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How does the Norwegian, Dutch and Canadian models compare in terms of investment management and returns?

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TABLE OF CONTENT

ABSTRACT	1
1. INTRODUCTION	1
2. BACKGROUND AND LITERATURE	3
2.1. BACKGROUND	3
2.2. PREVIOUS LITERATURE	5
3. THEORY	6
3.1. THE ENDOWMENT MODEL	6
3.2. LIABILITY OF A PENSION PLAN	8
3.2.1. <i>DEFINED BENEFIT (DB) PLAN</i>	8
3.2.2. <i>DEFINED CONTRIBUTION (DC) PLAN</i>	9
4. INSTITUTIONAL STRUCTURE AND INVESTMENT MANAGEMENT	9
4.1. HISTORIES AND STRUCTURES	9
4.1.1. <i>NORWAY</i>	9
4.1.2. <i>THE NETHERLANDS</i>	11
4.1.3. <i>CANADA</i>	12
4.1.4. <i>OVERVIEW</i>	13
4.2. THE EVOLUTIONS OF THE INVESTMENT MANAGEMENT APPROACHES	14
4.2.1. <i>NBIM</i>	16
4.2.2. <i>APG</i>	18
4.2.3. <i>CPPIB</i>	20
5. DATA	22
5.1. SOURCES	22
5.1.1. <i>NORWAY</i>	22
5.1.2. <i>THE NETHERLANDS</i>	23
5.1.3. <i>CANADA</i>	24
5.2. LIMITATIONS	24
5.2.1. <i>NORWAY</i>	25
5.2.2. <i>THE NETHERLANDS</i>	25
5.2.3. <i>CANADA</i>	26
5.3. RETURNS COMPUTATION	27
5.3.1. <i>NBIM</i>	27
5.3.2. <i>ABP</i>	29
5.3.3. <i>CPPIB</i>	30
6. COMPARISON	32
6.2. RETURNS	32
6.3. RISK	34
6.3.1. <i>STANDARD DEVIATION</i>	34
6.3.2. <i>SHARPE RATIO</i>	36
6.3.3. <i>BETA</i>	38
6.3.4. <i>INFORMATION RATIO</i>	39
6.3.5. <i>TRACKING ERROR</i>	39
6.3.6. <i>DISCUSSION</i>	40
6.4. COSTS	41
6.4.1. <i>TOTAL COSTS</i>	42
6.4.2. <i>OPERATING EXPENSES</i>	43
6.4.3. <i>TRANSACTION COSTS</i>	45
6.4.4. <i>EXTERNAL COSTS</i>	46
6.4.5. <i>DISCUSSION</i>	49

7. CONCLUSION	50
8. BIBLIOGRAPHY	53
9. APPENDIX.....	61
A. RETURNS	61
B. RISK.....	63
C. COST	64

ABSTRACT

This paper examines the similarities and differences between the Stichting Pensioenfonds ABP (Algemeen Burgerlijk Pensioenfonds), the Canadian Pension Plan and the Government Pension Fund Global. Based on the funds' investment management strategies, a comprehensive comparison has been made by examining the respective funds' risk-return relationships and their associated cost levels throughout the past two decades. The strategies have been linked up to the Endowment Model, pioneered by David F. Swensen. We find that, despite having numerous similarities due to the nature of their liabilities, the funds' embodiments have significant implications regarding performance. Overall, NBIM achieves the poorest risk-return relationship while ABP achieves the best, moreover, CPPIB is the least cost-efficient and NBIM is the most.

1. INTRODUCTION

Since the late 1990s the Norwegian oil fund, the Government Pension Fund Global (GPFG), together with the Canadian Pension Plan (CPP) and the Stichting Pensioenfond ABP (ABP), have grown to become among the largest pension funds in the world. During the past two decades, these three pension funds, both sovereign and regular, have become three large institutions with significant impact on the market and the environment. They are all recognized for being pathbreakers in terms of innovative investment management, with their own investment approaches. Notably, what the three funds have in common, is the substantial growth they have experienced in a relatively short amount of time, making them a highly interesting subject in the pensions fund industry.

Out of 300 pension funds in the world, these three were all ranked among the top ten largest pension funds in 2015 in terms of assets (Willis Tower Watson, 2016). Along with managing billions of dollars, the funds carry additional responsibilities to the public beyond earning positive returns, as these social institutions call for securing beneficiaries' long-term welfare. Given the ageing demographics they face, the necessity of managing the pension funds in a cost-efficient manner, as well as earning high enough profits to prevent risk factors such as longevity and inflation, are therefore crucial.

Thus, the objective of our thesis has been to document the similarities and differences between the Norwegian, the Canadian and the Dutch approach in terms of investment management and returns during the past two decades. The former relates to similarities and differences in the funds' investment philosophies, investment management, risk and asset allocations, while the latter relates to the different risk-return relationships and the funds' associated costs. Furthermore, a vital part of this study has been to document the real figures, as opposed to those stated by the organizations themselves.

Our research question is therefore:

How does the Norwegian, Dutch and Canadian models compare in terms of investment management and returns?

Further, as the pension funds are not publicly traded, they do not need to announce results in the same manner. One is therefore dependent on collecting information from their published reports, whether this is expressed monthly, quarterly, annually, or even at all. The degree of transparency, and in what manner the funds choose to present themselves, will therefore play a significant role in how they are viewed by the public, and by extension – this paper.

Structuring the available information and comparing how these three specific pension funds perform, whilst taking into account the amount of risk they take and their associated costs, will provide further knowledge on a relatively new topic. In addition, it might bring forth possibly revealing insights into how the funds are being managed.

In order to carry out our thesis, we have gathered information through the respective funds' websites, their financial reports and relating literature. We have also received quarterly returns from the ABP directly as they do not publish more frequent reports than annually.

Throughout our paper, we have found that all three funds have moved from a passively managed strategy, towards an active strategy, becoming more similar to an endowment model in terms of investment strategy. This entails that the funds have given higher weights of their allocations to equities and alternatives, as well as investments in emerging markets. As such, this shift has consequently brought on higher cost- and risk-levels for the funds, with varying results.

We argue that ABP is considered the superior fund with regards to risk and return, whereas GPFG gains the lowest returns compared to its level of risk. In fact, the latter performs quite poorly in total, when examining their results beyond inflation and beyond benchmark. Thus, one could question whether the fund would be better off performing a passive rather than an active management strategy.

Further, the Dutch fund seems to have shifted towards an active management strategy more cost-efficiently than its peers, while CPP seems to be the most expensive fund. However, when taking into consideration the funds' different

embodiments, where CPP has had a relatively more radical shift in strategy compared to GPFG, this potentially justifies its increasing cost levels.

In the following sections of this paper, we will first present the background for choosing the topic, followed by a literature review in section 2. In section 3, the Endowment Model as well as theory related to the liabilities of a pension plan will be described. Moving on to section 4, a presentation of the three funds' histories and structures will be given, as well as the evolutions of the investment management approaches, before a description of the data will be given in section 5. Further on, a comparison between the funds' costs levels and their risk-return relationships will be made in section 6, tying in their respective investment management strategies. Finally, conclusion remarks are drawn in section 7, where we will summarize the similarities and differences between the three pension funds.

2. BACKGROUND AND LITERATURE

2.1. BACKGROUND

This thesis consists of a selection of successful sovereign and regular pension funds, each possessing characteristics such as long-term investment horizons and repeatedly large capital inflows. The pension funds were chosen mainly due to their specific characteristics, as well as their accessibility and historical performance. The funds, GPFG, ABP and CPP, all share similar comparative advantages which will provide a good basis for comparing the funds' different investment philosophies, and –management styles, risk and asset allocations throughout the past 20 years. To our knowledge, there is no existing literature comparing these specific funds, at this date.

NBIM, which manages the GPFG, have for many years been recognized for their investment approach, some authors even calling it The Norway Model (Chambers, Dimson & Ilmanen, 2012). Similarly, APG and CPPIB, managers of ABP and CPP respectively, are well recognized for their investment approaches, both being recognized as pathbreakers in terms of innovative investment

management. The term Canadian Model has been used to describe CPPIB's management style due to their recent years of success (Barney, 2017), whilst ABP might be setting a trend with their unique investment philosophy, building a new model to follow (Heaney, 2008).

The attention these three funds' have received in recent years hinges largely on their respective managers' expertise and their capacity of executing innovative strategies, both resulting in high profits. Therefore, assets under management have rapidly increased, and as a result, all three funds were ranked among the world's top ten pension funds in 2015 (Willis Tower Watson, 2016). Nevertheless, the attention does not only relate to the high profits generated, it has also brought the funds' high risk- and cost levels on the agenda (Simon, 2013). As providers of long-term welfare, it can be viewed as highly important to disclose comparable figures of the funds' performances during the last two decades, taking into account their returns and their associated risk- and cost levels. Sovereign or not, we find that insight into these contents are of high interest to the public.

Although most of this information is retrievable by the public, it is measured and reported differently by each of the respective funds, all having their own objectives and views. As Susan K. Urahn states (2016), "pension investments are increasingly complex, but disclosure standards have not kept pace". Thus, the level of transparency is still highly inadequate, although an effort was made during the mid-2000s to put an end to this. Hence, finding the true figures as well as their corresponding interpretations without interference will be of high value. Moreover, extracting numbers based on historical book values from their reports, as well as comparing them in the same currency, will give a better framework for interpreting and comparing how the funds operate and perform. Both GPF and CPP have displayed a relatively high degree of transparency by publishing to the public their investment boards' monthly reports. On the contrary, ABP's reports have not been published more frequently than on an annual basis and were only retrievable from certain databases.

Lastly, we find it important to emphasize that returns earned by the respective funds do not directly affect the beneficiary's size of retirement benefits. However, the funds' realized returns indirectly affect current and future members' pension

payments and contribution rates. This is because the realized returns must be of such a caliber that they exceed both the level of inflation and the costs related to running the funds. Should it be the case that a pension fund does not manage to meet its liabilities, the taxpayers must then cover the difference between required and realized returns. Specifically, the members' payouts will either be reduced, or the contribution rates are forced to increase. In theory, a pension fund which over-performs over time may in contrast allow for increased retirement benefits, or a reduced contribution rate (Clemens & Emes, 2016 p. 6). This demonstrates how crucial it is with a well-managed pension fund.

2.2. PREVIOUS LITERATURE

During the last two decades, several studies have been conducted on the subject of investment management of pension funds. To our knowledge, there is no existing research comparing NBIM, APG and CPPIB, in one study, although they have all been compared to other funds separately. In this part of the thesis, we will review relevant research papers for our study, and their findings.

A research paper written by Vittas, Impavido and O'Conner (2008) compares four public pension funds, among them GPF and CPP, in terms of performance and investment strategies. The paper presents a historical overview of the four public pension funds' and how they have performed. Moreover, it discusses the funds' governance, their investment policies and strategies, and accordingly, their strategic asset allocations.

In regards to literature on the CPP, a report written by Philip Cross and Joel Emes (2016) examines what they call "the true costs" of CPP. They use CPPIB's quarterly reports in order to see the trend in costs and how they have increased throughout the past decade. To the authors' surprise, they find that total costs of running the CPP are vaguely displayed by the CPPIB and the Government.

The Norway Model is written by Chambers et al. (2012), and it addresses the management strategy and the performance of the GPF. Despite being enlightening when reviewing the fund's strategy, most of the information from this article is solely based on statements and reports published by NBIM

themselves, without additional investigation. Making it highly biased towards NBIM's view and meanings.

Another study by Ang, Brandt and Denison (2014) has reviewed NBIM's active management strategy more in detail. This study finds that NBIM's risk profile has reduced significantly over the years, generating consistently positive returns as of 2009, due to their active management strategy. On average, NBIM gained returns of 0.1 percent per month. However, this study is performed on behalf of the GPFG, thereby omitting to report critical aspects of the funds operations.

Further, OECD published the book "Institutional Investors in the New Financial Landscape" (OECD, 1998). This text portrays a thorough overview of the greatest forces affecting the rise in institutional assets, including recent trends, future prospects, financial market implications and different challenges. Among the selection of pension funds based in OECD-countries, is ABP, whereby its initial investment philosophy and asset allocation is comprehensively described.

3. THEORY

3.1. THE ENDOWMENT MODEL

The traditional investment portfolio generally consists of a strategic allocation plan, whose goal is to invest 60 percent of its assets in stocks and 40 percent in bonds (Lim, 2014). During the early 1990s, this traditional investment philosophy was challenged by an approach to institutional investment, known as the endowment model. The model was pioneered by David F. Swensen, who is the chief investment officer at Yale University (Monk, 2014). The model has been imitated by numerous other universities, due to its successful performance.

The endowments of universities are managed to permanently fund a share of the universities general expenses over the long term. Such as expenses is related to teaching, research and innovation, and public service missions of institutions (The American Council on Education, 2017). In many cases endowments are the most important sources of revenues for these institutions (The American Council on

Education, 2017). The funding of an endowment typically come from charitable donations, where the growth of assets comes from regular donations and positive net investment returns from the endowment's investments (The American Council on Education, 2017).

Endowment spending policies provide tools to ensure that income from the endowments are used for intended purposes, and further to ensure intergenerational equity and a sustainable "smooth spending course" (The American Council on Education, 2017). Most universities sets approximately around a four to five percent payout each year. Moreover, according to The American Council on Education (2017) an endowment's required return is around nine to ten percent. This is considered sufficient for the endowment to cover both a payout rate of five percent, investment management costs of one to two percent, and lastly to cover reinvestments of portions of the investment income in order to "maintain the endowment's value relative to inflation" (The American Council on Education, 2017).

Endowments have an infinite long horizon, and are therefore usually managed for the long-term in order to counterbalance the increasing demands of future funding, whilst maintaining the "purchasing power to fund future operations" (The American Council on Education, 2017). This long-term horizon makes it possible to invest in a broader set of investments.

In the 1990's, Yale's endowment shifted its focus from relying on stocks towards an increasing use of diversification as well as a more aggressive orientation towards active management of equities and alternative asset classes (Chambers & Dimson, 2015). The endowment thus believed that less liquid assets would yield higher returns. Further, the endowment's long-term horizon implied that it could bear the risk of investing a larger proportion in alternatives compared to individual investors with shorter horizons (Craig, 2017). In addition, the fund's portfolio management were to a large extent to be contracted out to external managers (Hudson, 2015).

As a result of the long-term horizon of an endowment, it is better equipped to effectively disregard the pressure to generate short-term returns, whilst being

unaffected by rapid short-term movements in the market. Hence, it is able to more efficiently control risk (The American Council on Education, 2017). Being a long-term investor further involves the potential to mitigate risk by using diversification, whereby risk factors such as capital market risk, as well as inflation- and deflation risk, can be diversified (Vigneron, 2010). Despite several advantages of investing in equities and alternatives, diversification prevail as being one of the best tools an investor has, in terms of reducing risk and increasing returns (Leibowitz, Bova & Hammond, 2010 p. 5).

Although the endowment model has gained significant popularity, other institutional investors believe the model is contradictory to long-term investing (Monk, 2014). This is because their external managers are protected from scrutiny (Monk, 2014), as the institutions are reluctant to question their profiled managers. This further entails that the funds are not informing their stakeholder about the amount being paid in fees to external managers (Monk, 2014). Needless to say, these features are highly problematic. Further, endowments are still exposed to market risks, despite having a long-term investment horizon, and by using diversification (The American Council on Education, 2017).

3.2. LIABILITY OF A PENSION PLAN

According to the OECD (1998 p. 283) “the liability structure is the starting point for the investment strategy of a pension plan”, and its structure differs notably whether it is a defined benefit plan or a defined contribution plan.

3.2.1. DEFINED BENEFIT (DB) PLAN

In a defined benefit (DB) pension plan the pension plan sponsor guarantees the pension benefits, and thereby accepts liability for future pension payments (OECD, 1998 p. 283). Hence, the sponsor’s main objective is to fund its liabilities over the long term, implying that a sponsor will need large reserves in order to cover its DB liabilities (Folpmers, 2012).

The pension plan sponsor thereby holds all the risk, which must be reflected in “the level of premium contribution” (OECD, 1998 p. 283). Risk factors related to

DB schemes are low interest rates, which will push up the liabilities, and increased life expectancy of pensioners (Folpmers, 2012).

A DB plan includes several types of pension plans, like the final pay plan and the average pay system. The former, and most expensive plan, involves that the benefit when retiring is based on the most recent salary, or the salary of the last two to five years. The latter involves that the pension is based on a sum of money which is “assigned to every working year” (OECD, 1998 p. 283).

3.2.2. DEFINED CONTRIBUTION (DC) PLAN

In a defined contribution (DC) pension plan, the member pays a “contribution in exchange for a given amount of money in the future” (OECD, 1998 p. 283). The amount of money is based on realized investment results. Further, the investment risk in a DC scheme is carried by the member, as opposed to a DB plan. The sponsor’s cost will thus be limited to a “pre-specified contribution rate”, and will thereby not produce any future fiscal liabilities (OECD, 1998 p. 283).

4. INSTITUTIONAL STRUCTURE AND INVESTMENT MANAGEMENT

4.1. HISTORIES AND STRUCTURES

4.1.1. NORWAY

The Government Pension Fund comprises of the Government Pension Fund - Global (GPFG), and the Government Pension Fund - Norway (GPFN). This study focuses on the GPFG, which solely invests outside of Norway, as this is the fund that has received worldwide recognition for its management approach. The GPFG was formally established in 1990 with the objective to facilitate governmental savings in order to finance public pension expenditures. The fund is not exclusively a pension fund, as it plays a large role in the Norwegian economy and its welfare. For example, in the occurrence of a budget deficit the fund will have to cover this gap (NBIM a, 2001). The fund is categorized as a defined benefit

pension plan based on final pay schemes (Ponds, Severinson & Yermo, 2011 p.16).

The asset owner of the fund is the state of Norway, represented by the Ministry of Finance, and the fund manager is represented by the Central Bank of Norway, through its asset management unit Norges Bank Investment Management (NBIM), established in 1998 (NBIM b, 2015). The Ministry of Finance has the legal responsibility of the fund and sets the guidelines and mandates for how NBIM should manage it. Since the fund is owned by the people, it has to operate in a more transparent manner than that of its peers. Thus, reports and other details regarding the operation of the fund, are published quarterly. Additionally, each spring and fall, a message concerning the management of the fund is sent by the Ministry of Finance to the Parliament of Norway.

The motive behind the establishment of the fund was that government assets would be preserved for future generations. I.e., it is set to secure long-term use of the government's petroleum revenue while at the same time accommodate for oil price movements (The Norwegian Government, 2017). The government additionally created the fiscal rule of four percent, which is an extraction rule introduced in 2001. While the fund initially was expected to have a lifetime of approximately 30 years, it is today expected to last for a century or more (Milne, 2012).

Since inception, the fund has grown rapidly, and in 2016 the fund comprised of 866 billion U.S. dollars in total assets and was classified as the second largest fund in the world, as shown in table 2 (Willis Towers Watson, 2016). The fund's size, its long-term horizon, the absence of any specific future liabilities, the regular large capital inflows, transparency and social responsibility approach are all characteristics that forms the Government Pension Fund - Global and The Norway Model (Chambers et al., 2012).

4.1.2. THE NETHERLANDS

The Stichting Pensioenfonds ABP is a Dutch pension fund responsible for managing the pension of the people working in the government and education sector (ABP a, 2017). The fund was established in 1922 under the control of the state and in 1996 the fund went private. Since the privatization of the fund, it has worked as an independent institution (Heaney, 2008), and is controlled by public regulations.

ABP is classified as a defined benefit pension plan, to 2.6 million people in the Netherlands. In 2008, ABP outsourced its asset management to the fund's subsidiary, Algemene Pensioen Groep N.V. (APG), which thereby became the administrators of ABP. APG is an organization that provides financial services such as asset management and consultancy to a number of collective investment arrangements. These services are provided to ABP and other Dutch pension funds (Stawick & Murphy, 2010). Among the fund's main sources of income are the employee contributions and positive net returns from APG's investments.

Originally, the objective of the fund was to cater for civil servants' retirement, which is the same objective as today. However, while under governmental control, the fund was not fully permitted to invest outside of the Netherlands and they also had to allocate most of their assets in government debt, restricting the fund from investing in a wide spectrum of investment opportunities (Burchill, 1996). This brought a significant restraint on achieving the high returns which could benefit civil servants in the future. ABP fought long for removing governmental influences, and for a greater autonomy (Burchill, 1996), especially since the fund was governed by their own special law due to its size. The main motive behind the privatization, however, was financial. Governmental inflows were starting to halter, and they did not want to be solely responsible for the future liabilities of employees (Burchill, 1996).

In 2016 ABP was ranked as the 5th largest fund in the world, as seen in table 2, managing more than 384 billion US dollars in total assets (Willis Tower Watson, 2016). Since its privatization, the fund has experienced a significant growth, indicating that its innovative management style throughout the past 20 years has

clearly paid off. For our purpose, the period from the privatization up until today, will be the main focus of this research paper.

4.1.3. CANADA

The Canadian Pension Plan (the CPP) is a public pension plan established in 1966. During the 1990s, it was feared that the CPP would become insolvent by 2015 (Vittas et al., 2008), due to their unsustainable investment plan, which solely consisted of investments in non-marketable government securities (Vittas et al., 2008), and the increasing ratio of retirees to workers (CPPIB a, 2017). Thus, in 1997, the Canadian Pension Plan Investment Board (CPPIB) was created by the Parliament, with the mission to invest excess funds of the CPP (Clemens & Emes, 2016 p. 4) and maximize long-term investment returns. Therefore, CPPIB's objective became to increase the reserves, an objective imperative for the future existence of the organization (Vittas et al., 2008).

The pension plan is a defined benefit scheme to all working Canadians. Moreover, CPP receives regular inflows through mandatory contributions from employers and employees. The plan was constructed by the federal government and a selection of the provincial governments (Ang et al., 2014 p. 109). Additionally, the fund is independent from the government, and according to Vittas et al. (2008 p. 43), it therefore must strive to attain "full public accountability and transparency".

Even though CPPIB works independently from CPP, it is accountable to the Parliament. The fund will therefore be influenced by the government although they operate at "arm's length" (CPPIB a, 2017). CPPIB is not responsible of managing any other assets than those transferred from the CPP, and they retain all profits they generate from their investments (Vittas et al., 2008 p. 36).

As seen in table 2, the CPP was in 2016 ranked among the top 10 pension funds in the world, managing more than 202 billion US dollars in total assets (Willis Tower Watson, 2016). Since the creation of CPPIB, the fund has grown significantly, and the board have received worldwide recognition for their

management approaches. The time period of interest is therefore from the creation of CPPIB up until today. Further, CPPIB is characterized by its long-term horizon, and regular net inflows from CPP up until at least the end of 2020 (CPPIB f, 2017).

4.1.4. OVERVIEW

Both GPFG, ABP and CPP share characteristics with endowments, all having long-term investment horizons, predictable payouts, and regular net inflows. Like endowments, the funds typically grow through a combination of donations, in form of e.g. tax wages, and positive investment returns. GPFG also gains revenue through the Norwegian government's oil revenues.

Further, GPFG and ABP are controlled by public regulations, whereas most college and university endowments are similarly controlled by endowment spending policies (The American Council on Education, 2017). As mentioned above, CPPIB, the investment board of CPP, is independent from government, but it is accountable to the Parliament, and are thus also influenced by the government.

ABP is the only fund which exclusively works as a pension fund. However, all three funds' motives have been to preserve assets for future generations, and to ensure a stable payout rate. Moreover, GPFG is more similar to an endowment. Its objective is to fund a share of the public expenses, whereas an endowment of a university funds a share of the university's general expenses over the long-term. In addition, GPFG is restricted by the four percent fiscal rule, like many endowments, which institutions often aim for a four to five percent payout each year.

As seen in table 1 below, the structures of each of the funds are quite similar, where the fund managers are set as separate units. For simplicity, the rest of the thesis will refer to the funds using the fund managers' names; NBIM, APG and CPPIB.

	Norway	Netherlands	Canada
Name of the pension fund	Government Pension Fund Global (GPFG)	Stichting Pensioenfonds (ABP)	The Canada Pension Plan (CPP)
Fund fiduciary owner	State of Norway	ABP	Government of Canada
Fund manager	NBIM	APG Investments	CPPIB

Table 1: Summary table of the institutional structure and name of the funds

Rank	Fund	Country	Total Asset Value in US\$ million
1	Government Pension Investment	Japan	\$1,163,203
2	Government Pension Fund	Norway	\$865,943
3	Federal Retirement Thrift	United States of America	\$443,328
4	National Pension	South Korea	\$435,405
5	ABP	Netherlands	\$384,271
6	National Social Security	China	\$294,939
7	California Public Employees	United States of America	\$285,774
8	Central Provident Funds	Singapore	\$211,373
9	Canada Pension	Canada	\$201,871
10	PFZW	Netherlands	\$186,471

Table 2: Reconstruction of Willis Tower Watson's table of top ten funds in the world (Willis Tower Watson, 2016)

4.2. THE EVOLUTIONS OF THE INVESTMENT MANAGEMENT APPROACHES

Optimization of asset allocations are fundamental to pension funds, as this is by far the most powerful tool affecting a fund's "total return and performance" (Dixon, 2008). As such, anything less than an optimal asset allocation, where risk is minimized and returns maximized, can be harmful to the welfare of beneficiaries.

Given the nature of their liabilities, these three comparable pension funds all have long-term investment horizons (Dixon, 2008). Taking this into account when examining an institution's strategic asset allocation is crucial, and therefore helps to explain why equities are favored over bonds. According to Dixon (2008), over time, the risk of equity lessens whilst its returns are mean-reverting, thus making equity a superior investment category compared to fixed income. As such, one would expect long-term investors to "place a substantially larger proportion of their portfolios in equities" (Dixon, 2008).

Further, investing in alternatives, more specifically in private equity, real estate, infrastructure and commodities, can play an important role for long-term investors when it comes to risk diversification. This given asset class can possibly gain high returns for a fund, as the valuation of alternative asset classes "is not exposed to the high volatility of securities traded on public markets" (Vittas et al., 2008 p.19). Thus, optimizing asset allocations goes beyond choosing relative weights in equities and bonds (Dixon, 2008).

What is common for all of the funds' strategies is how they are not forced to continuously match assets and liabilities as they operate as final wealth maximization funds. Further, the funds' strategies are to some extent determined by the stakeholders' perceived risk tolerance (Vittas et al., 2008 p. 16). The latter may explain why NBIM has the most conservative asset allocation (Vittas et al., 2008 p. 16).

Initially, the three pension funds were managing more traditional investments, like equities and bonds, using a "low-cost passive framework" (Paula & Della Croce, 2016 p. 23). However, these strategies have changed significantly over the years. The evolution of their strategic asset allocation policies is summarized in table 3 below, and further discussed more comprehensively in the next section.

	NBIM	CPPIB	APG
Initial Strategy (1998/2000)			
Asset allocation	<ul style="list-style-type: none"> • 60 % in fixed income • 40 % in equities 	<ul style="list-style-type: none"> • Dominance of fixed income • Invested 100 percent of cash flows in equities 	<ul style="list-style-type: none"> • 60-70 % in fixed income • 30-40 % in equities
Style	Passive	Passive	Passive
Current Strategy (2015/2016)			
Asset allocation	<ul style="list-style-type: none"> • 35-40 % in fixed income <ul style="list-style-type: none"> ○ 70 % governmental bonds ○ 30 % corporate bonds • 60 % in equities • 0-5 % in real estate 	<ul style="list-style-type: none"> • 27 % percent in fixed income • 52 % in equities • 21 % in real assets 	<ul style="list-style-type: none"> • 34 % in fixed income • 30 % in equities • 28 % in alternatives • 9 % in inflation linked • -1 % in overlay
Style	Mostly passive, some active	Mostly active, some passive	Mix active/passive

Table 3: Comparison of asset allocations and investment approaches

4.2.1. NBIM

Initially, NBIM invested solely in government bonds, but was later allowed to invest in up to 10 percent of a company's share holdings, a means for reducing company specific risk. As of 1998, the fund was organized with a small selection of portfolio managers, working as "managers of managers" whose tasks were to construct a diversified portfolio. In essence, the fund focused on passively indexed management using external managers (Vittas et al., 2008 p. 21). NBIM was from this year permitted to invest a maximum of 40 percent in equities by the Ministry of Finance, while the remaining were to be invested in fixed income instruments. Thus, NBIM's investment strategy was more alike that of a traditional investment portfolio, sharing few investment strategy features with the endowment model.

However, the fund soon changed its investment strategy from passively indexing to enhanced indexing (Vittas et al., 2008 p. 21). During 2007, the Ministry of Finance set a new long-term goal which involved higher weights in equities.

NBIM was now able to raise the equity content up to 60 percent, while the remaining 40 percent was to be allocated in fixed income instruments (NBIM f, 2017). The fund justified their strategy, which inevitably involved more risk, with the huge potential for gaining excess returns.

When the financial crisis hit in 2008, NBIM underperformed compared to their benchmarks, and a huge amount of its global equity portfolio lost value (Barton & Wiseman, 2014). Despite the major underperformance, the Ministry of Finance refused to give in for external pressure that required the fund to “de-risk the portfolio by taking fewer active bets” (Hudson, 2015). NBIM thus kept true to its long-term countercyclical strategy (Barton & Wiseman, 2014) during the financial crisis, as well as the “falling equity market of mid-2011” (Barton & Wiseman, 2014).

In 2008, NBIM was permitted to invest in emerging markets, and the Ministry of Finance further allowed the fund to start the work of creating a diversified real estate portfolio, which over time could yield long-term returns (NBIM f, 2017). By including real estate in NBIM’s portfolio of equities and bonds, NBIM could protect itself from the risk of inflation.

The fund had now advanced its investment strategy from comprising of European bonds, into a portfolio composing of 60 percent in equities, approximately 40 percent in bonds, and a meager proportion in property. In the long term, NBIM desires to invest up to 5 percent in this asset class. Despite its investments in alternatives, NBIM’s strategy was still far more conservative than a typical endowment, like the Yale model.

In 2012, NBIM stated in that their approach was based on active management in, however, the fund gained critique for claiming this. According to Milne (2012), some believe the fund has “spread its interests so widely that it ended up with returns and a risk appetite” of a passive investor, rather than an active one. This was further supported by a research director at Stanford University in the US, who underlined that NBIM behaved more like a large index (Milne, 2012).

During this period, the fund changed its bond indices from being weighted according to gross domestic product, rather than being weighted according to the size of leverage (Milne, 2012). This consequently reduced the fund's exposure towards Europe in exchange for a higher exposure in emerging markets, thus increasing the fund's risk.

As of today, NBIM proclaims their investment philosophy to be based on diversification, emphasizing their long-term investment horizon and the limited need of liquidity (NBIM f, 2017). Further, they state that active management is a vital part of their strategy, using both internal and external investors to manage the fund's investments. Moreover, NBIM has the most conservative strategy of the three funds (Vittas et al., 2008), as seen in table 3.

The investment made in both emerging markets and small companies located in developed markets, are at this point the responsibility of external equity managers, through the use of mandates. These investments are outsourced, as NBIM do not consider it convenient to internalize this expertise. At the end of 2016, the fund had "4.5 percent of its capital under external management" (NBIM e, 2017).

4.2.2. APG

At the beginning of the 1990s, ABP's portfolio mainly composed of fixed income instruments. In fact, it had more than 75 percent of its assets in government bonds, mostly domestic ones (OECD, 1998 p. 285). After the privatization, the fund evolved remarkably, and as of 1998, ABP was permitted to invest in the foreign market. The fund had at this time a passive investment management strategy, which was considered adequate as both equities and fixed income instruments produced returns that exceeded the requirements set down by the liabilities (Burchill, 1996). The fund, however, was resolute on expanding its foreign investments by the use of external managers (Burchill, 1996). ABP was at this point further determined to develop a more diversified portfolio. The fund therefore decided to increase the fraction of equities, to approximately 30-40 percent during a time period of 5 years (OECD, 1998 p. 285).

ABP's asset allocation was now moving in the same direction as the Yale model, except the latter relied more on alternatives. However, it was in accordance with the first principle which highlighted the benefits associated with equity.

Already in 2001, the fund had reached an equity allocation of 45 percent of its assets (NBIM a, 2001), whose accomplishment was mainly due to the lack of allocation boundaries set by authorities. After the new millennium, ABP's passive investment strategy had lost its dominance in favor of an active strategy.

By the end of 2006, ABP released a new three-year strategic plan, covering the years of 2007-2009. As mentioned above, ABP's asset management was outsourced to APG during this period. Further, the fund developed a portfolio approach during these years that was divided into two components; "the liability-hedging portfolio" (LHP), which was supposed to reflect liabilities of the fund, and a "risk-optimizing portfolio" (ROP), whose goal was to produce the highest returns possible within clear risk limitations (Heaney, 2008). As ABP's fund members consisted of an increasingly ageing demographic profile, the first component would be the greatest one (Heaney, 2008).

Since the fund sought to offset wage inflation of its investments in liabilities, their goal was to invest more in index-linked investments, i.e. alternatives. APG, which at this point was the administrators of ABP, therefore further relied more on alternatives, as they considered active management to be most rewarding among this specific asset class (Wuijster, 2008). The fund therefore believed that the risk premium would cover the idiosyncratic risk more with this specific asset class. The institutional sophistication of the fund permitted it to allocate large fractions in alternatives, and as of 2008, the fund had targeted 27 percent of its assets in this asset class (Dixon, 2008). By entering these markets, the fund emphasized areas that had "higher barriers to entry" and was "complex and illiquid in nature" (Heaney, 2008). APG aimed to develop this asset class while keeping the beta at a minimum, as to reduce risk related to common market factors (Heaney, 2008).

This three-year plan was the fund's first to include infrastructure in its allocation, and they planned to reach an allocation of 2 percent within three years (Heaney,

2008). Further, APG's allocation in hedge funds was planned to increase from 3.5 percent to 5 percent. With regards to emerging markets, the investment plan aimed to allocate 16 percent of its total listed equity in these markets (Norwegian Ministry of Finance, 2008). Moving the fund's investment strategy in this direction harmonized with Yale's endowment, valuing diversification and active management of alternatives, thereby being able to exploit its position as a long-term investor.

Moreover, the fund shifted their investment plan towards a greater focus on absolute returns. This implied that APG looked at the total return an asset had achieved, over a certain period of time, rather than comparing its performance relative to a benchmark. Having an absolute return strategy as their central philosophy, APG differentiated itself from many other pension funds, acting more like a hedge fund.

During 2010, the fund set out a new strategic investment policy, focusing on limiting risk associated with interest and inflation (Funds Europe, 2010). The strategy involved higher allocations in both investments with inflation-linked returns, and stocks in emerging markets, while lower weightings was allocated to investments in non-government loans and equities in developed markets (Funds Europe, 2010).

In 2015, the fund's asset-mix consequently consisted of 40 percent fixed-income instruments and 60 percent securities and alternative investments, whereas 10 percent of the alternatives were allocated in real estate (ABP, 2017). When investing in alternatives, APG takes use of external management. Passive investment is now only used as a strategy under specific conditions in "the total context of the portfolio" (Fixsen, 2005). Thereby, according to the fund, they do not have one exclusive investment strategy. However, their main investment strategy is considered to be active.

4.2.3. CPPIB

Since the CPP was dominated by fixed-income securities, the CPPIB initially invested all of its cash flows in equities (Vittas et al., 2008 p. 39), in order to

offset the dominance of fixed income securities. The strong belief in equities matched that of Swensen's model (Hudson, 2015). At the beginning, the CPPIB was required to invest only in passive investments (Clemens & Emes, 2016 p. 4). They were therefore only able to invest in stock index funds that matched the "overall performance of a given stock index such as the S&P 300" (Cooke, 2003 p. 127). At the beginning of the new millennium, however, the fund was able to invest actively up to approximately 50 percent, in individual stocks (Vittas et al., 2008 p. 39).

Moreover, the equity exposure was regulated by a Foreign Property Rule, which limited all equities to be invested in Canada (Vittas et al., 2008 p. 39). The Foreign Property Rule was although relaxed, enabling the fund to invest up to 25 percent in foreign investments by the end of 2000.

After the dotcom bubble in 2001, CPPIB's asset allocation was reviewed. Until now, one company (Nortel Networks) had accounted for 35 percent of the Toronto Market index, whose share price collapsed during 2001. And since CPPIB had allocated huge proportions of their portfolio in this index, were allowed to invest passively within Canada, they suffered significant losses. Consequently, CPPIB reduced its exposure towards the company, and the fund went from a completely passive investment management strategy, to a partially active one (Vittas et al., 2008 p. 43). The fund was, as of 2001, able to invest a maximum of 30 percent in foreign investments.

As of February 2005, the Foreign Property Rule was completely eliminated (Vittas et al., 2008 p. 39). In consequence, a new and more complex, active investment strategy was established during 2006 (Cross & Emes, 2016 p. 2). This strategy took into account the long-term investment horizon of the fund, and accordingly, its high risk tolerance. The new philosophy moved in the direction of Swensen's philosophy, valuing the benefits of diversification.

The strategy involved diversifying the portfolio broadly both geographically and by asset class by investing in alternative investments. CPPIB justified their transition from a passive investment management strategy to an active approach by the increased possibility of gaining higher returns through the use of asset- and risk diversification (CPPIB b, 2017). They further believed these were crucial

factors when preserving and expanding their asset holding, thereby managing the pension fund in a sustainable manner (CPPIB c, 2017).

Due to the elimination of the Foreign Property Rule, the 40 percent of total assets were invested in equities in 2007. Accordingly, the total foreign exposure increased from 36 percent in 2006 to a level of 45 percent in 2007 (Vittas et al., 2008 p. 39). Again, the fund's confidence in equities, the use of diversification and its increasing allocation in alternatives, was a move in line with the endowment model's strategy.

As of 2015, CPPIB has invested in all major asset classes (CPPIB b, 2017). Its portfolio entails investments in public markets, including government and corporate bonds, private companies, including equity and debt, and real assets, which includes "real estate, infrastructure, natural resources and agricultural land" (CPPIB b, 2017). As such, the fund claims they will refrain from over-relying in Canadian capital markets, and thereby benefit from global growth, and at the same time, the fund will be more robust during slow-growth periods within certain regions (CPPIB e, 2016). Further, investing in real assets works as a hedge against inflationary times, while the use of diversification works as a hedge against risk connected to longevity, birth rates, domestic performance etc. (CPPIB d, 2017 p. 8).

5. DATA

5.1. SOURCES

In our thesis, information is gathered through the funds' websites, financial reports and relating literature. Our principal data source has been the respective funds' financial reports, which is used to analyze different relationships and retrieve detailed information.

5.1.1. NORWAY

NBIM has provided fairly frequent figures to the public by publishing quarterly reports as of 2001. All reports were retrievable from NBIM's webpages. Thomson

Reuters Datastream has been used to collect the NOK/USD exchange rates, the Norwegian consumer price index (CPI) and benchmark indices (table 4). The Norwegian risk free rates are downloaded from Norges Bank's webpages (Norges Bank, 2017). All values is downloaded from the time period ranging from 01.01.2001 to 31.12.2016 in a quarterly frequency, except the returns from 1998 to 2000 which are reported annually.

Regarding the benchmark weights, NBIM has reported strategic weights, which is used to construct our benchmark for NBIM.

5.1.2. THE NETHERLANDS

APG has not, to this date, published quarterly reports on ABP. Thus, we have been forced to contact ABP's employees directly in order to retrieve any figures on the fund's quarterly returns. The received information contained quarterly total returns and market values of ABP's portfolio spanning from 31.03.1993 to 31.12.2016, in addition to returns and values of several asset classes, all measured in EUR. In this study, total returns have been the value of interest, as market values do not consider the fund's inflows and outflows.

Since none quarterly financial reports have been available, annual reports have been used to make a comprehensive comparison of the funds. Except the 2016 report, all reports were downloaded through the database PI Navigator, as only the 2016 report was available on ABP's webpages.

As with NBIM, Thomson Reuters Datastream is used to collect the EUR/USD exchange rates, the Dutch CPI and benchmark indices (table 4). The Dutch risk-free rates are retrieved from OECD's webpages (OECD b, 2017). All values are downloaded from the time period ranging from 31.12.1998 to 31.12.2016 in a quarterly frequency.

Concerning the benchmark weights, the fund has only published weightings that relates to both the benchmark and the actual portfolio. Thus, there are no available weightings that have covered merely the benchmark, as opposed to NBIM. Hence, none strategic weights have been available, only actual benchmark weights.

5.1.3. CANADA

Similar to NBIM, CPPIB has provided quarterly reports, which are retrievable back to year 2000. All reports have been collected from CPPIB's webpages.

Again, Thomson Reuters Datastream is used to collect the CAD/USD exchange rates, the Canadian CPI, the Canadian risk-free rate, and benchmark indices (table 4). All values are downloaded from the time period ranging from 31.12.1998 to 31.12.2016 in a quarterly frequency.

As for the benchmarks, strategic weights have been retrievable and is thus used.

5.2. LIMITATIONS

What is common for the three funds' financial reports is that all figures near the implementations of the funds are found to either be unreliable or missing. Thus, quarterly comparisons are during periods and sub-periods spanning from 2001-2016.

Furthermore, returns are not measured in a conservative manner. Since we do not know the exact moments the inflows have occurred, we assume that all inflows have ensued at the end of each period when calculating the returns. Thus, all net inflows are exchanged into US dollars at the last date of each quarter.

What is common for all three funds is that their reports have become more comprehensive over the years. This implies that there have been variations in the reporting from one year to another. To meet these obstacles, we consistently rely on the most conservative numbers reported.

More importantly, it is highly possible that some minor mistakes are made when reading and interpreting the reports. However, the advantage of being two is utilized, implying that all numbers are double checked.

Lastly, the extent of data concerning the funds' benchmark have varied quite a lot. For instance, the funds' benchmark returns are not easy to retrieve, neither the extent different indices are used. Due to this, a comparison of the fund provided

benchmarks and our constructed benchmarks, have not been possible to make. However, the results would most likely differ, in various extents, as this thesis do not use the same indices as the funds.

5.2.1. NORWAY

The fund has not reported values on total assets or total liabilities prior to year 2006. Due to this, we use figures calculated by the fund itself from 1998 to 2006, and as of 2007 our calculations on quarterly returns are used. Thus, smaller biases may exist as different methodologies and assumptions may have been taken. For example, it is likely that NBIM have calculated net inflows when they occur, rather than by the end of the quarter.

Moreover, the financial reports from earlier years are missing crucial information, which might result in minor flaws in our calculations from the fund's origin.

Additionally, NBIM has not reported transaction costs at all since its implementation, except in relation to real estate investments. Since one does not know the exact transaction costs that have been paid, total costs are possibly quite underestimated.

Regarding the benchmark weights, these have only been given annually and, as mentioned above, we have focused on strategic weights. NBIM, however, has in reality had some variations in the weights throughout a fiscal year as actual weights have not always complied with strategic weights. Further, the fund has not used the same indices as us. This is because, for us to make a more correct comparison of NBIM and the other two funds, we have had to use the same indices for the same asset classes for all three funds.

5.2.2. THE NETHERLANDS

As for APG's annual reports, total assets and total liabilities have only been reported publicly through the period of 2008 to 2016. There are annual reports prior to this date, however, the figures are found to be highly unreliable as well as

missing crucial information. Quarterly returns are calculated and given to us by the fund themselves. The data from 1998-2000 were annual returns divided in four, and have not been used in our calculations, to avoid biasing our figures. With that being said, we are not able to double check the received figures, a desired property when manually constructing a data set.

Further, the fund's operating costs and external management fees have been reported back to 2006, whilst transaction costs only have been reported since 2011. As with NBIM, total costs are quite likely underestimated due to this.

Similar to NBIM, benchmark weights have only been given annually, but since no strategic weights were available for APG, we are forced to use actual weights. The indices used differentiates from that of APG's benchmark.

5.2.3. CANADA

CPPIB's early financial reports are missing key information, potentially biasing our calculations. However, CPPIB's financial reports contains significantly more information than NBIM and APG's reports, where accumulated net inflows, total assets and total liabilities have been reported from mid 2000 to 2016. From 1999 to 2000 only net assets have been reported. We find that the numbers from 2000 and earlier are somewhat unreliable, as they yield calculations that are not coherent with other calculations completed.

As for transaction costs, CPPIB started reporting these in mid 2008, thus we can expect total costs to be underestimated in the periods before 2008. Additionally, CPPIB's benchmark was constructed as late as in 2006, limiting our time period for comparing benchmark returns significantly, since our hypothetical benchmark are based on weights set in the fund's benchmark.

As with NBIM and APG, benchmark weights have been announced annually, whereby strategic weights have been used. Similar to NBIM and APG, our indices do not comply with that of CPPIB's benchmark.

5.3. RETURNS COMPUTATION

5.3.1. NBIM

5.3.1.1. LOG QUARTERLY NET RETURNS

Calculations of quarterly returns are based on NBIM's reported values of total assets, total liabilities and accumulated net inflows, whereby all values are reported in NOK.

The log quarterly net returns are calculated as follows:

$$\log R_t = \frac{NA_t - (AccNI_t - AccNI_{t-1})}{NA_{t-1}} - 1$$

where:

$\log R_t$ = Log Quarterly Return in quarter t , whereby

R_t = Discrete Quarterly Return in quarter t

NA_t = Net Assets in quarter t

NA_t = Total Assets $_t$ – Total Liabilities $_t$

$AccNI_t$ = Accumulated Net Inflows in quarter t

The log quarterly net returns have further been converted from NOK into US dollars, by calculating the following:

$$US\$ \log R_t = \frac{\log R_t + 1}{\Delta \frac{NOK}{USD}} - 1$$

where:

$$\Delta \frac{NOK}{USD} = \frac{NOK/USD_t - NOK/USD_{t-1}}{NOK/USD_{t-1}}$$

As for the quarterly returns which are been retrieved directly from NBIM's homepages, all figures were given in USD.

5.3.1.2. RETURNS BEYOND BENCHMARK

In order to calculate returns beyond the benchmark, we create a hypothetical benchmark for NBIM. The weights in each of the indices are based on the fund's annually reported weights in their strategic benchmark. These asset classes include equities, fixed income and real estate. All indices used can be viewed in table 4. The weight components were all given in percentages. As for the indices,

all are reported in US dollars, however some are reported in total return ($I_{i,t}$) and others in month-to-date return ($\frac{I_t}{I_{t-1}}$).

The benchmark returns for each of the asset classes are calculated by multiplying the strategic weight in the specific component with the associated index for the given quarter:

$$BR_{a,t} = w_{a,t} \cdot \frac{I_t}{I_{i,t} - I_{i,t-1}}$$

where:

$BR_{a,t}$ = benchmark return on asset class a in quarter t

$w_{a,t}$ = strategic weight component in asset class a in quarter t

$I_{i,t}$ = total return on index i in quarter t

The above calculation was done for each asset class for each quarter. To find the total benchmark return for one quarter, the quarterly benchmark returns for each asset class are summed up:

$$BR_t = \sum BR_{a,t}$$

Further, by subtracting the quarterly benchmark return (BR_t) from the log quarterly net return ($US\$logR_t$), we found the quarterly returns beyond benchmark in quarter t :

$$Return\ beyond\ benchmark_t = US\$logR_t - BR_t$$

5.3.1.3. RETURNS BEYOND INFLATION

In order to calculate the returns beyond inflation, we have first calculated the quarterly inflation in Norway, based on quarterly changes in the consumer price index in Norway (CPI^{Norway}):

$$I_t = \frac{CPI_t^{Norway} - CPI_{t-1}^{Norway}}{CPI_{t-1}^{Norway}}$$

where:

I_t = inflation in quarter t

CPI_t^{Norway} = consumer price index in Norway in quarter t

Then, the quarterly inflation is subtracted from the log quarterly net return, in order to obtain returns beyond inflation in quarter t:

$$\text{Return beyond inflation}_t = \text{US\$log}R_t - I_t$$

5.3.2. ABP

5.3.2.1. LOG QUARTERLY NET RETURNS

Similar to NBIM, the same procedures have been made as in section 5.3.1. to calculate the quarterly net returns of ABP, except the exchange rate is replaced by the EUR/USD:

$$\text{US\$log}R_t = \frac{\log R_t + 1}{\Delta \frac{EUR}{USD}} - 1$$

where:

$$\Delta \frac{EUR}{USD} = \frac{EUR/USD_t - EUR/USD_{t-1}}{EUR/USD_{t-1}}$$

In regards to the quarterly returns they are exchanged from euros to US dollars with the below formula, before further proceeding with the calculations described in section 5.3.1.:

$$R_t = \frac{\text{€}R_t + 1}{\Delta \frac{EUR}{USD} + 1} - 1$$

5.3.2.2. RETURNS BEYOND BENCHMARK

In order to calculate the quarterly returns beyond benchmark, a hypothetical benchmark is made for ABP by using the procedures described in subsection 5.3.1.2. The weights in each of the indices are based on the fund's annually reported weights in their strategic benchmark. These asset classes include equities, fixed income, inflation linked bonds, hedge funds, real estate and commodities. The associated indices used can be viewed in table 4.

5.3.2.3. RETURNS BEYOND INFLATION

Similarly, the quarterly returns beyond inflation are similar to that of NBIM, whereby the quarterly inflation in the Netherlands is based on quarterly changes in the consumer price index (CPI) in the Netherlands.

$$I_t = \frac{CPI_t^{Netherlands} - CPI_{t-1}^{Netherlands}}{CPI_{t-1}^{Netherlands}}$$

where:

$I_t = \text{inflation in quarter } t$

$CPI_t^{Netherlands} = \text{consumer price index in Netherlands in quarter } t$

5.3.3. CPPIB

5.3.3.1. LOG QUARTERLY NET RETURNS

Similarly, CPPIB's log quarterly net returns are calculated using the above formulas shown in section 5.3.1., with the exception of the exchange rate, which is replaced by:

$$US\$logR_t = \frac{\log R_t + 1}{\Delta \frac{CAD}{USD}} - 1$$

where:

$$\Delta \frac{CAD}{USD} = \frac{CAD/USD_t - CAD/USD_{t-1}}{CAD/USD_{t-1}}$$

5.3.3.2. RETURNS BEYOND BENCHMARK

In order to calculate the quarterly returns beyond benchmark, we have created a hypothetical benchmark for CPPIB as well, using the above procedures. Similar to NBIM, the weights in each of the indices are based on the fund's annually reported weights in their strategic benchmark. Moreover, these asset classes include equities, fixed income instruments and real estate. The indices used can be viewed in table 4.

5.3.3.3. RETURNS BEYOND INFLATION

The calculations are identical to that of NBIM's returns beyond inflation, however the quarterly inflation in Canada is based on quarterly changes in the consumer price index (CPI) in Canada:

$$I_t = \frac{CPI_t^{Canada} - CPI_{t-1}^{Canada}}{CPI_{t-1}^{Canada}}$$

where:

I_t = inflation in quarter t

CPI_t^{Canada} = consumer price index in Canada in quarter t

	Norway	The Netherlands	Canada
CPI	NW CPI NADJ	NL CPI NADJ	CN CPI NADJ
Exchange rate	NOK/USD	EUR/USD	CAD/USD
Risk-free rate USD	US TREASURY BILL RATE - 3 MONTH (EP) NADJ	US TREASURY BILL RATE - 3 MONTH (EP) NADJ	US TREASURY BILL RATE - 3 MONTH (EP) NADJ
Risk-free rate Local currencies	NO3MTB	NL3MTB	CDN3MTB
Equities: Developed	S&P DEVELOPED BMI US - TOT RETURN IND	S&P DEVELOPED BMI US - TOT RETURN IND	S&P DEVELOPED BMI US - TOT RETURN IND
Equities: Emerging	MSCI EM US - TOT RETURN IND	MSCI EM US - TOT RETURN IND	MSCI EM US - TOT RETURN IND
Fixed income: Corporate	Barclays Global Aggregate - Corporate USD - Month-to-Date Rtn	Barclays Global Aggregate - Corporate USD - Month-to-Date Rtn	Barclays Global Aggregate - Corporate USD - Month-to-Date Rtn
Fixed income: Governmental	Barclays Global Aggregate - Sovereign USD - Month-to-Date Rtn	Barclays Global Aggregate - Sovereign USD - Month-to-Date Rtn	Barclays Global Aggregate - Sovereign USD - Month-to-Date Rtn
Fixed income: Emerging	Barclays EM USD Aggregate USD - Month-to-Date Rtn	Barclays EM USD Aggregate USD - Month-to-Date Rtn	Barclays EM USD Aggregate USD - Month-to-Date Rtn
Inflation linked	Barclays Global Inflation-Linked USD - Month-to-Date Rtn	Barclays Global Inflation-Linked USD - Month-to-Date Rtn	Barclays Global Inflation-Linked USD - Month-to-Date Rtn
Hedge funds	HFRI FUND WEIGHTED COMPOSITE E - TOTAL RETURN MTD (GPIG)	HFRI FUND WEIGHTED COMPOSITE E - TOTAL RETURN MTD	HFRI FUND WEIGHTED COMPOSITE E - TOTAL RETURN MTD
Real estate	FTSE EPRA NAREIT GLO REITS \$ - TOT RETURN IND	FTSE EPRA NAREIT GLO REITS \$ - TOT RETURN IND	FTSE EPRA NAREIT GLO REITS \$ - TOT RETURN IND
Commodities	S&P GSCI Commodity Total Return - RETURN IND. (OFCL)	S&P GSCI Commodity Total Return - RETURN IND. (OFCL)	S&P GSCI Commodity Total Return - RETURN IND. (OFCL)

Table 4: Overview of rates and indices used

6. COMPARISON

6.2. RETURNS

When comparing the funds' returns as well as their returns beyond inflation, the period of interest is from 2001-2016, and the common time period when comparing returns beyond benchmark is 2006-2015. Both periods are divided into different sub-periods, and the performance of each of the funds can be seen in table 5.

Summary report: quarterly total returns			
	NBIM	APG	CPPIB
a. Local currency - nominal quarterly total returns			
Sub-period 1: 2001-2005	0,732 %	1,237 %	0,130 %
Sub-period 2: 2006-2010	0,564 %	1,197 %	0,863 %
Sub-period 3: 2011-2016	2,728 %	2,037 %	2,525 %
Overall: 2001-2016	1,372 %	1,553 %	1,385 %
b. Local currency - inflation adjusted quarterly total returns			
Sub-period 1: 2001-2005	0,125 %	0,741 %	-0,014 %
Sub-period 2: 2006-2010	0,013 %	0,820 %	0,424 %
Sub-period 3: 2011-2016	2,214 %	1,659 %	2,144 %
Overall: 2001-2016	0,873 %	1,110 %	0,932 %
c. USD denominated - nominal quarterly total returns			
Sub-period 1: 2001-2005	1,875 %	2,584 %	2,002 %
Sub-period 2: 2006-2010	1,533 %	2,092 %	1,947 %
Sub-period 3: 2011-2016	1,078 %	1,088 %	1,285 %
Overall: 2001-2016	1,469 %	1,869 %	1,716 %
d. USD denominated - inflation adjusted quarterly total returns			
Sub-period 1: 2001-2005	1,447 %	1,998 %	1,449 %
Sub-period 2: 2006-2010	0,981 %	1,715 %	1,507 %
Sub-period 3: 2011-2016	0,564 %	0,709 %	0,904 %
Overall: 2001-2016	0,970 %	1,426 %	1,263 %

Table 5: Average nominal and inflation adjusted quarterly total returns in local currencies and in USD

On average, in the US denominated currency, APG obtains the highest returns during the overall period compared to CPPIB and NBIM, where the latter performs the worst. This is also the case when accounting for inflation. Moreover, the same conclusion is made when examining each of the sub-periods in details, with the exception of sub-period 3, where CPPIB achieves the highest return (table 5). This is mostly due to the overall consistency CPPIB realizes during the

period in comparison. Moreover, they might have been taking advantage of the good public equity market during 2014, additionally the relative value of the Canadian dollar fell during these years, both potentially leading to these returns (Shecter, 2015).

When looking at the results each of the three funds achieves in their local currencies (table 5), APG is still realizing the best results. Although below APB, CPPIB realizes a higher return before inflation than NBIM in both of the two first sub-periods, thus changing their relationship. Furthermore, when taking inflation into consideration, the relationship between the three funds' results changes in all of the three sub-periods. Nevertheless, APG obtains the overall highest returns both before and after inflation, with NBIM earning the lowest.

When comparing local and US currency, this displays a clear tendency in which the three funds all seem to realize higher returns in the US denominated currency, with the exception of sub-period 3. Naturally, differences in returns will arise when changing currency, however, in order to properly discuss and compare the funds' results, a common currency is found to be valuable, thus making it the main focus for the rest of the thesis.

Summary report: quarterly returns beyond inflation			
	NBIM	APG	CPPIB
a. Returns			
Sub-period 1: 2006-2010	1,533 %	2,092 %	1,947 %
Sub-period 2: 2011-2016	1,078 %	1,088 %	1,285 %
Overall: 2006-2016	1,285 %	1,544 %	1,586 %
b. Returns beyond inflation			
Sub-period 1: 2006-2010	0,981 %	1,715 %	1,507 %
Sub-period 2: 2011-2016	0,564 %	0,709 %	0,904 %
Overall: 2006-2016	0,754 %	1,166 %	1,178 %
c. Benchmark beyond inflation			
Sub-period 1: 2006-2010	0,302 %	0,926 %	0,859 %
Sub-period 2: 2011-2016	0,839 %	0,438 %	0,942 %
Overall: 2006-2016	0,595 %	0,660 %	0,904 %
d. Returns beyond inflation beyond respective benchmark			
Sub-period 1: 2006-2010	0,679 %	0,789 %	0,648 %
Sub-period 2: 2011-2016	-0,275 %	0,271 %	-0,038 %
Overall: 2006-2016	0,159 %	0,506 %	0,274 %

Table 6: Average quarterly fund returns and benchmark returns beyond inflation

As a result of CPPIB's notable performance in recent years, they earn the highest overall return during the reduced period of 2006-2016, slightly above APG, if inflation and their benchmark is not taken into consideration (table 6). Moreover, the same conclusion is made when accounting for the inflation. However, when taking the benchmark into consideration, the rank changes (table 6). Yet again APG is found to be the superior performer, whereas CPPIB earns a lower excess return while NBIM still remains at the bottom. Hence, despite the good performance CPPIB made recently, in comparison to APG, CPPIB performs worse overall, in relation to their benchmark.

Nevertheless, in total all three funds performs better than their respective benchmarks, implying that their active management strategy has been successful. However, if costs were to be included, the same conclusion would possibly not be made. Moreover, there are a few exceptions to the above result. For instance, both NBIM and CPPIB performs worse than their benchmark during the second period. For NBIM, this is a result of an overall poor performance in comparison, where the benchmark seems to be the most consistent of the two. As for CPPIB this is mostly related to their benchmark earning significant high returns during 2013.

6.3. RISK

In this part, several risk measures are used, such as the standard deviation, the information ratio, the sharpe ratio, the tracking error and the beta, in order to properly measure the amount of risk each of the funds are taking. Due to the constructed benchmark of CPPIB and its limitations mentioned previously, the information ratio, the beta and the tracking error will be reduced to the time period of 2006-2016. The standard deviation and the sharpe ratio will comprise of the time period of 2001-2016. Similar to the section about returns, also these periods are divided into several sub-periods.

6.3.1. STANDARD DEVIATION

Standard deviation represents the square root of the variance, which is the expected value of the squared deviations from the expected return (Bodie, Kane & Marcus, 2014). Despite its limitations, the measure is widely used and recognized

as the best indicator of portfolio risk within investment management (Wander & D'Vari, 2003 p. 35). The results can be viewed in table 7.

Summary report: quarterly standard deviation			
	NBIM	APG	CPPIB
a. Local currency - standard deviation			
Sub-period 1: 2001-2005	4,90 %	3,75 %	8,18 %
Sub-period 2: 2006-2010	5,20 %	5,12 %	4,56 %
Sub-period 3: 2011-2016	4,43 %	3,01 %	2,52 %
Overall: 2001-2016	4,87 %	3,95 %	5,44 %
b. USD denominated - standard deviation			
Sub-period 1: 2001-2005	4,70 %	5,97 %	10,33 %
Sub-period 2: 2006-2010	8,35 %	8,81 %	8,59 %
Sub-period 3: 2011-2016	4,65 %	4,79 %	3,58 %
Overall: 2001-2016	5,98 %	6,55 %	7,70 %

Table 7: Average quarterly standard deviation in local currencies and in USD

During the total period, CPPIB realizes the highest risk level in the US denominated currency, while NBIM achieves the lowest (table 7). CPPIB's high standard deviation is mostly a result of the large variations in returns during the first period. Even though APG has a higher risk level in both of the succeeding periods, CPPIB's first period dominates the overall period. As mentioned above, CPPIB was restricted by a Foreign Property Rule, which prohibited them to invest in equities outside of Canada until 2005. Thus, creating a large risk exposure related to the domestic market, which further lead to earning large returns, both positive and negative, within the period.

Furthermore, NBIM's and APG's risk levels increases from the first to the second period, even though returns decreases. This could be associated with their change in investment strategy, which both incurred a higher level of risks as well as a higher level of costs. Further on, the eruption of the financial crisis during the second period clearly had its impact on the funds. In addition, the conversion from local to US currency increases the standard deviation considerably for the two (table 7) as they experienced a large appreciation of their local currencies relative to the US dollar during the financial crisis.

As for CPPIB, their standard deviation decreases from the first to the second period, to a risk level more alike APG and NBIM. It therefore seems like the

elimination of the Foreign Property Rule helped the fund to diversify and thus reach a lower risk level. While the standard deviation is reduced, it is still quite large, mostly due to large variations in returns within the period. Realizing the same volatility as the other two funds in the second period indicates that the financial crisis had approximately the same effect on the three in terms of risk. The conversion from local to US currency, also had its impact on the fund, increasing the volatility significantly, especially during the two first sub-periods (table 7).

During the third period, the risk level for each of the three funds, decreases to a point lower than that of the first. This might be a result of the diversification they all strive to achieve, through their respective strategies, and the increased focus on active management. As explained above, by diversifying across different regions, the funds refrain from over-relying on domestic areas. Thereby being able to extract the benefits related to growth in some areas, while at the same time keeping themselves robust against losses in others. In addition, the funds refrain from over-relying on for instance the equity market by diversifying across different asset classes.

While it is interesting to see the different funds' risk levels during the past years, it reveals little about the funds' performances. To examine this relationship further, the returns has to be taken into consideration.

6.3.2. SHARPE RATIO

Concerning the findings above, the sharpe ratio has been used to further investigate the risk-return relationships. The sharpe ratio, or the reward-to-volatility ratio, have been used to present the trade-off between risk and return. I.e., the reward the manager has received for taking on risk (Dhanorkar, 2016). The measure is widely used by scholars, and highly recognized as a measure of investment management performance (Bodie et al., 2014). The findings can be viewed in table 8.

Summary report: sharpe ratio			
	NBIM	APG	CPPIB
a. Local currency - standard deviation			
Sub-period 1: 2001-2005	16,37 %	-26,68 %	-35,40 %
Sub-period 2: 2006-2010	-47,06 %	-28,96 %	-25,74 %
Sub-period 3: 2011-2016	31,49 %	69,33 %	54,584 %
Overall: 2001-2016	-5,74 %	-8,23 %	-7,07 %
b. USD denominated - sharpe ratio			
Sub-period 1: 2001-2005	-3,63 %	7,81 %	-0,62 %
Sub-period 2: 2006-2010	-6,20 %	0,42 %	-1,28 %
Sub-period 3: 2011-2016	21,18 %	20,73 %	33,37 %
Overall: 2001-2016	2,35 %	8,19 %	5,02 %

Table 8: Average quarterly sharpe ratio in local currencies and in USD. For NBIM, the only available numbers was from 2003-2016, thus the first sub-period is from 2003 to 2005, and overall is from 2003 to 2016.

Overall, APG's sharpe ratio in the US denominated currency, is the highest among the funds during the whole period, just above CPPIB, while NBIM's ratio is the lowest. This indicates that of the three, APG is obtaining the highest tradeoff between risk and return.

Examining the periods in detail, all of the three funds have realized significant high sharpe ratios during the third period compared to the other two periods, where the highest ratio of the funds is clearly that of CPPIB. This is a result of CPPIB's relatively low risk level realized throughout the third period, as well as the subsequent high returns earned compared to the other two. These results are not entirely explained by recent changes in the fund's strategies, but it might be a result of decisions taken over several years, such as diversification of both asset classes and geographic areas. Further, the fund may have been taking advantage of the good public equity market to a higher degree than the other two, as well as the depreciation of the Canadian dollar.

During the first two sub-periods, both CPPIB's and NBIM's sharpe ratio are negative. The risk free rates during the late 90's and early 2000's were significantly high due to the high inflation level, thus causing the sharpe ratio to be negative. As for the second period, this is a result of the notably high negative returns earned during the financial crisis. Since APG earns quite high returns, in

comparison, during both of these periods, they also realize positive excess returns, thus resulting in positive sharpe ratios.

As for the local currency, the results vary notably more within each of the different sub-periods. This is a result of the negative and high averages the funds earn in their excess return. In addition, the varying risk free rates displays the same tendencies for each of the three countries as within the USA, with notably high rates during the first sub-period and low in the last period. However, the most apparent difference between the two currencies (local and common), is that in the common currency the funds often earn a lower or negative average return beyond the risk free rate. Thus resulting in high and negative sharpe ratios.

6.3.3. BETA

In order to make a complete judgment on the funds’ riskiness, each of the funds betas have been calculated. Beta, in this case, represents a security’s sensitivity to the benchmark index (Bodie et al., 2014 p. 260). The results can be found in table 9.

	Beta		
	NBIM	APG	CPPIB
Overall: 2006-2016	1,197	1,310	1,003
Sub-period 1: 2006-2010	1,252	1,409	1,130
Sub-period 2: 2011-2016	1,095	1,100	0,723

Table 9: Beta. Calculated using quarterly frequency

Overall, the three funds achieve approximately the same beta above 1, indicating that they have all been more volatile than the market. APG is found to be slightly riskier than their benchmark compared to NBIM and CPPIB. The funds betas all decrease from the first to the second period, either implying that they have grown to become less risky or that the market have become riskier. Notably, CPPIB managed to obtain a beta lower than zero during the second period. However, they have also earned less return than the market.

6.3.4. INFORMATION RATIO

To further investigate the above results, the information ratio (IR) is used. The IR can be used to measure a manager’s ability to earn excess returns, while simultaneously adjusting for risk (Dhanorkar, 2016). The results are displayed in table 10.

Information ratio			
	NBIM	APG	CPPIB
Overall: 2006-2016	0,082	0,145	0,115

Table 10: Information ratio. Calculated using quarterly frequency.

From table 10, we see that APG has the highest overall IR, followed by CPPIB, and lastly, NBIM with the lowest. This suggests that APG has earned a higher excess return than the other two, relative to its given risk level. This is in line with the findings above. The higher the IR, the more consistent the manager of a fund is performing, thus NBIM seems to be least consistent of the three funds.

6.3.5. TRACKING ERROR

Lastly, the three funds’ performance and risk levels are measured using the tracking error (TE). The TE measures the standard deviation of the excess return between a fund and its respective benchmark (Bodie et al. 2014 p. 1058). It is often used as a measure to see how close the fund is performing, in relation to its benchmark. The results can be viewed in table 11, with additional annual tracking errors in figure 4 in the appendix.

Tracking error			
	NBIM	APG	CPPIB
Overall: 2006-2016	1,92 %	3,49 %	2,37 %
Sub-period 1: 2006-2010	2,38 %	4,30 %	2,76 %
Sub-period 2: 2011-2016	1,35 %	2,71 %	2,01 %

Table 11: Tracking error. Calculated using quarterly frequency.

Overall, NBIM obtains a notably lower TE compared to APG and CPPIB, implying that of the three, NBIM may have seemed to be following their

benchmark the closest. Furthermore, it also indicates that NBIM is the fund which has had the least volatile portfolio relative to their benchmark, while APG has had the most volatile portfolio. In addition, the TE might also be used as a measure of how much a fund is being actively or passively managed. As expected, NBIM has been the least actively managed fund. Notably, APG has yielded the highest TE, implying that they have more actively managed their fund than the other two. This seems contradictory to the strategies shown in table 5, where one would expect CPPIB to yield the highest TE.

Further on, from the first to the second period, all of the funds' TE's decrease. This might be a result of the impact the financial crisis, and the succeeding years, had on the funds. The investments the funds made within this period, yielded varying excess returns thus increasing the volatility of the whole first period, compared to the second. During the second period, the tracking errors are considerably smaller. Thus, indicating a trend towards a more passively managed fund. Or at least, they seem to be following their benchmark closer than previous years.

6.3.6. DISCUSSION

What is evident when comparing the three funds' volatility in relation to returns, is that APG has on average performed better than CPPIB, whereas NBIM almost always ends up at the bottom. In recent years, however, it may seem like this trend is starting to change, as CPPIB generates a significantly better tradeoff between risk and return. Thus, during the reduced time period of 2006-2015, CPPIB yields the best overall performance.

However, when concluding on the three funds and their overall performance, one cannot exclude the results obtained by CPPIB during the first period. In addition, as the information ratio tells us, CPPIB's performance has not been as consistent as APG's. Moreover, when looking at the TE, APG has the highest volatility in excess returns of the funds, however, they also have the highest overall returns compared to the other two.

In total, the poorest performance is earned by NBIM. In comparison, they achieve the lowest returns both with and without inflation and their benchmark. When

taking risk into account they also realize the poorest sharpe ratio, both during the whole period and in each of the sub-periods, except from the third. They are also found to be the least consistent. As the least actively managed fund, this might serve as an explanation.

When deciding which of the funds that has had the best performance, one must take into account whether the funds have emphasized high excess returns or the tracking error the most. For a fund with a long-term perspective, high excess returns and a high tracking error can be considered superior compared to low excess returns and low tracking error, indicating that APG's results might be considered superior compared to those of CPPIB and NBIM.

From the above findings, it also appears as if the three funds have become less risky in recent years, while at the same time earning higher returns. While this might be a result of the large variations in returns during the financial crisis, it might also be an outcome of the more stable and positive returns earned lately. As they all claim to have moved from a passive to an active strategy, as well as increasing their focus on alternatives and real assets, one would assume that the risk levels should have moved in the same direction. This further indicates that the active management style employed earlier are finally starting to work properly. However, as the TE shows, it seems like the funds are following their benchmark closer than before. Thus, raising the question of how actively the funds actually are managed.

6.4. COSTS

Due to the three funds' unique investment strategies, they have all had different costs related to external and internal management (Clemens & Emes, 2016 p. 8). While some claim that it is intuitive to compare costs related to the number of plan members the fund serves (Clemens & Emes, 2016 p. 7), this research paper focuses on comparing costs to assets, as this is the industry custom (Cross & Emes, 2016 p. 5). Due to limited data available as mentioned above, on average the main period is from 2008 to 2016. The common period is divided into different sub-periods.

6.4.1. TOTAL COSTS

Total costs consist of operating expenses, external management fees and transaction costs. In order to make a comparison of the funds' costs in relation to their performance, we use the ratio; total cost over total assets. The results can be viewed in table 12.

Summary report: average annual total costs over total assets			
Funds	NBIM	APG	CPPIB
2001-2016	n.a	n.a	0,44 %
Overall: 2008-2016	0,0692 %	0,5696 %	0,7017 %
Sub-period 1: 2008-2011	0,0878 %	0,4788 %	0,6527 %
Sub-period 2: 2012-2016	0,0544 %	0,6422 %	0,7408 %

Table 12: Average annual total costs over total assets in USD

Overall, APG and CPPIB achieves the highest ratio, whereas NBIM obtains a mere one tenth of this figure. This implies that NBIM might be the most cost-efficient when operating their assets, compared to the other two funds.

Looking at the extended time period from 2001 to 2016, CPPIB's ratio is severely reduced. By examining the years in figure 10 in the appendix, it is clear that for CPPIB the elimination of the fund's Foreign Property Rule in 2005, and the new and more complex active management strategy as of 2007, had an effect on total costs. Both factors incurred notable escalations in operating expenses, as their staffing and their assets under management expanded. Further, the expansion of active managers has contributed to the fund's increased ratio. Unfortunately, no data on costs have been possible to retrieve from APG and NBIM during the extended time period.

From the first to the second period, both ratios of APG and CPPIB increases, while NBIM's ratio decreases. Notably, NBIM's total costs over total assets have been kept quite stable during both periods, thus implying that its relative level of cost has increased more or less in line with its assets.

As for the increase APG has experienced, this is most likely a result of the fund intensifying their focus on investments in alternatives and in emerging markets,

which increased the need of engaging expertise (Leibowitz et al., 2010 p. 4). Thus, the shift towards more complicated investments has consequently brought on higher costs for the fund. However, contrary to NBIM, APG and CPPIB have increased their total cost relatively more than their total assets.

It is thus reasonable to speculate whether NBIM has expanded their assets under management more cost-efficiently compared to APG and CPPIB. In particular, when considering the fact that all three funds have shifted towards costlier and more complex investment strategies during these years.

Moreover, as previously mentioned, NBIM does not report transaction costs. NBIM is a large financial institution which presumably conducts several transactions during a year. Thus, these costs are expected to be quite large and one can assume that the total costs of running the GPFG have been significantly underestimated.

In order to get a deeper insight into the funds' costs, a more thorough examination has been made below. Specifically, operating expenses, transaction costs and external costs have been studied.

6.4.2. OPERATING EXPENSES

Operating expenses are per definition all expenses related to a fund's operating activities. Overall, the average operating expenses are approximately a quarter, and a third of total costs, for APG and CPPIB, respectively, while significantly higher for NBIM (figure 7 in the appendix). To further examine the operational expenses, the average annual changes have been analyzed, providing information on the three funds' cost tendencies throughout the years. Relevant results can be seen in table 13.

Summary report: average annual change in operating expenses			
	NBIM	APG	CPPIB
2002-2016	21,825 %	n.a	43,573 %
Overall: 2008-2016	10,347 %	12,520 %	20,950 %
Sub-period 1: 2008-2011	18,322 %	27,334 %	33,777 %
Sub-period 2: 2012-2016	3,967 %	0,668 %	10,689 %

Table 13: Average annual changes in operating expenses in USD

During the common period, both NBIM, APG and CPPIB have on average increased their operating expenses on an annual basis, as seen in table 13. This can be explained by the fact that all three funds have to a greater or lesser extent, moved away from a passive investment strategy, towards an active one. Moreover, since “professional market research costs money”, active managers tend to require higher fees compared to passive managers (Vanguard, 2017). Additionally, they have all grown to become quite large institutions, thus one would expect significant increases in this cost component.

In the first period, all three funds’ operating expenses increase extensively on an annual basis, as seen by the high positive values in table 13, where CPPIB achieves the highest increase and NBIM the least. For the same reasons regarding the increase in total cost over total assets, changing strategies towards more complicated investments, and increased use of active managers have contributed to the higher level of cost. Further, CPPIB’s new and more complex strategy incurred a great expansion of the staff. According to the fund’s annual reports, CPPIB almost doubled its staff during the first period. As of 2011, the fund had more than twice as many employees than NBIM, which over the same period had only expanded its staff by 45 percent. Unfortunately, it has not been possible to retrieve similar figures for APG.

Further on, during the second period, operating expenses seems to decelerate for all three funds, despite continuously increasing their staff and assets under management. In the second sub-period, CPPIB’s average annual change is found to be approximately one half of the first sub-period’s value, whilst NBIM’s is approximately one fifth. However, APG’s figures are approximately fourteen times as low.

In total, CPPIB obtains the greatest annual percentage increase in operating costs of the three funds, both when looking at each period independently, and when taking the common period into account. These results also apply to the extended period (2002-2016). Thus, it appears that APG and NBIM are trying to stabilize their cost level in recent years, however, this is not the case for CPPIB. As the latter is more actively managed than the other two, this might serve as an explanation.

6.4.3. TRANSACTION COSTS

Further, these three pension funds carry some additional costs related to operations, namely, transaction costs. These costs depend on both the volume of trades, as well as the costs of each transaction. Since NBIM does not announce transaction costs, only a comparison of CPPIB and APG have been made. As mentioned above, there are variations as to when these costs were reported, which can be seen in figure 6 in the appendix.

Summary report: average annual change in transaction costs		
	APG	CPPIB
Overall: 2008-2016	n.a	23,07 %
Sub-period 1: 2008-2011	n.a	29,747 %
Sub-period 2: 2012-2016	-4,218 %	17,723 %

Table 14: Average annual changes in transaction costs in USD

For the third sub-period, APG’s transaction costs are on average approximately 8 percent of their total costs (figure 7 in the appendix). Whilst for CPPIB, the ratio is roughly one-seventh for the third sub-period and slightly larger in the second. Thus making transaction cost a considerable cost component (figure 7 in the appendix). As large, actively managed pension funds, it is reasonable to expect such numbers.

For the whole period, the annual change in transaction cost is positive for CPPIB. The fund’s average annual change decreased from the first to the second period, though still revealing high figures, as seen in table 14. Since active managers are more likely to frequently buy and sell investments, CPPIB’s shift towards active management strategies may to some degree explain the fund’s increasing

transaction costs. However, for APG the second period’s figures are found to be negative. As seen in figure 9 in the appendix, this result stems from the large variations in transaction costs each year, therefore resulting in a misrepresentative average change.

Average annual transaction costs in relation to total assets.		
	APG	CPPIB
Overall: 2007-2016	-	0,106 %
Sub period 1: 2007-2010	-	0,110 %
Sub period 2: 2011-2016	0,072 %	0,104 %

Table 15: Average annual transaction costs in relation to total assets in USD

Regarding transaction costs in relation to total assets, CPPIB’s and APG’s ratios appear to be quite similar during the second period (table 15). Further, CPPIB’s ratios are rather stable over both periods, implying that there have not been any appreciable changes in the relative relationship between transaction costs and total assets for any of the funds.

6.4.4. EXTERNAL COSTS

In order to examine the total costs of managing APG, CPPIB and NBIM, external management fees play an important role, as all three funds have conducted a great part of their operations through external managers. This fee consists of a base fee and a performance based fee.

According to figure 7 in the appendix, external cost over total cost is significantly higher for APG than for NBIM and CPPIB. This means that overall, APG is the fund that is allocating the most of their costs to external managers in comparison. On average, NBIM allocates the least, while CPPIB allocates approximately half of their total costs to external managers.

Summary report: average annual change in external costs			
	NBIM	APG	CPPIB
2002-2016	21,10 %	n.a	115,676 %
Overall: 2008-2016	0,224 %	23,205 %	25,489 %
Sub-period 1: 2008-2011	4,165 %	46,843 %	40,371 %
Sub-period 2: 2012-2016	-2,928 %	4,295 %	13,583 %

Table 16: Average annual changes in external costs in USD

Regarding the average changes in external costs on an annual basis, both CPPIB and APG have relatively similar figures during the common period. As seen in table 16, both funds, on average, are steadily increasing their external fees each year, whereas NBIM's annual increase in external fees is relatively low in comparison. For the extended period (2002-2016), however, table 16 reveals significantly higher numbers for NBIM and CPPIB, in particular.

During the first period, both CPPIB and APG achieves the highest annual changes on average, whereas NBIM's figure is significantly lower. APG was quite early dedicated to expand its foreign investments, and therefore increased their use of external managers. Furthermore, APG has to a large extent used external managers when investing in alternatives. Since this asset class was severely expanded during the first period, this consequently meant engaging a large number of external employees. The increased use of external management also applies to CPPIB, and its more complex strategy as of 2007.

Moreover, in the second period, all three funds have notably lower figures. As seen in table 16, APG's figures are approximately one tenth of the first periods, and CPPIB' figures are more than halved. Also, NBIM has decreased their average annual changes in external costs from the previous period. This implies that the funds are finally finding a more stable payout level, with NBIM actually decreasing their costs in some years.

As external management fee consists of a performance based fee, one would assume there exists a relationship between returns and the percentage of external management fees over total assets. Even though the annual increases in external management fee might to some extent be a result of the change in strategy, there should also exist a relationship between the two.

In order to investigate whether there exists a relationship between performance and the amount paid to external managers, we run the following regression:

$$\text{Returns}^t = \frac{\text{External management fee}^t}{\text{Total assets}^t} \quad \text{Regression 1}$$

From figure 13 in the appendix, we see that the R^2 is quite low, for both CPPIB and NBIM, in particular, implying that the external management fee as a percentage of total assets cannot be explained by returns. Furthermore, for NBIM, the correlation is relatively close to 0, indicating that there does not exist any relationship between the two variables. Whereas for CPPIB, the correlation is slightly higher, suggesting that there might exist some kind of relationship. For APG, however, the R^2 is relatively high, which is the same for the correlation. Thus, in the case of APG there seems to exist a relationship between the two variables. Moreover, the results produced from NBIM and CPPIB is statistically insignificant, further confirming the implication above. Whereas for APG the results are statistically significant at a 10 percent level.

To gain further insight into these results, we run the following regression.

$$\text{Returns beyond benchmark}^t = \frac{\text{External management fee}^t}{\text{Total assets}^t} \quad \text{Regression 2}$$

As returns beyond benchmark might be interpreted as the performance of a fund manager, one would expect an even stronger relationship with this regression than with the previous one. Compared to regression 1, regression 2 achieves a slightly better R^2 and correlation for both NBIM and CPPIB, as one would expect.

However, the numbers are still quite low, indicating that there only exists a small relationship between the two variables, where CPPIB obtains the higher figure.

Moreover, for APG these figures decrease. In addition, APG results are now statistically insignificant, thus displaying a trend towards unreliable numbers.

Further on, NBIM's results are still statistically insignificant, however, CPPIB's results are now statistically significant at a 10 percent level.

The observations for NBIM and CPPIB are 40 and 44, respectively. These sizes are found to be large enough to produce reliable results. APG's sample size entails only 9 observations, thus running a regression on APG will most likely yield

unreliable statistics. Hence, the results concerning APG's regression, will be disregarded.

6.4.5. DISCUSSION

As wealth maximizing funds, they all claim that they are striving to reduce their total costs and optimize their exposures to the different asset classes, which weights are set by their investment strategies. While this, to some extent, seems to be the case for NBIM and APG, CPPIB however, appears to continuously increase their costs. Looking at NBIM's and APG's annual changes in total costs, this displays a clear tendency to halter the development experienced in previous years, in contrast to CPPIB. Having said that, during period of 2001-2016, CPPIB is probably the fund which has been through the most radical strategic changes.

As mentioned above, it appears that the cost of managing NBIM is significantly lower than the costs of managing APG and CPPIB. Furthermore, NBIM seems to be more cost-efficient, when examining recent changes found in total costs over total assets. Though, this ratio will naturally be smaller for NBIM, as the fund's assets under management is considerably larger than that of APG and in particular CPPIB. Thus, when taking the funds' sizes into account, this may indicate that there are advantages related to economies of scale (Cross & Emes, 2016 p. 6).

However, managing a fund actively requires considerably more resources compared to a passively managed fund, an important factor to take into consideration when comparing costs between funds. As previously mentioned, NBIM has gained critique for claiming to perform an active strategy, while in fact acting more like a passively managed fund. In contrast, CPPIB has significantly larger proportions of its fund managed actively, thereby potentially justifying its greater use of resources. This also applies to APG, which in many cases is acting more like financial investors. For instance, the fund has managed 100 percent of their equities actively since 2005 (Fixsen, 2005).

Further, there are also large variations to the extent external managers are used. NBIM uses external managers to manage some of its equity investments, and in 2016, the fund had 4.5 percent of its assets managed by external managers. In

light of this, and taking into account that the fund allocates 40 percent of their total costs to external managers, NBIM seems to reward their external managers generously. While there does not exist specific numbers for APG and CPPIB, it would be reasonable to assume that they both employ the use of external managers to a much higher degree than NBIM. Hence, when considering the fact that external managers tend to require higher fees, this further leaves motivation to question the use of providing investment mandates to external managers.

As previously observed, there does not seem to exist a correlation between either variables from the two regressions run for NBIM. This is also the case, to some extent for CPPIB. However, a relationship between the two variables in regression 2 was found for CPPIB, though very small. It is reasonable to assume that the results from the two regressions should have provided a higher correlation and R^2 than what was achieved for both of the two funds, especially for regression 2. Yet again, there is little to state about APG, due to lack of data.

7. CONCLUSION

This thesis has set out to document the similarities and differences between the three pension funds, the Stichting Pensioenfonds ABP, the Canadian Pension Plan and the Government Pension Fund Global, in terms of investment management and returns. Through previous literature on the subject as well as information published by the funds, we have made a detailed comparison comprising of the funds' historical developments within investment management and returns. The results thus provide further information on the topic of pension fund management.

What is evident from the results above, is that underlying the nature of their liabilities and their long-term horizon, the three funds share similar characteristics. During the past two decades, all three funds claimed to have moved towards active management strategies, though in various degrees, as they all believe active management is imperative for earning excess returns.

As such, their evolving strategies have consequently implied increased risk. Compared to their initial investment philosophies, the funds have become less risk

averse, moving from more traditional investment approaches, to a model more similar to an endowment. Thus, the funds are now investing in emerging markets and giving alternatives higher weights of their allocations, which investments are highly associated with an increased level of risk. However, the funds' increased use of diversification may seem to have counteracted increased risk levels, as all three funds have incurred lower levels of risk during recent years.

Having that said, the endowment model has received critiques, thus providing some uncertainties concerning its long-term performance. The equity market is a volatile market, and we do not know if the recent high returns are due to periodic fluctuations. Whether the funds' shift towards active management strategies will pay off for the coming generations, is yet to see.

Whether the time period is 2001-2016 or 2006-2016, overall APG seems to have the ultimate risk-return relationship compared to CPPIB and NBIM, whereas the latter mostly winds up at the bottom. As the beta shows, APG is the riskiest portfolio in relation to their benchmark, thus taking risk is obviously paying off. Concerning NBIM's low figures, this raises some questions regarding whether the fund should perform an active strategy, instead of relying on a more passive one. As a passive strategy will incur lower costs, this might in the case of NBIM serve as a better option.

All three funds have to various extents embraced the Yale model by for instance investing in alternatives and international stocks, and implementing a more active management style. When examining the annual changes in costs, APG seems to have made this shift in strategy more cost-efficiently than its peers. However, overall NBIM is found to be the most cost-efficient in its operations, but is also the fund which has the most conservative strategy, and is the fund which uses active management the least. Thus, indicating that their managers are paid relatively high fees, taking into account the degree of assets being managed actively. For CPPIB's part, the fund manages large proportions of their assets actively, potentially justifying their costs levels.

In addition, there only seems to exist a relationship between external fees over total assets and management performance for CPPIB. Thus again, NBIM winds

up at the bottom. As there are no clear results for APG, it is difficult to make a statement whether they can or cannot justify their external management fees. For NBIM, however, it appears peculiar to allocate such a large proportion of total costs to external managers when they are not associated with returns. As the results also are relatively weak for CPPIB, the same conclusion can be drawn, however, not to the same degree.

For further research on the topic, it would be interesting to investigate how the funds are managed when taking into account the amount of assets that are being managed externally. Unfortunately, this information was not retrievable for us, as a lean selection of information was available during the period this paper was written. Moreover, it can be useful to compare several other pension funds, to broaden the selection of comparisons. Thus contributing to an increased level of information access and transparency on the subject of investment management of pension funds.

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9. APPENDIX

a. RETURNS

Summary report: annual returns - US denominated currency			
2001	-6,87 %	-5,65 %	-21,11 %
2002	5,07 %	9,69 %	-18,62 %
2003	23,25 %	30,40 %	44,64 %
2004	13,80 %	19,21 %	21,76 %
2005	2,25 %	-1,97 %	18,53 %
2006	14,40 %	20,87 %	15,26 %
2007	9,78 %	14,36 %	21,30 %
2008	-28,10 %	-25,45 %	-32,11 %
2009	28,76 %	24,11 %	25,90 %
2010	8,57 %	7,95 %	14,54 %
2011	-4,20 %	0,79 %	2,72 %
2012	14,29 %	15,17 %	12,04 %
2013	14,09 %	10,72 %	6,08 %
2014	-0,64 %	0,84 %	5,75 %
2015	-2,71 %	-7,98 %	-3,75 %
2016	4,46 %	6,59 %	7,74 %

Figure 1: Annual returns (in USD)

	Summary report: net assets and inflows in million USD											
	NBIM			APG			CPPIB					
	Net assets	Inflows	Net assets	Inflows	Net assets	Inflows	Net assets	Inflows				
2000	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a				
2001	n.a	n.a	n.a	n.a	n.a	n.a	28 015,95	29 816,03				
2002	n.a	n.a	n.a	n.a	n.a	n.a	42 525,01	48 191,36				
2003	n.a	n.a	n.a	n.a	n.a	n.a	73 511,67	77 952,45				
2004	n.a	n.a	n.a	n.a	n.a	n.a	130 899,70	118 103,56				
2005	n.a	n.a	n.a	n.a	n.a	n.a	239 579,99	198 708,98				
2006	n.a	n.a	n.a	n.a	n.a	n.a	339 879,17	261 858,80				
2007	1 363 119,54	1 160 596,99	n.a	n.a	n.a	n.a	456 781,57	329 454,18				
2008	1 456 640,75	1 402 990,36	176 735,00	786,00	444 085,93	346 121,98						
2009	1 573 000,87	1 467 226,38	212 419,00	519,00	417 849,39	354 611,77						
2010	1 919 650,25	1 605 389,91	237 597,00	1 063,00	523 960,40	412 518,90						
2011	2 214 704,68	1 866 262,85	246 545,00	1 569,00	607 343,20	443 908,55						
2012	2 547 131,28	2 060 718,46	281 574,00	1 445,00	670 545,06	460 132,23						
2013	3 050 081,29	2 137 507,00	300 878,00	1 901,00	736 733,63	462 587,50						
2014	3 464 399,48	2 103 484,65	344 788,00	554,00	827 356,15	453 883,82						
2015	3 413 051,01	1 673 023,56	352 350,00	-1 997,00	831 125,46	399 960,79						
2016	3 475 593,92	1 654 433,82	383 097,00	-2 157,00	887 809,23	413 149,04						

Figure 2: Net assets and net accumulated inflows (in million USD)

b. RISK

Summary report: annual standard deviation - US denominated currency			
2001	8,04 %	8,65 %	28,61 %
2002	10,24 %	12,63 %	22,27 %
2003	10,29 %	11,53 %	15,95 %
2004	9,72 %	13,94 %	12,01 %
2005	3,60 %	6,62 %	9,40 %
2006	2,97 %	4,83 %	2,50 %
2007	3,26 %	4,77 %	7,65 %
2008	12,60 %	17,91 %	19,26 %
2009	24,29 %	23,08 %	21,16 %
2010	18,61 %	23,17 %	13,57 %
2011	15,99 %	14,53 %	12,44 %
2012	11,09 %	11,60 %	7,15 %
2013	6,95 %	6,34 %	6,01 %
2014	6,99 %	8,65 %	6,20 %
2015	7,74 %	2,79 %	6,22 %
2016	5,06 %	11,04 %	5,39 %

Figure 3: Annual standard deviations (in USD)

Summary report: annual tracking error			
2006	0,69 %	1,82 %	1,54 %
2007	0,78 %	2,04 %	1,84 %
2008	2,57 %	5,73 %	4,80 %
2009	2,93 %	3,06 %	1,62 %
2010	3,13 %	6,37 %	0,88 %
2011	1,41 %	3,04 %	2,27 %
2012	1,71 %	2,86 %	1,32 %
2013	1,25 %	2,15 %	0,55 %
2014	1,44 %	1,68 %	1,09 %
2015	0,91 %	2,77 %	1,96 %
2016	1,73 %	4,28 %	2,61 %

Figure 4: Annual tracking errors (in USD). Calculated using quarterly frequencies.

c. COST

Summary report: yearly costs in million USD												
	NBIM			APG			CPPIB					
	Total assets	Total costs	%Start	Total assets	Total costs	%Start	Total assets	Total costs	%Start			
2001	n.a	39,15	n.a	n.a	n.a	n.a	8 651,13	6,49	0,075 %			
2002	n.a	74,01	n.a	n.a	n.a	n.a	11 679,38	8,58	0,073 %			
2003	n.a	108,76	n.a	n.a	n.a	n.a	24 071,52	13,00	0,054 %			
2004	n.a	149,78	n.a	n.a	n.a	n.a	42 468,76	34,51	0,081 %			
2005	n.a	188,92	n.a	n.a	n.a	n.a	69 782,46	73,03	0,105 %			
2006	n.a	239,13	n.a	n.a	n.a	n.a	94 476,24	85,64	0,091 %			
2007	509 496,21	313,97	0,062 %	n.a	n.a	n.a	123 286,89	374,33	0,304 %			
2008	435 386,10	371,64	0,085 %	346 530,92	722,83	0,209 %	94 329,69	590,38	0,626 %			
2009	507 921,51	523,12	0,103 %	369 116,45	1 416,10	0,384 %	122 043,21	729,13	0,597 %			
2010	588 531,27	492,04	0,084 %	349 597,40	2 182,70	0,624 %	145 045,04	925,30	0,638 %			
2011	565 907,39	447,36	0,079 %	347 797,75	2 430,14	0,699 %	158 522,96	1 188,35	0,750 %			
2012	696 714,79	383,19	0,055 %	415 185,33	2 718,54	0,655 %	194 763,48	1 511,73	0,776 %			
2013	851 182,41	480,03	0,056 %	448 153,27	3 280,90	0,732 %	227 544,47	1 525,66	0,670 %			
2014	864 745,28	487,91	0,056 %	474 257,39	3 068,69	0,647 %	250 015,11	1 750,66	0,700 %			
2015	864 974,61	470,66	0,054 %	430 905,89	2 586,48	0,600 %	264 453,96	2 195,50	0,830 %			
2016	901 093,44	450,33	0,050 %	445 431,46	2 569,37	0,577 %	273 329,11	1 987,41	0,727 %			
Average												
Sub-period 1: 2008-2011	524 436,57	458,54	0,0878 %	353 260,63	1 687,94	0,479 %	129 985,22	858,29	0,653 %			
Sub-period 2: 2012-2016	835 742,11	454,43	0,0544 %	442 786,67	2 844,80	0,642 %	242 021,23	1 794,19	0,741 %			
Overall: 2008-2016	697 384,09	456,25	0,0692 %	402 997,32	2 330,64	0,570 %	192 227,45	1 378,24	0,702 %			
2001-2016	n.a	n.a	n.a	n.a	n.a	n.a	510 599,79	812,48	0,444 %			

Figure 5: Annual total costs over total assets (in USD)

Summary report: yearly total costs in USD												
	NBIM			APG			CPPIB					
	Operating	External	Transaction	Operating	External	Transaction	Operating	External	Transaction			
2001	23,52	15,63	n.a	n.a	n.a	n.a	4,91	1,58	n.a			
2002	46,81	27,20	n.a	n.a	n.a	n.a	6,91	1,67	n.a			
2003	49,36	59,40	n.a	n.a	n.a	n.a	10,98	2,01	n.a			
2004	56,45	93,33	n.a	n.a	n.a	n.a	23,59	10,92	n.a			
2005	68,19	120,73	n.a	n.a	n.a	n.a	39,17	33,86	n.a			
2006	91,51	147,63	n.a	n.a	n.a	n.a	69,32	16,32	n.a			
2007	146,82	167,15	n.a	n.a	n.a	n.a	143,94	159,80	70,59			
2008	176,58	195,06	n.a	289,13	433,70	n.a	178,20	320,33	91,85			
2009	227,74	295,38	n.a	329,99	1 086,11	n.a	199,68	404,71	124,74			
2010	252,89	239,15	n.a	470,88	1 711,82	n.a	262,12	471,99	191,19			
2011	285,77	161,58	n.a	576,38	1 535,71	318,05	440,32	557,25	190,78			
2012	281,88	101,32	n.a	627,56	1 886,63	204,35	499,39	819,23	193,10			
2013	314,85	165,18	n.a	693,11	2 314,96	272,83	460,60	870,59	194,46			
2014	324,56	163,35	n.a	631,65	2 230,12	206,92	633,82	945,13	171,71			
2015	328,29	142,38	n.a	611,59	1 738,08	236,81	720,83	1 104,69	369,98			
2016	345,58	104,75	n.a	587,50	1 766,71	215,17	695,32	985,26	306,82			
	Average											
Sub-period 1: 2008-2011	235,75	222,80	n.a	416,60	1 191,83	318,05	270,08	438,57	149,64			
Sub-period 2: 2012-2016	319,03	135,40	n.a	630,28	1 987,30	227,22	601,99	944,98	247,22			
Overall: 2008-2016	282,01	174,24	n.a	535,31	1 633,76	242,36	454,48	719,91	203,85			

Figure 6: Annual operating-, external and transaction costs (in USD)

Summary report: average annual cost over total cost											
	NBIM			APG			CPPIB				
	Operating	External	Transaction	Operating	External	Transaction	Operating	External	Transaction		
2001-2016	55,38 %	44,62 %	n.a	n.a	n.a	n.a	48,27 %	41,99 %	n.a		
Overall: 2008-2016	62,05 %	37,95 %	n.a	24,43 %	69,66 %	n.a	32,24 %	52,53 %	15,22 %		
Sub-period 1: 2001-2007	46,79 %	53,21 %	n.a	n.a	n.a	n.a	68,87 %	28,44 %	n.a		
Sub-period 2: 2008-2011	51,58 %	48,42 %	n.a	27,15 %	69,58 %	n.a	30,74 %	51,92 %	17,35 %		
Sub-period 3: 2012-2016	70,43 %	29,57 %	n.a	22,26 %	69,72 %	8,02 %	33,45 %	53,03 %	13,52 %		

Figure 7: Average annual operating-, external- and operating costs over total costs (in USD)

Summary report: average annual cost over total assets											
	NBIM			APG			CPPIB				
	Operating	External	Transaction	Operating	External	Transaction	Operating	External	Transaction		
2001-2016	n.a	n.a	n.a	n.a	n.a	n.a	0,157 %	0,223 %	n.a		
Overall: 2008-2016	0,041 %	0,028 %	n.a	0,132 %	0,399 %	n.a	0,228 %	0,368 %	0,106 %		
Sub-period 1: 2001-2007	n.a	n.a	n.a	n.a	n.a	n.a	0,066 %	0,037 %	n.a		
Sub-period 2: 2008-2011	0,045 %	0,04 %	n.a	0,118 %	0,338 %	n.a	0,203 %	0,337 %	0,113 %		
Sub-period 3: 2012-2016	0,038 %	0,016 %	n.a	0,143 %	0,448 %	0,062 %	0,248 %	0,392 %	0,101 %		

Figure 8: Average annual costs over total assets (in USD)

Summary report: annual changes in costs												
Date	NBIM				APG				CPPIB			
	Total cost change	Operating cost change	Transaction cost change	External cost change	Total cost change	Operating cost change	Transaction cost change	External cost change	Total cost change	Operating cost change	Transaction cost change	External cost change
2000	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
2001	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
2002	89,04 %	99,01 %	n.a	74,04 %	n.a	n.a	n.a	n.a	32,18 %	40,58 %	n.a	6,04 %
2003	46,95 %	5,44 %	n.a	118,41 %	n.a	n.a	n.a	n.a	51,45 %	59,00 %	n.a	20,33 %
2004	37,72 %	14,38 %	n.a	57,12 %	n.a	n.a	n.a	n.a	165,56 %	114,84 %	n.a	442,10 %
2005	26,13 %	20,79 %	n.a	29,36 %	n.a	n.a	n.a	n.a	111,59 %	66,00 %	n.a	210,09 %
2006	26,58 %	34,19 %	n.a	22,28 %	n.a	n.a	n.a	n.a	17,27 %	76,98 %	n.a	-51,79 %
2007	31,29 %	60,45 %	n.a	13,22 %	n.a	n.a	n.a	n.a	337,10 %	107,66 %	n.a	878,98 %
2008	18,37 %	20,27 %	n.a	16,70 %	2,36 %	30,10 %	n.a	-10,4 %	57,72 %	23,80 %	30,13 %	100,45 %
2009	40,76 %	28,97 %	n.a	51,43 %	95,91 %	14,13 %	n.a	150,4 %	23,50 %	12,05 %	35,81 %	26,34 %
2010	-5,94 %	11,04 %	n.a	-19,04 %	54,14 %	42,70 %	n.a	57,6 %	26,90 %	31,27 %	53,27 %	16,62 %
2011	-9,08 %	13,00 %	n.a	-32,43 %	11,34 %	22,40 %	n.a	-10,3 %	28,43 %	67,99 %	-0,22 %	18,07 %
2012	-14,34 %	-1,36 %	n.a	-37,30 %	11,87 %	8,88 %	-35,75 %	22,9 %	27,21 %	13,41 %	1,22 %	47,01 %
2013	25,27 %	11,70 %	n.a	63,04 %	20,69 %	10,45 %	33,51 %	22,7 %	0,92 %	-7,77 %	0,70 %	6,27 %
2014	1,64 %	3,08 %	n.a	-1,11 %	-6,47 %	-8,87 %	-24,16 %	-3,7 %	14,75 %	37,61 %	-11,70 %	8,56 %
2015	-3,54 %	1,15 %	n.a	-12,84 %	-15,71 %	-3,18 %	14,45 %	-22,1 %	25,41 %	13,73 %	115,46 %	16,88 %
2016	-4,32 %	5,27 %	n.a	-26,43 %	-0,66 %	-3,94 %	-9,14 %	1,6 %	-9,48 %	-3,54 %	-17,07 %	-10,81 %

Figure 9: Average annual changes in total-, operating-, transaction- and external costs (in USD)

Date	Summary report: annual cost over total assets											
	NBIM			APG			CPPIB					
	Operating	External	Transaction	Operating	External	Transaction	Operating	External	Transaction			
2000	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	
2001	n.a	n.a	n.a	n.a	n.a	n.a	0,057 %	0,018 %	n.a	n.a	n.a	
2002	n.a	n.a	n.a	n.a	n.a	n.a	0,059 %	0,014 %	n.a	n.a	n.a	
2003	n.a	n.a	n.a	n.a	n.a	n.a	0,046 %	0,008 %	n.a	n.a	n.a	
2004	n.a	n.a	n.a	n.a	n.a	n.a	0,056 %	0,026 %	n.a	n.a	n.a	
2005	n.a	n.a	n.a	n.a	n.a	n.a	0,056 %	0,049 %	n.a	n.a	n.a	
2006	n.a	n.a	n.a	n.a	n.a	n.a	0,073 %	0,017 %	n.a	n.a	n.a	
2007	0,029 %	0,033 %	n.a	n.a	n.a	n.a	0,117 %	0,130 %	0,057 %	n.a	n.a	
2008	0,041 %	0,045 %	n.a	0,083 %	0,125 %	n.a	0,189 %	0,340 %	0,097 %	n.a	n.a	
2009	0,045 %	0,058 %	n.a	0,089 %	0,294 %	n.a	0,164 %	0,332 %	0,102 %	n.a	n.a	
2010	0,043 %	0,041 %	n.a	0,135 %	0,490 %	n.a	0,181 %	0,325 %	0,132 %	n.a	n.a	
2011	0,050 %	0,029 %	n.a	0,166 %	0,442 %	0,119 %	0,278 %	0,352 %	0,120 %	n.a	n.a	
2012	0,040 %	0,015 %	n.a	0,151 %	0,454 %	0,065 %	0,256 %	0,421 %	0,099 %	n.a	n.a	
2013	0,037 %	0,019 %	n.a	0,155 %	0,517 %	0,084 %	0,202 %	0,383 %	0,085 %	n.a	n.a	
2014	0,038 %	0,019 %	n.a	0,133 %	0,470 %	0,053 %	0,254 %	0,378 %	0,069 %	n.a	n.a	
2015	0,038 %	0,016 %	n.a	0,142 %	0,40335 %	0,060 %	0,273 %	0,418 %	0,140 %	n.a	n.a	
2016	0,038 %	0,012 %	n.a	0,132 %	0,39663 %	0,051 %	0,254 %	0,360 %	0,112 %	n.a	n.a	

Figure 10: Annual operating-, external- and transaction costs over total assets (in USD)

Summary report: annual cost over total cost												
Date	NBIM			APG			CPPIB			Transaction cost		
	Operating	External	Operating	External	Operating	External	Operating	External	Operating	External	Operating	External
2000	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
2001	60,08 %	39,92 %	n.a	n.a	n.a	n.a	n.a	n.a	75,68 %	24,32 %	n.a	n.a
2002	63,25 %	36,75 %	n.a	n.a	n.a	n.a	n.a	n.a	80,49 %	19,51 %	n.a	n.a
2003	45,38 %	54,62 %	n.a	n.a	n.a	n.a	n.a	n.a	84,50 %	15,50 %	n.a	n.a
2004	37,69 %	62,31 %	n.a	n.a	n.a	n.a	n.a	n.a	68,36 %	31,64 %	n.a	n.a
2005	36,10 %	63,90 %	n.a	n.a	n.a	n.a	n.a	n.a	53,63 %	46,37 %	n.a	n.a
2006	38,27 %	61,73 %	n.a	n.a	n.a	n.a	n.a	n.a	80,94 %	19,06 %	n.a	n.a
2007	46,76 %	53,24 %	n.a	n.a	n.a	n.a	n.a	n.a	38,45 %	42,69 %	18,86 %	15,56 %
2008	47,51 %	52,49 %	40,00 %	60,00 %	23,30 %	76,70 %	n.a	n.a	30,18 %	54,26 %	17,11 %	20,66 %
2009	43,53 %	56,47 %	21,57 %	78,43 %	23,72 %	63,19 %	n.a	n.a	28,33 %	51,01 %	16,05 %	12,77 %
2010	51,40 %	48,60 %	23,08 %	69,40 %	21,13 %	70,56 %	13,09 %	7,52 %	37,05 %	46,89 %	12,75 %	9,81 %
2011	63,88 %	36,12 %	20,58 %	72,67 %	21,13 %	70,56 %	8,32 %	6,74 %	33,03 %	54,19 %	12,75 %	9,81 %
2012	73,56 %	26,44 %	20,58 %	72,67 %	21,13 %	70,56 %	8,32 %	6,74 %	33,03 %	54,19 %	12,75 %	9,81 %
2013	65,59 %	34,41 %	20,58 %	72,67 %	21,13 %	70,56 %	8,32 %	6,74 %	33,03 %	54,19 %	12,75 %	9,81 %
2014	66,52 %	33,48 %	20,58 %	72,67 %	21,13 %	70,56 %	8,32 %	6,74 %	33,03 %	54,19 %	12,75 %	9,81 %
2015	69,75 %	30,25 %	23,65 %	67,20 %	23,65 %	67,20 %	9,16 %	9,16 %	32,83 %	50,32 %	16,85 %	15,44 %
2016	76,74 %	23,26 %	22,87 %	68,76 %	22,87 %	68,76 %	8,37 %	8,37 %	34,99 %	49,58 %	15,44 %	15,44 %

Figure 11: Annual operating-, external- and transaction costs over total assets (in USD)

Summary report: annual total cost over total assets			
Date	NBIM	APG	CPPIB
2000	n.a	n.a	n.a
2001	n.a	n.a	0,08 %
2002	n.a	n.a	0,07 %
2003	n.a	n.a	0,05 %
2004	n.a	n.a	0,08 %
2005	n.a	n.a	0,10 %
2006	n.a	n.a	0,09 %
2007	0,06 %	n.a	0,30 %
2008	0,09 %	0,21 %	0,63 %
2009	0,10 %	0,38 %	0,60 %
2010	0,08 %	0,62 %	0,64 %
2011	0,08 %	0,70 %	0,75 %
2012	0,06 %	0,65 %	0,78 %
2013	0,06 %	0,73 %	0,67 %
2014	0,06 %	0,65 %	0,70 %
2015	0,05 %	0,60 %	0,83 %
2016	0,05 %	0,58 %	0,73 %

Figure 12: Annual total costs over total assets (in USD)

Summary regression table				
NBIM				
	Regression 1		Regression 2	
	Intercept	Variable X	Intercept	Variable X
Coefficients	0,0119	-19,0998	-0,0032	39,7781
Standard error	0,0202	232,9132	0,0057	65,4380
tStat	0,5913	-0,0820	-0,5559	0,6079
P-value	0,5578	0,9351	0,5815	0,5469
R-Square	0,0002		0,0096	
Correlation	0,0133		0,0981	
Observations	40		40	
APG				
	Regression 1		Regression 2	
	Intercept	Variable X	Intercept	Variable X
Coefficients	-0,2333	51,4892	-0,0916	15,8355
Standard error	0,1353	25,5512	0,0526	9,9272
tStat	-1,7237	2,0151	-1,7422	1,5952
P-value	0,1284	0,0837	0,1250	0,1547
R-Square	0,3671		0,2666	
Correlation	0,6059		0,5163	
Observations	9		9	
CPPIB				
	Regression 1		Regression 2	
	Intercept	Variable X	Intercept	Variable X
Coefficients	0,0305	-18,3245	0,0176	-18,6379
Standard error	0,0244	28,1867	0,0089	10,2916
tStat	1,2483	-0,6501	1,9741	-1,8110
P-value	0,2188	0,5192	0,0550	0,0773
R-Square	0,0100		0,0724	
Correlation	0,0998		0,2691	
Observations	44		44	

Figure 13: Summary results of regression 1 and 2