

Global Public Pension Funds 2004-2014:
How Public Pension Funds Change Strategies with Their Investment Portfolio

Thesis

Presented in Partial Fulfillment of the Requirements
for the Bachelor of Science in Business Administration Degree with Research Distinction
in the Max M. Fisher College of Business of The Ohio State University

By

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2016

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Abstract

Applying public pension funds in eight countries—Canada (CPP), Denmark (ATP), Japan (GPIF), Netherlands (ABP), Norway (GPFNG), South Korea (NPS), Sweden (AP), and the United States (CalPERS), I investigate backgrounds, changes in investment strategies, and performance from 2004 to 2014. With comparison among portfolio over the time periods, I find that: (i) public pension funds shifted investments from fixed income to equities; (ii) there is increased investments in global markets transferred from domestic markets; (iii) investments in public markets moved to private markets through alternative investments. Another administrative change in those pension funds is increased in-house management of their investments, and this change is to reduce fees and to exert better control. I also compare investment performances among three sub-periods, pre-crisis (2004-2006), intra-crisis (2007-2010), and post-crisis (2011-2014). The data indicate that all of the eight countries have the lowest returns in intra-crisis; and six out of eight countries represent higher investment returns in pre-crisis compared to post-crisis.

Acknowledgements

I would like to express my gratitude to my advisor, Professor Jay W. Wellman in Department of Finance. Professor Wellman's patience, encouragement, and expertise made this research delightful and meaningful learning experience. He helped me to understand overall research process and to improve research skills in all the time of research. Even in times when I struggled with my data and the results were not clear, his encouragement and compliments motivated me to put more efforts. I could not have imagined having a better advisor for conducting this research. I would like to thank the other two members of my thesis committee, Professor Michael W. Brandl and Associate Dean Patricia M. West, whose time and feedback are invaluable to this thesis. I also appreciate Undergraduate Research Office in The Ohio State University for providing a research scholarship and giving opportunities to serve as a peer research mentor for other undergraduate students. Last but not the least, I would like to thank my family: my parents, my siblings, and grandmother. Their love and support always enable me to challenge myself and take a step forward.

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Chapter 1. Introduction

We will all retire at some point in our lifetime, and financing for the life during retirement is necessary for all of us. For many, pension funds will be their primary income after they retire. However, many of these people may face a pension crisis: a predicted shortfall in corporate, state, and federal pension payments in the United States, Europe, and Asian countries. According to 2008 data, the estimates for the underfunding of the United States state pension programs range from \$1 trillion using the discount rate of 8% to \$3.23 trillion using U.S. Treasury bond yields as the discount rate (Novy-Marx and Rauh). Due to demographic changes over the decades, the percentage of younger workers has declined relative to the number of retirees, the result of lower birth rates in developed countries in recent decades. As a result of this shift, inflows into pension funds have declined and outflows from pension funds have been increasing. As a result, many pension funds in the world are predicted to be in deficit in the coming years. What makes people more anxious about their pension is the financial environment where a crisis in one country can lead to the contagion that causes crisis in other countries.

In a defined contribution (DC) plan, such as 401k or 403b plans in the United States, beneficiaries bear both the investment risk and the longevity risk. The provider may contribute some funds to the beneficiaries' account, but the beneficiaries decide the

asset allocation and asset selection and bear the full consequences of those choices. No beneficiary is promised a stream of benefits or assured of accumulating sufficient funds at retirement in a DC plan (Stewart, Piros, and Heisler).

On the other hand, in a defined benefit (DB) plan, the provider is contractually obligated to make a stream of benefit payments to beneficiaries during their retirement. Contrary to a DC plan, a DB plan makes provider bear the investment risk because it must cover any shortfall if the required benefit payments cannot be met from the fund. Moreover, the provider has to bear longevity risk that comes from unexpected long life spans of beneficiaries. Since managing a DB plan is more complex for pension providers, eight public pension funds that are managed in a DB plan are selected around the world for this paper. The eight countries and each name of pension funds include Canada (CPP), Denmark (ATP), Japan (GPIF), Netherlands (ABP), Norway (GPFNG), South Korea (NPS), Sweden (AP)¹, and the United States (CalPERS).

We already have seen the 2008 financial crisis that began in the United States impacted the economy of the world. Due to the crisis, the value of worldwide pension fund assets fell by \$3.5 trillion (Keeley and Love). Because of the large amount of invested capital and the importance of this money to its members, stability of annual growth rate and sophisticated risk management are key concerns. A poor performance adversely effect the size of pension funds of eight countries, which is over \$3.5 trillion and has a great number of members to support. Therefore, investigating how well pension

¹ Swedish public pension fund, AP is composed with AP1 to AP4, and AP6 (There is no AP5). In this research, data from AP1 to AP4 is used; this is because AP6 has smaller assets under management, which is SEK 23 billion, compared to AP1 to AP4, whose average assets are approximately SEK 300 billion. AP6 is mostly used to invest directly in unlisted companies.

funds diversify their investment portfolios and the returns earned by the portfolios during the crisis is important. This paper helps to understand worldwide public pension industry over the last 11 years. Furthermore, the results from this paper could potentially help to prevent pension funds from losing value due to another crisis in the future and safeguard their funds.

The objective of this paper is to explore the public pension industry at a global level, to investigate investment trends, and to evaluate risk-adjusted investment performance. First, the paper illustrates background of each public pension fund, such as year of origin, purpose, beneficiaries, assets under management, target returns, and any other features. Next, the investment portfolio held by these funds in 2004, 2009, and 2014 are analyzed to observe asset allocation of each pension fund and to discover mutual trends of changes during the period just before, during and after the recent financial crisis. In addition, it assesses excess returns per unit of risk taken by comparing Sharpe ratio among the eight countries. With the data sub-divided into three periods around the 2008 financial crisis: (1) before-the-crisis (2004-2006), (2) during-the-crisis (2007-2010), (3) after-the-crisis (2011-2014), the influence of the crisis on public pension industry is to be studied with Sharpe ratio as well.

Chapter 2. Backgrounds of Public Pension Funds

The selected eight countries are spread geographically – four countries in Europe, two countries in North America, and two countries in East Asia – and each country has a developed and relatively stable financial market. Each pension fund is known to be a public pension fund with the largest amount of assets under management in each country. The total assets under management of eight public pension funds is approximately \$3.5 trillion as of June 2015. Annual financial reports of each pension fund are collected from its website, and data from those reports are the primary data sources for this paper. Figure 1 displays the assets under management in each fund. A description of fund – year of origin, beneficiaries, asset management team, fund size, goals, target return, and any distinct characteristics – follows.

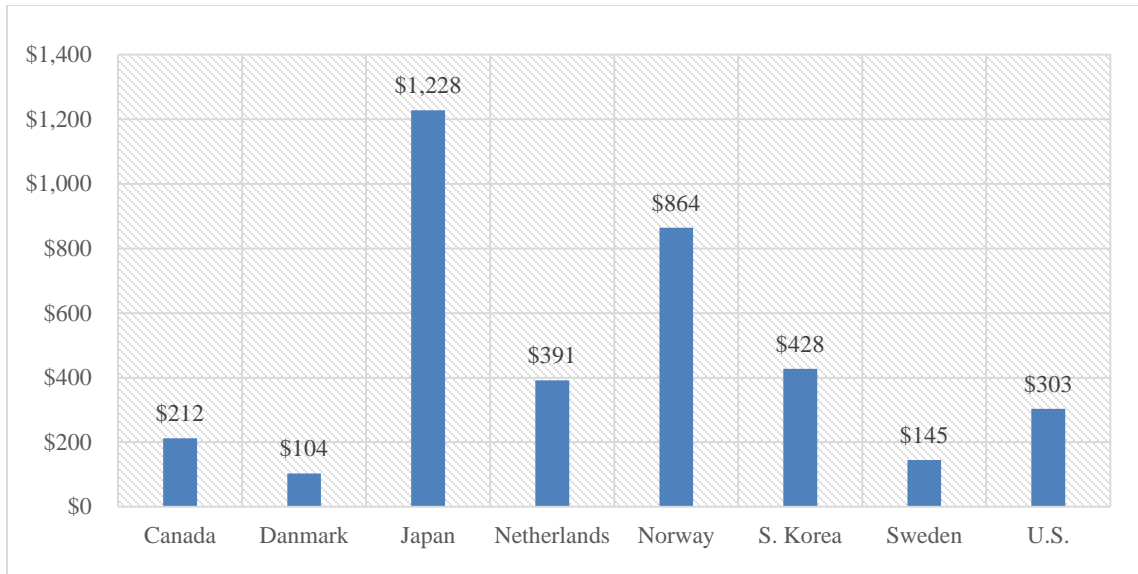


Figure 1. Size of Global Public Pension Funds as of June 2015 (in \$ billions)²

Canada (CPP)

The Canadian Pension Plan (CPP) was first established in 1965 by the Canadian government, and this nationally-administrated program mandates all employed Canadians who are 18 years of age and over to contribute a prescribed portion of their earnings income. In 1997, CPP Investment Board (CPPIB), which is a professional investment management organization independent of the government, was created to monitor and invest the funds held by the CPP. As of December 2015, net asset under management is \$282.6 billion in Canadian dollars, which is equivalent to \$212.27 billion US dollars. The critical purpose of CPP Fund is “to help Canadians build financial security in retirement” and to invest the fund assets on behalf of the 18 million contributors and beneficiaries, all the employed Canadians. CPPIB believes that the Reference portfolio has an expected

² Sources for assets under management as of June 2015 are from the annual report of each fund in 2015: CPP, ATP, GPIF, ABP, GPF, NPS, AP 1-4, and CalPERS.

return that will equal or exceed over the long-term the 4.0% real rate of return (CPP Investment Board).

Denmark (ATP)

The Arbejdsmarkedets Tillægspension (ATP) was established in 1964 by the Prime Minister as a supplementary lifelong pension for senior citizens in Denmark. The ATP requires all Danes to contribute a part of their income and prepare for their old age through the ATP scheme, and the aim of the ATP is to ensure a certain level of welfare provision for beneficiaries. ATP has two separate portfolios; the hedging portfolio and the investment portfolio. When ATP receives contributions from its members, the 80 percent is maintained under hedging portfolio and the 20 percent is maintained under investment portfolio. The hedging portfolio is designed to safeguard guarantees and to ensure that the promise of ATP to its members is fulfilled. Therefore, the hedging portfolio mainly consists of bonds and interest rate swaps to hedge the interest rate risk on guarantees. If the hedging portfolio exceeds returns of 3 percent, ATP transfers funds to investment portfolio; on the other hand, if rate of returns of hedging portfolio is lower than 3 percent, ATP uses investment portfolio to replenish the deficits. The investment portfolio is to generate a return that is sufficient to preserve the long-term purchasing power of pensions. Using the 20 percent of contributions, ATP invests funds in different asset classes in order to generate extra returns. For this reason, ATP refers investment portfolio as a bonus potential and utilizes it in unexpected situations. As of December 2015, the assets under hedging portfolio are DKK 603 billion and assets under investment portfolio are DKK 102 billion. The combined total of 705 billion Danish kroner equals to

\$103.8 billion in US dollars. The target return of the investment portfolio has been set up at 7 percent after tax and expenses.

Japan (GPIF)

The Government Pension Investment Fund (GPIF) is an independent administrative institution established by Japanese government in 2001. This system consists of the Employee' Pension and National Pension Programs, and the two programs together serve the government employees of Japan. As of 2010, 68 million participants of working age and 38 million pensioners were served. The amount of assets under management of GPIF as of September, 2015 is ¥139.82 trillion in Japanese yen, which equals to \$1.23 trillion in US dollars, and it is the world's largest pension fund. The purpose of GPIF is "to contribute to the stability of the pension system by achieving the investment returns required for the system" (GPIF Japan). GPIF is expected to provide a rate of return 1.1% above the rate of change in nominal wages over the long horizon (Tamaki). It is fundamentally managed as a pay-as-you-go system that incorporates the concept of intergenerational dependency; and this system causes a difficulty of funding pension benefits in the light of a declining birthrate and an aging population.

Netherlands (ABP)

The Algemeen Burgerlijk Pensioenfonds (ABP), which means Dutch Civil Servants Pension Fund, was established in 1992 to assure income security after retirement to 2.8 million beneficiaries of government and education employees. ABP was privatized in 1996 to solve financial problems the organization had and to give more availability for its members to negotiate the pension scheme; however, the primary function of ABP remains unchanged and ABP remains as the pension fund with the largest amount of

assets in Netherlands (Lutjens). In 2008, ABP's subsidiary, All Pensions Group (APG) was established to professionally and independently oversee administration and assets management. The total assets under management are €356 billion, which equals to \$391.2 billion in US dollar. Over the long term, ABP expects a return of more than 5 percent annually on its invested funds.

Norway (GPFG)

The Petroleum Fund of Norway was established in 1990 as a fiscal policy tool to underpin long-term considerations when phasing petroleum revenues into Norwegian economy, and it changed its name to Government Pension Fund Global (GPFG) in 2006. GPFG is managed by Norges Bank Investment Management on behalf of the Ministry of Finances, and the goal of GPFG is “to safeguard and build financial wealth for future generations”. Since contributions of this fund are from petroleum revenues of Norway, all the Norwegian citizens are beneficiaries of the fund. The amount of assets under management is 7.235 trillion in Norwegian Krone, which equals to \$863.97 billion in US dollar, and it is the largest pension fund in Europe. The fund does not have target rate of return; however, returns on the fund's equity and fixed income investments are compared with indices from FTSE group and Barclays Capital.

South Korea (NPS)

The National Pension Service (NPS) was established in 1986 to secure the retirement benefits of Korean citizens with income security; thus, it is available to all employees, employers, and the self-employed. NPS has an investment management team, Fund Investment Office, and its purpose is “to preserve and grow the pension fund asset, which was created as the reserve fund to finance pension benefit for Korean people”. As of

December 2015, the assets under management is approximately 512 trillion in Korean won, which equals to \$427.52 billion in US dollar. Target return of NPS is real rate of economic growth + inflation rate \pm adjustments. NPS use KOSPI and MSCI All Countries World Index as domestic and overseas equities benchmark respectively. Also, Barclays Global Aggregate Index is used as benchmark for overseas fixed income return. According to its actuarial report in 2013 by National Pension Research Institute, the fund is projected to grow to a peak in 2043 and run out around 2060. Like the Japanese pension fund, NPS has an issue of intergenerational dependency, and demographic aging and low birth rate will cause to be underfunded.

Sweden (AP)

The Sweden's National Pension Funds (AP) originated from the world's first pension fund created by Swedish parliament in 1913, and it was reformed to three divisional funds: The First, Second and Third AP Funds in 1960. With several reformations since, AP now consists of the First, Second, Third, Fourth and Sixth AP Funds. They were designed to balance surpluses and deficits arising from the difference between pension contribution and disbursements, which derive from demographic and/or economic fluctuations; thus, they are referred to as "buffer funds". The First to Fourth AP Funds are allowed to invest in several different asset classes; however, Sixth AP Funds has a specific purpose of investing in mid-sized unlisted companies. The funds operate competitively and independently in terms of asset allocation, risk management, and governance policies. As of December 2015, the total amount of assets under management is 1.23 trillion in Swedish krona, which equals to \$144.88 billion in US dollar. Assets amount of the First, Second, Third, and Fourth AP Funds lies between SEK 290 billion

and SEK 310 billion; however, the Sixth AP Funds has 23.6 billion of assets under management (Table 1).

AP1	AP2	AP3	AP4	AP6	Total
290.2	306.5	303	310	23.6	1233.3

Table 1. Assets under Management of AP funds as of December 2015 (in SEK billions)

The goal for AP funds is to achieve stability of the national pension system. An annual real return after expenses of Target return of the First to Fourth AP Funds is around 4% on the total portfolio measured over rolling ten-year period.

United States (CalPERS)

At the federal level, the United States has Social Security Trust Funds, which includes retirement plan for senior citizens; however, this plan is not only used for the old-age but also used for survivors and disability. Thus, Social Security Trust Funds is considered to be inappropriate in this study due to its multiple uses. Instead, California Public Employees' Retirement System (CalPERS) is used in this study. CalPERS is a public pension fund with the largest amount of total net assets in the United States. It was originated from State Employees' Retirement System established in 1932, and the organization changed its name to CalPERS in 1992 to avoid confusion with systems in other states. CalPERS consists of health benefits and retirement benefits, and The Public Employees' Retirement Fund (PERF) is to provide retirement benefits services to school and public employers. As of June 2015, total net assets in the PERF are about \$303 billion in US dollars. The primary goal of this program is "to meet our funding obligations and pay for organization expenses without interruption, regardless of market conditions". In a long term, CalPERS expects/targets to have 4 percent in real rates of return.

Chapter 3. Investment Portfolio and Asset Allocation

3.1 Comparison on Investment Portfolio

Investment assets can be categorized into broad asset classes, such as equities, bonds, real estate, and alternative assets such as private equities, hedge fund, and venture capital. The asset allocation decision is the choice among broad asset classes, while the security selection decision is the choice of which particular securities to hold within each asset class (Bodie, Kane and Marcus). Typically the board of directors of public pension funds sets a target or reference portfolio in form of allocation guidelines in various asset classes, and uses the security selection decision to elaborate its investment portfolio (Pennacchi and Rastad). To investigate changes in the investment portfolios of global public pension funds during the recent decade, target asset allocation of each country in 2004, 2009, and 2014 are compared; however, for countries where a target investment portfolio is not available or an actual portfolio is different from the target, investment portfolios with market value at the end of year are used.

Canada (CPP)

The portfolio of CPP is composed mainly of equities and bonds: in 2004; it consisted of 54% bonds, 43% publicly traded equities, and 3% of private equities and real estate (Figure 2). In light of its investment portfolio in 2000, which was composed of 93% of bonds and 7% of equities, CPP has changed its investment portfolio to have more

equities in order to achieve higher expected return. The 2004 portfolio still mainly has traditional assets and has a very small portion of real estate and private equities; however, CPP investment board states in the annual report of 2004 that it expected proportions of bonds, equities, and alternative assets to reach 35%, 58%, and 7% respectively sometime in 2006.

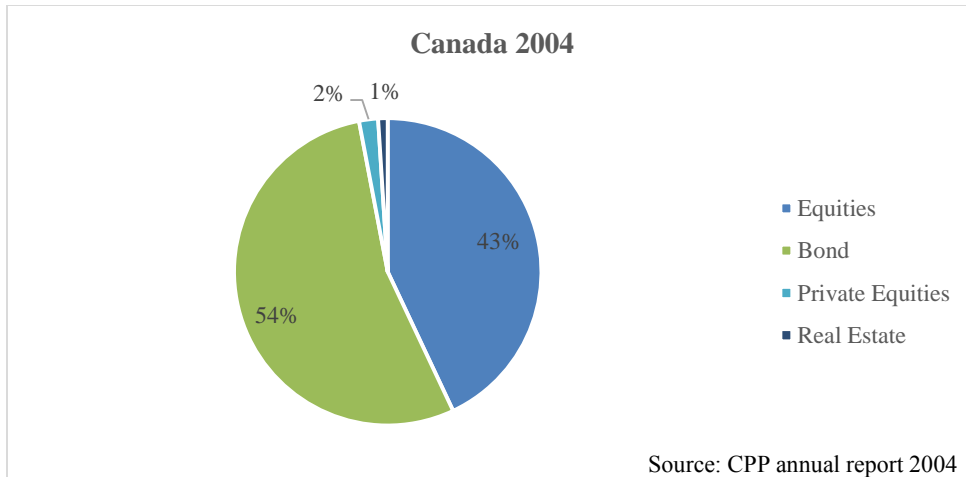


Figure 2. Investment Portfolio of Canada with Market Value in 2004

The investment portfolio in 2009 represents significant changes compared to the portfolio of 2004. The portfolio becomes more diversified with different asset classes. More than half of assets are invested in equities, and bonds, which account for 54% of the 2004 investment portfolio, decreases to 26%. More importantly, alternative asset classes, such as real estate, infrastructure, and private equities, occupy 18% of the total portfolio (Figure 3).

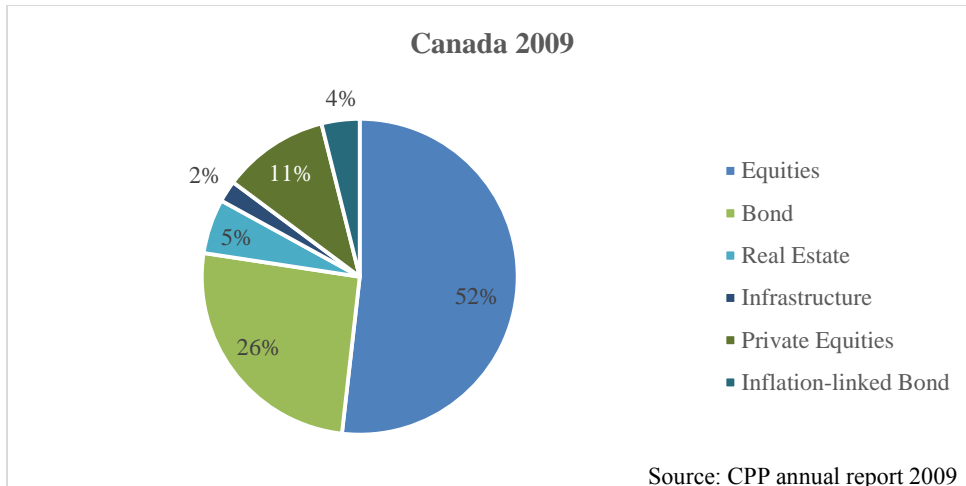


Figure 3. Investment Portfolio of Canada with Market Value in 2009

The target portfolio of CPP as of 2014 is composed of 65% of equities—10% of Canadian equities and 55% of global equities—and 35% of bond—30% of Canadian bond and 5% of foreign bond (Figure 4). But actual portfolio with market value in 2004 is quite different from the target. The investment portfolio of 2014 indicates a similar portion of equities and bond compared to the portfolio of 2009. Even though its reference portfolio only has bonds and equities, CPP actually invests about one fourth in different assets classes (Figure 5). The annual report in 2014 publicly announces separate ratio of equities in Canada, developed countries, and emerging countries instead of ratio of publicly traded equities and private equities.

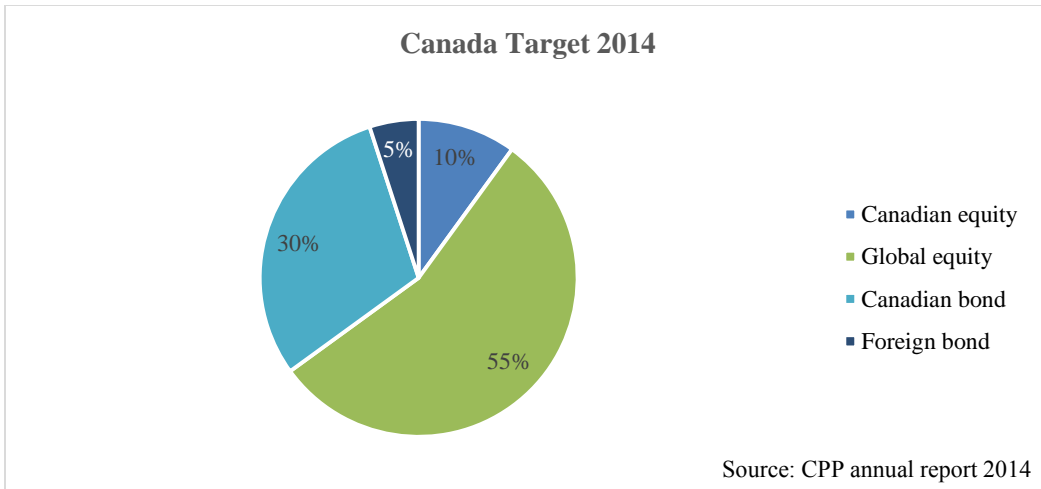


Figure 4. Target Investment Portfolio of Canada in 2014

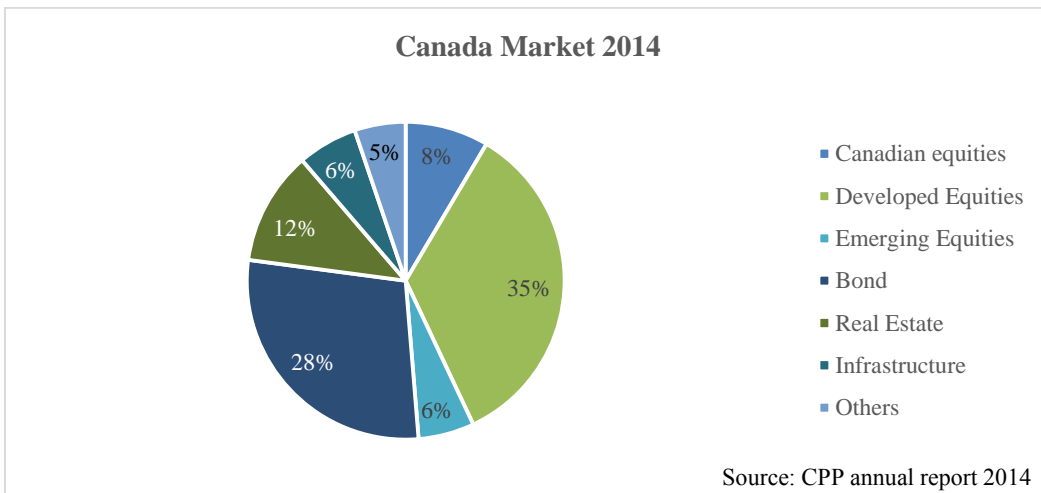


Figure 5. Investment Portfolio of Canada with Market Value in 2014

The main changes over the decade are increased allocation to equities and alternative assets, and decreased allocation to bonds. CPP especially has growing interests in private investing opportunities. In this way, CPP expects to diversify portfolio risks over different asset classes as well as seize growing potential through private investing.

Denmark (ATP)

In 2004, Denmark used a traditional method of asset allocation with equities, bonds, and alternative assets to diversify its investment. Domestic and foreign bonds

account for 65% of the fund and domestic and foreign equities accounted for 17%. Although ATP expresses desire to increase the allocation to alternative asset classes, investments in real estate and private equities remains at a low level.

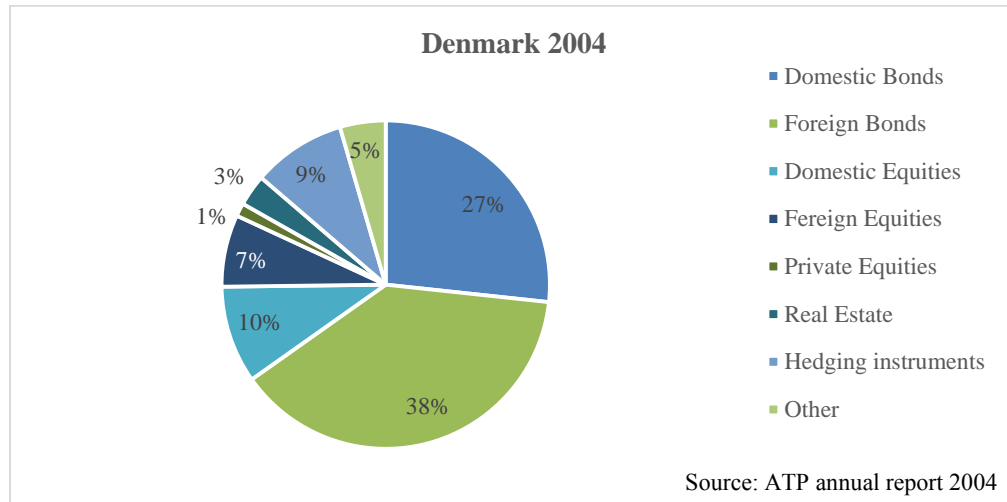


Figure 6. Investment Portfolio of Denmark in 2004

In 2009, the asset allocation of ATP looks significantly different from the portfolio in 2004, and this is because ATP has changed its structure of portfolio management. An active liability hedging program was first introduced to ATP in 2001; however, in 2006, ATP created a new department that specialize in hedging its pension liabilities from interest rate changes, and the fund was divided into two portfolios: investment and hedging. ATP mainly has interest rate swaps under hedging portfolio. Under investment portfolio, ATP has Beta portfolio and Alpha portfolio. The Beta portfolio is to focus on strategic allocation with a long horizon in assets of varying levels of risk and earning returns commensurate with their risk, while the Alpha portfolio is to focus on active management that seeks to achieve excess returns (Vittas).

Within the Beta portfolio, there are five risk classes: interest rate risk, credit risk, equity risk, inflation risk, and commodities risk. The interest rate risk class, which consists of global, domestic mortgage, and U.S. mortgage bonds, accounts the largest portion, 44% of the total portfolio, followed by Inflation risk class (Figure 7).

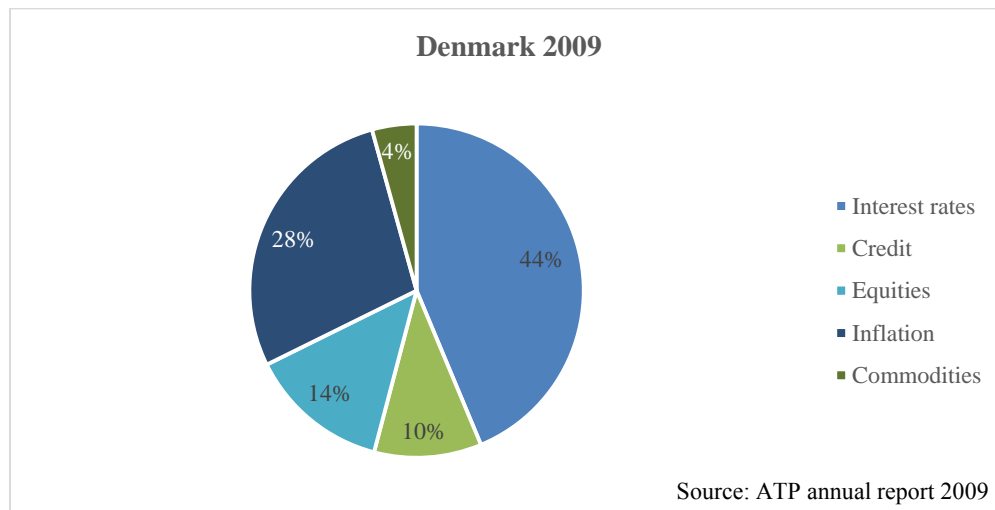


Figure 7 Investment Portfolio of Denmark in 2009

It is interesting to see that ATP invests in many bonds under risk classes: Global bond, Domestic mortgage bond, U.S. mortgage bond, High-yield bond, Index-linked bond, and Oil bonds. These bonds comprise 81.6% of the total portfolio (Table 2).

Interest rates		Credit		Equities		Inflation		Commodities	
43.7%		10.4%		13.6%		28.0%		4.3%	
Global bond	35.6	High-yield bond	5.3	Listed domestic	8.2	Index-linked bond	19.9	Oil bond	4.3
Domestic mortgage bond	16.1			Listed foreign	0.2	Real estate	4.7		
US mortgage bond	0.4	Loans	5.1	Private	5.1	Infrastructure	1.9		
						Beta reference	0.4		
						Financial contracts	1.1		

Table 2. Investment Portfolio of Denmark by Specific Asset Class in 2009³

Asset allocation of the Beta portfolio in 2014 still follows the risk class model.

However, the interest rates risk class, which was the largest portion in 2009, was

³ Source is from the annual report of ATP in 2009

decreased to the smallest portion of 7%. In the annual report in 2014, ATP states that lower allocation in interest rates and inflation should be viewed in light of the expansionary monetary policy of central banks. In addition, asset allocation to equities increased from 14% to 56%, and this is due to actual increase of allocated funds as well as the strong price increases in the equity market of Denmark (Figure 8).

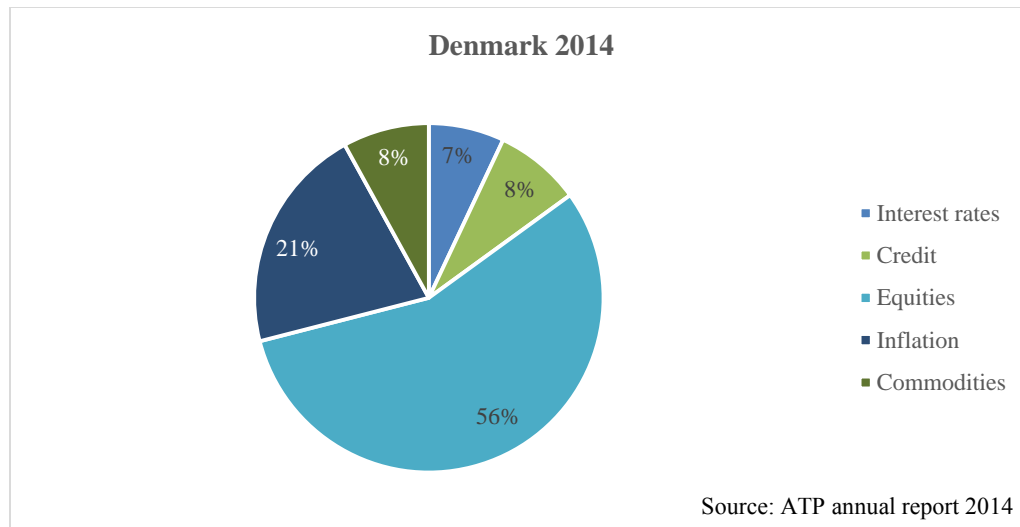


Figure 8. Investment Portfolio of Denmark in 2014

Over the decade, Denmark has changed its portfolio structure by abandoning the traditional asset allocation decision based on benchmark and adopting a risk allocating methodology. By using this strategic asset allocation, ATP is expected to be more diversified in the future in risk terms; it means that the total risk arising from equities could be lowered in favor of other sources of risk (Vittas).

Japan (GPIF)⁴

In the annual report in 2005, GPIF stipulates that the target portfolio should be maintained over the long term. One of distinct characteristics of Japanese pension fund,

⁴ As the annual report of 2004 is not available in public, investment portfolio of 2005 is used as a substitute.

GPIF is that domestic bonds account for $67\% \pm 8\%$ of the target portfolio. Regarding the equity side, $11\% \pm 6\%$ is to be invested in domestic equities, and $9\% \pm 5\%$ is to be invested in international equities. Short-term assets, which accounts 5%, is invested mainly into certificates of deposits and financing bills (Figure 9).

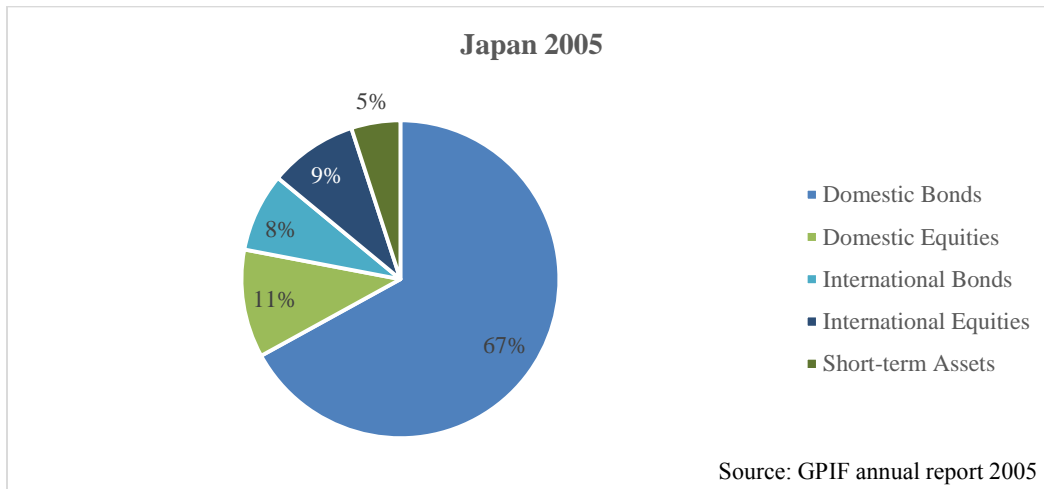


Figure 9. Target Investment Portfolio of Japan in 2005

The target portfolio in 2009 has a similar structure to the portfolio in 2005. However, out of 65% domestic bonds, 50% is to be invested in market investments and 15% is to be invested in Fiscal Investment and Loan Program (FILP), which is a loan program by the government only for special government-affiliated corporations (Figure 10).

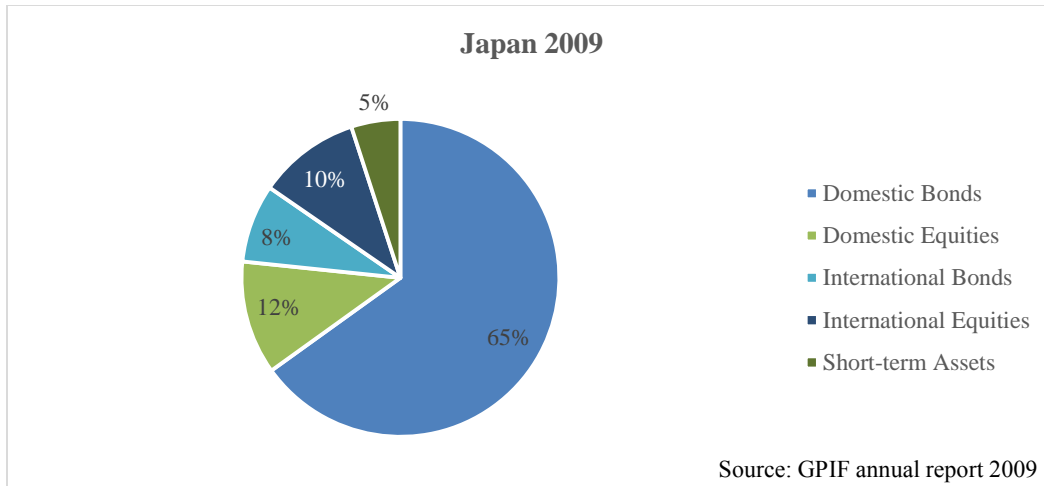


Figure 10. Target Investment Portfolio of Japan in 2009

The second Medium-term Plan, which was from 2010 to 2014, GPIF announced a new asset mix in order to prepare for the third term in June 2014. Given that the economy of Japan has been in persistent deflation, GPIF reviewed its policy asset mix in order to correspond with the changes of long-term economic prospects. Thus, GPIF significantly decreases domestic bonds and increases domestic and international equities up to 50%. Considering the permissible range of deviation $\pm 9\%$ for domestic equities and $\pm 4\%$ for international equities, the share of equities in the portfolio lies between 33% and 67%. In addition, GPIF plans to develop a dedicated team to invest 5% of the portfolio to alternative assets such as infrastructure, private equities, and real estates (Figure 11).

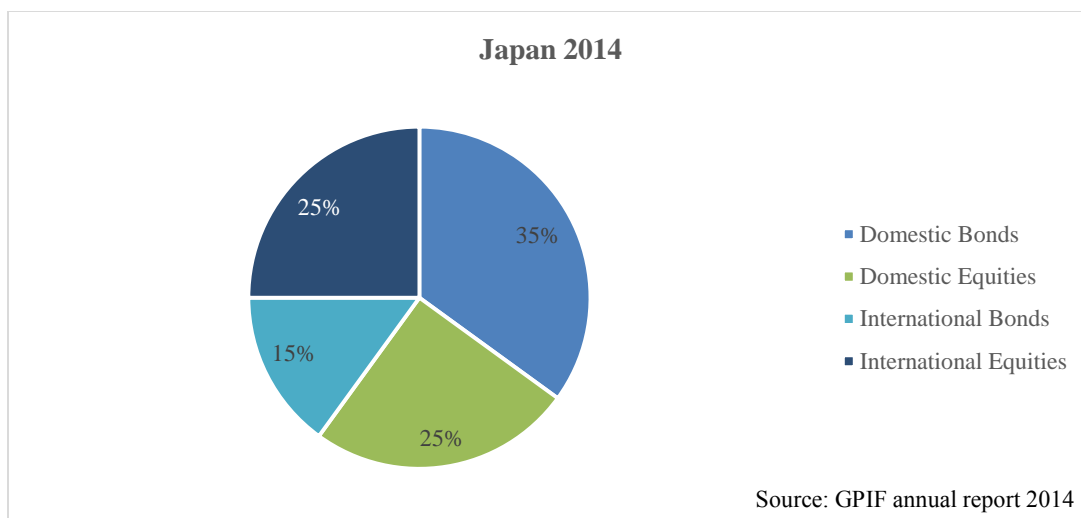


Figure 11. Target Investment Portfolio of Japan in 2014

Overall, due to deflation and negative interest rate in Japan, GPIF has significantly decreased investment in domestic bonds and transferred towards international bonds and equities. By adding more global financial securities, the portfolio obtained balance between its domestic and global aspects.

Netherlands (ABP)⁵

Until the mid-1990s, more than 95% of ABP's investment were in Dutch fixed income securities; however, the asset mix has become diversified by adding alternative investments and spreading assets geographically. ABP believes alternative investments have reduced the risk profile and also produce attractive returns. The investment portfolio of Netherlands in 2005 is mainly composed of equities and bonds (including index-linked bonds), 37% and 43% respectively. As its belief, ABP has many alternative assets such as real estate, private equities, commodities, and hedge funds besides traditional asset classes (Figure 12).

⁵ As the annual report of 2004 is not available in public, the target investment portfolio of 2005 is used to be analyzed.

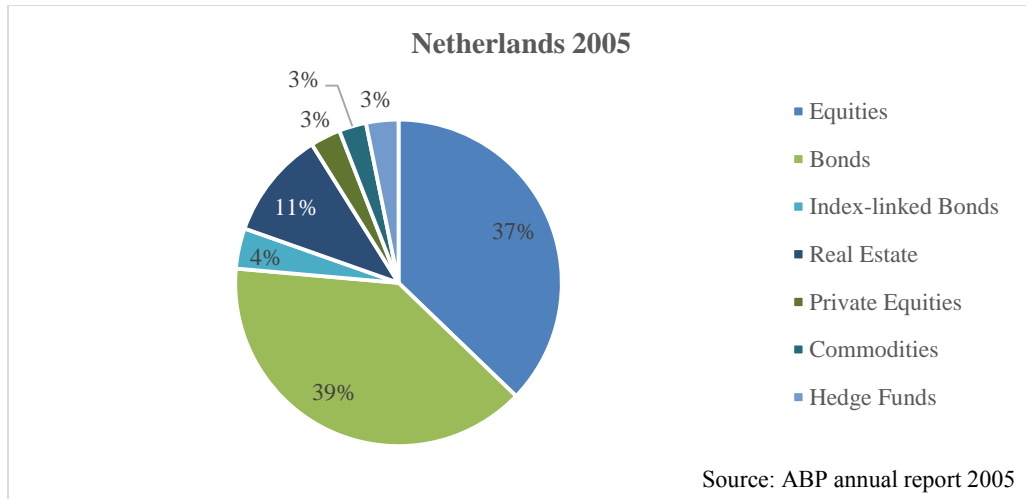


Figure 12. Investment Portfolio of Netherlands in 2005

During 2006, ABP compiled a new strategic investment plan for the years 2007-2009. ABP states that the new strategic portfolio has a wider spread over the various investment categories including infrastructure and innovation, and offers a better long-term outlook for indexation without increasing any corresponding risk. The portfolio of 2009 actually represents new asset classes of infrastructures and innovation by decreasing the share for bonds. Compared to the portfolio of 2004, there is a shift away from bonds to alternative assets; a share of bonds decreased from 39% to 33% and alternative assets increased from 20% to 26%. Moreover, according to its annual report, even within equities and alternative assets categories, ABP shifts its funds from public to private markets (Figure 13).

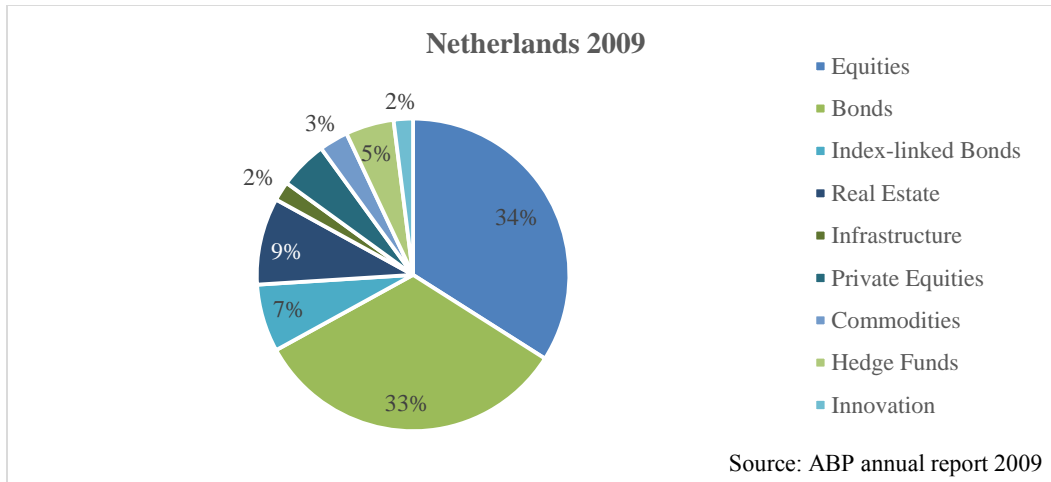


Figure 13. Investment Portfolio of Netherlands in 2009

From 2010 to 2012, the proposed portfolio by ABP indicates a higher weighting for inflation-linked investments to be less vulnerable to inflation and a lower weighting for non-state loans due to its illiquidity during a crisis. Furthermore, ABP reduces investments in equities in developed market and escalates equities in emerging markets. The 2014 portfolio shows equities in developed countries and equities in emerging countries separately, but the total shares for equities, which is 33%, keeps similar to the portfolio in 2004 (Figure 14).

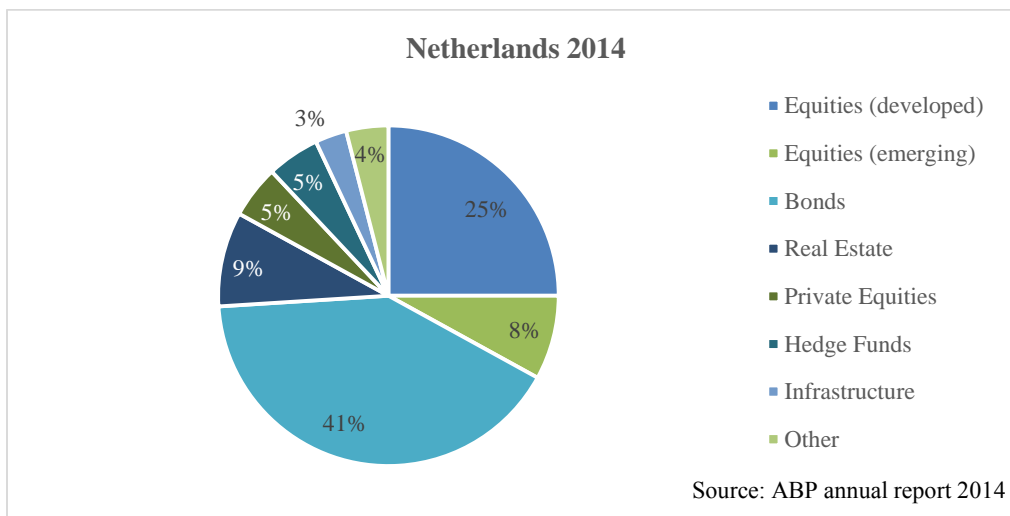


Figure 14. Investment Portfolio of Netherlands in 2014

Over the decade, ABP keeps the portfolio with similar ratio among equities, bonds, and diverse alternative assets.

Norway (GPFG)

GPFG has a very simple investment portfolio in 2004. 40% of its fund is to be invested in equities and 60% is to be allocated to bonds. Most equity and bond holdings of GPFG are in a various European countries, the United States, and Japan. According to the annual report in 2007, the Ministry of Finance decided in June 2007 to increase the fund's share of equity investments to 60% from 40%. Consequently, the decision was fulfilled in the investment portfolio in 2009.

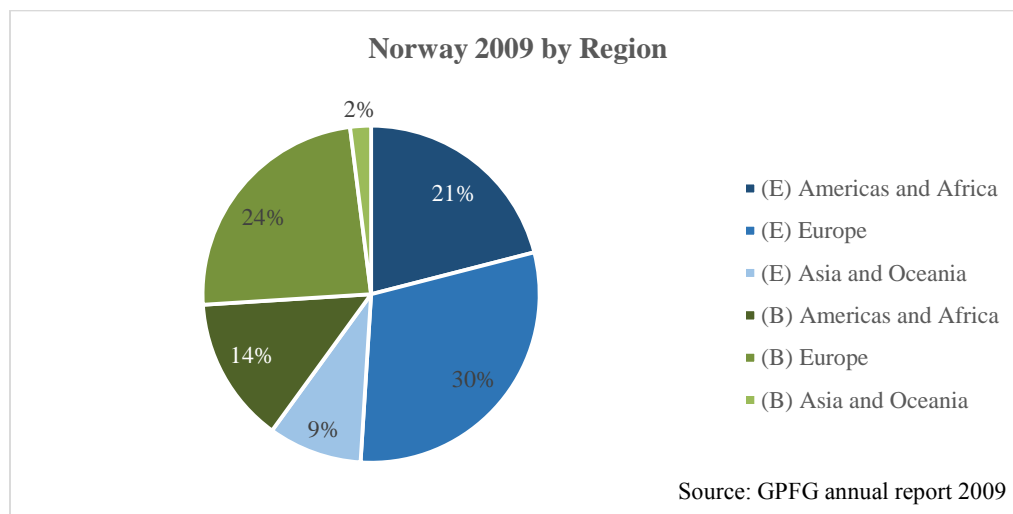


Figure 15. Investment Portfolio of Norway by Region in 2009

In the figure 15, (E) refers to Equities; (B) refers to Bonds. With market values, 60% of the portfolio is invested in equities as shown in blue parts of the chart, and 40% of the portfolio is in bonds as shown in green parts of the chart. In 2009, GPFG additionally considers geographical spread of the portfolio. Among 60% of equities, it assigns 21%, 30%, and 9% to Americas and Africa, Europe, and Asia and Oceania.

Regarding bonds portion, among 40% of bonds, it allocates 14%, 24%, and 2% to Americas and Africa, Europe, and Asia and Oceania (figure 15). In the annual report in 2009 specifies that the top three companies with large equity holdings are U.K companies: HSBC, Royal Dutch Shell, and BP. The top three government with the large bond holdings are the U.S., U.K, and Japan.

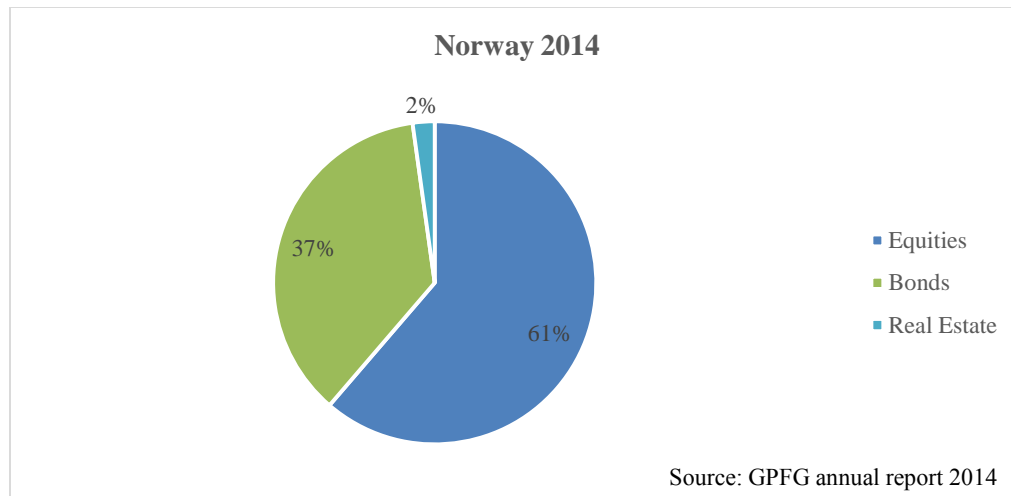


Figure 16. Investment Portfolio of Norway in 2014

The GPFG targets to have 61% of equities, 27% of bonds, and 2% of real estate in 2014. Compared to the portfolio in 2009, the share of equities stays the same, but the portion of bonds is decreased and shifted to real estate (Figure 16). The investment portfolio by regions indicates that investment in Europe has decreased from 54% to 39%. Instead, investment in Americas and Africa has increased from 35% to 41%, and investment in Asia and Oceania has increased from 11% to 18% (Figure 17). In the annual report of 2014, the GPFG has equity holdings in more than 9,000 companies, up from about 8,000 a year earlier. The fund's fixed-income investment is more diversified with more than 4,200 securities, from 3,800 securities in 2013. The data also suggests

that GPFG aims to invest more in emerging markets, such as Latin America and Asia, and Middle East, and targets the U.S. market instead of investing in Europe.

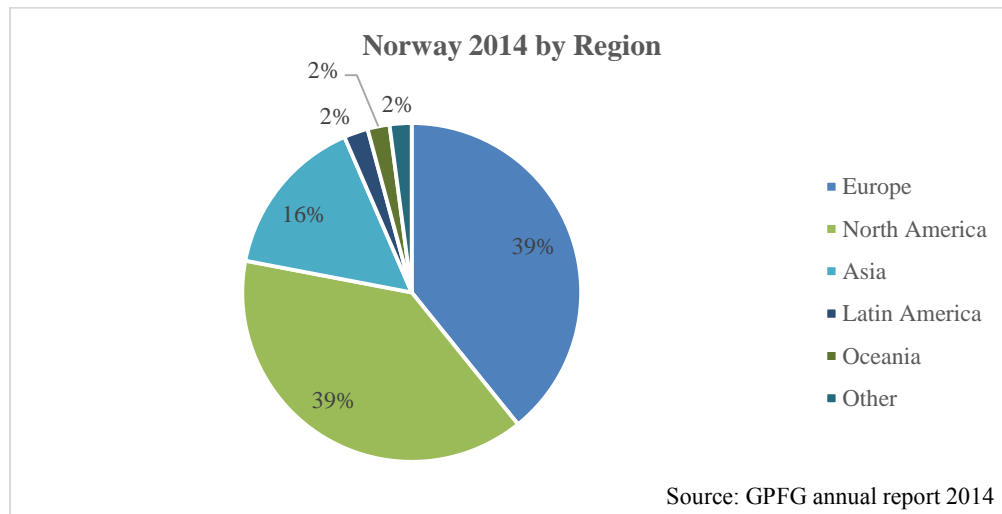


Figure 17. Investment Portfolio of Norway by Region in 2014

As a whole, the GPFG has increased equities and alternative assets by decreasing bonds. Furthermore, it has increased investments in North America and emerging markets such as Latin America and Asia.

South Korea (NPS)

The investment portfolio of NPS in 2004 holds 88% of domestic bonds which is the largest portion among the portfolios of participated countries. In addition, 9% of the portfolio is to be invested in equities in domestic market. 0.3% of funds was invested in global equities (Figure 18). Among 88% share of bonds, 40% is government bonds, 26% is in financial bonds issued by the Bank of Korea according to the annual report. Thus, the investment performance and economy of South Korea were significantly correlated in 2004.

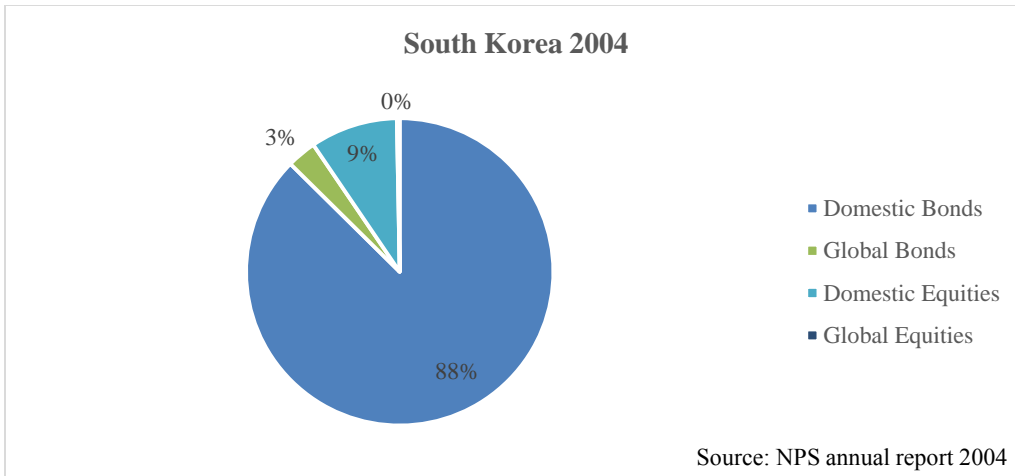


Figure 18. Investment Portfolio of South Korea in 2004

In 2009, NPS decreased the share of domestic bonds to 72% and increased domestic equities and alternative assets. However, at least 85% of the portfolio was still invested in the domestic market (Figure 19). NPS states in the annual report of 2009 that it planned to reduce bonds in the portfolio to 60% and increase equities and alternative assets to 30% and 10%, respectively. In terms of alternative assets, NPS seeks to opportunities to invest in real estate, energy and resource projects, power-generation facilities, and manufacturing plants.

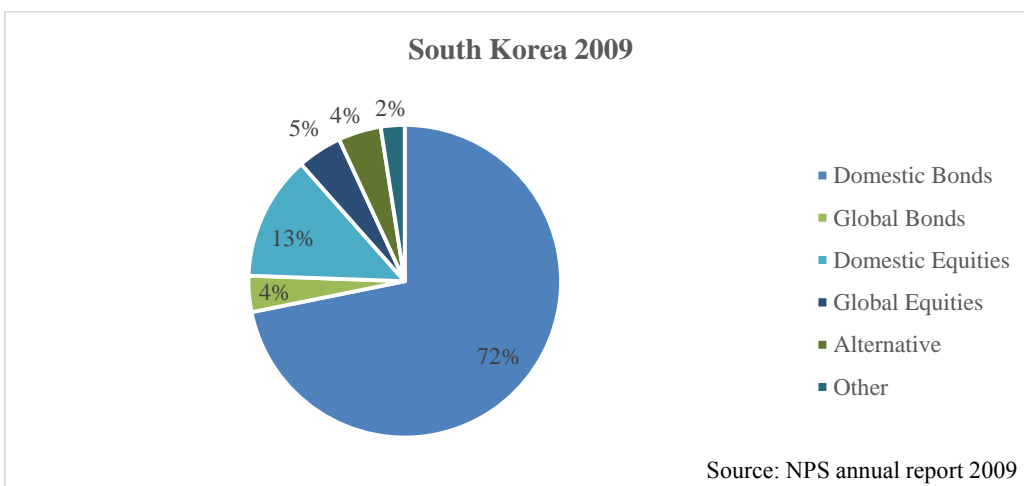


Figure 19. Investment Portfolio of South Korea in 2009

As mentioned in the annual report in 2009, the investment portfolio of 2014 is significantly changed from the portfolio of 2009. Even though domestic bonds account for 54% of the portfolio, 25% of the fund is invested in global financial market. Moreover, alternative assets increased from 4% to 11%. Compared to the 2009 portfolio, it is more diversified in terms of asset classes and geographic spread (Figure 20).

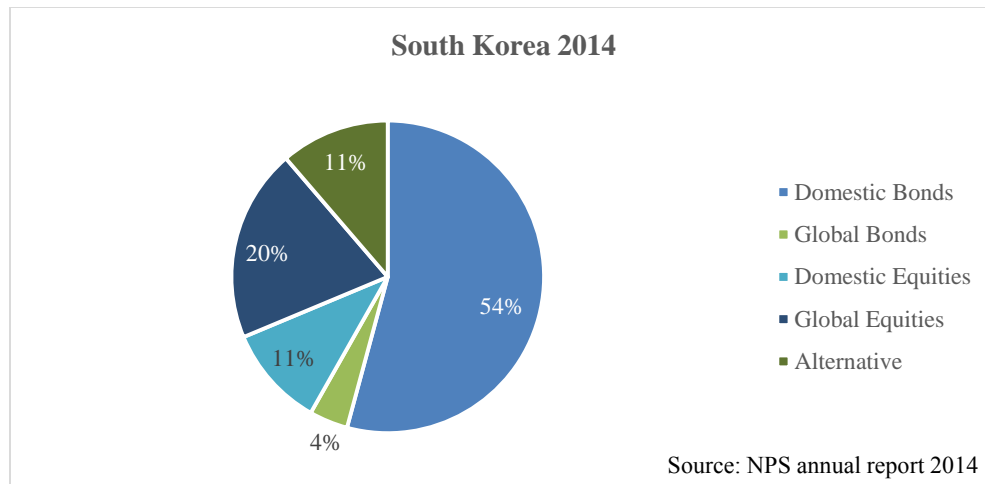


Figure 20. Investment Portfolio of South Korea in 2014

By the end of 2018, NPS targets to have the limit on portion of domestic bonds up to 50%, and invest in global bonds more than 10%. NPS also reports in the annual report in 2014 that it is planning to keep 10% alternative assets in the portfolio; in this way, it takes more risks but expects higher returns.

Sweden (AP)⁶

The average portfolio of AP including the first, second, third, and fourth AP fund as of 2004 is composed of 60% of equities and 35% of bonds and 5% of alternative assets. Alternative assets invested are mainly real estate and private equities. In the

⁶ Since AP funds consists of four large funds (AP1 to AP4) and a small fund with special purpose (AP6), the average investment portfolio of AP1 to AP4 is used to easily compare over the decade.

annual report in 2004, AP funds states that they plan to increase equities in emerging markets, especially Asia, and decrease Swedish inflation-linked bonds and Swedish government bonds (Figure 21).

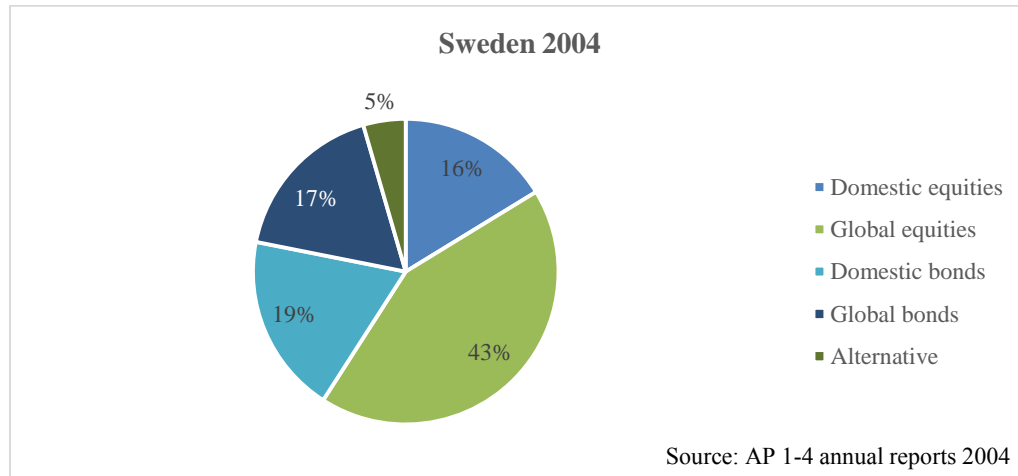


Figure 21. Investment Portfolio of Sweden in 2004

In 2009, the portfolio has increased shares of global bonds and alternative assets. On the other hand, global equities and domestic bonds are reduced by 4% and 5% respectively. Within global equities section, AP funds have the largest portion in the U.S. market, followed by European countries excluding Sweden and emerging countries. The breakdown of bonds in annual report of the first AP fund displays that the largest part, which is about 50%, accounts for loans, and the other half is equally invested in government bonds and index-linked bonds. On the contrary, the breakdown of the fourth AP fund shows that it has only 26% of governmental bonds and 74% of fixed income portfolio is invested in non-governmental bonds (Figure 22).

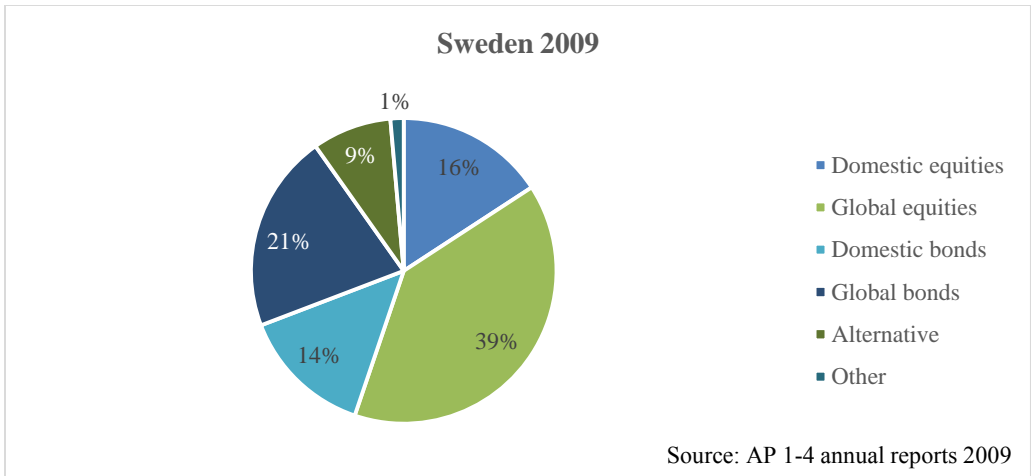


Figure 22. Investment Portfolio of Sweden in 2009

Compared to the portfolio of 2009, AP reduces domestic and global equities and raise its investment in domestic bonds and alternative assets. On average, the total equities account for about 50% of the portfolio and domestic bonds, global bonds, and alternative assets respectively accounts for 18%, 15%, and 16% (Figure 23).

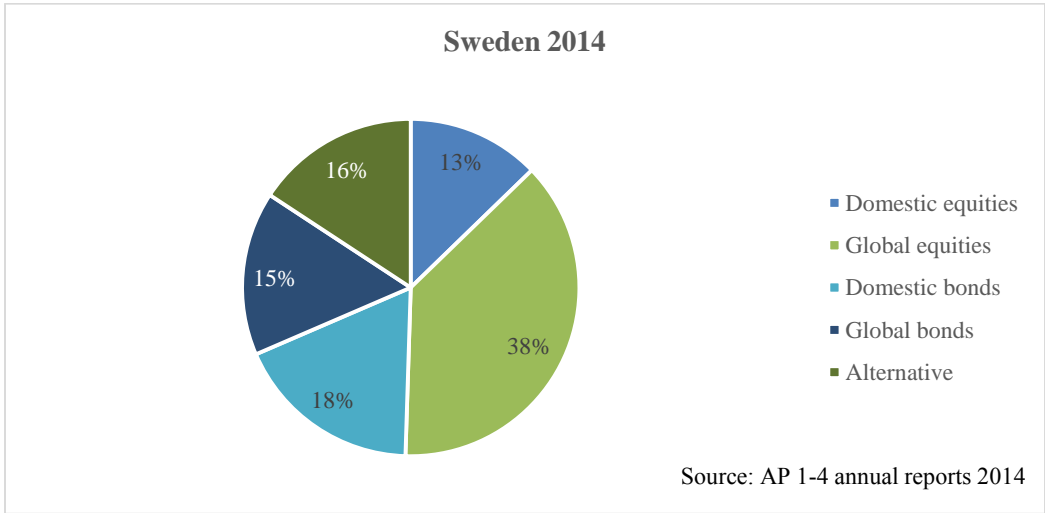


Figure 23. Investment Portfolio of Sweden in 2014

As Swedish funds are divided into four major funds, each AP fund has different investment portfolio; however, they has followed similar trends of investment portfolio. All AP funds attempts to increase investment outside Sweden either with bonds or with

equities in order to diversify risks. In addition, AP fund shifts investment from public market to private market through real estate and private equities.

United States (CalPERS)

The investment portfolio of CalPERS in 2004 is composed of 61% of equities, 25% of bonds, and 14% of alternative assets. In terms of geographical diversification, a large share of portfolio including alternative assets is invested in domestic market, and only about 25% is invested in international market (Figure 24). The largest stock holdings of CalPERS in 2004 is in General Electric Company, followed by Microsoft Corporation, and the largest bond holdings is in Federal Home Loan Mortgage Corporation.

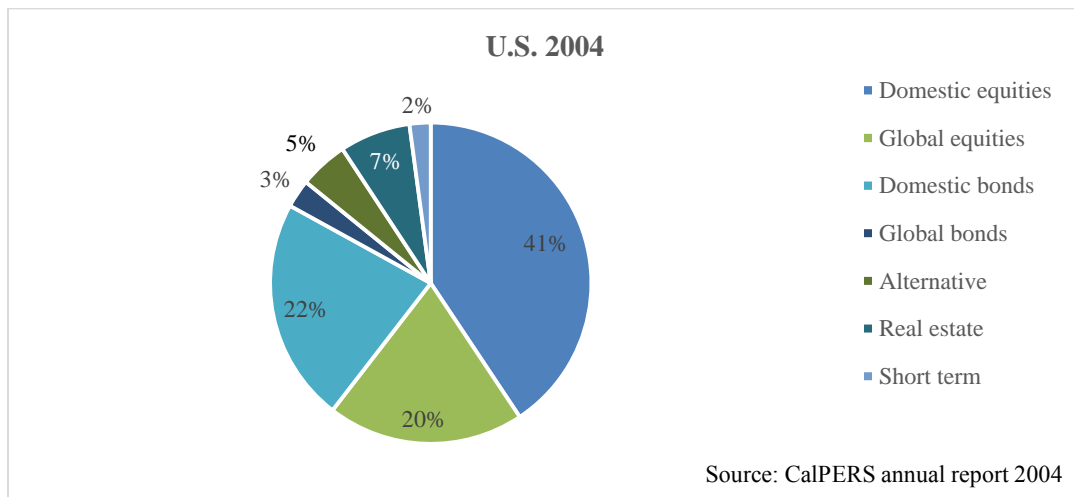


Figure 24. Investment Portfolio of the U.S. in 2004

CalPERS made significant adjustments in the target portfolio of 2009. CalPERS decided to allocate only 28% to domestic equities and 5% to domestic bonds, which are entirely inflation-linked bonds. Instead, investment in global bonds evidently increased from 3% to 19%. Additionally, allocation to real estate and alternative assets also increased up to 10% respectively (Figure 25). As of 2009, the largest stock holdings of CalPERS was in Exxon Mobil Corporation, and interestingly General Electric Company,

which was the largest holdings in 2004, was out in the top ten holdings in 2009. The largest bond holdings also have been changed from federal mortgages to corporate bonds, Chase Issuance Trust.

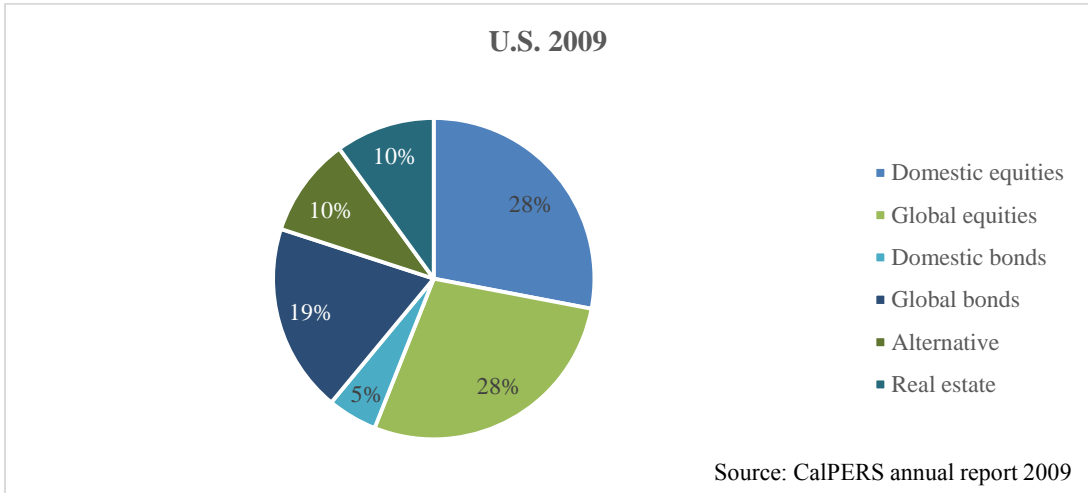


Figure 25. Investment Portfolio of the U.S. in 2009

The target portfolio of 2014 does not discretely stipulate shares for domestic and global investment, and simply allocates funds by asset classes. However, the investment portfolio in 2014 suggests that CalPERS avoided investing in global equities or global bonds and focuses on U.S. market. Moreover, the portfolio in 2004 specifies shares of real estate and private equities instead of presenting alternative assets. Target allocation to real estate has been 11% of the portfolio; however, actual investment in real estate doubles its target amount (Figure 26, 27). On the other hand, as of September 2014, the CalPERS announced that it was terminating its \$4.5 billion hedge fund portfolio within alternative assets to reduce complexity and fees (Stewart).

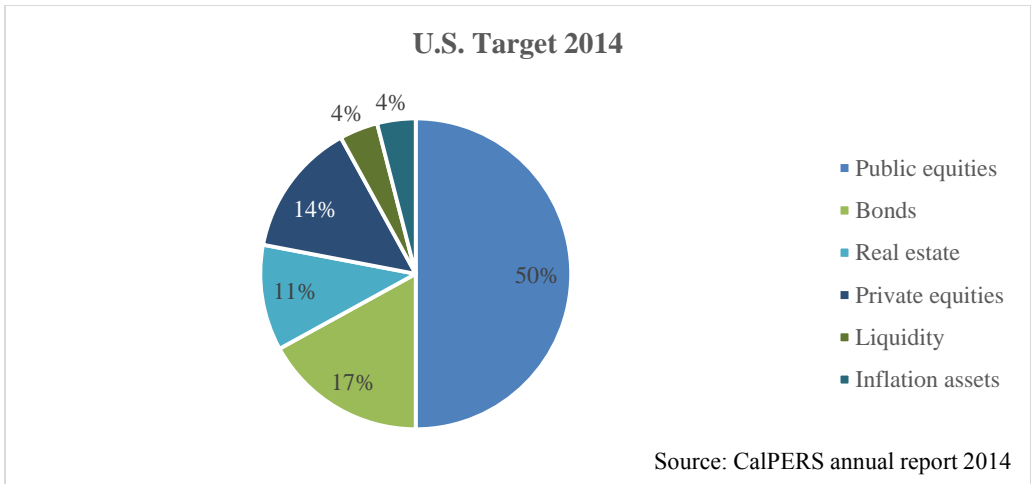


Figure 26. Target Investment Portfolio of the U.S. in 2014

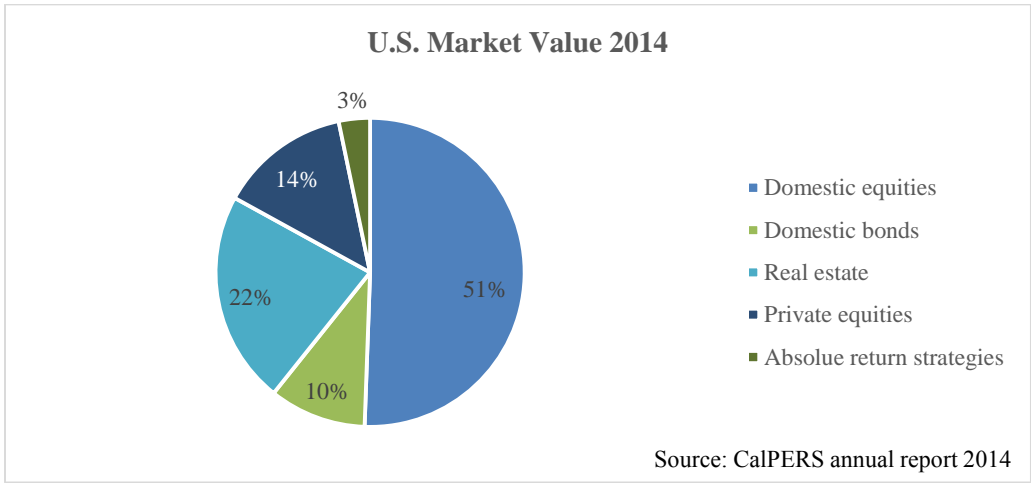


Figure 27. Investment Portfolio of the U.S. with Market Value in 2004

Overall, CalPERS decreased global equities and simplified its portfolio by removing hedge funds and only keeping real estate and private equities within alternative assets.

3.2 Changes in Investment Strategies

By analyzing the asset allocation of the eight countries from 2004 to 2014, common trends over the decade are found among the investment portfolios. Around 2004, the public pension funds tended to be risk-adverse and invested a large share in

fixed-income securities. But as time passed, they shifted their funds from fixed-income to equities. Five out of eight countries, Canada, Denmark, Japan, Norway, and South Korea, shows this trend. This result is also supported by the annual survey of public pension reserve funds in OECD countries; the survey shows that public pensions increased allocations to equities and reduced fixed income on average (OECD). The other three countries, Netherlands, Sweden, and U.S., did not increase their equities shares over the decade, but they already had a larger share in equities compared to bonds.

Secondly, investments in global equities and bonds are also gradually increasing while investments in domestic markets are decreasing. This tendency is shown in five out of eight countries: Canada, Japan, Norway, South Korea, and Sweden. Though Denmark did not shift its investments from domestic to global market, it originally has enough global assets in the portfolio from 2004. When public pension funds consider the geographic spread of their portfolio, many pension funds choose to have allocations in emerging markets, and the allocation has been gradually expanding over the past few years (OECD).

The most salient trend in portfolios of public pension funds is the investment shift from public markets to private markets. Pension funds have shown more interest in alternative assets rather than listed equities and bonds. According to a survey of large pension funds and public pension reserve funds, despite the different nature of each fund, they reveal a clear trend in alternative assets. The 16 public pension reserve funds, nearly the entire survey population, increased alternative assets over the past four years by 4.2 percentage points on average (OECD). Six countries, except Denmark and Japan, have been increasing alternative assets in their portfolio. The Canadian pension fund (CPP),

for instance, invested only 4.3% of its fund in private markets in 2009; however, the amount increased to 40.4% in 2014. The asset type in which CPP is most interested within alternative assets is private equity, followed by real estate (Table 3).

Asset Type (\$ billions)	2005	2010	2012	2013	2014
Private equity	2.9	16.1	26.3	32.6	41.3
Real estate	0.4	7.0	17.1	19.9	25.5
Infrastructure	0.2	5.8	9.5	11.2	13.3
Private debt	-	0.9	4.7	4.1	5.7
Private real estate debt	-	0.3	1.6	2.3	2.7
Total	3.5	30.1	59.2	70.1	88.5
% of Fund	4.3%	23.6%	36.6%	38.2%	40.4%

Table 3. Growth of Private Investing Programs of CPP

Additionally, Japan declared major changes in its investment policy in 2014, and it initiated a separate department that manages alternative investments. By moving towards private financial markets, pension funds added more asset classes (Table 4).

Name	Country	Bonds to Equities	Domestic to Global	Public to Private
CPP	Canada	√	√	√
ATP	Denmark	√		
GPIF	Japan	√	√	
ABP	Netherlands			√
GPF	Norway	√	√	√
NPS	South Korea	√	√	√
AP	Sweden		√	√
CalPERS	United States			√

Table 4. Common Adjustments in Investment Strategies

Another modification that is not shown in the portfolios is the increasing amount of internally managed funds. Many public pension funds partially depend on external asset management companies to professionally invest their funds. However, using external asset management groups entails extra costs and keeps pension funds from direct control. According to an article about public funds in the U.S., more public funds across the U.S. considers handling investments in-house in order to reduce asset management

fees. Although the primary motivation for this change is to cut costs, there are other motivating factors other than fee savings: keep staffs engaged in the market, facilitate oversight of external managers, and exert better control over their portfolio (Lightbody). CalPERS, for example, has reduced \$285 million dollars of investment management fees since 2010 by bolstering internal asset management (Figure 28). As mentioned above, after the 2008 financial crisis, CalPERS gradually divested hedge funds, which require external expertise, and it decreased the dependency on external asset management even more.

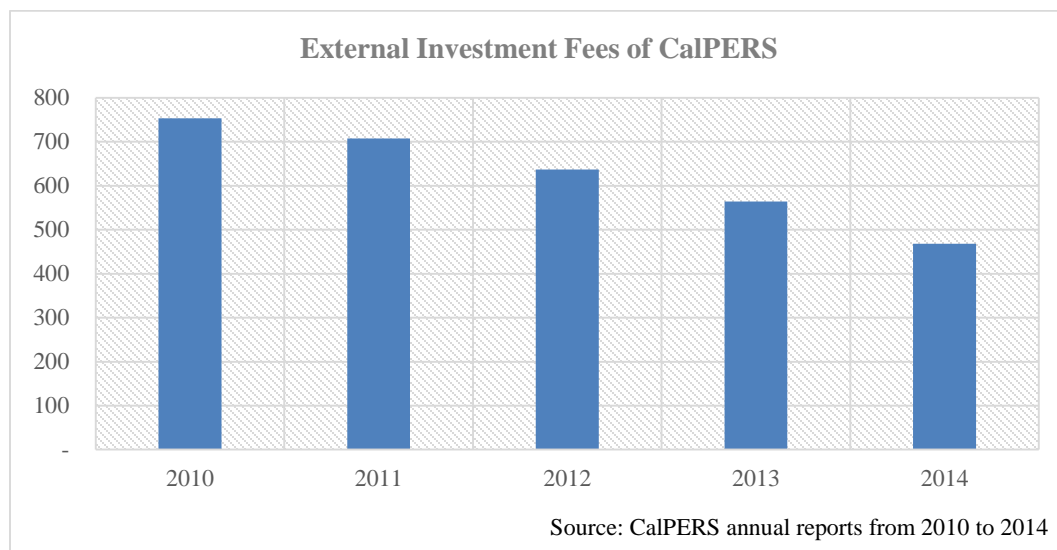


Figure 28. External Investment Fees of CalPERS

Another distinct example is that of the Swedish fund AP2. It has increased its internal asset management from 18% in 2001 to 75% as of 2013 (figure 29). Besides U.S. and Sweden, public pension funds of Netherlands, South Korea, and Canada have a large amount of assets internally managed or plan to increase internal asset management.

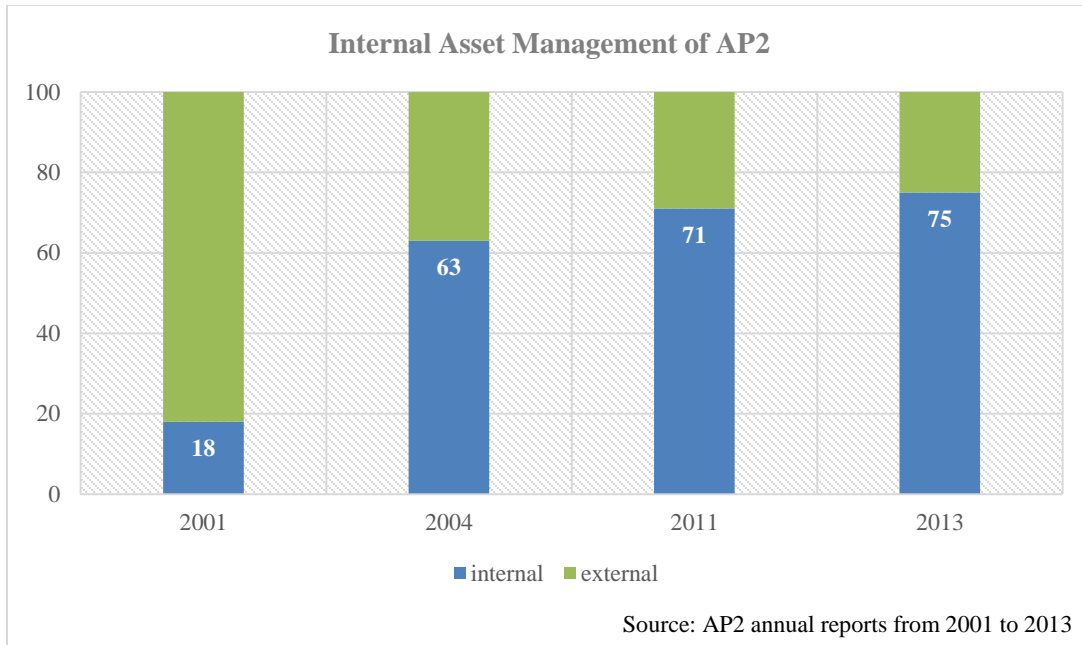


Figure 29. Percentage of Internal Asset Management of AP2

Increased internal management potentially enables pension funds to have better investment performance. According to a research by CEM benchmarking, there is compelling empirical evidence that internal management is positively related to pension fund performance. The research maintains that “A 10% increase in internal management was associated with 4.6 basis points higher net value added” (Lum). Likewise, public pension funds expect to improve investment performance by internally managing their funds.

Chapter 4. Investment Performance and the 2008 Financial Crisis

The 2008 financial crisis in the United States negatively impacted the global economy. Global pension funds, which had invested in different markets including the U.S., suffered major losses on their investments. The 2008 weighted average real returns of private and public pensions of OECD countries was negative 23.0%. Public pension schemes not only suffered from losses on their investments, but also suffered from reduced contribution revenue due to unemployment and lower earnings during the crisis (Whitehouse).

I can use the Sharpe ratio to investigate the investment performance of public pension funds over the recent decade and to explore impact of the 2008 financial crisis on pension funds. Using the Sharpe ratio enables us to make the performance of one portfolio comparable to that of another portfolio by adjusting risks, and it measures excess return per unit of volatility. For the rate of return, annual returns of pension funds are used. As a risk free rate, returns of 1-year government bonds in each country are used to match with the annual returns of pension funds.

$$\text{Sharpe Ratio} = \frac{\text{rate of return} - \text{risk free rate}}{\text{standard deviation of excess return}}$$

First, the investment performance over eleven years from 2004 to 2014 can be compared through the Sharpe ratio of each country. Denmark has shown distinct

performance compared to other countries with the Sharpe ratio of 1.01, while Norway has the lowest value of 0.29. Although public pension funds are not composed of 100% equities in their portfolio, the Sharpe ratios of each pension fund over the 11 years are compared with Sharpe ratios of the major stock index in each country. Every pension fund, except Norway, results in higher Sharpe ratios compared to its equity market index. Denmark represents the highest Sharpe ratio of 1.01, followed by South Korea with 0.75 (Table 5).

Name	Country	Pension Sharpe	Equity Sharpe
CPP	Canada	0.60	0.35
ATP	Denmark	1.01	0.41
GPIF	Japan	0.56	0.22
ABP	Netherlands	0.51	0.19
GPFNG	Norway	0.29	0.46
NPS	South Korea	0.75	0.23
AP	Sweden	0.60	0.45
CalPERS	US	0.47	0.36

Table 5. Sharpe Ratio of Pension Funds and Equity 2014 to 2014

To easily compare the impact of the crisis, the decade is divided into three sub-periods: (1) pre-crisis (2004-2006), (2) crisis (2007-2010), and (3) post-crisis (2010-2014). In the pre-crisis period the data of all the eight countries represents positive Sharpe ratios, and the average of the eight countries Sharpe ratio is 3.36. The data appears that Netherlands (ABP) has the highest Sharpe ratio of 5.05, followed by South Korea (NPS) with 4.33, and by Norway (GPFNG) with 3.92. The country with the lowest value is Japan with 1.38 (Table 6).

During the crisis, from 2007 to 2010, four out of eight countries had a negative Sharpe ratio, and the mean of the Sharpe ratios among the eight countries is 0.20. Four countries with negative values include Canada, Japan, Norway, and the United States.

Denmark is the only country where the Sharpe ratio is greater than 1.0, and it is 1.26. The highest value in intra-crisis period is less than the lowest value in before-the-crisis. In during-the-crisis period, Japan again has the lowest value of -0.24 (Table 7).

In the post-crisis period, from 2011 to 2014, the Sharpe ratio of all the eight countries return to positive, and the average Sharpe ratio among the eight countries is 1.51. The average investment performance of post-crisis is recovered compared to that of intra-crisis, but it is still less than the average of the pre-crisis period. Post-crisis, Canada represents the highest value of 2.48, followed by 2.15 of Denmark, while Norway has the lowest value of 0.74 among the eight countries (Table 8).

Pension funds with a greater Sharpe ratio receive more compensation for the risk that the fund takes. Six countries, Denmark, Netherlands, Norway, South Korea, Sweden, and the United States, shows the highest Sharpe ratio in pre-crisis period, followed by post-crisis and by intra-crisis. On the other hand, the other two countries, Japan and Canada, shows the highest Sharpe ratio in post-crisis, followed by pre-crisis and by intra-crisis (Table 9). Consequently, on average, public pension funds made the greatest investment profits in pre-crisis. During the crisis, many countries with risky assets, such as equities and alternative assets, showed negative Sharpe ratios; but countries with a large share of less risky assets, such as bonds, were able to maintain positive values. But, Sharpe ratios in this period indicate that all the eight countries has the worst investment returns during the crisis. After the crisis, on average, public pension funds have recovered their investment returns to some degree; however, their returns are not as great as the returns before the crisis.

Name	Country	Nominal Returns (%)			Average return (%)	Standard Deviation (%)	Average Risk Free (%)	Sharpe Ratio	Sharpe Ratio Rank
		2004	2005	2006					
CPP	Canada	17.60	8.50	15.50	13.80	4.76	3.61	2.14	7
ATP	Denmark	8.30	11.40	7.90	9.19	1.92	3.04	3.21	6
GPIF	Japan	2.91	9.57	3.52	5.29	3.68	0.19	1.38	8
ABP	Netherlands	11.50	12.80	9.50	11.26	1.66	2.87	5.05	1
GPIFG	Norway	8.94	11.09	7.92	9.31	1.62	2.97	3.92	3
NPS	South Korea	6.01	5.39	5.87	5.76	0.33	4.35	4.33	2
AP	Sweden	11.25	17.75	10.69	13.19	3.92	0.22	3.31	5
CalPERS	United States	16.60	12.30	11.80	13.55	2.64	4.12	3.57	4

Table 6. Investment Performances in pre-crisis (2004-2005)

Name	Country	Nominal Returns (%)				Average Return (%)	Standard Deviation (%)	Average Risk Free (%)	Sharpe Ratio	Sharpe Ratio Rank
		2007	2008	2009	2010					
CPP	Canada	12.90	-0.30	-18.60	14.90	1.29	15.43	1.72	-0.03	5
ATP	Denmark	5.90	18.80	8.50	6.80	9.88	5.96	2.34	1.26	1
GPIF	Japan	-4.69	-7.61	7.88	-0.27	-1.34	6.75	0.30	-0.24	8
ABP	Netherlands	3.80	-20.20	20.20	13.50	3.10	17.68	1.72	0.08	3
GPIFG	Norway	4.30	-23.30	25.50	9.60	2.42	20.32	2.95	-0.03	5
NPS	South Korea	6.98	-0.21	10.84	10.39	6.91	5.11	3.82	0.61	2
AP	Sweden	4.15	-21.57	19.73	10.40	1.94	17.70	1.50	0.03	4
CalPERS	United States	19.10	-5.10	-24.00	13.30	-0.68	19.50	0.94	-0.08	7

Table 7. Investment Performances in intra-crisis (2007-2010)

Name	Country	Nominal returns (%)				Average Return (%)	Standard Deviation (%)	Average Risk Free (%)	Sharpe Ratio	Sharpe Ratio Rank
		2011	2012	2013	2014					
CPP	Canada	11.90	6.60	10.10	16.50	11.22	4.12	1.01	2.48	1
ATP	Denmark	20.10	9.90	14.50	6.50	12.64	5.90	-0.02	2.15	2
GPIF	Japan	2.29	10.21	6.75	12.27	7.81	4.37	0.07	1.77	3
ABP	Netherlands	3.30	4.80	6.2	14.50	7.11	5.01	-0.02	1.42	4
GPF	Norway	-1.40	4.70	15.90	7.60	6.52	7.19	1.23	0.74	8
NPS	South Korea	2.31	7.00	4.20	5.26	4.68	1.96	2.73	0.99	7
AP	Sweden	-1.68	11.72	13.68	14.42	9.33	7.56	0.49	1.17	6
CalPERS	United States	21.70	0.10	13.20	15.90	12.44	9.13	0.15	1.35	5

Table 8. Investment Performances in post-crisis (2011-2014)

Name	Country	04-06 Sharpe	Rank Among Periods	07-10 Sharpe	Rank Among Periods	11-14 Sharpe	Rank Among Periods
CPPIB	Canada	2.14	2	-0.03	3	2.48	1
ATP	Denmark	3.21	1	1.26	3	2.15	2
GPIF	Japan	1.38	2	-0.24	3	1.77	1
ABP	Netherlands	5.05	1	0.08	3	1.42	2
GPF	Norway	3.92	1	-0.03	3	0.74	2
NPS	South Korea	4.33	1	0.60	3	0.99	2
AP	Sweden	3.31	1	0.02	3	1.17	2
CalPERS	United States	3.57	1	-0.08	3	1.35	2

Table 9. Sharpe ratio comparison in pre, intra, and post-crisis

Chapter 5: Conclusion

This research paper investigates changes in investment strategies and performance of global public pension funds from 2004 to 2014. The investment portfolios of 2004, 2009, and 2014 in eight countries are compared in order to study changes in asset allocations. Annual reports of eight countries during those periods are reviewed to discover any major administrative changes. To fairly compare investment performance, Sharpe ratios are computed to consider risk-adjusted rates of return.

The results of this study represent three main changes in asset allocations through investment portfolios and one administrative change over the decade. First, public pension funds shifted their investment from fixed income to equities. Next, investments in domestic markets decreased while investments in global equities and fixed income increased. Finally, public pension funds shifted investments from public markets to private markets. They have been increasing alternative assets, such as private equities and infrastructure, in their portfolios. The administrative change shown is that public pension funds increased internal management of funds to reduce fees and exert better control.

When the performance of each public pension fund over the decade is compared to that of equity markets, public pension funds except Norway have superior investment performance with higher Sharpe ratios. In the comparison among three sub-periods-- before (2004-2006), during (2007-2010), and after the 2008 financial crisis (2011-2014)--

all eight countries have the lowest investment returns during the crisis period. In addition, six out of eight countries, including Denmark, Netherlands, Norway, South Korea, Sweden, and the U.S., have the best investment performance in pre-crisis, followed by post-crisis. Two countries, Japan and Canada, show the highest returns in post-crisis, followed by pre-crisis. Hence, the data indicate that on average investment returns of public pension funds have been recovered some degree after the crisis, but performance is not as great as those before the crisis.

There are several avenues for further research in this area. One is investigating whether these portfolio adjustments actually lead to positive impacts on investment performance. Another is investigating if there is a correlation between a type of asset class in the portfolio and the amount of liabilities. For example, it is possible to examine if a pension fund with less liabilities tends to have a greater ratio of risky assets, or vice versa. Yet another is to extend the analysis in this paper through including more public pension funds or even private pension funds to study the whole pension industry. Finally, I used annual rates of return to compute Sharpe ratios in order to investigate investment performances relative to risks taken in portfolios; however, those Sharpe ratios are incomplete due to the small sample size. If I had been able to assess to monthly rates of returns, the results would have been more sophisticated.

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