International Diversification for Swedish Investors

A comparative study of different national and international scale portfolios

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Abstract:
This thesis aims to investigate the benefits of international diversification from a Swedish perspective. It presents a comparative study of the performance of different portfolios based on their degree of international diversification with a focus on Swedish investors frame of reference. Such a study is motivated by the contradictory literature about portfolio diversification and information portfolio theory that advocate for a more concentrated portfolio. It focuses solely on comparing portfolios constituted with major indices of a representative sample including countries from different parts of the world. The different scales of those portfolios start from a divided part of the Swedish economy to end with a global portfolio. We observed that international diversification can outperform the domestic portfolios when considering risk and return. In addition, we observed that the best performing portfolios over the periods are systematically concentrated on emerging countries and that the high return of those emerging countries is often not associated with a correspondingly high standard deviation as it should be expected. The best levers of performance that we identified as a result of this comparative study are, first, the strategy consisting in focusing on the most concentrated portfolios in order to maximize the return and then trying to time the market, thanks to a specialized information collection strategy, but this bear a high undiversifiable risk. Or second, adopting an intentionally diversified portfolio and collecting information about the most promising emerging markets that will be then over weighted in the portfolio to lower the risk and higher the return. Lastly, the study recommend that home-biased investors should change their behavior and consider international investments when building a portfolio.

Keywords: Portfolio Diversification, International Diversification, Concentrated Portfolio, Home Bias, Mean Return, Risk, Volatility, Equity indices, Optimal Portfolio, Swedish Investors, Sweden, Global Portfolio, Emerging, Western Europe, Eastern Europe.
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1. Introduction

The introduction chapter contains the background of portfolio diversification in general with a focus on international diversification and the theoretical background behind these topics. Then, the problem formulation based on practical and theoretical aspects. After this, the demonstration of the research purpose showing the objective of the study performed; leading to the formulation of the research question. As well as highlighting how this study will contribute to answering the research questions. In addition, a part about the contribution and delimitations, recognizing the boundaries and limitations of the study; another part consisting of the definitions’ list to make the reader more familiar with the concepts mentioned throughout the study. Lastly, a disposition of the following chapters shows the layout of the whole thesis.

1.1 Problem Background

Portfolio diversification is a topic widely discussed in finance for almost the past century. The turning point in this topic was with the American economist Harry Markowitz who wrote the paper “Portfolio Selection” in 1952, which made him the Nobel Prize winner in economic sciences in the year 1990.

Portfolio diversification is a critical matter for every investor because the target of diversification is to lower the risk and optimize the return, which is not an easy task. In other words, it can be described as not putting all the eggs in the same basket; then if one basket is damaged, the owner will not lose everything. Moreover, portfolio diversification method is different from one investor to another, and there is not one method that fits all sizes, because investors have different beliefs based on different factors and information which lead to different investment strategies. This diversity of beliefs and thoughts makes it a tough task for every investor to find the best method while building their portfolio. The portfolio can be diversified or concentrated based on different criteria such as geographical choices, industries choices, the risk acceptance, return expectations, and other variables that affect the selection of the constituents of the portfolio. However, there is an opposition in the existing literature according to portfolio diversification. Where some researchers such as Van Nieuwerburgh and Veldkamp (2010) think that when the investors can access the needed information, the investment decisions will be more rational, and the resulted portfolio tends to be a concentrated one. On the other hand, other researchers such as Markowitz (1952) believe that the diversified portfolio is the optimal one in the majority of cases.

Markowitz theory focuses on optimal portfolio diversification, which is the maximum expected return with the lowest risk possible; the variance of the portfolio demonstrates the risk. (Markowitz, 1952) According to Markowitz, the investors can choose the portfolio with the highest return according to the level of risk that he is willing to bear. Also, using the Markowitz method can lead to an undiversified portfolio or concentrated portfolio sometimes, since some stocks can be performing very well with very low volatility, which gives them a very big weight in the portfolio. (Markowitz, 1952)

The traditional portfolio theory predicts that a portfolio must be diversified and Markowitz (1952) is the best example of that theory. However, studies showed that investors tend to keep their investments concentrated in a few markets. (Choi, et al., 2017)
Choi et al. (2017) have performed a study of 10,771 institutional investors from 72 different countries, the study aimed to test the benefits of a concentrated portfolio and if it leads to higher abnormal returns. The portfolio concentration level was divided into three levels, home country, foreign country and industry concentration. In the paper, Choi et al. (2017) highlights the importance of information asymmetry and say that having information that other investors do not have; allows the investors who have the information asymmetry to achieve higher returns. The study results show that concentrated portfolios in fewer countries and fewer industries lead to higher returns, which also is in opposition to the theory that international diversification is systematically beneficial. (Choi, et al., 2017) Based on these finding, it is suggested that the investors that tend to have concentrated portfolios are founded on market information that not everyone has. (Choi, et al., 2017)

The previous articles show the opposition of results generated by the previous research and make the diversification topic interesting for research, even though, it has attracted many researchers for a long time ago. Furthermore, the reviewed articles show different types of diversification, as the “mean-variance model”, geographical diversification and sector diversification, but diversification is not limited to these three types. The focus in the upcoming theories will be on geographical diversification and international diversification because this thesis is testing geographical and international diversification for Swedish investors.

Investors tend to be more comfortable while investing in familiar regions, countries, markets or companies. Investors tend to ignore the existing portfolio theories and make their investment decisions based on familiarity with the places or industries they are investing in. According to Huberman (2001), employees tend to invest in their employers’ company, which conflicts with the portfolio theory principles and make the portfolio riskier than a diversified one. Moreover, investors tend to put their money in companies they think that they know well, as well as popular companies on the media, which makes it more familiar to them. (Huberman, 2001) French & Poterba (1991) agree with Huberman (2001) that investors are “home biased” and prefer home countries in their investment choices regardless of the portfolio theories. Home bias is as well the result of the psychological impact on the investors’ decision. French & Poterba (1991) mentioned that investors are more optimistic when expecting returns in their home countries, and every investor that contributed in the study has expected a higher return while investing in his home country than in a foreign country. This is the result of people being overconfident about events they think that they have control over. Then, when investing in familiar areas such as home countries or their own company, the overconfidence leads to optimistic expectations regarding the outcome of their investments. (Nofsinger, 2014, p. 12) In addition, the familiarity of the investors with the local capital market and the access to the related information will increase the investors’ overconfidence, leading to overweight domestic investments. (Barber & Odean, 2001) In other words, the lack of diversification is mainly the result of the investors’ choice and not the portfolio theory or other constraints. Similarly, different beliefs exist around international diversification, while it is considered beneficial in some cases and non-beneficial in other cases.

According to Driessen and Laeven (2007), global diversification is beneficial for investors in developed and developing countries. However, the benefits are larger for developing countries. Furthermore, countries with a high-risk rate benefit more from international diversification, (Driessen & Laeven, 2007) because investing in foreigner
countries that have a lower rate of risk will lower the overall portfolio risk. Grubel (1968), De Santis and Gerard (1997) also add evidence that international diversification is beneficial. The article of Driessen and Laeven (2007), shows that international diversification benefits are based on different aspects such as the country situation, local market specification and other aspects not mentioned in that article. However, these aspects are not stable and can vary with the evolution of financial markets since the financial markets are in continuous development, as well as the development of the tools used to build portfolios, similarly the increase in the financial data availability. This evolution may lead to different results in the future, and what is beneficial in the time when the article was written may not be beneficial nowadays.

Additionally, the benefits of international diversification can be tested using different financial measures, the most common measure is the constant correlation between the assets. Nonetheless, using additional measures can lead to more precise results. These additional measures can be return, standard deviation, skewness and kurtosis. You and Daigler (2010) evaluated international diversification considering, Skewness and Kurtosis as well as the tradeoff between the Standard Deviation, correlation, skewness and kurtosis. You and Daigler (2010) found out that international diversification is not advantageous when compared to the S&P 500, because the S&P 500 outperformed all the other international portfolios studied. This means that investing only in the USA outperform international diversification and conflict somehow with Driessen and Laeven (2007).

As mentioned previously in the introduction, the financial markets are in continuous evolution that urges the investors to be up to date and adjust their strategies accordingly. Emery and Gulen (2019) highlighted the importance of the internet that affects investors’ behavior. The increase in the availability of information online has contributed to the international diversification leading to a decrease in the geographical bias. Moreover, countries that have more access to internet explained by the number of financial data downloaded online tend to be more open to international investments. Along with that, testing the investors’ behavior before and after the first online trade, showed that investors tend to be more open to international diversification after the first trade online, as well as the average distance between them and the countries they invest in increase. (Emery & Gulen, 2019) The decrease in the geographical bias and openness to international diversification is not the result of investors educating their selves, but, it is the result of the information available online. (Emery & Gulen, 2019)

Liljeblom et al. (1995) conducted a study about the benefits of international diversification for Nordic investors. In this study 18, national stock markets formed the sample, 17 countries where members of the Organization for Economic Co-operation and Development (OECD) and Hong Kong was the only country in the sample out of the OECD. Liljeblom et al. (1995) have found that equally weighted Nordic portfolio outperformed the value-weighted global portfolio. However, the global portfolio based on the mean-variance model has been the best investment. In conclusion, international diversification is beneficial to Nordic investors using the mean-variance model. (Liljeblom, et al., 1995)

Conclusively, portfolio diversification has been the center of attention in the finance field for a long time. Different results and conclusions have been drawn regarding diversification strategies and portfolio selection, but the optimal strategy or method that
seduce all investors do not exist. Consequently, portfolio selection is a personal setting for each investor leading to different approaches from different investors considering different aspects. International diversification is one of the aspects to consider when building an investment portfolio, and previous researches show that different measures and criteria affect the acceptance of international diversification by the investors. Some examples of these criteria can be, the behavior of the investors when they are home biased and more optimistic about local returns, as well as the information available about foreign markets and securities. Furthermore, the opposition exists in the previous researches’ results, when some conclude that international diversification is beneficial, and others deduce the opposite. The existing clash of results makes the topic more interesting for research, giving the opportunity to come up with new conclusions for a specific group of investors, which are the Swedish investors in this thesis.

1.2 Problem Formulation
Some investors may be more interested in investing locally, and others may be open to investing abroad by building an international portfolio. Previous research has produced contradicting results in whether international diversification is beneficial or not, as well as if a portfolio should be diversified or concentrated. Most research conducted in that field is based on US investors. Moreover, the majority of the previous researches, have evaluated international diversification based on the constant correlation between the stocks or indices, then ignored other measures that could affect the results significantly. Some of the ignored measures are risk, kurtosis and skewness. The fact that most of the studies were focused on the US stocks portfolio, compared to a global one. Therefore, it will be interesting to test the benefits of international diversification for Swedish investors by comparing the Swedish portfolio to different portfolios containing foreign indices.

Furthermore, the “Home Bias” aspect played an essential role in international diversification. In the case of Sweden, the country is a worldwide leader in integrity since it is one of the least corrupted countries in the world (Transparency International, 2018). The country’s integrity creates trust between the Swedish people and their government as well as domestic institutions. In a way or another, this fact increases the “Home Bias” of Swedish investors, because they trust their domestic companies more than foreign companies, as well as the information released about the Swedish capital market. The strong trust relation in Sweden makes the study of international diversification for Swedish investors more interesting, since some investors may miss foreigners’ investments opportunities due to the trust in the available local investments.

Furthermore, the structure of the portfolios that will be compared in this study will be interesting as it is divided regionally as well as considering the type of countries included in the portfolio as emerging, developing and developed countries. So, this will show if it is beneficial to invest in developing countries for Swedish investors. Adding to that, due to the “Brexit”, Swedish investors may stop investing in the UK in case they do, because the tax regulations may affect the investors’ decisions. Thus, testing the impact of excluding the UK from the European portfolio will be a relevant issue for the current situation and will give an insight into that issue for the readers of this thesis.

Additionally, taking into consideration the Risk, Kurtosis, Skewness and Sharpe Ratio when assessing the benefits of international diversification, will contribute to the existing research gap, since most of the previous researches have ignored these measures while evaluating international diversification.
In this context, a study that assesses the potential of international diversification for Swedish investors should be of interest for all the Swedish investors as well as non-Swedish investors. Since it gives an insight about new foreign investments opportunities, that some investors may never think about.

### 1.3 Purpose and research question

The purpose of this research is to investigate if the international diversification when investing in equity indices will beat domestic investments for Swedish investors. As well as assessing different levels of international diversification, by building portfolios that represent different regions, containing different types of countries and compare it to the local Swedish portfolio. In other words, a comparison between different international equity portfolios, versus a Swedish equity portfolio and another Swedish sector concentrated portfolio. The research question is as follows:

“Does international diversification matter for Swedish investors?”

In this thesis, the research question will be examined by building different portfolios that contain equity indices and represent different regions and countries. Then, a comparison between all the portfolios and the Swedish portfolios to assess if investing abroad is beneficial to Swedish investors. The study will be based on analyzing historical data for the previous ten years and divide it into different periods. The comparison between the portfolios will consider different financial measures such as the standard deviation, return, Sharpe ratio, kurtosis and skewness. The mentioned analysis suggests if the Swedish investors should invest abroad or not. The results will be explained and supported by the findings of the empirical study. If the results show that it is beneficial to invest overseas, it will be mentioned in which countries and the benefits of investing there. Additionally, the recommendations addressed to the investors at the end of this study, help the investors to adjust their investment behavior thus they can enhance their portfolios’ performance.

Finally, a more detailed description of how the study is conducted will be mentioned in the chapter 3. This contains how the portfolios are built, the studied periods and all the other aspects considered while drawing the conclusions.

### 1.4 Study Contribution and Limitations

This study contribute information about the impact of international portfolio diversification for Swedish investors, which should be of concern to every Swedish investor. It can be a household investor, a professional investor, financial analysts, risk managers or portfolio managers. However, it is not limited only to those; the information can benefit anyone interested in investments or is planning to start investing. In addition, it contributes beneficial information to non-Swedish investors as well, since the study delivers information about the performance of different countries around the world. The findings of this study can open the eyes of any investor to investments opportunities that they never thought to test before.

The theoretical contribution of this thesis is directed toward adding evidence for or against international diversification. This evidence will be from a Swedish perspective, where there was not much research performed regarding international diversification.
The benefits of international diversification will be evaluated based on standard deviation, return, Sharpe ratio, kurtosis and skewness. While the traditional measure used in most of the previous studies is the constant correlation (You & Daigler, 2010).

This study is limited to the timeframe when the historical data is analyzed, which is from the beginning of 2009 to the end of 2018. It is also limited to the countries studied, that are presented by the 40 indices analyzed.

1.5 Definition of Concepts

The purpose of this section is to explain the concepts frequently used in this study to make the reader more familiar and to avoid confusions that may arise concerning the concepts. This section is a general definition of the concepts, though a more detailed explanation will be mentioned when the concept will be discussed. The reference of the definitions is (Bodie, et al., 2011) unless another source is mentioned.

**Sharpe ratio:** The Sharpe ratio measures the expected return by a unit of risk compared to a risk-free investment which is T-Bills. The difference between the risky investments and the risk-free investments shows the payoff for taking the risk. In other words, measuring the risk premium of investing in stocks compared to the Treasury bills rate. (Sharpe, 1994)

**Kurtosis:** The Kurtosis calculation shows the fatness of the tails of a probability distribution. The Kurtosis indicates the probability of observing extreme high or low returns.

**Skewness:** The skewness measures the asymmetry in the returns’ distribution. Skewness gives insight about the estimation of risk. If a distribution is positively skewed it means that the standard deviation of the distribution overestimates the risk of the distribution. On the contrary, if a distribution is negatively skewed it means that the standard deviation of the distribution underestimates the risk of the distribution.

**Standard deviation:** The standard deviation measures the volatility of an assets’ return. The volatility gives an insight into the movement of asset returns, which help to expect the risk. The highest the standard deviation is, the more volatile the returns are and the riskier the asset is.

**Return:** The return of a stock is the percentage of loss or gain generated from holding this stock for a certain period. The return of a portfolio is the sum of the returns of the single constituents multiplied by their corresponding weight.

**Diversified Portfolio:** A diversified portfolio contains a big number of different securities. In other words, to avoid the excessive risk exposure to any one source of risk.

**Concentrated Portfolio:** A concentrated portfolio contains a small number of different securities that do not achieve a high level of diversification. A concentrated portfolio is usually riskier than a diversified one.

**International diversification:** International diversification is when including international securities that trade abroad in a portfolio, to make it more diversified and reduce the risk.
**Market Capitalization:** It is the market value of the outstanding shares of a company. It is calculated by multiplying the number of outstanding shares by their market price. An index market capitalization is the sum of the market capitalization of the index constituents.

**Home Bias:** An investor is home biased when he prefers investing in his home-country’s assets ignoring the diversification efficiency.

**Stock market Index:** It is a measure of a part of the stock market. In the majority of the times, the constituents of the market index are the top performing companies of that market. The index price is computed from the constituents’ prices and typically it is a weighted average.

### 1.6 Disposition

- **Chapter 1: Introduction**
  The introduction consists of a problem background that describes the theoretical background behind the research topic which is international portfolio diversification; a problem formulation section showing the practical issue related to the topic; a research purpose showing the aim of the study, leading to the research question; a contribution and limitations parts that shows to which audience the study will add value, as well as the boundaries of the study; Lastly, the disposition part showing the layout of the thesis.

- **Chapter 2: Theoretical Framework**
  The theoretical framework chapter consists of 5 parts, dividing the literature review to 5 specific topics. The first part interprets the literature related to portfolio selection and views about the optimal portfolio method. The second part discusses the existing contradiction in the theory, around the diversification or concentration of the portfolio. The third part focus on the previous research that focused on international diversification and its benefits. The fourth part included the theory that explains the reasons that lead the investors to be home biased or open to international diversification. The fifth part reviews related studies that are performed in the Nordic countries. Lastly, a summary that collects and summarize the whole chapter.

- **Chapter 3: Method**
  The purpose of the third chapter is to explain the theoretical and practical methods used through this thesis. The first three parts discuss the theoretical methodology. Then, the last part discusses and explain the practical methods used and motivate the choice. Additionally, it mentions the limitations of the practical method.

- **Chapter 4: Results**
  The results chapter shows the empirical results of the study. The results contain the annual return, annual standard deviation, annual Sharpe ratio, Skewness and Kurtosis of all the studied portfolios. As well as the T-test results for some series of return. This chapter is divided into 8 parts, each part represents a period of the study.
Chapter 5: Analysis of results
The purpose of this chapter is to analyze the empirical results of the study and interpret it. After the analysis and interpretation, we come up with relevant recommendations.

Chapter 6: Conclusions
The purpose of this chapter is to conclude the whole study and answer the research question. It also positions the study results in the literature and provides the contribution of the study. Furthermore, it contains some recommendations to the practitioners. Lastly, the limitations of the findings and recommendations for further studies.
2. Theoretical Framework

The main goal behind this part is to set a basis of knowledge used in this study. This will be necessary to comprehend the approach presented in the following parts concerning the problem of international diversification. The results of this study will take a position in the theoretical background that have been previously produced in the last decades. Linking the results of this study to the existing literature will help to argue for our results, as well as contributing to the existing research gaps.

This part will be divided as follow, starting with a review of the literature concerning the subject of diversification and selection of a diversified portfolio. It will be logically followed by a confrontation between this literature and the evidence that goes in the direction of less diversification. Then it finally moves to the subject of international diversification with the general literature on the subject followed then by the introduction of home bias and some studies concerning the specific case of the Nordic countries.

2.1 Optimal Risky Portfolio

Building a portfolio is a top-down process, the investors need to make a series of choices, from a capital allocation between cash, risk-free assets and risky portfolio to asset selection to get the most return with a considered risk from the portfolio.

The starting point of this process is the consideration that for a set future period, each asset will bear a return and with this return bear a risk of default. Those future returns and risk rates are uncertain and thus must be estimated to be used as comparative indicators between stocks. They can be estimated using historical data, information available and the knowledge acquired by analyzing those assets. The available information and news about the capital market will affect the investors’ decisions. The goal for investors is to achieve additional return compared to other investors through a gathering of asymmetric information process. (Choi, et al., 2017) The risk is often referred to as volatility and corresponds to the standard deviation of the return of an asset.

Each stock presents different expected returns and volatilities, stocks’ returns’ time series also present different correlations between each other. This assumption is fundamental and allow the investors to compare assets between each other in order to select the best combination. Markowitz (1952) introduced a portfolio optimization method based on those indicators referred to as the mean-variance optimization method. The basis of this method is that associating stocks in a portfolio lead to a reduction of the overall risk of the portfolio through diversification. But the overall risk cannot be eliminated following the rule of large numbers. Building a diversified portfolio looks like selecting only the best-performing stocks and eliminating the totality of risk, thus obtaining a high return and low volatility of return portfolio, is impossible (Markowitz, 1952). The reason for that is the fact that daily returns of stocks are mostly correlated.

The first step following the Markowitz method to build a portfolio is to create a universe of possible investments. The largest is that universe the more opportunities are available to the investors, as well as a higher chance to build a well-performing portfolio in term of risk and return. If the focus is on this study, the international universe would then present more opportunities than a national one. Then, from this universe of securities available, which all have independent expected returns and volatility, a vast set of combinations would be possible in order to create a well-diversified and well-performing
portfolio. Then, it is possible to obtain the expected return of the portfolio by using a weighted average of the expected return of the components. Concerning the Variance of the portfolio, it is necessary to build the covariance matrix of all the securities that are part of the portfolio in order to calculate the variance of the portfolio (Markowitz, 1952). From this universe solely, the best combination of variance and return should be selected. For each level of risk (variance), only the portfolio with the best-expected return is considered for investment, that creates a smaller group of portfolios named the optimal portfolios (Markowitz, 1952). A rule for optimal portfolios is that the optimal portfolio return increase if its volatility increases, volatility increase if the return increase, but the relation is not linear. (Markowitz, 1952)

William F. Sharpe in his study, “Mutual Fund Performance” introduced a nowadays broadly used manner of comparing portfolios considering the same criteria as the optimization method of Markowitz. It is known today as the Sharpe ratio. It’s a ratio comparing the return and the volatility of a portfolio (Sharpe, Mutual Fund Performance, 1966). Here “S” is the Sharpe ratio, E[R] is the expected return, E[Rf] is the expected risk-free rate and \( \text{var}[R - R_f] \) is the variance of the return taking into consideration the variation of Risk-free rate.

\[
S = \frac{E[R - R_f]}{\sqrt{\text{var}[R - R_f]}}
\]

This version is the updated version of the Sharpe ratio, published in 1994 (Sharpe, The Sharpe ratio, 1994). The higher this measure is, the higher is the expected return per unit of risk of the studied portfolio. It is a simple measure to compare the relative performance of portfolios.

Thus, this method can be used to compare the different portfolios produced through the Markowitz optimal portfolio building process. The Markowitz method provides an infinite number of optimal portfolios, depending on the level of risk selected. It can be represented graphically and have been named the efficient frontier. (Markowitz, 1952) The Sharpe ratio allows an investor to calculate the expected return by a unit of risk and select the best-suited portfolio based on the mean expected return and variance.

Markowitz M-V method implies the right type of diversification because it selects the stocks that are the less correlated between each other and thus ensure a better diversification. The portfolios that are the result of this method maximize the diversification that lowers the most the volatility of the portfolio and avoid putting significantly correlated stocks in the same portfolio. (Markowitz, 1952). The main problem of this method is that to select the optimal portfolio for a future period, it uses the expected return and variance, which are uncertain because they are a prediction of the future. This prediction can be based on the analysis of the available information and current news, as well as on historical data. Michaud (1989) has formulated an objection to this method. He wrote: “The major problem with MV optimization is its tendency to maximize the effects of errors in the input assumptions” (Michaud, 1989). It means that if there is an error in the estimation of volatility and return for the future period, the mean-variance optimized portfolio will be erroneously weighted. This error leads to overweight and underweights some stocks, and it also ignores stocks that should be the main constituents of the optimal portfolio. (Michaud, 1989) This is explained by the fact that if an error leads to overestimating the expected return of a stock, this stock will be selected in almost every portfolio.
An advice would be that the investors should review the expected return and variance of the portfolio’s components in order to consider the “judgment of practical men” (Markowitz, 1952). Which help to incorporate the possibility of nuances or elements that are not taken into account in the calculation of those expected returns and variance. Nevertheless, errors are inevitable, and they will irremediably lead to the disappointment mentioned earlier.

It is also essential to consider that the optimizer produces a unique portfolio for a set level of risk. This is misleading; the area around the point representing this portfolio on the efficient frontier should be considered to offer similar opportunities (Michaud, 1989). Besides, the investors can find different portfolios in this area, which they could find more appealing for many reasons that are not taken into consideration by the Markowitz optimizer. (Michaud, 1989) Those reasons could be related to the liquidity of the assets or personal preferences for examples.

Concerning the assets allocation, the mean-variance optimization tends to select in general a small number of securities, usually less than 20, with the lowest correlation possible. The estimation error is common, and following a benchmark like an index as an asset allocation strategy could be preferable. (Michaud, 1989) Also, Markowitz method is not easy to use as an investment strategy; in fact, equal weighting often significantly outperforms it. Therefore, it can be counterproductive. (Michaud, 1989) More common approaches are advised concerning investment: “Valid financial considerations, not the rigid application of a computer program, should dominate the portfolio construction process.” (Michaud, 1989). This comment from Michaud is valid, mean-variance optimizer should not be used as a point by point method of how to invest, but rather as an advisor and should always be double checked by a skilled manager. On the other hand, mean-variance optimizer is a perfect tool to find which portfolio had performed the best in the past by using historical values and try to gain knowledge from that observation. It allows the manager to see what the best performing portfolio over a period of time was and under the constraint he chooses.

An important aspect of mean-variance optimizer as stated previously is the capacity to forecast return and produce a coherent expected return. It is a deep field of research and this study was not focused on the problem of forecasting return or prices. But it seems relevant to broach the subject in order to have basic knowledge of what to expect concerning returns. It explains the fundamentals on which this work is based.

Determination of the expected return for an asset in a market starts with the determination of the interest rate in this market. This interest rate is determined by the preferences and expectations of market actors (Sharpe, 1964). In addition to the interest rate another element to consider is that expected return of stock also depends on a market risk premium that need to be added to the interest rate. It is the variable that adjust corresponding to level of risk underlying this asset by considering the difference in level of risk between the expected return of the asset and the interest rate value, called risk free rate (Sharpe, 1964). It corresponds to this equation and have been named Capital Asset Pricing Model (Fama & French, 2004):

\[ E[R_i] = R_f + \beta_i(E[R_m] - R_f) \]

Where: \( E[R_i] \): expected return of asset i  
\( R_f \): risk free rate
bi: beta of the asset i
Rm: market return

This assumption can be demonstrated and applied to single assets (Sharpe, 1964). Thus, it is determined that in the equilibrium condition market, there is a simple linear relationship between efficient portfolios expected return and the standard deviation of their return (Sharpe, 1964). That is the main concept that we want to refer to in this study. The rule of thumb behind this theory is that assets that are not affected much by market changes will have an expected return close to the interest rate and asset that are more responsive and amplify more the market changes, thus bearing more risk, will theoretically promise higher expected return.

The expected return of an asset is thus dependent on the interest rate, market correlation and risk premium. If the risk of an asset in a portfolio is diversified, then only the market risk remains, and additional expected return of this risk theoretically also disappears. It is important to note that this simple linear relationship has been proven wrong in reality, the relation is not linear and better version have been created to compensate the slight difference between observation and theory cf. (Fischer & Black, 1972).

2.2 Discussion around Portfolio Diversification

When building a portfolio, more elements should be considered to limit the risk and enhance the return. One of these elements is the correlation between the assets forming the portfolio, since having a low correlation leads to a more diversified portfolio. Sharpe differs between the risks attributed to an asset (Sharpe, 1964). The risk of an asset can be divided into two categories: a part of this risk is assigned to the market and thus is not diversifiable, called systematic risk, the other part is the risk related to the particularity of the stock that can be diversified, called unsystematic risk. If a stockholder invests in the market portfolio, which is a fully diversified portfolio, he then is only exposed to the systematic risk, often called market risk (Evans & Archer, 1968). The unsystematic risk is diversifiable by definition and thus an asset that is prone to reduce the unsystematic risk of the portfolio is more valuable (Booth & Fama, 1992).

In a portfolio, the portfolio compounded return is higher than the weighted average of the compounded return of the component of this portfolio due to the diversification effect (Booth & Fama, 1992). Consequently, the return contribution of an asset is more significant than its compound return. This can be explained because its contribution to the portfolio variance of return is less than its own variance of return. This phenomenon is explained by the diversification effect that implies an augmentation of the participation of this asset to the overall compound return of the portfolio. (Booth & Fama, 1992). The contribution is not linear and proportional to the weight of an asset in a portfolio. It also depends on the correlation of this asset with the other assets of the portfolio. For example, small-cap stocks have a significantly higher contribution to the overall portfolio compounded return. This contribution is due to their high variance of return and the fact that they are on average, less correlated with the rest of the asset contrarily to big cap stocks that are more correlated. The consequences for a security to have a lower correlation with the constituents of the portfolio is that its risk is more diversifiable and then their contribution to the portfolio compounded return is higher (Booth & Fama, 1992). In the case of this study, it is then relevant to take as a proposition that small or remote countries will be less correlated and then bring a better contribution to a portfolio return composed of bigger or more closely grouped countries.
An interesting question then is, from what number of random stocks of a particular market a portfolio can be considered as diversified? Observations show that most of the unsystematic risk is eliminated when the portfolio reaches 8 securities. From this point, adding 8 other securities to the portfolio to observe a significant change in portfolio risk, at 0.05 level. If a portfolio contains 16 random securities, 19 new securities are needed to lower the risk (Evans & Archer, 1968). It seems that there is no significant impact on risk to expand the portfolio over approximately 10 stocks. They also proved that there is an expectable relationship between the number of securities in a portfolio and its risk dispersion (Evans & Archer, 1968). It also takes a level of significant change in portfolio risk to determine if more or less diversification is needed. This assumption can be argued against. Another approach is that cost should be considered; this result is obtained by taking as an assumption that the more stock an investor holds the more cost he faces (Statman, 1987). Then the logical approach should be that the investors should stop diversifying when the diversification starts to cost them more than the benefits they get from diversification. According to Statman (1987), this approach determines the most diversified portfolio possible to hold, thus, to be considered a well-diversified portfolio, a portfolio of random stocks should include at least 30 stocks for a borrowing investor and 40 stocks for a lending investor.

Concerning the impact of the portfolio management on the diversification effect, it is important to note that active portfolio management does not bring more return on average. “Diversification returns are assured only for those portfolios that maintain relatively fixed asset weights”. (Booth & Fama, 1992). In fact, through simulation, it is shown that trying to time the market imply more variance of compounded return and convey slightly less portfolio compounded return. This is due to the fact that investors’ change in the portfolio bring more volatility and then uncertainty of the overall portfolio return. (Booth & Fama, 1992)

Now that it has been stated that diversification bring intrinsic benefits, it is also interesting to discuss the fact that most of the time investors do not invest in well-diversified portfolios. Investors often prefer to invest in familiar areas and ignore portfolio theory. They often invest in their field of expertise or the companies they know the best (Huberman, 2001). This behavior could be only the results of ignorance but in some degrees, it is also observable among professional investors. This is explained by the fact that investors think that by focusing more on certain assets they will be able to get an edge over their competition. (Choi, et al., 2017)

When investing, managers can choose between two strategies concerning information collection. The first is to collect general information about a large number of assets and the second is to focus on a more specific class, type or sector of assets in order to obtain more information than its competitor and try to make profit thanks to this asymmetry of information (Nieuwerburgh & Veldkamp, 2010). Nieuwerburgh and Veldkamp describe the concept of information in that theory as follow:

“Information [...] is a tool to reduce the conditional variance (the uncertainty) of the asset's payout”

(Nieuwerburgh & Veldkamp, 2010)
Without information advantage, investing in a diversified portfolio is optimal. But, when investors can spend time collecting information and choose which assets to favorize based on its payoff, the conventional theory of diversification is worthless (Nieuwerburgh & Veldkamp, 2010). One asset could be more interesting to learn about than the other because learning about it would bring more value. So, it is not possible to prove that it is optimal to learn about multiple assets, unless all the assets are symmetric. (Nieuwerburgh & Veldkamp, 2010)

Choi et al. (2017) agree with Nieuwerburgh and Veldkamp (2010) by stating that the information asymmetry allows investors to earn higher returns. When investors are allowed to collect information of their choice before the constitution of the portfolio, they get better returns by investing in a portfolio that could theoretically seem suboptimal or even irrational (Nieuwerburgh & Veldkamp, 2010). Those results tend to show that there is probably no interest in investing in a fully diversified portfolio and that having a part of specialization could lead to better returns. The articles of Choi et al. (2017) and Nieuwerburgh and Veldkamp (2010) seems to be linkable to the subject of international diversification. But it also appears that it can be a slippery slope, it has been observed that when an investor decides to specialize in an asset because he has an initial comparative information advantage, he tends to overweight this asset in his portfolio and the information asymmetry grow even more (Nieuwerburgh & Veldkamp, 2010). Studies tend to show that there is a happy middle that leads to the optimal return.

2.3 International Portfolio Diversification

An international portfolio is the case when a portfolio contains investments in foreigners’ countries. The target from that diversification is to exploit the emergence of new markets and regions as well as lower the risk by diversifying. This description of international portfolio diversification looks as if it is always beneficial to invest internationally. Conversely, some researchers argue against international diversification. According to portfolio diversification theories, a well-diversified portfolio will limit the risk and makes an investment more secure as well as it maximizes the return. As an example of portfolio diversification see. (Markowitz, 1952) Referring to that theory, the more the number of investments alternatives exist, the more the diversification opportunities enhance. Because the investors will have a broader choice that works with his strategy. Therefore, when investors limit their investments locally, they will eliminate many choices that are available to enrich their portfolio diversification.

Driessen & Laeven (2007) studied the benefits of international diversification for small investors who invest in stocks only. Their results agree with the previous assumption as they found that international diversification is beneficial in developed and developing countries. However, the benefits are more significant for developing countries. Driessen & Laeven, in their 2007 study, assume that international diversification is more beneficial for developing countries. This advantage is because they will have the option to invest in more mature markets, which will give them many stable investment possibilities to lower their risk. But, in term of return, it seems that developed countries may benefit more. Due to the fact that non-developed markets have a higher potential to grow abnormally and achieve higher returns, than developed and saturated markets. Driessen & Laeven (2007) adds that countries with higher risk rate benefit more from diversification, as they can lower their risk by investing in more secure countries. Though the diversification benefits are decreasing, the improvements in countries risk overtime explain this. Grubel (1968),
De Santis and Gerard (1997) added to evidence that international diversification is beneficial.

You and Daigler (2010) investigated international diversification by using some measures that are not traditionally used when evaluating international diversification. The majority of previous research about international diversification was based on the constant correlation factor. You and Daigler (2010) study is based on comparing the skewness and kurtosis, as well as the trade-off between the standard deviation risk, correlation, skewness and kurtosis. This study leads to more accurate results since the correlation shows if the returns of different countries move together or not but, would not consider the risk and return trade-off or the extreme movement of markets. The constant correlation between stocks gives an insight into the diversification opportunity, but more accurate conclusions may be drawn by adding more measures as You and Daigler (2010) did.

Moreover, testing international diversification based on constant correlation generates incomplete results. (You & Daigler, 2010) According to You and Daigler (2010), benefits of international diversification are different with different benchmarks, in the case where the S&P 500 was the benchmark, international diversification has insignificant benefits. However, the global portfolio has outperformed all the other tested markets outside the US. This finding may be explained by the size of the benchmark market as well as the types of assets existing in the market. Perhaps, a bigger market as the US gives more diversification opportunities locally, while a smaller market would not be able to offer that. Moreover, You & Daigler’s (2010) paper shows evidence with and against international diversification, which makes it more interesting to study it considering different benchmark market and time. Based on these findings, we will consider the kurtosis and skewness measures in our study, as well as the Sharpe ratio and standard deviation leading to more accurate results.

While the previously mentioned researches added evidence to the international diversification, other researches stated that it is not beneficial to diversify internationally. Errunza et. Al (1999) think that investors can mimic international diversification by a local portfolio without investing in assets that only trade abroad. This theory was based on calculating the correlation between the local assets and the assets traded abroad, then, include the most highly correlated with foreigner assets. That way will mimic international diversification by trading locally. The correlation of the industries indices that formed the local diversified portfolio is higher with foreigner indices than the S&P 500, which is the regional index for the USA. (ERRUNZA, et al., 1999) Those findings seem smart, since forming a local portfolio that mimics the international diversification, will give his owner the international diversification benefits, as well as cost-saving benefits by avoiding the wide range of investments. However, this theory may not be right, since You & Daigler (2010) assured, that measuring international diversification based on correlation only is incomplete. Moreover, Errunza et al. (1999) found that for 11 out of 16 markets studied, diversification beyond the local market is insignificant. However, Thailand and Chile benefit the most from international diversification. This result is consistent with Driessen and Laeven (2007) which mentioned that international diversification is more beneficial for developing countries. Thailand and Chile, which are developed countries, confirm that finding, according to Erunza et al. (1999) results.
Erunza et al. (1999) ended their research by concluding that international diversification benefits are fast disappearing. This is also consistent with Driessen and Laeven (2007), as they mentioned that countries are improving their markets risk, which decreases the benefits of international diversification. Choi et al. (2017) and Moskowitz (2001) added some evidence against international diversification. Moskowitz’s study showed that mutual funds investing locally outperformed other funds that are geographically diversified. Both of them associated this outperformance to the information advantage. (Choi, et al. 2017; Moskowitz, 2001)

In this section, we discussed articles that support and criticize international diversification without focusing on the reasons behind the choice of international diversification or local concentration. The next section will discuss the reasons that make investors home-biased or lead to avoid international diversification, as well as other facts that facilitate or hinder international diversification.

2.4 Motives and Hinders of International Diversification

Behind every investment choice, there is a whole process performed by the investor leading to his final decisions. Investors decisions can be rational when based on financial measures, studies and information. On the other hand, irrational decisions can be made when the feelings and psychologic issues are involved as the overconfidence issue. When thinking about international investments, many thoughts come up, as the transactions cost, institutional constraints, taxation differences, information availability, and many others. However, the majority of researches have concluded that the most significant reason behind not investing internationally is the investor’s will.

French and Poterba (1991) estimate the ownership of the five largest stock markets in the world as follows: 92.2% for the US, 95.7% for Japan, 92% for the UK, 79% for Germany, and 89.4% for France. These findings show the high level of domestic concentration. In this study, French and Poterba (1991) state that every investor from the UK, Japan and USA have expected a higher return of investing in his home country than abroad. Investors tend to be optimistic when asked about the returns in their local capital market. (French & Poterba, 1991) One reason for this optimism can be the familiarity with the local capital market, and another one can be the information acquired.

Moreover, it can be the overconfidence of the investors when they think that they have all the information, and they can control the outcome. (Nofsinger, 2014, pp. 12-14) Besides, institutional constraints were not the reason that limits the international diversification, since the foreign investments have never approached to these constraints. The reason behind the ignorance of international diversification, is the investors’ behavior, as they think that foreign investments are riskier because they have less information about these (French & Poterba, 1991). All these factors, show that international diversification is not the result of constraints, but the result of investors’ choices, which is not based on financial theory in most of the cases. Investors tend to invest in familiar areas ignoring portfolio theory and principles. Many invest in their employer’s company; in companies, they think they know and in popular companies in the media. These investment decisions are the results of familiarity, but, it conflicts with the portfolio theory since it is riskier than a diversified portfolio. (Huberman, 2001) Strong and Xu (2003) agree with French and Poterba (1991), as they found that fund managers show a relatively high optimistic level to their home equity market. They
mentioned as well that institutional factors have failed to justify the home bias puzzle and linked this issue to the investors’ behavior.

Furthermore, it was unclear if the optimistic attitude is behind the home bias, or it is an ex-post justification for investing in the domestic market. (Strong & Xu, 2003) Optimism affects the investors’ decisions, since investors tend to be more optimistic on events they think they have control on, and the familiarity with the local markets enhance their overconfidence and optimism. (Nofsinger, 2014, pp. 12-14) Thus, it looks that optimism is one of the reasons for being home bias and not an ex-post excuse to that.

Chan et al. (2005) performed a study about the home bias reasons and factors affecting that, the degree of the stock market development has the most substantial impact on the home bias. In addition to the stock market development, familiarity plays a significant role in the home bias phenomenon. As evidence to the familiarity fact, Swedish speaking Finnish investors are more likely to invest in Finnish companies that have Swedish speaking CEOs and publish their annual reports in the Swedish language. It is also interesting to note that Finnish speaking investors would not invest as much in these companies. (Chan, et al., 2005) Strong evidence of the existence of home bias in every market, rather if it is developed or emerging, though, the degree of home bias differs from country to another. As much as the country is far from the rest of the world and have a different language, the investors will be more home biased and have the highest weight of capital allocated in their home country. Foreigners invest less in these countries as well. (Chan, et al., 2005) The most robust variables that affect the home bias issue exists in Sweden, which is our study’s benchmark. The capital market is well developed, and in continuous development as well as Sweden have a unique language, these indicators mean that Swedish investors tend to be more home bias considering Chan et al. (2005) findings. Moreover, capital markets that are far away and have different languages such as India, Thailand and many more, will probably not be a point of interest for Swedish investors. So, it will be interesting to consider these countries to see if it’s beneficial to invest there from a Swedish perspective.

Moskowitz (2001), highlighted the importance of the information collection and showed that older and smaller mutual funds that have more geographically concentrated portfolios outperformed other funds. The information acquisition and information asymmetry explain this outperformance. If the investors are close geographically, they can get a better quality of information with less cost. They can check the operation personally, as well as asking the customers and suppliers about the company. Moreover, private information may be accessed through the interaction between fund managers and the managers of the local companies in the country club or similar places. (Moskowitz, 2001) Moskowitz point of view is very logical, but it does not work that way everywhere. Especially in less sociable societies. However, the acquired information is vital in any investment decision, and information advantage will add value to its owner.

Coeurdacier and Guibaud (2011) findings are consistent with the fact, that information availability and familiarity with local markets, push investors to allocate the biggest part on domestic investments. It also affects the choice of foreigner investments, that will be acquired to hedge the local risk exposure. Moreover, familiarity matters and some investors only invest locally due to familiarity, but the ones who invest internationally usually select their stocks very well. (Coeurdacier & Guibaud, 2011) These findings add to evidence that people who invest internationally have more knowledge in finance, since
they do it to hedge risk, and they select their stocks very well. In contrast, the investors holding a domestic portfolio are based on feelings and familiarity; they also conflict with portfolio theory and principles.

The development of the technology and internet gave an easier and broader access to capital market information abroad. This technology development contributes to the development of international diversification and decreases the geographical bias. Information availability is treated differently from one investor to another; some will use it to enhance their knowledge about markets they are already familiar with. On the other hand, some other investors will use this information to broaden their investments internationally. (Emery & Gulen, 2019)

Moreover, countries that have better internet quality and access tend to download more financial data. This is translated by being more open to international diversification. After starting to trade online, investors tend to decrease their geographical bias and start to invest more internationally. (Emery & Gulen, 2019) From this article, we can relate to Sweden, where the internet quality is very high, and the population is familiar with online transactions since it was embedded in the Swedish daily life a long time ago. Familiarity with technology makes Swedish investors more open to international diversification. However, based on the article of Chan et al. (2005), it is implied that the Swedish investors tend to be more home biased since they have a unique language and a developed capital market.

Conclusively, different reasons may affect the decision of investing internationally or not. However, most of the reviewed studies have found that ignoring international diversification is based on the investors’ decision and not the other facts that may affect this choice. Moreover, feelings, overconfidence, familiarity, and optimism lead to ignoring international diversification, which conflicts with the portfolio theory, which shows that investors that make choices based on these factors take irrational decisions. On the other hand, investors that are more sophisticated and educated tend to consider more international diversification. However, some professional fund managers tend to invest only on a national level due to the information advantage. Lastly, different facts and conflicts exist in previous research and the existing theory. In other words, we can’t say if international diversification is beneficial or not because it can be different from case to another. The best way to get the answer to that is to test it by ourselves.

### 2.5 Nordic Studies about International Diversification

Liljeblom et al. (1995) from the Swedish School of Economics and Business administration in Helsinki, have studied the benefits of international diversification for Nordic countries. Their study was made on 18 different countries, 17 of them were OECD countries, and the 18th was Hong Kong. Liljeblom et al. (1995) found that the equally weighted Nordic portfolio outperformed the value-weighted global portfolio. However, the Mean-Variance global portfolio had the best performance overall. This study indicates substantial benefits of international diversification for Nordic investors. (Liljeblom, et al., 1995)

Karlsson and Norden (2007) performed a study to test the home bias impact in the portfolios of mutual funds; these tested portfolios are formed as a portion of the pension plan in Sweden. In Sweden, there is no constraints or regulations that hinder international
diversification. However, government employees are more likely home bias because their jobs are very safe, and they want to hedge against domestic inflation. In addition, home bias is linked to overconfidence, and that’s why men are more home bias than women because men are overconfident. A typical home biased investor is more likely a man, unmarried, poorly educated, public sector employee, who invest small amounts and did not have any experience with risky assets investments. Also, it is not a skilled or sophisticated investor, having a very secure job and tend to be overconfident. (Karlsson & Norden, 2007) As mentioned in the previous sections of this chapter, a home biased investor is more likely to be poorly educated and takes an irrational investment decision, that does not follow advanced financial analysis prior investment.

Karlsson and Norden (2007) stated that the more the investor is sophisticated, the less home biased he is. Investors that had, previous experience is risky investments, a higher level of education and a large amount of money invested, tend to benefit more from international diversification. (Karlsson & Norden, 2007) As mentioned before in this chapter, international diversification can be beneficial on many occasions as well as not beneficial sometimes. Being home biased eliminates the option of international diversification, which means blocking an opportunity, that may be beneficial. This is associated with the poor education and overconfidence of home biased investors.

Conclusively, Liljeblom et al. (1995) found that international diversification is beneficial for Nordic investors. Karlsson and Norden (2007) found that some Swedish investors are home-biased, and some others are open for international diversification. These findings are consistent with a part of the reviewed literature and contradict with another part. This contradiction in the literature makes us curious to test the international diversification for Swedish investors and fill the existing gap. This study may help home biased investors to be more open for international opportunities, or advice the educated investors to review their investment strategies.

**2.6 Summary**

This chapter aims to set the theoretical basis of this study, which will be used and referred to through the whole study. It also helps to show the previous opinions about the studied topic and highlight the contradiction in the literature. Lastly, it helps to find a research gap to support the research purpose and to precise the research contribution.

The flow of this chapter started by reviewing literature about the portfolio diversification topic in general, such as Markowitz (1952) and Michaud (1989). It is followed by a discussion about portfolio diversification, where some researchers as Van Nieuwerburgh and Veldkamp (2010) argued for the information importance, that makes a concentrated portfolio more beneficial than a diversified one. Then, the focus in the literature was on the international diversification and its motives and hinders. It is also a contradiction in the literature related to international diversification. Some research argued for international diversification, such as Driessien, Laeven (2007), Grubel (1968) De Santis and Gerard (1997).

On the other hand, other research argued against international diversification and favorized locally concentrated portfolios. Some of these researchers are Choi et. Al (2017) and Moskowitz (2001). Furthermore, You and Daigler (2010) and Errunza et al. (1999) argued against international diversification, but, in some cases of their studies, international diversification was beneficial.
Then, literature about the motives and hinders of international diversification is reviewed. In most of the studies, the reasons behind the home-biased issue are the familiarity with the local markets, the overconfidence of the investors and mainly the choice of the investors which conflicts with the portfolio theories. On the other hand, the more educated and sophisticated the investors are, the more open to investing internationally.

The last part of this chapter contained the review of previous studies about the Nordic countries and Sweden. Liljeblom et al. (1995) found that international diversification brings benefits for Nordic investors. In addition, Karlsson and Norden (2007) studied what types of Swedish investors tend to be home-biased and which types tend to not. Home-biased are mainly man, poorly educated with a high-security level job. While the more open to diversification, have higher education level, have previous experience in risky investments and are more sophisticated investors.

Conclusively, the literature reviewed shows a contradiction between the different articles. Some articles favor the portfolio diversification and other portfolio concentration. Some articles state that international diversification is beneficial, and some others state that it is not. This opposition created a Gap in the literature since there is not an answer whether the diversified or concentrated portfolio is better. Neither if international diversification nor local concentration is better. This contradiction creates a gap and shows the need for a study from a specific perspective to find the answer to this question.
3. Methodology

The main purpose of this part is to share with the reader the scientific beliefs that the authors of this study holds and comprehend their philosophical starting point. But it is also to precisely describe and understand the practical methods used to answer the research question. The part will be composed of 4 sections, it begins by taking into consideration our preconceptions. Then, we explain the scientific approach we decided to adopt in this study, which correspond to the philosophical stances behind the studies from an ontological perspective as well as an epistemological perspective. It will then be followed by the presentation of the approach we have chosen to answer the research question as well as the choices we faced. It will end by presentation of the methods that we used practically to obtain the results presented in the following part.

3.1 Preconceptions

Both of us are Umeå School of Business and Economics master students specialized in finance writing our master thesis. We have different backgrounds but followed the same courses during this last year of masters about general investments topics like valuation of assets, investments, portfolio management and risk management. We both are International students, Nathan Lercier coming from France and Charbel Sawwan from Lebanon. Also, both of us had a finance background before this year, and thus we have a grasp on fundamental financial theories and concepts. Nathan Lercier had previous banking experience concerning financial risk management and credit risk through two different six-month internships. Charbel Sawwan had previous working experience in accounting and auditing in different companies for two years. We share a common interest in finance, for the portfolio management subject, and we are familiar with the topic of asset allocation and diversification.

This study has been carried out with the goal of objectivity in mind. We have been careful to consider any bias in our approach. The choice of the quantitative data analysis method has been made in order to base the study on hard and objective evidence easily reproducible by anyone willing to challenge the results. This method also induces the least amount of personal preconception to interfere with this work. Nevertheless, we are aware of the fact that the specific choice of this method has been influenced by our own philosophical stances on science. All the information relative to those stances will be available in the following section.

3.2 Scientific Approach

While conducting the study, it has been essential for us to identify our philosophical starting points. It is crucial to identify those assumptions for the pure and simple reason that it underpins the totally of the research and our critical point of view on the subject treated in this study. The scientific approach adopted by the researcher has been divided into two categories under the name of the paradigm. A paradigm is, according to Collis and Hussey, “a framework that guides how research should be conducted based on people’s philosophies and their assumptions about the world and the nature of knowledge” (Collis & Hussey, 2014, p. 343).

Those two paradigms are named interpretivism and positivism. Interpretivism corresponds to the philosophical assumption that reality is subjective because our
perception of things affects the actual results. It assumes that there is multiple reality depending on the individuals and that the world cannot be separated from the actors within it. Even more, it is impossible to isolate the thing that occurs in the world, and that is reported in the study from what is in the scholar mind (Creswell, 2014). On the opposite side, positivism focus on measuring phenomena from an objective point of view. The underlying assumption of positivism is that it exists a reality independent from the scholar perspective and that it is the role of the researcher to try to find a model that fits as closely as possible to that reality. To determine those model positivist researchers, base their theories on empirical research, that can be demonstrated and are reproducible (Collis & Hussey, 2014, pp. 43-56). And because reality is assumed as independent from them, positivists consider that their research has no effect in itself on reality (Creswell, 2014). The positivist scholar is particularly interested in predicting future phenomena, establishing a causal relationship between variable to, in the end, develop fixed laws that rule the observed phenomena.

A deducitive approach, quantitative data collection and statistical analysis is therefore characteristic for research under the positivist paradigm (Collis & Hussey, 2014, pp. 43-56).

As stated before, the purpose of this study is to investigate if the international diversification, when investing in equity indices, will beat domestic investments for Swedish investors. As well as assessing different levels of international diversification. We measure the causal relationship between the degree of international diversification and other variables; thus, it is typical of the objectivist paradigm (Collis & Hussey, 2014, pp. 43-56). The ontological assumption, assumption concerning the nature of reality, on which this work is based is that it exists an objective reality concerning market laws and that it is not open to subjective interpretation. This study aims to investigate international diversification effects compared to more domestic portfolios by analyzing their characteristics over the same period and using the exact same method to do so. It will thus bring a measurable and unbiased answer, which correspond to the epistemological stance of positivism. (Collis & Hussey, 2014, pp. 43-56)

From an axiological point of view, this study has been led, leaving nothing open to interpretation during the data collection and analysis. We tried to use all the available data we had following an unbiased process. The data used in this study was available before the study and will still be available in the future in the exact same way it is today. The results and the method used are, therefore, independent of the authors. We invite the reader to verify and find those results again on his own if he feels that it is necessary. Since all those fundamental stances tend to be characteristic of the positivist paradigm (Collis & Hussey, 2014, pp. 43-56), and that this study aims to answer the research question with evidence from measurable observations, this paradigm seems appropriate for this study.

The paradigm chosen by the authors of a study generally greatly influence the way the study will be conducted. This study tries to have a grasp on law-like generalization in the international diversification field by studying different portfolio over an extended period.
Thus, every portfolio composition has been done using impartial information and based on logical and unbiased choices. The method we used to build them follows methods that are widespread in the industry and use the data that was available to us. The conditions in which this study have been led are reproducible and available to every master student. This corresponds to a classical quantitative approach to collecting data. (Collis & Hussey, 2014, pp. 43-56)

3.3 Research Approach and Methodological Choice
There are two ways to approach research, deductively or inductively, to assess the relation between the theory and practices. Using a deductive approach, the authors will develop theory and hypotheses, then conduct research or study to test these hypotheses, which will lead to accept or reject the hypotheses. On the other hand, the inductive approach is when the authors collect and analyses data to come up with a new theory. (Saunders, et al., 2009) However, deductive approach is the most popular approach in scientific researches. This thesis will follow a deductive research approach, since it will be testing different hypotheses about international diversification, to conclude if it is beneficial or not for the Swedish investors.

We decided in this thesis to follow a positivism assumption. According to Collis and Hussey (2014, p.47), quantitative method is one of the characteristics of positivism. Moreover, the results that this study aims to generate are based on historical financial data and there is no other alternative than the quantitative analysis method to follow. The purpose of this study is to compare the performance of different indices portfolios that represent different levels of international diversification. The comparison will consider different financial measures as Standard deviation, return, kurtosis, skewness and Sharpe ratio. To generate these financial analyses, a quantitative analysis of historical prices of the used indices must be performed. Therefore, this study will follow a quantitative method.

3.4 Practical Method
The purpose of this section is to explain the method followed to gather the data and analyses it, on which the following discussions and results are based on. This is to make the reader more familiar with the method used to generate the results of the study.
A comparison between nine portfolios will be performed in this study; the portfolios are made from national equity indices, and one portfolio representing the Swedish industrial sector contains a Nasdaq Swedish industrial index.

3.4.1 The Portfolios selection
The purpose of this study is to evaluate the impact of international diversification for Swedish investors. Sweden will be the benchmark of the study. To evaluate international diversification, we built nine different portfolios that represent different degrees of geographical diversification. All the portfolio’s constituents are national equity indices because the national equity index is equivalent to a diversified local portfolio. One exception to that is the Swedish industrial index, which represents the industrial sector in Sweden. We chose the Swedish industrial index to present a more concentrated Swedish portfolio and not to investigate sector diversification. The portfolio selection was based on different factors, like the geographical location of the countries, the type of country if it is developed or not and the taxation issue in the UK case. A detailed description of the portfolio will follow with a motivation for the selection choice.
The portfolios selection start with a concentrated portfolio, which represents only one sector in Sweden and then starts to be more and more diversified gradually. The second portfolio will contain equities in Sweden only, then in Western Europe and after that in Whole Europe having Western and Eastern European countries representatives. Both European portfolios will be analyzed containing the UK and without the UK, since the “Brexit” may affect the Swedish investments in the UK. Then, more diversified portfolios are built, one representing the emerging countries and the last portfolio is the global one containing assets from countries that represent different geographical regions. The portfolios will be represented in detail with their constituents, with a motivation of the selection choices.

1. The Swedish industrial sector portfolio represented by the Swedish industrial index (SX2000PI). This portfolio was chosen to signify a sector concentrated investment strategy, it represents local investment in Sweden with concentration on the industrial sector only. The choice of this portfolio is not to test the sector diversification issue, but we chose it to show a more concentrated Swedish portfolio.

2. The Swedish domestic portfolio represented by the Swedish national index (OMXS30). The OMXS30 consists of the 30 most actively traded stocks on the Stockholm Stock Exchange. The limited number of stocks included in the OMXS30 assure that all the constituents of the OMXS30 have an excellent liquidity. Also, the composition of the OMXS30 is revised twice a year. (Nasdaq, 2019) This shows a traditional home bias investment strategy when all the capital is invested in the domestic market. However, since the portfolio is made by the Swedish index (OMXS30) it is a diversified portfolio at a national scale.

3. The Nordic area portfolio represented by the Nordic index containing 4 countries (OMXN40). The following table shows the portfolio constituents:

<table>
<thead>
<tr>
<th>Country</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td>OMXN40</td>
</tr>
<tr>
<td>Denmark</td>
<td>OMXN40</td>
</tr>
<tr>
<td>Finland</td>
<td>OMXN40</td>
</tr>
<tr>
<td>Iceland</td>
<td>OMXN40</td>
</tr>
</tbody>
</table>

The Nordic portfolio contains investment in 4 different countries, as shown in table 1, this is the first level of international diversification when a part of the investment is made abroad. This portfolio was selected due to the high level of transparency in the Nordic countries (Transparency International, 2018) and familiarity with Sweden. Thus, we consider that maybe some Swedish investors may invest in the Nordic countries due to familiarity and trust. Moreover, Huberman (2001) mentioned that people tend to invest more in familiar areas, and we assume that Swedish are familiar with the Nordic countries.

4. The Western European area and UK portfolio containing 11 countries, 10 of them from Western Europe and UK. The Nordic index represent 4 countries as mentioned in the able 1. The following table shows all the countries and the indices that represent these countries.
This portfolio represents Western European countries and the UK, where all the countries are developed. Previous studies showed that developing countries benefit more from international diversification. (Driessen & Laeven, 2007) consequently, this portfolio will test the international diversification through developing countries only and test if it is beneficial. Furthermore, this portfolio represents one region, which is Europe and Sweden is a part of this region, which means that Swedish investors are more familiar with Europe more than the rest of the world. We assume that the probability of Swedish investors investing in Europe is higher than investing in the rest of the world. Lastly, the UK is included in that portfolio, which allows us to test the benefits of investing in the UK, European may stop investing in the UK after the “Brexit”.

5. The Western European area excluding UK containing 10 countries from Western Europe. The following table shows all the constituents of this portfolio:

<table>
<thead>
<tr>
<th>Country</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>DAX 30 PERFORMANCE</td>
</tr>
<tr>
<td>France</td>
<td>FRANCE CAC 40</td>
</tr>
<tr>
<td>Italy</td>
<td>FTSE BMI</td>
</tr>
<tr>
<td>Switzerland</td>
<td>SWISS MARKET (SMI)</td>
</tr>
<tr>
<td>Spain</td>
<td>IBEX 35</td>
</tr>
<tr>
<td>Netherland</td>
<td>AEX</td>
</tr>
<tr>
<td>Nordic1</td>
<td>OMX NORDIC 40</td>
</tr>
</tbody>
</table>

This portfolio is similar to the portfolio represented in table 2, but it excludes the UK. The exclusion of the UK is made to be able to test if the UK will add value to the Western European portfolio or not. Hence, the UK will leave the European Union after the “Brexit” and this may lead to less European investment in the UK due to the regulation and taxation differences after the “Brexit”. The difference we see here is hypothetical because the United Kingdom did not officially leave the European Union yet and already had a special status in the EU. Thus, it does not show what would be the impact on the rest of the EU and on the UK itself in term of performance in the future. But rather show what the previous effects of the UK during the last ten years on the European portfolio were and if it is a loss for European investors or if the change is for the better.

---

1 The Nordic index represents 4 countries that are: Sweden, Denmark, Finland and Iceland
2 The Nordic index represents 4 countries that are: Sweden, Denmark, Finland and Iceland
6. The Western and Eastern European area and UK portfolio, containing 19 countries’ indices. The following table shows all the constituents of this portfolio.

<table>
<thead>
<tr>
<th>Country</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>FTSE 100</td>
</tr>
<tr>
<td>Germany</td>
<td>DAX 30 PERFORMANCE</td>
</tr>
<tr>
<td>France</td>
<td>FRANCE CAC 40</td>
</tr>
<tr>
<td>Hungary</td>
<td>BUDAPEST (BUX)</td>
</tr>
<tr>
<td>Romania</td>
<td>ROMANIA BET (L)</td>
</tr>
<tr>
<td>Poland</td>
<td>WIG 20 POLAND</td>
</tr>
<tr>
<td>Cyprus</td>
<td>CYPRUS GENERAL</td>
</tr>
<tr>
<td>Estonia</td>
<td>OMX TALLINN (OMXT)</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>PRAGUE SE PX</td>
</tr>
<tr>
<td>Slovakia</td>
<td>SLOVAKIA SAX 16</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>BULGARIA SE SOFIX</td>
</tr>
<tr>
<td>Croatia</td>
<td>CROATIA CROBEX</td>
</tr>
<tr>
<td>Nordic(^3)</td>
<td>OMX NORDIC 40</td>
</tr>
<tr>
<td>Slovenia</td>
<td>SLOVENIAN BLUE CHIP (SBI TOP)</td>
</tr>
<tr>
<td>Macedonia</td>
<td>MACEDONIAN SE MBI 10</td>
</tr>
<tr>
<td>Lithuania</td>
<td>LITHUANIA OMXVGI</td>
</tr>
</tbody>
</table>

*Table 4: Western and Eastern Europe and UK Portfolio*

This portfolio still represents Europe, and it adds some Eastern European countries, which are developing countries. The aim of building such a portfolio is to highlight the benefits of investing in developing countries in case these benefits exist. We assume that Swedish investors did not consider investing in some developing countries due to different reasons. The language difference, the fact that they are developing countries with undeveloped capital markets and unfamiliarity may exclude these countries from the Swedish investors’ portfolio. (Chan, et al., 2005) Testing this may lead to some recommendations regarding investments in developing Eastern European countries, that Swedish investors may never think about.

---

\(^3\) The Nordic index represents 4 countries that are: Sweden, Denmark, Finland and Iceland
7. The Western and Eastern European area excluding UK, containing 18 countries represented by 15 equity indices. The following table shows all the constituents of this portfolio.

<table>
<thead>
<tr>
<th>Country</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>DAX 30 PERFORMANCE</td>
</tr>
<tr>
<td>France</td>
<td>FRANCE CAC 40</td>
</tr>
<tr>
<td>Hungary</td>
<td>BUDAPEST (BUX)</td>
</tr>
<tr>
<td>Romania</td>
<td>ROMANIA BET (L)</td>
</tr>
<tr>
<td>Poland</td>
<td>WIG 20 POLAND</td>
</tr>
<tr>
<td>Cyprus</td>
<td>CYPRUS GENERAL</td>
</tr>
<tr>
<td>Estonia</td>
<td>OMX TALLINN (OMXT)</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>PRAGUE SE PX</td>
</tr>
<tr>
<td>Slovakia</td>
<td>SLOVAKIA SAX 16</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>BULGARIA SE SOFIX</td>
</tr>
<tr>
<td>Croatia</td>
<td>CROATIA CROBEX</td>
</tr>
<tr>
<td>Nordic(^4)</td>
<td>OMX NORDIC 40</td>
</tr>
<tr>
<td>Slovenia</td>
<td>SLOVENIAN BLUE CHIP (SBI TOP)</td>
</tr>
<tr>
<td>Macedonia</td>
<td>MACEDONIAN SE MBI 10</td>
</tr>
<tr>
<td>Lithuania</td>
<td>LITHUANIA OMXVGI</td>
</tr>
</tbody>
</table>

*Table 5: Western and Eastern European Portfolio*

This portfolio is the same as the previous one shown in table 4, but it excludes UK due to the Brexit issue as explained in the 5\(^{th}\) point.

8. The Emerging countries portfolio, this portfolio contains 13 indices representing emerging countries. The following table the constituents of this portfolio.

<table>
<thead>
<tr>
<th>Country</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>SHANGHAI SE A SHARE</td>
</tr>
<tr>
<td>Korea</td>
<td>KOREA SE COMPOSITE (KOSPI)</td>
</tr>
<tr>
<td>Taiwan</td>
<td>TAIWAN SE WEIGHED TAIEX</td>
</tr>
<tr>
<td>Singapore</td>
<td>STRAITS TIMES INDEX L</td>
</tr>
<tr>
<td>Thailand</td>
<td>BANGKOK S.E.T.</td>
</tr>
<tr>
<td>India</td>
<td>NIFTY 500</td>
</tr>
<tr>
<td>South Africa</td>
<td>FTSE/JSE ALL SHARE</td>
</tr>
<tr>
<td>Turkey</td>
<td>BIST NATIONAL 100</td>
</tr>
<tr>
<td>Mexico</td>
<td>MEXICO IPC (BOLSA)</td>
</tr>
<tr>
<td>Russia</td>
<td>MOEX RUSSIA INDEX</td>
</tr>
<tr>
<td>Argentina</td>
<td>S&amp;P MARVAL INDEX</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>SAUDI TADAWUL ALL SHARE (TASI)</td>
</tr>
<tr>
<td>Brazil</td>
<td>BRAZIL BVSP</td>
</tr>
</tbody>
</table>

*Table 6: Emerging countries portfolio*

\(^4\) The Nordic index represents 4 countries that are: Sweden, Denmark, Finland and Iceland
This portfolio is formed from emerging countries as classified by Thompson Reuters. All the countries are located outside Europe, and most of them are far away from Sweden by distance. Most of these countries are developing and have languages that are unfamiliar to Swedish. According to Chan et al. (2005), Coeurdacier and Guibaud (2011), the mentioned characteristics make Swedish investors not attracted to invest in these countries. However, these countries may offer good opportunities and add value to Swedish investors. These facts make this portfolio interesting to study and give the study the potential to come up with good new investment recommendations.

9. The global portfolio containing 21 countries from all the different continents. The following table contain the constituents of this portfolio.

<table>
<thead>
<tr>
<th>Country</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>S&amp;P 500 COMPOSITE</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>FTSE 100</td>
</tr>
<tr>
<td>Germany</td>
<td>DAX 30 PERFORMANCE</td>
</tr>
<tr>
<td>Japan</td>
<td>TOPIX</td>
</tr>
<tr>
<td>France</td>
<td>FRANCE CAC 40</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>HANG SENG</td>
</tr>
<tr>
<td>China</td>
<td>SHANGHAI SE A SHARE</td>
</tr>
<tr>
<td>Korea</td>
<td>KOREA SE COMPOSITE (KOSPI)</td>
</tr>
<tr>
<td>Australia</td>
<td>S&amp;P/ASX 200</td>
</tr>
<tr>
<td>Canada</td>
<td>S&amp;P/TSX COMPOSITE INDEX</td>
</tr>
<tr>
<td>India</td>
<td>NIFTY 500</td>
</tr>
<tr>
<td>South Africa</td>
<td>FTSE/JSE ALL SHARE</td>
</tr>
<tr>
<td>Mexico</td>
<td>MEXICO IPC (BOLSA)</td>
</tr>
<tr>
<td>Russia</td>
<td>MOEX RUSSIA INDEX</td>
</tr>
<tr>
<td>Argentina</td>
<td>S&amp;P MARVAL INDEX</td>
</tr>
<tr>
<td>Nordic⁵</td>
<td>OMX NORDIC 40</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>SAUDI TADAWUL ALL SHARE (TASI)</td>
</tr>
<tr>
<td>Brazil</td>
<td>BRAZIL BVSP</td>
</tr>
</tbody>
</table>

Table 7: Global Portfolio

This last portfolio is formed from equity indices representing countries from all over the world. The countries selected to represent the most significant markets worldwide, emerging markets, developed and developing countries as well as presenting all the continents. This portfolio is geographically diversified over the whole world, including countries that Swedish may be familiar with as well as the opposite of that. This portfolio is the most diversified among the nine portfolios we created according to all the characteristics of diversification mentioned before.

3.4.2 Analyzed Data

The accuracy of the data is critical to generate accurate results. We focused in this study on having accurate data from reliable and trusted sources. Hence, we avoid any kind of mistake that inaccurate data can cause. All the data used in this study was downloaded

⁵ The Nordic index represents 4 countries that are: Sweden, Denmark, Finland and Iceland
from “Thomson Reuters DataStream” software and “Thomson Reuters Eikon”. Eikon from Thomson Reuters is vast database software. It provides different types of data, such as economic, company and finance data. Datastream provides enhanced practicality; it gives access to a vast database which is older than 40 years. Datastream allows its users to download, organize and analyze data in a flexible setup where the user can apply different functions at the same time. The flexibility particularly helps the analysis. (Umeå University Library, 2019)

The University of Umeå has a computer which gives the students access to “Thomson Reuters DataStream” software and “Thomson Reuters Eikon”.

The data downloaded from “Thomson Reuters DataStream” include the historical indices prices, the current market capitalization of the selected indices, historically risk-free rate of Swedish T-bills and historical currency exchange rates.

The study analyzes historical data for the past 10 years from 01-01-2009 to 31-12-2018. The historical indices prices were downloaded for the last 10 years in SEK as a currency and in USD as well. Historical indices prices are downloaded with daily frequency. There are four indices historical prices that were downloaded from “Thomson Reuters Eikon” and in the local currency which are:

- Poland (WIG20)
- Brazil (BVSP)
- Lithuania (OMXVGI)
- Sweden Industrial (SX2000PI)

These indices historical prices were downloaded from “Thomson Reuters Eikon” in local currencies since the historical prices in SEK were not available on “Thomson Reuters DataStream” for the last 10 years. These indices prices were converted to SEK and USD according to the historical exchange rates downloaded from “Thomson Reuters Eikon”. The historical indices prices were downloaded in USD as well because the historical market capitalization was calculated based on the index price evolution and the current market capitalization, which was available in USD only.

The current market capitalization of all the indices was downloaded in USD from “Thomson Reuters Eikon”.

Historical currency exchange rates for the past 10 years from 01-01-2009 to 31-12-2019 were downloaded. The exchange pairs are as following:

- SEK/USD
- SEK/Brazilian Real (BRL)
- SEK/Poland Zloty (PLN)
- SEK/Euro

Monthly risk-free rates for Swedish T-bills was also downloaded from “Thomson Reuters Eikon” from 01-01-2009 to 21-12-2018. The Swedish T-bills rates are used to calculate the Sharpe ratio. We chose the Swedish T-bills rate as a risk-free rate because Sweden is the benchmark of the study.

### 3.4.3 Calculations and Comparison

After collecting and organizing the data, it has been necessary to proceed to the selection of the necessary software. The software’s main utility is to calculate the portfolios’
indicators needed to analyze their performance and statistical properties, as well as realize graphs used to analyze the results of this thesis. The choice of those software is based on their capacity to fulfill the role of the calculator and of producing those graphs efficiently but also to be directly usable within the scope of this study.

Microsoft Excel, a spreadsheet software, has been used for the most basic calculation concerning weights of the portfolios as well as calculating indicators for the individuals time series of each index and the correlation between the indices. It also has been useful to organize the results in a good manner in order to facilitate this analysis, as well as producing some graphs to show a part of the results.

R is an open source programming language and free software environment for statistical computing and graphics. The principal packages used in this study are quantmod, PerformanceAnalytics, ROI and xts. This software is used to proceed to the most complicated calculation, particularly concerning portfolio due to the compounding effect induced by those kinds of calculations. It is also of great use when proceeding to portfolio optimization. It is an appropriate tool to determine the optimal portfolio under any set of constraint and with any set objective. It is used here to follow the mean-variance portfolio optimization developed by Markowitz (1952).

The following points are intended to explain all the calculation and technical steps that are the roots of the results presented in the next part. It goes without saying that those explanations are not intended to detail every step that has been followed during this study. Nevertheless, their goal is to give the reader enough insight so he can fully comprehend the results of this study and reproduce those results if needed.

Weight Allocation:
It has been previously stated how we selected the indices to build the different scales of portfolio diversification. After that the indices were weighted based on the historical market capitalization of each index. The weight formula is the following:

\[
\text{Index Weight} = \frac{\text{Index Historical MC}}{\sum \text{Indices Historical MC}}
\]

Where, MC: Market Capitalization

Then the weight is used to calculate all the indicators of the portfolio, like the return and standard deviation. These indicators will be explained later in this section, as well as explaining how the weight was used. The market capitalization method was used for the indices’ allocation in the portfolios. The reason behind that choice, is that it is an easy method to allocate the weights of a portfolio and could be used by any person who does not have an advanced knowledge in finance. This makes our study fits all the Swedish investors, in case they are sophisticated or not.

Variance and Standard Deviation:
The variance and standard deviation measure the volatility of the returns of a financial asset. The volatility allows the investors to assume how risky the asset is. We will use the standard deviation in our study to show the volatility of the studied portfolios.

---

6 Historical market Capitalization was calculated as explained in the section 3.4.4
The single index variance formula is as follows:

$$\sigma^2 = \frac{\sqrt{\sum_{i=1}^{n}(r_i - r)^2}}{n - 1}$$

Where
- N: Total number of days
- r: Mean return
- ri: Return at period i

The portfolio variance formula is as follows:

$$\sigma_p^2 = \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j Cov(r_i, r_j)$$

Where
- w: Index weight
- i: Index i
- j: Index j
- n: Total number of indices in the portfolio

The standard deviation is calculated in the same way in case it was for a single index or for a portfolio. It is the square root of the variance as showing in the following formula:

$$\sigma = \sqrt{\sigma^2}$$

**Skewness:**
The calculation of the “Skewness” of a distribution correspond to the calculation of its asymmetry using the cubed standard deviation from the mean of the distribution. The value of skewness gives information on the shape of the distribution to the investor. It is calculated as:

$$Skew = E \left[ \frac{(R - \bar{R})^3}{\sigma^3} \right]$$

Where
- R: Excess return
- $\bar{R}$: Average Excess return
- $\sigma$: Standard deviation

In this study, we take into consideration skewness in order to gather as much information as possible about the underlying risk of every asset and portfolio we try to analyze. Due to the fact that skewness is the result of a cube product, it can be positive and negative. Skewness give insight about the estimation of risk, if a distribution is positively skewed it means that the standard deviation of the distribution overestimate the risk of the distribution. On the contrary, if a distribution is negatively skewed it means that the standard deviation of the distribution underestimate the risk of the distribution.

Here the following figures are representations of daily returns distributions with different skewness, to illustrate this concept:
Figure 1: Zero skewed distribution

Figure 2: Negatively skewed distribution

Figure 3: Positively skewed distribution
**Kurtosis:**

The calculation of the Kurtosis of a distribution correspond to the calculation of the deviation of a distribution from normality using, in the same way as skewness is calculated, the fourth power of standard deviation from the mean of the distribution. It measures the likelihood of extreme value on both side of the distribution. It is calculated as:

\[
Kurtosis = \left[ \frac{E(R - \bar{R})}{\sigma^4} \right] - 3
\]

Where: R: Excess return \\
\( \bar{R} \): Average Excess return \\
\( \sigma \): Standard deviation

Three must be subtracted to the equation because the ratio of a normal distribution is three. Thus, if the kurtosis of a distribution is higher than zero it denotes the presence of “fat tails” in the distribution. This means that extreme outcomes are more likely in this distribution than in the normal distribution. It gives an information about the general risk related to an asset.

Here is a representation that illustrate this concept:

![Figure 4: Illustration of Kurtosis change in a statistical distribution](image)

**Sharpe Ratio:**

The Sharpe ration is a ratio introduced by William F. Sharpe and named accordingly. It has been introduced in order to compare the performance of different fund between each other (Sharpe, Mutual Fund Performance, 1966), and then became a popular tool to compare portfolios. It has been created as a ratio between excess return and risk to compare the performance of portfolio per unit of risk.
It is calculated as:

\[
S = \frac{E[R - R_f]}{\sqrt{\text{var}[R - R_f]}}
\]

Where: S: Sharpe ratio  
E[R]: expected return  
E[R_f]: expected risk-free rate  
\text{var}[R - R_f]: variance of the return taking into consideration the variation of risk-free rate

This ratio is particularly useful to compare portfolios with a different level of risk and different annualized mean return as it is done in this study.

**Correlation of daily returns:**

Correlation is a measure that correspond to the linear relation between two independent variables. The higher is a correlation the more related are the variation of the two independent variable. If the case of two time series as it is the case in this study, a correlation of 1 would mean that the time series are exactly correlated. This means that the variations of one are exactly reproduced by the other. In the case of a correlation of -1 it means that the time series moves exactly in the opposite directions from one another.

Correlation is calculated as:

\[
\rho_{X,Y} = \frac{\text{cov}(X, Y)}{\sigma_X \sigma_Y} = \frac{E[(X - \mu_X)(Y - \mu_Y)]}{\sigma_X \sigma_Y}
\]

Where: X and Y: independent variables  
\(\rho_{X,Y}\): correlation of X and Y  
\text{cov}(X, Y): Covariance of X and Y  
\(\sigma\): standard deviation  
\(\mu\): mean return

In this study, correlation is used to understand the impact that an index has over a portfolio in term of diversification. The less correlated the component of a portfolio are the most risk disappear through diversification and thus bring more return per unit of risk. It is the foundation of the Markowitz optimal portfolio building method.

**Markowitz optimizer**

To determine the weights of a perfect portfolio over a passed period of time we decided in this study to use a portfolio optimizer focusing on the same objectives as Markowitz in its article named Portfolio Selection published in 1952. This way of building portfolio
is based on the assumption that investors solely are looking to maximize their portfolio return and minimize the standard deviation of their portfolio (risk). A portfolio Optimizer is a machine that has been coded to resolve the following problem: Out of a set universe of diverse investments, what is the best portfolio that someone can build based on historical data taking into account different constraints and different objectives.

In our case the universe was composed of the major indices of countries of certain geographical area. The objective was to maximize mean return of the portfolio and minimize the standard deviation. The constraints were that the portfolio needed to be composed entirely with country indices and could not include short strategies. The optimizer we coded took into consideration those objective and constraints as well as the time series characteristics of each individual index of the universe. It automatically built the covariance matrix as well in order to be able to calculate the standard deviation of the portfolio. Then, through a high number of calculations it generates a large number of portfolios of consecutively higher performance and lower risk to, in the end, obtain the best available portfolio. In our case it selected the portfolio with the best Sharpe ratio (highest mean return and lowest standard deviation).

The program we built then was able to deliver the time series of those optimal portfolio daily returns and thus any statistical information about those portfolios. The one we selected were: Annualized standard deviation, Annualized return, Sharpe ratio, Skewness and Kurtosis

**Portfolio time series:**

To calculate a portfolio time series of daily return based on the time series of daily return of its components we have considered the weight of each component in the portfolio and the daily return of each component. The formula is a weighted average formula of the component daily return,

\[ R_{p,t} = \sum_{i=1}^{n} W_{i,t} R_{i,t} \]

Where:  
\( R_{p,t} \): return of portfolio at time \( t \)  
\( n \): number of securities in the portfolio  
\( W_{i,t} \): weight of security \( i \) in the portfolio at time \( t \)  
\( R_{i,t} \): return of security \( i \) at time \( t \)

It is important to consider that every day the weights change under the influence of the previous daily return. So, to calculate the time series of returns of a portfolio over a whole historic period it is important to consider the compounding effect of the successive daily return.

Lastly, the calculations of the Standard deviation, return, Sharpe ratio, skewness and kurtosis will be calculated on 8 different periods of time. The calculation will consider the whole 10 years period for all the portfolio. Then it will be divided for 2 periods of 5 years each and 5 periods of 2 years each as follows:
1. From 01-01-2009 to 31-12-2018
2. From 01-01-2009 to 31-12-2013
3. From 01-01-2014 to 21-12-2018
4. From 01-01-2009 to 31-12-2010
5. From 01-01-2011 to 31-12-2012
6. From 01-01-2013 to 31-12-2014
7. From 01-01-2015 to 31-12-2016
8. From 01-01-2017 to 31-12-2018

This time period division is made to show the different benefits of international diversification in different times, then we can test if it is growing or decreasing with time. It shows the international diversification impact on long term investments of 10 years as well as short-term investments of 2 years.

T-test:

In this study we used independent t-test to test pairs of portfolios difference in mean. This is a statistical method that test the gap between two distribution of two independent variables. It is a usual measure of comparison to find what is the difference in distribution of two independent group, for example it could be between the effect of a medicine or a placebo in medical science. The goal of this test is to determine if the difference in mean between those two independent group is significant or not. The results of a t-test are a t value and a p value. The t value is defined as follow:

\[ t = \frac{(M1 - M2)}{SE} \]

M1: Mean of the first distribution
M2: Mean of the second distribution
SE: Standard error

The standard error is the difference that we can expect between to distribution due to chance. Here the stocks time series are considered as random variables. The standard error of differences is defined as follow:

\[ SE = \frac{(SE_1 + SE_2)}{2} \]

SE1: Standard error of the first distribution
SE2: Standard error of the second distribution

The p value is the probability for the difference of the two mean to be higher than the T value. If the p value is superior to 0.05 then it means that there is no significant difference between two mean.

3.4.4 Practical limitations

The difficulty we face in this study is to find the historical market capitalization for the indices, we could not find this data from any reliable sources. In “Thompson Reuters-
DataStream” we found the historical market capitalization for 5 out of 40 indices which was not enough. So, we came up with a method to calculate the historical market capitalization by calculating the variation of the indices’ prices, and then used the following formula to get the historical market capitalization.

\[
\text{Historical MC} = \frac{\text{Current MC}}{1 + x}
\]

Where: MC: Market Capitalization

\[
x = \frac{\text{Last price} - \text{First price}}{\text{First Price}}
\]

This calculation does not give the exact historical market capitalization of the indices. However, it will be used in this study since it was the only alternative possible and that the impact of the market capitalization is not fundamental for the results of the study. The market capitalization is just used to divide the weights of the indices in the different portfolios.

Concerning the Swedish industrial sector index (SX2000PI), the portfolio containing that index was included in this study to show a more concentrated Swedish portfolio. Not to investigate the sector diversification impact.

3.4.3 Ethical Consideration

The process of writing a thesis should follow a specific code of conduct. Umeå University provides the students with a thesis manual, including all the rules and regulation that should be considered when writing a thesis. During the process of our thesis, we took the responsibility of respecting the rules and proceeded the work with full integrity. According to Saunders et al. (2009), the importance of plagiarism has grown with time in academic institutions. This is due to the easy access to the previous research online as well as it is easy to copy others’ work. All the reviewed and mentioned literature in this thesis, are appropriately cited and referenced according to the rules of Umeå University as well as all the information mentioned from previous researches are expressed in our own words.

The research design of our study follows the rules stated by Umeå University. A quantitative method is used in this study to generate the results. Quantitative methods have a set of rules that the author should follow. We tried in our thesis to respect all the corresponding rules. Regarding the quality of data used in our analysis, we used the most reliable data sources, such as “Thomson Reuters Datastream” and “Thomson Reuters Eikon”. While working with data, it is very easy to make mistakes, which leads to false results and conclusions. (Saunders, et al., 2009, pp. 425-427) Also, the wrong interpretation of the results can generate misleading conclusions. To avoid mistakes and produce accurate results, we checked our data more than one time to make sure that there no data missing. Furthermore, when doing the calculations to generate results, we performed some of the calculations individually using two different software (R and Excel) to make sure that our results are the same and accurate. Still, we rechecked our calculation steps to make sure that everything is right, and the results are accurate, leading to reliable conclusions.
Lastly, we added the previous section 3.4.4, to clarify the difficulties we faced in our practical method and explain how we solved it. This allows the reader to understand properly the limitations mentioned and assure the integrity of our study.
4. Results

The purpose of this chapter is to show the results of our study. The results are the yearly return, standard deviation, Sharpe ratio, kurtosis and skewness. The results are for the market capitalization weighted portfolios as well as for the optimal portfolios weighted based on Markowitz method.

4.1 Portfolios’ Indicators for the period from 01-01-2009 to 31-12-2018

Table 8 shows the annual returns, annual standard deviation, annual Sharpe ratio, skewness and Kurtosis of all the studied portfolios for the period between 01-01-2009 and 31-12-2018.

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Sweden Industrial</th>
<th>Sweden</th>
<th>Nordic</th>
<th>Western Europe and UK</th>
<th>Western Europe</th>
<th>Europe and UK</th>
<th>Europe</th>
<th>Emerging countries</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Mean Return</td>
<td>9.31%</td>
<td>5.75%</td>
<td>5.73%</td>
<td>2.24%</td>
<td>2.07%</td>
<td>2.90%</td>
<td>3.01%</td>
<td>4.41%</td>
<td>6.03%</td>
</tr>
<tr>
<td>Annual St.Dev</td>
<td>0.230</td>
<td>0.198</td>
<td>0.179</td>
<td>0.164</td>
<td>0.173</td>
<td>0.165</td>
<td>0.178</td>
<td>0.146</td>
<td>0.129</td>
</tr>
<tr>
<td>Annual Sharpe Ratio</td>
<td>0.499</td>
<td>0.398</td>
<td>0.438</td>
<td>0.261</td>
<td>0.238</td>
<td>0.301</td>
<td>0.285</td>
<td>0.446</td>
<td>0.658</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.159</td>
<td>0.235</td>
<td>0.251</td>
<td>0.133</td>
<td>0.087</td>
<td>0.147</td>
<td>0.081</td>
<td>0.488</td>
<td>0.360</td>
</tr>
</tbody>
</table>

Table 8: Portfolios’ Indicators 2009-2018

The indices of these portfolios are weighted according to their market capitalization method. The most concentrated portfolio, which contains the Swedish industrial sector index, has outperformed all the other portfolios with a return of 9.31%. In the same time, it has the highest standard deviation as well as a high kurtosis of 3.446, which means that the Swedish industrial sector portfolio is the riskiest of all. The global portfolio has the highest return after the Swedish industrial portfolio. With a return of 6.03%, the global portfolio has the lowest volatility with a standard deviation of 0.1292. The global portfolio has as well the highest Sharpe ratio among all the other portfolios, which is explained by lower volatility and higher return combination than others.

We observed that compared to the Swedish industrial portfolio, the global portfolio gives a benefit in term of lowering the risk since it has a lower standard deviation and a lower kurtosis.

Compared to Sweden, Nordic and all the other portfolios, the global portfolio generates higher returns with lower risk. The Swedish and the Nordic portfolios come directly after the global portfolio in term of return with respectively 5.75% and 5.73% annual returns. However, they have a higher standard deviation and kurtosis, which makes them riskier. The skewness of all the portfolios is positively close to 0, which means that the return distribution is close to the normal distribution.

Investing in the UK increased the annual return and decreased the risk when investing in Western Europe only. On the other hand, when investing in whole Europe, investing in the UK lowered the risk, but, lowered the return as well.
The worst performing portfolio is the Western European portfolio, which has the lowest return with a relatively high standard deviation. Over the ten-year period from 2009 till 2018, Swedish investors can lower their portfolio risk by investing abroad; however, focusing on the industrial sector will generate the highest return.

A T-test has been performed to compare the mean of the different portfolios with the Swedish industrial portfolio mean. We chose the Swedish industrial portfolio since it has the highest return. For each portfolio we realized a sample composed of all the 6 months sub-periods of the ten-year period. This decision has been made in order to have a larger sample. Thus, those samples are composed of 20 observations.

The T-test comparing the Sweden Industrial portfolio and the Swedish portfolio results in a P-value of 0.1072 and a P-value of 0.1135 when we compare it with Nordic portfolio. The ones comparing the Europeans portfolio resulted as such: Western Europe and UK (P = 0.0381), Western Europe (P = 0.0416), Europe and UK (P = 0.0414) and Europe (P = 0.0511). Finally, the result of the test comparing Sweden industrial and the emerging countries portfolio is P = 0.2067, and the result of the test comparing Sweden industrial and the global portfolio is P = 0.1826. The significance level that we selected is 5%. Then we can observe here that the t-test show no significant difference in mean between the Swedish industrial portfolio and the two other Scandinavian portfolios (Sweden and Nordic). Also, the P value of the test concerning the Emerging countries portfolio and the global portfolio doesn’t show a significance difference in mean. Nevertheless, we could observe a significant difference for the rest of the portfolios. The T-test shows a significance when the difference in annual returns is higher than 6%. However, the other P-values were not too high with the highest P-value of 0.2067.

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Western Europe and UK</th>
<th>Western Europe</th>
<th>Europe and UK</th>
<th>Europe</th>
<th>Emerging countries</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Mean Return</td>
<td>5.48%</td>
<td>5.48%</td>
<td>12.85%</td>
<td>12.85%</td>
<td>12.73%</td>
<td>9.95%</td>
</tr>
<tr>
<td>Annual St.Dev</td>
<td>0.145</td>
<td>0.145</td>
<td>0.156</td>
<td>0.156</td>
<td>0.188</td>
<td>0.156</td>
</tr>
<tr>
<td>Annual Sharpe Ratio</td>
<td>0.524</td>
<td>0.524</td>
<td>0.966</td>
<td>0.966</td>
<td>0.796</td>
<td>0.777</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.200</td>
<td>0.200</td>
<td>0.994</td>
<td>0.994</td>
<td>0.216</td>
<td>0.107</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.523</td>
<td>2.523</td>
<td>13.781</td>
<td>13.781</td>
<td>2.954</td>
<td>5.115</td>
</tr>
</tbody>
</table>

Table 9: Optimal portfolios’ indicators 2009-2018

Table 9 shows the optimal portfolios’ indicators according to the Markowitz method to maximize return and minimize risk. The most beneficial portfolios are the European portfolios with and without the UK with a return of 12.85% and a very high Kurtosis of 13.781, which means that there were abnormal returns during the studied period. The European portfolios with and without the UK underperformed the Swedish portfolio and the Swedish industrial portfolio in term of return, however, it lowered the standard deviation and kurtosis a bit, as well as it increased the Sharpe ratio.

The optimal portfolios are concentrated by having two indices in each. The western European portfolios with and without the UK were optimized when investing 47% in the Nordic index (OMXN40) and 53% in the Swiss index (SMI). The optimal European portfolio was also concentrated, allocating 89% to Estonia and 11% to Lithuania. The emerging countries portfolio is mainly concentrated in Thailand, which weights 93% while Argentina weights 7%. Lastly, the optimal global portfolio contains the Indian
index (NIFTY500), which weights 30% and the American index (S&P500) weighing 70%. We noticed that the European and Emerging portfolio had a close annualized mean return. A t-test showed no significant difference between those two portfolios mean ($t = 0.058774$, $p$-value = 0.9531). Also, the correlation between the daily returns of Sweden and Estonia is 0.1 and 0.05 between Sweden and Lithuania. These correlations show that investing in Estonia and Lithuania will not only increase the return; it also decreases the risk.

Conclusively, the optimized portfolios did not give extremely high benefits comparing to the Swedish industrial sector index and the Swedish index. Only the global portfolio outperformed the Swedish portfolio when not optimized. The previous comparison shows benefits from the international diversification, but the selection of investment should be well done to benefit from that.

### 4.2 Portfolios’ Indicators for the period from 01-01-2009 to 31-12-2013

Table 10 shows the annual returns, annual standard deviation, annual Sharpe ratio, skewness and Kurtosis of all the studied portfolios for the period between 01-01-2009 and 31-12-2013.

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Sweden Industrial</th>
<th>Sweden</th>
<th>Nordic</th>
<th>Western Europe and UK</th>
<th>Western Europe</th>
<th>Europe and UK</th>
<th>Europe</th>
<th>Emerging countries</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annual Mean Return</strong></td>
<td>12.52%</td>
<td>12.13%</td>
<td>8.13%</td>
<td>2.57%</td>
<td>1.33%</td>
<td>4.01%</td>
<td>2.80%</td>
<td>4.74%</td>
<td>5.26%</td>
</tr>
<tr>
<td><strong>Annual St.Dev</strong></td>
<td>0.269</td>
<td>0.226</td>
<td>0.201</td>
<td>0.174</td>
<td>0.188</td>
<td>0.174</td>
<td>0.196</td>
<td>0.147</td>
<td>0.129</td>
</tr>
<tr>
<td><strong>Annual Sharpe Ratio</strong></td>
<td>0.548</td>
<td>0.636</td>
<td>0.512</td>
<td>0.265</td>
<td>0.179</td>
<td>0.350</td>
<td>0.247</td>
<td>0.466</td>
<td>0.568</td>
</tr>
<tr>
<td><strong>Skewness</strong></td>
<td>-0.030</td>
<td>-0.122</td>
<td>-0.084</td>
<td>0.037</td>
<td>0.022</td>
<td>0.026</td>
<td>0.002</td>
<td>-0.062</td>
<td>-0.123</td>
</tr>
<tr>
<td><strong>Kurtosis</strong></td>
<td>2.228</td>
<td>2.435</td>
<td>2.308</td>
<td>2.053</td>
<td>2.191</td>
<td>1.986</td>
<td>2.218</td>
<td>1.406</td>
<td>1.744</td>
</tr>
</tbody>
</table>

The indices of these portfolios are weighted according to their market capitalization. Sweden and Sweden industrial portfolios have outperformed all the other portfolios in the term of return by more than 100%. As well these two portfolios have the highest standard deviation and kurtosis, meaning that they are risky. Their skewness is negative and close to 0, which mean that their returns are almost normally distributed. The Nordic portfolio comes after the Swedish portfolio in term of return, as well as in term of risk. It had a higher return than all the other portfolios and a higher risk. Sweden industrial portfolio have the best Sharpe ratio, which means that the more volatile the returns are the more profit this portfolio will earn.

Over this period, as well the global portfolio has the lowest standard deviation, showing again that it has a benefit in term of risk adjustment. The global portfolio has also outperformed all the other European portfolios and the emerging countries portfolios. We compared the Global and the Swedish portfolio in a t-test of the independent variable.

For the period represented in table 10, the UK has been beneficial in both portfolios, the Western European and the European. Adding the UK index to these portfolios has
doubled their return, increase their Sharpe ratio, as well as decreasing the standard deviation and the kurtosis.

The skewness of all portfolios was between -0.5 and 0.5; this means that the distribution is almost normal. The worst performing portfolio for the period from 2009 till 2013 is the western European portfolio with an annual return of 1.33% and a relatively high standard deviation of 0.1888.

When the weight is allocated according to the indices market cap, investing in Sweden is the best in term of return, international diversification can be beneficial in term of lowering the risk.

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Western Europe and UK</th>
<th>Western Europe</th>
<th>Europe and UK</th>
<th>Europe</th>
<th>Emerging countries</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Mean Return</td>
<td>7.47%</td>
<td>7.47%</td>
<td>16.64%</td>
<td>16.64%</td>
<td>15.88%</td>
<td>10.30%</td>
</tr>
<tr>
<td>Annual St.Dev</td>
<td>0.162</td>
<td>0.162</td>
<td>0.205</td>
<td>0.205</td>
<td>0.194</td>
<td>0.191</td>
</tr>
<tr>
<td>Annual Sharpe Ratio</td>
<td>0.593</td>
<td>0.593</td>
<td>0.922</td>
<td>0.922</td>
<td>0.937</td>
<td>0.655</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.139</td>
<td>0.139</td>
<td>1.002</td>
<td>1.002</td>
<td>0.247</td>
<td>0.352</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.201</td>
<td>2.201</td>
<td>9.041</td>
<td>9.041</td>
<td>2.007</td>
<td>3.109</td>
</tr>
</tbody>
</table>

Table 11 shows the optimal portfolios’ indicators according to the Markowitz method. The optimal European portfolios with and without the UK and the optimal emerging countries portfolio have outperformed the Swedish portfolios, with higher return and lower risk. The kurtosis of the European portfolios is high, showing abnormal returns as well as the skewness, which is almost 1 indicating that the return distribution is asymmetric. On the other hand, all the other portfolios, even when optimized the still have a lower return than Sweden, with slightly lower volatility. In addition, the optimal portfolios did not contain many different countries; in the opposite, they are quite concentrated. The optimal Western European Portfolio includes 3 indices that are the German index (DAX30), the Swiss index (SMI), and the Nordic one (OMXN40). These indices are weighted respectively 8%, 37% and 54%. The optimal European portfolios with and without the UK are concentrated in Estonia only. The correlation between the returns of the Swedish index and the Estonian one is 0.1, which shows that investing in Estonia can lower the risk of the Swedish portfolio, and increase the return. The weights in the optimal emerging countries portfolio are divided between Thailand and Argentina only, with 75% to Thailand and 25% to Argentina, they both have a low correlation with Sweden of 0.07 and 0.23 respectively. Lastly, the optimal global portfolio is the most diversified in that period, since it includes the indices of 4 different countries where Argentina weight is 52%, the Nordic index 12%, Russia 13% and Korea 23%.

Based on these results, investing in Sweden is more beneficial in the period from the beginning of 2009 until the end of 2013. It seems that the Swedish capital market has been profitable after the 2008 crisis. Comparing the performance of the Swedish industrial sector, Sweden and Nordic portfolios with the other optimal portfolios show no extreme difference between these portfolios. So, back in the time, investors could not beat the Swedish portfolios, since they did not have the information that the optimal portfolios
are based on now. Though, Swedish investors could lower the risk of their portfolio by diversifying internationally. Also, the Nordic index was included in all the portfolios that it is a part, and Sweden represents a big part of this index.

### 4.3 Portfolios’ Indicators for the period from 01-01-2014 to 31-12-2018

Table 12 shows the annual returns, annual standard deviation, annual Sharpe ratio, skewness and Kurtosis of all the studied portfolios for the period between 01-01-2014 and 31-12-2018.

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Sweden Industrial</th>
<th>Sweden</th>
<th>Nordic</th>
<th>Western Europe and UK</th>
<th>Western Europe</th>
<th>Europe</th>
<th>Europe and UK</th>
<th>Emerging countries</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Mean Return</td>
<td>6.19%</td>
<td>-0.27%</td>
<td>3.39%</td>
<td>1.89%</td>
<td>2.74%</td>
<td>1.83%</td>
<td>3.22%</td>
<td>4.29%</td>
<td>7.03%</td>
</tr>
<tr>
<td>Annual St.Dev</td>
<td>0.183</td>
<td>0.165</td>
<td>0.154</td>
<td>0.155</td>
<td>0.156</td>
<td>0.155</td>
<td>0.157</td>
<td>0.143</td>
<td>0.126</td>
</tr>
<tr>
<td>Annual Sharpe Ratio</td>
<td>0.455</td>
<td>0.105</td>
<td>0.355</td>
<td>0.254</td>
<td>0.307</td>
<td>0.250</td>
<td>0.336</td>
<td>0.447</td>
<td>0.724</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.583</td>
<td>0.557</td>
<td>0.626</td>
<td>0.381</td>
<td>0.281</td>
<td>0.391</td>
<td>0.240</td>
<td>0.875</td>
<td>0.624</td>
</tr>
</tbody>
</table>

Table 12: Portfolios' Indicators 2014-2018

The indices of these portfolios are weighted according to their market capitalization. During the period represented in table 12, the global portfolios have outperformed all the other portfolios. The global portfolio has the highest return, highest Sharpe ratio and the lowest standard deviation of all the other portfolios. The returns of the global portfolio are positively skewed over that period with a relatively high kurtosis of 4.42, showing some abnormal returns between 2014 and 2018. The second-best performing portfolio over that period is the Swedish industrial sector portfolio having a 6.19% annual return and 0.455 Sharpe ratio. However, the global portfolio has the highest standard deviation which makes it the riskiest. The Emerging countries portfolio outperformed the other European portfolios, as well as the Swedish and Nordic portfolios. The emerging countries portfolio has a higher return, higher Sharpe ratio with a lower standard deviation, which makes it more profitable and less risky. Investing in the UK lower the return of the Western European portfolio and for the European portfolio, and it reduced the Sharpe ratio. It also lowered the standard deviation insignificantly, which is not beneficial, due to the significant decrease in the annual return. In addition, investing in the UK increase the kurtosis and skewness, which signify that the returns are more asymmetric and abnormal.

Lastly, the Swedish portfolio underperformed all the other portfolio, having a return of -0.27% and the second-highest standard deviation of 0.1655. During the period between 2014 and 2018 and when allocating the indices according to the market capitalization; Swedish investors can benefit from international diversification by increasing their returns and lowering their risk.
The indices of these portfolios are weighted according to their market capitalization. During the period represented in table 12, the global portfolios have outperformed all the other portfolios. The global portfolio has the highest return, highest Sharpe ratio and the lowest standard deviation of all the other portfolios. The returns of the global portfolio are positively skewed over that period with a relatively high kurtosis of 4.042, showing some abnormal returns between 2014 and 2018. The second-best performing portfolio over that period is the Swedish industrial sector portfolio having a 6.19% annual return and 0.455 Sharpe ratio. However, the global portfolio has the highest standard deviation, which makes it the riskiest. The Emerging countries portfolio outperformed the other European portfolios, as well as the Swedish and Nordic portfolios. The emerging countries portfolio has a higher return, higher Sharpe ratio with a lower standard deviation, which makes it more profitable and less risky. Investing in the UK lower the return of the Western European portfolio and for the European portfolio, and it reduced the Sharpe ratio. It also lowered the standard deviation insignificantly, which is not beneficial, due to the significant decrease in the annual return. In addition, investing in the UK increase the kurtosis and skewness, which signify that the returns are more asymmetric and abnormal.

Lastly, the Swedish portfolio underperformed all the other portfolio, having the lowest return of 0.27% and the second-highest standard deviation of 0.1655. During the period between 2014 and 2018 and when allocating the indices according to the market capitalization; Swedish investors can benefit from international diversification by increasing their returns and lowering their risk.
4.4 Portfolios’ Indicators for the period from 01-01-2009 to 31-12-2010

Table 14 shows the annual returns, annual standard deviation, annual Sharpe ratio, skewness and Kurtosis of all the studied portfolios for the period between 01-01-2009 and 31-12-2010.

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Sweden Industrial</th>
<th>Sweden</th>
<th>Nordic</th>
<th>Western Europe and UK</th>
<th>Western Europe</th>
<th>Europe and UK</th>
<th>Europe</th>
<th>Emerging countries</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Mean Return</td>
<td>40.61%</td>
<td>28.14%</td>
<td>17.71%</td>
<td>2.52%</td>
<td>0.18%</td>
<td>5.50%</td>
<td>3.23%</td>
<td>26.37%</td>
<td>9.60%</td>
</tr>
<tr>
<td>Annual St.Dev</td>
<td>0.292</td>
<td>0.248</td>
<td>0.212</td>
<td>0.184</td>
<td>0.192</td>
<td>0.184</td>
<td>0.197</td>
<td>0.166</td>
<td>0.143</td>
</tr>
<tr>
<td>Annual Sharpe Ratio</td>
<td>1.485</td>
<td>1.236</td>
<td>0.943</td>
<td>0.249</td>
<td>0.114</td>
<td>0.412</td>
<td>0.269</td>
<td>1.740</td>
<td>0.820</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.095</td>
<td>0.066</td>
<td>0.182</td>
<td>0.216</td>
<td>0.239</td>
<td>0.227</td>
<td>0.251</td>
<td>0.006</td>
<td>0.017</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>1.770</td>
<td>1.466</td>
<td>1.424</td>
<td>2.115</td>
<td>2.478</td>
<td>1.747</td>
<td>1.961</td>
<td>0.942</td>
<td>1.097</td>
</tr>
</tbody>
</table>

Table 14: Portfolios’ Indicators 2009-2011

The period represented by table 11 shows extreme positive returns for investing in Sweden, especially in the industrial sector. The indices of these portfolios are weighted according to their market capitalization. The portfolios representing the Swedish industrial sector and Sweden have outperformed all the other portfolios in term of annual return, which was respectively 40.61% and 28.14%. Though, they had the highest volatility among all the other portfolios. Those results can be explained by the fact that this period is directly after the global economic crisis in 2008. The neighboring countries have been hit heavily by the crisis with heavy falls in the GDP and the employment rate. The Swedish central bank helped them by lending them money on a short term. The Swedish central bank has also done swap agreement with the central banks of Latvia, Estonia and Iceland. (Sveriges Riksbank, 2018) We can assume that these agreements with the neighboring countries have helped in the recovery after the crisis as well as enhancing the Swedish capital market. We observe a similar situation in Switzerland during this period. The portfolio representing the emerging countries have a relatively high return of 26.37% with lower volatility than the Swedish industrial sector portfolio, and the Swedish portfolio, the good Swiss banking system may explain this.

The worst portfolio at that time was the one containing Western European countries, which had a 0.18% return with a relatively high standard deviation of 0.192. These results show that it was not beneficial to invest in Europe in the years 2009 and 2010, using the market capitalization method.

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Western Europe and UK</th>
<th>Western Europe</th>
<th>Europe and UK</th>
<th>Europe</th>
<th>Emerging countries</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Mean Return</td>
<td>17.71%</td>
<td>17.71%</td>
<td>39.84%</td>
<td>39.84%</td>
<td>47.19%</td>
<td>47.71%</td>
</tr>
<tr>
<td>Annual St.Dev</td>
<td>0.212</td>
<td>0.212</td>
<td>0.246</td>
<td>0.246</td>
<td>0.192</td>
<td>0.243</td>
</tr>
<tr>
<td>Annual Sharpe Ratio</td>
<td>0.943</td>
<td>0.943</td>
<td>1.727</td>
<td>1.727</td>
<td>2.606</td>
<td>2.084</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.182</td>
<td>0.182</td>
<td>1.284</td>
<td>1.284</td>
<td>0.071</td>
<td>0.131</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>1.424</td>
<td>1.424</td>
<td>8.346</td>
<td>8.346</td>
<td>0.845</td>
<td>1.277</td>
</tr>
</tbody>
</table>

Table 15: Optimal Portfolios’ Indicators 2009-2010
Table 15 shows the optimal portfolios’ indicators according to the Markowitz method. The global and the emerging countries portfolios had the best return using the Markowitz method. They had a yearly return respectively of 47.71% and 47.19%. However, the emerging countries portfolio has the lowest Standard deviation, which makes it the most efficient. Sweden and the Swedish sector portfolios have outperformed all the other optimal portfolios excluding the global one and the emerging countries one. This shows that investing in Sweden between 2009 and 2010 was better than international diversification since the investors would not be able to build that optimal portfolio since he does not have the information that we have right now.

Lastly, the optimal portfolios were very concentrated, dividing the weight to 3 countries maximum. The Western European portfolios with and without the UK was optimal by investing only in the Nordic index (OMXN30). The optimal European portfolio with and without the UK is very concentrated as well; it contains only Estonia and Lithuania’s indices. Estonia weights are 0.97, while Lithuania weights 0.03 only. The optimal portfolio of the emerging countries contained Russia, Thailand and Argentina, weighing respectively 0.165, 0.36 and 0.475. Lastly, the optimal global portfolio is constituted from 2 countries where Russia weight 0.27 and Argentina weight 0.73. Our study over the years 2009 and 2010, shows that the most concentrated portfolios performed the best. Even the optimal portfolios were concentrated in a few indices. This period was directly after the 2008 crisis, which may lead to abnormal results due to the lower price at the beginning of the period. After the crisis, economic rebounds are common and compensate a part of the loss in value operated during the crisis. It is part of the readjustment process of the market.

4.5 Portfolios’ Indicators for the period from 01-01-2011 to 31-12-2012

Table 16 shows the annual returns, annual standard deviation, annual Sharpe ratio, skewness and Kurtosis of all the studied portfolios for the period between 01-01-2011 and 31-12-2012.

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Sweden Industrial</th>
<th>Sweden</th>
<th>Nordic</th>
<th>Western Europe and UK</th>
<th>Western Europe</th>
<th>Europe and UK</th>
<th>Europe</th>
<th>Emerging countries</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Mean Return</td>
<td>-9.05%</td>
<td>-5.00%</td>
<td>-6.75%</td>
<td>-5.05%</td>
<td>-6.67%</td>
<td>-3.82%</td>
<td>-5.83%</td>
<td>-6.36%</td>
<td>-3.56%</td>
</tr>
<tr>
<td>Annual St.Dev</td>
<td>0.291</td>
<td>0.239</td>
<td>0.219</td>
<td>0.185</td>
<td>0.208</td>
<td>0.183</td>
<td>0.220</td>
<td>0.134</td>
<td>0.122</td>
</tr>
<tr>
<td>Annual Sharpe Ratio</td>
<td>-0.248</td>
<td>-0.129</td>
<td>-0.221</td>
<td>-0.169</td>
<td>-0.230</td>
<td>-0.102</td>
<td>-0.179</td>
<td>-0.333</td>
<td>-0.132</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.160</td>
<td>-0.295</td>
<td>-0.275</td>
<td>-0.154</td>
<td>-0.128</td>
<td>-0.199</td>
<td>-0.150</td>
<td>-0.313</td>
<td>-0.409</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>1.542</td>
<td>2.351</td>
<td>2.152</td>
<td>1.439</td>
<td>1.447</td>
<td>1.619</td>
<td>1.768</td>
<td>1.561</td>
<td>2.589</td>
</tr>
</tbody>
</table>

Table 16: Portfolios' Indicators 2011-2012

Over the period represented in Table 16, all the portfolios have negative returns, with a volatility rate that is quite similar to the other periods mentioned before. These negative results may be due to the Eurozone economic crisis. One more time, the global portfolio has the highest return with the lowest volatility. The Swedish industrial sector has the worst return in that period. This shows that in bad years, the high risk will cost the investors. The skewness of all the portfolios is negative and close to 0, which means that the distribution is approximately normal, which also means that there are frequently more
gains than losses. However, all the portfolios generated losses. Over this period, it is also interesting to observe that the addition of UK in the Western European and European portfolio brings a better return and lower standard deviation.

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Western Europe and UK</th>
<th>Western Europe</th>
<th>Europe and UK</th>
<th>Europe</th>
<th>Emerging countries</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annual Mean Return</strong></td>
<td>1.09%</td>
<td>1.09%</td>
<td>1.14%</td>
<td>1.05%</td>
<td>11.04%</td>
<td>3.19%</td>
</tr>
<tr>
<td><strong>Annual St. Dev</strong></td>
<td>0.147</td>
<td>0.147</td>
<td>0.156</td>
<td>0.178</td>
<td>0.204</td>
<td>0.170</td>
</tr>
<tr>
<td><strong>Annual Sharpe Ratio</strong></td>
<td>0.211</td>
<td>0.211</td>
<td>0.054</td>
<td>0.053</td>
<td>0.648</td>
<td>0.308</td>
</tr>
<tr>
<td><strong>Skewness</strong></td>
<td>0.256</td>
<td>0.256</td>
<td>0.304</td>
<td>0.316</td>
<td>0.358</td>
<td>0.357</td>
</tr>
<tr>
<td><strong>Kurtosis</strong></td>
<td>2.533</td>
<td>2.533</td>
<td>2.322</td>
<td>2.417</td>
<td>3.562</td>
<td>4.064</td>
</tr>
</tbody>
</table>

*Table 17: Optimal Portfolios' Indicators 2011-2012*

Table 17 shows the optimal portfolios' indicators according to the Markowitz method. The optimal emerging countries portfolio outperformed all the other portfolio with 11.04% return. The return of the optimal emerging countries portfolio is more by 10 times than all the other optimal European portfolios. However, the optimal emerging countries portfolio contains only the Thai national index (Bangkok S.E.T). The correlation between Swedish index and the Thai one is -0.02, which means that the returns of those indices move in the opposite direction. Thus, a negative correlation and close to zero means that it is beneficial to invest in Thailand over the years 2011 and 2012. All the optimal portfolios are concentrated, the Western European portfolios are represented by the Swiss index (SMI) only. The optimal European portfolio with the UK, contains UK weighting 37%, Germany weighing 29% and Estonia weighting 34%. The optimal European portfolio includes Estonia and Germany, weighing 46% and 54% respectively. The optimal Global portfolio contains USA and Germany weighting 99% and 1% respectively.

Lastly, the results presented in tables 16 and 17, shows that diversification is beneficial in the bad times, as the crisis period. International Diversification can help in reducing the portfolio risk in these times. It also shows that investing only in Sweden during that period will generate higher losses.
4.6 Portfolios’ Indicators for the period from 01-01-2013 to 31-12-2014

Table 18 shows the annual returns, annual standard deviation, annual Sharpe ratio, skewness and Kurtosis of all the studied portfolios for the period between 01-01-2013 and 31-12-2014.

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Sweden Industrial</th>
<th>Sweden</th>
<th>Nordic</th>
<th>Western Europe and UK</th>
<th>Western Europe</th>
<th>Europe and UK</th>
<th>Europe</th>
<th>Emerging countries</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Mean Return</td>
<td>11.06%</td>
<td>14.11%</td>
<td>19.05%</td>
<td>14.83%</td>
<td>15.91%</td>
<td>13.55%</td>
<td>14.42%</td>
<td>7.81%</td>
<td>18.00%</td>
</tr>
<tr>
<td>Annual St.Dev</td>
<td>0.150</td>
<td>0.133</td>
<td>0.127</td>
<td>0.133</td>
<td>0.141</td>
<td>0.131</td>
<td>0.141</td>
<td>0.122</td>
<td>0.108</td>
</tr>
<tr>
<td>Annual Sharpe Ratio</td>
<td>0.886</td>
<td>1.226</td>
<td>1.683</td>
<td>1.284</td>
<td>1.293</td>
<td>1.207</td>
<td>1.183</td>
<td>0.814</td>
<td>1.870</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.101</td>
<td>-0.146</td>
<td>-0.039</td>
<td>0.078</td>
<td>0.038</td>
<td>0.055</td>
<td>-0.011</td>
<td>-0.113</td>
<td>0.060</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>1.325</td>
<td>1.181</td>
<td>1.528</td>
<td>1.527</td>
<td>1.320</td>
<td>1.558</td>
<td>1.255</td>
<td>0.598</td>
<td>0.395</td>
</tr>
</tbody>
</table>

Table 18: Portfolios’ Indicators 2013-2014

All the portfolios have higher returns and lower volatility than the previous period presented in table 15. This observation can be the result of the Eurozone economic crisis that was between 2010 and 2012. The Nordic portfolio has the highest return, with a relatively high Sharpe ratio and low standard deviation. The Global portfolio has the second-highest return of 18%, the highest Sharpe ratio, and the lowest standard deviation, which makes it the optimal considering risk and returns.

The Swedish portfolio outperformed the Swedish industrial portfolio in term of risk and return. The Swedish portfolio is less volatile than all the four European portfolios. However, the Nordic portfolio outperformed the Swedish with higher return and lower risk. Thus, due to their close performance, we wanted to compare the Swedish portfolio and the European portfolio. Investing in the UK lowered the return of the Western European and European portfolios, but it lowered their risk at the same time. The worst portfolio of the period presented in table 18 is the emerging countries portfolio, which underperformed all the other portfolios by 50% less return and more. Lastly, table 18 shows how all the portfolios performed well after the Eurozone crisis, it also shows different benefits of investing outside Sweden, in term of risk and returns.

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Western Europe and UK</th>
<th>Western Europe</th>
<th>Europe and UK</th>
<th>Europe</th>
<th>Emerging countries</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Mean Return</td>
<td>19.89%</td>
<td>19.89%</td>
<td>27.83%</td>
<td>27.83%</td>
<td>31.63%</td>
<td>31.68%</td>
</tr>
<tr>
<td>Annual St.Dev</td>
<td>0.116</td>
<td>0.116</td>
<td>0.160</td>
<td>0.160</td>
<td>0.245</td>
<td>0.202</td>
</tr>
<tr>
<td>Annual Sharpe Ratio</td>
<td>1.923</td>
<td>1.923</td>
<td>1.900</td>
<td>1.900</td>
<td>1.398</td>
<td>1.698</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.179</td>
<td>0.179</td>
<td>0.213</td>
<td>0.213</td>
<td>0.745</td>
<td>0.681</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>1.439</td>
<td>1.439</td>
<td>3.676</td>
<td>3.676</td>
<td>3.828</td>
<td>3.480</td>
</tr>
</tbody>
</table>

Table 19: Optimal Portfolio Indicators 2013-2014

Table 19 shows the optimal portfolios’ indicators according to the Markowitz method. All the optimal portfolios outperformed the Swedish portfolio and the Swedish industrial portfolio. This shows a clear benefit of international diversification. The optimal
emerging countries portfolio and the optimal global portfolio had the best returns. However, the global one was less risky. The optimal Western European portfolios have the lowest volatility as well as the lowest returns. The optimal portfolios were all concentrated and did not contain more than three countries at the maximum. The optimal European portfolio is constituted of Bulgaria only. The optimal Western European portfolios include the Swiss index (SMI) and the Nordic index (OMXN40). They are weighing 92% and 8% respectively. Argentina and China formed the optimal Emerging countries portfolio weighting 47% and 53% respectively. Argentina and China were also present in the optimal global portfolio, along with the USA. USA and Argentina weighted 38% each, while China weighted 24%. The correlation between the returns of Sweden and the constituents of the optimal global portfolio are 0.36 with the USA, 0.22 with Argentina and 0.036 with China. The correlation of Sweden with China is very low, which means that investing in China will lower the portfolio risk. We do not see the UK included in any of the optimal portfolios.

Lastly, the tables 18 and 19 show clear benefits of international diversification for the Swedish investors.

### 4.7 Portfolios’ Indicators for the period from 01-01-2015 to 31-12-2016

Table 20 shows the annual returns, annual standard deviation, annual Sharpe ratio, skewness and Kurtosis of all the studied portfolios for the period between 01-01-2015 and 31-12-2016.

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Sweden Industrial</th>
<th>Sweden</th>
<th>Nordic</th>
<th>Western Europe and UK</th>
<th>Western Europe</th>
<th>Europe and UK</th>
<th>Europe</th>
<th>Emerging countries</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Mean Return</td>
<td>11.61%</td>
<td>0.38%</td>
<td>1.66%</td>
<td>0.90%</td>
<td>2.20%</td>
<td>1.58%</td>
<td>4.28%</td>
<td>0.21%</td>
<td>6.07%</td>
</tr>
<tr>
<td>Annual St.Dev</td>
<td>0.2197</td>
<td>0.2065</td>
<td>0.1937</td>
<td>0.1950</td>
<td>0.1936</td>
<td>0.1967</td>
<td>0.1950</td>
<td>0.1807</td>
<td>0.1524</td>
</tr>
<tr>
<td>Annual Sharpe Ratio</td>
<td>0.630</td>
<td>0.079</td>
<td>0.192</td>
<td>0.150</td>
<td>0.220</td>
<td>0.184</td>
<td>0.327</td>
<td>0.099</td>
<td>0.538</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.859</td>
<td>0.672</td>
<td>0.746</td>
<td>0.403</td>
<td>0.317</td>
<td>0.407</td>
<td>0.276</td>
<td>0.918</td>
<td>0.705</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>5.044</td>
<td>4.661</td>
<td>5.257</td>
<td>2.484</td>
<td>1.830</td>
<td>2.499</td>
<td>1.567</td>
<td>5.034</td>
<td>3.669</td>
</tr>
</tbody>
</table>

The returns of all the portfolios are positively skewed, which means that all these portfolios tend to be riskier than the standard deviation shows. The Swedish industrial portfolio outperformed all the other portfolios, having a return of 11.61% and a Sharpe ratio of 0.63, however, it is the riskiest. The Global portfolio comes directly after the Swedish industrial with a return of 6.07%, and it has the lowest standard deviation in all the portfolios. The Swedish portfolio has a low return of 0.38% with the second-highest standard deviation of 0.2065. Investing in the UK affected the European portfolios negatively, it lowered the return and increased the standard deviation. It also increases the kurtosis. Table 20 shows that the most concentrated portfolio outperformed all the others. It also shows that there is benefit from international diversification for Swedish investors since all the other portfolios had higher returns and lower standard deviations.
Table 21 shows the optimal portfolios’ indicators according to the Markowitz method. The optimal Western European portfolio shows that this portfolio, even when optimized gives a limited diversification benefit, compared to the other portfolios. The optimized European portfolio is the best for the years 2015 and 2016. However, the optimal European portfolio is concentrated in Hungary only. The optimal global portfolio and emerging countries portfolio also offer high returns. However, their volatility is way higher than the optimal European portfolio, represented by Hungary. The optimal portfolios are also concentrated in that period. The optimal Western European portfolio contains the indices of Germany (DAX30) and Netherland (AEX) only. Weighting 93% and 7% respectively. The correlation between the returns of the Swedish index (OMXS30) and the German index (DAX30) is 0.8, which is quite high. The volatility of the optimal Western European portfolio is slightly higher than the Swedish portfolio, and the high correlation confirms that investing in that portfolio would not lower the risk. The optimal Emerging portfolio is concentrated in Russia only. Lastly, the optimal global portfolio is constituted of the indices of Russia (MOEX) and Japan (TOPIX), weighing 97% and 3% respectively.

Tables 20 and 21 show that it is beneficial for Swedish investors to diversify using foreigner assets. It can increase their portfolios’ returns and lower the risk.

### 4.8 Portfolios’ Indicators for the period from 01-01-2017 to 31-12-2018

Table 22 shows the annual returns, annual standard deviation, annual Sharpe ratio, skewness and Kurtosis of all the studied portfolios for the period between 01-01-2017 and 31-12-2018.
The returns of all the portfolios were positively skewed, which means that all these portfolios tend to be riskier than the standard deviation shows. The Swedish portfolio had the highest return for the years 2017 and 2018 with acceptable risk. The kurtosis of the Swedish portfolio is 0.716, which shows some abnormal returns, but it still less than the other portfolios. The Swedish industrial portfolio has the second-high return and the highest standard deviation. The Nordic and global portfolio has close performance, mean return as well as standard deviation even if the global portfolio is much more diversified.

Investing in the UK was beneficial in the years 2017 and 2018 since it increased the European portfolios' returns as well as lowering their standard deviation risk. The global portfolio had the lowest volatility, but it did not generate a good return.

In the period from 2017 till the end of 2018, investing only in Sweden is the best, when weighing the indices using the market capitalization method.

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Western Europe and UK</th>
<th>Western Europe</th>
<th>Europe and UK</th>
<th>Europe</th>
<th>Emerging countries</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Mean Return</td>
<td>2.64%</td>
<td>2.64%</td>
<td>30.08%</td>
<td>30.08%</td>
<td>9.88%</td>
<td>9.88%</td>
</tr>
<tr>
<td>Annual St.Dev.</td>
<td>0.1173</td>
<td>0.1173</td>
<td>0.1342</td>
<td>0.1342</td>
<td>0.1487</td>
<td>0.1487</td>
</tr>
<tr>
<td>Annual Sharpe Ratio</td>
<td>0.401</td>
<td>0.401</td>
<td>2.436</td>
<td>2.436</td>
<td>0.813</td>
<td>0.813</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.408</td>
<td>0.408</td>
<td>0.920</td>
<td>0.920</td>
<td>0.269</td>
<td>0.269</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>1.697</td>
<td>1.697</td>
<td>5.092</td>
<td>5.092</td>
<td>0.709</td>
<td>0.709</td>
</tr>
</tbody>
</table>

Table 23: Optimal Portfolios’ Indicators 2017-2018

Table 23 shows the optimal portfolios’ indicators according to the Markowitz method. The results stated in table 23 shows opportunities in investing in abroad from the Swedish investors. However, all the optimal portfolios are very concentrated. The optimal Western European portfolio is constituted of the Dutch index (AEX) only, while the optimal European portfolio will contain the Macedonian index (SE MBI 10) only. The optimal emerging countries portfolio and the optimal global portfolio have the same constituents. They both include the Indian index (NIFTY 500) and the Brazilian index (BVSP), weighing 93% and 7% respectively. The correlation between the OMXS30 and SE MBI 10 is -0.004 which is almost zero, showing that these two indices are uncorrelated, which allows the Swedish investors to increase their portfolios’ returns and decrease the risk of these portfolios.

Conclusively, table 22 and 23 shows that there is benefit from investing internationally. But using a naïve allocation strategy as the market capitalization, investing in Sweden will be the best. This means, that the investors should make the international selection very well to benefit from it.
4.9 Graphical depiction of the cumulative daily returns over the ten-year period

The following graphical representation is the representation of the ten-year-period cumulative return taking into account the compounding effect. We thought that it would be a good illustration, to sum up, the observation made in the previous sections. It shows an overall correlation between the cumulative performance of the different portfolios as well as the specificities we noticed for each period.

This graphical representation confirms the observation made in the previous sections. We can see that Sweden industrial sector clearly overperformed the other portfolio over the whole period. We can observe that the European portfolios are the most correlated and performed poorly compared to the other portfolio. The portfolios without the UK is symmetrically performing a little bit better than the ones, including the UK. This graph overall show two periods of instability at this end of 2011 and in 2015, as well as periods of stable growth for the rest of the time. The eurozone crisis impact can explain the first instability period. Concerning the second period, we do not have a single and simple explanation for this long period of instability.
5. Analysis of results

This part is dedicated to drawing conclusions from the observations made in the previous part. It also gives an overview of our results, considering the theories that constitute the background of this study.

The point of view adopted in this study is the one of a Swedish investor, wondering about the benefit he could take from internationalizing his portfolio based on literature such as the article of French and Poterba published in 1991 and all the diversification focused literature from Markowitz (1952) to Booth and Fama (1992). Thus, the first element to take into consideration is the performance of Sweden compared to the other portfolios we built. In the course of the studied 10-year period, Sweden portfolio has been overperforming all the other portfolio during the first five years but underperforming them during the five last one. It is consistent through all the studied periods that the Swedish portfolio and the Swedish industrial portfolio, are the riskiest portfolio among all the portfolios we studied. This risk is beyond doubt the result of the fact that those two portfolios are the less diversified. Thus, investing in Sweden only can be risky, but it paid off in many periods. Investors could consider that having a concentrated portfolio of investment mean that it is easier to get information to maximize its performance through specialization (Nieuwerburgh & Veldkamp, 2010) and that there is no advantage of portfolio diversification (Choi et al., 2017), our results does not entirely contradict this theory but does not support it either. Since the benefits of international diversification were different from a period to another. Moreover, the T-Test showed no significant difference between the mean of the twenty six-month periods of the Swedish industrial sector over the period and the one of the Emerging or Global portfolio. It is important to note that there is no guarantee that it would still be true in the future, and that the volatility of Scandinavians portfolios show a net difference that is not taken into consideration in the T-test. This test doesn't allow us to exclusively recommend the internationally diversified portfolio for the only return oriented investor, there are nevertheless comparable concerning their risk.

Sweden performed extremely well at the beginning of the period from 2009 till 2010, but a favorable context can explain this for Sweden after the 2008 crisis and maybe other internal factors. What we know for a fact is that this performance is not the result of a good portfolio selection. Because the Swedish portfolio is a single index portfolio, that reflects the Swedish economy performance in general, which means that Sweden would not always perform well, and this does not contradict the theories that support the international diversification benefits such as (French & Poterba, 1991; De Santis and Gerard 1997; Driessen & Laeven 2007). Moreover, we observed that ten other single indices outperformed the Swedish index by having a better Sharpe ratio. About the case of the Sweden industrial portfolio, it was always the riskiest portfolio; however, it had the highest returns many times. From time to time, Sweden industrial has outperformed all the other portfolios. As we stated for Sweden, it means that collecting a large amount of information about this sector could generate high returns. However, it is risky because it implies even lower diversification than the Swedish portfolio. The observations that we mentioned in this paragraph support international diversification. Because Swedish investors can always lower their risk by investing abroad and sometimes increase their return, thus, what is consistent is that Swedish investors can use international diversification to adjust their portfolios’ risk.
In contrast to those domestic portfolios, the global portfolio has always been less risky among all the others. This observation is in accordance with international diversification theories as French and Poterba (1991) and Driessen and Laeve (2007) mentioned previously. Furthermore, we should note that the global portfolio has one of the most important positive skewness of the period (behind emerging). It means that its standard deviation overestimates its actual risk.

The Global portfolio also has the highest Sharpe ratio in the majority of the times and over the whole period. This good performance is probably due to the implication of different emerging countries and of the United States in this portfolio that allow a good diversification of risk thanks to the wide range of countries represented as well as a good return. The global portfolio shows that international diversification may lower the return, though it reduced the risk and offered a stable performance over the whole studied period.

Furthermore, the overall Sharpe ratio of market capitalization portfolios is low, compared to the optimal portfolios’ Sharpe ratios. It is explained by the diversification of the market capitalization portfolios, which are arbitrary based on market capitalization value and did not take into account any form of selection strategy to better performance. It is particularly true for European portfolios. Market capitalization of European and Western European portfolios have been underperforming the other market cap portfolios almost all the time. However, some countries, constituents of those portfolios generated an extremely high return over the whole period. Those constituents where emerging eastern European countries which were almost different from one 2-year period to another. Their market capitalization weight was too small in the European portfolio due to the presence of broader developed capital markets. Therefore, we can see a significant difference between optimal and market value portfolio weights in this region. From that finding, we can conclude that developing countries can add value when they have a significant weight. Thus, Swedish investors should consider the emerging countries when investing and used an advanced weighing method, not a naïve one like the market capitalization.

It is also important to talk about the particular case of the UK. When adding the UK to the European portfolios, it systematically lowers the risk of the portfolio and increases the skewness. Increasing the skewness means that the standard deviation overestimates the risk, which means that this decrease the risk even more. Conversely, adding the UK lowered the return of the European portfolios most of the time. Also, it is interesting to note that in the worst period for western European countries, investing in the UK seems to be a good pick, but when the other countries are doing great is can affect the portfolio return negatively. Accordingly, Swedish investors should consider the UK as an option to adjust their portfolio risk. It is even more real if we consider the fact that the country will be less bounded to the rest of the European economies in the near future because of the incoming Brexit. Those events will probably more or less diminish the correlation that the other western European countries have with the UK; the scale of this phenomena is, of course still unknown. This phenomena of reducing risk in the European portfolio is visible in the optimal portfolio of the 2011 and 2012 period, where all the countries were doing badly. The UK, for the first and only time, was included in the optimal portfolios. While most the other times it was only composed of emerging and developing countries.

We can link this finding to the article of Huberman (2001), where he mentioned that investors prefer familiar areas for their investments. Europe is probably a familiar area for Swedish investors. Thus, when the UK leaves the EU, they should consider it as an investment option even if it is no longer in their familiar area.
One of the goals of this study is to give recommendations to the Swedish investors to constitute a well-performing portfolio. To do so, it is essential to look at the pattern of best performing foreigner indices based on historical data. When we look at the optimal portfolios over all the periods, they are very concentrated, and the concentration is almost always focused on developing countries. As mentioned before the countries performing the best are changing in every period. The western European portfolio focused on Nordic countries, Switzerland and the Netherlands most of the time. European optimal portfolio focused on eastern Europe and countries such as Estonia, Macedonia, Hungary and Bulgaria. For the rest of the world, the optimal portfolios were concentrated on Thailand, Argentina and Russia depending on the period. This show that the idea of systematic diversification to obtain the best performance is not founded on an international scale. Concentrated portfolios bring a higher return, lower risk, and thus better Sharpe ratio overall.

These findings should contribute to recommendations in the direction of a changing of the behavior of Swedish investors. Since Sweden have a unique language and a developed capital market, then, Swedish investors would not be attracted to invest in the developed countries according to Chan et al. (2005). Based on our findings, we recommend Swedish investors to consider unfamiliar developing countries while selecting their portfolios because it can add value to their investments by lowering the risk and increasing the return.

From what we already said, we can see that the advantage of performance for an investor in Sweden is to be able to identify promising emerging countries from eastern Europe or the rest of the world. Moreover, in Eastern Europe, there were excellent opportunities almost every year during the period. Therefore, European diversification could offer very good diversification opportunities based on this data. In addition to that, by looking at the correlation between countries, a very low correlation is observable between Sweden and countries such as Estonia or Thailand, which represent even better diversification opportunities for Swedish investors in accordance to the theory (Booth & Fama, 1992).

Furthermore, as Emery and Gulen (2019) mentioned about the impact of the internet on the international diversification, as well as the availability of the financial information and data online. Since Sweden have an excellent internet quality, Swedish investors should use this advantage to gather information about the rest of the world as well as educate themselves about international investment opportunities, to be able to benefit from international diversification in the best way possible.

Karlsson and Norden (2007), identified the types of home biased Swedish investors as well as the open for international diversity. According to the results of our study, we recommend the home biased Swedish investors to change their behavior to be more open toward international diversification. This does not mean that they must invest internationally, but it is very beneficial if they consider international diversification instead of avoiding it. Since international diversification can generate high returns with less risk.

Finally, optimal portfolios were always concentrated in a few countries, which means that the diversification should not be the objective with a naïve method like the market capitalization. But active portfolio management is advised rather than passive one based on the findings of this study. Acquiring information on the best emerging market to invest in seem to be the best strategy available to Swedish investors based on our data due to the
low standard deviation of those high performers. Moreover, Swedish investors should assess international opportunities when selecting their investment, and based on that assessment. They should pick the best assets that fit their strategy, rather domestic or foreign assets.
6. Conclusions

The conclusion chapter aims to revisit the research question and the purpose of the thesis, as well as discussing to what extent the purpose of the study was met. It also explains how the research question is answered. We also include in this chapter, the most valuable and interesting findings of this study. Furthermore, we will mention the study’s position and contribution to the literature and the practical contribution. Then, recommendations to practitioners and lastly the limitations and possible further studies.

6.1 Purpose and answering the research question

Previous research about the international diversification generated contradicted conclusions about the benefits of international diversification. Since the previous literature provides different points of view around international diversification, the purpose of this study is to investigate the benefits of international diversification for the Swedish investors. This investigation is made by comparing nine different equity indices portfolios, that represent a different scale of diversification in various regions around the world. The aim of the comparison between the Swedish portfolios and the other international portfolios is to find an answer for our research question:

“Does international diversification matter for Swedish investors?”

The results of this study show that international diversification offers very good investment opportunities for Swedish investors. By comparing the Swedish portfolio with the other internationally diversified portfolios, we found that diversifying internationally, allows the Swedish investors to lower their portfolio’s risk, as well as increasing the portfolio’s Sharpe ratio. It also increases the return in some periods of the study.

After the economic crisis of 2008, over 2009 and 2010, all the tested portfolios had extremely high returns.

Investing in the UK had different impacts on the European portfolios at different times; it increased the returns sometimes and decreased it other times. However, when adding the UK to the portfolio, it lowered the volatility in most of the times, which makes it beneficial. Based on that finding, Swedish investors should consider the UK in their investment decisions even after the Brexit. Considering the UK does not mean always investing in the UK but assessing the opportunities that the UK may offer in the investing time and invest if it is beneficial.

Some Emerging and developed countries have performed very well over the studied period. Developing countries, such as Thailand and Estonia, generated the highest returns over the ten years, with relatively low risk. This finding means that developing countries increase the performance of the Swedish investors’ portfolio, even if Swedish investors are unfamiliar with these countries and their capital markets. It is beneficial for Swedish investors to consider developing countries when building a portfolio. Thus, they would not miss the opportunities that developing countries can offer.

Sweden outperformed other portfolios in term of return, over some parts of the period studied. Though, it had almost always the highest risk compared to the other international portfolios. The concentrated Swedish portfolio, represented by the Swedish industrial
sector, had a high return in the majority of the times. But, it always had the highest volatility risk, among all the other portfolios. This finding gives evidence that a concentrated portfolio could outperform diversified portfolios in term of return, but not in term of risk. Thus, having a watchlist of Swedish assets, and gathering the maximum information possible about these assets, could build a portfolio with a great performance, if the selection is made properly and rationally.

Based on the findings mentioned above, the answer to the research question is that international diversification matters for Swedish investors. It can improve their portfolios’ risk as well as return. However, the Swedish market has significant potential as well. Thus, Swedish investors should consider local and international assets when making investment decisions.

This study contributes to the research through the investigation of the benefits of portfolio diversification, where the previous research has contradicted points of view. This study fills this gap by arguing for the benefits of international diversification, with Sweden as a benchmark country. Sweden is compared to other portfolios that are internationally diversified, with different levels of international diversification. The results of this study add to evidence that international diversification is beneficial and should always be considered. This study agrees with the researchers, who stated that international diversification is beneficial.

The societal impact of our study is that it contributes to changing the Swedish investors’ behavior toward portfolio selection and investments. It also highlights the importance of international diversification for Swedish investors, which can lead to safer investments and maybe higher returns.

6.2 Recommendations to practitioners

Based on the findings of our study, we have several recommendations for Swedish investors, especially. These recommendations can be addressed as well to finance professionals and academics, as well as any other person interested in the portfolio theory.

Investors should not limit their selves in a country or a region. They should not exclude international diversification opportunities because they are unfamiliar with foreign countries or language. They should include foreign countries in their analysis and assess if it can add value and increase their returns.

Investors should not ignore emerging and developing countries, even if they are remote and have a different language. Developing countries tend to perform better than the developed countries, which can offer abnormal positive returns to investors. Developing countries should be definitely considered and assessed when building a portfolio.

Investors should favorize active portfolio management strategies. They should make the selection of assets based on the market information they collect and indicators that help to predict the future performance of the assets. The investors should not follow naïve portfolio management strategies as the market capitalization.

Optimal portfolios should not always be diversified; they can be concentrated. However, investors should consider all the available investment opportunities. Then, they should
select the assets that they expect to perform the best in the future, based on the information and not on their feelings.

Based on the performance of the Swedish industrial sector index, if investors have an appetite for risk, they can beat the market by building a locally concentrated portfolio based on market information. Though it is very risky.

Lastly, Swedish investors should benefit from the advanced technology embedded in Sweden and from the advantage of having a great internet connection. Thus, they can use this advantage to gather information about international investments and to educate themselves more about these investments and how to benefit from it. They should take advantage of the great internet to change their behavior and become more open towards international diversification.

### 6.3 Findings Limitations and Further Studies

The findings of this thesis are based on a sample of 40 indices studied, and on the portfolio selection and weight allocation method followed in this study. Performing the same study, with a larger or different sample or with different methods may lead to different results.

Further researches that investigate portfolio diversification and international portfolio diversification for Swedish investors can be performed.

Firstly, doing a similar study to our, but with selecting the portfolios based on the countries’ returns’ correlations and not only a regional and country types selection as we did.

Secondly, building a similar study but focusing on building different scales of internationally diversified portfolios specialized in one sector. Such a study could be extended by doing the same thing for different industries sectors in other to test the consistency of the results. This subject seems to be promising because according to us it would theoretically allow the investor to specialize and get an edge over the competition by specializing in one sector but also to benefit from international diversification to lower the risk of the portfolio.

Thirdly, a study about the behavior of Swedish investors can be made. It can also refer to our study, to give the Swedish investors some of our recommendations which can help to change their behavior.

Fourthly, adding to our study, some concentrated Swedish portfolios based on market information. This information could come from mutual funds past portfolios and investment banks' past portfolios. Then make a comparison between the concentrated portfolios the Swedish index and the other international portfolio. This study could generate more detailed results about the benefits of diversification. It also compares between diversified portfolio and a concentrated portfolio based on the information advantage.

Lastly, more studies could be performed, and more parameter could be added to investigate the benefits of portfolio diversification and international diversification. Nevertheless, the four suggestions mentioned above are the most relevant and interesting concerning our study.
References


