Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Economics and Management
Department of Economics

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Does Portfolio Rebalancing Reduce Sector Exclusion Risk for a Long-Term Investor

Master's thesis in Financial Economics
Supervisor: Snorre Lindset
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Preface

This master's thesis is the last assignment of our master's degree in Financial Economics at NTNU in Trondheim. As such, it is the end of our final years in the academic field of finance and economics. The thesis was a good experience, as it was challenging and educational at the same time. It has been interesting to write a paper where we were able to use the knowledge we have appropriated through our studies.

We want to extend a huge thanks to Snorre Lindset, our supervisor, for his insight and advice during the semester in writing the thesis. We would also like to extend a huge thanks to friends and family.

The entirety of this master thesis was collaboratively written by Petter Schmidt and Tor Morten Bragstad Grannes. All views or statements expressed within are solely their responsibility.

Abstract

In this thesis we are looking at how the exclusion risk is affected when the portfolios are exposed to three different rebalancing strategies, no rebalance, 10-year rebalance, and 5-year rebalance. We are using 30 sector portfolios with monthly returns over a 40-year period, starting in January 1983 and ending in December 2022. We look at the annualized returns and the variance of randomly generated portfolios to determine the exclusion risk. We look at six portfolio combinations applied to all three investment strategies. And created 10,000 portfolios for each portfolio combination, where possible. The same portfolios are used for the three different investment strategies to analyze them and track their development against each other during a 40-year investment period. The analysis of our three investment strategies gave somehow similar results, but we observed some differences. We do at the same time look at how the annualized return and the variance of the return between the portfolios in each month is affected by the three investment strategies. To evaluate the performance of the portfolios, we create the market portfolio by including all the sector portfolios into a single portfolio and risk-free rate given by 3-month US Treasury bills. For all created portfolios the annualized return has a significantly higher performance than the risk-free rate. Furthermore, we see that the exclusion risk varies depending on the investment strategy. For all three investment strategies, the exclusion risk decreases as more sectors are added to the portfolio.

Sammendrag

I denne masteroppgaven ser vi på hvordan eksklusjonsrisikoen påvirkes når porteføljene blir eksponert for tre ulike rebalanseringsstrategier: ingen rebalansering, rebalansering hvert 10. år og rebalansering hvert 5. år. Vi bruker 30 sektorporteføljer med månedlige avkastninger over en 40-årsperiode, fra januar 1983 til desember 2022. Vi ser på årlige avkastninger og variansen til tilfeldig generte porteføljer for å bestemme eksklusjonsrisikoen. Vi ser på seks porteføljesammensetninger som blir brukt på alle tre investeringsstrategiene. Vi oppretter 10 000 porteføljer for hver porteføljesammensetning, der det er mulig. De samme porteføljene brukes for de tre ulike investeringsstrategiene for å analysere dem og følge deres utvikling i løpet av en 40-års investeringsperiode. Analysen av våre tre investeringsstrategier ga noenlunde lignende resultater, men vi observerte noen forskjeller. Samtidig ser vi på hvordan årlig avkastning og variansen i avkastningen mellom porteføljene i hver måned påvirkes av de tre investeringsstrategiene. For å evaluere porteføljenes prestasjon oppretter vi en markedsportefølje ved å inkludere alle sektorporteføljene i én portefølje og en risikofri rente gitt av 3-måneders amerikanske statsobligasjoner. For alle opprettede porteføljer har årlig avkastning en betydelig høyere prestasjon enn den risikofrie renten. Videre ser vi at eksklusjonsrisikoen varierer avhengig av investeringsstrategien. For alle tre investeringsstrategiene reduseres eksklusjonsrisikoen når flere sektorer legges til i porteføljen.

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Chapter 1

Introduction

When writing this thesis, we have taken inspiration from Jokstad, Lindset & Tryland (2022). In their paper, they label the risk for long-term investors of missing out on well-performing firms or sectors as an exclusion risk. To measure the exclusion risk, they use the variance for the annualized return given by financial data from the US stock market. The data have been collected from Kenneth R. French's library. Using the data sample of 30 sector portfolios as a baseline to create different portfolio combinations. The created portfolios are being used to calculate the exclusion risk for the portfolios.

Jokstad, Lindset & Tryland (2022) used data over the last 90 years and track the performance of the portfolios from the beginning until the end. In the thesis, they apply two strategies, buy-and-hold and rebalancing the portfolios every 10 years. For both strategies, including more sectors in the portfolios, leads to a reduction in the exclusion risk.

In this thesis, we will use data provided by Kennet R. French. We have decided to look at a shorter time span of 40 years, 1983 - 2022. The decision to shorten the time span of the investment period is to make it more realistic for a real long-term investor. We have also lowered the number of portfolio combinations and generated 10,000 portfolios, when possible, for each portfolio combination.

Further, we investigate different approaches to various possible investment portfolios in the stock market. We want to investigate the difference between the three investment strategies and look at how the strategies perform over time. Our focus throughout the thesis is to look at how the exclusion risk behaves when applying

the buy-and-hold, 10-year rebalancing, and 5-year rebalancing strategies to the performance of the sectors from the data sample. We do compare the development of the exclusion risk against the return and variance of the portfolios, to find what the optimal approach to long-term investment may be.

In general, we can see that the exclusion risk for the 10-year rebalanced portfolios is higher than the non-rebalanced and the 5-year rebalanced portfolios, with one exception. For the buy-and-hold strategy, the exclusion risk is clearly lower than both rebalancing strategies when the portfolios consist of 5 and 25 sectors. Furthermore, when the portfolios contain 10 and 20 sectors the exclusion risk is lowest for the 5-year-rebalanced portfolios. We see that the average annualized return is consistently higher for the 5-year rebalancing strategy. The variance of the return between the portfolios of the non-rebalancing portfolios gets more volatile over time, while the rebalanced portfolios continue the same trajectory.

Chapter 2

Data

We obtained our data from Kenneth R. French and the Tuck School of Business at Dartmouth College. The dataset provides monthly returns for 30 sector portfolios from January 1983 to December 2022. The dataset offers two options for data analysis, namely, average value-weighted returns and average equal-weighted returns. For our analysis, we chose to use average equal-weighted returns as they provide a comprehensive understanding of the market performance, regardless of the size of the company. The sector classification of a stock is attributed to a four-digit SIC code. While the data is given at a monthly frequency, we can calculate the yearly returns using this formula,

$$r_y = \prod_{t=1}^{12}(1 + r_m) - 1. \tag{2.1}$$

The formula relates the yearly return, denoted by r_y, to the monthly return, denoted by r_m. Investors generally commence investing and saving towards the end of their twenties or early thirties and continue this until their retirement. As a result, we have considered a forty-year investment period to represent a typical investment horizon for a regular investor.

Each sector of the market contains a specific number of companies. The exact number of companies within each sector may vary over time. The sector with the least amount of companies in it is Coal during the last part of the 1990s when there were only two companies. The sector with the largest amount of companies in it is Finance in July 1997 with 1,369 firms.

2.1 Risk-Free Rate and Market Portfolio

The concept of a market portfolio involves a collection of investable assets available in the market. Typically, sectors are included in the portfolio based on their market value relative to the total market value (*Market portfolio*, 2023). However, in the context of this thesis, the market portfolio is based on an equally weighted measure that disregards individual stock market values within a sector and the total market value of the sector. In this approach, each sector is assigned an equal weight that has a similar impact on the market portfolio.

US Treasury bills are often considered risk-free investments, as the US government historically never has defaulted on its debt (*Investopedia* (2022)). For the purpose of this thesis, the 3-month US Treasury bill is utilized as the risk-free rate. The data for the risk-free rate is available for the entire period covered by this study, from 1983 until 2022. As shown in Figure 2.1.1, the risk-free rate has exhibited a declining trend over this period, with some fluctuations.

To compound the annualized risk-free rate, the conventional formula for calculating the average is used, which is as follows

$$\text{Annualized Return} = (1 + (\frac{(P_{s,t} - P_{s,t-1})}{(P_{s,t-1})}))^{1/n} - 1 \tag{2.2}$$

Here, ($P_{s,t}$ is the price of the sector today, and $P_{s,t-1}$) is the price of the sector in t-1. n corresponds to the number of years, which is 40 years in this case.

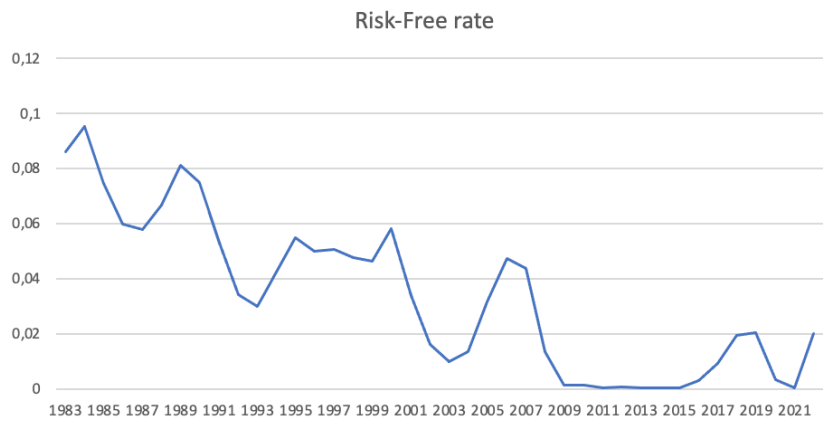


Figure 2.1.1: Figure (a) display the development of the risk-free rate from 1983 to 2022.

2.2 Tables

Throughout this paper, we will present various tables containing key metrics. The key metrics are exclusion risk and average return, for the portfolios and investment strategies. The specific content within each table will depend on the context and requirements of the respective sections of the paper, but will typically include some or all of the aforementioned variables.

First and foremost, the table caption will elucidate the contents of the table and highlight its significance within the context of our analysis. As illustrated in Table 2.2.1, there are four distinct variables. The left column represents the "Number of Sectors." This variable indicates the number of sectors included in the portfolios under examination. The other two columns display the values of two distinct variables, in this case, Exclusion Risk and Average Return.

The second row designates the investment strategy that is being analyzed. In this instance, the 5-year rebalanced portfolios are the subject of our evaluation. Finally, the three previously mentioned variables and their corresponding values are presented in the subsequent rows.

Table 2.2.1: The Table depicts the exclusion risk and average return associated with 5—year rebalance portfolio combinations. In the left column, the number of sectors in each portfolio is written. In the middle column, the exclusion risk associated with the portfolio combinations is shown. And in the right column, the average return to the portfolio combinations is written down.

Number of Sectors	Exclusion risk	Average return
5-year rebalancing		
1	11.7159	0,0982
5	2.2090	0.1213
10	0.5454	0.1116
20	0.1395	0.1123
25	0.0543	0.1125
30	0	0.1126

2.3 Calculating Variance

To find a measure for the volatility of the portfolio over time we calculate the variance of the return between the portfolios for every month in our 40-year investment period. To visualize the volatility over time we create a graph for all portfolio combinations and display the development of variance for the three investment strategies.

Starting in January 1983, calculating the variance of every single portfolio return using the formula,

$$\sigma^2 = \frac{\sum_{p=1}^{z}(x_p - \mu)^2}{z}. \tag{2.3}$$

Here, x_p is the return of portfolio p, μ is the average return, and z is the number of observations available. With the formula, we can find the variance of the return of every portfolio created and thus generate a graph showing the variance over time.

Chapter 3

Method and Theory

3.1 Portfolio Construction

In finance, a portfolio refers to a collection of financial investments, such as stocks, bonds, and other securities owned by an individual, a company, or a fund (*Tardi*, 2023). The purpose of having a portfolio is to diversify your investment and manage risk while aiming to receive a certain level of return.

A well-diversified portfolio usually contains a mixture of securities so the weight is well distributed across the assets in the portfolio (*Well diversified portfolio*, 2023). The composition of the portfolio depends on the investor's goals and risk tolerance.

The number of sectors a long-term investor would like to implement into their portfolio will vary depending on the individual investor. As such we decided to look at portfolios containing 1, 5, 10, 20, 25, and 30 sectors each. The portfolios were generated from a pool of 30 sectors. When referring to the number of sectors in portfolios we refer to this as portfolio combinations. To find the total number of possible portfolios we use the following formula,

$$C(30, s) = (30!)/(s!(30 - s)!). \tag{3.1}$$

The formula enables the calculation of the total number of combinations involving s out of 30. The variable s represents the number of sectors within a portfolio. By implication, if we were to compute the number of portfolios comprising 10 sectors, we would derive the following equation,

$$C(30, 10) = (30!)/(10!(30 - 10)!) = 30,045,015. \tag{3.2}$$

So, the total number of portfolios possible to create consisting of 10 different sectors is 30,045,015. With our six portfolio combinations we know would get a total of 60,405,069 portfolios. We however have decided to create 10,000 portfolios for each portfolio combination, where possible. For the portfolio combinations where it is not possible to generate 10,000 portfolios, we generate the maximum number of portfolios possible.

For the portfolio construction, we used a Monte Carlo simulation. A Monte Carlo simulation is used in order to generate random outcomes (*Cruse* (1997)). In total, the number of randomly generated portfolios is 40,031, where every portfolio created is unique. The same portfolios were implemented for all three investment strategies.

3.2 Return and Variance

Expected return and variance are fundamental to portfolio management, as they help investors evaluate and compare different investment options. According to Markowitz's modern portfolio theory, an investment portfolio's expected return and variance are key factors that investors should consider when constructing a portfolio (Markowitz (1952)).

The expected return for the data the analysis is based on is presented as percent monthly returns, in a simple form. Therefore, the return for a single sector in a period is calculated as,

$$r_{s,t} = (P_{s,t} - P_{s,t-1})/(P_{s,t-1}). \tag{3.3}$$

Here $P_{s,t}$ is the price of the sector, s, in time t. $P_{s,t-1}$ is the price of the same

sector, s, in time $t-1$.

The expected return of a portfolio is the weighted average of the expected returns of its individual sector. Mathematically, the expected return to be expressed as,

$$E(r_p) = \sum_{i=1}^{z} w_s E(r_s). \tag{3.4}$$

$E(r_p)$ is the expected return of the portfolio, w_s is the weight of sector s in the portfolio, $E(r_s)$ is the expected return of sector s, and z is the number of sectors in the portfolio. In our case, the weights of sectors are equal, as our data is based on equal-weighted returns.

The expected return of a portfolio is important because it measures the expected profitability of the portfolio and allows investors to compare the potential returns of different portfolios. However, it is not sufficient on its own to evaluate a portfolio's performance, as it does not take into account the portfolio's risk.

In conjunction with the expected return, it is imperative to compute the annualized return for each portfolio, as this metric will be employed in subsequent analysis. We calculate this return as,

$$r_n = (\prod_{t=1}^{12n}(1 + r_{p,s,t}))^{1/T} - 1. \tag{3.5}$$

For every distinct, randomly sampled portfolio denoted by p, a series of monthly returns $(r_{p,s,t})_{t=1}^{12n}$ is generated, where n represents a time span of 40 years. The compounding of these returns yields the aggregate return throughout the four-decade period.

Variance is a widely used metric for assessing the risk and volatility of financial investments. Specifically, it measures the extent to which the return of the in-

vestment deviates from its expected return. A higher variance indicates greater deviations (Marowitz (1987)).

To examine how the volatility of the portfolios is influenced by the rebalancing and its frequency, we have calculated the variance between the portfolios for all 480 months using the following formula,

$$\sigma_y^2 = \frac{\sum_{p=1}^{P}(x_p - \mu)^2}{P}. \tag{3.6}$$

Here, σ_y^2 is the variance of the return for the month y. x_p is the return of portfolio p and μ is the average return for all portfolios. P is the total number of portfolios.

The formula is a tool for determining the variance between portfolios by assessing the monthly return variance for each portfolio combination. The method gives a modest insight into the monthly variances, and allowing to trace the variance over time. As such, determine whether the investment is influenced by more frequent rebalancing at any given point.

3.3 The Buy-and-Hold Strategy

The present study analyzes the buy-and-hold investment strategy, which involves acquiring a long position in the market and holding the portfolio for the duration of the data sample. Specifically, in this study, the investor is required to enter the position at the beginning of the sample period, January 1983, and hold it for 40 years until the end of the sample period, December 2022. In the buy-and-hold strategy, the portfolios are only affected by the annualized compounded rate of return.

The buy-and-hold strategy depends on that the market will rise over time, thus providing investors with an opportunity to benefit from the overall upward trend.

However, this strategy also exposes investors to potential risks, such as market fluctuations and changes in economic conditions.

3.4 The Rebalancing Strategy

The rebalancing investment strategy aims to maintain a portfolio's target asset allocation by periodically buying and selling assets to bring the portfolio back to its original allocation. In this case, we investigate two different time aspects of rebalancing the portfolio - the 10-year and 5-year rebalancing strategies.

With the 10-year rebalancing strategy, the portfolio is rebalanced four times over a 40-year investment period. Each time the portfolio is rebalanced, investments in the different industries within the portfolio are re-weighted to achieve an equally weighted portfolio. The 5-year rebalancing strategy involves rebalancing the portfolio eight times over the same 40-year investment period. In this strategy, the portfolio is rebalanced more frequently than in the 10-year strategy, with the same goal of maintaining an equally weighted portfolio.

By applying these two different time aspects of rebalancing, investors can compare the differences between the two strategies and also compare them to the buy-and-hold strategy. However, it is important to keep in mind that the optimal rebalancing frequency depends on various factors such as the investor's risk tolerance, investment goals, market conditions, and the cost of rebalancing a portfolio.

Generally, rebalancing can help mitigate risk by ensuring that the portfolio remains diversified.

3.5 Exclusion Risk

Over the last years, investors have become increasingly discerning about their investment choices, paying greater attention to the underlying components of their portfolios. One notable example of this trend is the growing emphesis in environmental, social, and governance (ESG) factors. Policymakers and regulators have been progressively focusing on ESG considerations (Zhou, Liu, & Luo, (2022)). Furthermore, improved access to information has equipped individual investors with enhanced knowledge about environmental issues, consequently placing pressure on portfolio managers and firms to reduce negative externalities (Jagannathan, Ravikumar, & Sammon, (2017)). The authors also note a rising demand from investors for total divestment from fossil fuel interests (Jagannathan, Ravikumar, & Sammon, (2017)).

In light of these developments, a surge in investors excluding companies, sectors, or even entire markets when constructing a portfolio may be observed. Consequently, investors may forgo potential opportunities in the market. Jokstad, Lindset, & Tryland (2022) contend that long-term investors are exposed to diversifiable risk by excluding firms and sectors from their investment portfolios. They further argue that while these investment portfolios may be sufficiently diversified for short-term investors, they may not be adequate for long-term investors (Jokstad, Lindset, & Tryland (2022)).

Additionally, the authors reference Bessembinder's paper, "Do Stocks Outperform Treasury Bills?", to emphasize that only a limited number of stocks perform well over time (Bessembinder (2018)). By excluding sectors, long-term investors risk missing out on these few high-performing stocks. The authors assert that if these well-performing stocks are not incorporated into the stock portfolio, even long-term stock investments may yield low returns. As a result, these exclusions are deemed risky, and the authors proceed to label this risk as an "Exclusion Risk"(Jokstad, Lindset, & Tryland (2022)).

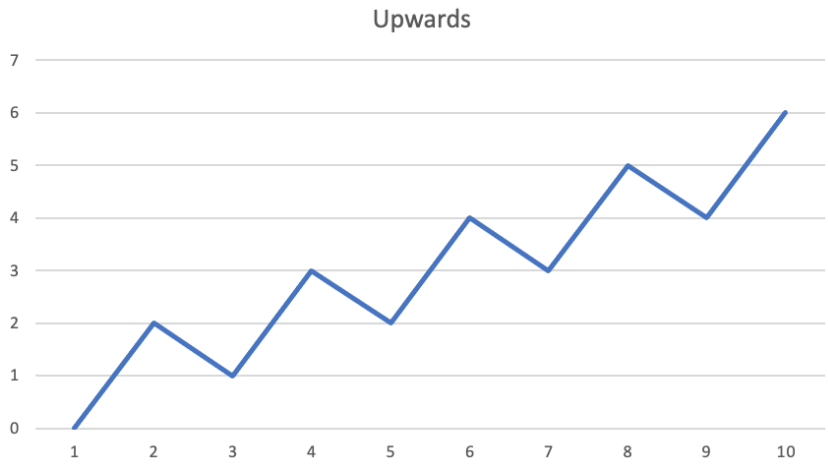
The authors propose employing the variance of the annualized return for investment strategy i as a metric to assess exclusion risk,

$$\Gamma_i = \frac{1}{z}\sum_{j=1}^{z}(r_{j,p} - \overline{r_{j,p}})^2. \tag{3.7}$$

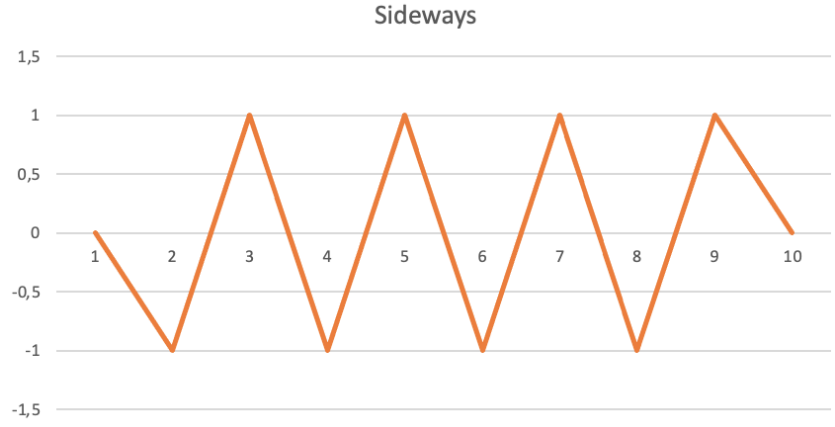
Where z denotes the number of simulation runs executed, $r_{j,p}$ represents the annualized return for portfolio p associated with investment strategy j, and $\overline{r_{j,p}}$ corresponds to the mean annualized portfolio return for investment strategy j.

3.6 Development of Companies

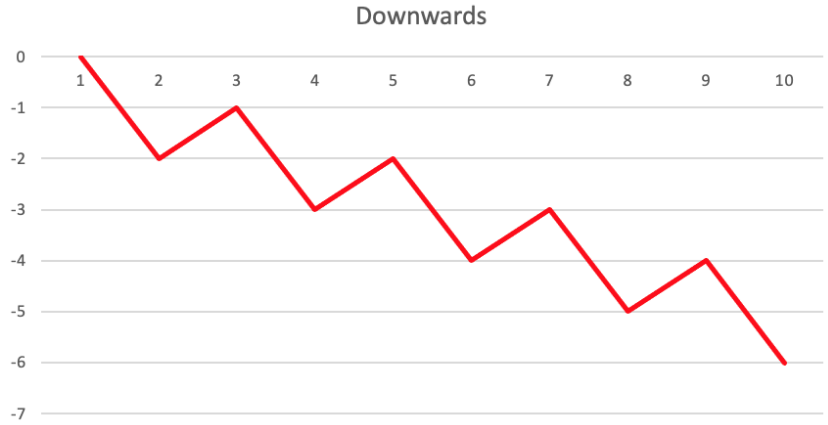
The development of a sector can vary over time. Typically, one can say that a sector is in a move upward, downward, or sideways movement path. In this thesis, we will focus on these three possible developments for the sector. The fourth scenario is that the company within the sector goes bankrupt. From Table 3.6.1 the three different development for a sector is graphically illustrated. These will later in the thesis be used in order to describe the development and performance of the portfolios created. As sectors will, for a long or short period of time, follow one of the three trends. Typically, over time sectors will vary and sectors will therefore appear in different trends at different points in time. For instance, a sector may be in an upwards trend for 5-10 years, and be in a downward trend for the next 5 years before returning to an upward trend.



(a) Upwards trend



(b) Sideways trend



(c) Downwards trend

Figure 3.6.1: The visualization presented in Figure (a) presents the hypothetical development of a stock or a sector in an upwards trend, while Figure (b) presents the hypothetical development of a stock or a sector in a sideways trend, and Figure (c) presents the hypothetical development of a stock or a sector in a downwards trend.

Chapter 4

Main Analysis

4.1 Risk-Free Rate and Market Portfolio

Let's consider an investment in the risk-free rate of $100 made in January of 1983 and tracked until the end of 2022. As illustrated in Figure 2.1.1 of the Data chapter, the Risk-Free rate has exhibited a declining trend over the past 40 years. Figure 4.1.1 displays the development of the investment at a risk-free rate. We observe a relatively steep performance of the risk-free rate until the years of the financial crisis in 2007-2008, after which it exhibits relatively poor performance. The total return on investment in the risk-free rate is calculated to $274.65. The outcome of this calculation is a return rate of 274.65%, which corresponds to an annual return rate of 3.36%.

Now, consider an investment of $100 into the market portfolio. Figure 4.1.2 provides the graphical representation of the performance for the $100 investment. However, by using the three different investment strategies we get three different results as the portfolio's result will be affected whether the portfolio is rebalanced or not, and by how frequently.

In Figure 4.1.2, the rebalancing strategy yields a higher return than the buy-and-hold strategy. Notably, the 5-year rebalancing strategy outperforms the 10-year rebalancing strategy.

With the buy-and-hold strategy for the market portfolio, the dollar return amounts to $6,363.86, resulting in a rate of return of 6,363.86% or an annual rate of return

of 10.98%.

With the 10-year rebalancing strategy for the market portfolio, the dollar return amounts to $6,439.73, resulting in a rate of return of 6,439.73% or an annual rate of return of 11.02%.

With the 5-year rebalancing strategy for the market portfolio, the dollar return amounts to $7,025.02, resulting in a rate of return of 7,025.02% or an annual rate of return of 11.26%.

These results indicate that the 5-year rebalanced market portfolio yields a higher annual rate of return.

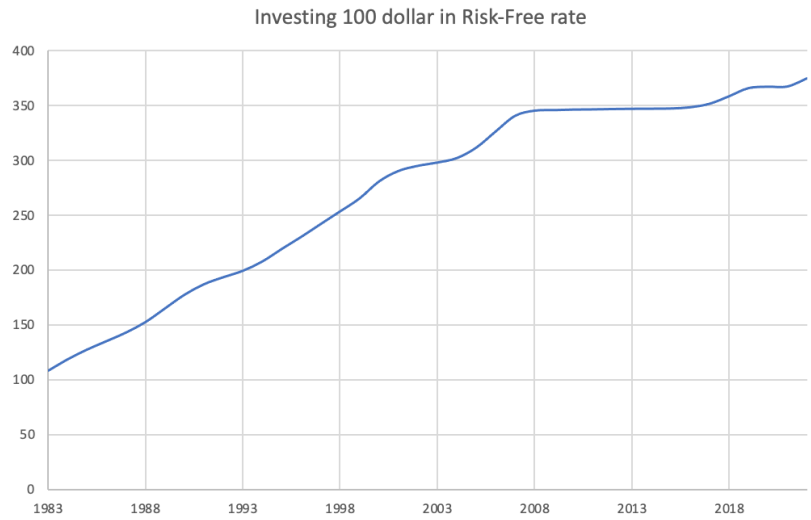


Figure 4.1.1: The Figure shows the development of investing 100 dollars in the risk-free asset at the beginning of 1983 and holding until the end of the investment period, December 2022.

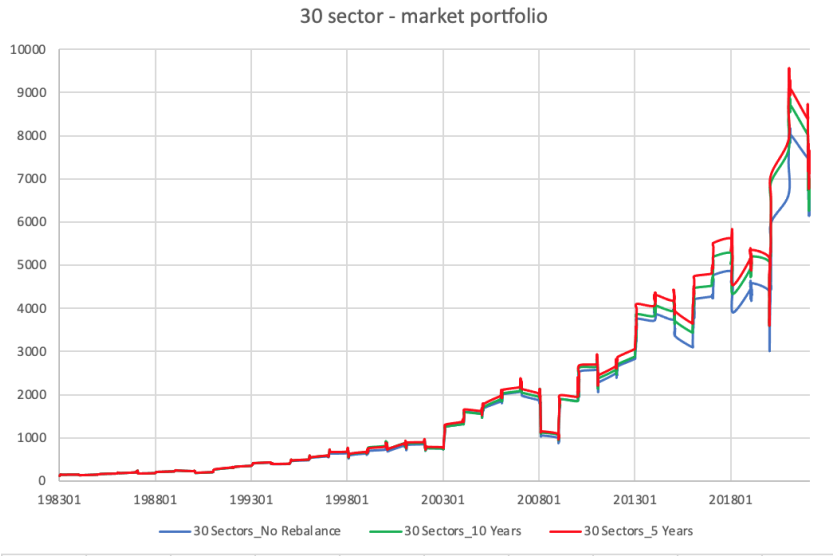


Figure 4.1.2: The Figure shows the development of investing 100 dollars in the market portfolio when all three investment strategies are utilized. The investment starts in January 1983 and ends in December 2022.

4.2 Applying the Buy-And-Hold Strategy

As in Chapter 4.1 Risk-Free Rate and Market Portfolio, consider an $100 investment in the six different portfolio combinations and track their performance from January 1983 until December 2022 by applying the buy-and-hold strategy. The performance is visualized in Figure 4.2.1.

The results indicate a negative relationship between the number of sectors included in a portfolio and the corresponding return. In particular, the 1-sector portfolio exhibits a dollar return of 9.386,105, corresponding to a return of 12.05%. The 5, 10, 20, 25, and 30-sector portfolios generate dollar returns of 6,656.73, 6,456.03, 6,375.93, 6,376.21, and 6.363,86, respectively, with corresponding rates of return of 11.11%, 11.02%, 10.99%, 10.99%, and 10.98%. These results indicate that the 1-sector portfolios offer better returns compared to the other portfolios considered. Notably, most portfolios outperform the 30-sector market portfolio, with the exception of the 20-sector portfolio, which exhibits a lower average rate of return.

From Figure 4.2.1 and the reported results, we see that investing in the 1 sector

portfolio has the clearly highest return. The reason behind this is that the return of the best-performing sectors has a greater impact than the worst-performing sectors. The investment will also be 100% focused on one sector. In other words, the investor who is able to pick the best-performing sector will beat the market and the other portfolio combinations.

When adding 4 more sectors to the portfolio the actual annual return drops towards the market portfolio, but does still perform better over time. Since the investor is able to invest a bigger part of its total portfolio into a still, relatively, low number of sectors. Further, the more sectors are added to the portfolios the return will go down. The Investor will give up some of the potential return for diversification benefits. The return of all the portfolio combinations, including the market portfolio, outperforms the risk-free rate.

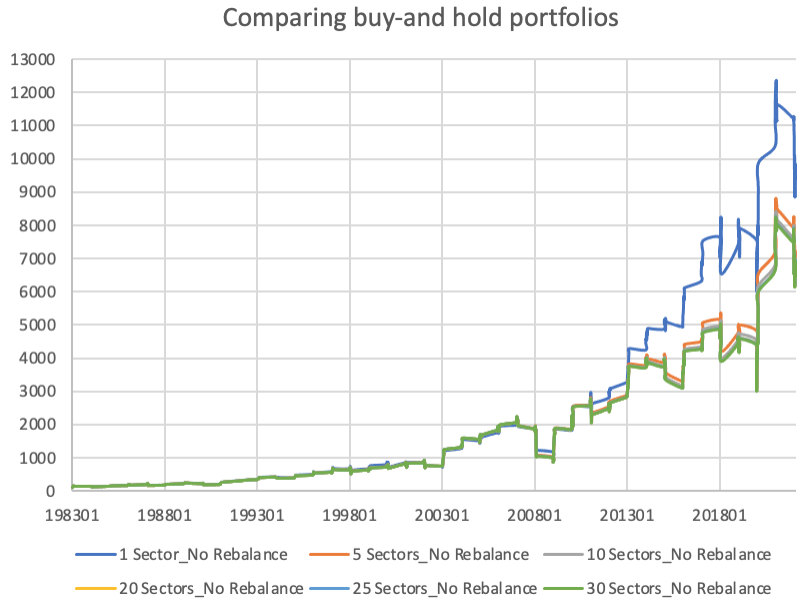


Figure 4.2.1: In the figure, we see the development when investing in the six different portfolio combinations by applying the buy-and-hold strategy. The depicted portfolios' development demonstrates how they perform over time when following this strategy.

4.2.1 Return

The analysis presented in Figure 4.2.2 sheds light on the performance of buy-and-hold portfolios comprising different sector combinations. In particular, Figure 4.2.2 (a) showcases the development of the average annual return for portfolios that include varying numbers of sectors. The figure indicates that the average annualized return of portfolios generally increases as more sectors are included in the portfolio. The trend is particularly pronounced for portfolios consisting of one to five sectors, where the average annualized return increases significantly. However, for portfolios comprising more than five sectors, the increase in annualized return is more modest. Specifically, the average annual return for portfolios consisting of one sector is 9.82%, which increases to 10.79% when the portfolio includes five sectors. Moreover, the average annualized return grows gradually to 10.98% when all sectors are included in the portfolio.

In Figure 4.2.2 (b), the performance of the best-performing and worst-performing portfolios is presented alongside the average annualized return. The figure indicates that the best-performing portfolio includes only one sector. Achieving an annualized return of 19.42%, this portfolio significantly outperforms the average annualized return. However, by adding more sectors the performance of the portfolio declines slightly and converges toward the average annualized return. When all 30 sectors are included, the portfolio will become the market portfolio. The best-performing portfolio outperforms the average for all other possible sector combinations.

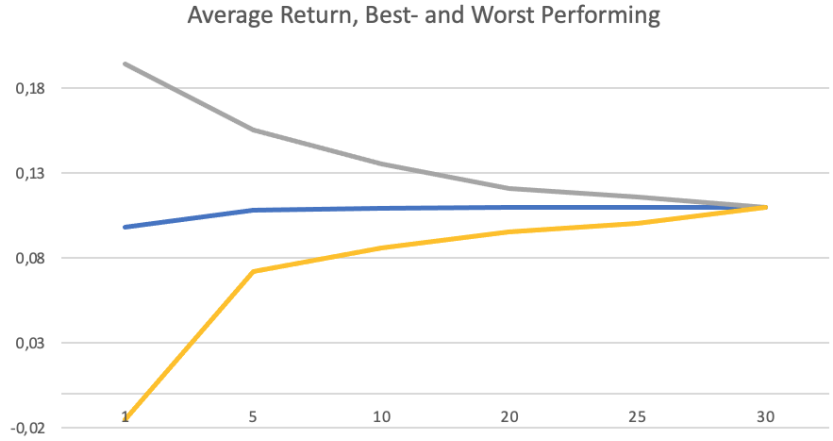
Conversely, the worst-performing portfolio is represented by the gray line in Figure 4.2.2 (b). The worst-performing portfolio that includes only one sector yields a negative annualized return of 1.5%. Holding this portfolio unfortunately leads to a loss. Specifically, for portfolios composed of five sectors, the average annualized return sits at 7.22%, a figure that is notably lower than that of the best-performing portfolio. Additionally, for portfolios comprising more than five sectors, the worst-performing portfolios tend to converge toward the average annualized return. Fi-

nally, for portfolios that include all 30 sectors, the worst-performing portfolio returns the same as the average annualized return and the best-performing portfolio.

Overall, the findings presented in Figure 4.2.2 suggest that the performance of buy-and-hold portfolios depends on the composition of sectors in the portfolio. Specifically, portfolios that contain a higher number of sectors tend to yield higher average annualized returns, with the most significant increase observed for portfolios that include up to five sectors. Furthermore, the best-performing portfolio generally includes only one sector, while the worst-performing portfolio includes a single sector and yields a negative annualized return.

Table 4.2.2 provides a detailed account of the average return, highest-performing, and lowest-performing sectors encompassed in the portfolios.

(a) Average return



(b) Average return, best performing and worst performing

Figure 4.2.2: The visualization presented in Figure (a) offers a comprehensive depiction of the average return, while Figure (b) presents a more nuanced representation of the average return, with additional information on the best-performing and worst-performing portfolios. The information provides a more complete understanding of the performance of the portfolios under consideration.

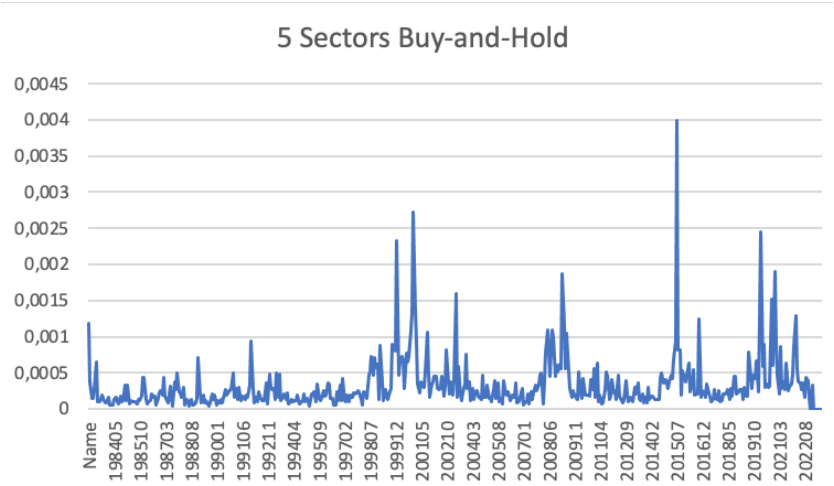
Table 4.2.1: The table shows the development of the average return given the number of sectors included within the portfolio. The best-performing and worst-performing portfolios are also included and given according to the different number of sectors included in the portfolio. The table also includes information about the annualized return.

Sectors	**Average return**	**Best**	**Worst**
No Rebalance			
1	0.0982	0.1942	-0.0150
5	0.1079	0.1551	0.0722
10	0.1090	0.1353	0.0862
20	0.1096	0.1212	0.0955
25	0.1098	0.1161	0.1003
30	0.1098	0.1098	0.1098

4.2.2 Variance

Figure 4.2.3 presents a graph illustrating the variance in return between the portfolios for the buy-and-hold strategy. The figure provides information about the development of the variance for portfolios consisting of 5 and 25 sectors. Where the development of the variance is visualized from January 1983 until December 2022. The variance has remained somewhat consistent, but at certain points, the variance has increased aggressively before decreasing back to the mean. These spikes in variance can often be associated with well-known financial incidents, such as The dot-com bubble in the 1990s, the Financial Crisis in 2007-2008, and the Covid-19 virus that spread across the world in 2020.

The mean-variance of the return between the portfolios of the buy-and-hold strategy during the 40-year time period is 0.0005. In some periods of uncertainty in the financial market, the variance surges exponentially and rises above 0.015. When this occurs the variance has risen by more than 2 900% from the mean.



(a) Variance of the 5 sector Buy-and-Hold strategy

(b) Variance of the 25 sector Buy-and-Hold strategy

Figure 4.2.3: Figure (a) displays the development of the variance of the return between the 5-sector buy-and-hold portfolios, Figure (b) displays the development of the variance of the return between the 25-sector buy-and-hold portfolios

4.2.3 Exclusion Risk

Figure 4.2.4 displays a graphical representation of the exclusion risk across various sectors in a portfolio. The illustration presents the exclusion risk for each of the 30 sectors. The graphical presentation displays that portfolios with a smaller number of sectors have a higher exclusion risk, which decreases rapidly as additional sectors are included. From portfolios consisting of five sectors up to those with 30 sectors, there is a relatively steady decline in exclusion risk towards zero.

In contrast, Table 4.2.2 provides more detailed empirical data on the evolution of exclusion risk. The table shows that portfolios containing only one sector have a high exclusion risk of 11.72. However, as the number of sectors in the portfolio increases, the exclusion risk decreases steadily. Notably, the most significant reduction in exclusion risk occurs when moving from portfolios with one sector to those containing five sectors. The exclusion risk drops significantly to 1.68, showing the risk of missing out on new financial assets is reduced. In other words, moving from a 1-sector portfolio to a 5-sector portfolio reduces exclusion risk by 85.62%.

Moreover, when the portfolio comprises 25 sectors, the exclusion risk is almost eliminated, with an average exclusion of 0.0005 which can be considered as almost zero exclusion risk. Thus, the table provides a nuanced perspective on the evolution of exclusion risk in portfolios of varying sector compositions.

In summary, the graphical representation in Figure 4.2.4 and the empirical data in Table 4.1.2 both demonstrate that portfolios with a smaller number of sectors have a higher exclusion risk, which decreases as additional sectors are included. The most significant reduction in exclusion risk occurs when moving from portfolios with one sector to those containing five sectors.

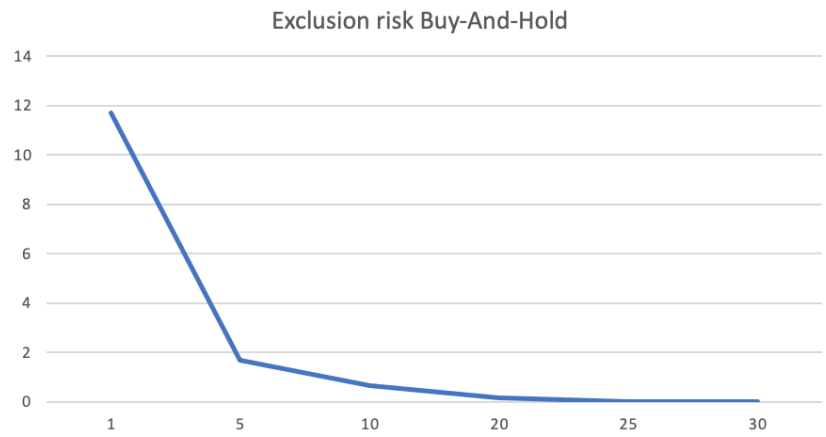


Figure 4.2.4: The figure visualizes how the exclusion risk is reduced when the portfolio combination changes to portfolios containing more sectors.

Table 4.2.2: The Table depicts the exclusion risk and average return with the buy-and-hold investment strategy.

Sectors	Exclusion risk	Average return
No Rebalance		
1	11.7159	0.0982
5	1.6843	0.1079
10	0.6744	0.1090
20	0.1680	0.1096
25	0.0005	0.1078
30	0	0,1098

4.3 Applying The Rebalancing Strategy

In the following part, an analysis of the performance of a rebalancing investment strategy is presented. Two different rebalancing strategies are considered: one that involves rebalancing the portfolio every 10 years, and another that involves rebalancing every 5 years. The study begins with an investment of $100 in each portfolio in January 1983, and the performance of these portfolios is tracked until December 2022.

Figure 4.3.1 (a) displays the performance of investing $100 into the portfolios consisting of 1, 5, 10, 20, 25, and 30 sectors and rebalancing them every 5 years. The portfolio return appears to be more correlated during the first half of the period, but there is greater variability in returns over time, with some portfolios fluctuating more than others.

For a 1-sector portfolio, the dollar return is 9,386.105, which corresponds to an annualized return of 12.05%. For the portfolios rebalanced every 5 years consisting of 5, 10, 20, 25, and 30 sectors, the dollar returns are respectively 7,115.8, 7,035.38, 7,015.58, 7,029.85, and 7,025.02. The corresponding annual rates of return are 11.29%, 11.26%, 11.25%, 11.26%, and 11.26%, respectively.

For the 1-sector portfolio, there is no rebalancing during the investment period.

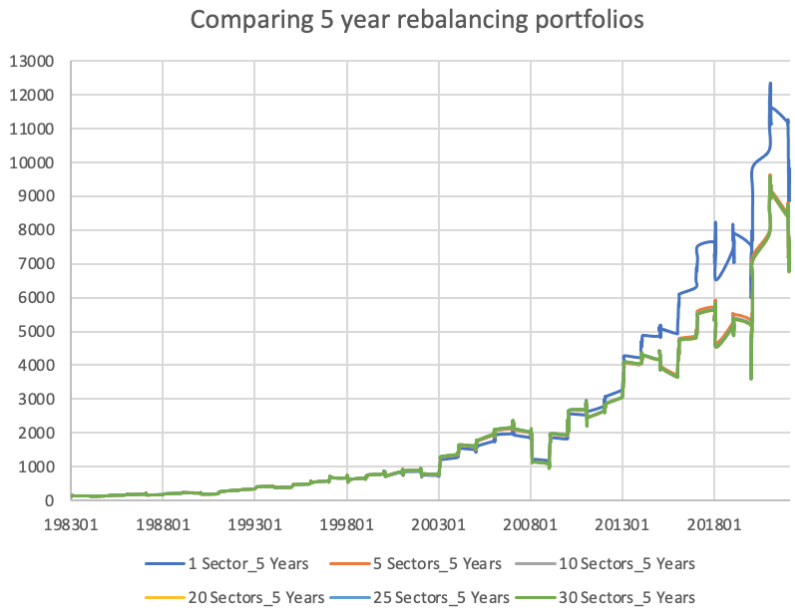
This is because the portfolio only consists of 1 sector, and therefore is unable to be rebalanced. The highest annualized return is for portfolios consisting of 1 sector. As more sectors are included within the portfolio, the annualized return will decrease. Like the buy-and-hold strategy, the investor will give up some of the return for diversification benefits.

Figure 4.3.1 (b) shows the performance of investing $100 into the portfolios consisting of 1, 5, 10, 20, 25, and 30 sectors and rebalancing them every 10 years. As with the 5—year rebalancing, the portfolios are more correlated during the first half of the period, but variability in returns increases after 2008-2013.

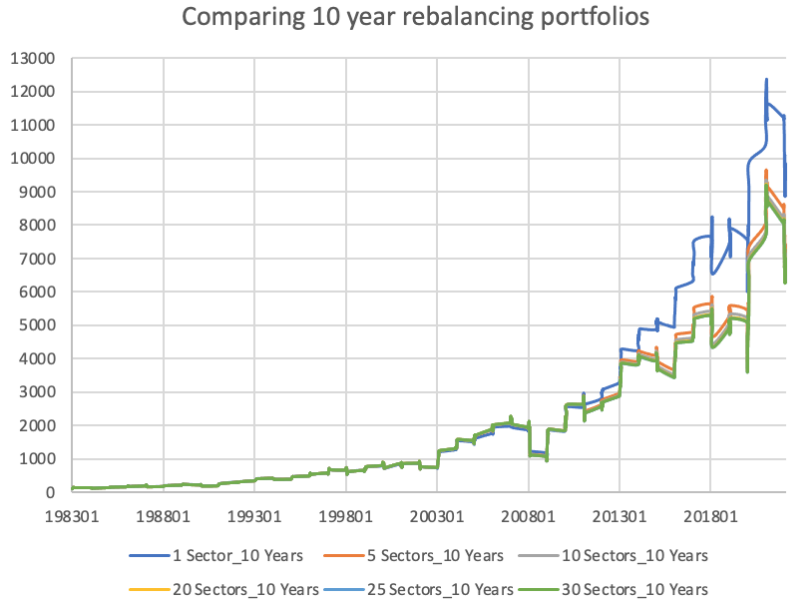
Holding a 1-sector portfolio with 10-year rebalancing results in a dollar return of 9,386.10, which corresponds to an annualized rate of return of 12.05%. For portfolios consisting of 5, 10, 20, 25, and 30 sectors, the dollar returns are respectively 6,875.38, 6,593.74, 6,468.85, 6,464.15, and 6,439.73 The corresponding annual rates of return are 11.20%, 11.08%, 11.03%, 11.03%, and 11,02%, respectively.

The development of the results for the 10-year rebalancing strategy is much as for the 5-year rebalancing strategy. The 1-sector portfolio does not have the opportunity of rebalancing. Therefore, the annualized return is 12.05% which is equal to the 5-year rebalancing strategy and the buy-and-hold strategy. The highest annualized return is the 1-sector portfolio. From the results, the annualized returns decrease when more sectors are added to the portfolio.

The 5-year rebalancing strategy generally performs better than the 10-year rebalancing strategy for all portfolio combinations, except for the 1-sector portfolio where they are equal. The annualized return for the 5-year rebalancing strategy yields a higher return for portfolios consisting of 5, 10, 20, 25, and 30 sectors.



(a) Investing \$100 in 5 year rebalancing portfolios



(b) Investing \$100 in 10 years rebalancing portfolios

Figure 4.3.1: Figure (a) shows the development of investing \$100 in the different portfolio combinations and rebalancing the portfolios every 5 years. Figure (b)shows the development of investing \$100 in the different portfolio combinations and rebalancing the portfolios every 10 years.

4.3.1 Return

The analysis presented in Figure 4.3.2 examines the performance of various portfolios, which are rebalanced every five years. In Figure 4.3.2 (a), the evolution of

the annual average return for these portfolios, each comprising distinct variations, is depicted. It is evident that the lowest average return is observed when each portfolio contains a single sector, while the highest return is achieved when each portfolio encompasses five sectors.

From Figure 4.3.2, when the portfolios consist of a single sector, the average return amounts to 9.82%, which increases to 12.13% when five sectors are included in each portfolio. Upon the inclusion of ten sectors in every portfolio, the return registers at 11.16%. From this point forward, the growth rate diminishes as more sectors are incorporated, culminating in an 11.26% return when all sectors are encompassed. The results are somewhat surprising as we expected the return to follow the same trend as the buy-and-hold strategy.

The 5-sector portfolio yields the highest average return of all portfolio combinations. The possible reason behind this is that the investor is able to invest in a lower amount of companies that are in an upwards trend and perform well over a specific time period that coincides well with the 5-year rebalancing strategy. Due to the strategy, the rebalancing of the portfolio enables the portfolio to be less affected by a downward trend and enables the portfolio to yield a higher average return. The rebalancing also makes the well-performing sectors influence the portfolio with a greater impact, giving the portfolio the possibility to yield a higher average return.

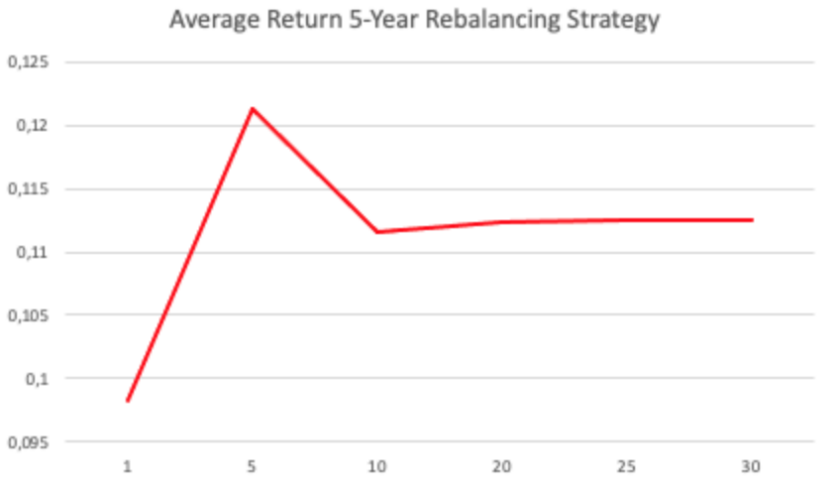
In Figure 4.3.2 (b), the best and worst-performing portfolios are exhibited alongside the average return. Similar to Figure 4.2.2 (b), the best-performing portfolio is the one in which only a single sector is included, yielding a return of 19.42%. The return remains identical to that in Figure 4.2.2 (b), as no rebalancing occurs when the portfolio consists of just one sector. As more sectors are added to the portfolio, the return gradually decreases until it encompasses all available sectors, at which point it is the same as the average return.

The worst-performing portfolio, when comprised of a single sector, yields a negative return of 1.5%, resulting in a decline in the portfolio's value. However, as more sectors are incorporated into the portfolios, the return increases. When each portfolio contains five sectors, the return reaches 7%, which, while still considerably lower than the average return, ensures that the portfolio no longer incurs losses. The trend persists as additional sectors are included in each portfolio. When 30 sectors are incorporated, the return of the worst-performing portfolio converges with the average return.

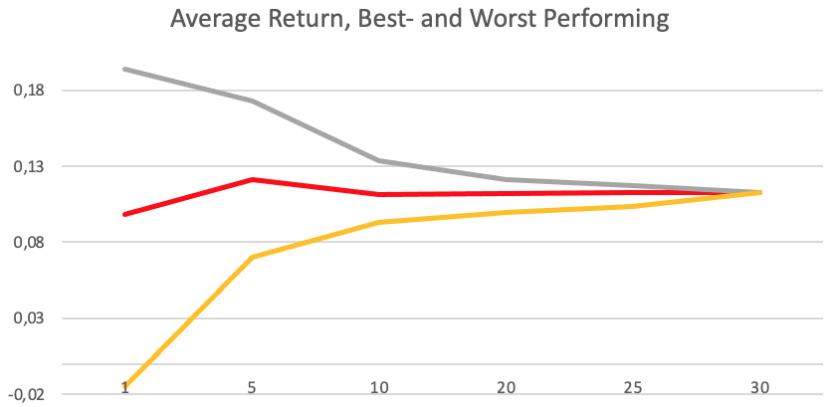
Ultimately, Figure 4.3.2 suggests that the performance of a portfolio is significantly influenced by the number of sectors incorporated within it, with a greater number of sectors generally leading to improved returns. However, in contrast to Figure 4.3.2, an outlier is observed in which the portfolio containing five sectors yields the highest average return. Nonetheless, akin to Figure 4.3.2, both the best-performing and worst-performing portfolios comprise just one sector.

Table 4.3.1: The Table shows the development of the annualized return given the number of sectors included within the portfolio. The best-performing and worst-performing portfolios are also included and given according to the different number of sectors included in the portfolio.

Sectors	**Average Return**	**Best**	**Worst**
5 Year Rebalance			
1	0.0982	0.1942	-0.0150
5	0.1213	0.1727	0.07
10	0.1116	0.1336	0.0928
20	0.1123	0.1215	0.0998
25	0.1125	0.1173	0.1034
30	0.1126	0.1126	0.1126



(a) Average return



(b) Average return, best performing and worst performing

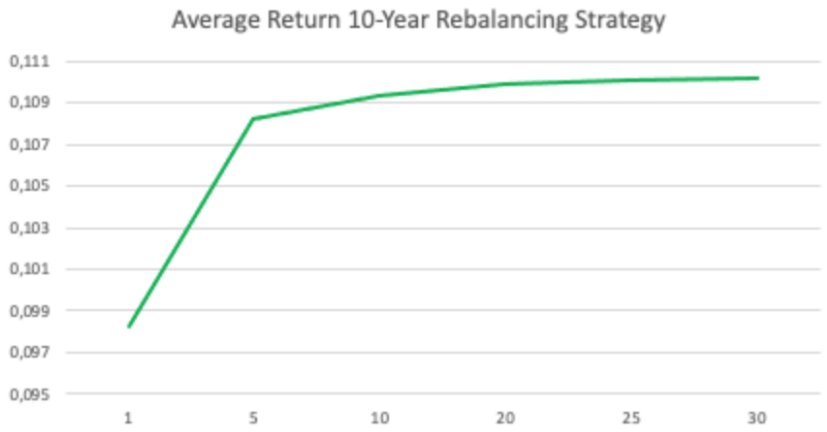
Figure 4.3.2: Figure (a) displays the average return of the portfolios when they are rebalanced every 5 years. The figure illustrates the development when more sectors are added to the portfolio. Figure (b) displays the Average Return compared with the best-performing and worst-performing portfolios. The figure illustrates the development when more sectors are added to the portfolio.

Figure 4.3.3 provides a comprehensive overview of the performance of the 10-year rebalanced portfolios with varying sector combinations. Figure 4.3.3 (a) offers a particularly insightful perspective on the average annual return for the constructed portfolios. As in Figure 4.3.2, the return increases as more sectors are incorporated into the portfolios. The trend is most evident when the sector composition transitions from one to five, with the return initially at 9.82% and subsequently increasing to 10.83%. Beyond the inclusion of five sectors, the growth in return becomes more modest, when all sectors are incorporated, the return reaches 11.02%.

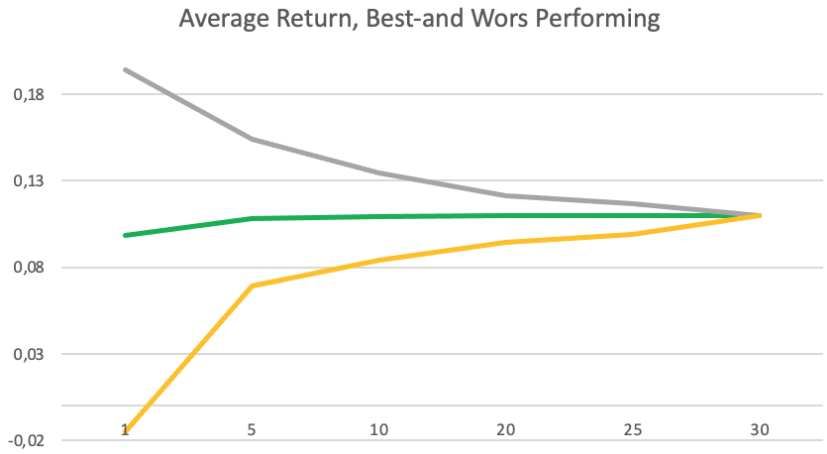
Figure 4.3.3 (b) presents the best-performing and worst-performing portfolios in conjunction with the average return. Consistent with the no rebalance and 5-year rebalance scenarios, the best-performing portfolio consists of only one sector, yielding a 19.42% return. The return of the best-performing portfolio diminishes as more sectors are integrated, culminating in an 11.02% return when all sectors are incorporated into the portfolio.

The trends observed for the worst-performing portfolio when rebalancing every 10 years mirror those identified previously. The return commences at negative 1.5% when only one sector is included and then exceeds as additional sectors are incorporated into the portfolio. The most substantial increase occurs when transitioning from one to five sectors, after which the growth becomes considerably more moderate. When all 30 sectors are included, the return of the worst-performing portfolio aligns with both the average return and the best-performing portfolio at 11.02%.

In summary, upon analyzing the data from Table 4.3.2, it becomes evident that the return trend when rebalancing every 10 years closely resembles the return pattern observed in portfolios without rebalancing. The return experiences a significant increase when transitioning from one to five sectors and subsequently undergoes a modest augmentation as more sectors are incorporated into the portfolio. The best and worst-performing portfolios exhibit similar behavior, both commence at



(a) Average return



(b) Average return, best performing and worst performing

Figure 4.3.3: Figure (a) displays the average return of the portfolios when they are rebalanced every 10 years. The figure illustrates the development of the return when more sectors are added to the portfolio. Figure (b) display the average return, best-performing and worst-performing portfolios and illustrates the development when more sectors are added to the portfolio.

high and low returns, respectively, and gradually converge towards the average annualized return.

Table 4.3.2: The table shows the development of the annualized return given the number of sectors included within the portfolio. The best-performing and worst-performing portfolios are also included and given according to the different number of sectors included in the portfolio.

Sectors	Average Return	Best	Worst
10 Year Rebalance			
1	0.0982	0.1942	-0.0150
5	0.1083	0.1542	0.07
10	0.1093	0.1348	0.0841
20	0.1099	0.1215	0.0941
25	0.1101	0.1167	0.0993
30	0.1102	0.1102	0.1102

4.3.2 Variance

Figure 4.3.4 presents the monthly variance of the return between portfolios in the 20-sector portfolio combination over a 40-year period. The graph shows how the variance is affected by the three different rebalancing strategies. The blue line represents the buy-and-hold strategy, the green shows the 10-year rebalancing strategy, and the red line illustrate the 5-year rebalancing strategy.

For the first 15 years, the variance of both rebalanced strategies stays quite consistent with the buy-and-hold strategy. It was first when the dot-com bubble hit that the variance of the rebalanced strategies deviate from the buy-and-hold strategy. Figure 4.3.4 helps visualize that the rebalanced portfolios have a variance much higher than the non-rebalanced portfolio during the dot-com bubble, where the 10-year rebalancing strategy more than doubles the variance. After the bubble ended in the early 2000's the variance of the three strategies all went down to the level before the dot-com bubble started.

After the dot-com bubble, the variance of the return between the portfolios continue to stay consistent until the Financial Crisis in 2007-2008. During the Financial Crisis, the same pattern is repeated where the rebalancing strategies emit a much higher variance than the buy-and-hold strategy. Again, the variance is reduced after the Financial Crisis is over and continues to stay consistent.

In 2013 the variance of the buy-and-hold strategy has a high surge that the rebalancing strategies do not have. It is notable to see for the first time a significant spike in the variance of one of the strategies, while the others show no signs of an increase. The root of this surge in variance for the buy-and-hold strategy comes from the Oil and Coal sectors. When the portfolios are not rebalanced their weights have become skewed over time as the value of some sectors will increase and some decrease. Oil and Coal have up until this point had a high return, and as such their weights increased over time and when the variance in the two sectors increased the buy-and-hold strategy was heavily affected.

At the end of the 40-year-long investment period, the Covid-19 virus had a big impact on the volatility of the market. From the beginning of 2020, the variance of the return increased for the 3 investment strategies. During this period, the variance for the rebalancing portfolios did not rise as steeply as the variance of the return on the buy-and-hold portfolio.

Figure 4.3.5 displays the relative performance given the variance of the return of the buy-and-hold portfolio as 1. Such an approach offers the chance to monitor the variance of the rebalancing strategies compared to the variance of the buy-and-hold strategy. When the values are above 1, the variance is higher for the rebalancing strategies than for the buy-and-hold. On the other hand, when the value is below 1 the rebalanced strategies have lower variance better than the buy-and-hold strategy. For the majority of the time, the variance of the rebalanced portfolios is higher than the buy-and-hold strategy. After 2013 there was a change and the variance for the rebalancing strategies is shown to be lower than the buy-and-hold strategy.

Given an investment period of 40 years, the variance of rebalancing the portfolios becomes more attractive. The market fluctuations do not affect the rebalanced portfolios with the same impact as they do for the buy-and-hold strategy. Over

time the buy-and-hold strategy is no longer as diverse as it was at the start of the investment period, and therefore subject to the volatility of the market. The rebalanced portfolios have their sectors rebalanced and gain from diversification benefits.

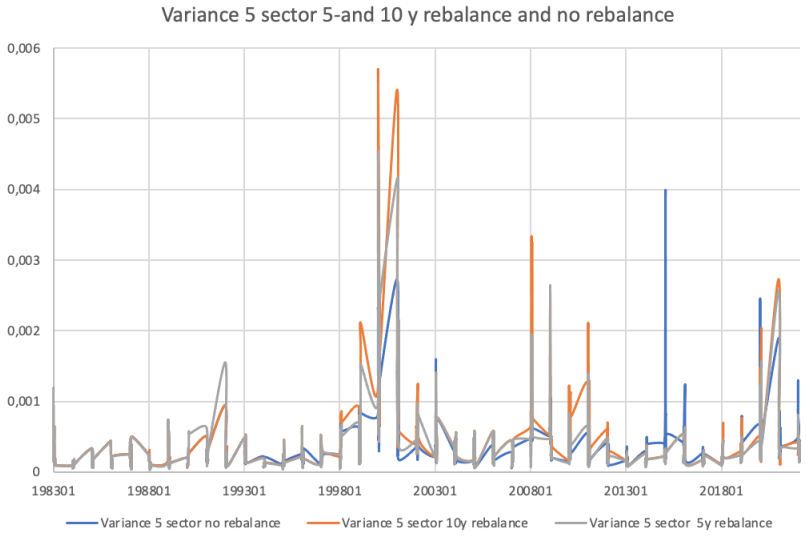


Figure 4.3.4: The Figure shows the average return of the portfolios when they are rebalanced every 10 years. With this graph, you are able to see how the average return reacts when more sectors are included in the portfolios.

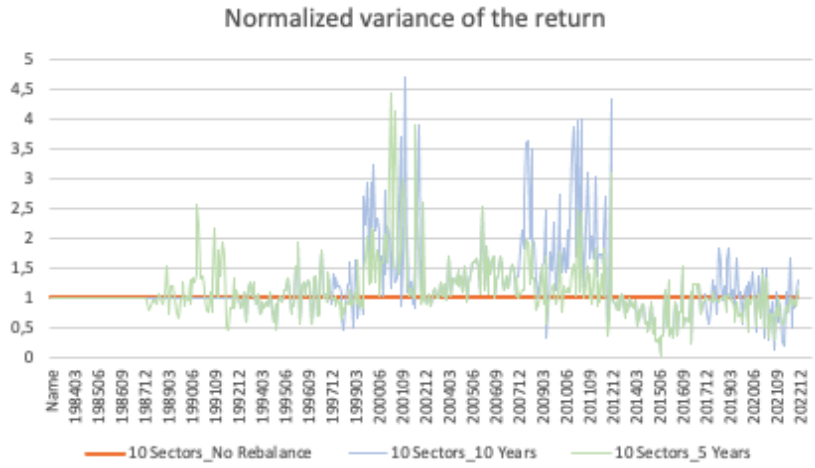


Figure 4.3.5: The Figure shows the variance of the return of the rebalancing strategies compared to the Buy-and-Hold strategy. The variance of all three strategies is divided by the variance of the Buy-and-Hold strategy.

4.3.3 Exclusion Risk

Figure 4.3.6 illustrates that adding more sectors to the portfolio results in a lower exclusion risk. The most significant decrease in exclusion risk occurs when transitioning from one to 5-sector portfolios, after which the reduction in risk levels off. When portfolios comprise only one sector, the exclusion risk stands at 11.72, whereas with 5-sector portfolios, the risk drops to 2.21. The reduction continues, and when the portfolio contains 25 sectors, the exclusion risk dwindles to 0.55 before vanishing entirely with 30 sectors.

Figure 4.2.7 illustrate portfolios rebalanced every 10 years, the exclusion risk remains the same at 11.72 when only one sector is included, but it is reduced to 1.98 when each portfolio contains five sectors. From this point onward, the exclusion risk continues to diminish, similar to the cases of 5-year rebalancing and the buy-and-hold strategy. When every portfolio contains 25 sectors, the exclusion risk decreases to 0.086, and as with both the 5-year rebalanced portfolios and the non-rebalanced portfolios, the exclusion risk is non-existent when every sector is included in the portfolios.

Tables 4.3.3 and 4.3.4, display the evolution of exclusion risk for 5-year and 10-year rebalancing strategies given the different number of sectors within the portfolio combination. From the tables holding the portfolio of 5 sectors, have the lowest exclusion risk when rebalancing every 10 years. The other portfolio combinations have a lower exclusion risk when being rebalanced every 5 years. This tells, that when holding portfolios containing 10 or more sectors, rebalancing the portfolio at a more frequent rate is preferred.

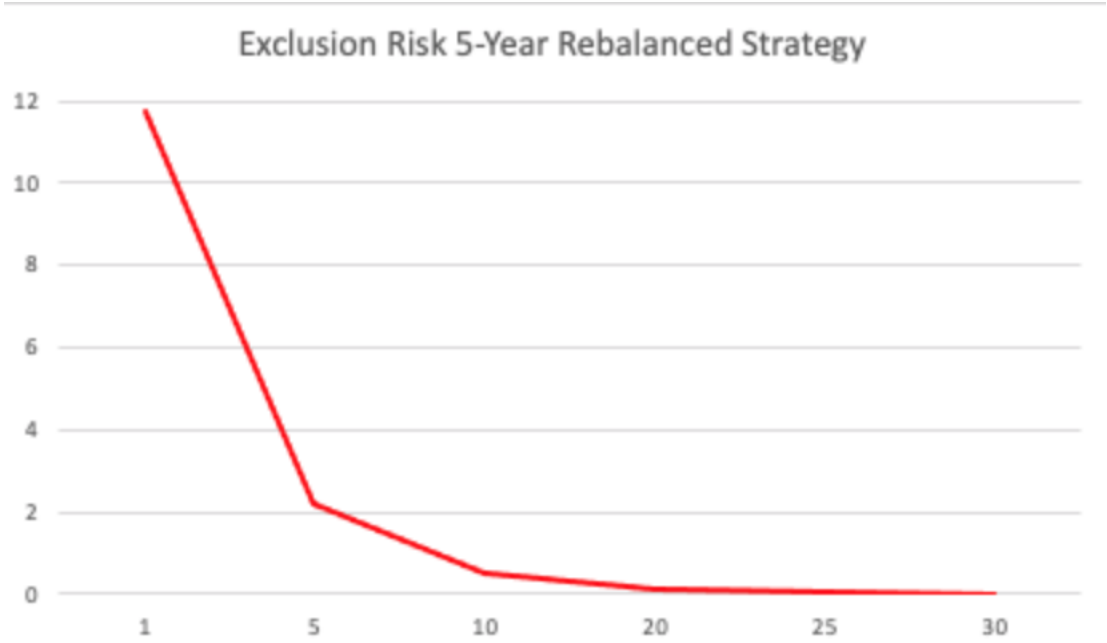


Figure 4.3.6: The figure shows the development of the exclusion risk when the portfolios are rebalanced every 5 years

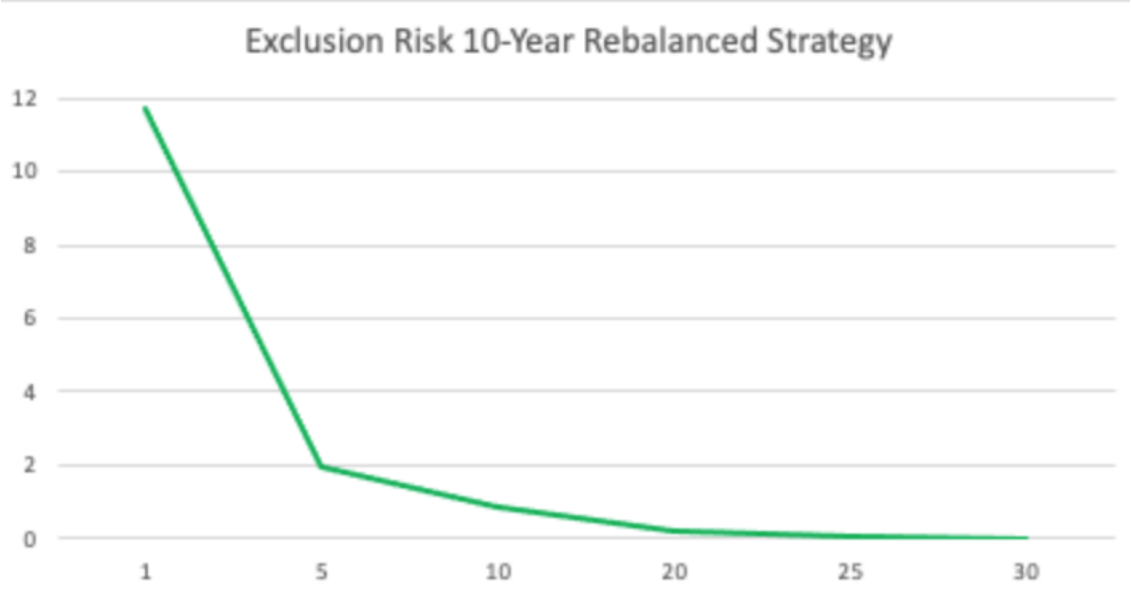


Figure 4.3.7: The Figure shows the development of the exclusion risk when the portfolios are rebalanced every 10 years

Table 4.3.3: The table depicts the development of the Exclusion Risk for portfolios with the 5-year rebalancing strategy. Here, the values of the exclusion risk are given for the different number of sectors within the portfolio.

Number of Sectors	**Exclusion risk**
5-year rebalancing	
1	11.7159
5	2.2090
10	0.5454
20	0.1395
25	0.0543
30	0

Table 4.3.4: The Ttble depicts the development of the Exclusion Risk for portfolios with the 10-year rebalancing strategy. Here, the values of the exclusion risk are given for the different number of sectors within the portfolio

Number of Sectors	**Exclusion risk**
10-year rebalancing	
1	11.7159
5	1.9817
10	0.8449
20	0.2195
25	0.0859
30	0

Chapter 5

Conclusion

We observe through our analysis that the exclusion risk is dependent on the number of sectors in a portfolio. Incorporating a greater number of sectors into a portfolio mitigates the exclusion risk. Consequently, minimizing the likelihood of missing out on potential opportunities is seen when a high number of sectors are included in the portfolio. The most substantial decline in exclusion risk happens when transitioning from a single-sector portfolio to one comprising five sectors. It indicates that when a portfolio displays high exclusion risk, diversification could be improved by incorporating more sectors.

From our results, the 10-year rebalance strategy is not as preferable as the two other investment strategies. When rebalancing the portfolios every 10 years the exclusion risk will always be outperformed by either rebalancing every 5 years or by not rebalancing at all. Based purely on exclusion risk the 10-year rebalancing strategy is never preferable for a long-term investor.

For the buy-and-hold and 5-year rebalancing strategy, the performance of the exclusion risk varies. When the portfolios consist of 5 and 25 sectors, the buy-and-hold strategy outperforms the 5-year rebalancing strategy. For the 10- and 20-sector portfolios, rebalancing every 5 years will reduce the long-term investor's exclusion risk. Therefore, we can not say that rebalancing the portfolio consistently reduces the exclusion risk.

In our analysis, the long-term investor will be able to increase the average annualized return of the portfolio by rebalancing. A more frequent rebalancing is also shown to improve the return of the portfolio. Therefore, rebalancing the portfolio

every 5 years will earn the investor the highest return on the investment. By not rebalancing the portfolios, the weights become skewed over time and thus less diversified compared to the rebalancing strategies.

In conclusion, the 10-year rebalancing strategy is not preferred as the exclusion risk and return are outperformed. We see that the 5-year and the buy-and-hold strategy gives us two different outcomes. The buy-and-hold portfolios give an investor a lower exclusion risk, but also a lower return and a less diversified portfolio. While the 5-year rebalancing portfolio has a higher exclusion risk, it will provide an investor with a higher average annualized return and a more diverse portfolio.

Chapter 6

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Chapter 7

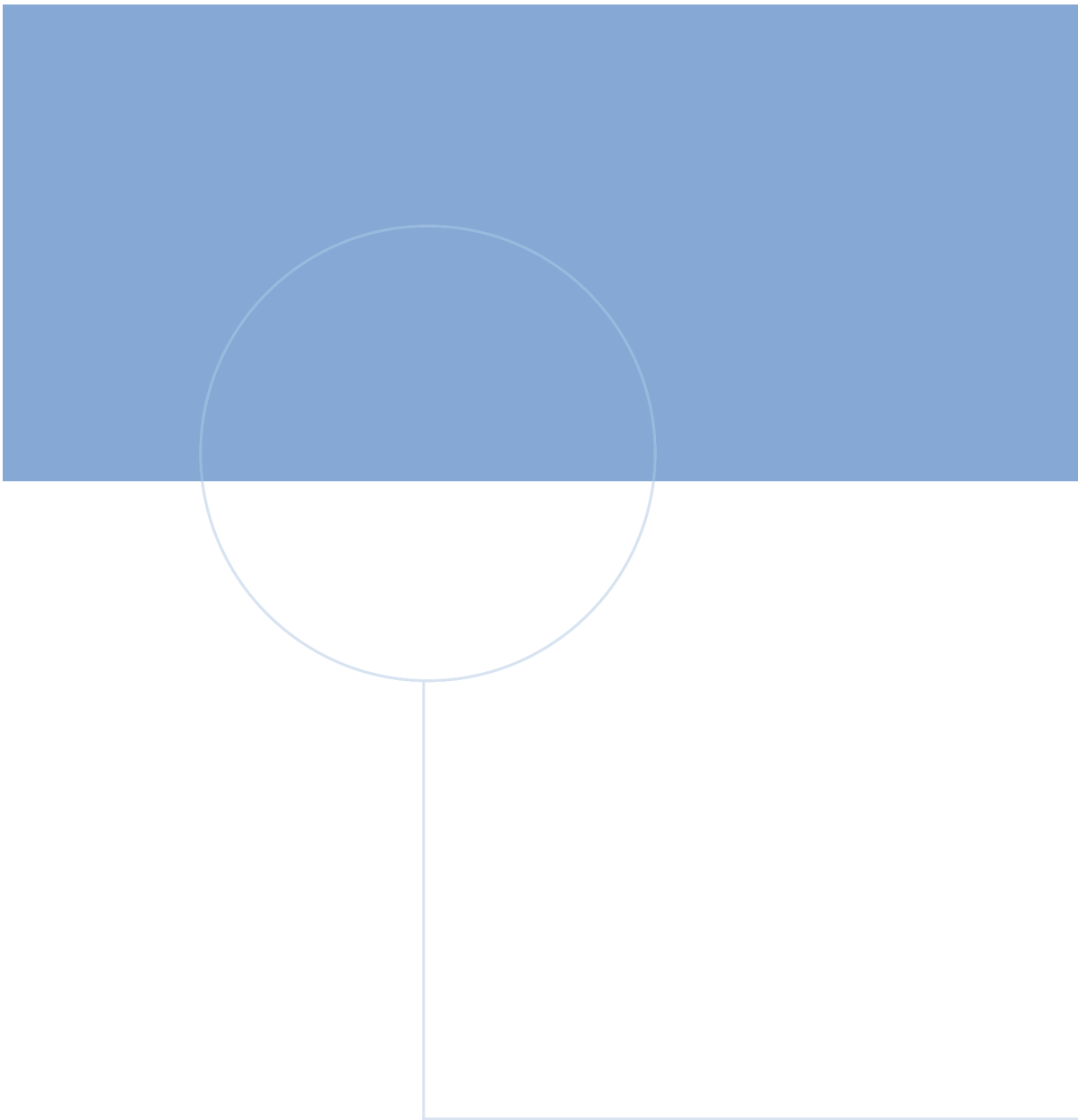
Appendix

Table 7.0.1: The Table shows the full name of every sector used in the thesis.

Sectors	**Full Name**
Food	Food Products
Beer	Beer & Liquor
Smoke	Tobacco Products
Games	Recreation
Books	Printing and Publishing
Hshld	Consumer Goods
Clths	Apparel
Hlth	Healthcare, Medical Equipment, Pharmaceutical Products
Chems	Chemicals
Txtls	Textiles
Cnstr	Construction and Construction Materials
Steel	Steel Works Etc
Fabpr	Fabricated Products and Machinery
ElcEq	Electrical Equipment
Autos	Automobiles and Trucks
Carry	Aircraft, Ships, and Railroad Equipment
Mines	Precious metals, Non-Metallic, and Industrial Mining
Coal	Coal
Oil	Petroleum and Natural Gas
Util	Utilities
Telcm	Communication
Servs	Personal and Business Services
BusEq	Business Equipment & appliances instruments
Paper	Business Supplies and Shipping Containers
Trans	Transportation
Whlsl	Wholesale
Rtail	Retail
Meals	Restaurants, Hotels, Motels
Fin	Banking, Insurance, Real Estate, Trading
Other	Everything Else

Table 7.0.2: The table shows the average amount of companies in a sector during our investment period. In addition, it also shows the median number, the lowest amount of companies, and the maximum amount of companies.

Full Name of Sectors	**Average**	**Mean**	**Max**	**Min**
Food Products	93.76	89	140	53
Beer & Liquor	13.31	12	25	8
Tobacco Products	5.05	5	9	3
Recreation	93.66	89	140	53
Printing and Publishing	13.31	12	25	8
Consumer Goods	5.03	5	9	3
Apparel	93.56	88	140	53
Healthcare, Medical Equipment, Pharmaceutical Products	13.30	12	25	8
Chemicals	5.01	5	9	3
Textiles	93.45	87	140	53
Construction and Construction Materials	13.28	12	25	8
Steel Works Etc	4.99	5	9	3
Fabricated Products and Machinery	93.34	87	140	53
Electrical Equipment	13.27	12	25	8
Automobiles and Trucks	4.97	5	9	3
Aircraft, Ships, and Railroad Equipment	93.26	86	140	53
Precious metals, Non-Metallic, and Industrial Mining	13.25	12	25	8
Coal	4.95	5	9	3
Petroleum and Natural Gas	93.20	86	140	53
Utilities	13.23	12	25	8
Communication	4.93	5	9	3
Personal and Business Services	93.08	86	140	53
Business Equipment & appliances instruments	13.20	12	25	8
Business Supplies and Shipping Containers	4.92	5	9	3
Transportation	92.97	85	140	53
Wholesale	13.16	12	25	8
Retail	4.90	5	9	3
Restaurants, Hotels, Motels	92.90	84	140	53
Banking, Insurance, Real Estate, Trading	13.13	12	25	8
Everything Else	4.89	5	9	3



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