Universitetet
i Stavanger

Faculty of Science and Technology

MASTER'S THESIS

Study program/Specialization:	Spring semester, 2023
Industrial Economics	Open / Confidential

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Thesis title:

Should the Norwegian Government Pension Fund Global include more types of infrastructure than renewable energy in its 2% capital allocation for infrastructure abroad?

Credits (ECTS): 30

Keywords:	Pages: 48
Portfolio theory	+ appendix: 20
Infrastructure	
Investment	Stavanger, 15. June 2023

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Should the Norwegian Government Pension Fund Global include more types of infrastructure than renewable energy in its 2% capital allocation for infrastructure abroad?

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June, 2023

Acknowledgements

We want to thank our supervisor, Atle Øglend, for guidance and expertise throughout the process of this thesis.

Abstract

This thesis examines whether the Norwegian Government Pension Fund Global could benefit from including more types of infrastructure than renewable energy in its 2% capital allocation for infrastructure abroad. This led to the research question: "Should the Norwegian Government Pension Fund Global include more types of infrastructure than renewable energy in its 2% capital allocation for infrastructure abroad?".

In particular, the thesis will examine energy, telecom, and transportation infrastructure in addition to renewable energy. As of 2023, the Ministry of Finance has mandated a maximum capital allocation limit of 2% towards infrastructure investments. Despite the mandated limit, only 0,1% of the fund is currently invested in infrastructure.

To address the research question, financial data from 115 companies across six countries (United States, France, Spain, South Korea, India, and China) and four sectors (energy, renewable, telecom, and transport) were analyzed for the period of 2017-2021. The financial data of each company was used to calculate the expected return, standard deviation, and Sharpe ratio. Return on equity served as the financial ratio for determining the expected return. A covariance matrix was created to assess the correlation between companies and the overall risk exposure of equally weighted portfolios in each sector, as well as a portfolio including all sectors and companies.

The results indicate that Norwegian Government Pension Fund Global should continue focusing on renewable investments, as it was the only sector with a Sharpe ratio above one, suggesting that the return generated is higher than the risk taken. A comparison between net profit margin and return on equity using the coefficient of variation was also done to see if changing the financial ratio could change the outcome. However, the comparison indicated that the renewable sector was one of the most stable and profitable sectors, supporting the initial conclusion.

Contents

Acronyms

CV **C**oefficient **o**f **V**ariation. 14, 44, 47, 51

GPFG **N**orwegian **G**overnment **P**ension **F**und **G**lobal. 1, 2, 4, 5, 6, 7, 8, 9, 18, 20, 24, 25, 48, 49

MPT **M**odern **P**ortfolio **T**heory. 10, 43

NBIM **N**orges **B**ank **I**nvestment **M**anagement. 6, 7, 8, 9, 43

NPM **N**et **P**rofit **M**argin. 14, 44, 47, 48, 51

OECD **O**rganization **f**or **E**conomic **C**ooperation **a**nd **D**evelopment. 20

ROE **R**eturn **o**n **E**quity. 3, 14, 23, 26, 27, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 44, 46, 47, 48, 50, 51, 59, 60, 61

USD **U**nited **S**tates **D**ollar. 1, 4, 6, 20, 21, 22, 23, 24, 25, 46

Chapter 1

Introduction

The first time oil was found on the Norwegian continental shelf was in 1969 in an oilfield later called Ekofisk. The Norwegian government has since the 70s earned a significant amount of money on oil production in the Northern Sea. To manage the oil revenue, they made an investment group in 1998 called "Oljefondet" (the Oil Fund). The main purpose of Oljefondet was to invest the income from oil in other countries than Norway, to secure the welfare of future generations in Norway [1]. Today, Oljefondet is known as Norwegian Government Pension Fund Global (GPFG) and has a value of more than 1.4 trillion USD invested in 9228 companies in 70 different countries in stocks, bonds, real estate, and renewable infrastructure [2].

1.1 Research Question

In 2020, the GPFG began investing in unlisted infrastructure for renewable energy. This was to diversify GPFG's portfolio by including a new asset to the portfolio with a low correlation to the stock market. As of 2023, GPFG is restricted by the Ministry of Finance to only invest in the renewable sector [3]. To determine if additional sectors would improve GPFG's infrastructure portfolio, the following research question was established: "Should the Norwegian Government Pension Fund Global include more types of infrastructure than renewable energy in its 2% capital allocation for infrastructure abroad?".

1.2 Scope

To answer the research question "Should the Norwegian Government Pension Fund Global include more types of infrastructure than renewable energy in its 2% capital allocation for infrastructure abroad?", a portfolio of 115 unlisted infrastructure companies abroad was made. The goal of the portfolio was to determine if including more types of infrastructure than renewable energy could improve the current infrastructure portfolio.

1.2.1 The Selected Sectors and Countries

To get a better understanding of unlisted infrastructure investments abroad, three countries were chosen to represent the western part of the world and three countries to represent the eastern part. Each of these countries was selected based on economic growth and the political stability of the country. To determine if the risk-return ratio would improve by adding more sectors to GPFG's current infrastructure portfolio, a selection of five companies representing each sector from each of the six countries was made. The new sectors added to the portfolio was the energy, telecom, and transport sector for the countries China, India, South Korea, France, Spain, and the United States.

1.2.2 Data Collected

The data collection of the 115 unlisted infrastructure companies is mostly gathered from Refinitiv Workspace. Every company has five observations, in total, this gives 575 observations. When the financial data of the companies were not available on Refinitiv, the companies' own website was used to find the data.

1.2.3 Financial Metrics used

The financial metrics mainly used are return on equity (ROE) and Sharpe Ratio. These financial metrics were used as they give an indication of the financial performance of the company and the expected return on investment in each of the companies.

1.2.4 Assumptions

For a company to be able to be included in the analysis it had to exceed 20 million USD dollars in yearly revenue from a single infrastructure revenue stream. This assumption was made to exclude small companies, as the ROE and standard deviation varies significantly from year to year in small companies compared to larger companies. For that reason, including small companies could give big variations in the data for a specific sector or country.

A single infrastructure revenue stream was another assumption made in this thesis. This means that the company uses a single revenue stream business model where the revenue source is the infrastructure they own and operate. The yearly revenue for each firm had to be solely from an infrastructure asset within a specific sector in a specific country. Including firms that get their revenue from infrastructure in multiple sectors or countries, could lead to a wrong illustration of the performance of a sector or country.

The financial metrics ROE and Sharpe ratio of the portfolio were calculated based on the assumption that the portfolio of the 115 companies was equally weighted. This assumption was made to get a better overview of the performance of each of the sectors and countries.

The risk-free rate is the average ten-year government bond for each country from January 2013 to January 2023. When calculating the portfolio with all sectors and all countries the average risk-free rate of the six countries combined has been used. Since infrastructure investments are long-term investments, the average risk-free rate for the 10-year period 2013 to 2023 has been used instead of the investment period 2017-2021 from the analysis part of the thesis. See charts of the ten-year government bond of every country in subsection 4.3.6.

1.2.5 Limitations used

The limitations used in the analysis are based on the companies' total revenue. The revenue source has to be mainly from a single infrastructure asset and exceed more than 20 million USD yearly. The companies can only operate in one respective country. Publicly available balance sheets are one of the selection criteria to be a part of this thesis, as it is needed to calculate the financial metrics. The companies selected in the analysis had to be private and unlisted, this is due to the strategy of GPFG. See subsection 2.1.3 for more information about GPFG.

This thesis excludes the comparison of infrastructure and other investment areas of GPFG, such as performances of the stock-, bond-, and real estate portfolio of GPFG.

The continents Africa, South America, and Oceania are not a part of the analysis, as a result of GPFG's strategy to mainly invest in infrastructure in Europe, North America, and Asia. See subsection 2.1.2 for more information.

Social infrastructure such as the health and education sector is excluded from the thesis, as the analysis will focus entirely on companies that own economic infrastructure.

Greenfield infrastructure has been excluded from the analysis since they are not yet operative as they have to go through a construction phase before generating cash flow. One of the selection criteria in this thesis is to have more than 20 million USD in revenue. As greenfield infrastructure companies do not have revenues, they have been excluded.

1.3 Structure of Thesis

The remaining part of the thesis is outlined as follows:

Chapter 2 introduces the reader to the GPFG.

Chapter 3 lets the reader get a better knowledge of portfolio theory, infrastructure investments, and other concepts before it is later introduced in the project.

Chapter 4 explains the limitations used to select firms to represent the data included in the analysis

Chapter 5 presents the results of the analysis.

Chapter 6 discusses the results from the analysis in Chapter 4.

Chapter 7 concludes the thesis.

Appendix A supplies the calculations.

Appendix B shows the companies used in the analysis.

Chapter 2

Background

2.1 Norwegian Government Pension Fund Global

The GPFG, also known as the Oil Fund, is a sovereign wealth fund established by the Norwegian government to manage the country's surplus oil revenue. The Fund was established in 1990 to save the country's petroleum wealth for future generations and support the long-term financial needs of Norway. It consists of a globally diversified portfolio of stocks, bonds, real estate, and infrastructure [4].

The strategy of the fund is to maximize the return on the national savings with a moderate level of risk while taking into account environmental, social, and ethical considerations, commonly referred to as ESG [4]. The fund is managed by Norges Bank Investment Management (NBIM) and is widely recognized as one of the largest and best-managed sovereign wealth funds in the world [5]. As of 2023, it has a capital of more than 14 trillion Norwegian Kroner (roughly 1.3 trillion USD) and is thus the second largest investment fund in the world besides China [6]. The market value of the GPFG from 1999 to 2023 is depicted in Figure 2.1.

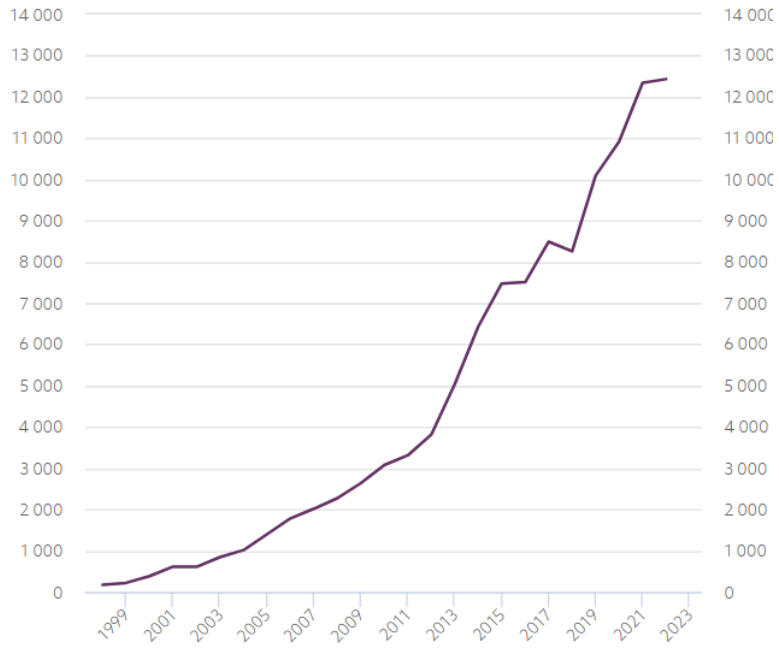

Figure 2.1: The market value of the GPFG measured in Norwegian Kroner in billions [7].

2.1.1 Risk Management

The management of risk deviations, of a portfolio from benchmark indices, is a crucial aspect of asset management. To ensure that such deviations remain within acceptable levels, the Ministry of Finance has decided that the expected relative volatility of the fund should not exceed 1,25 percentage points. This means that NBIM is obligated to manage the fund in a way that ensures that the expected difference in return between the fund and the benchmark index does not exceed 1,25 percentage points for more than one out of three years. This limit ensures that the fund's portfolio stays within acceptable risk parameters while also seeking to maximize the return [8].

2.1.2 The Portfolio

The Ministry of Finance with recommendations from NBIM has decided that GPFG may allocate a maximum of 70% of its capital to shares, 30% to bonds, 7% to real estate, and 2% to unlisted infrastructure for renewable energy [2]. As of February 2023, the portfolio is composed of 69,8% in stocks, 27,5% in bonds, 2,7% in real estate, and 0,1% in unlisted infrastructure for renewable energy [9]. See Figure 2.2 for the composition of the portfolio.

The small amount of capital allocated to unlisted infrastructure corresponds to the acquisition of the second largest offshore wind farm in the world, Borssele 1 and 2, located outside of the Netherlands. It was acquired in 2021 and is GPFG's first-ever investment in unlisted infrastructure for renewable energy. The fund currently owns 50% of the wind farm, with the remainder owned and operated by Ørsted AS. This illustrates that NBIM practices their strategy to only invest in unlisted infrastructure in Europe, Asia, and North America and which is owned and operated by a company they are familiar with [10]. Due to the scarcity of unlisted renewable infrastructure investment opportunities, it may take several years for the GPFG to find investments to increase their infrastructure portfolio towards the target allocation of 2% of the fund.

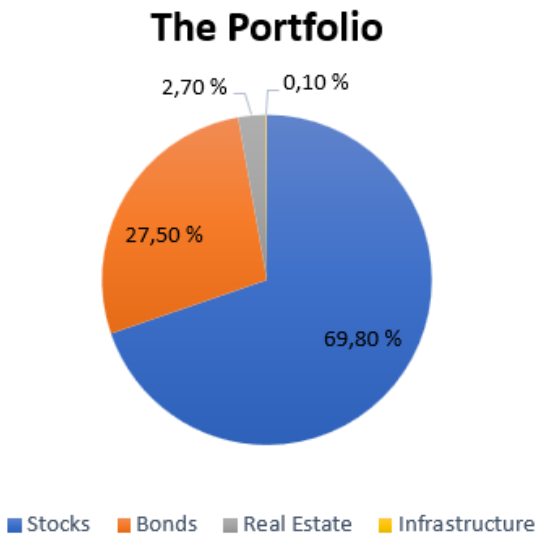

Figure 2.2: The composition of GPFG portfolio as of February 2023 [9].

2.1.3 Infrastructure and the GPFG

In 2020 the Ministry of Finance decided that unlisted infrastructure should be included as a part of the portfolio of the GPFG. The decision was made following extensive analysis by NBIM started in 2015, which concluded that investments in unlisted infrastructure would, in the long term, provide stable inflation-adjusted earnings and improve the risk diversification of the fund [3].

The Executive Board of NBIM has established risk frameworks for investments made by the GPFG in infrastructure. The fund is therefore restricted to investing only in certain geographical locations and in projects under development that have a specific debt ratio. Within these constraints, the GPFG can currently only invest in unlisted infrastructure in developed markets such as Europe, Asia, and North America and in projects that are either in operation or under construction [10]. Since NBIM is new to this type of investment, they have decided that the initial investments will only be made in firms they are familiar with or through partnerships with known investors, financial institutions, and development banks [3].

Chapter 3

Theory

3.1 Modern Portfolio Theory

The modern portfolio theory (MPT) is a framework developed by Harry Markowitz in the 1950s. It is based on the idea that investors can increase the expected return of their investment portfolio without increasing the volatility, by diversifying their portfolio. Diversification can be achieved by including a wide range of assets with low correlation to each other and with different risks and returns. This can reduce the impact of any individual asset's volatility on the overall portfolio return [11].

3.1.1 Risk-Free Rate

The risk-free rate is the rate of return on an investment with no risk of financial loss. The rate is often used as the yield of a Treasury bond because of its low risk. It is considered the minimum return an investor expects from an investment as it is regarded as unprofitable to take investment risk without achieving a higher return [12].

3.1.2 Expected Return

The expected return of a portfolio is the weighted average of the expected returns and weights of the assets in a portfolio. It is used to calculate the return that can be expected from investing in the portfolio [13]. For a portfolio of n assets with their respective weights and expected returns, the expected return of the portfolio is given by [14]:

$$E[r_p] = P^T E(R) \tag{3.1}$$

Where:

$E[r_p]$ = Expected return of portfolio

P^T = Transpose of portfolio weights

$E(R)$ = Expected return of each asset

3.1.3 Covariance Matrix

A covariance matrix is used to determine which assets to include in the portfolio in order to reduce the overall risk. The matrix shows the covariance between each asset and to which degree their returns are correlated. The formula for the covariance between two assets, X and Y, is given by [15]:

$$\text{Covariance}(X, Y) = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{n - 1} \tag{3.2}$$

Where:

X_i = Return of asset X_i

$\bar{X}$ = Mean return of asset X

Y_i = Return of asset Y_i

$\bar{Y}$ = Mean return of asset Y

n = Sample size

The covariances are then used in the matrix [16] :

$$V = \begin{pmatrix} \sigma_1^2 & \sigma_{1,2} & \cdots & \sigma_{1,n} \\ \sigma_{2,1} & \sigma_2^2 & \cdots & \sigma_{2,n} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{n,1} & \sigma_{n,2} & \cdots & \sigma_n^2 \end{pmatrix}$$

Where:

V = Covariance matrix

σ_1^2 = Variance of asset 1

$\sigma_{1,2}$ = Covariance between asset 1 and 2

3.1.4 Portfolio Variance

Portfolio variance measures the portfolio's overall risk by taking into account each individual variance of the assets in the portfolio and the correlation between the assets, as represented by their covariance [17]. The portfolio variance is found by multiplying the transposed portfolio weights with the covariance matrix of the returns, and with the portfolio weights [18]:

$$\sigma_p^2 = P^T V P \tag{3.3}$$

Where:

σ_p^2 = Portfolio variance

P^T = Transposed of portfolio weights

V = Covariance matrix

P = Portfolio weights

3.1.5 Portfolio Standard Deviation

Portfolio standard deviation measures the volatility of the portfolio [19]. The volatility indicates how much the return of a portfolio can differ from the mean. The portfolio standard deviation is calculated by taking the square root of the variance, which is given by transposed portfolio weights multiplied by the covariance matrix and the portfolio weights [20]:

$$\sigma_p = \sqrt{P^T V P} \tag{3.4}$$

Where:

σ_p = Portfolio volatility

P^T = Transposed portfolio weights

V = Covariance matrix

P = Portfolio weights

3.1.6 Sharpe Ratio

According to Investopedia [21], if the Sharpe ratio is equal to one, the investment is considered acceptable as it provides a reasonable return in relation to the level of risk taken. A ratio of two is considered very good, as the expected return on the investment is significantly higher than the expected risk. While if the ratio is less than one, indicates that the investment should not be done as the expected return does not justify the risk. The Sharpe ratio is used to estimate the return of a portfolio correlated to its risk. Sharpe ratio is calculated by using the return of the portfolio, subtracted by the risk-free rate, then divided by the portfolio's standard deviation [21]:

$$Sharpe\ Ratio = \frac{R_p - R_f}{\sigma_p} \tag{3.5}$$

Where:

R_p = Expected return of portfolio

R_f = Risk-free rate

σ_p = Standard deviation of the portfolio return

3.1.7 Return on Equity

ROE is a ratio that measures a company's net income related to its shareholders' equity. The ratio is used to get an overview of the return investors have made on the invested capital and is thus used in the analysis to calculate the expected return of a portfolio. ROE is calculated by dividing net income by shareholders' equity [22]:

$$\text{ROE} = \frac{\text{Net Income}}{\text{Shareholders' Equity}} \tag{3.6}$$

3.1.8 Net Profit Margin

Net profit margin (NPM) is a ratio that measures a company's profit related to its total revenue. NPM is used to find the most profitable sectors and companies. It is found by dividing net income by total revenue [23]:

$$\text{NPM} = \frac{\text{Net Income}}{\text{Total Revenue}} \tag{3.7}$$

3.1.9 Coefficient of Variation

According to Investopedia [24], if the CV value is equal to one or lower, the investment is considered acceptable. The coefficient of variation (CV) is used to measure how much the mean value varies compared to other data sets. It is used in finance to compare investments based on their degree of volatility to the return. A low CV value indicates that the return is less volatile since it does not vary significantly from the average return. As a result, investors tend to choose the investment with the lowest CV value as it provides the best risk-return trade-off. The CV is found by dividing the standard deviation of the sample by the mean value [24]:

$$\text{CV} = \frac{\sigma}{\mu} \tag{3.8}$$

Where:

CV = Coefficient of variation

σ = Standard deviation

μ = Mean

3.1.10 Excel Solver

Solver is a tool in Excel that allows the user to find the optimal value for a specific cell, known as the objective cell, by changing the values in other cells, known as variable cells, based on certain constraints. The tool is useful for optimization problems such as finding the best combination of variables to maximize or minimize the value of the objective cell. In the analysis part of the thesis, the tool has been used to find the optimal portfolio which provides the highest Sharpe ratio [25].

3.2 How is Infrastructure Defined?

The term infrastructure is often used as a synonym for physical structures such as roads, airports, hospitals, and bridges. Currently, there is no universally accepted definition of infrastructure. However, in 1994 American economist and former member of the Federal Reserve Board of Governors Edward M. Gramlich made a well-known attempt to define infrastructure [26]. His definition is as follows: "The definition that makes the most sense from an economics standpoint consists of large capital intensive natural monopolies such as highways, other transport facilities, water and sewer lines, and communications" [27], p. 1177.

3.2.1 Types of Infrastructure

There are two types of infrastructure assets, economic and social. The definition by Gramlich describes economic infrastructure. This type of infrastructure relies heavily on demand because the owner(s) of the structure receives revenue based on the actual usage of the infrastructure service. As this type of infrastructure is often seen as monopolistic, private owners are often regulated by the government to prevent the owners from charging unreasonably high fees for using the service [28].

A social infrastructure, on the other hand, refers to a physical structure that is constructed and designed by the private sector with the primary purpose of serving the education and health sector. Upon completion of construction, the government often rewards the private sector for making the social infrastructure accessible to the public. The public authority will then decide whether to pay the private operator a fee for managing the structure or to purchase it and continue to provide the service to the public [28]. Table 3.1 illustrates the types of infrastructure included in the two categories economic and social.

Classification of infrastructure			
Economic Infrastructure			**Social Infrastructure**
Transport	*Utilities*	*Other*	*General*
Bridges	Water and waste water treatment systems	Communication infrastructure	Education facilities
Rail roads	Gas distribution	Cable networks	Healthcare facilities
Toll roads	Electricity transmission and distribution	Storage facilities	Public transformation
Airports	Waste	Parking	Prisons
Sea ports	Power generation (renewable and nonrenewable)	Sport facilities	

Table 3.1: The two types of infrastructure (economic & social) [28].

One of the main differences between these two types of infrastructure lies in their revenue generation. The economic infrastructure earnings are based on service usage, while the social infrastructure's revenue remains constant regardless of usage [28].

As economic infrastructure typically involves higher risk than social infrastructure investments, the returns are also expected to be higher. The economic infrastructure directly impacts the production of goods and services, as it serves as a support system for economic growth. Investing in bridges, roads, and other critical infrastructures, can help local businesses to operate more efficiently, create more jobs, and be more productive [29].

The analysis will focus exclusively on investments in infrastructure included in the economic category. The sectors energy, renewable, telecom, and transport are part of the economic infrastructure category.

3.3 What are Infrastructure Investments?

After the 2008 financial crisis, investors started to look for new sources of return that could improve the diversification of their portfolios. They wanted a new type of asset that had a low correlation to the stock market in order to decrease the volatility of the portfolio. This would help reduce losses in the event of a future financial crisis [30].

An asset that caught the interest of investors was infrastructure as it offers stable, inflation-adjusted cash flows with low risk and long maturities while having no correlation to the stock market. Because of these benefits, pension funds have started to include infrastructure investments in their portfolios [30].

Two countries that have actively invested in infrastructure for many years are Australia and Canada. They are considered pioneers in infrastructure investment. Australia began investing in the 1990s while Canada began in the early 2000s. As the government pension fund of Australia was the first pension fund to invest in infrastructure it is often given credit for inventing infrastructure as an asset class. The first infrastructure investments by the Australian pension fund were in listed infrastructure funds and companies in the energy, transport, and communication sector in Australia [31].

However, in recent years, the Australian pension fund has shifted towards unlisted companies and funds in Australia and abroad. The Canadian pension fund has primarily invested in unlisted funds, companies, and direct infrastructure projects in Europe and the UK, as most infrastructure assets in Canada are owned by the government [31].

In 2020, the GPFG started to include infrastructure in the portfolio. Similar to the Canadian pension fund, GPFG prioritizes investments in unlisted funds and companies, and direct investments in infrastructure projects [3].

As infrastructure investments require specific expertise that the fund has not yet acquired, they have announced that they will collaborate with established firms, investors, financial institutions, and development banks for the first investments. This collaborative approach will allow the fund to share management responsibilities and acquire valuable expertise before making independent infrastructure investments in the future [3].

3.3.1 How to Invest in Infrastructure

There are mainly two types of infrastructure investments as shown in Figure 3.1. An investor can choose to invest in infrastructure that is in the greenfield or brownfield stage. The greenfield stage refers to infrastructure that is yet to be constructed or is under construction. Investments in such infrastructure projects carry a higher risk than projects in the brownfield stage, because it has to go through a construction phase before generating revenue. Since time lags, cost overruns, and other uncertainties can occur during the construction phase, most sovereign wealth funds do not invest in these types of projects as they consider it too risky [32].

However, investments in infrastructure in the brownfield stage are considered less risky as it is operational and is already generating a cash flow. Hence, investing in infrastructure in the brownfield stage is considered the best option for sovereign wealth funds such as GPFG as it gives a stable and predictable return [32].

Investors seeking to invest in infrastructure in the greenfield or brownfield stage have three options. They can either invest directly in an infrastructure project or invest in listed or unlisted infrastructure funds or companies. Investing directly in an infrastructure project requires a large allocation of capital as the goal is to get ownership of the asset. As it requires a significant amount of capital, most investors will rather invest in listed or unlisted in-

frastructure funds or companies, as it tends to carry less risk since the capital is diversified across multiple assets rather than used on a single project. Direct investment in an infrastructure project is usually only done by sovereign wealth funds, since they have a significant amount of capital compared to other investors. For most investors, unlisted infrastructure funds and companies have been the best option to invest in infrastructure. This is because it is not influenced by the fluctuations of the stock market, unlike listed infrastructure funds and companies. As unlisted infrastructure is not influenced by the stock market it can help reduce the overall risk exposure of the portfolio as it improves the diversification of the portfolio [33].

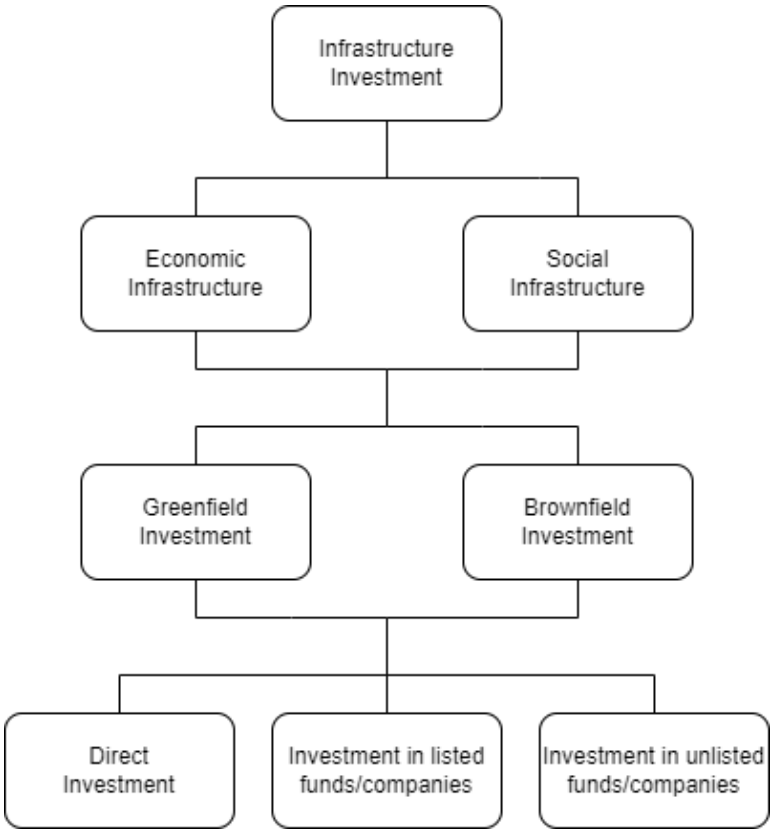

Figure 3.1: The different ways an investor can invest in infrastructure [29].

3.4 Infrastructure in the Selected Countries

Six countries from different regions have been selected for the analysis to investigate the potential of infrastructure investments abroad. The six countries are China, India, South Korea, Spain, France, and the United States. These countries have been chosen based on economic growth and political stability. Simultaneously, the countries are a part of the Organization for Economic Cooperation and Development (OECD) [34] or a key partner [35]. Countries in this organization have been primarily selected in accordance with GPFG mandate of investing a minimum of 70% of its capital in OECD countries [36].

3.4.1 China

In the first quarter of 2023, China had a significant increase of 10% in infrastructure investment, with the total amount of money invested reaching one trillion USD. This is a notable increase from the 909 billion USD invested in 2022. The funds have been allocated towards infrastructure projects such as railways, airports, water conservation, and new types of infrastructure assets like big data centers and charging stations for electric vehicles. The investments have been done in order to recover from the Corona period and to achieve their goal of creating 12 million new jobs in 2023 [37].

3.4.2 India

In 1991, India liberalized their economy by encouraging foreigners to invest in infrastructure in the country. As most of the infrastructure in India is owned by the government, concession agreements have been made between foreigners and the government to allow the private sector to build, own and operate infrastructure assets for a fixed period. At the end of the set maturity date, the infrastructure asset is returned to governmental ownership. This approach has enabled the development of infrastructure in India through private investments while also ensuring that the assets remain in public ownership over the long term [38].

3.4.3 South Korea

In 2023, the estimated market capitalization of South Korea's infrastructure market, when including both economic and social infrastructure, is approximately 55,4 billion USD. South Korea is considered to have one of the most advanced and high-tech information and communication infrastructures in the world. It has set a goal of modernizing its transportation infrastructure through a four-stage plan, with the first stage set to begin in 2023 and the final stage scheduled for completion in 2030. The transportation overhaul will include automated cars, buses, and trains. As the overhauling will require a significant amount of electricity, the demand for power-generating infrastructure is expected to increase towards the last stage in 2030 [39].

3.4.4 Spain

After the pandemic, Spain has been supported by the European Commission with 69,5 billion euro. Whereas 13,2 billion euro has been allocated to sustainable urban and long-distance mobility, such as railway infrastructure. Simultaneously, 7,8 billion euro is earmarked to improve the energy efficiency of both private and public buildings [40]. This makes Spain an interesting investment option for the future.

3.4.5 France

France has a well-developed economic infrastructure by European standards. Paris-Charles de Gaulle is a French airport that won the prize for the best airport in the cargo category and got second place for passengers in 2021 in Europe. Simultaneously, France had the biggest road network in Europe with 1,104,127 km spread across all over France in 2020 [41].

3.4.6 United States

In 2021, the government in the United States approved an infrastructure investment plan of 550 billion USD, earmarked for crucial projects including roads, bridges, high-speed internet access for every American citizen, and the electrification of schools. The motivation behind the infrastructure investments was to secure economic growth and create more jobs in the United States [42].

Chapter 4

Data

4.1 Data Source

Balance sheets and annual reports for unlisted companies are usually not publicly available, contrary to companies listed on a stock exchange, as they have no obligations to provide company data to the public. This has made it challenging to obtain the necessary data for this thesis.

The data used is mainly gathered from a finance terminal called Refinitiv Workspace. The data collected from each company is the balance sheets for the period January 2017 to December 2021. There are some exceptions in the financial periods, as the financial year in China and India starts on 1. April and ends on 31. March every year. When comparing China and India with the United States, France, Spain, and South Korea the period from January 2017 to December 2017 has been compared with 1. April 2017 to 31. March 2018.

Refinitiv Workspace did not have access to the financial statements of every company in every sector, so in some cases, annual reports or balance sheets are gathered from the companies' own sites. The financial statements provided by Refinitive Workspace were given in USD, while the statements found outside of Refinitive were given in the local currency of the country in which the firms operate.

Despite the difference in currency, as ROE is a percentage-based financial ratio, using the local currency in the calculations does not impact the results. Furthermore, using local currencies instead of USD is more accurate as exchange rates can fluctuate, leading to potentially overstating or understating a company's performance. Therefore, a common currency was not implemented in the analysis as using the local currencies improves the accuracy of the ROE calculation of each firm.

4.1.1 Refinitiv

Refinitiv with its 40 000 customers is one of the leading suppliers of financial markets data. It is part of the London Stock Exchange Group and provides customers worldwide with information, insights, and technology that enables the customers to do informed investment decisions and risk assessments with great accuracy [43].

4.2 Limitations

The research in this thesis is based on 115 unlisted private companies that own and operate economic infrastructure assets spread across six countries and four sectors. In each sector, every country is represented by five companies that have a minimum revenue of 20 million USD. These companies uses a single revenue stream business model, where the revenue source is the infrastructure they own and operate within the specific sector and country. The reason why the analysis has been done on 115 unlisted private companies and not 120, is because the Chinese telecom sector is entirely owned by the Chinese government.

4.2.1 Selection Criteria

The companies need to fulfill every selection criteria to be included in the analysis. These are the selection criteria:

- The company only operates in one country.
- The company only operates in one sector.
- Yearly revenue of more than 20 million USD.
- The company has to be private and unlisted.
- Public balance sheets for the period 2017-2021.
- The main revenue source is from one specific infrastructure type.

4.2.2 Countries

The Ministry of Finance has given the GPFG restrictions to only invest in companies in Europe, North America, and Asia. The fund is restricted to these regions since they are considered developed markets which often have lower investment risk. The GPFG has the mandate to invest a minimum of 70% in OECD countries [36]. The countries included in the analysis are therefore a mixture of OECD countries [34] and countries who are considered key partners [35].

Spain and France are chosen to represent Europe as they are considered cornerstones in the European market. To represent the Asian market India, China, and South Korea have been chosen. India has had a huge population growth during the past few years, which is attractive for investments in infrastructure. China is one of the largest countries in the world and has a huge potential for investments due to economic growth. South Korea is a modern country with already well-established connections to the United States and Europe. The infrastructure in South Korea is already modern, which makes it a safe place to do investments. The United States is the largest economy in the world, with economic growth over the last decade, and is therefore chosen to represent North America.

4.2.3 Sectors

Currently GPFG are only allowed by the Ministry of Finance to invest in the renewable sector. However, the sectors energy, telecom, and transport, have been included in the analysis to see if diversification across multiple industries can reduce the volatility of the infrastructure portfolio while improving the portfolio return.

4.2.4 Minimum Revenue

A minimum revenue limit of 20 million USD has been set for firms to be included in the analysis. This is to exclude small companies as they tend to have a higher risk and volatility, as their revenue usually varies extensively compared with larger companies. GPFG wants the highest possible return with moderate risk [44]. As a result, the limit was set to exclude the small firms to fit the investment mandate for GPFG.

4.2.5 Private Company

In order to meet GPFG's requirement of only investing in unlisted infrastructure companies, the selected companies had to be privately owned by private shareholders. The main difference between a private company and a public company is that the shares do not get traded on a public exchange, which makes them unlisted. As the shares are not publicly traded the private firms do not have obligations to provide any financial statements. This makes the selection of firms that fit the requirements and with available data challenging [45]. Since private companies can be solely owned by the government, every firm has been thoroughly researched to ensure that the private companies were privately owned.

4.2.6 Illustration of the Company Selection Process

An example of a firm that meets the requirements is Lincolnway Energy LLC, which owns and operates an ethanol plant in Nevada, United States. The sole revenue source comes from the sale of fuel-grade ethanol, which they produce roughly 190 million liters of each year from corn [46]. Lincolnway Energy LLC fits in the renewable sector since they own an ethanol production facility that makes fuel-grade ethanol, which is considered a renewable fuel. A reason for this is that ethanol is typically blended with gasoline to produce a fuel with more efficient combustion compared to gasoline and diesel fuel. This results in fewer by products such as carbon monoxide and other pollutants when the fuel is burned, making it a cleaner fuel alternative [47].

The firm is only present in the renewable sector, operates in the United States, has an average revenue of 117 million USD for the period 2017-2021, and is an unlisted private company and thus meets the requirements [48].

4.3 Methodology

4.3.1 Observations

The number of selected companies in this thesis is set to five companies to represent each country in each sector. The data used in the analysis is based on five observations per company (balance sheets from 2017-2021). This gives a total of 25 observations per country in each sector. As the analysis is based on four sectors, the total amount of observations per country will be 100. However, China will only have 75 observations due to the government's ownership of the telecom sector in China.

The different sectors have 150 observations for each sector, except for the telecom sector which has 125 observations due to the governmental telecom sector in China. Since each company has five observations, and the analysis includes 115 companies, the total amount of observations is 575.

4.3.2 Equally Weighted Portfolio

The ROE, standard deviation, and the Sharpe ratio are based on the assumption that the portfolio of each sector is equally weighted. This means that each of the 115 companies counts the same towards the financial metrics. The assumption has been made as it is the best way to get an overview of the performance of the sectors and countries based on the 575 observations made in the period 2017-2021.

4.3.3 Return on Equity of each Sector and Country

The net income and the shareholders' equity have been gathered from the companies' balance sheets for the period 2017-2021. These numbers were then used in Formula 3.6 to find the ROE for each of the firms in the period 2017-2021. The ROE for the five firms per country were added together and then divided by five to find the average ROE for every country in the sectors. The same method was used to find the average ROE for each sector.

4.3.4 Standard Deviation of each Sector and Country

The portfolio standard deviation for every country was found using Formula 3.4. The formula uses the correlation (see Appendix A for covariance matrix for every sector) between the firms and the weights of these firms to calculate how much the ROE tends to deviate from the mean. The same calculations were done to find the portfolio standard deviation per sector and the overall portfolio standard deviation of a portfolio with all sectors.

4.3.5 Sharpe Ratio of each Sector and Country

The Sharpe ratio of each country and sector was found using Formula 3.5. The average ROE for each country was calculated as shown in subsection 4.3.3, while the portfolio standard deviation per country was found as shown in subsection 4.3.4. The average risk-free rate for the last decade for the different countries was used to calculate the Sharpe ratio for each country in every sector. To find the Sharpe ratio for the different sectors, the average risk-free rates of the countries combined were used. The analysis did not use a common risk-free rate as the risk levels associated with investing in the different countries can differ, leading to varying investor expectations regarding return on investment in each of the countries. See subsection 4.3.6 for the risk-free rates for each of the six countries.

The average ROE for each sector was found by adding the ROE of each firm in the sector and then dividing by 30. However, for the telecom sector, the average ROE was calculated by dividing by 25 as China was excluded. The portfolio standard deviation per sector was found by using the correlation between each of the firms in the sector and their weights. The Sharpe ratio was then calculated by subtracting the risk-free rate from ROE and then dividing it by the portfolio standard deviation.

4.3.6 Risk-Free Rate for Each Country

As shown in Figure 4.1, the average risk-free rate for China over the past 10 years has been 3,36%.

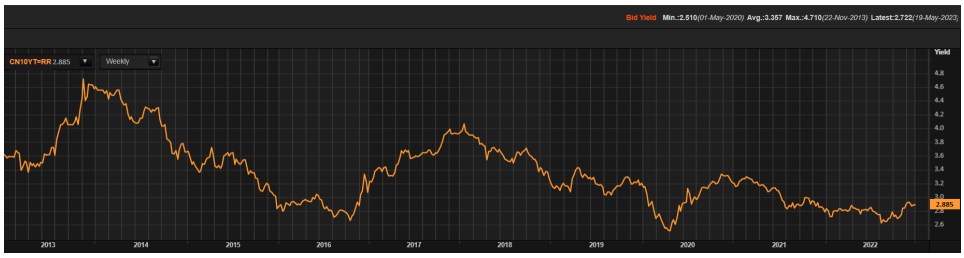

Figure 4.1: China 10Y bond yield [49].

As shown in Figure 4.2, the average risk-free rate for India over the past 10 years has been 7,26%.

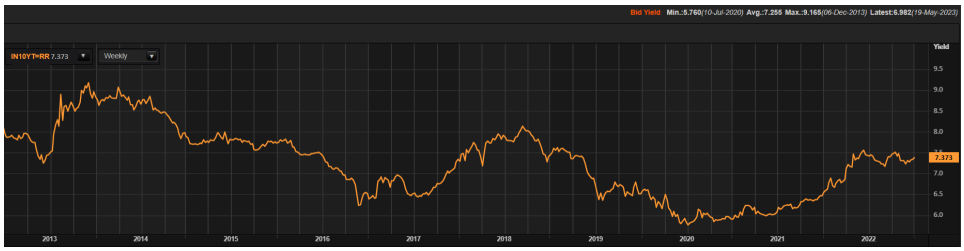

Figure 4.2: India 10Y bond yield [50].

As shown in Figure 4.3, the average risk-free rate for South Korea over the past 10 years has been 2,39%.

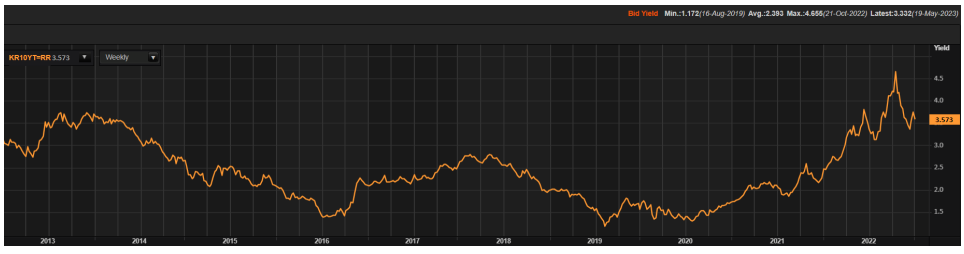

Figure 4.3: South Korea 10Y bond yield [51].

As shown in Figure 4.4, the average risk-free rate for Spain over the past 10 years has been 1,71%.

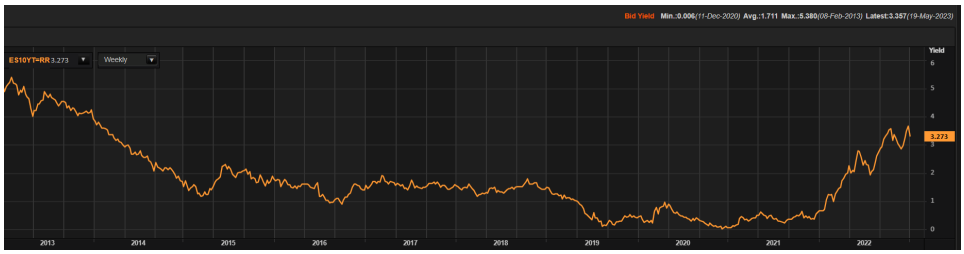

Figure 4.4: Spain 10Y bond yield [52].

As shown in Figure 4.5, the average risk-free rate for France over the past 10 years has been 0,85%.

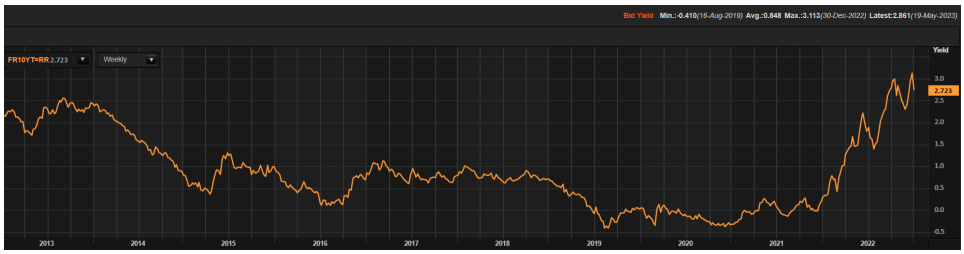

Figure 4.5: France 10Y bond yield [53].

As shown in Figure 4.6, the average risk-free rate for the United States over the past 10 years has been 2,15%.

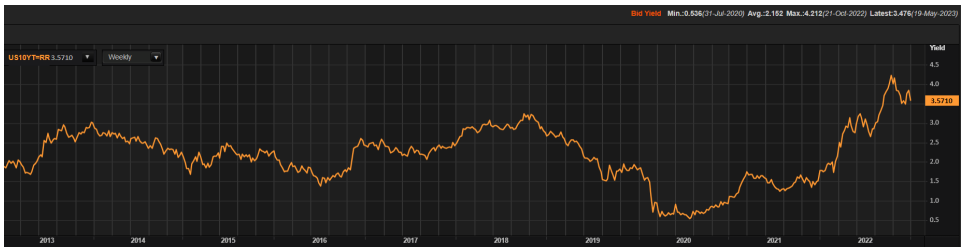

Figure 4.6: USA 10Y bond yield [54].

4.3.7 Sharpe Ratio of the Portfolio

The Sharpe ratio of the portfolio is calculated similarly to the Sharpe ratio of each sector and country. The main difference is that the Sharpe of the portfolio is using the covariance matrix as the correlation of the total portfolio, instead of the covariance matrix for each sector. Using the covariance matrix of the total portfolio gives better diversification and less risk, than the Sharpe ratio of each sector and country. In calculating the Sharpe ratio for the portfolio of all sectors and countries, the risk-free rates of the individual countries were used to find an average risk-free rate across all countries. This approach was similar to the method used for calculating the Sharpe ratio for each sector.

Chapter 5

Analysis

The goal of this section is to conduct an analysis that compares ROE, portfolio risk, and Sharpe ratio of the energy, renewable, telecom, and transport sector in six different countries. This will help answer the research question: "Should the Norwegian Government Pension Fund Global include more types of infrastructure than renewable energy in its 2% capital allocation for infrastructure abroad?".

The financial metrics are calculated based on the assumption that the portfolio of each sector is equally weighted, as this is acknowledged as the best way to get an overview of the performance of the sectors or countries. Standard deviation and sector portfolio risk occur in the sector analysis in the next few subsections. They are unequal because sector portfolio risk is calculated based on a covariance matrix shown in Appendix A.

On the other hand, the standard deviation is calculated based on the individual company variance in each sector. This shows the strength of a diversified portfolio, as the portfolio sector risk is lower than the standard deviation in every sector. The correlation between each firm helps to reduce the overall portfolio risk. The Sharpe ratio metric is calculated using the portfolio sector risk and the average ROE for each sector. The risk-free rate is set to 2,95% in the Sharpe ratio calculations, as an average risk-free rate for the last decade for the six countries combined.

5.1 Energy

The average ROE and standard deviation for the period 2017-2021 of each of the firms in the energy sector are illustrated in Table 5.1. See Appendix B for a ticker explanation.

Country	Ticker	Return on Equity (%)	Standard Deviation	Weight	Average return on equity for each country (%)
China (Energy)	LMIG	1,79 %	1,12 %	3,3%	
	CNCG	5,62 %	2,74 %	3,3%	
	HCIG	21,73 %	9,93 %	3,3%	7,20 %
	GPCEG	6,42 %	3,25 %	3,3%	
	XE	0,42 %	0,37 %	3,3%	
India (Energy)	NE	3,89 %	5,55 %	3,3%	
	RGPP	-124,30 %	150,61 %	3,3%	
	SPT	1,67 %	3,22 %	3,3%	-20,86 %
	AGC	8,18 %	2,76 %	3,3%	
	BG	6,23 %	4,87 %	3,3%	
South Korea (Energy)	GSC	4,99 %	7,76 %	3,3%	
	SO	11,72 %	17,12 %	3,3%	
	JSU	13,60 %	0,67 %	3,3%	11,72 %
	BT	12,39 %	2,51 %	3,3%	
	HTEP	15,91 %	10,04 %	3,3%	
Spain (Energy)	PN	6,63 %	10,62 %	3,3%	
	RE	-43,58 %	52,14 %	3,3%	
	CCP	15,39 %	2,27 %	3,3%	-2,26 %
	TE	4,44 %	1,73 %	3,3%	
	VE	5,83 %	1,53 %	3,3%	
France (Energy)	GSSS	27,46 %	24,81 %	3,3%	
	VR	6,90 %	2,12 %	3,3%	
	G	9,63 %	1,66 %	3,3%	29,90 %
	SPMR	56,46 %	8,11 %	3,3%	
	STPPP	49,03 %	14,52 %	3,3%	
USA (Energy)	AC	-93,03 %	128,80 %	3,3%	
	CR	8,27 %	12,73 %	3,3%	
	WMO	23,58 %	5,99 %	3,3%	-9,74 %
	EMP	1,72 %	3,17 %	3,3%	
	BM	10,77 %	17,42 %	3,3%	
			Total	100 %	Average return on equity 2,66 %

Table 5.1: ROE and standard deviation for each firm for the period 2017-2021, the average ROE for each country, and the average ROE for the energy sector.

The energy sector has a ROE at 2,66%, sector portfolio risk at 12,06%, and Sharpe ratio at -0,02 as shown in Table 5.2. The country with the highest Sharpe ratio in the energy sector is France with a value of 2,84. The country with the lowest Sharpe ratio in the sector is India with a value of -0,84.

Equally distributed all firms in energy sector					
Country	% Invested	Return on Equity (%)	Standard Deviation (%)	Risk-free Rate (%)	Sharpe Ratio
China	16,67 %	7,20 %	3,48 %	3,36 %	1,10
India	16,67 %	-20,86 %	33,40 %	7,26 %	-0,84
South Korea	16,67 %	11,72 %	7,62 %	2,39 %	1,22
Spain	16,67 %	-2,26 %	13,66 %	1,71 %	-0,29
France	16,67 %	29,90 %	10,24 %	0,85 %	2,84
United States	16,67 %	-9,74 %	33,62 %	2,15 %	-0,35
TOTAL	100,00 %				
Average Return on Equity		2,66 %			
Average Standard Deviation			17,00 %		
Average Risk-free Rate				2,95 %	
Average Sharpe Ratio					0,61

Average ROE (%)	2,66 %
Sector portfolio risk, standard deviation (%)	12,06 %
Average Risk-free rate (%)	2,95 %
Sharpe Ratio	-0,02

Table 5.2: Average ROE, standard deviation, and Sharpe ratio for the energy sector. The portfolio risk of the sector, the Sharpe ratio, and the average risk-free rate of the portfolio are found at the bottom of the table.

5.2 Renewable

The average ROE and standard deviation for the period 2017-2021 of each of the firms in the renewable sector are illustrated in Table 5.3. See Appendix B for a ticker explanation.

Country	Ticker	Return on Equity (%)	Standard Deviation	Weight	Average return on equity for each country (%)
China (Renewable)	GTEG	-4,31 %	10,57 %	3,3%	
	UP	27,77 %	4,99 %	3,3%	
	GHPP	15,15 %	8,81 %	3,3%	7,88 %
	CDCR	6,03 %	3,32 %	3,3%	
	DSPG	-5,24 %	16,54 %	3,3%	
India (Renewable)	SGWP	71,88 %	101,77 %	3,3%	
	TPSO	24,18 %	7,21 %	3,3%	
	THDC	14,18 %	7,72 %	3,3%	25,35 %
	GRGR	11,61 %	13,23 %	3,3%	
	VISO	4,92 %	11,57 %	3,3%	
South Korea (Renewable)	EDRE	24,35 %	15,66 %	3,3%	
	GSWC	12,15 %	1,33 %	3,3%	
	GECL	19,10 %	4,75 %	3,3%	15,18 %
	HECO	12,14 %	9,17 %	3,3%	
	HGPC	8,15 %	5,47 %	3,3%	
Spain (Renewable)	EDRE	-0,89 %	28,30 %	3,3%	
	IRES	1,97 %	1,07 %	3,3%	
	VBSL	47,29 %	46,61 %	3,3%	11,88 %
	SEMI	9,60 %	5,69 %	3,3%	
	PCSA	1,42 %	2,54 %	3,3%	
France (Renewable)	AESAS	5,63 %	9,54 %	3,3%	
	EDF	-32,13 %	69,85 %	3,3%	
	CFSAS	-1,99 %	5,94 %	3,3%	-0,78 %
	EGFS	12,76 %	32,52 %	3,3%	
	UESA	11,84 %	0,99 %	3,3%	
USA (Renewable)	PSE	3,33 %	0,34 %	3,3%	
	LE	-10,81 %	26,20 %	3,3%	
	REG	21,09 %	14,11 %	3,3%	7,17 %
	HES	18,78 %	19,74 %	3,3%	
	SPEC	3,44 %	0,82 %	3,3%	
			Total	100 %	Average return on equity 11,11 %

Table 5.3: ROE and standard deviation for each firm for the period 2017-2021, the average ROE for each country, and the average ROE for the renewable sector.

The renewable sector has a ROE at 11,10%, sector portfolio risk at 4,78%, and Sharpe ratio at 1,71 as shown in Table 5.4. The country with the highest Sharpe ratio in the Renewable sector is South Korea with a value of 1,76. The country with the lowest Sharpe ratio in the sector is France with a value of -0,07.

Equally distributed all firms in renewable sector Country	% Invested	Return on Equity (%)	Standard Deviation (%)	Risk-free Rate (%)	Sharpe Ratio
China	16,67 %	7,88 %	8,85 %	3,36 %	0,51
India	16,67 %	25,35 %	28,30 %	7,26 %	0,64
South Korea	16,67 %	15,18 %	7,28 %	2,39 %	1,76
Spain	16,67 %	11,88 %	16,84 %	1,71 %	0,60
France	16,67 %	-0,78 %	23,77 %	0,85 %	-0,07
United States	16,67 %	7,17 %	12,24 %	2,15 %	0,41
TOTAL	100,00 %				
Average Return on Equity		11,11 %			
Average Standard Deviation			16,21 %		
Average Risk-free rate				2,95 %	
Average Sharpe Ratio					0,64

Average ROE (%)	11,10 %
Sector portfolio risk, standard deviation (%)	4,78 %
Average Risk-free rate (%)	2,95 %
Sharpe Ratio	1,71

Table 5.4: Average ROE, standard deviation, and Sharpe ratio for the renewable sector. The portfolio risk of the sector, the Sharpe ratio, and the average risk-free rate of the portfolio are found at the bottom of the table.

5.3 Telecom

The average ROE and standard deviation for the period 2017-2021 of each of the firms in the telecom sector are illustrated in Table 5.5. See Appendix B for a ticker explanation.

Country	Ticker	Return on Equity (%)	Standard Deviation	Weight	Average return on equity for each country (%)
India (Telecom)	RJIL	-0,39 %	14,12 %	4,0%	
	BHLT	-59,37 %	99,06 %	4,0%	
	ATC	7,89 %	6,89 %	4,0%	-6,18 %
	BTL	-28,39 %	24,22 %	4,0%	
	TNL	49,36 %	25,84 %	4,0%	
South Korea (Telecom)	YTCL	8,34 %	4,73 %	4,0%	
	KTSA	9,17 %	4,76 %	4,0%	
	SKTC	7,91 %	4,19 %	4,0%	45,27 %
	KTSN	139,71 %	204,06 %	4,0%	
	STCL	61,22 %	25,43 %	4,0%	
Spain (Telecom)	VESA	-19,35 %	14,36 %	4,0%	
	TDES	20,19 %	17,87 %	4,0%	
	TMES	87,99 %	58,38 %	4,0%	22,09 %
	TSIC	43,25 %	37,90 %	4,0%	
	TGSS	-21,63 %	10,22 %	4,0%	
France (Telecom)	BTSA	7,09 %	1,69 %	4,0%	
	EUSA	20,89 %	2,85 %	4,0%	
	SCSA	16,57 %	7,27 %	4,0%	18,90 %
	SFSA	32,17 %	26,95 %	4,0%	
	ILSA	17,79 %	16,31 %	4,0%	
USA (Telecom)	HSSC	-0,04 %	3,64 %	4,0%	
	CBIN	-43,17 %	31,90 %	4,0%	
	INCO	-165,09 %	144,42 %	4,0%	-44,11 %
	BWCO	-14,05 %	9,23 %	4,0%	
	ACSG	1,79 %	2,79 %	4,0%	
			Total	100 %	Average return on equity 7,20 %

Table 5.5: ROE and standard deviation for each firm for the period 2017-2021, the average ROE for each country, and the average ROE for the telecom sector.

The telecom sector has a ROE at 7,20%, sector portfolio risk at 10,77%, and Sharpe ratio at 0,40 as shown in Table 5.6. It is important to mention that China is excluded from this sector due to a fully governmental regulated telecom sector. As a result, the equal distribution changes from 16,67% to 20,00% for every country included in the analysis. The country with the highest Sharpe ratio in the telecom sector is France with a value of 1,64. The country with the lowest Sharpe ratio in the sector is the United States with a value of -1,20.

Equally distributed all firms in telecom sector Country	% Invested	Return on Equity (%)	Standard Deviation (%)	Risk-free Rate (%)	Sharpe Ratio
India	20,00 %	-6,18 %	34,03 %	7,26 %	-0,39
South Korea	20,00 %	45,27 %	48,63 %	2,39 %	0,88
Spain	20,0 %	22,09 %	27,75 %	1,71 %	0,73
France	20,0 %	18,90 %	11,01 %	0,85 %	1,64
United States	20,00 %	-44,11 %	38,40 %	2,15 %	-1,20
TOTAL	100,00 %				
Average Return on Equity		7,20 %			
Average Standard Deviation			31,96 %		
Average Risk-free Rate				2,87 %	
Average Sharpe Ratio					0,33

Average ROE (%)	7,20 %
Sector portfolio risk, standard deviation (%)	10,77 %
Average Risk-free rate (%)	2,87 %
Sharpe Ratio	0,40

Table 5.6: Average ROE, standard deviation, and Sharpe ratio for the telecom sector. The portfolio risk of the sector, the Sharpe ratio, and the average risk-free rate of the portfolio are found at the bottom of the table.

5.4 Transport

The average ROE and standard deviation for the period 2017-2021 of each of the firms in the transport sector are illustrated in Table 5.7. See Appendix B for a ticker explanation.

Country	Ticker	Return on Equity (%)	Standard Deviation	Weight	Average return on equity for each country (%)
China (Transport)	HPEG	0,43 %	0,15 %	3,3%	
	GCIG	3,10 %	1,51 %	3,3%	
	GRBCD	0,93 %	0,50 %	3,3%	2,59 %
	GPHC	7,50 %	2,01 %	3,3%	
	GPF	0,97 %	0,59 %	3,3%	
India (Transport)	LTMR	-20,57 %	16,64 %	3,3%	
	EP	-20,34 %	17,10 %	3,3%	
	DIA	-2,74 %	5,74 %	3,3%	-0,11 %
	GHYA	31,22 %	39,41 %	3,3%	
	BIA	11,86 %	16,37 %	3,3%	
South Korea (Transport)	IB	-4,50 %	13,33 %	3,3%	
	SCH	-5,01 %	13,95 %	3,3%	
	NDBE	-14,93 %	54,23 %	3,3%	4,81 %
	SNH	26,67 %	7,53 %	3,3%	
	GSH	21,81 %	2,49 %	3,3%	
Spain (Transport)	TBCCGC	23,19 %	7,76 %	3,3%	
	ATMACGC	6,11 %	8,99 %	3,3%	
	AAEU	19,48 %	23,43 %	3,3%	7,20 %
	RMSME	-37,48 %	54,11 %	3,3%	
	D	24,70 %	30,49 %	3,3%	
France (Transport)	C	66,24 %	8,86 %	3,3%	
	SAPN	23,84 %	5,65 %	3,3%	
	APPR	-240,36 %	241,89 %	3,3%	-2,12 %
	S	63,03 %	8,52 %	3,3%	
	A	76,65 %	29,84 %	3,3%	
USA (Transport)	BNSF	18,36 %	14,13 %	3,3%	
	GPTC	-37,01 %	21,33 %	3,3%	
	TRIP	-4,84 %	5,71 %	3,3%	-6,38 %
	CA	-10,98 %	1,83 %	3,3%	
	SBE	2,57 %	3,09 %	3,3%	
			Total	100,00 %	Average return on equity 1,00 %

Table 5.7: ROE and standard deviation for each firm for the period 2017-2021, the average ROE for each country, and the average ROE for the transport sector.

The transport sector has a ROE at 1,00%, sector portfolio risk at 13,94%, and Sharpe ratio at -0,14 as shown in Table 5.8. The country with the highest Sharpe ratio in the transport sector is Spain with a value of 0,22. The country with the lowest Sharpe ratio in the sector is the United States with a value of -0,93.

Equally distributed all firms in transport sector Country	% Invested	Return on Equity (%)	Standard Deviation (%)	Risk-free Rate (%)	Sharpe Ratio
China	16,67 %	2,59 %	0,95 %	3,36 %	-0,81
India	16,67 %	-0,11 %	19,05 %	7,26 %	-0,39
South Korea	16,67 %	4,81 %	18,31 %	2,39 %	0,13
Spain	16,67 %	7,20 %	24,95 %	1,71 %	0,22
France	16,67 %	-2,12 %	58,95 %	0,85 %	-0,05
United States	16,67 %	-6,38 %	9,22 %	2,15 %	-0,93
TOTAL	100,00 %				
Average Return on Equity		1,00 %			
Average Standard Deviation			21,91 %		
Average Risk-free Rate				2,95 %	
Average Sharpe Ratio					-0,30

Average ROE (%)	1,00 %
Sector portfolio risk, standard deviation (%)	13,94 %
Average Risk-free rate (%)	2,95 %
Sharpe Ratio	-0,14

Table 5.8: Average ROE, standard deviation, and Sharpe ratio for the transport sector. The portfolio risk of the sector, the Sharpe ratio, and the average risk-free rate of the portfolio are found at the bottom of the table.

5.5 All Sectors

In an equally weighted portfolio, the ROE is at 5,42%, sector portfolio risk at 6,39%, and the Sharpe ratio is 0,39 as shown in Table 5.9. The country with the highest average Sharpe ratio is South Korea with a value of 0,79, while the country with the lowest average Sharpe ratio is the United States with a value of -0,70. The standard deviation varies from 20,46% to 28,70% for all countries, except for China which has a standard deviation of 4,43%.

Equally distributed all firms Country	% Invested	Return on Equity (%)	Standard Deviation (%)	Risk-free Rate (%)	Sharpe Ratio
China	13,04%	5,89%	4,43%	3,36%	0,65
China Energy	4,35%	7,20%	3,48%		1,21
China Renewable	4,35%	7,88%	8,85%		0,55
China Telecom	----	----	----		----
China Transport	4,35%	2,59%	0,95%		-0,43
India	17,39%	-0,45%	28,70%	7,26%	-0,12
India Energy	4,35%	-20,86%	33,40%		-0,71
India Renewable	4,35%	25,35%	28,30%		0,79
India Telecom	4,35%	-6,18%	34,03%		-0,27
India Transport	4,35%	-0,11%	19,05%		-0,16
South Korea	17,39%	19,24%	20,46%	2,39%	0,79
South Korea Energy	4,35%	11,72%	7,62%		1,14
South Korea Renewable	4,35%	15,18%	7,28%		1,67
South Korea Telecom	4,35%	45,27%	48,63%		0,87
South Korea Transport	4,35%	4,81%	18,31%		0,10
Spain	17,39%	9,73%	20,80%	1,71%	0,32
Spain Energy	4,35%	-2,26%	13,66%		-0,39
Spain Renewable	4,35%	11,88%	16,84%		0,53
Spain Telecom	4,35%	22,09%	27,75%		0,69
Spain Transport	4,35%	7,20%	24,95%		0,17
France	17,39%	11,48%	25,99%	0,85%	0,33
France Energy	4,35%	29,90%	10,24%		2,63
France Renewable	4,35%	-0,78%	23,77%		-0,16
France Telecom	4,35%	18,90%	11,01%		1,44
France Transport	4,35%	-2,12%	58,95%		-0,09
United States	17,39%	-13,27%	23,37%	2,15%	-0,70
United States Energy	4,35%	-9,74%	33,62%		-0,38
United States Renewable	4,35%	7,17%	12,24%		0,34
United States Telecom	4,35%	-44,11%	38,40%		-1,23
United States Transport	4,35%	-6,38%	9,22%		-1,02
TOTAL	100,0%				
Average Return on Equity		5,44%			
Average Standard Deviation			20,62%		
Average Risk-free Rate				2,95%	
Average Sharpe Ratio					0,21

Energy sector (%)	26,09%
Renewable sector (%)	26,09%
Telecom sector (%)	21,74%
Transport sector (%)	26,09%
TOTAL	100,0%

Average ROE (%)	5,44%
Portfolio risk for all sectors, standard deviation (%)	6,39%
Average Risk-free Rate (%)	2,95%
Sharpe Ratio	0,39

Table 5.9: Average ROE, standard deviation, and Sharpe ratio for sectors combined. The portfolio risk for all sectors, the Sharpe ratio, and the average risk-free rate of the portfolio are found at the bottom of the table.

5.6 Most Efficient Portfolio According to Excel Solver

As shown in Table 5.10, the optimal portfolio which gives the maximal Sharpe ratio (MS) possible is when invested 29,69% in the energy sector, 13,53% in the renewable sector, 30,46% in the telecom sector, and 26,31% in the transport sector. To find the optimal portfolio using Excel Solver the objective cell with the Sharpe ratio was set to be maximized by changing the variable cells, which were the weights in each sector. The constraints of the calculations were that the weights had to be positive and add up to 100% as it is not possible to short unlisted companies.

	Expected return (%)	Standard Deviation (%)	Average Risk-free Rate (%)	Sharpe Ratio	Invested (%)
MS Energy	14,03 %	0,03 %	2,95 %	371,16	29,69 %
MS Renewable	23,80 %	0,06 %	2,95 %	371,97	13,53 %
MS Telecom	20,77 %	0,03 %	2,95 %	663,81	30,46 %
MS Transport	28,39 %	0,03 %	2,95 %	764,10	26,31 %
Total	39,65 %	0,14 %	2,95 %	257,51	100,00 %

Table 5.10: The efficient portfolio according to Excel Solver.

Chapter 6

Results and Discussion

6.1 Key Findings

For an investment to be considered profitable, the Sharpe ratio has to be equal to one or higher according to Investopedia [21]. In the analysis in the previous chapter, the Sharpe ratio for the sectors energy, renewable, telecom, and transport and for the portfolio of all sectors combined was calculated. The ratios for the energy, renewable, telecom, and transport sector were found to be -0,02, 1,71, 0,39, and -0,14, while the Sharpe ratio for the portfolio consisting of all sectors was found to be 0,39 as shown in Table 6.1.

	Expected return (%)	Standard Deviation (%)	Average Risk-free Rate	Sharpe Ratio
Energy	2,66 %	12,06 %	2,95 %	-0,02
Renewable	11,10 %	4,78 %	2,95 %	1,71
Telecom	7,20 %	10,77 %	2,95 %	0,39
Transport	1,00 %	13,94 %	2,95 %	-0,14
Portfolio	5,44 %	6,39 %	2,95 %	0,39

Table 6.1: The financial metrics found in the analysis.

6.2 Discussion

Since the Sharpe ratio for the energy, telecom, and transport sector and the four sectors combined is below the threshold of 1, it is preferable for NBIM to only invest in the renewable sector rather than invest in all four sectors, as this is the only ratio which is greater or equal to one. It is important to note that the calculations and results are based on an equally weighted portfolio. However, using MPT to make a diversified portfolio with different weights can change the outcome, as this will make it possible to only include companies in the portfolio where the expected return is higher than the investment risk. By excluding firms with poor performance, the portfolio's Sharpe ratio is likely to improve significantly. This is because companies with negative or low Sharpe ratios reduce the portfolio's overall performance.

It is worth noting that the standard deviation of each sector portfolio is lower than the average standard deviation of the respective sector, see Table 6.2. The average standard deviation across all sectors is 20.62%, whereas it is reduced significantly to 6.39% when utilizing a covariance matrix. This illustrates how portfolio diversification effectively reduces the overall portfolio risk.

	Average standard deviation	Standard deviation of the sector portfolio
Energy	17,00 %	12,06 %
Renewable	16,21 %	4,78 %
Telecom	31,96 %	10,77 %
Transport	21,91 %	13,94 %
Portfolio	20,62 %	6,39 %

Table 6.2: Comparison between the average standard deviation of the sectors and the standard deviation of the sector portfolio.

6.2.1 Net Profit Margin VS Return on Equity

In Table 6.3 the CV was used to compare the profitability of each sector based on the financial ratios ROE and NPM. The CV for ROE shows that the profitability of the renewable sector is the most stable of all the sectors followed by the telecom sector. For NPM, it is the opposite, where telecom has the most consistent profitability followed by the renewable sector.

	Expected ROE	Standard Deviation	CV	Rank
ROE Energy	2,66 %	12,06 %	4,54	3
ROE Renewable	11,10 %	4,78 %	0,43	1
ROE Telecom	7,20 %	10,77 %	1,50	2
ROE Transport	1,00 %	13,94 %	13,98	4
ROE Portfolio	5,44 %	6,39 %	1,17	

	Expected NPM	Standard Deviation	CV	Rank
NPM Energy	-4,15 %	13,63 %	-3,29	4
NPM Renewable	13,99 %	18,21 %	1,30	2
NPM Telecom	4,42 %	1,18 %	0,27	1
NPM Transport	2,82 %	22,08 %	7,82	3
NPM Portfolio	4,26 %	10,34 %	2,43	

Table 6.3: CV comparison between NPM and ROE.

6.2.2 Uncertainties

The standard financial year in Europe, the United States, and South Korea start on 1. January and ends on 31. December every year. While for China and India, it starts on 1. April and ends on 31. March every year. For instance, when comparing the United States, France, Spain, and South Korea with China and India, the financial statements for period 1. January to 31. December 2017 was compared with period 1. April 2017 to 31. March 2018. This may have influenced the data if there were any major financial or geopolitics happenings in the period from 1. January to 31. March. The data could also be potentially incorrect, as it is uncertain whether the companies used in the analysis actually have reported the correct results in their financial statements.

In the analysis, the five financial periods 2017-2021 are used. The optimal solution would be to increase the number of periods to 20. By increasing the data set from five periods to 20, the data would most likely provide a more accurate financial overview of the businesses. On the other hand, increasing the number of periods would have decreased the number of companies heavily, as most renewable companies were established after 2010. Many companies in different sectors do not publish their balance sheet or annual report every year, which would lead to disqualification in this analysis if the amount of financial period was increased to 20.

The analysis uses five companies to represent each sector in each country. By using only five companies, each company can have a huge impact on the overall performance of the sector and country. This results in increased uncertainty in the analysis, as the calculations are based on a small sample, and may not accurately reflect the sectors. It is important to note that survivorship bias can be present in this analysis. The selected companies were chosen based on specific criteria such as revenue for the period 2017-2021 and if they were private and unlisted. By excluding companies that did not meet these requirements, there is a risk of introducing errors in the sector comparison as the excluded companies could have influenced the outcome if they survived the selection process.

A more reliable approach would be to include at least 20 firms per sector from each country. This would provide a more accurate representation of each sector as every firm will be less likely to influence the overall performance of the sector. However, this approach was not used in the analysis as the limitations (private company, unlisted, revenue over 20 million USD), made it difficult to find five firms to represent each sector in each country.

In Table 6.4, the company with the lowest ROE in each sector has been removed to see how sensitive the financial metrics are. After removing the firm in each sector the renewable sector, telecom sector, and the portfolio of all sectors combined is now considered a good investment compared with no removal where only the renewable sector should be invested in. This illustrates how sensitive the results are as a single company can have a huge impact on the metrics as it is based on a small sample.

All firms	Expected return (%)	Standard Deviation (%)	Average Risk-free Rate	Sharpe Ratio
Energy	2,66 %	12,06 %	2,95 %	-0,02
Renewable	11,10 %	4,78 %	2,95 %	1,71
Telecom	7,20 %	10,77 %	2,95 %	0,39
Transport	1,00 %	13,94 %	2,95 %	-0,14
Portfolio	5,44 %	6,39 %	2,95 %	0,39

Excluding the firm with lowest ROE in each sector	Expected return (%)	Standard Deviation (%)	Average Risk-free Rate	Sharpe Ratio
Energy	7,04 %	8,37 %	2,95 %	0,49
Renewable	12,61 %	5,20 %	2,95 %	1,86
Telecom	14,35 %	6,91 %	2,95 %	1,65
Transport	9,33 %	6,88 %	2,95 %	0,93
Portfolio	10,67 %	4,64 %	2,95 %	1,66

Table 6.4: Comparison between the sectors and the portfolio if the firm with the lowest ROE in each sector is removed.

The analysis uses standard deviation as a measure of risk. It's important to note that the analysis only contains unlisted companies, which may increase the risk due to a lack of liquidity. Investment positions in these companies are harder to sell because it requires finding a buyer rather than simply trading stocks on a stock market. Consequently, the lack of liquidity could be a hidden risk factor for investments in unlisted companies.

Chapter 7

Conclusion

7.1 Summary

From the previous chapter, the ROE of the portfolio was calculated as 5,44%, the portfolio risk as 6,39%, and the Sharpe ratio as 0,39. The Sharpe ratio should be higher than 1,00 to be considered a good investment. Given the Sharpe ratio of the portfolio, investing in an equally-weighted portfolio of all sectors would not be profitable. When comparing each sector, it is only the renewable sector that is considered a good investment, as it has a value of 1,71 while energy, telecom, and transport have -0,02, 0,39, and -0,14.

As shown in Table 6.3, the sector with the lowest CV using ROE was renewable, and the telecom sector when using NPM. The second lowest was the telecom sector for ROE and the renewable sector for NPM. Investments with a CV value equal to one or lower is considered a good investment. However, neither the portfolio of all sectors when using ROE nor NPM should be invested in as they have CV of 1,17 and 2,43.

Using Excel Solver the optimal portfolio is when investing 29,69% in the energy sector, 13,53% in the renewable sector, 30,46% in the telecom sector, and 26,31% in the transport sector. Keep in mind that the Sharpe ratio for each of these sectors and the portfolio ranges from 257 to 762, as the risk is calculated to be between 0,03% and 0,14%. This illustrates that the results calculated by Excel Solver should be evaluated with caution, as the risk may not be accurate as risk-free assets have 100 times higher risk.

The Sharpe ratio for each sector with 30 companies is -0,02, 1,71, 0,39, -0,14, and 0,39 for the portfolio as shown in Table 6.4. On the other hand, when removing the lowest-performance company in each sector the Sharpe ratio is 0,49, 1,86, 1,65, 0,93, and 1,66 for the portfolio. This shows how sensitive the analysis is. To reduce the sensitivity, it is possible to increase the number of companies from each sector, to reduce the impact a single firm can have on the results.

Based on the portfolio analysis of 115 companies for the period 2017-2021, the conclusion is that the GPFG, should not include more types of infrastructure than renewable energy in its 2% capital allocation for infrastructure abroad. The fund should only invest in renewable since the Sharpe ratio of the portfolio and all the other sectors is below the threshold of one when using ROE as the expected return. When comparing ROE with NPM, the renewable sector is one of the best-performing sectors, supporting the initial conclusion.

Based on the optimal portfolio by Excel Solver, the energy, telecom, and transport sectors are considered better investment options than the renewable sector. However, as the Sharpe ratio is abnormally high, the results have been excluded from the conclusion.

List of Figures

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Appendix A

Energy Sector

Return on Equity (yearly in %) - Energy sector

	China					India					South Korea					Spain					France					USA				
	LMIG	CNCG	HCIG	GPCEG	XE	NE	RGPP	SPT	AGC	BG	GSC	SO	JSU	BT	HTEP	PN	RE	CCP	TE	VE	GSSS	VR	G	SPMR	STPPP	AC	CR	WMO	EMP	BM
2021	1,07 %	9,64 %	38,94 %	4,60 %	0,98 %	2,17 %	-72,23 %	6,97 %	7,31 %	2,41 %	8,56 %	40,66 %	13,33 %	15,15 %	17,51 %	4,01 %	-29,10 %	12,84 %	5,73 %	8,49 %	26,25 %	4,50 %	10,54 %	53,74 %	42,81 %	-82,32 %	22,29 %	30,91 %	6,59 %	12,92 %
2020	0,31 %	6,17 %	14,99 %	1,59 %	0,07 %	12,49 %	-160,90 %	-1,52 %	10,02 %	5,47 %	-7,58 %	0,79 %	13,11 %	10,97 %	3,06 %	-10,69 %	-26,59 %	14,84 %	4,81 %	5,02 %	2,66 %	8,17 %	9,08 %	44,26 %	27,53 %	-299,21 %	-10,00 %	18,38 %	0,35 %	-8,90 %
2019	3,16 %	6,14 %	14,91 %	9,29 %	0,27 %	3,93 %	-369,58 %	0,32 %	3,69 %	5,82 %	4,11 %	-2,41 %	14,49 %	9,46 %	8,83 %	10,45 %	-135,79 %	18,98 %	6,37 %	5,43 %	10,62 %	9,85 %	10,63 %	65,31 %	53,85 %	-113,12 %	11,49 %	24,79 %	-1,46 %	2,80 %
2018	2,41 %	3,39 %	19,97 %	8,15 %	0,18 %	3,79 %	-16,52 %	1,99 %	9,73 %	2,94 %	6,72 %	11,91 %	12,95 %	11,49 %	22,16 %	14,37 %	-16,90 %	14,53 %	2,77 %	5,57 %	66,83 %	5,57 %	10,94 %	61,71 %	55,16 %	7,71 %	16,11 %	27,20 %	0,04 %	8,78 %
2017	1,99 %	2,74 %	19,84 %	8,48 %	0,61 %	-2,92 %	-2,23 %	0,59 %	10,14 %	14,52 %	13,12 %	7,66 %	14,12 %	14,87 %	27,99 %	15,01 %	-9,52 %	15,75 %	2,51 %	4,63 %	30,95 %	6,43 %	6,94 %	57,25 %	65,80 %	21,79 %	1,48 %	16,63 %	3,05 %	38,25 %
Variance	1,3E-04	7,5E-04	9,9E-03	1,1E-03	1,4E-05	3,1E-03	2,3E+00	1,0E-03	7,6E-04	2,4E-03	6,0E-03	2,9E-02	4,5E-05	6,3E-04	1,0E-02	1,1E-02	2,7E-01	5,1E-04	3,0E-04	2,3E-04	6,2E-02	4,5E-04	2,8E-04	6,6E-03	2,1E-02	1,7E+00	1,6E-02	3,6E-03	1,0E-03	3,0E-02
Standard Deviaton	1,12 %	2,74 %	9,93 %	3,25 %	0,37 %	5,55 %	150,61 %	3,22 %	2,76 %	4,87 %	7,76 %	17,12 %	0,67 %	2,51 %	10,04 %	10,62 %	52,14 %	2,27 %	1,73 %	1,53 %	24,81 %	2,12 %	1,66 %	8,11 %	14,52 %	128,80 %	12,73 %	5,99 %	3,17 %	17,42 %

Table A.1: Return on Equity, variance and standard deviation for each firm in the energy sector in each country.

Covariance Matrix (Energy sector)

		China					India					South Korea					Spain					France					USA				
		LMIG	CNCG	HCIG	GPCEG	XE	NE	RGPP	SPT	AGC	BG	GSC	SO	JSU	BT	HTEP	PN	RE	CCP	TE	VE	GSSS	VR	G	SPMR	STPPP	AC	CR	WMO	EMP	BM
China	LMIG	1,3E-04	-1,2E-04	-3,3E-04	3,5E-04	-4,9E-06	-3,2E-04	-5,7E-03	-2,3E-05	-1,7E-04	7,2E-05	4,4E-04	-6,2E-04	4,6E-05	-9,9E-05	3,6E-04	9,8E-04	-3,5E-03	1,8E-04	-5,6E-06	-4,1E-05	9,9E-04	7,5E-05	4,5E-05	8,9E-04	1,2E-03	8,9E-03	6,2E-04	1,2E-04	-1,6E-04	5,2E-04
	CNCG	-1,2E-04	7,5E-04	1,8E-03	-4,6E-04	4,9E-05	4,4E-04	-1,3E-02	5,3E-04	-3,5E-04	-8,1E-04	-5,1E-04	2,9E-03	-2,3E-05	9,1E-05	-1,3E-03	-1,5E-03	-3,4E-03	-1,9E-04	3,9E-04	3,5E-04	-3,1E-03	-7,7E-05	2,2E-04	-6,8E-04	-2,4E-03	-1,6E-02	1,2E-03	9,8E-04	4,3E-04	-2,0E-03
	HCIG	-3,3E-04	1,8E-03	9,9E-03	-6,3E-04	3,3E-04	-1,9E-03	6,0E-02	3,1E-03	-7,9E-05	-1,7E-03	3,3E-03	1,7E-02	-1,8E-04	1,8E-03	3,2E-03	4,0E-04	1,6E-02	-1,6E-03	3,3E-04	1,4E-03	4,6E-03	-1,7E-03	3,8E-04	-8,9E-04	-9,3E-04	3,3E-02	8,5E-03	4,0E-03	2,9E-03	4,4E-03
	GPCEG	3,5E-04	-4,6E-04	-6,3E-04	1,1E-03	6,1E-06	-1,3E-03	-4,6E-03	6,1E-06	-3,4E-04	5,2E-04	1,8E-03	-1,2E-03	1,3E-04	-7,4E-05	1,9E-03	3,3E-03	-6,4E-03	4,2E-04	-1,4E-04	-1,2E-04	3,7E-03	8,6E-05	1,5E-05	2,5E-03	4,4E-03	3,3E-02	1,8E-03	1,8E-04	-2,9E-04	3,0E-03
	XE	-4,9E-06	4,9E-05	3,3E-04	6,1E-06	1,4E-05	-1,3E-04	1,9E-03	1,0E-04	-1,1E-05	1,5E-05	1,9E-04	5,3E-04	3,6E-06	7,9E-05	1,8E-04	9,6E-05	4,0E-04	-3,7E-05	8,2E-06	4,1E-05	4,4E-05	-5,0E-05	-7,2E-06	8,3E-06	1,3E-04	2,0E-03	2,6E-04	8,8E-05	1,1E-04	3,8E-04
India	NE	-3,2E-04	4,4E-04	-1,9E-03	-1,3E-03	-1,3E-04	3,1E-03	-3,1E-02	-7,3E-04	9,2E-05	-1,4E-03	-4,2E-03	-2,9E-03	-1,8E-04	-8,5E-04	-4,9E-03	-5,1E-03	-2,9E-03	-6,4E-05	3,6E-04	-8,4E-05	-6,0E-03	4,6E-04	3,0E-04	-2,6E-03	-7,2E-03	-6,5E-02	-3,4E-03	-2,6E-04	-7,3E-04	-9,0E-03
	RGPP	-5,7E-03	-1,3E-02	6,0E-02	-4,6E-03	1,9E-03	-3,1E-02	2,3E+00	1,6E-02	3,5E-02	1,5E-02	5,1E-02	1,2E-01	-5,5E-03	2,8E-02	1,1E-01	3,5E-02	7,4E-01	-2,6E-02	-2,1E-02	2,3E-03	2,4E-01	-2,7E-02	-9,1E-03	-3,0E-02	5,0E-02	9,5E-01	1,6E-02	-4,6E-03	2,7E-02	1,5E-01
	SPT	-2,3E-05	5,3E-04	3,1E-03	6,1E-06	1,0E-04	-7,3E-04	1,6E-02	1,0E-03	-1,5E-04	-6,8E-04	1,3E-03	5,3E-03	-4,6E-05	5,0E-04	1,2E-03	7,4E-04	3,0E-03	-4,3E-04	1,2E-04	4,6E-04	2,6E-03	-5,2E-04	2,1E-04	3,3E-04	3,2E-04	1,6E-02	3,5E-03	1,6E-03	8,1E-04	1,4E-03
	AGC	-1,7E-04	-3,5E-04	-7,9E-05	-3,4E-04	-1,1E-05	9,2E-05	3,5E-02	-1,5E-04	7,6E-04	3,7E-04	-9,1E-05	2,6E-04	-1,2E-04	2,9E-04	1,0E-03	-4,6E-04	1,4E-02	-3,9E-04	-3,9E-04	-1,2E-04	2,5E-03	-3,0E-04	-2,4E-04	-1,3E-03	-3,4E-04	2,1E-03	-1,5E-03	-7,3E-04	1,9E-04	1,2E-03
	BG	7,2E-05	-8,1E-04	-1,7E-03	5,2E-04	1,5E-05	-1,4E-03	1,5E-02	-6,8E-04	3,7E-04	2,4E-03	1,5E-03	-3,3E-03	1,9E-04	3,8E-04	2,2E-03	1,6E-03	4,1E-03	3,6E-04	-4,1E-04	-4,6E-04	-1,7E-03	1,9E-04	-7,5E-04	1,3E-04	3,9E-03	1,9E-02	-3,1E-03	-2,4E-03	7,6E-06	6,1E-03
South Korea	GSC	4,4E-04	-5,1E-04	3,3E-03	1,8E-03	1,9E-04	-4,2E-03	5,1E-02	1,3E-03	-9,1E-05	1,5E-03	6,0E-03	5,5E-03	1,9E-04	1,2E-03	7,1E-03	7,2E-03	6,1E-03	-9,7E-05	-5,1E-04	2,5E-04	1,0E-02	-8,3E-04	-2,6E-04	3,8E-03	9,8E-03	9,4E-02	5,9E-03	1,0E-03	1,1E-03	1,2E-02
	SO	-6,2E-04	2,9E-03	1,7E-02	-1,2E-03	5,3E-04	-2,9E-03	1,2E-01	5,3E-03	2,6E-04	-3,3E-03	5,5E-03	2,9E-02	-4,3E-04	3,2E-03	6,0E-03	6,7E-04	3,5E-02	-3,0E-03	3,4E-04	2,4E-03	1,2E-02	-3,1E-03	7,4E-04	-1,8E-03	-2,0E-03	6,0E-02	1,5E-02	7,0E-03	4,9E-03	6,9E-03
	JSU	4,6E-05	-2,3E-05	-1,8E-04	1,3E-04	3,6E-06	-1,8E-04	-5,5E-03	-4,6E-05	-1,2E-04	1,9E-04	1,9E-04	-4,3E-04	4,5E-05	-2,0E-05	4,2E-05	3,0E-04	-2,4E-03	1,2E-04	3,2E-05	-2,8E-05	-6,6E-04	8,2E-05	-3,3E-05	2,9E-04	5,3E-04	1,8E-03	-1,5E-05	-1,1E-04	-4,3E-05	4,3E-04
	BT	-9,9E-05	9,1E-05	1,8E-03	-7,4E-05	7,9E-05	-8,5E-04	2,8E-02	5,0E-04	2,9E-04	3,8E-04	1,2E-03	3,2E-03	-2,0E-05	6,3E-04	1,7E-03	5,0E-04	8,7E-03	-3,8E-04	-1,5E-04	1,7E-04	1,4E-03	-4,3E-04	-1,9E-04	-4,7E-04	8,9E-04	1,4E-02	7,8E-04	8,9E-05	7,4E-04	3,2E-03
	HTEP	3,6E-04	-1,3E-03	3,2E-03	1,9E-03	1,8E-04	-4,9E-03	1,1E-01	1,2E-03	1,0E-03	2,2E-03	7,1E-03	6,0E-03	4,2E-05	1,7E-03	1,0E-02	8,5E-03	2,6E-02	-5,9E-04	-1,3E-03	3,4E-05	1,8E-02	-1,4E-03	-5,7E-04	3,3E-03	1,2E-02	1,2E-01	5,0E-03	2,2E-04	1,3E-03	1,6E-02
Spain	PN	9,8E-04	-1,5E-03	4,0E-04	3,3E-03	9,6E-05	-5,1E-03	3,5E-02	7,4E-04	-4,6E-04	1,6E-03	7,2E-03	6,7E-04	3,0E-04	5,0E-04	8,5E-03	1,1E-02	-4,8E-03	6,6E-04	-7,9E-04	-1,6E-04	1,8E-02	-4,7E-04	-3,6E-05	7,5E-03	1,5E-02	1,3E-01	7,4E-03	1,1E-03	-7,5E-05	1,3E-02
	RE	-3,5E-03	-3,4E-03	1,6E-02	-6,4E-03	4,0E-04	-2,9E-03	7,4E-01	3,0E-03	1,4E-02	4,1E-03	6,1E-03	3,5E-02	-2,4E-03	8,7E-03	2,6E-02	-4,8E-03	2,7E-01	-9,7E-03	-6,6E-03	3,4E-04	5,7E-02	-8,4E-03	-3,6E-03	-2,2E-02	-4,1E-03	1,3E-01	-1,1E-02	-5,8E-03	8,5E-03	3,3E-02
	CCP	1,8E-04	-1,9E-04	-1,6E-03	4,2E-04	-3,7E-05	-6,4E-05	-2,6E-02	-4,3E-04	-3,9E-04	3,6E-04	-9,7E-05	-3,0E-03	1,2E-04	-3,8E-04	-5,9E-04	6,6E-04	-9,7E-03	5,1E-04	1,0E-04	-2,0E-04	-1,9E-03	4,2E-04	-1,3E-05	1,0E-03	1,1E-03	-7,7E-04	-5,8E-04	-4,3E-04	-5,3E-04	-2,9E-04
	TE	-5,6E-06	3,9E-04	3,3E-04	-1,4E-04	8,2E-06	3,6E-04	-2,1E-02	1,2E-04	-3,9E-04	-4,1E-04	-5,1E-04	3,4E-04	3,2E-05	-1,5E-04	-1,3E-03	-7,9E-04	-6,6E-03	1,0E-04	3,0E-04	1,3E-04	-2,9E-03	1,6E-04	1,5E-04	-3,0E-05	-1,2E-03	-1,2E-02	4,4E-04	4,3E-04	-3,6E-06	-1,7E-03
	VE	-4,1E-05	3,5E-04	1,4E-03	-1,2E-04	4,1E-05	-8,4E-05	2,3E-03	4,6E-04	-1,2E-04	-4,6E-04	2,5E-04	2,4E-03	-2,8E-05	1,7E-04	3,4E-05	-1,6E-04	3,4E-04	-2,0E-04	1,3E-04	2,3E-04	2,3E-04	-1,9E-04	1,3E-04	-8,1E-05	-5,7E-04	9,8E-04	1,4E-03	7,6E-04	3,5E-04	-1,9E-04
France	GSSS	9,9E-04	-3,1E-03	4,6E-03	3,7E-03	4,4E-05	-6,0E-03	2,4E-01	2,6E-03	2,5E-03	-1,7E-03	1,0E-02	1,2E-02	-6,6E-04	1,4E-03	1,8E-02	1,8E-02	5,7E-02	-1,9E-03	-2,9E-03	2,3E-04	6,2E-02	-3,3E-03	9,5E-04	9,2E-03	1,9E-02	2,5E-01	1,7E-02	5,4E-03	5,1E-04	1,6E-02
	VR	7,5E-05	-7,7E-05	-1,7E-03	8,6E-05	-5,0E-05	4,6E-04	-2,7E-02	-5,2E-04	-3,0E-04	1,9E-04	-8,3E-04	-3,1E-03	8,2E-05	-4,3E-04	-1,4E-03	-4,7E-04	-8,4E-03	4,2E-04	1,6E-04	-1,9E-04	-3,3E-03	4,5E-04	-1,0E-05	2,5E-04	-3,6E-04	-1,3E-02	-1,4E-03	-5,5E-04	-5,3E-04	-1,6E-03
	G	4,5E-05	2,2E-04	3,8E-04	1,5E-05	-7,2E-06	3,0E-04	-9,1E-03	2,1E-04	-2,4E-04	-7,5E-04	-2,6E-04	7,4E-04	-3,3E-05	-1,9E-04	-5,7E-04	-3,6E-05	-3,6E-03	-1,3E-05	1,5E-04	1,3E-04	9,5E-04	-1,0E-05	2,8E-04	4,5E-04	-6,5E-04	-1,8E-03	1,4E-03	8,5E-04	-9,4E-05	-1,8E-03
	SPMR	8,9E-04	-6,8E-04	-8,9E-04	2,5E-03	8,3E-06	-2,6E-03	-3,0E-02	3,3E-04	-1,3E-03	1,3E-04	3,8E-03	-1,8E-03	2,9E-04	-4,7E-04	3,3E-03	7,5E-03	-2,2E-02	1,0E-03	-3,0E-05	-8,1E-05	9,2E-03	2,5E-04	4,5E-04	6,6E-03	9,2E-03	7,3E-02	6,2E-03	1,7E-03	-8,1E-04	4,4E-03
	STPPP	1,2E-03	-2,4E-03	-9,3E-04	4,4E-03	1,3E-04	-7,2E-03	5,0E-02	3,2E-04	-3,4E-04	3,9E-03	9,8E-03	-2,0E-03	5,3E-04	8,9E-04	1,2E-02	1,5E-02	-4,1E-03	1,1E-03	-1,2E-03	-5,7E-04	1,9E-02	-3,6E-04	-6,5E-04	9,2E-03	2,1E-02	1,7E-01	6,4E-03	-5,6E-04	-1,0E-04	2,0E-02
USA	AC	8,9E-03	-1,6E-02	3,3E-02	3,3E-02	2,0E-03	-6,5E-02	9,5E-01	1,6E-02	2,1E-03	1,9E-02	9,4E-02	6,0E-02	1,8E-03	1,4E-02	1,2E-01	1,3E-01	1,3E-01	-7,7E-04	-1,2E-02	9,8E-04	2,5E-01	-1,3E-02	-1,8E-03	7,3E-02	1,7E-01	1,7E+00	9,7E-02	1,7E-02	9,6E-03	1,8E-01
	CR	6,2E-04	1,2E-03	8,5E-03	1,8E-03	2,6E-04	-3,4E-03	1,6E-02	3,5E-03	-1,5E-03	-3,1E-03	5,9E-03	1,5E-02	-1,5E-05	7,8E-04	5,0E-03	7,4E-03	-1,1E-02	-5,8E-04	4,4E-04	1,4E-03	1,7E-02	-1,4E-03	1,4E-03	6,2E-03	6,4E-03	9,7E-02	1,6E-02	6,9E-03	1,5E-03	4,0E-03
	WMO	1,2E-04	9,8E-04	4,0E-03	1,8E-04	8,8E-05	-2,6E-04	-4,6E-03	1,6E-03	-7,3E-04	-2,4E-03	1,0E-03	7,0E-03	-1,1E-04	8,9E-05	2,2E-04	1,1E-03	-5,8E-03	-4,3E-04	4,3E-04	7,6E-04	5,4E-03	-5,5E-04	8,5E-04	1,7E-03	-5,6E-04	1,7E-02	6,9E-03	3,6E-03	5,9E-04	-2,2E-03
	EMP	-1,6E-04	4,3E-04	2,9E-03	-2,9E-04	1,1E-04	-7,3E-04	2,7E-02	8,1E-04	1,9E-04	7,6E-06	1,1E-03	4,9E-03	-4,3E-05	7,4E-04	1,3E-03	-7,5E-05	8,5E-03	-5,3E-04	-3,6E-06	3,5E-04	5,1E-04	-5,3E-04	-9,4E-05	-8,1E-04	-1,0E-04	9,6E-03	1,5E-03	5,9E-04	1,0E-03	2,6E-03
	BM	5,2E-04	-2,0E-03	4,4E-03	3,0E-03	3,8E-04	-9,0E-03	1,5E-01	1,4E-03	1,2E-03	6,1E-03	1,2E-02	6,9E-03	4,3E-04	3,2E-03	1,6E-02	1,3E-02	3,3E-02	-2,9E-04	-1,7E-03	-1,9E-04	1,6E-02	-1,6E-03	-1,8E-03	4,4E-03	2,0E-02	1,8E-01	4,0E-03	-2,2E-03	2,6E-03	3,0E-02

Table A.2: The variance-covariance matrix for the energy sector.

Renewable Sector

Return on Equity (yearly in %) - Renewable sector																														
	China					India					South Korea					Spain					France					USA				
	GTEG	UP	GHPP	CDCR	DSPG	SGWP	TPSO	THDC	GRGR	VISO	EDRE	GSWC	GECL	HECO	HGPC	EDRE	IRES	VBSL	SEMI	PCSA	AESAS	EDF	CFSAS	EGFS	UESA	PSE	LE	REG	HES	SPEC
2021	-19,24 %	30,59 %	1,59 %	6,70 %	-34,65 %	23,45 %	24,59 %	8,85 %	12,68 %	-15,20 %	5,39 %	12,66 %	24,43 %	0,22 %	-0,06 %	-49,43 %	1,98 %	46,72 %	0,92 %	4,94 %	-5,25 %	38,14 %	-11,76 %	5,76 %	10,88 %	3,21 %	16,96 %	12,37 %	53,52 %	3,29 %
2020	-0,75 %	33,59 %	19,94 %	5,60 %	4,98 %	10,81 %	36,01 %	11,23 %	3,43 %	9,26 %	18,42 %	11,50 %	11,67 %	13,10 %	11,69 %	23,89 %	2,48 %	83,09 %	13,70 %	0,80 %	4,77 %	14,94 %	1,20 %	6,72 %	11,44 %	3,37 %	0,98 %	10,46 %	4,04 %	4,21 %
2019	-9,46 %	20,36 %	10,97 %	7,89 %	2,41 %	252,96 %	17,73 %	9,65 %	14,60 %	5,96 %	22,73 %	11,35 %	18,38 %	5,69 %	7,04 %	12,45 %	0,70 %	103,76 %	7,22 %	3,00 %	17,97 %	-19,67 %	1,54 %	23,65 %	11,23 %	3,76 %	-53,54 %	32,91 %	12,65 %	4,14 %
2018	-0,93 %	26,11 %	22,60 %	9,33 %	0,17 %	35,43 %	19,09 %	13,56 %	31,21 %	11,35 %	26,80 %	14,26 %	21,55 %	21,00 %	14,35 %	3,93 %	1,24 %	4,15 %	11,12 %	-1,26 %	12,12 %	-140,53 %	-3,49 %	58,71 %	13,33 %	3,45 %	-7,76 %	39,67 %	12,58 %	2,19 %
2017	8,84 %	28,21 %	20,68 %	0,63 %	0,87 %	36,73 %	23,46 %	27,62 %	-3,86 %	13,23 %	48,40 %	11,00 %	19,46 %	20,68 %	7,72 %	4,68 %	3,45 %	-1,26 %	15,03 %	-0,40 %	-1,45 %	-53,53 %	2,57 %	-31,01 %	12,34 %	2,84 %	-10,71 %	10,04 %	11,10 %	3,39 %
Variance	1,1E-02	2,5E-03	7,8E-03	1,1E-03	2,7E-02	1,0E+00	5,2E-03	6,0E-03	1,8E-02	1,3E-02	2,5E-02	1,8E-04	2,3E-03	8,4E-03	3,0E-03	8,0E-02	1,2E-04	2,2E-01	3,2E-03	6,4E-04	9,1E-03	4,9E-01	3,5E-03	1,1E-01	9,8E-05	1,1E-05	6,9E-02	2,0E-02	3,9E-02	6,7E-05
Standard Deviaton	10,57 %	4,99 %	8,81 %	3,32 %	16,54 %	101,77 %	7,21 %	7,72 %	13,23 %	11,57 %	15,66 %	1,33 %	4,75 %	9,17 %	5,47 %	28,30 %	1,07 %	46,61 %	5,69 %	2,54 %	9,54 %	69,85 %	5,94 %	32,52 %	0,99 %	0,34 %	26,20 %	14,11 %	19,74 %	0,82 %

Table A.3: Return on Equity, variance and standard deviation for each firm in the renewable sector in each country.

Covariance Matrix (Renewable)																														
		China					India					South Korea					Spain					France					USA				
		GTEG	UP	GHPP	CDCR	DSPG	SGWP	TPSO	THDC	GRGR	VISO	EDRE	GSWC	GECL	HECO	HGPC	EDRE	IRES	VBSL	SEMI	PCSA	AESAS	EDF	CFSAS	EGFS	UESA	PSE	LE	REG	HES	SPEC
China	GTEG	1,1E-02	4,2E-04	8,5E-03	-2,0E-03	1,3E-02	-2,5E-02	1,1E-03	6,7E-03	-4,9E-03	1,1E-02	1,5E-02	-3,5E-04	-2,2E-03	8,9E-03	3,9E-03	2,1E-02	6,3E-04	-2,3E-02	5,8E-03	-2,4E-03	6,2E-04	-4,0E-02	4,8E-03	-9,8E-03	6,9E-04	-1,6E-04	-3,5E-03	-1,3E-03	-1,7E-02	-8,8E-05
	UP	4,2E-04	2,5E-03	2,7E-04	-5,6E-04	-2,2E-03	-4,5E-02	3,1E-03	2,1E-04	-2,7E-03	-1,2E-03	-1,7E-03	-1,2E-05	-6,7E-04	2,2E-04	-1,2E-04	-2,4E-03	3,6E-04	-4,0E-03	4,2E-04	-4,3E-05	-3,5E-03	1,4E-02	-7,7E-04	-5,8E-03	-6,8E-05	-9,2E-05	1,1E-02	-5,2E-03	1,6E-03	2,4E-05
	GHPP	8,5E-03	2,7E-04	7,8E-03	-6,0E-04	1,2E-02	-2,1E-02	9,0E-04	3,7E-03	-1,5E-04	9,6E-03	9,7E-03	6,6E-05	-2,1E-03	7,7E-03	4,4E-03	2,0E-02	2,6E-04	-1,6E-02	4,7E-03	-2,2E-03	2,5E-03	-4,3E-02	3,7E-03	3,0E-03	6,9E-04	-4,4E-05	-3,0E-03	2,4E-03	-1,5E-02	-1,7E-04
	CDCR	-2,0E-03	-5,6E-04	-6,0E-04	1,1E-03	-6,2E-04	1,0E-02	-7,4E-04	-2,1E-03	4,0E-03	-9,3E-04	-3,4E-03	3,1E-04	2,9E-04	-9,3E-04	3,4E-04	-8,1E-04	-3,3E-04	5,2E-03	-9,1E-04	1,6E-04	1,9E-03	-4,8E-03	-7,7E-04	1,0E-02	1,6E-05	9,3E-05	-1,4E-03	3,5E-03	9,8E-04	-7,4E-05
	DSPG	1,3E-02	-2,2E-03	1,2E-02	-6,2E-04	2,7E-02	4,4E-02	6,9E-04	4,3E-03	-2,0E-03	1,8E-02	1,6E-02	-5,8E-04	-5,6E-03	1,0E-02	7,5E-03	4,6E-02	9,0E-06	7,1E-03	8,0E-03	-3,1E-03	9,9E-03	-5,5E-02	9,2E-03	5,2E-03	7,6E-04	1,2E-04	-2,5E-02	6,8E-03	-3,2E-02	2,6E-04
India	SGWP	-2,5E-02	-4,5E-02	-2,1E-02	1,0E-02	4,4E-02	1,0E+00	-4,2E-02	-2,1E-02	2,0E-02	9,3E-03	1,3E-03	-4,1E-03	-9,2E-04	-3,2E-02	-5,8E-03	7,2E-02	-7,2E-03	2,8E-01	-1,3E-02	7,9E-03	7,1E-02	1,7E-02	2,0E-02	6,4E-02	-2,8E-03	2,3E-03	-2,5E-01	7,3E-02	-3,5E-02	3,4E-03
	TPSO	1,1E-03	3,1E-03	9,0E-04	-7,4E-04	6,9E-04	-4,2E-02	5,2E-03	-3,6E-04	-5,1E-03	-5,6E-05	-2,4E-03	-3,1E-04	-2,3E-03	-8,0E-05	3,6E-04	4,0E-03	4,2E-04	7,8E-03	1,2E-03	-2,8E-05	-3,1E-03	2,7E-02	3,8E-04	-8,7E-03	-2,3E-04	-6,3E-05	1,0E-02	-7,3E-03	-2,1E-03	2,7E-04
	THDC	6,7E-03	2,1E-04	3,7E-03	-2,1E-03	4,3E-03	-2,1E-02	-3,6E-04	6,0E-03	-5,4E-03	4,9E-03	1,1E-02	-3,5E-04	2,9E-06	5,0E-03	7,2E-04	4,9E-03	6,1E-04	-2,5E-02	2,9E-03	-1,2E-03	-2,4E-03	-2,0E-02	2,2E-03	-1,5E-02	3,7E-04	-2,0E-04	2,5E-04	-3,4E-03	-5,3E-03	-1,1E-04
	GRGR	-4,9E-03	-2,7E-03	-1,5E-04	4,0E-03	-2,0E-03	2,0E-02	-5,1E-03	-5,4E-03	1,8E-02	-1,4E-03	-7,5E-03	1,6E-03	2,7E-03	3,9E-05	2,2E-03	-5,2E-03	-1,1E-03	-5,5E-03	-2,6E-03	-2,7E-04	6,7E-03	-5,2E-02	-3,1E-03	4,1E-02	5,5E-04	2,6E-04	-3,4E-03	1,6E-02	3,4E-03	-7,0E-04
	VISO	1,1E-02	-1,2E-03	9,6E-03	-9,3E-04	1,8E-02	9,3E-03	-5,6E-05	4,9E-03	-1,4E-03	1,3E-02	1,4E-02	-2,5E-04	-3,0E-03	9,1E-03	5,4E-03	2,9E-02	2,1E-04	-1,1E-02	6,1E-03	-2,6E-03	5,3E-03	-5,2E-02	6,1E-03	1,4E-03	7,6E-04	-4,8E-06	-1,3E-02	4,2E-03	-2,2E-02	-3,4E-05
South Korea	EDRE	1,5E-02	-1,7E-03	9,7E-03	-3,4E-03	1,6E-02	1,3E-03	-2,4E-03	1,1E-02	-7,5E-03	1,4E-02	2,5E-02	-6,7E-04	-1,0E-03	1,1E-02	3,5E-03	2,2E-02	8,2E-04	-3,9E-02	7,0E-03	-2,9E-03	9,2E-04	-6,0E-02	6,7E-03	-2,0E-02	9,3E-04	-2,5E-04	-1,3E-02	-2,7E-04	-1,9E-02	-1,8E-04
	GSWC	-3,5E-04	-1,2E-05	6,6E-05	3,1E-04	-5,8E-04	-4,1E-03	-3,1E-04	-3,5E-04	1,6E-03	-2,5E-04	-6,7E-04	1,8E-04	3,2E-04	1,8E-04	2,0E-04	-1,2E-03	-6,4E-05	-2,6E-03	-2,1E-04	-6,6E-05	1,8E-04	-5,2E-03	-4,6E-04	3,5E-03	7,1E-05	9,3E-06	1,2E-03	1,1E-03	7,0E-04	-9,3E-05
	GECL	-2,2E-03	-6,7E-04	-2,1E-03	2,9E-04	-5,6E-03	-9,2E-04	-2,3E-03	2,9E-06	2,7E-03	-3,0E-03	-1,0E-03	3,2E-04	2,3E-03	-1,0E-03	-1,4E-03	-1,1E-02	-1,0E-04	-1,1E-02	-1,7E-03	3,8E-04	-1,2E-03	-6,4E-03	-2,0E-03	2,4E-03	5,3E-05	-3,0E-05	2,5E-03	1,6E-03	7,0E-03	-2,5E-04
	HECO	8,9E-03	2,2E-04	7,7E-03	-9,3E-04	1,0E-02	-3,2E-02	-8,0E-05	5,0E-03	3,9E-05	9,1E-03	1,1E-02	1,8E-04	-1,0E-03	8,4E-03	4,0E-03	1,5E-02	3,7E-04	-2,8E-02	4,6E-03	-2,3E-03	1,2E-03	-5,0E-02	3,1E-03	1,0E-03	8,1E-04	-1,1E-04	-4,1E-04	2,2E-03	-1,3E-02	-3,4E-04
	HGPC	3,9E-03	-1,2E-04	4,4E-03	3,4E-04	7,5E-03	-5,8E-03	3,6E-04	7,2E-04	2,2E-03	5,4E-03	3,5E-03	2,0E-04	-1,4E-03	4,0E-03	3,0E-03	1,2E-02	-5,1E-05	-4,4E-03	2,4E-03	-1,2E-03	2,9E-03	-2,7E-02	1,9E-03	8,2E-03	4,0E-04	4,0E-05	-3,0E-03	3,5E-03	-9,1E-03	-1,1E-04
Spain	EDRE	2,1E-02	-2,4E-03	2,0E-02	-8,1E-04	4,6E-02	7,2E-02	4,0E-03	4,9E-03	-5,2E-03	2,9E-02	2,2E-02	-1,2E-03	-1,1E-02	1,5E-02	1,2E-02	8,0E-02	2,2E-07	3,0E-02	1,3E-02	-4,7E-03	1,7E-02	-6,8E-02	1,5E-02	7,8E-03	9,6E-04	2,7E-04	-4,0E-02	8,6E-03	-5,5E-02	7,4E-04
	IRES	6,3E-04	3,6E-04	2,6E-04	-3,3E-04	9,0E-06	-7,2E-03	4,2E-04	6,1E-04	-1,1E-03	2,1E-04	8,2E-04	-6,4E-05	-1,0E-04	3,7E-04	-5,1E-05	2,2E-07	1,2E-04	-2,3E-03	3,0E-04	-7,6E-05	-7,9E-04	1,4E-03	1,2E-04	-2,9E-03	5,3E-06	-3,3E-05	1,5E-03	-1,3E-03	-1,6E-04	8,6E-06
	VBSL	-2,3E-02	-4,0E-03	-1,6E-02	5,2E-03	7,1E-03	2,8E-01	7,8E-03	-2,5E-02	-5,5E-03	-1,1E-02	-3,9E-02	-2,6E-03	-1,1E-02	-2,8E-02	-4,4E-03	3,0E-02	-2,3E-03	2,2E-01	-7,8E-03	6,7E-03	1,8E-02	2,0E-01	4,1E-03	1,4E-02	-3,4E-03	1,1E-03	-5,4E-02	6,6E-04	-6,3E-03	3,1E-03
	SEMI	5,8E-03	4,2E-04	4,7E-03	-9,1E-04	8,0E-03	-1,3E-02	1,2E-03	2,9E-03	-2,6E-03	6,1E-03	7,0E-03	-2,1E-04	-1,7E-03	4,6E-03	2,4E-03	1,3E-02	3,0E-04	-7,8E-03	3,2E-03	-1,3E-03	8,2E-04	-1,8E-02	2,8E-03	-3,9E-03	3,3E-04	-5,6E-05	-2,1E-03	-6,9E-04	-1,0E-02	1,6E-05
	PCSA	-2,4E-03	-4,3E-05	-2,2E-03	1,6E-04	-3,1E-03	7,9E-03	-2,8E-05	-1,2E-03	-2,7E-04	-2,6E-03	-2,9E-03	-6,6E-05	3,8E-04	-2,3E-03	-1,2E-03	-4,7E-03	-7,6E-05	6,7E-03	-1,3E-03	6,4E-04	-5,7E-04	1,4E-02	-8,8E-04	-1,2E-03	-2,2E-04	2,0E-05	3,7E-04	-8,8E-04	3,8E-03	8,9E-05
France	AESAS	6,2E-04	-3,5E-03	2,5E-03	1,9E-03	9,9E-03	7,1E-02	-3,1E-03	-2,4E-03	6,7E-03	5,3E-03	9,2E-04	1,8E-04	-1,2E-03	1,2E-03	2,9E-03	1,7E-02	-7,9E-04	1,8E-02	8,2E-04	-5,7E-04	9,1E-03	-3,0E-02	2,6E-03	2,1E-02	2,3E-04	2,7E-04	-2,1E-02	1,1E-02	-1,1E-02	4,7E-05
	EDF	-4,0E-02	1,4E-02	-4,3E-02	-4,8E-03	-5,5E-02	1,7E-02	2,7E-02	-2,0E-02	-5,2E-02	-5,2E-02	-6,0E-02	-5,2E-03	-6,4E-03	-5,0E-02	-2,7E-02	-6,8E-02	1,4E-03	2,0E-01	-1,8E-02	1,4E-02	-3,0E-02	4,9E-01	-1,1E-02	-1,2E-01	-6,6E-03	-8,4E-05	4,1E-02	-6,9E-02	6,3E-02	4,3E-03
	CFSAS	4,8E-03	-7,7E-04	3,7E-03	-7,7E-04	9,2E-03	2,0E-02	3,8E-04	2,2E-03	-3,1E-03	6,1E-03	6,7E-03	-4,6E-04	-2,0E-03	3,1E-03	1,9E-03	1,5E-02	1,2E-04	4,1E-03	2,8E-03	-8,8E-04	2,6E-03	-1,1E-02	3,5E-03	-4,5E-03	1,5E-04	1,2E-05	-9,7E-03	3,7E-04	-1,1E-02	2,0E-04
	EGFS	-9,8E-03	-5,8E-03	3,0E-03	1,0E-02	5,2E-03	6,4E-02	-8,7E-03	-1,5E-02	4,1E-02	1,4E-03	-2,0E-02	3,5E-03	2,4E-03	1,0E-03	8,2E-03	7,8E-03	-2,9E-03	1,4E-02	-3,9E-03	-1,2E-03	2,1E-02	-1,2E-01	-4,5E-03	1,1E-01	1,2E-03	8,0E-04	-1,5E-02	4,0E-02	-4,2E-03	-1,3E-03
	UESA	6,9E-04	-6,8E-05	6,9E-04	1,6E-05	7,6E-04	-2,8E-03	-2,3E-04	3,7E-04	5,5E-04	7,6E-04	9,3E-04	7,1E-05	5,3E-05	8,1E-04	4,0E-04	9,6E-04	5,3E-06	-3,4E-03	3,3E-04	-2,2E-04	2,3E-04	-6,6E-03	1,5E-04	1,2E-03	9,8E-05	-5,8E-06	-1,3E-05	6,9E-04	-9,2E-04	-6,2E-05
USA	PSE	-1,6E-04	-9,2E-05	-4,4E-05	9,3E-05	1,2E-04	2,3E-03	-6,3E-05	-2,0E-04	2,6E-04	-4,8E-06	-2,5E-04	9,3E-06	-3,0E-05	-1,1E-04	4,0E-05	2,7E-04	-3,3E-05	1,1E-03	-5,6E-05	2,0E-05	2,7E-04	-8,4E-05	1,2E-05	8,0E-04	-5,8E-06	1,1E-05	-5,2E-04	3,3E-04	-1,1E-04	5,8E-06
	LE	-3,5E-03	1,1E-02	-3,0E-03	-1,4E-03	-2,5E-02	-2,5E-01	1,0E-02	2,5E-04	-3,4E-03	-1,3E-02	-1,3E-02	1,2E-03	2,5E-03	-4,1E-04	-3,0E-03	-4,0E-02	1,5E-03	-5,4E-02	-2,1E-03	3,7E-04	-2,1E-02	4,1E-02	-9,7E-03	-1,5E-02	-1,3E-05	-5,2E-04	6,9E-02	-2,0E-02	2,6E-02	-7,2E-04
	REG	-1,3E-03	-5,2E-03	2,4E-03	3,5E-03	6,8E-03	7,3E-02	-7,3E-03	-3,4E-03	1,6E-02	4,2E-03	-2,7E-04	1,1E-03	1,6E-03	2,2E-03	3,5E-03	8,6E-03	-1,3E-03	6,6E-04	-6,9E-04	-8,8E-04	1,1E-02	-6,9E-02	3,7E-04	4,0E-02	6,9E-04	3,3E-04	-2,0E-02	2,0E-02	-6,2E-03	-5,3E-04
	HES	-1,7E-02	1,6E-03	-1,5E-02	9,8E-04	-3,2E-02	-3,5E-02	-2,1E-03	-5,3E-03	3,4E-03	-2,2E-02	-1,9E-02	7,0E-04	7,0E-03	-1,3E-02	-9,1E-03	-5,5E-02	-1,6E-04	-6,3E-03	-1,0E-02	3,8E-03	-1,1E-02	6,3E-02	-1,1E-02	-4,2E-03	-9,2E-04	-1,1E-04	2,6E-02	-6,2E-03	3,9E-02	-3,2E-04
	SPEC	-8,8E-05	2,4E-05	-1,7E-04	-7,4E-05	2,6E-04	3,4E-03	2,7E-04	-1,1E-04	-7,0E-04	-3,4E-05	-1,8E-04	-9,3E-05	-2,5E-04	-3,4E-04	-1,1E-04	7,4E-04	8,6E-06	3,1E-03	1,6E-05	8,9E-05	4,7E-05	4,3E-03	2,0E-04	-1,3E-03	-6,2E-05	5,8E-06	-7,2E-04	-5,3E-04	-3,2E-04	6,7E-05

Table A.4: The variance-covariance matrix for the renewable sector.

Telecom Sector

Return on Equity (yearly in %) - Telecom sector																										
	India					South Korea					Spain					France					USA					
	RJIL	BHLT	ATC	BTL	TNL	YTCL	KTSA	SKTC	KTSN	STCL	VESA	TDES	TMES	TSIC	TGSS	BTSA	EUSA	SCSA	SFSA	ILSA	HSSC	CBIN	INCO	BWCO	ACSG
2021	6,58 %	-69,68 %	5,20 %	-53,26 %	37,82 %	15,98 %	10,32 %	6,71 %	98,43 %	52,83 %	-29,21 %	-1,01 %	130,01 %	0,60 %	-26,14 %	5,11 %	18,71 %	21,09 %	33,04 %	11,93 %	5,51 %	-6,42 %	-192,80 %	-15,26 %	3,51 %
2020	3,65 %	-227,40 %	5,82 %	-50,72 %	82,12 %	6,27 %	7,19 %	12,64 %	26,53 %	27,53 %	-21,88 %	34,13 %	169,67 %	75,58 %	-19,11 %	8,63 %	21,02 %	26,26 %	43,11 %	9,28 %	-0,12 %	-29,09 %	-399,86 %	-21,76 %	-0,70 %
2019	-25,04 %	-10,45 %	19,81 %	-30,58 %	19,11 %	6,81 %	9,21 %	1,47 %	500,00 %	67,93 %	-36,13 %	2,46 %	50,43 %	12,02 %	-36,89 %	7,81 %	25,52 %	15,57 %	70,48 %	11,19 %	-4,73 %	-47,57 %	-107,71 %	-11,14 %	2,80 %
2018	10,40 %	-2,98 %	1,98 %	-5,00 %	37,93 %	9,18 %	3,06 %	9,96 %	13,89 %	97,75 %	-7,39 %	30,87 %	51,05 %	41,19 %	-15,25 %	8,45 %	20,80 %	12,11 %	12,73 %	46,91 %	-0,51 %	-93,07 %	-22,37 %	0,21 %	4,91 %
2017	2,47 %	13,69 %	6,66 %	-2,37 %	69,83 %	3,45 %	16,10 %	8,78 %	59,69 %	60,07 %	-2,13 %	34,51 %	38,81 %	86,86 %	-10,78 %	5,45 %	18,40 %	7,83 %	1,52 %	9,66 %	-0,32 %	-39,69 %	-102,74 %	-22,31 %	-1,55 %
Variance	2,0E-02	9,8E-01	4,7E-03	5,9E-02	6,7E-02	2,2E-03	2,3E-03	1,8E-03	4,2E+00	6,5E-02	2,1E-02	3,2E-02	3,4E-01	1,4E-01	1,0E-02	2,8E-04	8,1E-04	5,3E-03	7,3E-02	2,7E-02	1,3E-03	1,0E-01	2,1E+00	8,5E-03	7,8E-04
Standard Deviaton	14,12 %	99,06 %	6,89 %	24,22 %	25,84 %	4,73 %	4,76 %	4,19 %	204,06 %	25,43 %	14,36 %	17,87 %	58,38 %	37,90 %	10,22 %	1,69 %	2,85 %	7,27 %	26,95 %	16,31 %	3,64 %	31,90 %	144,42 %	9,23 %	2,79 %

Table A.5: Return on Equity, variance and standard deviation for each firm in the telecom sector in each country.

Covariance Matrix (Telecom sector)																										
		India					South Korea					Spain					France					USA				
		RJIL	BHLT	ATC	BTL	TNL	YTCL	KTSA	SKTC	KTSN	STCL	VESA	TDES	TMES	TSIC	TGSS	BTSA	EUSA	SCSA	SFSA	ILSA	HSSC	CBIN	INCO	BWCO	ACSG
India	RJIL	2,0E-02	-2,8E-02	-9,7E-03	2,9E-03	1,8E-02	1,9E-03	-1,2E-03	4,9E-03	-2,8E-01	7,7E-04	1,3E-02	1,3E-02	2,5E-02	1,8E-02	1,1E-02	-3,9E-04	-3,4E-03	5,6E-04	-3,0E-02	9,5E-03	3,7E-03	-2,7E-03	-2,1E-02	4,8E-04	2,6E-05
	BHLT	-2,8E-02	9,8E-01	1,3E-02	1,8E-01	-1,5E-01	-2,9E-03	1,2E-02	-2,3E-02	6,0E-01	2,0E-01	4,1E-02	-3,4E-02	-5,4E-01	-8,6E-02	7,6E-04	-6,2E-03	1,0E-03	-6,5E-02	-8,3E-02	5,5E-02	-8,0E-03	-1,4E-01	1,4E+00	4,1E-02	9,6E-03
	ATC	-9,7E-03	1,3E-02	4,7E-03	-2,1E-03	-8,9E-03	-8,4E-04	7,3E-04	-2,4E-03	1,4E-01	-1,1E-03	-6,5E-03	-6,6E-03	-1,1E-02	-9,2E-03	-5,7E-03	1,2E-04	1,6E-03	-1,8E-04	1,5E-02	-5,2E-03	-1,7E-03	2,8E-03	8,1E-03	-5,1E-04	-4,2E-05
	BTL	2,9E-03	1,8E-01	-2,1E-03	5,9E-02	-2,8E-03	-6,2E-03	1,3E-03	2,3E-04	-5,7E-02	4,4E-02	2,7E-02	2,2E-02	-1,2E-01	3,7E-02	1,3E-02	5,8E-05	-6,5E-04	-1,6E-02	-4,0E-02	2,0E-02	-3,6E-03	-5,7E-02	2,7E-01	7,9E-03	-7,9E-05
	TNL	1,8E-02	-1,5E-01	-8,9E-03	-2,8E-03	6,7E-02	-5,5E-03	3,3E-03	8,9E-03	-3,6E-01	-4,1E-02	1,9E-02	3,5E-02	6,9E-02	8,5E-02	1,9E-02	5,8E-05	-4,0E-03	4,2E-03	-3,0E-02	-1,3E-02	1,9E-03	2,0E-02	-2,4E-01	-1,6E-02	-5,9E-03
South Korea	YTCL	1,9E-03	-2,9E-03	-8,4E-04	-6,2E-03	-5,5E-03	2,2E-03	-6,5E-04	-2,9E-04	-8,7E-03	7,9E-04	-3,0E-03	-5,6E-03	1,0E-02	-1,4E-02	-1,6E-03	-2,6E-04	-3,0E-04	1,4E-03	1,5E-03	1,2E-03	1,3E-03	5,0E-03	3,4E-05	1,4E-03	8,9E-04
	KTSA	-1,2E-03	1,2E-02	7,3E-04	1,3E-03	3,3E-03	-6,5E-04	2,3E-03	-4,4E-04	1,0E-02	-4,3E-03	9,8E-04	-4,6E-04	-5,7E-03	5,0E-03	6,4E-04	-6,2E-04	-4,8E-04	-1,2E-03	-2,8E-03	-5,6E-03	1,8E-04	8,6E-03	-1,4E-04	-3,3E-03	-8,8E-04
	SKTC	4,9E-03	-2,3E-02	-2,4E-03	2,3E-04	8,9E-03	-2,9E-04	-4,4E-04	1,8E-03	-7,8E-02	-3,0E-03	3,7E-03	6,0E-03	1,1E-02	1,1E-02	3,5E-03	1,6E-04	-7,2E-04	7,5E-04	-6,6E-03	1,5E-03	5,5E-04	-1,2E-03	-2,7E-02	-7,9E-04	-4,2E-04
	KTSN	-2,8E-01	6,0E-01	1,4E-01	-5,7E-02	-3,6E-01	-8,7E-03	1,0E-02	-7,8E-02	4,2E+00	5,2E-02	-2,1E-01	-2,4E-01	-4,0E-01	-4,1E-01	-1,8E-01	3,2E-03	4,9E-02	-9,6E-03	4,4E-01	-1,0E-01	-4,6E-02	3,3E-02	6,4E-01	2,1E-02	1,1E-02
	STCL	7,7E-04	2,0E-01	-1,1E-03	4,4E-02	-4,1E-02	7,9E-04	-4,3E-03	-3,0E-03	5,2E-02	6,5E-02	1,2E-02	-9,2E-04	-1,2E-01	-2,7E-02	1,8E-03	5,3E-04	1,1E-03	-1,3E-02	-2,0E-02	3,4E-02	-2,3E-03	-6,6E-02	3,4E-01	2,0E-02	4,9E-03
Spain	VESA	1,3E-02	4,1E-02	-6,5E-03	2,7E-02	1,9E-02	-3,0E-03	9,8E-04	3,7E-03	-2,1E-01	1,2E-02	2,1E-02	2,1E-02	-3,2E-02	4,0E-02	1,4E-02	-2,1E-04	-2,5E-03	-6,4E-03	-3,6E-02	1,0E-02	3,4E-04	-2,2E-02	6,7E-02	2,8E-04	-1,2E-03
	TDES	1,3E-02	-3,4E-02	-6,6E-03	2,2E-02	3,5E-02	-5,6E-03	-4,6E-04	6,0E-03	-2,4E-01	-9,2E-04	2,1E-02	3,2E-02	-4,6E-03	6,3E-02	1,6E-02	1,0E-03	-1,8E-03	-2,9E-03	-3,0E-02	7,9E-03	-1,1E-03	-2,5E-02	-3,2E-02	-2,5E-03	-2,6E-03
	TMES	2,5E-02	-5,4E-01	-1,1E-02	-1,2E-01	6,9E-02	1,0E-02	-5,7E-03	1,1E-02	-4,0E-01	-1,2E-01	-3,2E-02	-4,6E-03	3,4E-01	-1,2E-03	-4,5E-03	1,2E-03	-3,2E-03	4,0E-02	4,3E-02	-3,4E-02	1,1E-02	1,1E-01	-7,7E-01	-2,3E-02	-3,0E-03
	TSIC	1,8E-02	-8,6E-02	-9,2E-03	3,7E-02	8,5E-02	-1,4E-02	5,0E-03	1,1E-02	-4,1E-01	-2,7E-02	4,0E-02	6,3E-02	-1,2E-03	1,4E-01	3,0E-02	9,3E-04	-3,9E-03	-5,5E-03	-5,4E-02	-5,8E-03	-2,6E-03	-1,8E-02	-1,4E-01	-1,7E-02	-8,4E-03
	TGSS	1,1E-02	7,6E-04	-5,7E-03	1,3E-02	1,9E-02	-1,6E-03	6,4E-04	3,5E-03	-1,8E-01	1,8E-03	1,4E-02	1,6E-02	-4,5E-03	3,0E-02	1,0E-02	-1,8E-04	-2,2E-03	-2,6E-03	-2,5E-02	5,1E-03	1,0E-03	-8,6E-03	6,2E-03	-1,4E-03	-1,1E-03
France	BTSA	-3,9E-04	-6,2E-03	1,2E-04	5,8E-05	5,8E-05	-2,6E-04	-6,2E-04	1,6E-04	3,2E-03	5,3E-04	-2,1E-04	1,0E-03	1,2E-03	9,3E-04	-1,8E-04	2,8E-04	3,0E-04	3,4E-04	1,7E-03	1,2E-03	-3,7E-04	-3,2E-03	-4,4E-03	6,4E-04	8,1E-05
	EUSA	-3,4E-03	1,0E-03	1,6E-03	-6,5E-04	-4,0E-03	-3,0E-04	-4,8E-04	-7,2E-04	4,9E-02	1,1E-03	-2,5E-03	-1,8E-03	-3,2E-03	-3,9E-03	-2,2E-03	3,0E-04	8,1E-04	2,2E-04	6,4E-03	-3,0E-05	-8,3E-04	-2,6E-03	3,2E-03	8,6E-04	2,2E-04
	SCSA	5,6E-04	-6,5E-02	-1,8E-04	-1,6E-02	4,2E-03	1,4E-03	-1,2E-03	7,5E-04	-9,6E-03	-1,3E-02	-6,4E-03	-2,9E-03	4,0E-02	-5,5E-03	-2,6E-03	3,4E-04	2,2E-04	5,3E-03	1,1E-02	-4,0E-03	8,4E-04	1,2E-02	-9,1E-02	-1,9E-03	-5,3E-05
	SFSA	-3,0E-02	-8,3E-02	1,5E-02	-4,0E-02	-3,0E-02	1,5E-03	-2,8E-03	-6,6E-03	4,4E-01	-2,0E-02	-3,6E-02	-3,0E-02	4,3E-02	-5,4E-02	-2,5E-02	1,7E-03	6,4E-03	1,1E-02	7,3E-02	-1,7E-02	-4,0E-03	2,2E-02	-1,3E-01	4,4E-05	1,4E-03
	ILSA	9,5E-03	5,5E-02	-5,2E-03	2,0E-02	-1,3E-02	1,2E-03	-5,6E-03	1,5E-03	-1,0E-01	3,4E-02	1,0E-02	7,9E-03	-3,4E-02	-5,8E-03	5,1E-03	1,2E-03	-3,0E-05	-4,0E-03	-1,7E-02	2,7E-02	-3,0E-04	-4,5E-02	1,4E-01	1,3E-02	3,1E-03
USA	HSSC	3,7E-03	-8,0E-03	-1,7E-03	-3,6E-03	1,9E-03	1,3E-03	1,8E-04	5,5E-04	-4,6E-02	-2,3E-03	3,4E-04	-1,1E-03	1,1E-02	-2,6E-03	1,0E-03	-3,7E-04	-8,3E-04	8,4E-04	-4,0E-03	-3,0E-04	1,3E-03	6,1E-03	-1,2E-02	-6,0E-04	1,1E-04
	CBIN	-2,7E-03	-1,4E-01	2,8E-03	-5,7E-02	2,0E-02	5,0E-03	8,6E-03	-1,2E-03	3,3E-02	-6,6E-02	-2,2E-02	-2,5E-02	1,1E-01	-1,8E-02	-8,6E-03	-3,2E-03	-2,6E-03	1,2E-02	2,2E-02	-4,5E-02	6,1E-03	1,0E-01	-2,9E-01	-2,3E-02	-3,6E-03
	INCO	-2,1E-02	1,4E+00	8,1E-03	2,7E-01	-2,4E-01	3,4E-05	-1,4E-04	-2,7E-02	6,4E-01	3,4E-01	6,7E-02	-3,2E-02	-7,7E-01	-1,4E-01	6,2E-03	-4,4E-03	3,2E-03	-9,1E-02	-1,3E-01	1,4E-01	-1,2E-02	-2,9E-01	2,1E+00	8,8E-02	2,1E-02
	BWCO	4,8E-04	4,1E-02	-5,1E-04	7,9E-03	-1,6E-02	1,4E-03	-3,3E-03	-7,9E-04	2,1E-02	2,0E-02	2,8E-04	-2,5E-03	-2,3E-02	-1,7E-02	-1,4E-03	6,4E-04	8,6E-04	-1,9E-03	4,4E-05	1,3E-02	-6,0E-04	-2,3E-02	8,8E-02	8,5E-03	2,3E-03
	ACSG	2,6E-05	9,6E-03	-4,2E-05	-7,9E-05	-5,9E-03	8,9E-04	-8,8E-04	-4,2E-04	1,1E-02	4,9E-03	-1,2E-03	-2,6E-03	-3,0E-03	-8,4E-03	-1,1E-03	8,1E-05	2,2E-04	-5,3E-05	1,4E-03	3,1E-03	1,1E-04	-3,6E-03	2,1E-02	2,3E-03	7,8E-04

Table A.6: The variance-covariance matrix for the telecom sector.

Transport Sector

Return on Equity (yearly in %) - Transport sector																																						
	China					India					South Korea						Spain							France							USA								
	HPEG	GCIG	GRBCD	GPHC	GPF	LTMR	EP	DIA	GHYA	BIA	IB	SCH	NDBE	SNH	GSH	TBCCGC	ATMACGC	AAEU	RMSME	D	C	SAPN	APPR	S	A	BNSF	GPTC	TRIP	CA	SBE
2021	0,61 %	1,88 %	0,77 %	10,37 %	1,42 %	-28,35 %	-27,46 %	0,76 %	-7,53 %	-10,84 %	-14,02 %	-7,38 %	-105,22 %	25,89 %	25,39 %	20,03 %	-9,80 %	13,95 %	-131,28 %	34,64 %	79,21 %	28,47 %	-670,19 %	71,56 %	53,62 %	12,68 %	-18,67 %	-4,08 %	-8,27 %	-2,53 %
2020	0,51 %	1,77 %	1,15 %	5,32 %	1,65 %	-37,30 %	-28,85 %	-12,24 %	-10,30 %	4,04 %	-12,20 %	11,47 %	36,84 %	22,76 %	22,03 %	12,09 %	12,28 %	8,80 %	-34,39 %	-26,91 %	60,87 %	14,26 %	-172,16 %	51,39 %	36,21 %	11,11 %	-22,30 %	-14,20 %	-10,66 %	3,02 %
2019	0,29 %	4,52 %	1,70 %	5,98 %	0,43 %	-31,50 %	-16,19 %	0,51 %	37,00 %	10,95 %	16,15 %	-15,74 %	-6,26 %	25,05 %	20,29 %	32,31 %	8,92 %	6,99 %	2,39 %	54,35 %	66,04 %	26,67 %	-125,40 %	56,78 %	99,09 %	12,46 %	-28,97 %	-5,37 %	-10,86 %	5,09 %
2018	0,25 %	2,39 %	0,64 %	8,40 %	0,30 %	-5,88 %	-36,56 %	-4,07 %	59,03 %	28,57 %	1,80 %	7,08 %	-14,36 %	39,54 %	22,54 %	28,14 %	9,89 %	61,06 %	-15,09 %	29,37 %	69,25 %	26,36 %	-139,46 %	67,71 %	102,10 %	11,94 %	-44,16 %	-0,39 %	-11,82 %	4,91 %
2017	0,50 %	4,94 %	0,41 %	7,40 %	1,06 %	0,20 %	7,34 %	1,35 %	77,92 %	26,56 %	-14,24 %	-20,48 %	14,35 %	20,14 %	18,79 %	23,36 %	9,25 %	6,60 %	-9,01 %	32,06 %	55,86 %	23,46 %	-94,61 %	67,68 %	92,26 %	43,61 %	-70,93 %	-0,15 %	-13,27 %	2,38 %
Variance	2,3E-06	2,3E-04	2,5E-05	4,0E-04	3,5E-05	2,8E-02	2,9E-02	3,3E-03	1,6E-01	2,7E-02	1,8E-02	1,9E-02	2,9E-01	5,7E-03	6,2E-04	6,0E-03	8,1E-03	5,5E-02	2,9E-01	9,3E-02	7,8E-03	3,2E-03	5,9E+00	7,3E-03	8,9E-02	2,0E-02	4,5E-02	3,3E-03	3,4E-04	9,5E-04
Standard Deviaton	0,15 %	1,51 %	0,50 %	2,01 %	0,59 %	16,64 %	17,10 %	5,74 %	39,41 %	16,37 %	13,33 %	13,95 %	54,23 %	7,53 %	2,49 %	7,76 %	8,99 %	23,43 %	54,11 %	30,49 %	8,86 %	5,65 %	241,89 %	8,52 %	29,84 %	14,13 %	21,33 %	5,71 %	1,83 %	3,09 %

Table A.7: Return on Equity, variance and standard deviation for each firm in the transport sector in each country.

		Covariance Matrix (Transport sector)																															
		China					India					South Korea					Spain					France					USA							
		HPEG	GCIG	GRBCD	GPHC	GPF	LTMR	EP	DIA	GHYA	BIA	IB	SCH	NDBE	SNH	GSH	TBCCGC	ATMACG	AAEU	RMSME	D	C	SAPN	APPR	S	A	BNSF	GPTC	TRIP	CA	SBE		
China	HPEG	2,3E-06	-6,5E-06	-2,6E-06	9,7E-06	8,3E-06	-5,7E-05	5,9E-05	-9,5E-07	-3,1E-04	-1,6E-04	-1,7E-04	-2,2E-05	-2,8E-04	-7,4E-05	1,3E-05	-8,9E-05	-8,0E-05	-2,1E-04	-6,0E-04	-1,7E-04	1,6E-05	-2,0E-05	-2,4E-03	2,5E-05	-3,4E-04	5,5E-05	5,3E-05	-2,4E-05	1,2E-05	-4,1E-05		
	GCIG	-6,5E-06	2,3E-04	6,0E-06	-9,0E-05	-3,9E-05	1,1E-03	2,2E-03	5,4E-04	4,4E-03	1,3E-03	7,2E-04	-1,8E-03	2,7E-03	-4,3E-04	-3,2E-04	7,1E-04	4,6E-04	-1,2E-03	5,1E-03	2,7E-03	-7,5E-04	2,1E-04	2,0E-02	3,6E-05	3,1E-03	1,5E-03	-2,2E-03	4,1E-04	-1,8E-04	1,8E-04		
	GRBCD	-2,6E-06	6,0E-06	2,5E-05	-5,8E-05	-5,0E-06	-6,5E-04	-1,8E-04	-4,7E-05	-7,7E-04	-2,8E-04	4,8E-04	7,8E-06	4,3E-04	-5,6E-05	-8,3E-06	9,0E-05	8,4E-05	-4,1E-04	6,3E-04	1,2E-04	2,8E-05	-3,0E-05	1,7E-03	-3,1E-04	-8,1E-05	-4,1E-04	6,5E-04	-1,6E-04	2,9E-05	5,7E-05		
	GPHC	9,7E-06	-9,0E-05	-5,8E-05	4,0E-04	4,9E-07	1,0E-03	-6,4E-04	6,0E-04	-2,3E-04	-8,3E-04	-8,8E-04	-3,5E-04	-9,7E-03	5,2E-04	3,3E-04	1,4E-04	-1,5E-03	1,6E-03	-8,0E-03	2,5E-03	1,3E-03	8,0E-04	-3,7E-02	1,6E-03	2,3E-04	3,9E-06	1,3E-04	6,7E-04	1,6E-04	-4,3E-04		
	GPF	8,3E-06	-3,9E-05	-5,0E-06	4,9E-07	3,5E-05	-4,2E-04	5,7E-05	-1,3E-04	-1,6E-03	-6,2E-04	-6,5E-04	1,6E-04	-1,9E-04	-2,8E-04	4,5E-05	-4,3E-04	-1,7E-04	-8,0E-04	-1,8E-03	-1,2E-03	-1,8E-05	-1,9E-04	-6,6E-03	-8,5E-05	-1,6E-03	6,0E-05	3,9E-04	-2,1E-04	4,3E-05	-1,2E-04		
India	LTMR	-5,7E-05	1,1E-03	-6,5E-04	1,0E-03	-4,2E-04	2,8E-02	1,2E-02	4,0E-03	5,8E-02	2,2E-02	-3,3E-03	-7,1E-03	9,0E-03	3,6E-03	-1,7E-03	4,7E-03	2,8E-03	1,8E-02	2,9E-02	1,7E-02	-4,5E-03	3,1E-03	1,4E-01	9,0E-03	3,3E-02	1,7E-02	-3,2E-02	8,0E-03	-2,2E-03	8,8E-04		
	EP	5,9E-05	2,2E-03	-1,8E-04	-6,4E-04	5,7E-05	1,2E-02	2,9E-02	5,1E-03	3,7E-02	9,0E-03	-3,8E-03	-2,0E-02	2,6E-02	-8,9E-03	-3,2E-03	2,0E-03	2,5E-03	-2,4E-02	3,1E-02	1,5E-02	-9,6E-03	2,2E-04	1,3E-01	1,6E-03	1,6E-02	2,2E-02	-2,6E-02	3,2E-03	-1,8E-03	-5,4E-06		
	DIA	-9,5E-07	5,4E-04	-4,7E-05	6,0E-04	-1,3E-04	4,0E-03	5,1E-03	3,3E-03	1,1E-02	7,4E-04	1,5E-03	-7,0E-03	-1,7E-02	-3,7E-04	-2,0E-04	3,0E-03	-2,4E-03	-1,7E-03	-3,5E-03	1,6E-02	1,2E-03	2,8E-03	-3,3E-02	3,3E-03	1,0E-02	3,5E-03	-4,5E-03	2,6E-03	-3,5E-05	-4,5E-04		
	GHYA	-3,1E-04	4,4E-03	-7,7E-04	-2,3E-04	-1,6E-03	5,8E-02	3,7E-02	1,1E-02	1,6E-01	5,9E-02	1,3E-02	-2,6E-02	7,0E-02	5,9E-03	-6,9E-03	2,0E-02	1,6E-02	2,8E-02	1,4E-01	6,0E-02	-1,7E-02	7,2E-03	6,0E-01	1,2E-02	1,0E-01	3,7E-02	-7,6E-02	1,7E-02	-6,2E-03	6,2E-03		
	BIA	-1,6E-04	1,3E-03	-2,8E-04	-8,3E-04	-6,2E-04	2,2E-02	9,0E-03	7,4E-04	5,9E-02	2,7E-02	5,5E-03	-2,3E-03	5,2E-02	4,2E-03	-2,8E-03	5,9E-03	1,0E-02	1,8E-02	7,2E-02	8,4E-03	-8,9E-03	9,6E-05	3,2E-01	1,2E-03	3,7E-02	1,1E-02	-2,9E-02	5,0E-03	-2,8E-03	3,7E-03		
South Korea	IB	-1,7E-04	7,2E-04	4,8E-04	-8,8E-04	-6,5E-04	-3,3E-03	-3,8E-03	1,5E-03	1,3E-02	5,5E-03	1,8E-02	-2,5E-03	9,0E-03	3,7E-03	-8,3E-04	8,3E-03	3,9E-03	6,6E-03	3,9E-02	2,2E-02	8,4E-04	2,7E-03	1,3E-01	-3,4E-03	2,5E-02	-7,5E-03	4,1E-03	9,1E-04	-2,2E-04	2,8E-03		
	SCH	-2,2E-05	-1,8E-03	7,8E-06	-3,5E-04	1,6E-04	-7,1E-03	-2,0E-02	-7,0E-03	-2,6E-02	-2,3E-03	-2,5E-03	1,9E-02	1,3E-02	5,3E-03	1,7E-03	-5,4E-03	2,7E-03	1,7E-02	-8,1E-03	-3,1E-02	2,0E-03	-4,1E-03	-3,1E-03	-4,0E-03	-2,0E-02	-1,3E-02	1,4E-02	-4,2E-03	5,7E-04	5,9E-04		
	NDBE	-2,8E-04	2,7E-03	4,3E-04	-9,7E-03	-1,9E-04	9,0E-03	2,6E-02	-1,7E-02	7,0E-02	5,2E-02	9,0E-03	1,3E-02	2,9E-01	-8,2E-03	-1,0E-02	-5,1E-03	4,7E-02	-1,3E-02	2,5E-01	-7,7E-02	-4,4E-02	-2,2E-02	1,2E+00	-3,2E-02	1,6E-02	2,1E-02	-4,6E-02	-1,0E-02	-7,4E-03	1,3E-02		
	SNH	-7,4E-05	-4,3E-04	-5,6E-05	5,2E-04	-2,8E-04	3,6E-03	-8,9E-03	-3,7E-04	5,9E-03	4,2E-03	3,7E-03	5,3E-03	-8,2E-03	5,7E-03	7,0E-04	2,3E-03	3,0E-04	1,7E-02	2,5E-03	3,9E-03	2,9E-03	1,6E-03	5,7E-03	2,0E-03	9,1E-03	-5,1E-03	1,1E-03	1,6E-03	1,4E-05	7,4E-04		
	GSH	1,3E-05	-3,2E-04	-8,3E-06	3,3E-04	4,5E-05	-1,7E-03	-3,2E-03	-2,0E-04	-6,9E-03	-2,8E-03	-8,3E-04	1,7E-03	-1,0E-02	7,0E-04	6,2E-04	-6,1E-04	-1,7E-03	1,7E-03	-1,2E-02	-9,9E-04	2,0E-03	3,3E-04	-5,2E-02	6,7E-04	-3,9E-03	-2,3E-03	3,9E-03	-2,4E-04	4,0E-04	-4,9E-04		
Spain	TBCCGC	-8,9E-05	7,1E-04	9,0E-05	1,4E-04	-4,3E-04	4,7E-03	2,0E-03	3,0E-03	2,0E-02	5,9E-03	8,3E-03	-5,4E-03	-5,1E-03	2,3E-03	-6,1E-04	6,0E-03	6,6E-04	5,6E-03	1,9E-02	2,1E-02	7,5E-04	3,2E-03	5,4E-02	1,7E-03	2,1E-02	4,3E-04	-4,7E-03	3,0E-03	-3,9E-04	1,1E-03		
	ATMACGC	-8,0E-05	4,6E-04	8,4E-05	-1,5E-03	-1,7E-04	2,8E-03	2,5E-03	-2,4E-03	1,6E-02	1,0E-02	3,9E-03	2,7E-03	4,7E-02	3,0E-04	-1,7E-03	6,6E-04	8,1E-03	2,6E-03	4,5E-02	-8,8E-03	-6,5E-03	-2,9E-03	2,1E-01	-4,8E-03	8,1E-03	2,1E-03	-7,8E-03	-1,0E-03	-1,3E-03	2,5E-03		
	AAEU	-2,1E-04	-1,2E-03	-4,1E-04	1,6E-03	-8,0E-04	1,8E-02	-2,4E-02	-1,7E-03	2,8E-02	1,8E-02	6,6E-03	1,7E-02	-1,3E-02	1,7E-02	1,7E-03	5,6E-03	2,6E-03	5,5E-02	1,4E-02	5,6E-03	6,2E-03	3,8E-03	6,3E-02	7,2E-03	2,8E-02	-1,0E-02	-5,5E-03	5,7E-03	-6,4E-04	2,3E-03		
	RMSME	-6,0E-04	5,1E-03	6,3E-04	-8,0E-03	-1,8E-03	2,9E-02	3,1E-02	-3,5E-03	1,4E-01	7,2E-02	3,9E-02	-8,1E-03	2,5E-01	2,5E-03	-1,2E-02	1,9E-02	4,5E-02	1,4E-02	2,9E-01	1,0E-02	-3,7E-02	-7,6E-03	1,3E+00	-2,1E-02	9,9E-02	2,1E-02	-6,2E-02	2,8E-03	-8,3E-03	1,6E-02		
	D	-1,7E-04	2,7E-03	1,2E-04	2,5E-03	-1,2E-03	1,7E-02	1,5E-02	1,6E-02	6,0E-02	8,4E-03	2,2E-02	-3,1E-02	-7,7E-02	3,9E-03	-9,9E-04	2,1E-02	-8,8E-03	5,6E-03	1,0E-02	9,3E-02	8,4E-03	1,6E-02	-7,1E-02	1,4E-02	6,9E-02	7,5E-03	-1,6E-02	1,3E-02	-1,7E-04	2,5E-04		
France	C	1,6E-05	-7,5E-04	2,8E-05	1,3E-03	-1,8E-05	-4,5E-03	-9,6E-03	1,2E-03	-1,7E-02	-8,9E-03	8,4E-04	2,0E-03	-4,4E-02	2,9E-03	2,0E-03	7,5E-04	-6,5E-03	6,2E-03	-3,7E-02	8,4E-03	7,8E-03	3,1E-03	-1,8E-01	3,5E-03	-4,3E-03	-7,9E-03	1,2E-02	6,3E-04	1,4E-03	-1,5E-03		
	SAPN	-2,0E-05	2,1E-04	-3,0E-05	8,0E-04	-1,9E-04	3,1E-03	2,2E-04	2,8E-03	7,2E-03	9,6E-05	2,7E-03	-4,1E-03	-2,2E-02	1,6E-03	3,3E-04	3,2E-03	-2,9E-03	3,8E-03	-7,6E-03	1,6E-02	3,1E-03	3,2E-03	-5,3E-02	3,6E-03	1,0E-02	1,7E-05	-9,6E-04	2,5E-03	2,2E-04	-3,7E-04		
	APPR	-2,4E-03	2,0E-02	1,7E-03	-3,7E-02	-6,6E-03	1,4E-01	1,3E-01	-3,3E-02	6,0E-01	3,2E-01	1,3E-01	-3,1E-03	1,2E+00	5,7E-03	-5,2E-02	5,4E-02	2,1E-01	6,3E-02	1,3E+00	-7,1E-02	-1,8E-01	-5,3E-02	5,9E+00	-1,0E-01	3,6E-01	1,1E-01	-2,9E-01	2,6E-03	-3,9E-02	6,8E-02		
	S	2,5E-05	3,6E-05	-3,1E-04	1,6E-03	-8,5E-05	9,0E-03	1,6E-03	3,3E-03	1,2E-02	1,2E-03	-3,4E-03	-4,0E-03	-3,2E-02	2,0E-03	6,7E-04	1,7E-03	-4,8E-03	7,2E-03	-2,1E-02	1,4E-02	3,5E-03	3,6E-03	-1,0E-01	7,3E-03	8,1E-03	4,0E-03	-6,4E-03	4,0E-03	1,0E-04	-1,4E-03		
	A	-3,4E-04	3,1E-03	-8,1E-05	2,3E-04	-1,6E-03	3,3E-02	1,6E-02	1,0E-02	1,0E-01	3,7E-02	2,5E-02	-2,0E-02	1,6E-02	9,1E-03	-3,9E-03	2,1E-02	8,1E-03	2,8E-02	9,9E-02	6,9E-02	-4,3E-03	1,0E-02	3,6E-01	8,1E-03	8,9E-02	1,3E-02	-3,9E-02	1,3E-02	-3,2E-03	5,3E-03		
USA	BNSF	5,5E-05	1,5E-03	-4,1E-04	3,9E-06	6,0E-05	1,7E-02	2,2E-02	3,5E-03	3,7E-02	1,1E-02	-7,5E-03	-1,3E-02	2,1E-02	-5,1E-03	-2,3E-03	4,3E-04	2,1E-03	-1,0E-02	2,1E-02	7,5E-03	-7,9E-03	1,7E-05	1,1E-01	4,0E-03	1,3E-02	2,0E-02	-2,7E-02	3,9E-03	-1,8E-03	-2,2E-04		
	GPTC	5,3E-05	-2,2E-03	6,5E-04	1,3E-04	3,9E-04	-3,2E-02	-2,6E-02	-4,5E-03	-7,6E-02	-2,9E-02	4,1E-03	1,4E-02	-4,6E-02	1,1E-03	3,9E-03	-4,7E-03	-7,8E-03	-5,5E-03	-6,2E-02	-1,6E-02	1,2E-02	-9,6E-04	-2,9E-01	-6,4E-03	-3,9E-02	-2,7E-02	4,5E-02	-8,0E-03	3,5E-03	-1,9E-03		
	TRIP	-2,4E-05	4,1E-04	-1,6E-04	6,7E-04	-2,1E-04	8,0E-03	3,2E-03	2,6E-03	1,7E-02	5,0E-03	9,1E-04	-4,2E-03	-1,0E-02	1,6E-03	-2,4E-04	3,0E-03	-1,0E-03	5,7E-03	2,8E-03	1,3E-02	6,3E-04	2,5E-03	2,6E-03	4,0E-03	1,3E-02	3,9E-03	-8,0E-03	3,3E-03	-3,9E-04	2,4E-06		
	CA	1,2E-05	-1,8E-04	2,9E-05	1,6E-04	4,3E-05	-2,2E-03	-1,8E-03	-3,5E-05	-6,2E-03	-2,8E-03	-2,2E-04	5,7E-04	-7,4E-03	1,4E-05	4,0E-04	-3,9E-04	-1,3E-03	-6,4E-04	-8,3E-03	-1,7E-04	1,4E-03	2,2E-04	-3,9E-02	1,0E-04	-3,2E-03	-1,8E-03	3,5E-03	-3,9E-04	3,4E-04	-3,7E-04		
	SBE	-4,1E-05	1,8E-04	5,7E-05	-4,3E-04	-1,2E-04	8,8E-04	-5,4E-06	-4,5E-04	6,2E-03	3,7E-03	2,8E-03	5,9E-04	1,3E-02	7,4E-04	-4,9E-04	1,1E-03	2,5E-03	2,3E-03	1,6E-02	2,5E-04	-1,5E-03	-3,7E-04	6,8E-02	-1,4E-03	5,3E-03	-2,2E-04	-1,9E-03	2,4E-06	-3,7E-04	9,5E-04		

Table A.8: The variance-covariance matrix for the transport sector.

Appendix B

Energy companies

China

LMIG - LuAn Mining Industry Group Co Ltd
CNCG - China National Coal Group Corporation
HCIG - Huadian Coal Industry Group Co Ltd
GPCEG - Guizhou Panjiang Coal and Electricity Group
XE - Xinjiang Energy Co Ltd

India

NE - Nayara Energy Ltd
RGPP - Ratnari Gas & Power Private Limited
SPT - Sikka Ports & Terminals Ltd
AGC - Assam gas company Ltd
BG - Bhagyanagar Gas Limited

South Korea

GSC - GS Caltex Corp
SO - SeoulOil Co Ltd
JSU - Jeongil Stolthaven Ulsan Co Ltd
BT - Boryeong LNG Terminal Co Ltd
HTEP - Hanwha TotalEnergies Petrochemical Co Ltd

Spain

PN - Petroleos del Norte SA
RE - Repsol Exploracion SA
CCP - Cepsa Comercial Petroleo SA
TE - Tamoil Espana SA
VE - Vitogas Espana SAU

France

GSSS - Gestion Securite de Stocks Securite SA
VR - Vermilion Rep Sas
G - Grtgaz SA
SPMR - Societe du Pipeline Mediterranee-Rhone
STPPP - Ste Des Transports Petroliers Par Pipelines

United States

AC - Apache CORP
CR - Continental Resources, Inc
WMO - Western Midstream Operating, LP
EMP - EnLink Midstream Partners, LP
BM - Brigham Minerals, Inc.

Renewable companies

China

GTEG - Guodian Technology and Environment Group Corp Ltd
UP - United Power
GHPP - Guangdong Huizhou Pinghai Power Generation Plant Co Ltd
CDCR - China Datang Corporation Renewable Power Co., Limited
DSPG - Datang Shanxi Power Generation Co Ltd

India

SGWP - Suzlon Gujarat Wind Park Ltd
TPSO - Tata Power Solar
THDC - THDC India Limited
GRGR - Greenko group
VISO - Vikram Solar

South Korea

SPVC - SPV Co.
GSWC - GS Windpower Co Ltd
GECL - GS EPS Co Ltd
HECO - Hanwha Energy Corp
HGPC - Hyundai Green Power Co

Spain

EDRE - EDP Renewables Europe SL
IRES - Iberdrola Renovables Energia SA
VBSL - Vertex Bioenergy SL
SEMI - Sociedad Espanola de Montajes Industriales SA
PCSA - Peninsular Cogeneracion SA

France

AESAS - Akuo Energy SAS
EDF - EDF ENR Solaire SAS
CFSAS - Comax France SAS
EGFS - Engie Green France SASU
UESA - Uem SA

United States

PSE - PowerSouth Energy Cooperative
LE - LINCOLNWAY ENERGY LLC
REG - Renewable Energy Group Inc
HES - Homeland Energy Solutions LLC
SPEC - Southern Pine Electric Coop

Telecom companies

India

RJIL - Reliance Jio Infocomm Limited
BHLT - Bharti Hexacom Ltd
ATC - ATC India
BTL - Bharti Telemedia Limited
TNL - Telesonic Networks Limited

South Korea

YTCL - YonhapNews TV Co Ltd
KTSA - KT SAT
SKTC - SK Telink Corp
KTSN - KT Service Nambu
STCL - SK TNS Co Ltd

Spain

VESA - Vodafone Espana SAU
TDES - Telefonica de Espana SAU
TMES - Telefonica Moviles Espana SAU
TSIC - Telefonica Soluciones de Informatica y Comunicaciones de Espana SA
TGSS - Telefonica global solutions sl

France

BTSA - BOUYGUES TELECOM SA
EUSA - Eutelsat SA
SCSA - Sewan Communications SAS
SFSA - SFR FIBRE SAS
ILSA - Iliad SAS

United States

HSSC - Hughes Satellite Systems Corporation
CBIN - Cincinnati Bell Inc
INCO - Inseego Corp
BWCO - Boingo Wireless corp
ACSG - Alaska Communications Systems Group, Inc.

Transport companies

China

HPEG - Hunan Provincial Expressway Group Co Ltd
GCIG - Guangzhou Communication Investment Group Co Ltd
GRBCD - Guangdong Road & Bridge Construction Development Co Ltd
GPHC - Guangdong Provincial Highway Construction Co Ltd
GPF - GuangDong Provincial Freeway Co Ltd

India

LTMR - L&T Metro Rail
EP - Essar Ports Limited
DIA - Delhi International Airport Ltd
GHYA - Gmr Hyderabad International Airport Ltd
BIA - Bangalore International Airport Ltd

South Korea

IB - Incheon Bridge Co. LTD
SCH - Seoul-Chuncheon Highway Co Ltd
NDBE - New Daegu Busan Expressway Co Ltd
SNH - Seoul Northern Highway Corporation
GSH - Gyeong Su Highway Corp

Spain

TBCCGC - Tunels de Barcelona i Cadi Concessionaria de la Generalitat de Catalunya SA
ATMACGC - Autopista Terrassa Manresa Autema Concessionaria de la Generalitat de Catalunya SA
AAEU - Abertis Autopistas Espana Unipersonal SA
RMSME - Renfe Mercancias Sociedad Mercantil Estatal S.A.
D - Dornier SA

France

C - Cofiroute SA
SAPN - Société des Autoroutes de Paris Normandie
APPR - Autoroutes Paris-Rhin-Rhône SA
S - SANEF SA
A - Atlandes SA

United States

BNSF - Burlington Northern Santa Fe LLC
GPTC - Grand Parkway Transportation Corporation
TRIP - Toll road investors partnership II, L.P.
CA - Connector 2000 Association Inc.
SBE - South Bay Expressway, LLC