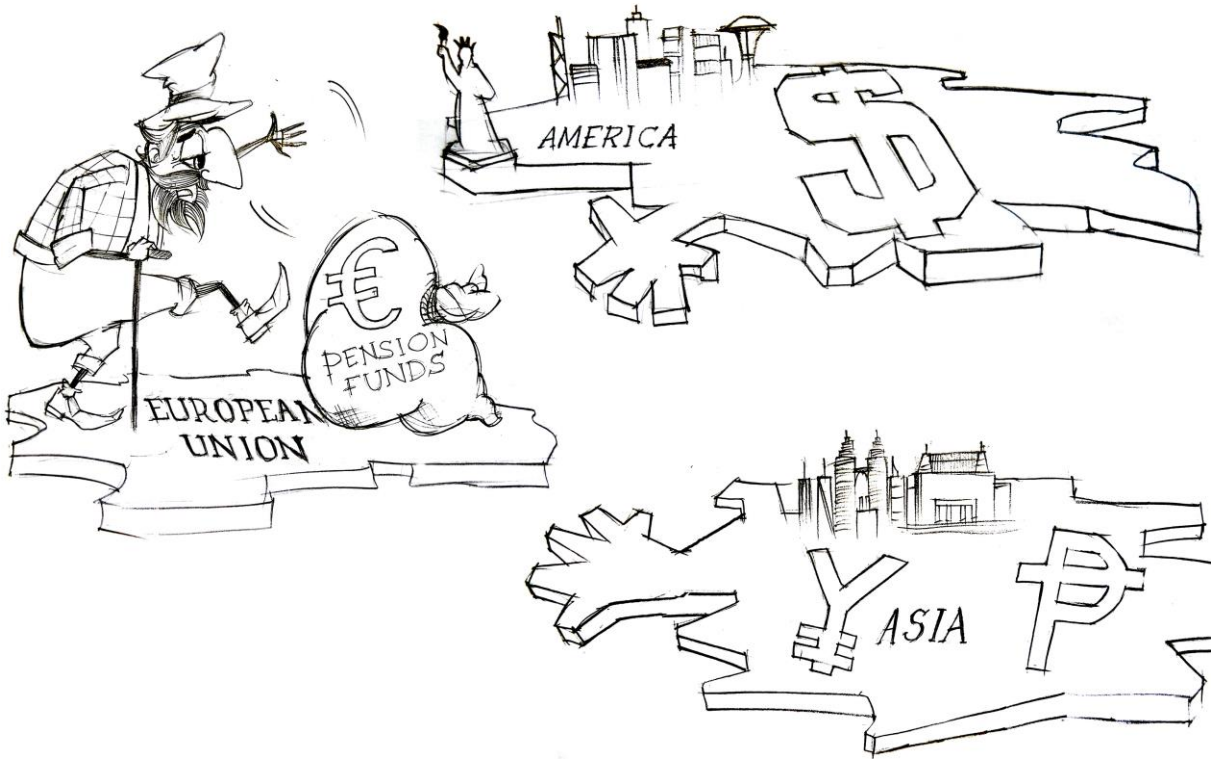
EUROPEAN UNION PENSION FUNDS

AND

THE HOME BIAS

Geographical asset allocation in light of the three goals set by the European Commission.



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Abstract

This thesis examines whether European Union pension funds overweigh domestic assets in their portfolio and aims to determine why they have a so called home bias. Up to 79% of the 110 respondents of a secondary survey are shown to be biased towards domestic and European assets when compared to the capital asset pricing model. Part of the home bias can be explained by real exchange rate risks, asymmetric information and behavioural factors. Further explanations, such as indirect diversification benefits, human capital correlation, stock market development, funds characteristics and regulation on foreign asset holdings are discussed, estimated and tested. In conclusion this paper finds that real exchange rate volatility and bond holdings have a significantly positive relationship with pension fund home biases. Funds who allocate more of their portfolio to bonds also have a higher home bias for their equity portfolios. The percentage of externally managed portfolio shows a negative relationship with fund home biases. There is no significant effect for different fund sizes, types and regulations. Surprisingly, funds that are located in countries with higher human capital correlations show higher home biases, especially for equities.

Keywords

Asset allocation, pension funds, home bias, European Union, modern portfolio theory, asymmetric information model, human capital, regulation.

1 Introduction

Since the Treaty of Rome (1957) the European Union (EU) has stimulated the free movement of goods, workers, services and capital. Free movement of workers in a single market also implies that citizens build up pensions while working abroad and because of that, one might suggest that pension harmonisation might be necessary to some level. The framework of institutions for occupational retirement provisions (IORP) (Directive 2003/41/EC) already allows cross-border schemes within the EU. It also states that pension funds should have sufficient assets, reasonable internal control, diversification and transparency. However, supervision and exact rules still remain the responsibility of Member States. Uebelmesser (2004) shows that the harmonisation of pension systems within the EU is still sub-optimally low and that this could distort the allocation of labour and endanger distributive activities.[1] West (2009) explains that it is difficult to develop a Union-wide pension system standard, because of different levels of prosperity, different systems[2] (Poteraj, 2008) and because citizens simply prefer to rely on their own governments (European Commission, 2007).[3]

There remains a large difference between member state pension fund regulations, and Europe is currently seeking to harmonise the rules for pension funds. According to the European Commissioner for Internal Market and Services, the EU rules for pension funds (as set out in Directive 2003/41/EC) are being reviewed to: (1) protect participants, (2) maintain sustainability, and; (3) strengthen the single market (Barnier, 2012).[4] Most of the recent discussions on revision of the IORP Directive have been on quantitative requirements related to liability risk management, valuation of liabilities and minimum capital requirements.[5] As

[1] *According to the European Insurance and Occupational Pensions Authority (2012), there are currently 84 active cross-border schemes within the EU.*

[2] *There still are large cross-country variations in retirement ages of up to ten years (European Commission, 2009). Some have already suggested a Union-wide retirement age (Pignal, 2010; The New York Times, 2011).*

[3] *Respondents of a 2007 poll by the European Commission said that 'Pensions' are one of the most important topics facing their country. The topic however scored the lowest of all 19 topics on whether or not decisions should be jointly made within the EU instead of by national governments.*

[4] *Commissioner Barnier (2013) plans to present a proposal in June 2013*

[5] *According to pension lobbyists, the use of so called Solvency II requirements are unwarranted for pension funds as insurance companies have very different risk profiles and do not have the same steering instruments as*

stated, the 2003 IORP Directive already includes a qualitative requirement that assets should be diversified to "avoid excessive reliance on any particular asset, issuer or group of undertakings" and that long-term investors can, in particular, benefit "from the advantages of international diversification". Many pension funds, however, still hold a substantial proportion of domestic assets, which might mitigate the benefits of international diversification. Decreasing their bias towards domestic assets (home bias) might also be in the interest of: (1) protecting participants, (2) maintaining sustainability, and; (3) strengthening the single market.

This thesis aims to determine, based on economic theory and earlier literature, whether EU pension funds have a home bias and then to discuss the factors that, according to earlier literature, can explain this bias. Possible explanatory factors such as real exchange rate fluctuations, inflation hedging, information asymmetries, indirect diversification benefits and fund characteristics are discussed. By using secondary survey and country data, this thesis aims to find the 'best' estimators for those explanatory factors. The effect of these cross-sectional estimators on pension fund home biases shall be tested using a multivariate regression. A number of funds that are included in the survey by Investment Pensions Europe (IPE), mainly Dutch, also show negative home biases. As discussed in this thesis, this might be a result of a positive correlation between domestic market returns and human capital.

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pension funds (Pensioen Federatie, 2008). Solvency II would require pension funds to have higher buffers, a higher value of liabilities, lower benefits and more defensive investment strategies (De Haan, Joseph, Vos and Wijckmans, 2012). The Dutch policy, FTK requires a confidence level of 97.5% and Solvency II requires a higher buffer of 99.5%. European Commissioner Barnier (2012) has already stated that future European rules for pension funds will not be a 'copy and paste' of Solvency II.

The next chapter provides a theoretical approach to earlier studies by explaining the home bias and what factors can explain the home bias for pension funds. Chapter 3 presents the survey data, methodology and explains how the variables are determined. This thesis then continues with a statistical analysis on the factors that possibly explain the home biases. To conclude, this thesis determines the reliability of the results, and to what degree these findings can explain why pension funds hold a larger weight of domestic assets than the capital asset pricing model might prescribe.

2 Theoretical Framework

This chapter explains how the capital asset pricing model (CAPM) prescribes a theoretical optimal portfolio weight of foreign and domestic assets. It further discusses the literature on factors that can explain investor home biases.

2.1 Portfolio Diversification

Within Markowitz's (1952) modern portfolio theory selection model, investors have the possibility to hold multiple assets. If portfolio weights, ω_a and ω_b can be held in assets a and b, risk[6], σ can be decreased by investing in more than just one asset as long as asset returns are not perfectly correlated.[7]

$$\sigma(r_{a,b}) = \sqrt{\omega_a\sigma_a^2 + \omega_b\sigma_b^2 + 2\omega_a\omega_b\sigma_a\sigma_b\rho_{ab}}$$

Figure 1 and 2 show the correlation, (ρ_{ab}) between European assets and other markets. The European market is not perfectly correlated to the other markets, so allocating assets abroad can lower volatility. International diversification can therefore allow portfolios to generate superior risk adjusted returns (Sharpe, 1963; Grubel, 1968; Levy & Sarnat, 1970).

[6] *In this case, standard deviation; the chance that returns are different than expected returns.*

[7] $\rho_{ab} < 1$

Figure 1: Correlations for European markets based on ten years of historical *daily* returns. Panel data from STOXX Benchmark indices that cover 95% of free float market capitalisation worldwide (STOXX Limited, 2013). For the correlations with individual European countries, the (domestic) index of the country is excluded from the European STOXX Total Market Index. The same was applied for STOXX Global by excluding Europe.

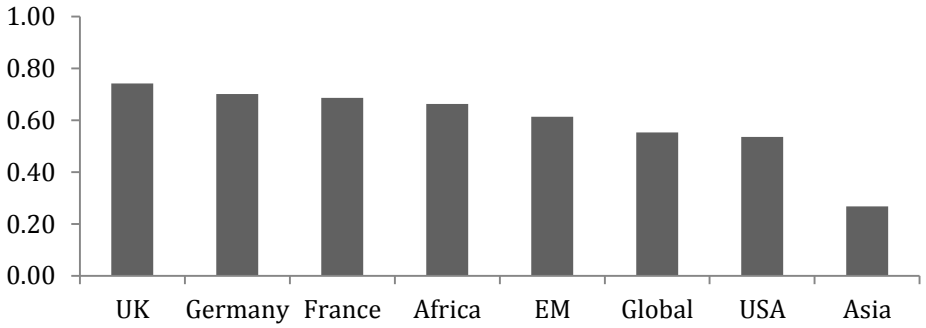
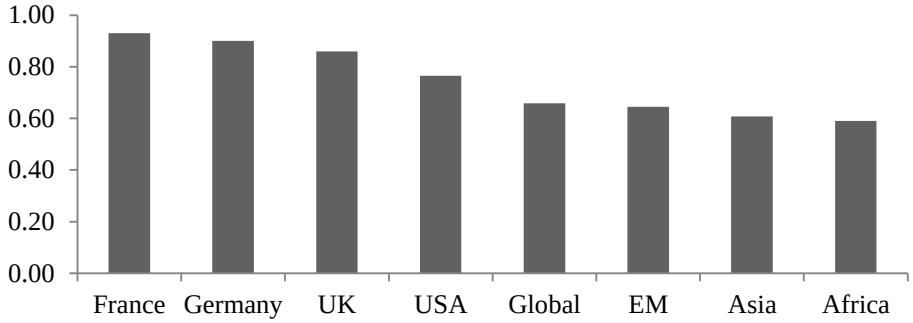


Figure 2: Correlations for European markets based on ten years of historical *monthly* returns. Monthly returns can provide a better indication for longer and more strategic investment decisions. Panel data from STOXX Benchmark indices cover 95% of free float market capitalisation worldwide (STOXX Limited, 2013). For the correlations with individual European countries, the (domestic) index of the country is excluded from the European STOXX Total Market Index. The same was applied for STOXX Global by excluding Europe.



International diversification is especially important for pension funds, because: (1) human capital[8] and the other savings of pension plan participants are also correlated to domestic performance (Eldor, Pines & Schwartz, 1988; Baxter & Jermann, 1997), (2) pension funds are in some cases too large to trade actively on their domestic markets, because these markets are

[8] *Competencies, knowledge and abilities that individuals possess to produce goods, services or ideas (Kodwani and Tiwari, 2007)*

not liquid[9] enough (Chan-Lau, 2005; Zalewska, 2005), and; (3) investing in growing economies could provide returns that possibly 'beat' demography and thereby keep pension systems sustainable (Economist Newspaper Ltd., 1992). The question remains what level of international diversification is 'ideal' according to theory.

2.2 Market Portfolio

The intertemporal CAPM (Sharpe, 1964; Merton, 1973) states a theorem in which investors hold a proportion of risk free assets and the market portfolio. As described by Solnik (1974), international investors hold the worldwide market portfolio of equities and bonds as long as eight assumptions are fulfilled: (1) constant equilibrium within capital markets, (2) perfect markets; no transaction costs, taxes or capital controls and investors are price takers, (3) short selling allowed, (4) borrowing and lending at the same rate (differences between countries allowed), (5) assets and currencies continuously traded (flexible exchange rates), (6) investors have homogeneous expectations, (7) no international capital flow constraint, and; (8) domestic consumption only. The fact that real markets do not fulfil these assumptions might account for some of the reasons why investors do not hold the 'perfect' worldwide market portfolio of assets.

Research suggests that investors in general often overweigh domestic assets when compared to the optimal CAPM portfolio weight (French & Poterba, 1991; Lewis, 1999; Chan, Covrig & Ng; 2005). According to Cooper and Kaplanis (1994) logical explanations of a home bias are inflation risk hedging and restrictions on foreign investments and/or transaction costs. Generally a split is made between institutional and behavioural factors. These factors will be discussed later in this chapter following the methods to determine home bias.

[9] *Mainly the problem of price impact: (1) imbalances between buy and sell orders, or; (2) informational impact of orders (Damodaran, 2005)*

2.3 Home Bias

The home bias of individual funds can be measured based on the model of Sharpe (1964) and Merton (1973). Their model assumes that investors hold a combination of domestic risk free assets and worldwide diversified market capitalisation. In line with the work of Cooper and Kaplanis (1986), Chan et al. (2005) and Fidora et al. (2006) the home bias (*home*) can be calculated as a proportion of overweight in domestic assets, ω_d.[10] The 'ideal' weight in foreign assets, ω_f is a ratio of foreign market capitalisation divided by the total worldwide market capitalisation of equities ($E_{worldwide} =$ €45 trillion) and debt securities ($D_{worldwide} =$ €21 trillion).

$$Home\ Bias = 1 - \frac{1 - \omega_d}{\omega_f}$$

$$\omega_f = \frac{E_{worldwide} + D_{worldwide} - E_{domestic} + D_{domestic}}{E_{worldwide} + D_{worldwide}}$$

The method described above is sometimes called the 'model' based approach. Dahlquist, Pinkowitz, Stulz and Williamson (2003) state that (floating) shares represent fewer than half of the total market capitalisation, and therefore; La Porta, Lopez-de-Silanes, and Shleifer (1999) suggest the use of floating share capitalisation instead of total market capitalisation. However, when calculating the home bias with floating capitalisation, the home bias does not disappear (Dahlquist et al., 2003; Sercu & Vanpee, 2007). Research by Bekaert et al. (2009) also includes a so called 'raw' measure for the home bias which is only based on the difference in portfolio weight of domestic assets and whatwould be optimal according to the CAPM.

A different from the model-method is the so called 'data' based approach (Baele, Pungulescu & Ter Horst, 2006). This approach does not rely on the CAPM, but measures the optimal allocation according to the mean-variance framework, by using historical returns (Sercu et al., 2007).[11] The 'data' based mean-variance method however largely relies on historical data.

[10] *Likewise, underweight in foreign assets or negative foreign bias.*

[11] *In some cases a more complex Bayesian framework has been used to introduce mistrust in the model (Pastor, 2000; Baele et al., 2006; Sercu et al. 2007).*

Only applying a mean-variance analysis with 2 assets, namely a domestic asset and a portfolio of all foreign assets, will minimise the benefits of further foreign diversification within foreign assets. As an illustration, it is however possible to do a mean-variance analysis with the European and Global returns. By following this method a mean-(minimum) variance 'optimal' portfolio weight in European equities can be found. The Markowitz model allows us to find the minimum variance by minimising:

$$\omega_a\sigma_a^2 + \omega_b\sigma_b^2 + 2\omega_a\omega_b\sigma_a\sigma_b\rho_{ab}$$

This is subject to:

$$\omega_a\overline{r_a}+\omega_b\overline{r_b} = \overline{r}$$

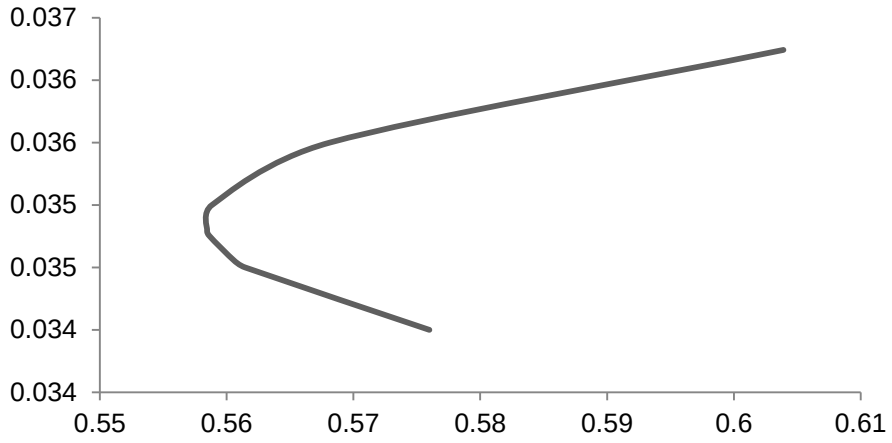
$$\omega_a+\omega_b = 1$$

$$\omega_a \geq 0$$

$$\omega_b \geq 0$$

This calculation results into the Markowitz Bullet shown below in figure 3 where the minimum variance point holds if three-quarters of the portfolio weight is allocated to non-European Global assets. For this calculation free float market data from STOXX limited was used. This data is however unavailable for most of the EU equity markets, so it is not possible to do a mean-variance calculation as part of the 'data' based approach. Therefore the fund home bias for survey respondents in the next chapter is calculated by using the 'model' based approach.

Figure 3: Markowitz bullet for a portfolio of European STOXX Total Market Index and STOXX Global (Europe excluded). Panel data from STOXX Benchmark indices that covers 95% of free float market capitalisation worldwide (STOXX Limited, 2013)



2.4 Institutional Factors

2.4.1 Inflation, Exchange Rates and Bonds

By using a Markowitz modern portfolio theory selection model Fidora, Fratzscher and Thimann (2006) show that real exchange rate volatility drives home bias. Cooper and Kaplanis (1994b) also tested this, but found that purchasing power parity deviations should in general not explain home biases. Fidora et al. (2006) did however not only show that exchange rate volatility drives home bias, but also showed that assets with relatively high return volatility respond less to this effect. It would therefore be interesting to see the difference between, for instance, equity (with higher volatility) compared to bonds. Long-term investors who hold a large proportion of 'less volatile' domestic T-bills might also be more conservative in investing abroad (Campbell, Viceira & White, 2002). Another explanation for this might be found in the research of Kirabaeva and Razin (2009), where a home bias emerged when they showed that domestic bond holdings hedge real exchange rate risks. This might suggest that domestic bonds are perceived to provide a better hedge against domestic risks such as inflation. Likewise, Bodie (2001) suggests using inflation-protected bonds to hedge a minimum standard of living after retirement[12]. Pension funds might therefore prefer to allocate assets to bonds as it provides a better hedge against increases in liabilities.

2.4.2 Euro

Evidence also shows that besides real exchange rate volatility, the home bias has also decreased as a result of the introduction of the Euro (Schoenmaker & Bosch, 2008; Van Lelyveld, Verschoor & Rubbaniy, 2010). Possible explanations for this could be that the European Central Bank now sets Euro-wide inflation targets and exchange rate volatilities of the 'larger' monetary union have decreased.

2.4.3 Multinational Firms

Multinational firms are, to a large degree, dependent on foreign revenues or results from subsidiaries. Pension funds that invest in multinational firms can therefore also be expected to benefit from some sort of indirect diversification benefits (Heston & Roewenhorst, 1994). Ghazalian and Furtan (2008) explained that home bias estimations often do not recognize the role of multinational activities. Mathur and Hanagan (1983) found that despite the existence

[12] *Especially treasury inflation protected securities or corporate inflation-linked bonds (Weinberg, 2003).*

of barriers to direct international diversification, investors can still achieve certain unique economic and financial diversification advantages by investing in multinational firms (indirect diversification). Rowland and Tesar (2004) show this by applying mean-variance spanning tests on multinational firms in seven countries, but they also showed that diversification benefits can further increase by adding extra foreign assets to the portfolio. The question on a fund to fund basis remains whether pension funds in a country with more indirect diversification opportunities might also have a higher bias.

2.4.4 Information

Domestic investors are also likely to have better information about domestic markets and vice-versa, and have less information about foreign markets. This was investigated by Shukla and van Inwegen (1995), who found that British fund managers investing in the US had lower alphas; Sharpe and Treynor ratios than American fund managers. Bravo-Ortega (2005) show that changes in information asymmetries are consistent with changes in home equity biases. However, Van Nieuwerburgh and Veldkamp (2009) show that even if domestic investors can gain foreign information, they still choose not to do so. This might suggest that investors have a bias towards domestic assets because they know too little about foreign markets, or from a more behavioural perspective,[13] because they think they know more about domestic markets (Van Nieuwerburgh et al., 2009).

2.4.5 Size

According to Dyck and Pomorski (2011), larger funds use fewer external managers (higher internal management) and are associated with a better performance of the entire pension plan portfolio, which might suggest that information asymmetries are lower. However, when observing the worldwide equity holdings of mutual funds, Hau and Rey (2008) find a positive correlation between fund size and home bias. In all countries (except for the UK and Switzerland), bigger funds where more biased towards domestic assets, but did invest in a larger number of countries. As Hau et al. (2008) said, their findings constitute a challenge for existing theories. Research by Ni (2009) shows an outcome that is more in line with existing theories as the home bias is negatively related to fund size. A possible reason for this would

[13] *Behavioural factors are discussed in more detail in a later subchapter.*

be that under the assumptions of the endogenous asymmetric information model; larger funds in assets have more foreign information and therefore might hold more foreign assets.

2.4.6 Transaction Costs and Development

Another reason not to hold foreign assets would be that trading them is more costly than trading domestic assets (Black, 1974; Stulz, 1981; Tesar & Werner, 1995). Transaction costs generally consist of commissions, bid-ask spreads and the price impact of trades (Damodaran, 2005). Chan, Covrig and Ng (2005) use transaction costs as one of the measurements for stock market development and show that countries have a lower total home bias if their stock market is more 'developed'.[14] Research by Bekaert and Wang (2009) shows that countries with more 'developed' stock markets exhibit relatively higher home biases (which is perhaps due to overconfidence). There is also a causality problem, as Zalewska (2005) explains, whereby home biases can deteriorate stock market development. Mondria and Wu (2010) showed that openness, decreases home biases. From a fund to fund basis this can possibly also be explained because of transaction costs. In research by Tesar and Werner (1995) it is however pointed out that funds had higher turnover rates on foreign assets compared to domestic assets. This might suggest that transaction costs are an unlikely explanation for fund to fund home biases. It is still important for funds to take transaction costs into account, as Balduzzi and Lynch (1999) show; investors who ignore transaction costs in the asset allocation process can face a loss of as much as 16.9%.

2.4.7 Restrictions and Development

Domestic asset allocation is sometimes also said to create benefits as it helps raise the supply of funds, stimulate the financial infrastructure of a country and thereby improve overall competitiveness. Cross-country evidence shows little support that by holding domestic assets, pension funds provide externalities for domestic financial development (Reisen, 1997). The risk tolerance of pensioners is low, so the goal of pension funds is to provide returns with a low volatility and not to stimulate domestic financial development. Excessive portfolio caps on foreign assets can therefore be sub-optimal in light of three goals set by the European Commission and go against the concept of free movement of capital (Bell, 2007; Santis and Sarno, 2008; Organisation for Economic Co-operation and Development, 2011). While most

[14] *Stock market development was measured by transaction costs, relative size of market capitalization to GDP and turnover ratios.*

European Union countries do not have any limits at all for Organisation for Economic Co-operation and Development (OECD) countries, or at least do not have any restriction on holding assets within the European Free Trade Association (EFTA) and Central European Free Trade Agreement (CEFTA) regions. Some countries (that are included in the sample) such as Austria, Finland and Italy, do have limits on non-OECD holdings of 10-30% (Erdos, 2006; Chybalski, 2009; OECD, 2011; OECD, 2012b). This can possibly be justified through the goal of protecting the fund's sustainability or the adequacy of participants, just as restrictions on investments are applied for single issuers. These restrictions might not be harmful at all considering the fact that the market capitalisation of OECD countries is approximately 75% of total world market capitalisation (The World Bank, 2012). Some countries, such as Latvia (30%) also have restrictions on investing in currencies that are different from the currency of their obligations. Swinkels, Vejina and Vilans (2005) however show that Latvian restrictions do not restrict pension funds to invest more internationally. Very strict foreign investment restrictions can however limit free movement of capital and thereby limit the benefits of diversification (Bell, 2007; Santis & Sarno, 2008). The European Court of Justice has for example already ruled against Poland for its foreign investment limits of 5% in 2011, because Poland has failed to justify them on the basis of public interest or TFEU Article 65 (Ottawa, 2012).

2.5 Behavioural Factors

Institutional factors often neglect individual behaviour and therefore Fellner and Maciejovsky (2003) sought to find behavioural explanations for the home bias. The main behavioural explanations are that investors simply prefer to invest in firms that they are familiar with (Concept of familiarity) (Heath and Tversky, 1991; Huberman, 2001) and that they are more optimistic towards domestic firms (French and Poterba, 1991). From a country to country basis, Anderson, Fedenia, Hirschey and Skiba (2010) show that cultural differences between countries also provide an explanation for the home bias. Brunia, Plantinga and Scholtens (2002) find that European funds have a strong home bias with respect to socially responsible investments. As suggested by Nørregaard (2011), this somewhat indicates that investors might prefer to allocate assets at home in a different way than they would abroad, as a result of personal interests, as one example. These concepts all suggest that in some cases investors invest in what their behaviour tells them to do while ignoring the principles of portfolio theory.

2.6 Conclusion

Earlier literature has shown different methods to determine if a home bias exists. The literature also provides different explanations for home biases. Factors such as real exchange rate fluctuations, inflation hedging, transaction costs, information asymmetries, indirect diversification benefits, fund characteristics, restrictions and behavioural factors have been discussed. The next chapter describes the estimators that are included in the dataset.

3 Methodology and Data

This chapter presents the methodology and the data used for the empirical study.

3.1 Hypotheses

In the empirical study, we will test: (1) whether a home bias exists, and; (2) whether factors can explain why pension funds have home biases, through a cross-sectional multivariate analysis. The explanatory factors that will be tested are: (1) whether funds with larger real exchange rate risks also have higher home biases, (2) whether funds that allocate more portfolio weight to bonds also have higher home biases, (3) whether the use of external managers decreases pension fund home biases, (4) whether funds located in countries with more indirect diversification possibilities also hold higher home biases, (5) whether funds located in countries with a higher correlation between human capital and capital returns have a lower home bias, (6) whether funds located in the Euro-zone have a lower home bias, (7) whether fund home biases are a result of regulation on foreign assets, (8) whether there are differences in home biases for different sizes of funds, and; (9) whether there are differences in home biases for different types of funds. All these factors are derived from the literature in the previous chapter.

The analysis is limited by the availability of estimators. By making a few assumptions, the exclusion of explanatory variables such as transaction costs should not harm the results. Behavioural explanations are also somewhat hard to measure with raw data on pension funds. For this reason, in this thesis pension funds will have to be assumed to invest rationally, thereby not falling for any behavioural biases. The thesis will also observe whether there are differences in these factors when explaining different home biases, such as equity, bond and European asset biases.

3.2 Data

The analysis relies mostly on survey data from IPE International Publishers Limited's (2012) European Institutional Asset Management Survey. The original cross-sectional dataset covers 146 anonymous observations, with over one trillion Euro in assets and a response rate of 69%

(Gartmann, 2011; Gane, 2012).[15] IPE had to remove the fund names before sending me the surveys as the survey was conducted on an anonymous basis. This should not be a problem for the analysis, as a funds' name should not provide any economic meaning in explaining a funds' home bias. The variables that are derived from the survey questions (shown in the appendix) are shown below in table 1.

Table 1: Variables that can be derived from the survey

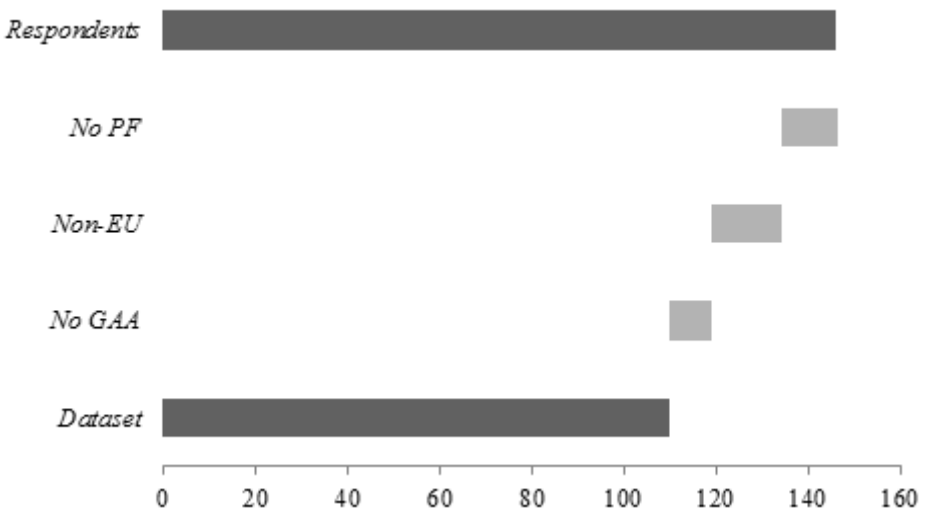
Country			
Sector(s) in which organisation operates			
Company/Corporate	*Industry-wide/Multi-employer/Professional*	*Public sector*	*Other:*
Organisation size			
Small (under €1bn)	*Medium (€1bn - €5bn)*	*Large (over €5bn)*	
Current strategic asset allocation (%):			
Equity	*Fixed Income*	*Real Estate*	*Other:*
Breakdown of fund's strategic asset allocation, for the following regions (%)			
Domestic	*Rest of Europe*	*Rest of World*	
Investment assets, by asset class and by investment type:			
Internally Managed	*Externally Managed*		
Types of derivatives or derivative products used within portfolio			
Interest rate swaps	*Inflation rate swaps*	*Other swaps*	
Options	*Futures/forwards*	*Other derivatives/products*	
If you hedge your currency risks, what proportion of your assets is covered by a hedge (%)			

If respondents are not a corporate, industry-wide, public sector or third pillar pension fund, but a life insurer, corporate treasury, bank, mutual fund, foundation or charity, their observation is also removed (See 'No PF' in figure 4). Only observations of funds located within the European Union are included. The observations from funds located in Croatia,[16] Iceland, Liechtenstein, Norway and Switzerland are therefore excluded (Non-EU in figure 4). Another 9 respondents did not answer the question on geographical asset allocation (GAA in figure 4) so these are also excluded from the cross-sectional dataset.

[15] *146 (69%) of the total of over 200 funds completed the survey*

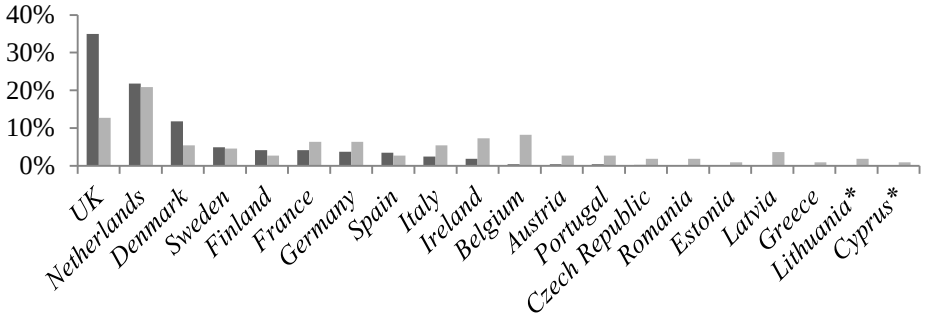
[16] *Croatia was not an EU member when the data was collected in 2011.*

Figure 4: From 146 respondents to a dataset of 110 observations.



As shown in figure 4, this leads to a total of 110 observations from 21 EU countries; Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Netherlands, Portugal, Romania, Spain, Sweden and the United Kingdom. Table 2 shows how many funds, sizes and types contribute to the survey data per country. The amount of observations per country are somewhat representative for the amount of assets that pension funds in Europe hold as seen in figure 5.[17]

Figure 5: The total relative size of a country's pension fund assets (*dark*) (OECD, 2012) and the percentage of relative contribution to the unweighted regression (*light*). * no data available



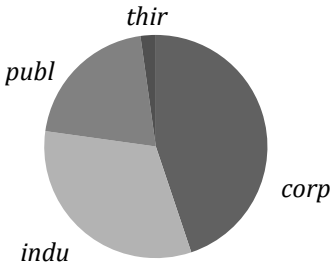
[17] *The Netherlands and the United Kingdom together hold over half of all European pension assets.*

Table 2: Number of observations per country and the number (#) of small (s), medium (m), large (l), company/corporate pension fund (corp), industry-wide/multi-employer/professional pension fund (indu), public sector pension fund (publ) and third pillar pension fund (thir) observations.

	#	**#s**	**#m**	**#l**	**#corp**	**#indu**	**#publ**	**#thir**
Austria	3	1	1	1	1	1	1	1
Belgium	9	7	2	0	5	3	3	0
Cyprus	1	1	0	0	0	1	0	0
Czech Republic	2	1	1	0	0	1	0	1
Denmark	6	1	1	4	1	5	0	0
Estonia	1	1	0	0	0	1	1	0
Finland	3	3	0	0	3	0	0	0
France	7	0	1	6	5	3	4	0
Germany	7	3	4	0	5	2	2	0
Greece	1	1	0	0	0	0	1	0
Ireland	8	3	5	0	6	2	1	0
Italy	6	2	4	0	2	5	1	0
Latvia	4	4	0	0	3	2	3	0
Lithuania	2	2	0	0	1	1	2	0
Netherlands	23	12	8	3	17	7	0	0
Portugal	3	1	0	2	1	2	1	0
Romania	2	2	0	0	1	1	0	0
Spain	3	0	3	0	2	3	0	0
Sweden	5	0	2	3	1	2	3	0
UK	14	2	9	3	7	2	5	0
Total	110	47	41	22	61	44	28	2

The dataset contains 47 small (under one billion Euros), 41 medium (one to five billion Euros) and 22 large funds (over five billion Euros). The dataset includes corporate (*corp*), industry-wide (*indu*), public (*publ*) and third pillar (*thir*) funds[18]. Figure 6 shows the different types of funds that contribute to the survey dataset.

Figure 6: The different types of plans represented in the survey dataset



[18] *Respondents were able to answer multiple sectors in which their organisations operated*

Figure 7 shows that for most, fixed income is the largest group of assets. Figure 7 also shows that the portfolio weights differ between different pension funds. The pension funds that are included in the survey also mainly rely on external managers as seen in figure 8. Respondents indicated their use of products such as interest rate swaps, inflation rate swaps, options, futures, forwards and other derivatives, products and swaps. A total of 54% of the respondents use products to hedge real exchange rate risks (figure 9), whereby on average 46% of a fund's total assets are covered by the hedge.

Since the survey is conducted on a voluntary basis, the data is perhaps vulnerable to response bias.[19] Testing for this bias can, in some cases, be done by comparing early and late responses or by simply comparing the characteristics of the respondents with the non-respondents (Oppenheim, 1966; Salant and Dillman, 1994). These tests are however difficult because IPE has only provided the survey data. However, considering a response rate of over 60%,[20] the data has only a small likelihood of a (non-)response bias (Salant et al., 1994; Draugalis, Coons and Plaza, 2008). The survey dataset does not provide any information on what type of fixed income assets the respondents invest in. Therefore for simplicity this thesis assumes that these fixed income assets are all bonds.[21] Another drawback is that the survey only gives a snapshot of the asset allocation, and not a long-term average. As said by the former Secretary General of the European Federation for Retirement Provision (EFRP), collecting and analysing pension fund data across countries and types of funds is difficult, because of the wide diversity and different structures of institutions between countries (Verhaegen, 2013). The multivariate analysis will therefore try to include any relevant country specific factors that, according to earlier research, justify a pension fund to hold a home bias.

[19] *It could be the case that either smaller or larger funds do not respond.*

[20] *A response rate of 65% if the respondents who did not answer the question on geographical asset allocation are also counted as non-respondents*

[21] *Fixed income notes are therefore neglected*

Figure 7: Portfolio weights of the 110 pension funds in a descending order

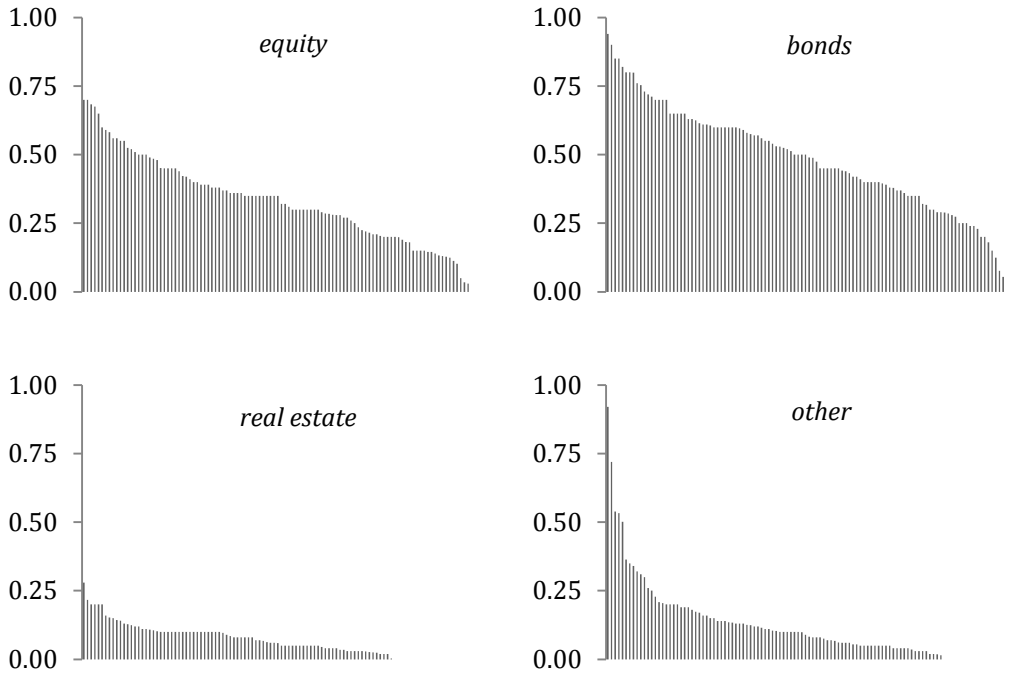


Figure 8: Average percentage of the portfolio managed internally and externally

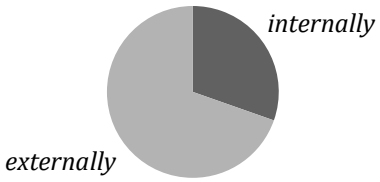
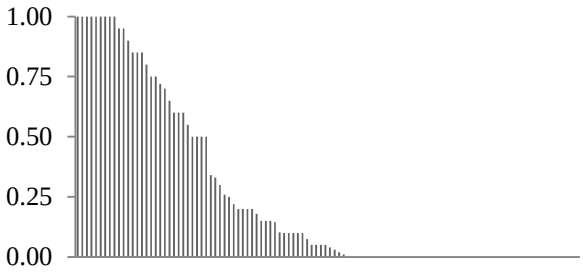


Figure 9: Percentage of total assets hedged by real exchange rate risks



3.3 Dependent Variable

The home bias of individual funds will be measured in line with the model of Sharpe (1964) and Merton (1973). This 'model' based approach assumes that investors hold a combination of domestic risk free assets and worldwide diversified market capitalisation. This thesis is unable to use free floating capitalisation as a measure for the benchmark (suggested by La Porta et al. (1999) and Dahlquist et al. (2003)) because this data is unavailable for most of the equity markets that are analysed. The 'data' based mean-variance method relies largely on historical data. Since, the survey does not have any data on where a fund's assets are exactly located; it is somewhat difficult to do a mean-variance analysis with historical data for the measurement of the optimal portfolio weights. The 'model' based home bias is in line with Cooper et al. (1986), Chan et al. (2005) and Fidora et al. (2006) and calculated as a proportion of overweight in domestic assets, ω_d compared to the 'ideal' weight in foreign assets, ω_f.

$$Home\ Bias = 1 - \frac{1 - \omega_d}{\omega_f}$$

The calculation of the home bias in this thesis will not take into account the use of domestic 'risk free' CAPM holdings, due to three reasons: (1) the survey data does not make any distinction between different types of domestic (risk free or not) fixed income assets, (2) many domestic fixed income assets are not considered to be risk free anymore,[22] and; (3) the risk free rate can be mimicked by using derivatives in combination with any other bonds.[23]

Benchmark weights of domestic and worldwide market capitalisations of capital are estimated by equity market capitalisation and total debt securities. Equity market capitalisation,[24] E is gathered from The World Bank and Standard & Poor's data on market capitalisation of listed companies. Total debt securities, D is based on The Bank for International Settlement's data

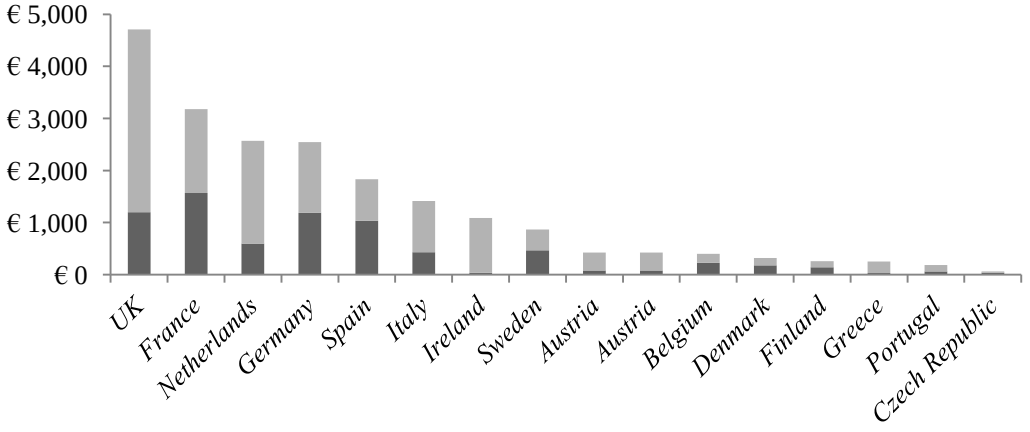
[22] *Many sovereign EU bonds do not yield risk free returns, because of default and reinvestment risks (Damodaran, 2008; Mayordomo, Peña and Schwartz, 2009).*

[23] *By using, for example, forward and future contracts on exchange rates and credit default swap (Damodaran, 2008). Over 70% of the surveyed funds use such products.*

[24] *Share price times the number of shares outstanding.*

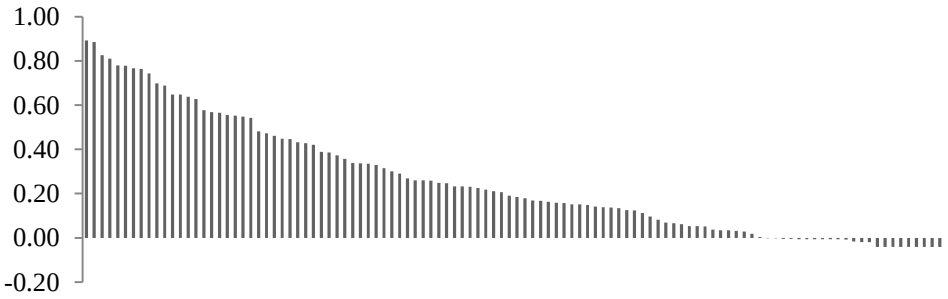
on debt securities by residence of issue. Both are calculated on an average basis for the year 2011. Figure 10 shows the total market capitalisation of both debt and equities.

***Figure 10**: Total domestic market capitalisation (in billions of €) of equity (dark) and debt securities (light) in 2011. Sources: The World Bank (2012) and The Bank for International Settlements (2012).*



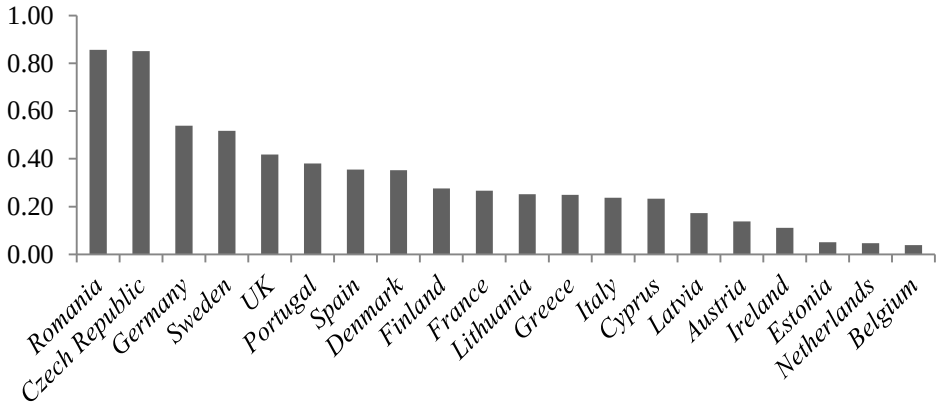
As shown in figure 11 and 12, the home bias shows large differences between funds and countries within the survey data. Over 79% of the observed funds have a home bias above zero. For some funds, of which most observations are located in the Netherlands, a negative home bias ('foreign bias') exists, indicating they do not invest 'enough'[25] in domestic assets. A possible explanation for not investing domestically could be that human capital is also correlated to domestic performance, as discussed and included in a second regression in the next chapter.

Figure 11: The home biases of the 110 funds in a descending order



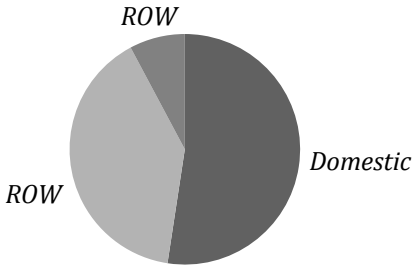
[25] *According to the model by Sharpe (1964), Merton (1973) and Solnik (1974)*

Figure 12: Country average of the home bias according to the survey (from high to low)



From a perspective of diversification, alternative instruments can also be considered as an important source of return and diversification (Blewett, 2013). There have been findings that signify that home biases exist in private equity (Hochberg and Rauh, 2013) and real estate (Ortalo-Magne and Prat, 2010). As shown in figure 13, the survey respondents also show a large tendency towards domestic real estate assets. Assets such as real estate, participation in hedge funds or private equity are however not included in the total worldwide market capitalisation. This is because they would likely create distortions and because it is difficult to find the capitalisation of alternative investments per country (Morgan, 2010).

Figure 13: Allocation of real estate portfolio. Domestic, rest of Europe (ROE) and rest of World (ROW).



3.4 Independent Variables

This part will describe the factors included in the multivariate analysis. The following variables are selected: (1) real exchange rate volatility, (2) portfolio weight in bonds, (3) portfolio weight externally managed, (4) relative size of indirect diversification benefits, and; (5) human capital correlation and dummies for Euro-zone, regulation on foreign assets, size and type. The choice for these variables is explained below.

Earlier research showed that real exchange rate volatility drives home biases (Fidora et al., 2006). Fear of exchange rate volatility can be limited by hedging currency risk. The standard deviation of real effective exchange rates from the past ten years is collected from Eurostat, σ_r. The survey data gives a proportion of assets covered by an exchange rate hedge, h_e, so therefore real exchange rate risk is defined as the total unhedged real exchange rate volatility (*rerv*).

$$Real\ Exchange\ Rate\ Risk = (1 - h_e) \cdot (\sigma_r)$$

Fidora et al. (2006) also show that bond returns are generally less volatile than equity returns.[26] As discussed earlier, Bodie (2001) suggest the use of domestic bonds to provide a hedge against inflation. These bonds are ideally treasury inflation protected securities or corporate inflation-linked bonds (Weinberg, 2003). The survey data does not provide any data on what type of bonds respondents invest in. It is questionable whether corporate or treasury, short or long-term bonds provide better hedges against liability increases. Historically short-term high grade bonds yield barely enough to keep up with inflation (Russell, 2007) and long-term nominal bonds typically do poorly in times of high unanticipated inflation (Collimore, 2010). However, domestic bond holdings in general are perceived to provide a good hedge against real exchange rate risks (Coeurdacier and Gourinchas, 2011; Kirabaeva et al., 2009) and have a lower volatility of returns (Fidora et al., 2006). Therefore funds with higher bond holdings are expected to show higher home biases and the total percentage of allocation to bonds is included in the equation (*bond*).

[26] *According to Fidora et al. (2006) this is a reason why home biases are higher for bonds than for equities.*

Likewise Euro-zone[27] countries might also show a lower home bias, mainly because they can freely invest throughout Euro-countries without facing exchange rate risk and can expect the European Central Bank to maintain some sort of inflation target that is similar to their domestic inflation (Schoenmaker et al., 2008; Van Lelyveld et al., 2010).

As economic theory and earlier research also show differences between different groups, other dummy variables are included. This makes it possible to test whether a certain dummy is significant, and thereby indicating that the size of the home bias is different for certain groups. Besides being located in the Euro-zone or not (*euro*) a dummy on whether or not any regulation on foreign asset exists (*regu*)[28] is also included. The dataset contains one Greek observation and the OECD (2012b) survey states that investments are only permitted in EU and European Economic Area (EEA) countries. The observed Greek pension fund does however invest 30% in the rest of the world. The information provided from Swinkels et al. (2005), Erdos (2006); Chybalski (2009), OECD (2011) and OECD (2012b) therefore only gives an indication on the foreign investment restrictions. The dummy is therefore one (1) if restrictions do not allow (according to the information),[29] pension funds to invest the market capitalisation benchmark. For example, a limit on non-OECD investments of 30%[30] is not considered as a restriction, because OECD market capitalisation is approximately 75% of global market capitalisation (The World Bank, 2012).

As earlier research by Hau et al. (2008) and Ni (2009) also shows differences in home biases between different sizes of funds, it might be necessary to also include the size of a fund. The IPE survey does not include any continuous numerical variables on the number of participants or total endowments, but does have an indication whether a fund is small, medium or large. Therefore the analysis will include a dummy on whether the size of a fund is small (*s*) (under one billion Euros), medium (*m*) (one to five billion Euros) or large (*l*) (over five billion Euros). To test whether differences between types of fund exist, dummies for corporate

[27] *74 of the 110 respondents are located in a Euro-zone country*

[28] *Kreuger (1978) was one of the first to use a dummy on whether or not any (in her case; trade) restrictions existed.*

[29] *No information could be found for Romania, so there are assumed to be no restrictions.*

[30] *20% would be.*

(*corp*), industry-wide (*indu*), public sector (*publ*) and third pillar pension funds (*thir*) are included.

The analysis includes indirect diversification opportunities (*indi*), as investing in for example domestic based multinational firms can also be perceived as a form of (indirect) international diversification (Heston et al., 1994; Rowland et al., 2004). Domestic indirect diversification opportunities are measured by the relative size of a country's exports.[31] This is calculated by dividing a country's exports with the total domestic market capitalisation.

$$indi = \frac{Total\ Exports}{Market\ Capitalization}$$

As shown by Shukla et al. (1995) and Bravo-Ortega (2005), pension funds are also likely to have more information on domestic markets than on foreign markets. If pension funds do not wish to acquire more foreign information themselves (Van Nieuwerburgh et al. 2009) or at least know that their behaviour[32] biases them towards domestic assets, they might wish to use external managers that do have the information that they might not possess. Therefore the multivariate analysis is in line with the endogenous asymmetric information model, including the percentage of assets that are externally managed (*extm*).

[31] *Somewhat similar to the measurement of openness by Chan et al. (2005). Mondria. and Wu (2010). This combines the measurement of stock market capitalization with 'openness' by Beck, Demirguc-Kunt and Maksimovic (2006).*

[32] *Described by Fellner and Maciejovsky (2003)*

3.5 Alternative Variables and Constant Terms

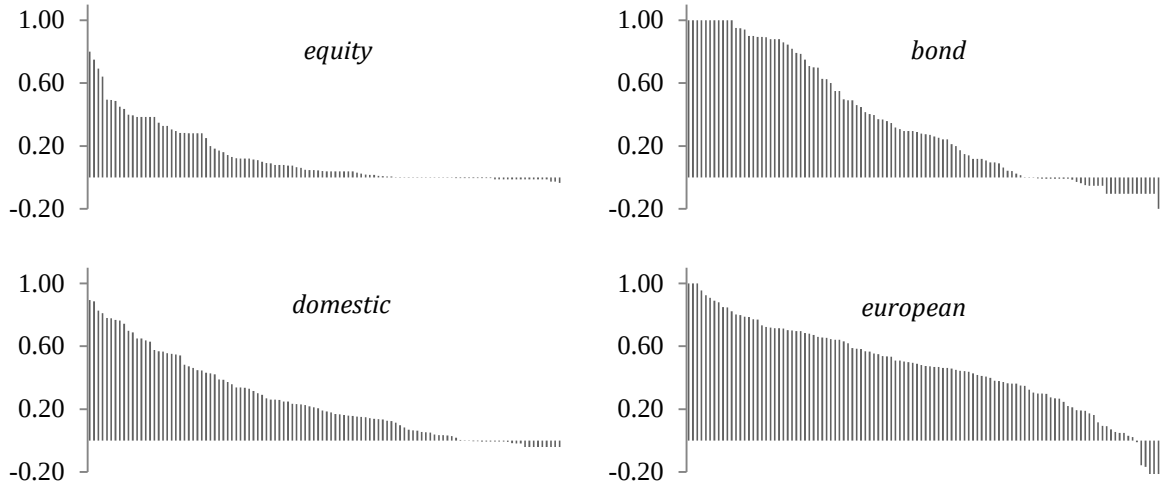
As discussed earlier, one reason why pension funds should not invest in domestic assets only, is because their performance may be highly correlated to labour income. "Human capital" is measured either quality-based or labour-income based (Schumann, 2002). Baxter et al. (1997) show this relation (labour-income based) between the growth of labour income and capital income, by using a vector error correction model (VECM).[33] The best available data for calculation of this correlation are the yearly gross labour earnings and domestic equity market returns of the past 15-20 years from Eurostat. This measure of domestic human capital correlation is added to the alternative regression (*huca*).

Different home bias variables are also included for equity, bond and Euro assets, such as equity home bias (*homeequi*), bond home bias (*homebond*) and European asset bias (*eurbias*). This is to test for differences between equity and bond home biases. Biases for different types of assets can also depend on different regulations for different types of assets. However for simplicity this thesis assumes that regulations on geographical asset allocation are the same for all types of assets. As shown in figure 14, the home bias is larger for bond assets than for equities[34]. The figure (14) also shows that the survey respondents are to an even larger degree biased towards European assets.

[33] *VECM is applied when data is non-stationary or similar*

[34] *This could possibly be because of different regulations for bond holdings.*

Figure 14: Equity home bias, Bond home bias and European asset bias of the 110 survey respondents



The effect of stock market development levels on a country's total home bias is examined by Chan et al. (2005) and Bekaert et al. (2009), who both found different results. To measure stock market development they used measures such as relative size of market capitalisation to GDP, transaction costs, and turnover ratios. Zalewska (2005) explains that pension fund home biases could in some cases also have an effect on stock market developments. From a fund to fund basis there is (besides transaction costs) no clear economic clarification as to why a pension fund would have a higher or lower home bias if it is located in a country with a more developed domestic stock market. A higher size of stock market capitalisation would imply that the benchmark of domestic assets according to the CAPM is also higher. The relative size of market capitalisation to GDP (*deve*)[35] is included in the dataset to test if it does have any effect on the multivariate analysis or if it distorts it in any way.

Transaction costs can explain the home bias to some degree as explained by Black (1974), Stulz (1981), Cooper et al. (1994), Tesar et al. (1995) and Chan et al. (2005).[36] However, data on the differences between foreign transaction costs within European Union countries is not available. The cost of trading abroad is therefore assumed to be the same for any fund located in whatever European Union country. This assumption is somewhat in line with the idea of a

[35] *As a measure of stock market development as used by Chan et al. (2005).*

[36] *Also a measurement of stock market development*

single market with free movement of capital and services. This would mean that the effect of transaction costs (if significant) is included in the intercept.

3.6 Statistics

This chapter has outlined the variables to be used in next chapter's multivariate analysis. A summary of all statistics is shown below in table 3.

Table 3: Summary of statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
home	110	0.26	0.26	-0.04	0.89
rerv	110	0.96	0.73	0	2.47
bond	110	0.49	0.19	0	0.94
extm	110	0.63	0.39	0	1
indi	110	0.49	0.85	0.06	5.07
huca	110	0.18	0.25	-0.28	0.6
euro	110	0.67	0.47	0	1
regu	110	0.1	0.3	0	1
s	110	0.43	0.5	0	1
m	110	0.37	0.49	0	1
l	110	0.2	0.4	0	1
corp	110	0.55	0.5	0	1
indu	110	0.4	0.49	0	1
publ	110	0.25	0.44	0	1
thir	110	0.02	0.13	0	1
homeequi	110	0.13	0.19	-0.04	0.80
homebond	110	0.36	0.39	-0.20	1
eurbias	110	0.47	0.29	-0.40	1
deve	110	0.45	0.24	0.04	0.87

4 Multivariate Analysis

The institutional factors that, according to earlier research and in theory, explain pension fund home biases that shall be tested for the 110 survey responses using a multivariate regression.

4.1 Regression analysis A

The dataset includes survey information on fund asset allocation and their country specific variables[37] for the year 2011. Every pension fund adds the same informational value to each observation of the home bias and weighted estimations are not considered. The variables included in the analysis are unhedged real exchange rate volatility (*rerv*), portfolio weight in bonds (*bond*), portfolio weight externally managed (*extm*), relative size of export (*indi*), human capital correlation (*huca*)[38] and dummies for Euro-zone (*euro*), regulation on foreign asset holdings (*regu*), size (small (*s*), medium (*m*),[39] large (*l*)) and *type* (industry-wide (*indu*), corporate (*corp*), public sector (*publ*), third pillar (*thir*). Below is the regression function of the home bias (*home*), including an intercept, α and error term, ε_i.

$$home_i = \alpha + \beta_1 rerv_i + \beta_2 bond_i + \beta_3 extm_i + \beta_4 indi_i + \beta_5 euro_i + \beta_6 regu_i + \gamma_1 size_i + \gamma_2 type_i + \varepsilon_i$$

The expectations for the regression, based on earlier studies are shown in table 4. There is no exact expectation on the effect of different types and sizes of funds. For size there have been studies indicating both negative and positive relations on the home bias. From an economic perspective it might be logical that in line with the assumptions of the endogenous asymmetric information model, larger funds have lower home biases.

[37] *Obtained from Eurostat, The World Bank, OECD*

[38] *Included in a second regression which is discussed later in the next chapter*

[39] *Variable m is omitted because of multicollinearity.*

Table 4: Regression expectations

rerv	+	More risk on holding foreign securities
bond	+	Less volatile returns and provide a 'hedge' against real exchange rate risks
extm	-	Fewer asymmetric information
indi	+	Multinationals could also provide (indirect) diversification benefits
huca	-	A reason not to hold domestic assets
euro	-	Less real exchange risks
regu	+	Limit on holding foreign assets
deve	~	More developed stock markets

Table 5 presents the results based on the first unweighted regression. There is a significantly positive relationship between a funds unhedged real exchange rate volatility and the home bias, which is in line with the theory that cross-country stochastic deviations from the purchasing power parity drive home biases. Funds that are exposed to higher real exchange rate volatilities also have a significantly higher bias towards European assets. Real exchange rate volatility is also partly explained by the fact that Euro countries have a significantly lower volatility than non-Euro countries.[40] Compared to the bond home bias, the equity home bias responds less to real exchange rate risks. One reason for this may be that bond returns are also less volatile. As shown in earlier research by Fidora et al. (2006), "the home bias should be higher for bonds than for equities as bond returns typically are less volatile than equity returns."

The analysis also shows that if funds allocate more portfolio weight to bonds, they show a significantly higher bias towards domestic assets, which might be because bond holdings are in general perceived to offer better hedges against inflation risks than other assets and because bonds in general have lower return volatility. One per cent extra portfolio weight in bonds, in general, means half a per cent extra home bias. Part of this relation might be due to the fact

[40] *Therefore the second regression will drop the euro/non-euro dummy*

that risk free domestic bonds are also included the home bias.[41] Likewise, regulation on bond holdings could be different than for equities.[42] However, the relation remains significant when looking at just the equity home bias. This implies that funds who allocate more of their portfolio to bonds are more likely to have a higher home bias for their equity portfolios. The bond portfolio weight also shows a significant effect in explaining the European asset bias. The strong relation of bond portfolio weights shown throughout the results is unlikely to be solely explained by the fact that domestic bonds are thought to provide better hedges against increases in liabilities. The fact that bond securities also generate less volatile returns might also attract more conservative investors[43] which might also be more biased towards domestic assets. To conclude, the relation between bond holdings and home biases could possibly be because (1) domestic bonds are perceived to provide better hedges against increases in liabilities, (2) risk free domestic assets are included in the CAPM portfolio and (3) investors that allocate more weight to bonds, that generate less volatile returns might also be more conservative in the sense that they hold more domestic assets.

As discussed earlier, information asymmetries[44] could be decreased by using external managers. Funds have a significantly lower home bias if a higher percentage of its portfolio is managed externally. Also in line with the asymmetric information model is that this effect is larger for smaller pension funds.

The estimation factor for the relative size of domestic multinational firms (indirect diversification benefits) within a country is significantly negatively related to the home bias. This does not necessarily constitute a challenge for existing theory that investing in domestic multinational firms can be seen as a form of foreign diversification. It only says that funds in countries with a larger relative size of exports (to market capitalisation) have a smaller home bias. Therefore, although a large amount of multinational exporting firms might provide

[41] *This is explained in chapter 3.2*

[42] *As discussed in chapter 3.5*

[43] *The term conservative investors is also used by Campbell et al. (2002) to describe long-term investors who hold a large portfolio weight in domestic T-bills.*

[44] *And thereby eventually home biases.*

indirect diversification benefits, the overall openness[45] of the economy still causes pension funds in this country to allocate more assets abroad. [46]

Euro-zone located funds also show a significantly lower home bias than non-Euro-zone located funds, which can possibly be explained by Union-wide inflation targets and more stable exchange rates. The sample does not show any significant effect of size on home biases and the type of fund also does not lead to any significant explanation. Whether there is regulation on foreign asset holdings or not does not have any effect on the home bias, which indicates that not all regulations on foreign assets pose a large problem on free movement of capital, such as in Poland.[47]

[45] *In this case relative size of total exports on market capitalisation, but more often assumed to be imports and exports relative to GDP (Dollar, 1992).*

[46] *Research by Chan et al. (2005) also found a positive relation between 'openness' and home biases*

[47] *Before the ECJ ruling against Poland for its 5% cap on foreign investments in 2011.*

Table 5: Effect on the home bias * significant at 10%, ** significant at 5%, *** significant at 1%, regression holds for Huber–White heteroscedasticity-consistent standard errors. Expectations (Expect.) are included.

	Dependent variable: Home Bias				
	Coefficient	Expect.	Standard Error	T- or F-statistic	P-value|
*rerv***	0.08	+	0.03	2.31	0.02
*bond****	0.59	+	0.11	5.38	0.00
*extm****	-0.18	-	0.05	-3.54	0.00
*indi****	-0.09	+	0.03	-2.93	0.00
*euro****	-0.23	-	0.05	-4.62	0.00
regu	-0.04	+	0.07	-0.51	0.61
size				1.17	0.32
s	-0.03		0.05	-0.72	0.48
l	-0.08		0.05	-1.51	0.14
type				0.46	0.76
corp	-0.03		0.05	-0.64	0.52
indu	-0.02		0.05	-0.37	0.71
publ	0.04		0.05	0.70	0.49
thir	0.05		0.16	0.32	0.75
*α***	0.25		0.11	2.37	0.02

4.2 Regression Analysis B

A second regression is formulated where: (1) the variable for human capital correlation is included, (2) insignificant variables from the first regression such as size, type and regulation are dropped,[48] and; (3) the dummy for Euro or non-Euro is dropped because of its effects on real exchange rate volatility and human capital. The alternative regression is shown below:

$$home_i = \alpha + \beta_1 rerv_i + \beta_2 bond_i + \beta_3 extm_i + \beta_4 indi_i + \beta_5 huca_i$$

The reason for dropping the Euro dummy is because real exchange rate volatilities are expected to be lower for Euro countries.[49] In the dataset, the mean of Euro-zone pension fund real exchange rate volatility is less than half the mean volatility of non-Euro funds. Human capital correlation might also be more similar for Euro or non-Euro categories. Including the Euro dummy will therefore underestimate the effect of real exchange rate volatility and human capital correlation. Further robustness testing for (multi)collinearity is included in a later chapter.

The results for the second regression are shown in table 6. The significant factor for human capital correlation shows that funds located in countries where labour earnings have moved together with equity returns for the past fifteen years, have significantly higher home biases. This somewhat contradicts the theory by Baxter et al. (1997) where less should be invested in domestic assets because of a correlation between domestic capital returns and labour income. Perhaps upward moving equity markets together with upward moving labour earnings create overconfidence in domestic assets, but this is more from a behavioural perspective and outside the scope of this paper. As seen in table 6, this effect of human capital is only significant in explaining total and equity home biases and insignificant in explaining the bond home bias.[50] Explanatory factor (*indi*), whether direct diversification benefits or measure of openness is also insignificant in explaining the bias towards domestic bonds. The next chapter

[48] *The dropped variables are also insignificant if included in the second regression.*

[49] *In line with Fidora et al. (2006), Schoenmaker et al. (2008) and Van Lelyveld et al. (2010).*

[50] *Could be because human capital correlation is calculated with the movements of equity markets*

includes a simplified regression that only includes the institutional factors that show an effect in line with their theories.

Table 6: Effect on the home bias (included: human capital correlation) (excluded: *size*, *type*, *regu* and *euro*) * significant at 10%, ** significant at 5%, *** significant at 1%, regression holds for Huber–White heteroscedasticity-consistent standard errors

	Dependent variable: Home Bias				
	Coef.	Expect.	Std. Err.	t	P>|t|
*rerv****	0.12	+	0.04	3.45	0
*bond****	0.6	+	0.11	5.39	0
*extm****	-0.15	-	0.05	-2.76	0.01
*indi***	-0.05	+	0.03	-1.95	0.05
*huca***	0.23	-	0.1	2.39	0.02
α	-0.07		0.08	-0.87	0.39

	Dependent variable: Equity Home Bias				
	Coef.	Expect	Std. Err.	t	P>|t|
*rerv****	0.07	+	0.03	2.55	0.01
*bond****	0.23	+	0.09	2.66	0.01
*extm***	-0.08	-	0.04	-2	0.05
*indi***	-0.05	+	0.02	-2.17	0.03
*huca****	0.22	-	0.08	2.92	0
α	-0.01		0.06	-0.22	0.83

	Dependent variable: Bond Home Bias				
	Coef.	Expect	Std. Err.	t	P>|t|
*rerv****	0.19	+	0.06	3.31	0
*bond**	0.33	+	0.18	1.83	0.07
*extm****	-0.23	-	0.09	-2.63	0.01
indi	-0.07	+	0.05	-1.42	0.16
*huca**	0.29	-	0.16	1.81	0.07
α	0.14		0.14	0.99	0.32

4.3 Simplified Regression

In the additional simplified regression, indirect diversification opportunities and human capital correlation are excluded. This is because their estimated coefficients are inconsistent with the institutional theories that they relied on. Funds with indirect diversification benefits were expected to show higher home biases, but the results show the contrary. There are no limitations on the benefits of diversifying internationally for funds located in less 'open' economies. Funds located in countries with higher human capital correlation were also expected to show lower home biases. The fact that this relation is significantly positive could be explained from a behavioural perspective, but does not justify funds to hold substantial home biases. The factors unhedged real exchange rate volatility, percentage of allocation to bonds and externally managed remain significant at a confidence level of one per cent. Additional testing for fund biases towards European assets show significant levels at a five per cent confidence level for bond portfolio weights and unhedged real exchange rate risks. This arguably over-simplified analysis shows an intercept of zero in which a home bias emerges when a fund is exposed to real exchange rate risks and part of the portfolio is invested in bonds. Using external managers only decreases the home bias and not the European asset bias.

$$home_i = \alpha + \beta_1 rerv_i + \beta_2 bond_i + \beta_3 extm_i$$

Table 7: Effect on the home bias (excluded: *indi* and *huca*) * significant at 10%, ** significant at 5%, *** significant at 1%, regression holds for Huber–White heteroscedasticity-consistent standard errors

	Dependent variable: Home Bias				
	Coef.	Expect.	Std. Err.	t	P>|t|
rerv***	0.13	+	0.03	4.36	0
bond***	0.47	+	0.11	4.19	0
extm***	-0.16	-	0.05	-2.99	0
α	0.01		0.09	0.11	0.91

	Dependent variable: European Bias				
	Coef.	Expect.	Std. Err.	t	P>|t|
rerv**	0.07	+	0.03	2.18	0.03
bond***	0.99	+	0.12	8.51	0
extm	-0.06	-	0.06	-1.12	0.26
α	-0.04		0.09	-0.44	0.66

4.4 Checks

The classical assumptions must also be met for the ordinary least squares (OLS) method and thereby T- and F-statistics to hold (Gujarati, 2001). Assumption 1 holds as the regression is linear[51] and has an additive error ε_i. The error term has a zero mean (A. 2). The existence of the constant term (α) compensates the chance that the population mean of the error term might not equal to zero. In order to test whether the error term is correlated with the explanatory variables, the error term's (*error*) correlation with all variables is shown in table 8. The correlation between the error term and the independent variables are all zero (A. 3). As also seen in table 8, there is no perfect multicollinearity between the explanatory variables (A. 4). The variance of the error term should be constant (A. 5). Heteroskedasticty indicates that the variance of the error term increases as variable values increase.[52] This means that the coefficients but not the statistical tests can be interpreted. In order to correct for heteroscedasticity a robust regression[53] is used to check the validity of the statistical tests. With the robust regression, parameter estimates do not change, but the standard errors become slightly larger. The regression is not influenced by the presence of serial correlation because it does not have any time variables (A.6) and the error term is normally distributed[54] (A.7).

Relative size of stock market capitalisation to GDP is added to test if there is an effect of stock market development on the observed home biases (not expected) and whether it might distort other variables such as the relative size of exports. If stock market development is included it does not provide a significant result at all and does not distort any other significance levels. A variance inflation factor test is also conducted to test how much the variance of the coefficient estimates are inflated by collinearity. As shown in table 9 VIF values are far below the critical values indicating that the variance of the coefficient estimate is not being inflated by collinearity.

[51] *NLCHECK by Jann (2008) rejects nonlinearity.*

[52] *Breusch-Pagan test for heteroscedasticity rejects the hypothesis that the error term is constant.*

[53] *Huber–White heteroscedasticity-consistent standard errors*

[54] *The hypothesis that the error term (ε) is normally distributed cannot be rejected using Jarque-Bera, Shapiro-Francia and Kolmogorov-Smirnov tests.*

Table 8: Correlations of the variables

	home	rerv	bond	extm	indi	huca	euro	regu	s	l	corp	indu	publ	thir	r
home	1.00														
rerv	0.33	1.00													
bond	0.33	-0.19	1.00												
extm	-0.37	-0.15	-0.19	1.00											
indi	0.02	0.35	0.19	-0.15	1.00										
huca	0.34	0.45	-0.25	-0.17	-0.19	1.00									
euro	-0.45	-0.54	0.11	0.08	-0.23	-0.33	1.00								
regu	-0.08	0.12	0.00	-0.09	0.39	-0.07	-0.03	1.00							
s	-0.10	0.12	0.07	-0.02	0.36	-0.28	0.09	0.26	1.00						
l	0.04	-0.12	-0.01	-0.13	-0.19	0.16	-0.14	-0.09	-0.43	1.00					
corp	-0.12	-0.09	0.15	0.10	-0.05	0.01	0.23	0.05	0.22	-0.24	1.00				
indu	0.04	-0.13	0.11	-0.20	0.12	-0.05	-0.02	-0.09	-0.22	0.10	-0.43	1.00			
publ	0.09	0.26	-0.11	-0.13	0.26	0.13	-0.17	0.15	-0.08	0.23	-0.36	-0.05	1.00		
thir	0.15	0.06	0.20	-0.10	0.10	-0.14	-0.05	0.18	0.16	-0.07	-0.15	-0.11	-0.08	1.00	
error	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00

Table 9: Variance inflation factor (VIF) tests for collinearity

First			**Second**			**Simplified**		
Variable	VIF	Tolerance	Variable	VIF	Tolerance	Variable	VIF	Tolerance
rerv	1.85	0.5408	rerv	1.75	0.5717	rerv	1.08	0.9274
bond	1.34	0.7489	bond	1.19	0.8377	bond	1.09	0.9164
extm	1.19	0.8382	extm	1.12	0.8911	extm	1.08	0.9299
indi	1.87	0.5361	indi	1.48	0.6739			
euro	1.6	0.6238	huca	1.6	0.6265			
regu	1.29	0.7756						
s	1.55	0.6443						
l	1.42	0.7035						
corp	1.89	0.5287						
indu	1.71	0.5855						
publ	1.6	0.627						
thir	1.31	0.7661						
Mean VIF	1.55		Mean VIF	1.43		Mean VIF	1.08	

5 Conclusion

This thesis has analysed the home bias in European pension funds. The CAPM prescribes a theoretical optimal portfolio weight of foreign and domestic assets. A home bias is observed in over 79% of the funds who participated in the survey. The institutional factors that could explain home biases for EU pension funds have been tested using a multivariate analysis. Surveyed funds with larger unhedged real exchange rate volatilities generally have larger home biases. Pension funds might prefer to allocate assets to domestic bonds, since bonds are thought to provide better hedges against increases in liabilities and less volatile returns. However, funds that allocated more to bonds in general also had higher equity home biases. This might be because conservative investors who allocate large proportions to bonds are also more 'conservative' in the sense that they are more biased towards domestic assets. A lack of information about foreign assets might be decreased by using external managers and thereby eventually cause lower home biases. Investing in domestic multinationals could also provide indirect diversification benefits as their performance relies largely on export, but this does not provide an explanation for the observed home biases as the regression shows a negative relationship. This might be a result from the fact that countries with a relatively larger export have more 'open' economies, therefore; funds might allocate more assets abroad. Some survey respondents also have a negative home bias, which might be because of a positive correlation between domestic market returns and human capital. The measurement of human capital correlation, however, showed a positive relation to the home bias, especially to equities. This goes against the idea that fewer domestic assets should be held, but can possibly be explained from a behavioural point of view. The regression did not show any significant differences in home biases for different sizes and types of funds. Individual member state regulation on foreign asset allocation also does not show a significant effect for home biases, which indicates that not all regulations on foreign assets pose a large problem on the free movement of capital. A home bias is observed in over 79% of the funds who participated in the survey and this bias can only partly be explained. The idea that transaction costs and behavioural factors contribute to the home bias might seem logical. The question remains, however, as to what extend these factors pose limitations on the benefits of international diversification and justify funds to hold substantial home biases.

5.1 Suggestions for Future Research

Future research might be able to include surveys with more qualitative questions that are directly related to factors that could explain a fund's choice to hold domestic assets. This method would also provide better insights into the behavioural factors that contribute to the home bias and would also help to further explain the observed relationships between bond holdings and home biases. The explanatory factors, human capital correlation and indirect diversification benefits showed results that were different than the expectations. A better estimate for indirect diversification benefits (for example, the number of multinational enterprises or GDP openness) might show different results that are possibly more in line with theory. Further research on the (perhaps behavioural) factors that drive the relation between home biases and human capital correlation might provide a valid reason for pension funds to decrease their home biases.

5.2 Policy Recommendation

This thesis only partly explains why pension funds hold a home bias. If pension funds themselves can also only party explain their home bias, decreasing it still might be in favour of (1) protecting participants, (2) maintaining sustainability and (3) strengthening the single market. The current IORP Directive already states that pension funds should "avoid excessive reliance on any particular asset, issuer or group of undertakings" and can benefit "from the advantages of international diversification". The inclusion of an article that pension funds should also avoid excessive, unnecessary or unjustifiable reliance on a single country might also help protect participants and maintain sustainability.

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7 Appendix

Attached are the questions of the secondary survey conducted by IPE International Publishers Limited (2012).

Contact details:
Organisation: (#)
Country:

Sector(s) in which organisation operates:

- Pension funds - Company/Corporate
- Pension funds - Industry-wide/Multi-employer/Professional
- Pension funds - Public sector
- Life insurance
- Non-life insurance
- Corporate/Treasury
- Bank
- Foundation/Charity or other Non-profit
- Mutual
- Other

Organisation size:

- S (under one billion Euros)
- M (one to five billion Euros)
- L (over five billion Euros).

Current strategic asset allocation (%):

- Equity
- Fixed income - Government/Sovereign
- Fixed income - Corporate bonds
- Fixed income - Other
- Real estate
- Cash
- Private equity
- Hedge fund
- Commodities
- Infrastructure
- Forestry/Timberland/Agricultural land
- Other alternatives

% breakdown of fund's strategic asset allocation, for the following regions:

- Equity - Domestic (%)
- Equity - Rest of Europe (%)
- Equity - Rest of World (%)
- Fixed income - Domestic (%)
- Fixed income - Rest of Europe (%)
- Fixed income - Rest of World (%)

- Real estate - Domestic (%)
- Real estate - Rest of Europe (%)
- Real estate- Rest of World (%)

Planned changes in 2011 to strategic asset allocation:

- Equity - Own country
- Equity - Rest of Europe
- Equity - USA
- Equity - Asia (Inc. Japan)
- Equity - Other markets
- Fixed income - Government/Sovereign
- Fixed income - Corporate bonds
- Fixed income - Other
- Real estate
- Cash
- Private equity
- Hedge fund
- Commodities
- Infrastructure
- Forestry/Timberland/ Agricultural land
- Other alternatives

How often does your fund review strategic asset allocation?
How often do you review your asset allocation on an interim basis?

Investment assets, by asset class and by investment type, as at 30/6/10:

- Fixed income - Internally Managed
- Fixed income - Externally Managed
- Equity - Internally Managed
- Equity - Externally Managed
- Real estate - Internally Managed
- Real estate - Externally Managed
- Other - Internally Managed
- Other - Externally Managed

% of externally managed investments as at 30/6/10 in:

- Segregated accounts
- Investment funds/limited partnerships etc.

Approach/techniques employed to manage liabilities/guarantees:

- Liability driven investment strategies
- Other matching strategies

Types of derivatives or derivative products used within portfolio:

- Interest rate swaps
- Inflation rate swaps

- Other swaps
- Options
- Futures/forwards
- Other derivatives/products

If you use overlays in your portfolio, please state which types:

If you hedge your currency risks, what proportion of your assets is covered by a hedge? (%)

Overall duration of fixed income portfolio and actual liabilities, in years:
- Fixed income portfolio
- Actual liabilities

If you use hedge funds, which of the following do you use:
- Internally managed strategies
- Hedge funds of funds
- Managed platform
- Single strategies

Hedge fund strategies used:
- Multi-strategies
- CTA global
- Convertible arbitrage
- Equity market neutral
- Global macro
- Event driven
- Long/short equity
- Other

% of portfolio managed:
- Actively (%)
- Passively (%)

Techniques used to gain index exposure:
- Open-ended mutual funds
- Segregated index tracking equity accounts
- Derivatives
- Exchange Traded Funds
- Other

% of your asset allocation:
- Currently covered through ETFs (%)
- Expected in 2 years' time (%)

In choosing ETFs for portfolio, importance of the following features (1= least important, 5= most important):
- Liquidity

- Cost factors
- Counterparty
- Absence of derivatives
- Number of authorised participants

Current use of indexes/index products as part of portfolio:
- Benchmark indexes
- Fundamental index/products
- Enhanced index products
- Intelligent index (quant index)
- Other

If you use SRI/ESG investment in portfolio currently, what % is covered by these strategies?

Do you have a written policy on, or follow external principles or guidelines for:
- SRI/ESG
- Corporate governance strategy
- Voting
- Mandating voting to a third party
- Engagement strategy
- Require external managers to be signatories to UNPRI
- None
- If 'None', do you plan to draft such a policy in the coming year?

Reasons for pursuing SRI or ESG strategies:
- Beliefs of owners and Board
- Governance
- Social and environmental values
- Corporate culture
- Performance
- Other

Do you plan to increase % of assets governed by an SRI policy in the next year?

Do you require any of your managers to be signatories to the United Nations Principles of Responsible Investing?

When selecting an external investment manager, significance of following (1= Not at all significant, 5= Very significant):
- Clarity of investment process
- Client service
- Corporate governance
- Financial strength of external manager
- Investment management fees - level of fees
- Investment management fees - transparency of fees
- Performance
- Quality of reporting

- Reputation of asset manager (brand)
- Risk control
- Stability of investment team
- Understanding of your organisation's particular goals and needs
- SRI/ESG credentials
- Other criteria

Current compensation of an external investment manager:

- Cash
- Fixed income
- Equity
- Balanced
- Real estate
- Private equity
- Hedge funds
- Other

What would your preference be for compensating an external investment manager?

- Fixed income
- Equity
- Balanced
- Real estate

- Types of performance fees favoured:
- 1-year performance
- Rolling basis
- High watermark
- Hurdle (e.g. Libor/benchmark plus)
- Other

Termination of investment manager relationships:

- In 2009 - Pooled funds
- In 2009 - Segregated accounts
- In 2010 - Pooled funds
- In 2010 - Segregated accounts

Reasons for terminating investment managers relationships in the past three years (1= Not at all important, 5= Most important):

- Unsatisfactory performance
- Failure to control risk
- Lack of clarity in fund management policy
- Breach of investment constraints
- Inability of investment manager to advise on investment
- Change of investment strategy or asset re-allocation
- Internal reorganisation of your group
- Reorganisation of investment manager's group
- Inadequate reporting/contact

- Excessive turnover of investment team
- Cost competition
- Other

If you do securities lending, what percentage do you permit:

- Equities (%)
- Bonds (%)
- Other
- No strict limit

If you have employed an external investment consultant during the past year, what have they been employed to do:

- Asset allocation
- Select investment managers
- Liability management
- Risk management advice
- Investment performance measurement
- Alternative investment advice
- Internal structure/governance
- Fiduciary management
- Implemented consulting
- External manager monitoring