seven asset classes were found for the whole time period researched in the master's thesis. Regarding the asset classes considered traditional – equities and fixed income – the correlation between the two was 0.662 over the ten-year period. As this is not perfect correlation of 1, adding these two asset classes to a pension fund's portfolio will offer diversification benefits.

Concerning equities, the only asset class with a correlation to equities below 0.3 was somewhat surprisingly hedge funds. As it was explained previously, a correlation below 0.3 is considered attractive for portfolio diversification. All of the other asset classes had correlations to equities higher than 0.3, but lower than 0.9. The highest of those was 0.817 for private equity. Still, this means that all of the alternative investments would provide diversification to a portfolio of equities.



Considering fixed income investments, there were two asset classes correlated to fixed income with a coefficient less than 0.3: hedge funds with 0.07 and infrastructure with 0.205. In general, fixed income has lower correlation to alternative asset classes than do equities. As it may be seen in table 7, all of the correlations are below 0.5.

Other more significant takeaways from the ten-year correlation analysis would be that the hedge fund benchmark had a correlation below 0.3 to all of the other asset classes. Private equity, on the other hand is relatively highly correlated to all other investments, except for commodities and fixed income. Real estate is attractively little correlated to only hedge funds and commodities, and infrastructure to fixed income, hedge funds, and commodities. It is also worth pointing out that the commodities and hedge fund benchmarks had a negative correlation of -0.084 over the ten years researched. Table 7 below presents the correlation matrix for 2005 to 2014.

Table 7. Correlation coefficients of the bench mark returns, 2005-2014

Asset Class	Equities	Fixed income	Real estate	Private equity	Hedge funds	Commodities	Infrastructure
Equities	1						
Fixed income	0.662	1					
Real estate	0.716	0.487	1				
Private equity	0.817	0.426	0.798	1			
Hedge funds	0.108	0.007	0.218	0.101	1		
Commodities	0.565	0.452	0.265	0.401	-0.084	1	
Infrastructure	0.555	0.205	0.575	0.651	0.161	0.132	1

Source: Author's calculations based on data from Bloomberg Terminal

Moving on to the five-year period of 2005-2009, equities and fixed income have a correlation of 0.660, which is just slightly less than for the ten-year period. Once again, equities

have relatively high correlations with all of the alternative asset classes, especially with private equity (0.854). However, the correlation to hedge funds is again low at 0.192.

Fixed income is less correlated to all of the alternative asset classes, most notably to hedge funds with 0.070 and infrastructure with 0.275. Among the highest correlated assets are private equity with both real estate and infrastructure, 0.822 and 0.738, respectively. Again, hedge funds and commodities are negatively correlated at -0.084. Table 8 presents the correlation matrix for the period of 2005 to 2009.

Table 8. Correlation coefficients of the benchmark returns, 2005-2009

Asset Class	Equities	Fixed income	Real estate	Private equity	Hedge funds	Commodities	Infrastructure
Equities	1						
Fixed income	0.660	1					
Real estate	0.699	0.406	1				
Private equity	0.854	0.408	0.822	1			
Hedge funds	0.192	0.070	0.317	0.163	1		
Commodities	0.517	0.443	0.247	0.407	-0.084	1	
Infrastructure	0.695	0.275	0.610	0.738	0.178	0.238	1

Source: Author's calculations based on data from Bloomberg Terminal

Finally, concerning the time period 2010-2014, the correlation coefficient between equities and fixed income is higher by 0.013, which means that the co-movement of these two asset classes has risen since the financial crisis. However, they still provide diversification possibilities.

The correlation of equities with real estate and commodities has increased, but on the other hand, the coefficients are lower for private equity and infrastructure. Most notably, during the latest five-year period the correlation between equities and hedge funds has been negative. Hedge funds have had negative correlation to all of the other asset classes, except for

infrastructure. Considering that this period has seen strongly rising markets, it may imply that hedge funds have not been able to take advantage of that trend. In this case, the negative correlations have enabled portfolio diversifying, but likely have not contributed much to increasing profits.

When it comes to fixed income correlations with other asset classes, the coefficients compared to 2005-2009 are higher for real estate, private equity, and commodities. Similarly to equities, infrastructure and hedge funds have been recently less correlated to the fixed income markets. Results for the 2010-2014 correlation analysis are presented in Table 9 below.

Table 9. Correlation coefficients of the benchmark returns, 2010-2014

Asset Class	Equities	Fixed income	Real estate	Private equity	Hedge funds	Commodities	Infrastructure
Equities	1						
Fixed income	0.673	1					
Real estate	0.759	0.706	1				
Private equity	0.791	0.490	0.722	1			
Hedge funds	-0.068	-0.159	-0.049	-0.111	1		
Commodities	0.684	0.484	0.357	0.446	-0.094	1	
Infrastructure	0.304	0.090	0.416	0.366	0.045	0.000	1

Source: Author's calculations based on data from Bloomberg Terminal

After reviewing the correlation analyses results for the three time periods, it may be concluded that all of the alternative asset classes researched provide diversification possibilities. However, the private equity benchmark has a somewhat surprisingly high correlation to equities. To research this further, for example, an econometric model with time lags could be constructed. This should enable capturing the delay concerning private equity asset valuations. Relying only on the correlation coefficients, it seems that hedge funds would enable the highest diversification. However, as it was already mentioned, it may not always be

profitable. In general, infrastructure and commodities also have some of the lowest correlations to other asset classes, notably private equity, fixed income, and real estate. Private equity, quite naturally, has high correlation to listed equities and therefore caution should be used when combining private equity to a portfolio with an already high allocation to equities. As the correlation of real estate with equities and bonds has increased over the last five years (by 0.061 and 0.301, respectively), care should be taken in allocating funds into this asset class.

Although it is likely that pension fund managers turn some attention to the correlations between asset classes, they also have other considerations in mind when allocation their clients' assets. Therefore, interviews were conducted with Estonian pension fund managers to gain some insight into their views on alternative asset classes.

### **3.1.3. Summary of the interviews**

In order to gain perspective on why and how pension fund managers have invested into alternative assets, interviews with four Estonian pension funds were carried out. As mentioned in chapter 2.3, with respect to the fund managers' privacy wishes, the asset management companies' nor the interviewees' names will be published. Altogether nine questions were presented to the interviewees and following is a summary of their responses. The interview questions and transcripts are available in appendices 1 to 5.

Beginning with more general topics, the fund managers were asked about their techniques in allocating the funds' assets among the asset classes. Mentioned by Fund managers B and C, the regulatory aspects should be considered first, as there are limits set for asset allocation. All of the fund managers said they follow macroeconomic trends, and also monetary politics, and capital movements. Three of the interviewees said they use portfolio optimisation techniques, such as the Black-Littermann mean-variance optimisation and modified Markowitz optimisation with real return distributions, for allocating funds among asset classes. The modelled portfolios are tested in a risk system and evaluated qualitatively. It was also mentioned that the portfolio might significantly differ from the strategic asset allocation due to the situation in financial markets, availability of the desired assets, home bias, and the investment team's specific skills. Fund manager D emphasized cognitive risk regarding both price levels and leverage. In case the risk seems high, the fund manager allocates a larger share of the portfolio into low-risk assets, regardless of the return offered by riskier assets.

Regarding risk management, the fund managers said that there are internal limits set on allocation to various asset classes, which need to insure that the portfolios are managed according to the long-term investment policy. Also, sufficient diversification needs to be provided. Fund manager C mentioned that the risk management process is continuous, as the fund manager's task is to alter the portfolio composition according to the changes in the markets and macroeconomics. The criteria set for each individual investment is also part of the risk management process. The quantitative risk management methods in several of the pension funds include tracking error, volatility, duration, Value at Risk, and expected shortfall. The portfolios in Pension fund C are also stress tested in the context of asset classes. It was mentioned by Fund manager D, that in his opinion, some of the historical risk metrics have lost their reliability due to the fact that the markets are largely dependent on national central bank policy.

Moving on to alternative investments, the fund managers were asked, which asset classes they consider as "alternative" in the first place. Fund manager A considers as alternative all those assets that are not liquid, do not have a specific market price, or that use alternative investment strategies in liquid markets. These include hedge funds, commodity funds, private equity, and real estate. Fund manager B similarly pointed out that alternative assets in his view are not regularly traded and therefore may have a liquidity premium: private equity funds, real estate fund, and timber funds. Fund manager C does not consider real estate and private equity necessarily as alternative investments, but rather as separate asset classes. As "alternative" he pointed out hedge funds, commodity funds, and all other funds that use strategies besides long-only investment. Fund manager D considers real estate, private equity, and timber as alternative investments. None of the fund managers, however, pointed out infrastructure as an alternative investment.

The fourth question presented concerned the fund managers' overall view of alternative assets. Fund manager D pointed out that as there is less investment capital in alternative assets, they might be priced more reasonably than traditional assets. However, some illiquid assets may have larger price swings. Fund manager B considers the liquidity premium as a must-have when making alternative investments. He also mentioned that currently, in order to participate in the economic development of Estonia/the Baltics, alternative assets may essentially be the only possibility. In Fund manager A's opinion, all alternative investments provide portfolio diversification, but much depends on the investment team covering the various asset class

investments. Fund manager C is sceptical regarding hedge funds, but finds that real estate should surely be a part of the pension fund's long-term asset allocation strategy.

As it was described in chapter 1.4, illiquidity may pose somewhat of a problem when investing into alternative asset classes. However, all of the fund managers interviewed state that they are not too concerned with the liquidity problems due to the fact that pension funds have very long investment horizons. Of course, as pension funds still have some liquidity needs, the allocation to alternatives should remain at a reasonable level and also provide a liquidity premium.

The sixth question asked the fund managers to provide some insight into how they have pre-planned their funds' allocation into alternative asset classes. Three of the managers said that the allocations were carefully planned, as the investment is generally long-term and illiquid. Regarding private equity, Fund manager C explained that prior to investing, there was research carried out on private equity funds as an asset class in different market situations to find the general expected return on the asset class. In addition there was analysis on various private equity fund structures, asset evaluations, etc. Fund manager D mentioned that there have been occasions when he has not had the appropriate instrument to carry out the investment ideas. Contradicting to the others, Fund manager B said the pension funds' allocation to alternative assets has been rather incidental and has happened over a longer period of time. In his opinion, over time, the traditional asset markets in Eastern-European countries reflect less of the region's economic development and therefore some of the traditional investments have been replaced with alternatives in the same region.

Concerning the regions, into which the pension funds allocate their alternative investments, the fund managers were asked whether they prefer local or foreign markets. All of the fund managers said they prefer local investments (the Baltics) regarding real estate and private equity. Some of the reasons for this preference:

- The local markets are still developing and may provide more opportunities;
- Better knowledge of the environment;
- Possibility to negotiate the terms of investments;
- The liquidity premium seems to be among the highest;
- Better access to the information regarding the background and reliability of the alternative asset fund managers.

As the downside of local investments, the small size and limited investment opportunities were pointed out. Regarding hedge funds and commodity funds, Fund manager A mentioned that the know-how is surely in foreign countries and therefore these investments in the pension fund are exclusively foreign.

Finally the fund managers were asked about their plans regarding the allocation to alternative assets for the future. Fund manager D said that he is looking to increase the pension fund's allocation into real estate and private equity, and also make direct investments into unlisted companies. Fund manager C may increase allocation into private equity in the future, but Fund manager B pointed out that the availability of funds with a reliable team and a reasonable strategy, structure, and fees are scarce in the Baltics. Fund manager A has no plans to change the current allocation to alternative assets.

In conclusion, considering the fund managers' explanations above, there are several key takeaways from the interviews. First, similarly to what the author noticed while researching the pension funds in Finland, Denmark, the Netherlands, and Switzerland, the pension fund managers in Estonia strongly prefer making investments into local real estate and private equity. Secondly, the relative illiquidity of alternative asset classes is not considered a major issue as long as there is a premium for the lack of liquidity. Third, alternative investments, such as private equity and real estate, enable participating in the local economic development better than the traditional investments into stocks and bonds. On the more general topics of asset allocation and risk management, all of the fund managers follow macroeconomic trends and in addition to various quantitative methods use their judgement of the risk and returns offered.

The description of the pension systems in the countries researched, including Estonia, was provided in chapter 1.2, followed by the introduction of four Estonian pension funds in chapter 2.1. Therefore, at this time, the author deems appropriate to dedicate a chapter to comparing Estonian pension funds to their international peers.

### **3.2. Comparison to Estonian pension funds**

The OECD considers all countries with pension assets below 20% of GDP as not yet mature pension fund markets, as explained in chapter 1.1. As of year-end 2013, Estonian pension funds' assets amounted to 9.6% of GDP. Thus, the author believes the Estonian pension industry has much to learn from the older and more mature pension fund markets of Finland,

Denmark, the Netherlands, and Switzerland. Following is a comparison of the asset allocation and risk-return measures of Estonian pension funds to the countries mentioned previously.

Beginning with asset allocation, presented on figure 17, the Estonian pension funds clearly have a larger allocation to cash and deposits compared to the other countries. On the other hand, allocation to alternative investments is significantly smaller, but has increased from 1.5% in 2005 to 6.9% of total assets in 2014. The largest investments regarding alternative asset classes are made into real estate – 4.9% as of 2014. There is no amount allocated into hedge funds and commodities. The small portion invested into alternative assets may be due to the relative youth of the Estonian pension system and also the alternative assets market. As described in chapter 2.3, the pension fund managers find the local alternatives market very small. It was also pointed out by one fund manager, that the availability of alternative investment funds with a reliable team and reasonable strategy, structure, and fees is scarce in the Baltics. Considering this, the author expects that as both the local pension fund and alternative asset markets mature, the pension funds will allocate more of their clients' assets into alternative investments.



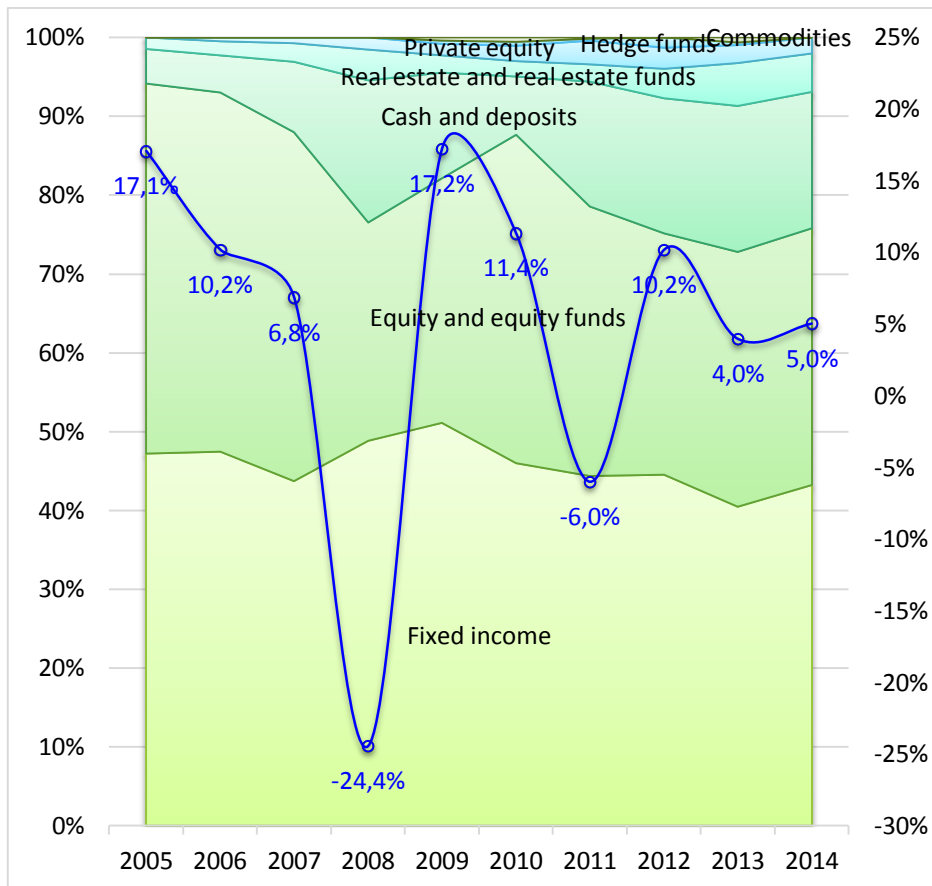


Figure 17. Estonia, pension funds' asset allocation and returns, 2005-2014  
 Source: Prepared by the author based on the data from pension funds' annual reports

Regarding the investment returns of Estonian pension funds, they have fluctuated more than the returns of the foreign peers researched. None of the countries with mature pension fund markets had such a large loss in 2008 nor did three of them make any loss in 2011. Even though in the case of some individual pension funds, the losses reached 20% in 2008, none were as large as for Estonian funds combined. Interestingly, the only funds making losses in 2011 were all the funds from Finland and only BVK from Switzerland. Estonian funds' allocation into equities has been similar to other countries, except for Denmark. Therefore, considering the high allocation to cash (which likely actually increased during the year, not in the beginning of 2008 and 2011), it could be assumed that the Estonian pension funds made riskier equity investments. Also, the funds likely did not benefit from asset class diversification as there was very little invested into alternative assets. Figure 18 below presents the cumulative returns of the pension funds with 2004 set at 100%. As it may be seen, the Dutch funds have increased their clients' assets by 177.9% over the ten-year period, followed by the Danish funds with 168.3%. The pension funds in Finland and Estonia have reached similar cumulative ten-year

returns of 155.5% and 151.4%, respectively. It is noteworthy that until 2007, Estonian funds had the best performance, but in 2008 also suffered the largest losses. By 2011 Estonian funds were again on par with those of Denmark and the Netherlands, but have not recovered since then. Somewhat surprisingly, the Swiss pension funds have had the lowest cumulative return.

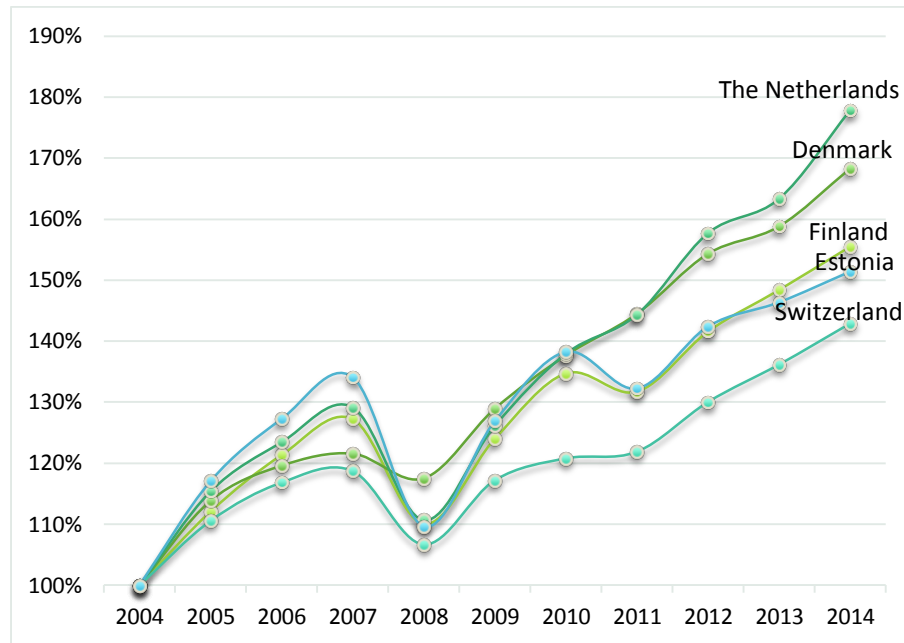


Figure 18. Cumulative returns of pension funds, 2005-2014  
 Source: Prepared by the author based on the data from pension funds' annual reports

Lastly, the risk and return metrics of Estonian pension funds and foreign peers are compared. Table 10 below presents the standard deviation, median return, geometric mean return, and the Sharpe ratio for the combined Estonian pension funds. For easier comparison, the same metrics are again provided for other countries. As it may be seen, Estonian funds have the highest standard deviation of 11.9%, followed by the Netherlands with 10.3%. However, both the median and geometric mean returns are lower for Estonia, which explains why the cumulative return described above is significantly smaller for Estonia. Also, Estonian Sharpe ratio is the lowest, which implies that the risks taken were not compensated by higher returns. Comparing Estonian risk-return metrics to those of Finland, the results are similar. However, Denmark, with its large allocation to fixed income, has performed better than Estonia when it comes to standard deviation, geometric mean return, and the Sharpe ratio.

Table 10. Standard deviation, median return, geometric mean return, and Sharpe ratio

<b>Country/metric</b>	<b>Std. dev</b>	<b>Median</b>	<b>G.mean</b>	<b>Sharpe</b>
Estonia	11.88%	10.17%	4.98%	0.387
Finland	9.45%	8.58%	5.64%	0.548
Denmark	5.88%	7.79%	6.65%	1.220
Netherlands	10.28%	10.94%	7.42%	0.698
Switzerland	6.45%	6.01%	4.10%	0.671

Source: Prepared by the author based on the data from pension funds' annual reports

Considering the points made in the paragraphs above, there are several conclusions to be made regarding Estonian pension funds compared to the mature pension fund markets. First, the Estonian pension fund asset allocation regarding equities and fixed income is similar to that of Finland, the Netherlands, and Switzerland. However, there is very little invested into alternative asset classes. Moreover, largely the amount that the other countries have allocated into alternative investments, Estonian funds are keeping on deposits. Secondly, as the returns of the combined Estonian pension funds have fluctuated more and have a higher standard deviation, it may be assumed that Estonian funds have made riskier investments. However, considering the lower returns compared to Finland, Denmark, and the Netherlands, the risks taken have not paid off. Third, it is likely that Estonian pension funds have not taken advantage of the asset class diversification benefits as much as the other countries. This may again explain the higher volatility and lower returns.

The final chapter makes conclusions on the findings described in previous chapters. However, as the analysis in the master's thesis is carried out on historical data, the findings may not prove applicable in the future.

## CONCLUSION

As the importance of private pension funds in Europe is increasing, the pension fund managers are looking for various ways to meet their return targets at a reasonable risk level. This includes diversifying among both traditional and alternative asset classes. The objective of the master's thesis was to find out in what way have investments into alternative asset classes affected the return and risk of selected European pension funds. The objective was achieved through both qualitative and quantitative analysis methods. These included researching European demographics and pension markets; describing the pension systems in Finland, Denmark, the Netherlands, and Switzerland; introducing various alternative asset classes; conducting scenario- and correlation analysis, and interviewing Estonian pension fund managers.

One of the key findings regarding asset allocation was that the changes in pension funds' asset allocations have been a steady process over the ten years researched. The general theme is that the amount invested into alternative assets has slowly increased year-over-year on the account of the traditional assets. Also, in all of the countries researched, the most popular alternative investment was real estate, followed by private equity. Only the Danish pension funds categorised their investments into infrastructure as a separate asset class. The Dutch funds also mentioned their infrastructure investments, but categorised them under real estate or "other". Also, it is noteworthy that none of the foreign pension funds consider real estate as an alternative investment.

The results of the scenario analysis presented somewhat mixed outcomes. Scenario 1 consisted of removing all alternative assets from the portfolio and replacing the amount with a deposit. Scenario 2 removed all alternative assets, except real estate. Scenario 3 once again removed all alternative investments, but instead of depositing the amount, the portfolio was fully invested into equities and fixed income instruments. For each scenario the standard deviation, median return, geometric mean return, and the Sharpe ratio were calculated in order to allow comparisons to the funds' actual results. Overall, standard deviation metrics were lower for Scenarios 1 and 2 compared to the pension funds' actual results. This is a quite natural outcome as deposit interest rates are less volatile than the returns of various alternative assets.

Scenario 3, however, generally resulted in significantly higher standard deviation metrics than for the actual portfolio, as equities are more volatile than, for example, real estate and private equity. The scenario analysis proved that overall, the alternative investments as a group have positively contributed to the pension funds' investment returns. Both the funds' actual median and geometric mean return were higher than for Scenarios 1 and 2. Regarding Scenario 3, both the median and geometric mean return were slightly higher than for the actual pension funds. This means that having taken on more risk (measured by standard deviation) and been fully invested into equities and fixed income, the pension funds would have earned higher returns. However, they would have missed out on diversification benefits, as explained later. The Sharpe ratio provided slightly mixed results, but was overall very informative. In the case of Scenario 1, the lower standard deviation did not compensate for the lower returns, but taking on more risk in Scenario 3 resulted in a lower Sharpe ratio as the higher returns did not compensate for the additional risk. Interestingly, Scenario 2 provided the highest Sharpe ratio. This means that the pension funds would be able to achieve the best risk-return relationship when allocating their investments into equities, fixed income, cash and real estate.

Regarding the results of the correlation analysis, it was quite clear that all alternative asset classes provide diversification benefits when combined with traditional assets. However, the private equity benchmark had a remarkably high correlation to equities. This, in essence, is not a surprise as both public and private companies benefit from economic growth periods and suffer from recessions. To research this matter further, an econometric model with time lags could be constructed, which captures the delay in private equity asset valuations. Private equity valuations are carried out quarterly and reported one quarter later, which creates approximately a six-month time lag. Hedge funds, on the other hand, had very low or even negative correlations to other assets and would enable high diversification. However, as the markets have been rising for the last several years, the low correlation of hedge funds means that largely they have not been able to reap the benefits of the asset price increases. In general, infrastructure and commodities also have some of the lowest correlations to other asset classes.

There are several key takeaways from the interviews conducted with Estonian pension fund managers. First, the fund managers strongly prefer making investments into local real estate and private equity, which is a similar approach to the foreign funds researched. This home-bias is explained by information asymmetry – local fund managers and companies are known better. Secondly, the relative illiquidity of alternative asset classes is not a major issue

to the fund managers as pension funds have a very long investment perspective. On the other hand, a premium needs to compensate for the lack of liquidity. Finally, the pension fund managers pointed out that investing into local alternative assets enables participating in the local economic development better than the listed assets.

Finally the asset allocation, and risk and return metrics of the pension funds operating in more mature markets were compared to Estonian pension fund results. The Estonian pension fund asset allocation is similar to others regarding equities and fixed income. However, the local funds are keeping a considerably larger amount on deposits and have invested very little into alternative asset classes. Actually, what the foreign funds have allocated to alternative assets, the Estonian funds are mostly depositing. Moreover, it is worth pointing out that the investment returns of Estonian pension funds have fluctuated more and have a higher standard deviation compared to the others. This may implicate that Estonian pension fund managers have made riskier investments into equities and bonds. However, as the ten-year cumulative return is lower than for Finland, Denmark, and the Netherlands, this means that the risks taken have not paid off. It also seems that Estonian pension funds have not taken advantage of asset class diversification, which may again explain the higher volatility and lower returns.

Considering the findings above, the author suggests that Estonian pension fund managers look further into various alternative asset classes. However, there is a large barrier on the way of increasing investments into local real estate and private equity – the Baltic alternative assets market is still very young and small. Therefore, as both the Estonian pension market and alternative investments market mature, the author expects the pension fund managers to allocate more capital into non-traditional asset classes. The research conducted in this master's thesis presents quite clearly that alternative investments may decrease risk, improve returns, and provide diversification opportunities.

However, the research carried out is surely not yet comprehensive enough to draw firm conclusions. The limitations include the number of scenarios simulated and also the low number of countries researched (countries where data was available). However, the author believes that the five largest funds from each country provide an overall picture of the whole pension fund market in that country. Further research should include more scenarios focused on separating the various alternative investments within the asset class (private equity, hedge funds, etc.) instead of treating them as one. Also, the scenarios could increase the allocation into alternative assets on the account of fixed income and equities. It would be interesting to research more

European countries and perhaps even other developed and emerging markets. Of course, this depends largely on data availability, which in the case of alternative assets tends to be scarce. Overall, the author finds that the master's thesis developed a practical approach for researching the effect of alternative assets on pension funds' risk and return metrics. Furthermore, many interesting aspects regarding these investments were found, which may prove useful for Estonian pension fund managers.

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## **APPENDICES**

### **Appendix 1. Interview questions provided to pension funds**

1. How do you form the funds' asset allocation regarding various asset classes? Which methods do you use?
2. How do you perform risk management in the context of asset classes and which metrics do you use for measuring risk?
3. Which asset classes do you consider as alternative?
4. What is your overall stand towards the mentioned asset classes? Do you find that they enable portfolio diversification, offer higher returns, decrease risk, etc.?
5. Do you consider the illiquidity of some alternative asset classes as a problem? Why?
6. Is the funds' allocation to alternative investments rather incidental or planned? Please explain.
7. When choosing alternative investments, do you prefer local or foreign investments? Why?
8. Are you planning to change the allocation to alternative asset classes in the future? Why and in which way?
9. Other comments, observations regarding alternative investments?

## **Appendix 2. Interview transcript, Pension fund A**

1. Simply put, the bases of allocation are global macroeconomic trends (economic growth, inflation) and monetary policy prognoses, which form the view on the prospects of different asset classes. Based on these views we compose the expected return, risk and correlations for the asset classes, and solve a portfolio optimisation exercise to gain the asset class portfolios. In addition we compare the obtained asset class parameter values to the values priced in at the market in order to evaluate the asset class attractiveness by itself. We test the obtained portfolios in a risk system and also evaluate them qualitatively.
2. In risk management context, there are limits set for asset class portfolios. These limits need to ensure that the portfolios are managed according to the long term investment policy, that there is sufficient diversification, and that the limits have enabled enough opportunities for tactical management of the portfolios. For risk measuring we use volatility, VaR, and duration. We also stress-test the portfolios in the context of asset classes and take into account liquidity risks.
3. As alternative asset classes we consider hedge funds, commodity funds, private equity, real estate – in general everything illiquid or without a specific market price, or that use alternative investment strategies in liquid markets.
4. More or less all asset classes help with portfolio diversification, although much is up to the team managing the investments of the asset class. A good asset class is like a good car, which is of no use at a race if the driver has no skills. We consider achieving a higher return for the fund portfolio possible mainly via private equity investments, hedge funds mainly reduce risks.
5. Generally I do not consider it as a problem if the asset class's illiquidity is compensated with an according liquidity premium. However, the portfolios specific liquidity needs set allocation limits to asset classes with little liquidity; for example the possible selling or exchanging of shares by the fund's shareholders during the long-term period of holding that asset class. Therefore, in order to be represented in the portfolio, the liquidity risks need to be compensated by an appropriate premium, at the same time illiquid assets have an allocation limit.
6. The allocation is planned carefully since in general the assets are illiquid and are acquired for long-term placement. The Global Financial Crisis was an example of how the worst

scenario may risk the pension fund's liquidity or operations even if the allocation to an alternative asset class is relatively modest. In the worst-case scenario an allocation of 10% into illiquid assets may be fatal for a pension fund and also to the fund management company's market share. This may not be caused by the illiquid assets as an unsuccessful investment, but rather by the liquidity- and valuation problems caused by the worst-case scenario.

7. The know-how regarding hedge funds and commodity funds is outside of Estonia and thus these are exclusively foreign. In the cases of private equity and real estate the proximity to the team and local situation is slightly more important, which is why we rather consider local opportunities. On the other hand, the local market is smaller and the amount of investment opportunities is very limited, which forces us to consider foreign options as well.
8. In the big picture do not plan to change the allocation.
9. In general, theory overrates the risk diversification effects of alternative asset classes, such as real estate and private equity. One is inclined to evaluate the effect of price volatility regarding other assets mainly in a normal market. Unfortunately private equity and real estate are accompanied by the so-called stale pricing and the changes in market situation arrive delayed by the independent appraisers, or may not arrive at all if the recession turns out to be short. This does not mean that the assets are untouched by what is happening in the financial markets. Therefore, we do not particularly take into account the risk diversification effect. Rather while planning the investment, we suppose that illiquid assets need to offer a liquidity premium compared to liquid assets and also the sensitivity to market changes (beta) is high. The latter because these asset classes are characterised by financial leverage and also their secondary market is sensitive regarding the situation in financial markets.

### **Appendix 3. Interview transcript, Pension fund B**

1. The primary limits come from regulation, where the funds have been given maximum limits for equity risk, credit risk, etc. Within these limits we have historically used the Black-Littermann optimisation (mean variance optimisation) as well as various modifications of growth and growth/price (valuation) models.
2. We view risk: a) on the fund portfolio level through the tracking error limit; b) based on asset classes through the max and min asset class allocation limits.
3. All that is not regularly (daily/weekly) traded and which return might therefore have additional liquidity premium. Practically, as of today, these are the following asset classes: private equity funds, real estate funds, timber funds. We have not looked at hedge funds and commodities (the latter are not enabled by the legislation).
4. Since we try to be guided foremost by the existence of liquidity premium, these asset classes are meant for increasing return. Of secondary importance is the aspect that as of today these are essentially only asset classes that enable participating in the Estonian/Baltic economic development.
5. On the contrary. If the illiquidity is accompanied by a liquidity premium, then this is exactly what we are looking for in those asset classes.
6. Rather incidental. Over time we have, on the account of these asset classes, decreased investments into liquid Baltic and Central- and Eastern-European instruments. In our opinion the liquid markets of these regions have started reflecting the economic development less and less. Therefore we prefer the so-called alternative investments in these regions, which benefit widely from the economic development.
7. Currently our first preference is definitely the Baltics, because: (i) the liquidity premium here seems to be among the best (of course it was the other way around during the boom); and (ii) information on the investment funds/team backgrounds/ reliability is easier to obtain. If it happens that cyclically reason (i) disappears (looking at the recent transactions with commercial real estate and unlisted shares, it seems to constantly decrease at the moment), then surely our interest in the Baltics will decrease.
8. As long as we focus mainly on the Baltics regarding alternative investments, a lot depends on investing possibilities on this market. Funds with a reasonable strategy, structure, and costs are unfortunately limited in the Baltics.



## Appendix 4. Interview transcript, Pension fund C

1. /---/ funds SAA (strategic asset allocation) is designed based on the fund's investment limits and the long-term return expectations of various asset classes (modified Markowitz optimization with real return distributions). SAA, however, is not a quantitative process: SAA has developed based on many other factors (home bias, team specifics, actual situation in the markets, availability of instruments, etc.). In /---/ case the SAA defines the neutral allocations of major asset classes (for example in the case of a 50-50 fund the neutral allocation to equities is 45%), margins for going over- and underweight of those, as well as the instrument classes, -types and analysis principles for fulfilling them. The actual portfolio may differ quite radically from the SAA portfolio, at least in the case of some asset classes (currently for example government bonds, money market instruments), while regarding other assets classes affecting the fund's risk level the most (primarily assets with equity risk), a significant departing from the SAA allocation requires a more thorough process.
2. The total risk of the portfolio is measured with a VaR/ES model. Risk management actually takes place daily, as the fund managers' task is to alter the portfolio composition accordingly to the market and macroeconomic developments. Also, analysis criteria applied to single instruments is part of risk management.
3. Hedge funds, CTAs, all kinds of funds that are not traditional long-only investments. We do not consider real estate and traditional private equity as alternative asset classes, these are separate asset classes for us.
4. I am very sceptical about hedge funds. Real estate should definitely be a long-term allocation in the pension fund. PE is more complicated, there is no single answer here.
5. For a pension fund illiquidity itself is not a problem if the allocation into this kind of assets is kept at a reasonable level.
6. If we are talking about PE, then there was about a year of pre-planning, where we investigated in more detail how PE funds as an asset class behaves in different market situations, and what would be the asset class's general return expectation. In addition, analyses on different structures, fund evaluation, etc. I would also point out that we invested into PE via the /---/ fund and the participation of /---/ and /---/ was an important

assisting factor. In other words, the participation of two professional investors was a big motivation for us.

7. Rather Estonia/the Baltics, because the environment and teams here are easier to evaluate.
8. The allocation is not currently carved in stone. We assume a 3-5% allocation into PE in the long term (real estate does not belong under here).
9. –

## Appendix 5. Interview transcript, Pension fund D

1. The approach is top-down > from general to specific. I follow the global macro trends and also the capital flows. An important criteria is cognitive risk, meaning both price level and leverage. If the risk seems to high, I allocate assets to lower-risk asset classes despite the potential returns offered. /---/
2. At this time, when the markets are under the influence of central banks and essentially are not functioning, many historical risk metrics have lost their importance. As the measurable volatility is very low in every asset class for longer periods, there are fast short-term movements. Since the traditional metrics cannot be trusted, I simply keep risk levels low /---/.
3. I do not think of it as a categorisation – I have simply never limited myself to shares and bonds. But if I have to categorise for someone else, I would include real estate, private equity, and timber under this term.
4. They are often more reasonably priced as less cash flows into these assets. They may decrease price fluctuation risks, but not always. Some illiquid assets may even move in a larger amplitude.
5. It is not a problem for me, but as I mentioned earlier, the price fluctuations from little liquidity might (but not necessarily) be larger.
6. Rather planned. I often know what I would like to do, but there are no tools for it. However, if an instrument appears, I will use it. /---/
7. Rather local. If we take a significant role we have the possibility to negotiate the terms. Also, the local market is still in a developing phase. Opportunities occur.
8. Increase investments into both real estate and private equity through both funds and direct investments into companies.
9. –

## Appendix 6. Example of scenario analysis

<b>ASSET ALLOCATION:</b>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average
Fixed income	42,0%	39,0%	39,8%	48,7%	48,3%	43,2%	46,0%	45,0%	43,2%	38,9%	43,4%
Equity and equity funds	47,0%	50,0%	47,5%	36,6%	39,3%	43,5%	39,0%	39,0%	40,5%	42,1%	42,5%
Real estate and real estate funds	7,0%	7,0%	8,0%	10,6%	8,0%	7,6%	8,0%	8,0%	7,3%	6,8%	7,8%
Private equity	3,0%	3,0%	3,4%	3,4%	3,3%	4,0%	5,0%	5,0%	4,9%	6,2%	4,1%
Hedge funds	1,0%	1,0%	0,7%	0,7%	1,1%	1,7%	2,0%	2,0%	3,5%	5,4%	1,9%
Commodities	0,0%	0,0%	0,2%	0,0%	0,0%	0,0%	0,0%	1,0%	0,6%	0,5%	0,2%
Cash and deposits	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%

<b>RETURNS:</b>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Std.dev	Median	G.mean
<b>Total</b>	<b>14,3%</b>	<b>9,8%</b>	<b>6,0%</b>	<b>-20,6%</b>	<b>18,9%</b>	<b>12,3%</b>	<b>-1,7%</b>	<b>12,9%</b>	<b>7,5%</b>	<b>8,7%</b>	<b>11,1%</b>	<b>9,3%</b>	<b>6,2%</b>
Fixed income	4,1%	1,1%	2,5%	2,7%	13,3%	6,3%	3,5%	11,5%	0,4%	4,9%	4,3%	3,8%	5,0%
Equity and equity funds	26,1%	16,9%	6,3%	-41,9%	35,5%	20,0%	-10,0%	17,2%	16,6%	12,5%	21,8%	16,8%	7,4%
Real estate and real estate funds	7,2%	12,2%	10,1%	0,7%	-2,9%	7,2%	5,9%	4,7%	3,6%	5,6%	4,3%	5,8%	5,3%
Private equity	28,5%	24,1%	38,2%	-15,5%	-3,6%	18,7%	13,9%	10,0%	14,4%	22,8%	15,6%	16,6%	14,1%
Hedge funds	3,9%	6,1%	9,9%	-17,1%	17,4%	6,9%	-0,5%	10,4%	11,8%	6,2%	9,3%	6,6%	5,1%
Commodities	0,0%	0,0%	3,8%	-3,4%	0,0%	0,0%	-6,1%	5,2%	-3,6%	-36,0%	11,7%	0,0%	-4,8%
Cash and deposits	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%

Source: Prepared by the author based on the data from pension funds' annual reports

## Appendix 6 Continued

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<b>SCENARIO 1:</b>										
Allocation to alternatives	11,0%	11,0%	12,3%	14,7%	12,4%	13,3%	15,0%	16,0%	16,3%	18,9%
Alternatives return	1,4%	1,6%	2,2%	-0,6%	-0,2%	1,4%	1,2%	1,1%	1,4%	1,9%
Deposit return	0,22%	0,31%	0,48%	0,59%	0,09%	0,06%	0,14%	0,07%	0,04%	0,07%
	<b>13,12%</b>	<b>8,47%</b>	<b>4,29%</b>	<b>-19,44%</b>	<b>19,14%</b>	<b>10,95%</b>	<b>-2,72%</b>	<b>11,83%</b>	<b>6,18%</b>	<b>6,83%</b>
	-1,2%	-1,3%	-1,7%	1,2%	0,2%	-1,4%	-1,0%	-1,1%	-1,3%	-1,9%
	All alternative assets except real estate									
	Total return for all alternative assets									
	Deposit interest x allocation to alternatives									
	<b>Return without alternatives, but with deposit</b>									
	Return compared to actual portfolio									
<b>SCENARIO 2:</b>										
Allocation to alternatives	4,0%	4,0%	4,3%	4,1%	4,4%	5,7%	7,0%	8,0%	9,0%	12,1%
Alternatives return	0,9%	0,8%	1,4%	-0,6%	0,1%	0,9%	0,7%	0,8%	1,1%	1,6%
Deposit return	0,08%	0,11%	0,17%	0,16%	0,03%	0,03%	0,07%	0,03%	0,02%	0,05%
	<b>13,49%</b>	<b>9,13%</b>	<b>4,79%</b>	<b>-19,79%</b>	<b>18,86%</b>	<b>11,46%</b>	<b>-2,32%</b>	<b>12,17%</b>	<b>6,43%</b>	<b>7,18%</b>
	-0,81%	-0,67%	-1,21%	0,81%	-0,04%	-0,84%	-0,62%	-0,73%	-1,07%	-1,52%
	All alternative assets except real estate									
	Total return for alternatives except real estate									
	Deposit interest x allocation to alternatives									
	<b>Return without alternatives, but with deposit</b>									
	Return compared to actual portfolio									
<b>SCENARIO 3:</b>										
Fixed income	47,2%	43,8%	45,6%	57,1%	55,1%	49,8%	54,1%	53,6%	51,6%	48,0%
Equity and equity funds	52,8%	56,2%	54,4%	42,9%	44,9%	50,2%	45,9%	46,4%	48,4%	52,0%
Fixed income return	1,9%	0,5%	1,1%	1,5%	7,3%	3,1%	1,9%	6,2%	0,2%	2,4%
Equity return	13,8%	9,5%	3,4%	-18,0%	15,9%	10,0%	-4,6%	8,0%	8,0%	6,5%
	<b>15,7%</b>	<b>10,0%</b>	<b>4,6%</b>	<b>-16,4%</b>	<b>23,3%</b>	<b>13,2%</b>	<b>-2,7%</b>	<b>14,1%</b>	<b>8,2%</b>	<b>8,9%</b>
	1,4%	0,2%	-1,4%	4,2%	4,4%	0,9%	-1,0%	1,2%	0,7%	0,2%
	Proportionately increased									
	Proportionately increased									
	Increased allocation x return									
	Increased allocation x return									
	<b>Return with increased fixed income and equities</b>									
	Return compared to actual portfolio									

10-year bond yield 0,30% (02.04.2015 Bloomberg)

	Std.dev	Median	G.mean	Sharpe
<b>Actual</b>	<b>11,09%</b>	<b>9,25%</b>	<b>6,22%</b>	<b>0,5342</b>
Scenario 1	10,62%	7,65%	5,34%	0,4743
Scenario 2	10,73%	8,15%	5,60%	0,4935
Scenario 3	10,98%	9,41%	7,34%	0,6410

Source: Prepared by the author based on the data from pension funds' annual reports