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ASSET ALLOCATION IN SOVEREIGN WEALTH FUNDS:
GOVERNMENT PENSION FUND - GLOBAL

Agil Samadov

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Approved by

Advisory Committee

Peter Schuhmann
Joe Farinella

Cetin Ciner
Chair

Accepted by

Dean, Graduate School
## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>iv</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>v</td>
</tr>
<tr>
<td>DEDICATION</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>viii</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1. SOFAZ and GPF-G</td>
<td>4</td>
</tr>
<tr>
<td>1.1 The State Oil Fund of the Republic of Azerbaijan (SOFAZ)</td>
<td>4</td>
</tr>
<tr>
<td>1.2 Government Pension Fund – Global (Norway)</td>
<td>6</td>
</tr>
<tr>
<td>2. ASSET ALLOCATION</td>
<td>10</td>
</tr>
<tr>
<td>2.1 Asset Classes</td>
<td>11</td>
</tr>
<tr>
<td>2.2 Strategic Asset Allocation</td>
<td>13</td>
</tr>
<tr>
<td>2.3 Tactical Asset Allocation</td>
<td>14</td>
</tr>
<tr>
<td>2.4 Rebalancing</td>
<td>15</td>
</tr>
<tr>
<td>3. EQUITY PORTION OF PORTFOLIO</td>
<td>17</td>
</tr>
<tr>
<td>3.1 Equity Investment Decision</td>
<td>17</td>
</tr>
<tr>
<td>3.2 Transition Phase</td>
<td>19</td>
</tr>
<tr>
<td>3.3 New Guideline 2007</td>
<td>21</td>
</tr>
<tr>
<td>4. LITERATURE REVIEW</td>
<td>27</td>
</tr>
<tr>
<td>4.1 Academic Research on Asset Allocation Policy</td>
<td>27</td>
</tr>
<tr>
<td>4.2 Academic Research on Sovereign Wealth Funds</td>
<td>34</td>
</tr>
<tr>
<td>5. HYPOTHESIS</td>
<td>38</td>
</tr>
<tr>
<td>6. DATA AND METHODOLOGY</td>
<td>40</td>
</tr>
<tr>
<td>6.1 Sample</td>
<td>40</td>
</tr>
<tr>
<td>6.2 Measures</td>
<td>41</td>
</tr>
<tr>
<td>6.3 Statistical Method</td>
<td>41</td>
</tr>
<tr>
<td>7. EMPIRICAL RESULTS</td>
<td>44</td>
</tr>
<tr>
<td>7.1 Contemporaneous Model</td>
<td>44</td>
</tr>
<tr>
<td>7.2 Models with Lagged Variables</td>
<td>45</td>
</tr>
<tr>
<td>7.3 Stepwise Selection Model</td>
<td>47</td>
</tr>
</tbody>
</table>
CONCLUSION ........................................................................................................................................... 49
BIBLIOGRAPHY .................................................................................................................................. 50
ABSTRACT

The objective of this paper is to contribute to the limited empirical studies regarding the asset allocation in Sovereign Wealth Funds. The research was conducted based on the data of Government Pension Fund – Global (Norway) and the results of this study can be very useful for other SWFs, especially for the State Oil Fund of Azerbaijan Republic (SOFAZ). Thus, the basic idea of the present research derived from the current investment situation of SOFAZ. This study aims to find out which factors are important in making a decision about the equity investment of portfolio in Sovereign Wealth Funds. The research employed three different models in order to find the effect (both current and lagged) of variables such as returns on equity and bond portfolio of the Fund, oil prices, equity and bond indexes and others. As a result of regression analysis there has been found statistically significant evidence that the lagged effects of variables are bigger than the current ones. Thus, five out of eight variables were statistically significant in the lagged periods compared to two significant variables in the contemporaneous model. There were some significant variables in all three models such as FTSE World Equity Index and the Tracking Error of the portfolio. This means that these factors are important at all times and without depending on a combination of variables. In addition, there has been presented the best composition of significant variables which can be used by SOFAZ and as well as other SWFs and/or Institutional Investors.
ACKNOWLEDGEMENTS

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DEDICATION

I would like to dedicate this master thesis to my family whose continued understanding and support motivated me to complete this research work on time.
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Major Features of SWFs</td>
<td>2</td>
</tr>
<tr>
<td>2. Results of Model 1</td>
<td>44</td>
</tr>
<tr>
<td>3. Results of Model 2</td>
<td>46</td>
</tr>
<tr>
<td>4. Results of Model 3</td>
<td>48</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total Assets of SOFAZ in USD millions</td>
<td>5</td>
</tr>
<tr>
<td>2. Total Assets of GPF-G in NOK million</td>
<td>7</td>
</tr>
<tr>
<td>3. Portfolio Performance Contribution of Factors</td>
<td>14</td>
</tr>
<tr>
<td>4. Real return for every year between 1900 and 2006, on a portfolio of equities in the US, Japan, United Kingdom, France and Germany, as weighted by the weights applicable to the Government Pension Fund – Global. Local currency</td>
<td>22</td>
</tr>
<tr>
<td>5. Real return for every year between 1900 and 2006, on a portfolio of bonds in the US, Japan, United Kingdom, France and Germany, as weighted by the weights applicable to the Government Pension Fund – Global. Local currency</td>
<td>23</td>
</tr>
<tr>
<td>6. Model computations of accumulated returns in percent after 15 years, and attendant Probabilities</td>
<td>24</td>
</tr>
<tr>
<td>7. Decomposition of Total Variations</td>
<td>32</td>
</tr>
</tbody>
</table>
INTRODUCTION

Sovereign Wealth Funds (SWFs) are government-owned investment funds which are commonly funded by the transfer of foreign exchange assets, and which are set up to serve the objectives of a stabilization fund, a savings fund for future generations, a reserve investment corporation and a pension reserve fund by investing the funds on a long term basis, often overseas.¹

SWFs are generally categorized as stabilization funds, savings funds, pension reserve funds, or reserve investment corporations (Table 1).² Most of the current SWFs are either savings funds for future generations or fiscal stabilization funds. There are only a few pension reserve funds (Australia’s Future Fund, Chile’s Pension Reserve Fund, Ireland’s National Pensions Reserve Fund, New Zealand’s Superannuation Fund, and the Russia Federation’s National Wealth Fund) available today and even fewer reserve investment corporations (China Investment Corporation, Korea Investment Corporation, and Government Investment Corporation of Singapore). Some SWFs such as State Oil Fund of Azerbaijan, Kuwait Investment Authority, and Norway’s Government Pension Fund-Global (GPF-G) have multiple objectives and a number of countries also have more than one SWF with different objectives, including Chile, the Russian Federation, and Singapore.

SWFS are also categorized according to the source of their foreign exchange assets. Commodity SWFs are funded by commodity exports, either owned or taxed by government (e.g.

¹ S.Kern, 2008, DB Research
² See, for example, IMF (2007, 2008); and Hammer, Kunzel, and Petrova (2008).
the Gulf States, Norway, Russia, and Azerbaijan).\(^3\) Non-commodity SWFs are funded generally by the transfer of assets from official foreign exchange reserves (e.g. China, other Asia countries). Current estimates show that funds derived from oil and gas export revenues account for some two thirds of the total assets held by SWFs, with the rest consisting of funds mainly controlled by Asian surplus exporters.

Table 1. Major Features of SWFs.

<table>
<thead>
<tr>
<th>Source</th>
<th>Country</th>
<th>Policy Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Macro stabilization Saving Pension Reserve Reserve Investment</td>
</tr>
<tr>
<td>Oil and Gas</td>
<td>UAE</td>
<td>GPF-G</td>
</tr>
<tr>
<td></td>
<td>Norway</td>
<td>General Reserve Fund</td>
</tr>
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<td>Qatar</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kuwait</td>
<td>State Oil Fund</td>
</tr>
<tr>
<td></td>
<td>Azerbaijan</td>
<td>Oil Stabilization Fund</td>
</tr>
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<td>Iran</td>
<td></td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>Other Commodity</td>
<td>Botswana</td>
<td></td>
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<tr>
<td></td>
<td>Chile</td>
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<tr>
<td>Fiscal Surpluses</td>
<td>Australia</td>
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<td></td>
<td>Korea, Republic</td>
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<td></td>
<td>Singapore</td>
<td>Temasek</td>
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<td></td>
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\(^3\) Aizenman and Glick, 2008
The difference in types of SWFs results in differences in their investment objectives as well. For example, a reserve investment corporation should take into account the possible implications of balance of payments risks, and will want to hold a portion of its portfolio in liquid assets. The type of SWFs and its objectives have also impact on its investment horizon. For instance, savings SWFs have longer investment horizons than stabilization SWFs. However, pension reserve funds should define their investment horizons from the timing of the future anticipated liabilities falling due, which can be decades in the future.

The two SWFs are briefly introduced in Section 2. Section 3 is about an asset allocation which creates a basis for ideas in the further sections. Section 4 shows how Government Pension Fund - Global decided to invest in equities, the transition process and another new guideline about equity portfolio. The literature review, Section 5, summarizes all the previous studies related to an asset allocation and SWFs. Section 6 presents the hypothesis of this study. Data and methodology is described in Section 7 and is followed by empirical results of this paper in Section 8. Finally, Section 9 concludes the present study.
1. SOFAZ and GPF-G

1.1 The State Oil Fund of the Republic of Azerbaijan (SOFAZ)

The State Oil Fund of the Republic of Azerbaijan was established in December 29, 1999. Fund has the following objectives:

- Preservation of macroeconomic stability, ensuring fiscal-tax discipline, decreasing dependence on oil revenues and stimulating development of the non-oil sector

- Taking into account that oil and gas are depletable resources ensuring intergenerational equality with regard to the country's oil wealth and accumulate and preserve oil revenues for future generations

- Financing major national scale projects to support socio-economic progress\(^4\)

The first revenues of SOFAZ were transferred in January 4, 2001. The amount of transfer was USD 270,964,700 and you can see from the table below how the revenues of SOFAZ have grown since that time.

\(^4\) SOFAZ, 2011
SOFAZ’s revenues are going to increase rapidly in the following years due to the fact that Azerbaijan has 7 billion barrels proved reserves.\(^5\) Fund in ten years of its performance invested its revenues only to fixed income (mostly government securities) and kept small portion of its portfolio as cash in international bank accounts. However, because of the oil price increases in recent years, the fund’s portfolio has grown more than expected. And now SOFAZ’s executives have decided to allocate its assets more to riskier assets. They plan to decrease the allocation of fixed income and increase the allocation of equities in the portfolio. They take steps to move in that direction. Fund is already looking at passive equity investments in the developed world equity markets.\(^6\) If we consider that SOFAZ has only ten years of performance and Azerbaijan is young capitalist country, it will be useful for them to take into account the performance of other SWFs, especially in this stage of its activity. Using the past data of

\(^{5}\text{CIA, 2010}\)

\(^{6}\text{SWFs Institute, 2010}\)
successful and more experienced SWFs may have a positive impact in the performance of SOFAZ. They can just analyze other ones’ investment policies and define how other SWFs managed this process effectively. Based on these reviews Fund can improve its asset allocation policy and find out which factors are important to be considered in allocation of assets.

Because of some important features about SWFs we are going to continue our research analysis regarding the asset allocation policies of SWFs based on the case of Government Pension Fund – Global (Norway).

1.2 Government Pension Fund – Global (Norway)

The Government Pension Fund – Global was established in 1990. The goal of the GPF-G is to generate the highest possible return within set risk limits. According to the fund’s mechanism the oil revenues of Norway should only be allocated to the Fund when there is a budget surplus. Because of the budget deficits the first half of the 1990s, only in 1996 for the fiscal year 1995 the first transfer was made from the state budget to the Fund. It shows that the Fund is fully integrated with the state budget. However, after that transfer GPF-G has begun to grow dramatically. Thus, just in five years GPF-G amounted to Norwegian Krone (NOK) 613.7 billion (about USD 80 billion). There is also an interesting fiscal rule regarding the budget policy that no more than 4 percent of the Fund’s return should over time be spent on the annual state budget. It was established in 2001 and it seems that it played an important role in the growth of GPF-G. The historical total assets of the Fund were described in Figure 2. The Fund reports the

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7 NBIM, 2011
size of its assets only in NOK and now the total size of GPF-G is 3,102,000 million NOK which is more than USD 570 billion.

Source: Quarterly Report, 2011

Until 2006 the Fund called Petroleum Fund, when it was renamed to Government Pension Fund. The change was made because of the intention of the Government to use the Fund to finance an expected increase in future public pension costs. However, till now GPF-G haven’t got any relationship with pension liabilities.

The Norwegian central bank, Norges Bank manages GPF-G on behalf of the Ministry of Finance. The separate asset management unit of Norges Bank, Norges Bank Investment Management (NBIM) carries out the operational management of the assets of the Fund.\textsuperscript{8} The Ministry of Finance is responsible for laying down the investment strategy of the GPF-G. This

\textsuperscript{8} NBIM, 2011
strategy is expressed in its benchmark portfolio that establishes a basis for Norges Bank’s management of the Fund. The quality of the operational management can be measured by comparing the actual returns with the return on the benchmark portfolio. One important management goal is to get an excess return, measured in this manner, within the stipulated limits and restrictions. Another important objective is to implement the created strategy in a cost-effective manner.

There are some major reasons why we choose Government Pension Fund-Global for our research analysis:

- SOFAZ and GPF-G are both saving and stabilization funds
  (as it was mentioned earlier they are considered SWFs with multiple objectives)
- Both of them are funded from oil and gas exporting
- Until 1998 Norges Bank had no experience like SOFAZ in managing of international equities \(^9\) (NBIM was established in January of 1998)
- The size of both funds is roughly the same before they started to invest to equities
  (SOFAZ, USD 22 billion and GPF-G, NOK 113,401 million (USD 21 billion))
- For both of them the transparency is important in the management of portfolio
  (Linaburg – Maduell Transparency Index 10 points out of 10 \(^10\))

Beside these factors GPF-G is widely accepted as a good example of effective management of oil revenues. \(^11\) Furthermore, now Government Pension Fund – Global is the

\(^10\) SWF Institute, 2011
\(^11\) N.Usui, Asian Development Bank, 2007
second largest SWF in the world after Abu Dhabi Investment Authority (USD 627 billion\textsuperscript{12}) and it seems that it is going to be the first during the following years.

Due to the facts mentioned above regarding Government Pension Fund Global, we can conduct very reasonable research analysis for SOFAZ. The results of this study can give more practical view to SOFAZ in their performance about asset allocation policy.

\textsuperscript{12} SWF, Institute
2. ASSET ALLOCATION

Asset Allocation is a decision must be made by investors how the funds to be invested should be distributed among the major asset classes. In this decision process there are following steps:

1. Specify assumptions about asset classes
2. Select optimum asset classes
3. Establish Strategic Asset Allocation (SAA)
4. Implement tactical asset allocation
5. Rebalance tactical asset allocation
6. Conduct ongoing review\(^\text{13}\)

The first step is about how investors make assumptions with regard to future expected returns, risk and the correlation of future returns among asset classes. In the second step investors should select asset classes that best match the investors’ profile and objectives and have the maximum expected return for a given level of risk. The most important stage for investors is to establish a long term asset allocation policy (SAA). Sometimes investors can make a decision to deviate from strategic weights of asset classes because of some market opportunities and implement tactical asset allocation. However, they should rebalance it frequently taking into account strategic asset allocation framework. The final step is to review SAA from time to time in order to ensure the appropriateness of the weights of different asset classes.

A well-diversified portfolio may hold several asset classes, categories, styles, and sectors.\(^\text{14}\) In order to understand the differences among all asset classes and their various

\(^{13}\) Darst, 2008, page 4
components, successful investors study all of them. Thus, they make analysis to estimate the long-term expectations of risk and return, and they try to find out how the returns on one asset class may move in relation to other asset classes. Then they consider the advantages and disadvantages of including each investment in their portfolio. The proper asset allocation may reduce the probability of a large loss and also the frequency of losing periods, but it is not a unique method for the elimination of the whole portfolio risk. Investors can and will have periods when their portfolio will drop in value. The key to success for investors with any asset allocation strategy is to have the right portfolio for their needs, keep costs low and control risk so that they won’t panic in the face of occasional losses.

2.1 Asset Classes

SWFs apply a wide range of investment strategies reflecting their various objectives. Some SWFs invest solely in publicly-listed financial assets (e.g., bonds and equities), while others invest across all major asset classes, including alternative investments. But we can confidently say that most of the SWFs have switched a focus from buying government bonds of G7 countries. Now the asset allocation of SWFs almost includes all of the available investment tools. Morgan Stanley considers that 25 percent bonds, 45 percent equities and 30 percent alternative investments are reasonably targeted portfolio structure for many SWFs\textsuperscript{15}. GPF - G can be a good example. Thus, as it has matured, it increased the portion of equity and has already started to invest in alternative assets last year.

\textsuperscript{14} Ferri, 2010, page 10
\textsuperscript{15} J.Yu et al., Procedia Computer Science, 2010, p.2434
*Cash* – Mostly stabilization funds with liquidity demand hold cash for serving its objectives. However, others hold only small portion of its portfolio in cash because of the associated risk with it.

*Fixed income* – There is a tendency in SWFs investing to other fixed income securities rather than government bonds. However, they have very strict regulations towards fixed income in terms of investment security. For example, the Ministry of Finance of Norway has set a credit risk for GPF – G that maximum 3 percent of fixed income holdings can be rated lower than “BBB” credit rating from at least one of the following agencies: Moody’s, Standard & Poor’s and Fitch.16

*Equities* – As the risk-return characteristics of equities fit the demand of long term investors, it plays an important role in the strategic asset allocation of SWFs. Normally the average return of stock will excess the average return of bonds and the risk will be higher than bonds. However, the recent study indicates that for a long investment horizon the risk of equities is lower than fixed income securities.17 In fact, the risk of equities has two sources: a) systematic risk which can be reduced through geographically diversified portfolio of fund investments b) non-systematic risk which can be eliminated through allocation of assets in a variety of sector and investment targets. However, this does not mean that equities don’t have any risk for a long term. Because in some periods the correlations among various markets can rise and the effect of diversified portfolio may be weaken.

*Alternative Investments* – Those investments are investment tools other than traditional investments such as equities, bonds and cash. These assets have higher return and higher risk

16 Annual Report, 2011, page 12
17 J.Yu et al., Procedia Computer Science, 2010, p.2435
than traditional ones. The major alternative investment areas are private equity, real estate, commodities and hedge funds.

A number of SWFs has begun to invest in alternative asset classes in recent years (China Investment Corporation, Abu Dhabi Investment Authority). Government Pension Fund – Global got a mandate in March of 2010 to gradually invest as much as 5 percent of its assets in real estate. In November of 2010 the Fund announced about the agreement with the local company to invest in real estate in London. It would be completed till the spring of 2011 (no information about completion yet) and it was the first investment of the Fund in this asset class. They are going initially to invest in the largest European real estate markets such as the UK, France and Germany, before looking at other parts of the world.

2.2 Strategic Asset Allocation

Asset allocation decision of SWFs also involves Strategic and Tactical asset allocation that is to allocate sovereign wealth in all asset classes in order to disperse risk and ensure return. SAA is generally known as “buy and hold” strategy. It focuses on creating the best long-term mix of different assets for investors. It means it should not change based on short term market fluctuations. SAA determines optimize allocation proportions of each asset class in initial term, which is the most important decision that control total investment risk and meet investment return objectives. This strategy changes infrequently primarily in response to meaningful changes in the investor’s risk profile and objectives, altered expectations regarding assets’ returns, standard deviations and correlations, and emergence of a new class of assets that the

18 NBIM, 2011
Some literatures indicate that SAA has a very important role in an investment management process. Figure 3 illustrates the portfolio performance contribution of different factors.

![Pie chart showing portfolio performance contribution](image)

**Figure 3. Portfolio Performance Contribution of Factors**

Source: Brinson, Singer and Beebower (2001)

### 2.3 Tactical Asset Allocation

Once strategic weights of various asset classes have been established, investors can turn attention to the possibility of active departures from the normal asset mix created by SAA. Investors can make opportunistic shifts in the assets’ weights in order to take advantage of favorable market and economic conditions for particular subsets of the asset set. Tactical asset allocation (TAA) may offer opportunities to add measurably to a portfolio’s returns.

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20 Darst, 2008, page 26
TAA assumes active shifts to an investment mix based on short-term market forecasts for returns. These expectations may be a function of fundamental variables such as earnings or interest-rate forecasts, economic variables such as the outlook for economic growth in different countries, or technical variables such as recent price trends and charting patterns.

This strategy may offer good opportunities to enhance long-term portfolio return and it can be more effective than a static allocation. However, the generation of extra returns involves taking risk and active changes can also lead to significant losses. As we have all seen in the past couple of years, international markets are very volatile, as events can happen very quickly with quite severe consequences.

Many investors use a combination of these two types of asset allocation. TAA allows investors to establish an allocation response intended to capture higher rewards. SAA helps investors to make a long term plan by using asset classes to attain multiyear or even multidecade goals.

2.4 Rebalancing

Asset allocation rebalancing, also known as portfolio rebalancing refers to the process of bringing the weights of assets in the actual benchmark portfolio back in line with the strategic weights by buying or selling these assets. Divergent movements in asset prices may affect the portion of the portfolio’s holdings in each asset class over time. Therefore, investors apply a rebalancing plan to prevent excessive deviation from the strategic weights set by SAA.
The Ministry of Finance has set strategic weights for each asset class in the GPF – G. The Fund’s investments should be distributed 60 percent equities, 35-40 percent fixed income securities and as much as 5 percent real estate. Due to price movements in the equity and bond markets in various geographical regions, for example, a stronger increase in equity prices can push the equity portion above 60 percent. This can be resulted a deviation of actual benchmark portfolio from the strategic long-term benchmark portfolio. In order to avoid unnecessary transaction costs, the monthly capital inflows of the Fund are used to purchase equities or bonds in those regions that have shown the weakest development over the last month.

Normally when the portions in the actual benchmark portfolio will change, the NBIM will make the same changes to the actual portfolio. However, the shifts due to active management of the Fund can be exception and this can be another reason of shifts from strategic weights. Therefore, according to regulations of the Ministry of Finance, equity investments can move between 50 and 70 percent.

\[\text{NBIM, 2011}\]
\[\text{NBIM, 2011}\]
3. EQUITY PORTION OF PORTFOLIO

3.1 Equity Investment Decision

Up to the end of 1997 the Fund’s entire capital was invested in government and government-guaranteed bonds and bills, according to roughly the same strategy that followed by Norges Bank in its management of foreign exchange reserves. However, during 1997 considerable amount of capital was transferred to the Fund and Norges Bank raised the issue of investing some of the capital in international equities. In the Revised Budget of 1997, the Ministry of Finance also proposed that investments in equities should be permitted. It was pointed out that the Fund would become larger than previously estimated and therefore, they want to adopt a longer investment horizon. They intended to prepare new guidelines for the management of GPF-G and present it in the autumn of 2007, during the issue about the National Budget for 1998.

During this short period of time they made assessments which involved trade-off between expected return and risk. Norges Bank calculated the historical returns for stock and bond markets in order to see which one provide a higher return. They carried out a study based on G10 countries with the return figures for the past two decades and also the study regarding stock and bond markets since 1871. The equity returns were much higher than bond return as they believed. In addition, they also found out that calculated over five-year periods, the return on portfolios consisting of both equities and fixed-income instruments (50% and 50%) has varied
less than the return on portfolios consisting only of securities from one of these asset classes. This study was conducted based on the data from the UK for the period 1926-1996.\textsuperscript{23}

Norges Bank also considered the risk associated with the equity investments. Thus, they believed that the risk can be reduced by spreading equity purchases over time, with purchases at different price levels. This idea may suggest that the process of acquiring the equity portion of the Petroleum Fund should be implemented for a long period of time. However, it would be reasonable if the size of GPF-G was expected constant. Hence the projections presented by the Ministry of Finance showed that there would be new large transfers to the Fund in the following 15-20 years. Norges Bank considered that if the equity portion was remained at the same level, further equities should be purchased every year for a long time. It means the equity purchases in the following years would be larger as quantities than in the 1998 and equity would be probably purchased within equally short periods of time. Consequently, they believed that the increase in the size of the Fund would help to spread the equity purchases over time which can reduce the risk that equities could be purchased at high prices. They thought it would be more risky to expect the size of the GPF-G to be larger in order to build up the equity portion of its portfolio in the short period of time.

In addition to these considerations, Norges Bank has also paid attention to the asset allocation of other institutional investors. Thus, based on the data of institutional investors of OECD countries, they realized that the equity portion of portfolios varies from 12 percent till 69 percent. However, there was a tendency mostly towards having 20 to 40 percent of an equity portion.\textsuperscript{24}

\begin{flushleft}
\textsuperscript{23} Annual Report, 1998, page 34
\textsuperscript{24} Annual Report, 1998, page 38
\end{flushleft}
Finally, in the autumn of 1997 new regulations relating to the management of the GPF-G was presented to the Parliament. The equity portion of portfolio was fixed at 40 percent and permitted range of 30-50 percent was defined. The proposal was endorsed by the Parliament.

Moreover, they discussed that it was the appropriate time due to the fact that there was upturn in equity markets in the preceding years. But they also pointed out that if otherwise happened in the following years, it would be less of importance because of having long term investment horizon. According to these discussions we can say that one should expand the equity portfolio of the GPF-G gradually in line with increases in the Fund’s size.

3.2 Transition Phase

From the beginning of 1998 equities started to be added to the benchmark portfolio in five monthly steps of 8 percentage points each. Since the first of June equities have accounted for 40 per cent of the benchmark portfolio. 21 different countries were permitted for equity investment of the Fund. The regulation for these investment countries was that they should have well-functioning liquid securities markets and satisfactory company, stock exchange and securities legislation.25

The main purpose of activities during this period was to adapt the portfolio as cost-effectively as possible, and with adequate control. The equity portion of portfolio was created according to a plan compiled by Norges Bank in which an external equity manager, Barclays Global Investor (BGI) played an important role. The three other external managers that were selected at the same time, State Street, Bankers Trust and Gartmore, assisted BGI, mainly by

providing additional crossing opportunities to those available at BGI. The main advantage of crossing is allowing large equity portfolios to be purchased without using brokers and incurring brokerage fees. Furthermore, during crossing equity prices are influenced to a lesser extent than through trades using brokers. The 82.6 per cent of the Fund’s equity portfolio was acquired in this way in the inception phase.

Norges Bank made also attempts in order to reduce the costs of equity purchases by spreading them over time. Because the influence of the purchases on the market could have led to a rise in the prices of the equities earmarked for purchase. They achieved some of the equity exposure by buying futures contracts for equity indices, so that the timing of buying physical equities could be adapted more easily to the opportunities for crossing portfolios.

In the beginning of 1998 the internal equity management of Norges Bank was limited to trading futures contracts for equity indices. However, in the second half Norges Bank began to prepare the base for its own trading in physical equities, with the intention of making cost-effective purchases of equity portfolios which will later be taken over by external managers. The second aim of Norges Bank was to be able to actively adapt the portfolio to changes in the market indices included in the benchmark portfolio. The last objective was to engage in an active management in some market segments with its own capabilities.

In the first five months of the year, Norges Bank was selling the part of the Fund’s bond holdings. This was coordinated with a redistribution of the bond portion of portfolio in order to minimize the number of transactions. The new benchmark for the bond portfolio included more

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countries than previously, was based on other indices, and had a longer duration. These were the main changes in the bond portfolio in the transitional phase up to June 1998. Among other things, Norges Bank also paid attention on avoiding unnecessary exchanges of currency.

3.3 New Guideline 2007

After four years the equity portion was discussed in the National Budget of 2002. The Ministry of Finance pointed out that the equity portion of 30-50 percent came close to what was perceived as an acceptable level of risk for the Fund at that time. And also based on an overall assessment, the Ministry considered that it is not appropriate time for increasing the equity portion of the portfolio.

The Ministry of Finance discussed the two recommendations it had received from Norges Bank and the Strategy Council regarding the increase in the equity portion of the Fund in the National Budget for 2007. They considered that the allocation of equities in the benchmark portfolio of the Fund should be increased to 60 percent based on their analysis, evaluations and model computations. The recommendations were supported by documentation and therefore, the Ministry decided to clarify this important issue in detail.

In order to find the optimal equity portion the choice of equity portion needs to be based on a trade-off between the expected return and risk associated with various investment choices. The Ministry of Finance made some calculations to find out the consequences in terms of returns and risk of GPF-G and it was based on historical returns going back to the year 1900. In the Figure 4 the real returns on an equity portfolio was illustrated and the years since 1998 are framed. Based on historical returns in the United States, Germany, France, the United Kingdom and Japan, annual real returns have been calculated in the currency of each country and weighted
together with weights reflecting the composition of the Government Pension Fund – Global\textsuperscript{27}. It is important to note that 1999 was one of the best years in the stock market over the last 107 years, and that 2002 was the second worst year since 1900. However, the experience showed that these fluctuations could be handled.

Figure 4. Real return for every year between 1900 and 2006, on a portfolio of equities in the US, Japan, United Kingdom, France and Germany, as weighted by the weights applicable to the Government Pension Fund – Global. Local currency

Source Ministry of Finance

In order to compare the portfolio returns they made the same calculations for the annual real return on a portfolio of long-term bonds since 1900. The Figure 5 illustrates that returns on

\textsuperscript{27} Ministry of Finance, 2006
bonds were less variable than those on equities. However, if we look at the number of years with negative returns, we will find out that as much as 40 of the last 107 years have registered a negative real return on bonds, as compared to 29 of the last 107 years for equities. From these figures they realized that excess return on equities relative to bonds in the 20th century was considerably higher. However, the magnitude of this risk premium is more uncertain.

Figure 5. Real return for every year between 1900 and 2006, on a portfolio of bonds in the US, Japan, United Kingdom, France and Germany, as weighted by the weights applicable to the Government Pension Fund – Global. Local currency
The Ministry of Finance also carried out model computations concerning how an increase in the equity portion from 40 to 60 percent may influence the expected return and risk of the Fund. It was illustrated in the Figure 6. It shows the expected consequences over the coming 15 years based on other assumptions than those implied by historical returns.²⁸

Figure 6. Model computations of accumulated returns in percent after 15 years, and attendant probabilities

Source Norges Bank and the Ministry of Finance

²⁸ Ministry of Finance, 2006
They found that in about 25 percent of the cases, the accumulated real return is 45 per cent or less irrespective of whether the equity portion is 40 pct. or 60 pct. The model computations were summarized under reference to items 1-3 of Figure 6:

1. There is a high probability that a 60 pct. equity portion will generate a higher accumulated return after 15 years. In some cases the return is considerably higher than in case of a 40 pct. equity portion.

2. There is a probability of about 25 pct. that a 60 pct. equity portion will generate a lower aggregate return than a 40 pct. equity portion. Even for these outcomes (all observations to the left of the vertical line), the black line is not significantly higher than the orange one. This means that the reduction in return is limited, even in the 25 pct. or so least favorable outcomes.

3. The probability that the portfolio will generate a negative accumulated real return after 15 years is low, irrespective of whether the equity portion is 40 pct. or 60 pct.\(^\text{29}\)

The Ministry of Finance carried out a lot of model computations and other evaluations, but major ones were presented in this study. After these long assessments the view of the Ministry was that the increased risk related to the equity portion of 60 per cent can be characterized as moderate:

- The overall value of the petroleum wealth consists of remaining oil and gas reserves and the current size of the Fund. By selling oil and gas and investing in equities and fixed

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\(^{29}\) Ministry of Finance, 2006
income securities, the petroleum wealth has been diversified across more assets, and the overall risk has been reduced.

- The return on long-term investments in real interest rate bonds was significantly lower in 2006 than 1997.

- It was not possible to invest the entire Fund in real interest rate bonds, because of the Fund’s size. Such investments have been risky in the longer run, and the Strategy Council pointed out, in its letter to the Ministry of Finance, that the risk associated with bonds has increased with longer investment horizons. This has partly to do with the fact that the last 100 years involved periods of very high inflation, which have resulted in negative real returns.\textsuperscript{30}

The Ministry also looked at what decisions other large funds have made in their choice of equity portion. They realized that large pension funds of US and Europe generally had the equity portion in excess of 50 per cent, but large government reserve funds held around 60 per cent.\textsuperscript{31}

After these all considerations the Government concluded that an increase in the equity portion of the benchmark portfolio of the Government Pension Fund – Global from 40 to 60 pct. represented a good trade-off between the expected return and risk associated with the investments of the Fund. The guideline for the management of the GPF-G was amended by way of the equity portion of the strategic benchmark portfolio of the Fund being fixed at 60 pct. Moreover, the permitted range of an equity portion was defined 50–70 per cent. This meant that the bond portion of the strategic benchmark portfolio would be 40 pct. and the permitted range would be 30–50 pct.

\textsuperscript{30} Ministry of Finance, 2006
\textsuperscript{31} Ministry of Finance, 2006
4. LITERATURE REVIEW

This paper builds on the literature on international asset allocation of SWF portfolios. It means we have two principal streams of research regarding our study analysis. The first examines the determinants of portfolio performance, whether the asset allocation policy is important or active management. The second research stream examines sovereign wealth funds themselves.

4.1 Academic Research on Asset Allocation Policy

Institutional investors and, more recently, individual investors, have long recognized that asset allocation is the most crucial decision required to achieve their investment goals. The basic asset allocation problem is to decide which asset classes to include in a portfolio and in what proportions. This is a special case of the “Portfolio Selection Model” first formulated by Nobel Laureate Markowitz (1952). Thus, active shifting of asset weights as well as security selection within each class matter for the returns of the portfolio. However, the overall performance is governed by the portfolio’s asset allocation. In other words, the portfolio’s allocation among various asset classes has more influence on the aggregate portfolio return than any other single investment decision. This issue has been demonstrated several times in academic journals since 1986. Academicians have tried to find answers to such questions as “how important is asset allocation policy in determining performance? In particular, what is the impact of the long-term asset allocation policy mix relative to the impact of active performance from market timing and security selection?”
The first attempt to answer these questions was made by Brinson, Hood, and Beebower (BHB, 1986) in their article “Determinants of Portfolio Performance”. They analyzed the returns of 91 large U.S. pension plans between 1974 and 1983. Their goal was to determine, from historical investment data on U.S. pension plans, which investment decisions had the greatest impact on the magnitude of total return and on the variability of that return. BHB did regression analysis with time-series returns of each fund on a weighted combination of benchmark indices reflecting each fund’s policy. As a result of their study they found that the investment policy, i.e. strategic asset allocation (SAA), explained 93.6 percent of the total variance in actual plan returns over time (as measured by the $R^2$). Only a small portion of the total variation in returns was explained by the manager’s ability to time the markets and individual security selections.

After the studies of BHB Hensel, Ezra, and Ilkiw (HEI 1991) and Ibbotson and Kaplan (IK 2000) found out that most of the variation in a typical fund’s return comes from the market movement. Asset allocation policy is different among funds, but almost all of them participate in the general market instead of just holding cash. Thus, their result also confirmed the BHB result that approximately 90 percent of the variability of a fund’s return across time is explained by the variability of policy returns. However, the problem was that the time-series $R^2$ was simply high because funds participate in the capital markets in general and not because they follow a specific asset allocation. The BHB (1986) just implicitly assumed cash as a benchmark portfolio. However, HEI (1991) and IK (2000) pointed out that if we want to measure the impact of a fund’s specific asset allocation policy, we should compare it with the average asset allocation of the peer group universe. After using a more realistic baseline they found out that the specific policies explain far less than half of the remaining time-series variation of the funds' returns.
A lot of articles were published about the BHB studies and most of them pointed out that the BHB answer does not match up with investor questions. Therefore, in their landmark study “Does Asset Allocation Explain 40, 90, or 100 Percent of Performance?” Ibbotson and Kaplan attempted to clarify this misinterpretation. They defined three distinct questions regarding the importance of asset allocation and tried to answer these questions:

1. How much of the variability of returns across time is explained by policy (the question BHB has answered)? In other words, how much of a fund's ups and downs do its policy benchmarks explain?
2. How much of the variation in returns among funds is explained by differences in policy? In other words, how much of the difference between two funds' performance is a result of their policy difference?
3. What portion of the return level is explained by policy return? In other words, what is the ratio of the policy benchmark return to the fund's actual return?

The BHB (1986) has only answered to the first question. In this study the IK (2000) tried to answer all the three questions. As we mentioned above the result of IK (2000) about the first question, we go directly to the second question.

To answer this question IK (2000) presented a cross sectional regression on annualized cumulative returns across a large universe of balanced funds over a 10-year period and found that about 40 percent of the variation of returns among funds was explained by policy. In 2007 Vardharaj and Fabozzi in their article named “Sector, Style, Region: Explaining Stock Allocation Performance” also applied IKs’ similar techniques for equity funds. As a result, they found that
the $R^2$’s were time-period sensitive and that approximately 33 percent to 75 percent of the variance in fund returns *among* funds was attributable to differences in asset allocation policy.

In 2011 in the article titled “The Determinants of the Importance of Asset Allocation” Jacobsen and Biwer also conducted research studies to find a solution to this question. Their answer was “it depends”. From their view the importance of asset allocation depends on the equity risk premium and the tracking error of a portfolio. Thus, they found that if the equity risk premium is larger, the asset allocation is more significant and vice versa. Investors cannot control the equity risk premium, but they can control the number of managers and who they select as a manager. This defines the tracking error of a portfolio.

The third question is very important, but it has a fairly trivial answer. IK (2000) pointed out that asset allocation policy provides investors with the passive return (beta return), and the remainder of the return is the active return (alpha or excess return). They supported the idea that alpha equals to zero across all portfolios (before costs) because on average, managers do not beat the market. In aggregate, the gross active return is zero. They concluded that on average the passive asset allocation policy determines 100 percent of the return before costs and somewhat more than 100 percent of the return after costs. This 100 percent answer applies to the all-inclusive market portfolio and is a mathematical identity—at the aggregate level. Many people also mistakenly thought that the BHB (1986) result (that asset allocation policy explains more than 90 percent of performance) applies to the *return level* (the 100 percent answer). However, they wrote only about the *variation* of returns, so they likely never encouraged this misrepresentation.
In 2006 Mark Kritzman (2006) in his article titled “‘Determinants of Portfolio Performance—20 Years Later’: A Comment” illustrated that the methodology BHB (1986) used reveals nothing about asset allocation or security selection. He created simply an example in which there are only stock and bond markets in the world and that each market has only two securities of equal size. The stock market and the bond market have the same performance each and every period. Furthermore, Stock A has the same returns as Bond A and Stock B has the same returns as Bond B. It means whether you allocate 100 percent to the stock index or 100 percent to the bond index or to any combination in between, you will obtain the same performance each and every period and, on average, across all periods. In other words, asset allocation simply does not matter. Obviously, security selection is the sole determinant of portfolio performance. However, after applying the methodology of BHB (1986) to these imaginary portfolios, Kritzman (2006) realized that asset allocation determines 100 percent of portfolio performance and that none of performance is determined by security selection. This article clearly revealed that the methodology of BHB was false and the time has come for folklore to be replaced with reality.

Finally, Xiong, Ibbotson, Idzorek, and Chen (2010) in their article clarified all the previous studies and conducted the appropriate regression analysis in order to define the importance of an asset allocation. Based on the three components of portfolio return they attempted to interpret previous studies. Portfolio’s total return can be divided into three parts:

1) the market return,
2) the asset allocation policy return in excess of the market return,
3) the return from active portfolio management
(see, e.g., Bailey, Richards, and Tierney 2007; Solnik and McLeavey 2003).

Figure 7 illustrates the decomposition of total variations under two distinct methodologies of BHB (1986) and of HEI (1991) and IK (2000) on the basis of the Xiong, Ibbotson, Idzorek, and Chen (2010) dataset. They selected three portfolio peer groups from the Morningstar U.S. mutual fund database: U.S. equity funds, balanced funds, and international equity funds. The return data was for 10 years from May, 1999 to April, 2009. Figure 7 shows the previously studies’ interpretations of the explanatory power of asset allocation policy for total return variations. The two bars on the left depict the BHB (1986) time-series regression analysis for both equity and balanced funds. We can see that they put the two parts together and collectively labeled them as an asset allocation policy. In other words, they did not separate market returns from other returns. BHB (1986) combined the first two parts and compared them with the third part of total return.

Figure 7. Decomposition of Total Variations
Source: Ibbotson et al. 2010
In contrast, the two bars on the right side depict the argument of both HEI (1991) and IK (2000) that market movement dominates time series regressions on total returns. These two bars allow for a more detailed decomposition of the passive return into two components—the specific fund’s asset allocation policy return in excess of the market and the applicable market return. HEI (1991) and IK (2000) compared the second part with the third part of the portfolio’s total return.

Xiong, Ibbotson, Idzorek, and Chen (2010) thought logically that cross-sectional regressions naturally would remove market movements. In contrast, time-series analyses of total returns do not naturally remove market movements. However, time-series analyses of excess market returns and cross-sectional analyses of either total or excess market returns are relevant to each other. Instead of total returns as regression variables for both time series and cross-sectional analyses, they used excess market returns.

As a result of these regression analyses firstly they found that market movement dominates time-series regressions on total returns. This observation is identical with such previous studies as HEI (1991) and IK (2000). Secondly, they revealed that excess market asset allocation policy and active portfolio management have about an equal amount of explanatory power after removing the applicable market effect. In other words, if we remove market movements, asset allocation and active management are equally important in determining portfolio return differences within a peer group.
According to these articles we can confidently say that asset allocation policy has much more importance in determining the portfolio performance. This should be an important factor especially for SWFs (mostly saving funds) because of their long term investment horizon. For example, during the financial crisis in 2008 despite of the sharp decline in world equity indexes, Government Pension Fund – Global continued to increase the portion of equity in their portfolio (from 40% to 60%).

As a result, they have experienced the best year since their establishment in terms of returns in the following year after crisis. This can be a pure evidence of their strategic asset allocation policy.

4.2 Academic Research on Sovereign Wealth Funds

Because of the lack of data regarding global asset allocation and equity investments of SWFs, few empirical studies have been published. Transparency issues of SWFs have been raised a lot of times in press. According to press there is a possibility that SWF assets could be used to further political purposes and target strategic acquisitions. Therefore, we are going to mention some major research analysis related to our study.

The first empirical analysis on SWFs was conducted by Bortolotti, Fottak, Megginson and Miracky (2008). They tried to analyze the financial impact of SWF investments in listed companies around the world. As a sample they used 75 acquisitions of equity stakes invested by 16 SWFs from 1989 to 2008 in their research study. Fottak, et al. (2008) found a positive average abnormal return of 1% in the announcement date of SWF investments. However, after two years of transaction an average abnormal return is negative 41%. They considered that this effect is not
associated with the size of equity stake purchased by SWFs. They interpreted this negative impact on the firms’ profitability as a result of additional agency costs imposed by SWFs.

After his article several academic studies have addressed the same topic. Thus, Kotter and Lel (2008) used larger sample for their event study analysis. They collected data regarding 163 SWF announcements from 1982 to 2008. The result of their empirical research was the same with the previous study, but they also find that transparency of the fund is related to the market reaction at the time of the announcement. Dewenter, Han and Malatesta (2009) conducted research analysis based on a sample of 196 acquisitions and 47 divestitures by SWFS between 1987 and 2008. They found out that SWFs investment announcement for a firm is associated with a statistically significant positive abnormal return, on average. And the divestment announcement of SWFs for firms resulted with a statistically significant negative abnormal return, on average. They also found that the relationship between abnormal returns and percent acquired is non-linear: small acquisitions lead to positive reactions while large acquisitions lead to smaller, even negative reactions. Knill, Lee and Mauck (2009) analyzed a larger sample size (232 SWF investments) than previous studies, but find the same results as previous ones. The different thing they did in their research was that they paid attention to market volatility as well.

Lee et al. (2009) were interested in whether SWFs add instability, as often claimed by the press, or produce stability by allowing a larger investor-base. The result of their empirical reach was that target markets display lower returns and volatility after SWF investments, but the decline in returns is not compensated by a sufficient lower volatility. Another study about SWF transactions was Chhaouchharia and Laeven (2008). In addition to valuation effect of SWF investments, they also attempted to identify biases in the global asset allocation of SWFs. Thus,
they found that investments tend to exhibit positive abnormal returns at the time of the announcement, but a poor long-run performance of investment targets. The result about the biases was that SWFs tend to invest in countries that share similar cultural traits. The funds seek industrial diversification, but they do so while investing mainly in countries sharing the same culture. Bortolotti, Fottak, Megginson and Miracky (2009) again performed event study analysis employing by far the largest sample of 1,216 SWF investments. This time they include private equity and real estate investments in their sample as well. They documented that SWFs purchase, on average, a sizable minority stake in target companies, which can either be publicly traded or private. Fottak, et al. (2009) also found that SWFs mostly buy equity stakes in listed companies by purchasing newly-issued common or preferred stock directly from target companies in friendly transactions that exclude outside participation by existing shareholders. Due to this fact of SWF investments we can confidently say that SWFs will become the allies of target-firm managers and will be constrained from playing a meaningful disciplinary or monitoring role. In addition, SWFs have a tendency to invest in underperforming companies. Using a sample of 235 SWF acquisitions of equity stakes in publicly traded companies, they found a significantly positive mean abnormal return of about 0.9% around the announcement date. However, one year after the transactions abnormal returns of the firms were negative 15.49%.

Fernandes (2009) took a different approach than previous studies by focusing on SWF holdings, rather than transactions. Using the largest data on over 21,000 SWF holdings from 2002 through 2007, he found that firms with higher SWF ownership have higher firm valuations and better operating performance. His results also indicated that SWFs have a stabilizing effect on financial markets.
We can find out from that all the empirical research studies are about equity investments. They are about equity transactions of SWFs, not about which factors determine the equity portion of their portfolio. It means the present study is the first in this area and makes a contribution to the empirical literature regarding the performance of SWFs.
5. HYPOTHESIS

Taking into consideration all of the issues regarding the asset allocation in GPF-G, the following research question has been developed:

Which factors do determine the equity portion change in the portfolio of GPF-G?

Eight factors were included to this research study. Factors such as the size of total fund, the returns on the equity and bond portfolio of the Fund and world crude oil prices have to be included to our model due to the fact that they were in the assessments of the Ministry of Finance of Norway regarding the equity portion of GPF-G.

Other variables are also reasonable to be involved based on the fact that they were used by the GPF-G in its assessments as it was presented in annual reports. They are world equity and bond indexes, volatility index and the tracking error of the Fund.

For the assessment of world equity prices they use FTSE World Index (FTWI01). This index is a free float market capitalization weighted index.\(^\text{34}\) It involves the constituents of the large and mid capitalization universe of developed and emerging market segments.

Barclays Capital Global Aggregate Bond Index (BNDGLB) is employed by GPF-G for the evaluation of bond market prices. This index is a market capitalization-weighted index, meaning the securities in the index are weighted according to the market size of each bond type. Mostly US traded investment grade bonds are represented.

Both of these indexes are accepted as benchmark indexes for the Fund.

\(^{34}\) Bloomberg, 2011
Volatility in world equity markets can also be important factor for an equity portion decision. The Fund evaluates the VIX Index which is a common measure of the implied volatility of S&P 500 index options and calculated by Chicago Board Options Exchange (CBOE).

In order to reduce the marker risk the Ministry of Finance has set a limit for a deviation between the return on the actual portfolio and the return on the benchmark portfolio. This limit is expressed as the expected tracking error which is calculated as the standard deviation between the actual return and the return on the benchmark portfolio. It cannot be higher than 1.5 percentage points on annual basis. It means that in two years out of three the difference between the returns on the actual and benchmark portfolio will be less than 1.5 percentage points, if NBIM uses the entire risk limit.

We are going to do regression analyses in order to find which factors are significant in the change of equity portfolio of the GPF-G.

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35 Annual Report 1998, page 47
6. DATA AND METHODOLOGY

6.1 Sample

Our sample consists of different variables from different sources. For our analysis we gathered all of the data available from the last quarter of 1997 till the first quarter of 2011.

Total size of the Fund was taken from annual reports of GPF-G. They publish it in Norwegian krone and it involves returns on the portfolio, the oil revenues and the movements in krone.

Returns for the equity and bond portfolios of the GPF-G were collected from the annual reports of the Fund as well. They report their returns in percentage points in Norwegian krone and international currencies every year. Return in the local currency is the official one, since the Fund’s accounts are kept in NOK. Therefore, it is more appropriate to select returns in NOK to include to our sample.

As Norway gets its oil from the North Sea, we use the Brent oil prices for our sample. We collected this data from the Bloomberg Professional.

We use for the tracking error the quarterly percentage points available in their annual reports.

All of the quarterly index prices were taken from the Bloomberg Professional as well.

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6.2 Measures

The importance of variables which can have an impact in the change of equity portion was mostly measured on p values and significance f, however the coefficient of determination (R Square) should be considered as well.

In statistical significance testing p values define that we should reject the null hypothesis or not. If p value is lower or equals to 0.10, we should reject the null hypothesis and the result is said to be statistically significant, otherwise vice versa. However, we have to be careful from automatically dismissing variables which have p values above 0.10 but close to it. The same rules apply for Significance F.

There is no determined number for R Square, but practically it will be considered better if it is higher than 0.60.

6.3 Statistical Method

For our statistical analysis we used a regression method called Ordinary Least Squares (OLS) which produced the coefficient estimates. The dependent variable in our regression is the percentage change in the equity portion of our portfolio. Our independent variables are also calculated as percentage changes. The following model illustrates the OLS regression:

\[ Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} \]

\[ Y_i = \% \text{ Change in Equity Portion of the Fund} \]

\[ X_{1i} = \% \text{ Change in Total Assets of the Fund} \]

\[ X_{2i} = \% \text{ Change in Return on Equity of the Fund} \]
In order to look at our variables from different viewpoints, we are going to develop three different models. They are as following:

1. Contemporaneous Model

2. Lagged Model

3. Stepwise Selection Model

In the first model we are going to run a multiple regression with our all variables in time. Here we should pay attention only P values of variables.

However, the second model is the bunch of different simple regressions with 4 lagged periods. The purpose of this model is to find the joint lagged effect of each variable in Y. We take into account here only Significance Fs of each variable.
The third model is special, because we are trying to find the best composition of variables with low p values. We are going to use all variables with both t time and lagged periods in regression analysis.
7. EMPIRICAL RESULTS

As we have three models to test, we are going to look at the results separately and at the end try to compare them.

7.1 Contemporaneous Model

Firstly, we do regression analysis in the current time (period t) to see whether the change in some X variables follows the change in Y. The results of the multiple regression described in Table.

Table 2. Results of Model 1

<table>
<thead>
<tr>
<th>Variables</th>
<th>P values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return on Equity</td>
<td>0.603079139</td>
</tr>
<tr>
<td>Return on Bond</td>
<td>0.774313125</td>
</tr>
<tr>
<td>Total Fund</td>
<td>0.699441782</td>
</tr>
<tr>
<td>Brent</td>
<td>0.345300361</td>
</tr>
<tr>
<td>VIX Index</td>
<td>0.734742562</td>
</tr>
<tr>
<td>Tracking Error</td>
<td>0.11475566*</td>
</tr>
<tr>
<td>FTWI01 Index</td>
<td>0.09271127*</td>
</tr>
<tr>
<td>BNDGLB Index</td>
<td>0.988094067</td>
</tr>
</tbody>
</table>

\[ \text{R Square} = 0.228456 \]

Values marked with asterisks ***, **, * denote a statistically significant result the 1%, 5% and 10% two sided level of significance, respectively.\(^{37}\)

The results for p values show that only one variable, FTWI01 Index is significant at 10 percent level in t time. Due to the fact that GPF-G chose this index as a benchmark for equity

\(^{37}\) Stock & Watson, 2007, p. 775
portfolio and the performance of equity management is compared against this index, it is reasonable that it has more impact in the change of equity portion. However, there is also another interesting point that as we mentioned before, the change in equity portion can happen because of the price changes in the equity portfolio of the Fund. The management team always tries to rebalance it frequently and keep it close to strategic weights, but if we take into account that we use the quarterly data, deviations can be the result of prices changes.

There is also one variable that is close to be considered significant (close to 0.10). The tracking error of the portfolio is one of the important measures of the Fund in order to avoid a market risk. From the inception of the Fund this measure has been calculated every year and the Ministry of Finance has set a limit especially for it, as we mentioned earlier. This means the Fund is very cautious regarding this variable and despite of the fact that it is the measure of portfolio, it seems that it is also important to make a decision about equity portfolio. Because as the most part of the returns of the portfolio comes from equity investments, it is more reasonable that this variable is significant in our regression analysis.

The R square of our model is 22.8% and this means that in t time the included variables explain only small part of variation in Y.

7.2 Models with Lagged Variables

As we saw from the previous model, variables in t time don’t affect so much the change in the equity portion, we should take into account lagged effect of our variables. In this model we test the joint lagged effect of our variables going back 4 quarters (it is just an assumption). Table 3 describes our results for lagged regressions.
Table 3. Results of Model 2

<table>
<thead>
<tr>
<th>Variables</th>
<th>Significance F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return on Equity</td>
<td>0.933613</td>
</tr>
<tr>
<td>Return on Bond</td>
<td>0.031773**</td>
</tr>
<tr>
<td>Total Fund</td>
<td>0.211978</td>
</tr>
<tr>
<td>Brent</td>
<td>0.017555**</td>
</tr>
<tr>
<td>VIX Index</td>
<td>0.10905*</td>
</tr>
<tr>
<td>Tracking Error</td>
<td>0.003473***</td>
</tr>
<tr>
<td>FTW101 Index</td>
<td>0.095589*</td>
</tr>
<tr>
<td>BNDGLB Index</td>
<td>0.362713</td>
</tr>
</tbody>
</table>

Values marked with asterisks ***, **, * denote a statistically significant result the 1%, 5% and 10% two sided level of significance, respectively.

As we see from the results, the joint lagged effect of the variables is very strong. Five out of eight variables are significant at different percentage levels.

The most significant one is the tracking error of the portfolio (it was close to be significant in the previous model) and it means that this measure is significant in all periods for the Fund in making a decision regarding equity portion.

The return on the bond portfolio and Brent oil prices are both significant at 5 percent level. From the assessment of the Ministry of Finance we have witnessed that past returns are important for the Fund and now this model proves that lagged effect of bond returns of the Fund is robust. Bond returns should be considered especially in the evaluation of an equity risk premium. Despite of the high fluctuations in oil prices during the financial crisis, it has grown
dramatically, on average, in the past ten years. As most of the capital inflows of the GPF-G consist of oil revenues, it should be more appropriate to consider this variable when taking more risk, investing in equities and it seems they use historical oil prices to define the equity portfolio.

FTSE World Equity Index is significant at 10 percent level, whilst VIX Index is close to being considered as a significant variable (close to 0.10). FTWI01 was significant in the previous model as well and it seems that this variable is very important for the Fund in making decision about the equity portfolio. VIX Index is very common volatility index for portfolio managers in assessment of world equity markets. The results of this model show that GPF-G has also considered this Index during its last thirteen years of performance.

7.3 Stepwise Selection Model

This model presents the best composition of all variables in all periods with the lowest p values. It has chosen and removed the variables step by step based on low p values. There are nine variables in this model and all of them are significant at some percentage level except one which is very close to be significant (close to 0.10). The mix of variables with low p values has increased R Square till 0.6848 and this is a very good result from the statistical view.

In overall, this model has the same results with the previous ones in terms of selected variables. Thus, FTWI01 and the tracking error are both significant in this model again and it means that these two variables are always significant in every mix of variables and can be considered as independent variables.
In addition, Brent was presented in the second model having a lagged effect, while the results of this model shows that it affects in t time as well. We can conclude this with the statement that this variable is significant in t time depending on combination of different variables. It is not independent as the previous ones.

There are also two more variables, total size and return on equity of the Fund, which haven’t shown up in the preceding models. It seems that these variables are not so significant, but depending on mix of different variables they can have lagged effects in the change of the equity portfolio.

Table 4. Results of Model 3

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable Entered</th>
<th>Variable Removed</th>
<th>Number Vars In</th>
<th>Model R-Square</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FTW</td>
<td></td>
<td>1</td>
<td>0.2756</td>
<td>0.0001</td>
</tr>
<tr>
<td>2</td>
<td>FTW2</td>
<td></td>
<td>2</td>
<td>0.4151</td>
<td>0.0018</td>
</tr>
<tr>
<td>3</td>
<td>FTW1</td>
<td></td>
<td>3</td>
<td>0.4827</td>
<td>0.0194</td>
</tr>
<tr>
<td>4</td>
<td>Brent</td>
<td></td>
<td>4</td>
<td>0.5273</td>
<td>0.0477</td>
</tr>
<tr>
<td>5</td>
<td>TF4</td>
<td></td>
<td>5</td>
<td>0.5585</td>
<td>0.0883</td>
</tr>
<tr>
<td>6</td>
<td>TREP</td>
<td></td>
<td>6</td>
<td>0.6001</td>
<td>0.0428</td>
</tr>
<tr>
<td>7</td>
<td>Brent4</td>
<td></td>
<td>7</td>
<td>0.6285</td>
<td>0.0838</td>
</tr>
<tr>
<td>8</td>
<td>TREP2</td>
<td></td>
<td>8</td>
<td>0.6552</td>
<td>0.0865</td>
</tr>
<tr>
<td>9</td>
<td>FTW1</td>
<td></td>
<td>7</td>
<td>0.6368</td>
<td>0.1526</td>
</tr>
<tr>
<td>10</td>
<td>Brent2</td>
<td></td>
<td>8</td>
<td>0.6642</td>
<td>0.0785</td>
</tr>
<tr>
<td>11</td>
<td>ROE4</td>
<td></td>
<td>9</td>
<td>0.6848</td>
<td>0.1188</td>
</tr>
</tbody>
</table>
CONCLUSION

The primary goal of this research was to find out important factors which can influence to the equity portfolio decision. The study used the quarterly data of GPF-G from 1997:12 till 2011:3. The sample included factors such as returns on equity and bond portfolio of the Fund, oil prices, equity and bond indexes and others. The regression analysis was conducted in three various models.

As a summary of these three models, key finding was that the lagged effects of variables were bigger than the current ones. Thus, five out of eight variables were statistically significant in the lagged periods compared to two significant variables in the contemporaneous model. There were some significant variables in all three models such as FTSE World Equity Index and the Tracking Error of the portfolio. This means that these factors are important at all times and without depending on a combination of variables.

Moreover, if we should choose among these three models, stepwise selection model is the best from the practical viewpoint. The result of this model can be used by SOFAZ and as well as other SWFs and/or Institutional Investors in order to improve their asset allocation policy. It is also important to note that this model has 0.68 R Square which is very good result from practical viewpoint.
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