

Preliminary Thesis
Handelshøyskolen BI

“Does Real Estate Investment Improve the
Risk-Return Trade-off of the Government
Pension Fund- Global?”

GRA 19502 – Preliminary Thesis

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Hand-in date:
15.01.2018

Campus:
BI Oslo

Program:
Master of Science in Business
Major in Finance

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Summary

The preliminary thesis represents the framework of our master thesis, and gives an outline of how we will proceed to answer our main question: *“Does Real Estate Investment Improve the Risk-Return Trade-Off of the Government Pension Fund – Global?”*

The purpose is to study the contribution of real estate as an asset in a mixed portfolio combined with equity and fixed income. We will do a time series analysis of the funds monthly returns by running an ordinary least squares (OLS) regression. We group the dataset into two categories before the analysis: The monthly returns before the inclusion of real estate, and monthly return after the inclusion. By separating the dataset, we can analyze if there has been any effect on the risk-return trade-off. The regression analysis is done by applying three different performance measuring models: Fama and French’s 3 and 5-factor model and Carhart’s 4-factor model. The next step is to analyze the regression output and estimate risk-adjusted return ratios. Our conclusion will be based on these findings.

1. Introduction

The preliminary thesis report will outline the initial stages of our master thesis. Firstly, we will give a brief introduction about the Norwegian Government Petroleum Fund – Global and Norges Bank Investment Management's (NBIM's) investment strategy in real estate, which is the motivation of our research question.

In the second part, we will review literature that is related to our question. Previous research within portfolio management and real estate investments.

Further, we will introduce the relevant financial theory within portfolio management and performance measuring. Combined with the literature, the theory will help to form our expectations and build our arguments.

In the methodology part, we will explain how we will proceed to address the main question of our thesis. This is the framework we will use to answer our research question.

Motivation

“We work to safeguard and build financial wealth for future generations” -
Norges Bank Investment Management.

In 1969, oil companies discovered Ekofisk, the largest oil field ever found. This was the start of the Norwegian oil adventure and the establishment of the Government Pension Fund – Global (GPF) in 1990. The fund was established to ensure a long-term management of the excess petroleum revenues. The first deposit was made in 1996, and the fund has grown to become one of the largest pension funds in the world since. For a long time, unlike its peers, the fund did not include real estate into its portfolio and the fund was only invested in equity and fixed income. NBIM made its first recommendation to the Ministry of Finance in 2006 regarding including real estate as an asset class. Five years later, NBIM made the first real estate investment in 2011, and has since maintained an increase in the real estate investments by 1% each year.

Today the fund has allocated 2.5% of its investments in unlisted real estate, while NBIM are given mandate to allocate up till 7% of its funds. We will therefore

expect to see a further increase in real estate investments in the following years.

Some researchers have been critical regarding the inclusion of real estate, arguing that it has not improved the risk-return tradeoff, but rather the opposite. We are therefore interested in investigating what contribution the inclusion of real estate has had to the GPF. Our research question to be studied is:

“Does Real Estate Investment Improve the Risk-Return Trade-Off of the Government Pension Fund – Global?”

To address this question, we will have to make a time series analysis of the GPF's monthly returns before and after the inclusion of real estate as an asset class. We will focus on the net return – taking transaction costs, management costs and taxation into consideration. The returns must be adjusted for risk before we can analyze the effect on the risk-return trade-off after the inclusion of real estate. We will apply different conventional methods to measure risk-adjusted return that will hopefully underpin our findings. It is also important to identify any shortcomings with these approaches when they are applied.

NBIM and GPF

The formal framework of the GPF was first established through the Norwegian Parliament's Government Pension Fund Act. NBIM are responsible of managing the fund, and their aim is to achieve the highest possible return within the investment mandate that is given by the Ministry of Finance. The fund is invested globally in international equities, fixed income and real estate.

Real Estate Investments

NBIM invest in real estate to create a more diversified portfolio and to reduce the overall risk of the portfolio. The first real estate purchase was made in 2011, and the aim is to sustain an increase in the real estate investments by 1% each year. The real estate investment strategy is to invest in global cities that are expected to continue to play a key role in the global economy. The real estate investments are divided in to three sectors: Commercial real estate, retail and logistics. Since the

fund is invested globally, they invest through partners to benefit from their local knowledge and expertise. External management is often costly, but previously studies has shown that large pension funds might benefit of it. The investments do also have market-specific structures. In France for instance, real estate is held through regulated investment vehicles (OPCIs). In the US, properties are invested through domestically controlled real estate investment trusts (D-REITs). The GPFG's return on unlisted real estate investments depends on rental income, operating expenses, changes in the value of properties and debt, movements in exchange rates, and transaction costs for property purchases and sales (NBIM 2017, Q3 Report, page 12). These are factors that we need examine closely when analyzing the effect on risk-return tradeoff by introducing real estate into the portfolio. In 2017, Unlisted real estate investments returned 2.7% while listed real estate investments returned 1.1% (NBIM 2017, Q3 Report, page 12).

2. Literature review

Jensen (1968) addressed the problem on how to evaluate the performance of mutual fund managers. By using the Capital Asset Pricing Model (CAPM), he argue that superior performance by managers can be captured by Alpha (Jensen, 1968). Jensen found that managers underperformed with an average value of negative alpha compared to a risk-adjusted benchmark. The research that followed Jensen suggested that it exists a set of skilled managers that can outperform the market (Grinblatt and Titman, 1989). Hendricks (1993) found that it is possible to develop a trading strategy on past performance to generate economically significant returns.

In the article by Bond and Mitchell (2010) they investigate whether fund managers deliver superior risk-adjusted return in the direct real estate market. They do this by using a dataset containing annual fund performance from 1981 to 2006. They conclude that few managers have managed to generate excess risk-adjusted returns. However, according to Lee and Ward (2001), there is evidence that returns on commercial real estate assets show persistence. To explain why this is so, Bond and Mitchell look at two possible reasons. The first reason can be

that it is possible to artificial smooth property valuation, and therefore show persistence in the returns. The second reason is that the knowledge of the underlying persistence can lead to momentum trading that would achieve positive risk-adjusted performance. Bond and Mitchell also address that it is not clear that this persistence could be exploited because of high transaction costs and illiquidity which is required to trade in commercial property assets.

Goetzmann and Ibbotson (1990) found several reasons for institutional investors to include real estate as an asset class in the portfolio. They found that real estate was the only major asset class that had consistently exceeded inflation over the past 16 year, and thus provides a hedge against inflation to the institutional investors (Goetzmann & Ibbotson, 1990). The article also found that commercial real estate has little or no correlation to the stock market, which makes it an effective hedge against fluctuations in the financial markets. They also mention the US real estate market specifically, and how low correlations between the real estate markets across different regions can reduce risk for investors that can diversify regionally. Goetzmann and Ibbotson's study is supported by the findings of Giliberto (1990). He found that equity real estate investment trusts (EREITs) performance was heavily influenced by stock and bond market movements, while unsecuritized real estate investments was barely affected (Giliberto, 1990). His study argues that institutional investors that invest in EREITs must accept a volatility similar of that of stocks. However, a study by Liu and Mei (2003) argues that there is no significant premium for investing in real estate. Since they did not find any risk premium associated with real estate investments, they argued that the only benefit would be a potential diversification effect against unsystematic risk, and they therefore conclude that the best asset allocation is to only include stocks and bonds.

It is also argued in the literature that institutional investors should invest 15-20 percent of the fund assets in real estate, however institutional investors invest only 2-3 percent of their assets in real estate (Chun, Sa-Aadu, & Shilling, 2004). Rehring argue that the weight of real estate should increase with the investment horizon (Rehring, 2012). Therefore, according to research made by Chun et al., institutional investors are underinvested in real estate. Chun et al. argue that institutional investors are underinvested because of several reasons; Investments

in real estate have relatively high average returns compared to the risk, real estate risk has moderated and real estate investments are informationally inefficient, hence skilled investors could exploit mispricing (Chun et al., 2004).

3. Theory

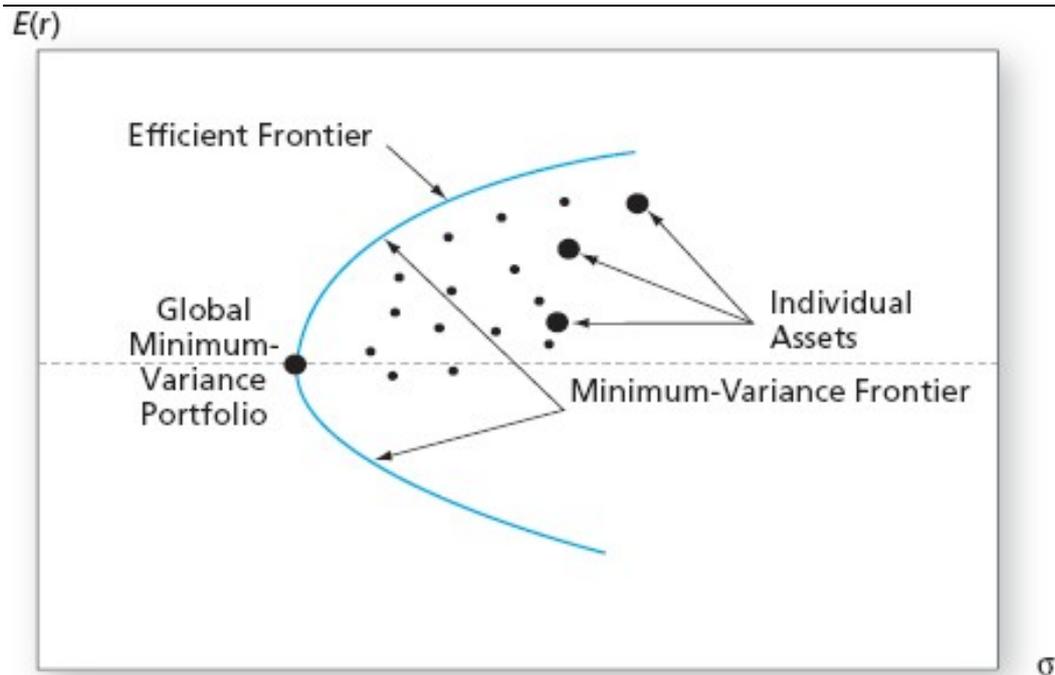
In this part, we will present the relevant financial theory that will help building our arguments when answering our thesis question “*Does real estate investment improve the risk-return trade-off of the Norwegian Government Pension Fund – Global?*”

Risk-Return Trade-off

There is always risk associated with an investment. If an investor want higher expected returns it must be paid a price in terms of accepting higher risk. In the case where higher expected returns are achievable without bearing extra risk, all investors would buy the high-return asset and eventually increase the prices. The asset will be considered attractive by investors until its expected return is commensurate to its risk. This is an implication of the highly competitive financial markets and the no-free-lunch proposition (Bodie, Kane, & Marcus, 2014). As thousands of investors search for investments with high expected returns, it is rare or impossible to find any arbitrage opportunities. We will therefore assume that there is a risk-return trade-off in every asset included in a portfolio, where higher expected returns are expected to have higher risk and vice versa. A portfolio manager diversifies a portfolio with an aim to limit the exposure to each asset and to improve the risk-return trade-off. In a mixed portfolio with different asset classes it is necessary to not only consider the risk of an asset separately, one must also consider the interplay between all assets of the portfolio. Diversification will influence portfolio risk and how to measure the risk-return trade-off of a portfolio, and these implications are more closely elaborated in modern portfolio theory (MPT) that is developed by Harry Markowitz.

Modern portfolio theory

MTP was first introduced by Harry Markowitz in his paper *Portfolio selection (1952)*. Markowitz argued that investors could maximize their expected returns with minimal risk through diversification by using the “expected returns – variance of returns rule” (perhaps better known as *mean-variance portfolio*). The concept is that mean-variance portfolios can earn the same return as a single asset, but with lower risk. This is contrary to the no-free-lunch proposition. The different combinations of mean-variance portfolios that are available to an investor are summarized in the *minimum-variance frontier*. Given the assumptions that investors only focus on maximizing returns and reducing volatility, a rational investor would choose the portfolio with lowest possible volatility for a given expected return, or the highest expected return for a given volatility. The efficient frontier that is figured below represents the available set of mean-variance portfolios. Any portfolio above the Global Minimum-Variance Portfolio is considered as efficient, because they earn a higher return than those portfolios that are below the Minimum-Variance Portfolio, but has the same variance. The dots in between the variance frontier represent inefficient investments because it is possible to achieve higher returns without increasing the variance/risk. An investor can apply the minimum-variance framework to choose the optimal weight of each asset class to create a minimum-variance portfolio (optimize the risk-return trade-off).



Source : <http://datascience.uconn.edu/index.php/projects/students-work/item/51-minimum-variance-portfolio-and-monte-carlo-simulation-on-selected-stocks-returns>

Liquidity preference

Given the same expected return, it will always be desirable for an investor to hold liquid assets that can quickly be converted in to cash. Liquid assets are less risky because they can easily be sold in times of contracting markets. If an investor holds an illiquid asset the portfolio risk will increase, and the risk must be awarded in terms of higher expected returns. This is the *liquidity preference theory*, which was first introduced by John Maynard Keynes (Keynes, 1937). The theory argues that investors require a liquidity premium for the increased risk of holding long-term assets such as real estate that reduce the investors liquidity.

Adjusting Returns for Risk

Financial risk is necessary to increase returns, and every asset has its own risk profile that needs to be considered before investing. Some of the most common financial risk factors are currency risk, equity risk, foreign investment risk, credit risk and liquidity risk. Portfolio performances must be adjusted for risk before they can be assessed appropriately. The easiest way to measure performance is to compare investment funds with similar risk profiles relative to the comparison universe. However, similar funds have often different strategic investment

categories, so that they are not fully comparable (Bodie et al., 2014). It is therefore desirable to use more precise risk-adjustment approaches. A common approach is to apply the mean-variance criteria when adjusting for risk. When the CAPM was introduced, many academicians developed different approaches to measure risk-adjusted performance. Even though each approach has its limitations, they are widely used to measure performance. Some of the most common approaches will be elaborated in the following part:

Sharpe Ratio

The Sharpe Ratio (Sharpe, 1994) is the reward-to-volatility ratio, and is the most commonly used measure of risk-adjusted returns. The ratio measures the trade-off between reward and risk by dividing the assets risk premium by the standard deviation of excess returns. A shortcoming is that its numerical measure is not easy to interpret. The ratio does not compare rates of return, only ratios that are pure numbers and therefore difficult to interpret whether the difference is economically significant or not (Bodie et al., 2014).

$$\text{Sharpe ratio} = \frac{(\bar{r}_p - \bar{r}_f)}{\sigma_p}$$

Treynor measure

Treynor measure gives also a measure of trade-off between reward and risk. It is like the Sharpe ratio, but it uses systematic risk in the denominator. The Treynor measure is desirable to use when an asset is part of a large investment portfolio. In that case, one should measure the excess return against the systematic risk to evaluate the assets contribution to performance (Bodie et al., 2014).

$$\text{Treynor measure} = \frac{(\bar{r}_p - \bar{r}_f)}{\beta_p}$$

Jensen measure

Jensen's measure, or Jensen's alpha, measures the excess return of a portfolio above what is predicted by the CAPM. A positive alpha implies that the portfolio yields a higher return than the market. The measure is commonly applied to determine the excess return given the portfolio's exposure (Bodie et al., 2014)

$$\text{Jensen's alpha: } \alpha_p = \bar{r}_p - [\bar{r}_f + \beta_p(\bar{r}_m - \bar{r}_f)]$$

Information ratio

The information ratio measures risk-adjusted returns relative to a benchmark index, but it focuses on the nonsystematic risk of the portfolio (tracking error). The ratio measures the performance of "active" returns that could have been diversified away by choosing a passive investment strategy such as holding a market index portfolio (Bodie et al., 2014).

$$\text{Information Ratio} = \frac{(r_p - r_m)}{\varepsilon_p}$$

The M² Measure

The M² measure, also referred to as the Modigliani-Modigliani measure, focuses on total risk of a portfolio. The risk-adjusted returns are measured relative to a benchmark index, which makes it easier to interpret compared to the Sharpe ratio. To compute the M² measure one must assume a portfolio with the same risk as the market index. It is therefore necessary to either de-leverage or leverage the portfolio to adjust its volatility (Bodie et al., 2014). The M² measure will in turn be the difference between the portfolio return and the market index return:

$$M^2 = r_{p^*} - r_m$$

4. Methodology

We will apply relevant financial theory, literature and empirical studies to answer our research question. We want to investigate if the inclusion of real estate as an asset class has improved the risk-return trade-off of the GPFG. Our first step will be to gather historical data of the GPFG's monthly returns during the period 1996-2017. The historical dataset will be grouped in to two categories before measuring performance: Monthly returns before introducing real estate as an asset class, and monthly returns after introducing real estate. The funds' performance will be compared to a benchmark index that "comprises an equity index based on FTSE Group's Global All Cap stock index, and a bond index based on various bond indices from Bloomberg Barclays Indices" (Q3 Report NBIM, 2017, page 14).

Empirical tests

We will employ three different models of performance measurement: Fama and French's 3-factor model (E. F. Fama & French, 1993), Fama and French's 5-factor model (F. E. Fama & French, 2015), and Carhart's 4-factor model (Carhart, 1997). Hopefully, applying several models will strengthen the support of our empirical findings. We will run a OLS time-series regression for each model (X-axis) against the GPFG's excess return above the benchmark index (Y-axis).

We will start by applying the Fama and French's 3-factor model. The model explains portfolio returns by including "small capitalization minus big capitalization" (SMB) portfolio returns, "High minus low book-to-value" (HML) portfolio returns and the markets excess return above risk free rate as explanatory factors:

$$r_p = R_f + \beta_1(R_m - R_f) + \beta_s(SMB) + \beta_h(HML) + \alpha$$

The 5-factor model is an extension of the 3-factor model, and is aimed at capturing a higher explanatory power of a portfolios return. Fama and French added the difference between the returns on diversified portfolios of stocks with robust and weak profitability (RMW), and the difference between the returns on diversified portfolios of the stocks of low and high investment firms (CMA) (F. E. Fama & French, 2015):

$$r_p = R_f + \beta_1(R_m - R_f) + \beta_s(SMB) + \beta_h(HML) + \beta_r RMW + \beta_c CMA + \alpha$$

The last model we will apply is Carhart's 4-factor model. He extended Fama and French's 3-factor model with Jegadeesh and Titman's one-year momentum anomaly as a factor (Jegadeesh & Titman, 1993):

$$r_p = R_f + \beta_1(R_m - R_f) + \beta_s(SMB) + \beta_h(HML) + \beta_m(MOM) + \alpha$$

Further, we will estimate risk-adjustment performance ratios and analyze each regressions alpha to investigate the risk-return trade-off. In addition to measuring the funds standard deviation and return, we must also consider the correlation between real estate and the other asset classes. The dataset, after the inclusion of real estate, must therefore be tested for correlation and cointegration between the returns on real estate and equity/fixed income.

Potential shortcomings

A shortcoming is that we do not have much data. The fund made its first real estate investment in 2011, so we can only base our findings on 7 years of time series data. This is not optimal considering that real estate investments have a long-term perspective. We therefore find it important to also use empirical studies of other foreign pension funds that invest in real estate as a comparison/support to our findings.

Hypothesis

From theory and previous research, it is argued that investments in real estate contribute to diversification, a hedge against inflation and a reduction in the overall risk of a portfolio. We will therefore expect that the GPFG's risk-return trade-off has been improved since the inclusion of real estate in 2011. Our expectations can be defined in the following hypothesis test:

H_0 : *Real estate investments has not improved the risk-return trade-off*

H_1 : *Real estate investments has improved the risk-return trade-off*

5. Following parts

So far, we have outlined the theoretical and methodological framework we will use to address the main question. We will now apply the frameworks on the GPFG's returns and analyze the output.

The next step will be to collect all necessary data, which is available at the GPFG's database. The data will be categorized into two periods: The period before the inclusion of real estate and the period after inclusion of real estate. We will also define the dependent and explanatory variables that will be used in the regression.

After the data is collected we will run three different regressions on the historical returns. This is the section where our hypothesis test is being tested. The regression output will be analyzed and we will compute different risk-adjusted return ratios. Our conclusion will be based on the regression outputs, so we consider this to be the most important part of our thesis.

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