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Strategic Finance

Comparison between index mutual funds and ETFs – an investment decision-making perspective

Indeksirahastojen ja ETF:ien eroavaisuudet sijoituspäätöksen näkökulmasta

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ABSTRACT

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Keywords: ETF, Index mutual fund, Passive investment strategy

The objective of the study is to find the potential differences between the two competing passively managed investment products: ETFs and index mutual funds. The thesis will study the impacts of these potential differences on investment decision-making. The study is defined to concern the U.S. market from 2011 to 2019. The chosen benchmark indexes are divided to large-cap, mid-cap and small-cap categories, which represent a wide range of the U.S. Market. The total number of ETFs in the study is 11 and the same number for index mutual funds is 30. Because of the nature of the data, the study utilizes a quantitative research method. The measures used to compare the performance of the funds are annual profit, Sharpe ratio, Treynor ratio, Jensen's alpha, and Information ratio. The study utilizes standard deviation and beta to compare the volatility of the funds. Lastly, the tracking ability is tested by three different tracking error formulas. The study also includes the comparison of expense ratios. In addition to these measures, the study investigates the structural differences of the investment products.

In terms of performance ETFs outperform index mutual funds on average. The volatility measures speak in favour of index mutual funds. Especially, the beta of index mutual funds is closer to the volatility of the market. Additionally, the tracking error speaks in favour of index mutual funds. These results suggest that even though index mutual funds have been tracking their benchmarks closer on average, ETFs have been able to provide returns beyond those of its benchmark in respect to their volatility. However, the differences found are minimal. Therefore, the study suggests investors to emphasize the structural differences of the products rather than performance or volatility differences.

TIIVISTELMÄ

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Tutkielman tavoitteena on löytää mahdolliset eroavaisuudet keskenään kilpailevien passiivisten sijoitustuotteiden, indeksirahastojen ja ETF:ien, väliltä. Tutkimus pyrkii osoittamaan löydettyjen eroavaisuuksien vaikutukset sijoituspäätösten kannalta, ja täten helpottaa sijoittajien päätöksentekoa kahden passiivisen sijoitustuotteen välillä. Tutkimus pohjautuu Yhdysvaltojen markkinoille ja käsittää vuodet 2011-2019. Tutkimuksessa on mukana neljä vertailuindeksiä, joiden pohjalta ETF:iä valikoitui yhteensä 11 ja indeksirahastoja 30 kappaletta. Hyödynnettävän datan luonteen vuoksi, tutkimus soveltaa kvantitatiivista tutkimusmenetelmää. Eroavaisuuksia rahastojen suoriutumisien väliltä etsitään Sharpen ja Treynorin luvulla, Jensenin alphalla sekä Informaatiosuhteella. Keskihajontaa ja betaa hyödyntämällä tutkimus pyrkii löytämään eroavaisuuksia rahastojen kokemien riskien väliltä. Lisäksi tutkimus tarkastelee kolmella eri kaavalla laskettuja aktiiviriskejä, joiden avulla pyritään erottamaan rahastojen kyky jäljittää vertailuindeksinsä. Rahastojen kulut käydään myös läpi. Edellä esiteltyjen mittareiden lisäksi, tutkielma huomioi sijoitustuotteiden rakenteelliset eroavaisuudet.

ETF:t menestyivät indeksirahastoja paremmin suoritumista osoittavien mittareiden perusteella. Indeksirahastot puolestaan menestyivät riskimittareiden perusteella paremmin. Etenkin indeksirahastojen beta oli keskimäärin lähempänä yhtä, ja siten lähempänä markkinoiden volatiliteettia. Myös aktiiviriski puhuu indeksirahastojen puolesta. Saadut tulokset ehdottavat, että vaikka indeksirahastot ovat jäljittäneet vertailuindeksiään suhteessa paremmin, ETF:t ovat kyenneet tuottamaan tuloja yli vertailuindeksiensä suhteutettuna niiden riskiin. Kuitenkin eroavaisuudet rahastojen välillä ovat pieniä. Tulokset viittaavatkin siihen, että sijoittajien tulisi painottaa rahastojen rakenteellisia eroavaisuuksia sijoituspäätöksissään.

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1. Introduction

Exchange-Traded Funds (ETFs) and index mutual funds are generally considered to be substitutes for one another. Both ETFs and index mutual funds represent an investing strategy called passive investing, in which the funds are designed to track or replicate a specific index. The funds accomplish this by investing in the same proportions and securities as the underlying index. (Sharifzadeh & Hojat 2012) Thus, ETFs and index mutual funds are seen as competing products. This study concentrates on the potential differences between index mutual funds and ETFs. Thereby, the objective of the research is to find the potential differences and study their impact on investment decision-making. By studying this problem, investors will have a better understanding on the actual differences and similarities between index mutual funds and ETFs. The results will provide essential information to support the investors' decision-making between choosing an index mutual fund or an ETF.

The first chapter addresses the purpose of the study and introduces the challenge it sets along with the research question. The research then begins with a literature review, which introduces the reader to the concepts of ETFs and index mutual funds. This section also introduces the results on previous studies that have measured differences between the two investment vehicles. The literature review chapter is followed by the methodology part of the thesis. The study attempts to find differences in terms of performance, volatility, tracking ability and expense ratios of the funds. Next, the results of the measures are discussed in the results chapter. This part also includes a comparison of the expense ratios of all the funds in the sample. Finally, the last chapter includes a summary of the study along with conclusions of the results. In this part, the study introduces suggestions on how investors might use these results to make a more informed investment-decision. Also, the proposals for future studies are presented briefly.

1.1 Background and purpose of research

There are previous studies examining the performance differences between index mutual funds and ETFs. The results of previous studies are generally quite coherent, showing that the differences between the two investment vehicles are quite minimal, nevertheless important to investigate. However, some of the results do differ from each other. Some studies have shown there is no statistical significance in the differences of performance between ETFs and index mutual funds in the U.S. market (Sharifzadeh & Hojat 2012). In contrast, other studies investigating the Chinese market have indicated that on average ETFs outperform index funds (Wu, Xiong and Gao 2020).

However, the performance differences could also be depending on the geographical area of the study. There are also some differences in results concerning tracking errors of the funds. Some studies concerning the U.S. market have found that ETFs outperform their benchmark index, while index funds underperform (Elton, Gruber and Souza 2019). These authors also found that index mutual funds actually track their benchmark closer compared to ETFs. On the other hand, Blitz, Huji and Swinkels (2012) find that both ETFs and index funds generally underperform their benchmark indexes in the European market. There are several studies that indicate the importance of expenses on performance differences (Elton, Gruber and Souza 2019; Blitz, Huji and Swinkels 2012; Kostovetsky 2003). Expenses are also found to affect the tracking error (Rompotis 2009b; Rompotis 2011).

Thus, some studies have suggested that there are no differences in the performance of ETFs and index mutual funds. These studies generally indicate that the differences of the two investment products are found in the product features. On the other hand, some studies have found differences in performance and tracking ability between the two passive investment products. These differences in performance could also depend on the geographical area of the study. Few of the existing papers actually aim to answer the question whether these potential differences should affect investor's decision-making.

The purpose of this study is to find an answer, whether there are any differences between these competing products, and if so, should they impact investor's decision-making. The research will address this by studying the potential differences, and which of these could be seen meaningful. After interpreting the results, the study will make suggestions on how investors with different kind of objectives could use these results to make more informed decisions on choosing the most suitable passively managed investment product. The study uses findings on earlier literature to support these suggestions.

1.2 Research questions

The research question of the study is formatted as follows:

Are there any differences between Exchange-Traded Funds and Index mutual funds?

This thesis aims to answer the research question by studying the following sub-questions:

- Are there differences in terms of performance between the two investment types?
- Are there differences in terms of risk and tracking ability?
- What is the role of expense ratios and how do they affect the overall performance of the funds? Do the expense ratios differ between the two investment types?
- Should there be differences, could investors use these differences for a more informed investment decision?

The study along with the research question focuses on finding the differences in the United States passive investment market between the years 2011 to 2019. The research question aims to find out is there any advantage for investors to have two such similar investment types available to them. Can the study find any crucial differences between index mutual funds and ETFs, that explain the simultaneous existence of these two? Is it possible that these two investment vehicles are both still valid but for different purposes? On top of the differences found in performance, risk and tracking ability, the main-research question also aims on the differences in the very design of the investment products.

1.3 Limitations of the study

This research is defined to concern the U.S. Market. The rationale for this is the large size and long history of the U.S. passive investment market. The U.S. ETF market is the largest in the world, with 2096 funds and a total net asset of $4.4 trillion. This counts for 70 per cent of the ETF net assets worldwide. (Investment Company Institute 2020) This is shown in Figure 1. By analysing the U.S. market, the study will get a comprehensive outcome. However, the results on this study may not be generalizable to other markets. In the United States, ETFs have been available for investors as an investment product for 27 years (Investment Company Institute 2020). As a percentage of the total assets under passive management, the number of ETFs grew from 1.45% to 61% between the years 1993-2007 (Svetina 2010). The data for the study is gathered from the years 2011-2019. For a significant amount of funds data was not available until year 2011. The studying period is therefore adjusted to the access of data. 2011 proved to offer the best trade of in terms of length of the time window and number of funds available. Still, there might be some drawbacks on choosing 2011 as the starting point. For instance, it is possible that on this day there are new passively managed funds that offer slightly different features, but with shorter historical data. Gastineau (2002) has brought up the factor, that ETFs are still evolving, and this might change the financial world once again. This should be kept in mind when interpreting the results.

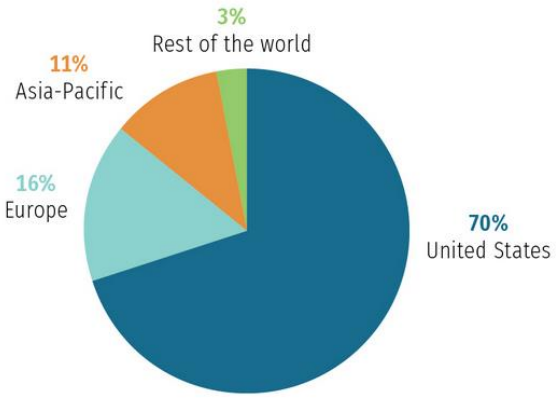

Figure 1. Worldwide ETF total net assets in 2019: $ 6.3 trillion
Source: Investment Company Institute 2020

The research will concentrate on studying the differences in performance, volatility, tracking ability and expense ratios. The chosen areas leave some differences between ETFs and index mutual funds out of notice. For instance, the study leaves out the effects of dividend policies and the impact of taxation. In addition, the study does not include all expenses and it solely focuses on finding the differences in expense ratios, and how they might affect the performance of the funds. It is worthy of noting, that these other sectors most likely affect the investors' decision-making as well. The limitations made are a result of the data constraints. However, by studying the risk-adjusted returns and tracking ability of the funds, this study is able to offer valuable information to support the decision-making of investors. Generally speaking, one of the key factors investors are looking for is the fund's ability to generate profit while minimizing the risk involved. Also, investors most likely take into consideration how well a fund has achieved its goals. In case of passively managed funds, this is indicated by the tracking ability of the funds. Even though, expense ratio does not cover all the fees involved, it is a crucial matter for investment decision-making. Ergo, even with the restrictions the study provides essential information for investment decision-making.

2. Theoretical background

An exchange-traded fund (ETF) is a fund that represents ownership in a basket of stocks and can be traded on an exchange. Usually ETFs track a specific index, such as the S&P 500 (Fevurly 2013, 145). ETFs can be bought and sold similar to any company stocks during the day while the stock exchanges are open (Ferri 2008, 23). Index fund management also consists of building a portfolio tracking the total return performance of its underlying index (Meziani 2016). In comparison to ETFs that trade throughout the day, index mutual funds are priced at their net asset values (NAVs) at the end of the

day. In index fund management the only decision investors must make is to choose the suitable portfolio diversification at the best possible price. Thus, investors do not attempt to take advantage of the movements of the market by forecasting those, nor to identify overvalued or undervalued securities. (Meziani 2016) In contrary, prices of ETFs change throughout the day, which investors can use as an advantage as they can sell or buy them at any point of the day (Fevurly 2013, 145).

2.1 Brief history of ETFs and indexing

In 1993 the first ETF, the Standard & Poor's 500 Trust ETF, was launched in the U.S. markets. Similar to index mutual funds, ETFs provide a diversified portfolio, which is one of the most important concepts in investing. ETFs can be based on a group of stocks or on any stock index, which allows them to offer a diverse range of products. In the mid-to-late 1990s ETFs started to receive attention from investors, but not until the years 2005-2006, ETFs started to show significant market momentum. By the end of 2005 the managed ETFs' assets were as large as 301 billion dollars, and on the following two years they had already doubled that amount resulting in a 608-billion-dollar asset. ETFs have gained investors an annualized return of 46% between the years 1993-2014. The demand for ETFs has increased by both institutional and individual investors along the increased awareness of these investment products. (Meziani 2016) The rapid expansion of ETFs is demonstrated in Figure 2.

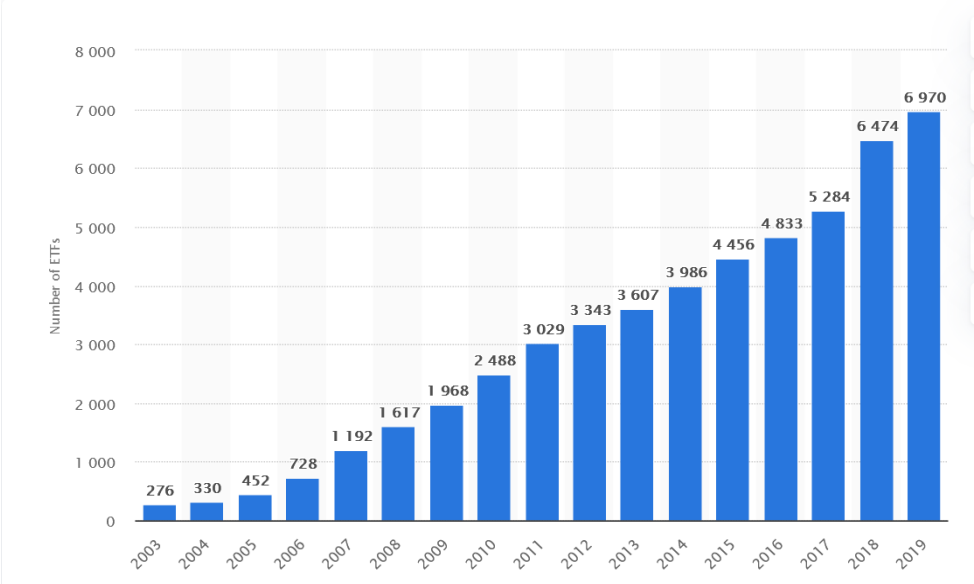

Figure 2. Number of Exchange-Traded Funds worldwide in 2003-2019
Source: Statista 2020

Like stated above, index fund management, also referred to as *indexing,* consists of building a portfolio tracking the total return performances of its underlying index. This is the alternative

passive investment strategy for ETFs (Meziani 2016). The history of mutual index funds goes further than that of ETFs. The first low-cost index funds were introduced in 1970 (Ferri 2008, 9). Indexing was designed to create a fund representing a principal segment of the market without utilizing traditional stock selection techniques which lead to a high turnover. Index mutual funds can also represent the entire market. By developing indexing, investors have been able to achieve number of things at once: the objective portfolio selection criteria; limited portfolio management direction, which also decreased the costs in fund operations; low portfolio turnover; lower trading costs and lastly, the higher degree of natural tax-efficiency. (Gastineau 2002) Although, indexing has been the prominent investment strategy, individual and institutional investors have been increasingly favouring ETFs as the passive investment strategy. This is due to their generally low operating costs, flexible trading, and the more advantageous taxation possibilities (Meziani 2016).

2.2 Structure of ETFs

ETFs are created by a creation and redemption process, which takes place in the primary market. The creation and redemption process allows authorised participants to exchange cash or baskets of securities for ETF shares. Likewise, ETF shares can also be exchanged back to cash or basket of securities. (iShares 2020) The continuous ability of ETF companies to create new shares and redeem the existing shares keeps the market price of ETFs in line with their underlying security values. An arbitrage mechanism ensures that the market price of ETFs is close to their true net asset value of the underlying securities. (Ferri 2008, 23) For example, if the market price of an ETF is below its value, traders may buy units of the ETF in the market and redeem them for the underlying basket of securities. This way traders may capture the price difference, which should lead to the fund's market price to be close to its net asset value. In practice, the effectiveness of arbitrage depends on several other factors as well, such as the amount of transaction costs and the bid-ask spreads. (Charupat & Miu 2013) The deviations between market price and net asset value of ETFs have shown to disappear quickly because of the arbitrage (Gallagher & Segara 2006).

Most ETFs and index mutual funds aim to track the performance of chosen indexes. A benchmark index is used as a tool that measures the total value of a financial market or a segment of the market. More specifically, the benchmark indexes are developed to capture the performance and price of a segment or the total financial markets. Each security is weighted by its market capitalization compared to all other securities in the index. The securities are usually selected passively to reflect a good cross-section of the market. For example, Frank Russell & Company, Morningstar and Standard & Poor's provide passively selected indexes. (Ferri 2008, 81- 110) ETFs can track their index

either by holding the underlying securities or by holding a derivative. The former is called physical-based and the latter SWAP-based ETFs. The physical-based ETFs usually buy all the securities in the underlying index and hold the securities as fund assets. This offers a great transparency, since investors know what they own at any time. (iShares 2020)

The portfolio manager must make a decision on how and when the portfolio will be adjusted to reflect the changes in the benchmark index. ETF managers can make adjustments by posting new creation or redemption baskets on the morning of the day the index change becomes effective. The redemption/creation process should replicate the index performance very closely. Thus, before expenses ETFs should be very close to their benchmark index. Any creations or redemptions that take place on the date the index changes will be implemented with baskets that reflect the index change. Therefore, the only task portfolio managers should have is to modify the portfolio for the changes that will go into effect at today's close. (Gastineau 2004)

2.3 Main differences between ETFs and index mutual funds

Both ETFs and index mutual funds aim to track their benchmark indexes. However, they differ in the way they are structured (Charles Schwab 2020). This will be discussed in more detail in the next chapter. Even though these differences between the two interfamilial investment products are little, they are important to analyse, and provide useful information to investors (Kostovetsky 2003).

2.3.1 Buy and sell characteristics

One of the main differences between ETFs and index mutual funds is the way they are bought and sold. ETFs trade throughout the day and can be bought through a brokerage account. Whenever an investor wants to buy or sell an ETF, the investor will do so directly from another marker participant. The market participant could be either another induvial investor or a firm which is specialized in selling and buying ETFs. Because ETFs are not purchased from the fund company itself, the price which they trade might differ from their net asset value. Most time ETFs trade at prices which are very close to their net asset value. This is the case especially with well-know and liquid ETFs. In contrast, index mutual funds are purchased directly from the fund companies and therefore are priced once a day after the market close. (Charles Schwab 2020)

In other words, mutual funds are sold at their NAV, whereas ETFs are sold at their market price. However, the market prices of ETFs are usually very close to the fund's NAV because of the market competition. If the ETF's market price however exceeds its NAV, the fund shares are called to trade

at premium to the fund value. Similar to stocks, ETFs are bought at the ask price and sold at the bid price. The bid price is always lower than the ask price, since the bid-ask price is determined from a standpoint of a dealer. The dealer can profit from the spread between the two prices: the ask price of ETFs is above the market price and the bid price is below the market price. For the investors, on the other hand this spread represents a trading cost that will be added to the normal trading fee (Fevurly 2013).

2.3.2 Tax efficiency

One distinguishing factor between ETFs and index funds is their tax efficiency. ETFs were created to offer investors the diversification presented by the mutual funds, but also to relieve the tax burden on investors (Meziani 2016). Due to the creation and redemption process explained earlier, ETFs can issue and redeem by taking in or distributing in-kind securities held by the fund. These in-kind distributions do not trigger realized capital gains, since ETFs can create and redeem their shares in kind, rather than in cash. (Dellva 2001) Because of this process, ETFs rarely distribute capital gains (Kostovetsky 2003). For mutual funds this is different. Since they do not have a similar creation and redemption process, rather many of them need to distribute year-end capital gains. (Dellva 2001) Index mutual fund managers are forced to sell stocks, when the redemptions exceed additions. This leads to the distribution and therefore immediate taxation of capital gains to the shareholders (Meziani 2016).

2.3.3 Expenses

An efficient fund will produce the maximum return with minimal input. The input of an ETF is seen as the expense ratio, which is the charge of the fund doing its job. That is, replicating the benchmark index. (ETF 2020) Both ETFs and index mutual funds are considered to be relatively affordable from the perspective of expense ratio. The expense ratio of a fund measures management fees as a percentage of total managed assets. In other words, the expense ratio indicates the amount deducted from an account to cover the administrative fees and operating costs of the fund per year. (Meziani 2016) However, because of the structural differences, the cost associated with trading ETFs and mutual funds differ from each other (Poterba & Shoven 2002). ETF investors are affected by similar costs that originate from trading stocks listed in exchange: bid-ask spreads, brokerage fees and commissions. Since ETFs are traded on exchange the issuers do not need to provide any services on transfer agency to unit holders. This is not the case for index mutual funds. In addition, ETFs that utilize the in-kind creation and redemption process, tend to attract lower transaction costs than

index mutual funds. This is a result of index mutual funds having to purchase (liquidate) the securities underlying the benchmark indexes when there is a net positive (negative) fund flow. However, both ETFs and index mutual funds are subject to transaction costs that are associated with changes in the indexes' compositions. These costs are generated because the funds must ensure that their portfolios of the constituent securities can mimic those of the benchmarks. The transaction costs are generally higher for funds with underlying assets that are less liquid and that track more volatile indexes. (Charupat & Miu 2013)

Additionally, shareholder transactions differ between ETFs and index mutual funds. Majority of index mutual funds are no-load, which means they do not charge commissions on transactions, as opposed to ETFs. Since, ETFs are purchased on the secondary market, the investors must pay a commission for the brokage house. The bid-ask spreads are the other component of transaction costs on ETFs. For the largest, most liquid ETFs, such as the Standard & Poor's Depositary Receipts (SPDR) and Invesco QQQ Trusts (QQQ), the bid-ask spreads are estimated to be below 2 cents per share (Kostovetsky 2003). The commissions on ETFs can be large for investors who make systematic contributions for their retirement plan, for example. Fortunately, the competition between the mutual funds and ETFs has decreased the commission costs for ETFs and stocks (Fevurly 2013).

The amount and significance of these transaction costs are specific to each type of investor, as well as their strategy and horizon of trading (Charupat & Miu 2013). Even though the costs for ETFs are generally lower, the cost advantages are argued to be really for the buy-and-hold ETF investors. This can be explained by the characteristic of ETFs trading like stocks, that result in higher brokerage commissions. Thereby, it is crucial to consider each investor's personal goals, finances, and abilities to tolerance risk. All these factors should be weighted before choosing the suitable ETF for an investor. For some investors the trading flexibility of ETFs can be seen as an advantage. On the other hand, the more cost-conscious investors might be interested in the mutual funds, for their feature that offers the possibility to purchase shares directly from the fund company at no costs. (Meziani 2016)

2.4 Previous research on differences between ETFs and index mutual funds

Rompotis (2009a) studies the debate of two interfamily investment vehicles in the U.S. market: Exchange-Traded Funds versus index mutual funds. The research shows that index mutual funds and ETFs are fully invested in their benchmarks, which is shown as a relatively low tracking error for both ETFs and index funds. By a regression analysis Rompotis (2009a) shows that both ETFs and index

funds pursue full replication strategies, which increases the level of index funds and ETFs dependence on the risk and return of the tracking indexes. The beneficial effects of the full replication strategies are portrayed on the low tracking error estimates for index funds and ETFs. Sharifzadeh & Hojat (2012) also compare the performance of index mutual funds and ETFs in the U.S. market. They accomplish this by comparing the Sharpe ratio and the risk-adjusted buy and hold total returns over the years 2002-2010. Their results indicated that over 50 per cent of the selected ETFs outperformed their pair index funds. However, the outperformance is not statistically significant. For this, the evidence suggests that investor's decision choosing between index funds and ETFs, depends on the product features rather than the performance of the funds.

Wu, Xiong and Gao (2020) investigate the performance differences of ETFs and index mutual funds in the Chinese stock market. The results of their study indicate that on average ETFs perform better than index mutual funds both pre-expense and post-expense. In addition, Wu, Xiong and Gao (2020) find that the influencing factors on return performance are different for index funds and ETFs. For the latter, the major factors are the amount of security lending and the number of passive funds in the same family. On the other hand, the major determinants for index funds are turnover, expenses and the number of passive funds in the same family. Elton, Gruber and Souza (2019) also get similar results on their research on comparing the performance of passive mutual funds and ETFs. Their study is based on the U.S. market. The authors find that on average ETFs pre-expenses slightly outperform their benchmark index. In contrast, index mutual funds slightly underperform. By examining performance post expenses, they show that the expense ratio becomes an important factor affecting the differential return. The next authors also highlight the importance of expenses. Blitz, Huji and Swinkels (2012) study the performance of ETFs and index mutual funds that are listed in Europe. Firstly, they find that both ETFs and index funds generally underperform their benchmark index. Secondly, Blitz et al. (2012) find that the expense ratio is a significant determinant of these funds' performance. Lastly, the authors discover an important factor, the dividend taxes, that is not included in the expense ratio. For its part, dividend taxation explains the performance differences between ETFs and index funds in the European market.

Kostovetsky (2003) also investigates the major differences between traditional index funds and their competitors ETFs in the U.S. market. The differences are tested by establishing a threshold model to compare the costs of the funds. The objective of the study is to analyse the sorts of investors who would prefer index funds over ETFs and vice versa. The results suggest that ETFs are especially important for the larger investors, as well as the long-term retail investors. The key differences

between these two similar investment vehicles are share-holder transaction fees, management fees and taxation efficiency. Agapova (2011) studies the implications of substitutability of ETFs and index mutual funds in the U.S. market. The study examines substitutability by aggregate fund flows. The results show that ETFs and index funds are substitutes, yet not perfect substitutes for one another. Agapova (2011) suggests that the coexistence of ETFs and index funds can be explained by a clientele effect that segregates the two investing instruments into different market niches.

Rompotis (2009b) evaluates the ability of iShares to accurately replicate the performance of their underlying indexes. The sample for the study includes international, domestic (U.S.) and sector market funds. The author finds that iShares fail to track their benchmark indexes accurately. By regression analysis, the author is able to indicate that the tracking error is affected by expenses and risk. The author also finds that iShares are traded at a premium to their net asset value, especially the international iShares differ from their premiums. On top of these results, Aber, Li and Luc (2009) find differences in the tracking abilities of ETFs and index mutual funds. The study is based on the U.S. market and utilizes the funds of Vanguard and iShares. At one extreme the tracking abilities of these funds are almost identical, and at the other extreme, they differ more than 10 per cent. Based on the mean-variance analysis, the authors show that the index mutual funds tracked their benchmark closer than ETFs. The difference is only 2 to 3 basis point on average. In addition to these evidence of the tracking error Rompotis (2011) investigates the ETFs ability to beat the market; asses the tracking error persistence and studies the factors that induce the tracking error. The author shows that majority of the selected ETFs are able to beat the market both at aggregate and annual levels. The market is represented by the S&P 500 Composite index. Rompotis (2011) also indicates that the tracking error of the selected ETFs persist at the short-term level. The persistence in tracking error is explained by expenses, age, and risks of the ETFs. This study is also based on the U.S. market.

In brief, earlier literature has shown that both index mutual funds and ETFs have relatively low tracking errors due to their full replication strategies. At the same time, studies have indicated that both ETFs and index mutual funds have failed to perfectly replicate their benchmark index. There are also studies showing that index mutual funds have been able to track their benchmark closer compared to ETFs. While some studies have shown that ETFs outperform index mutual funds in terms of performance, some studies suggest that there is no statistical significance between these differences. Many studies have highlighted the importance of expenses and their impact on performance and tracking error. The key differences between ETFs and index mutual funds are found to be share-holder transaction fees, management fees and taxation efficiency. It should be

noticed that some of the studies are based outside the U.S. and differences found on performance could be related to the geographical area. This thesis contributes to the literature by enlighten the subtle differences in the perspective of an investor.

3. Research methodology

The aim of the study is to investigate the potential differences between the two competing investment products. The studying period took place from January 2011 to December 2019. Because of the nature of the data and the research questions, the study utilizes a quantitative research method. Data for the study is gathered from the Thomson Reuters Datastream, which includes daily closing prices for the benchmark indexes and similar prices for the ETFs and index funds. The sample period of the study results in 2346 daily observations for each fund and benchmark index. To make the sample comparable, all the prices included represent the total returns. The total return indexes in Datastream assume that dividends are re-invested to purchase additional units of equity. This section discusses the data used in the study and describes how the pairing of the funds is executed. Later, the chapter introduces measures used in the study.

3.1 Data

The benchmark indexes of the study can be divided to three categories: large-cap, mid-cap and small-cap. In this study large-cap is represented by the S&P 500 Composite index. Mid-cap is represented by the S&P 400 index. Lastly, Russell 2000 and S&P 600 indexes make the small-cap category of this study. These indexes represent a wide range of the U.S. market and therefore are chosen for the study. It still needs to be noted that the results of the study cannot be generalised to other markets, since the geographical area could also have an impact on the differences. After choosing the benchmarks, the study then finds ETFs and index mutual funds that follow the same benchmark index. The funds were found by searching equities and unit trusts that included the name “index fund” or “ETF” from the Thomson Reuters Datastream. The study also utilized the *ETF Database* to find all possible ETFs available. For a considerable amount of the funds, data was not available until year 2011. The studying period was therefore adjusted for this.

The sample of funds is then cleaned by eliminating funds, whose objective is other than following the benchmark index; funds that are not passively managed; that are categorised as insurance funds, commodity funds or bond passive products, and funds that are not listed in the U.S. market.

This is done manually checking the provider's webpages for each fund separately. The sample of funds includes ETFs and index mutual funds that invest different percentages of their assets to stocks included in the benchmark index. There are funds, which invest at least 80% of their assets to stocks in the benchmark, and funds that invest substantially all their assets to these stocks. Objectives of the funds are shown in an attachment in the end of this thesis. The rationale for selecting funds that differ on how much they invest on stocks in the benchmark is to cover a wider selection of funds. When gathering data for the study, it was quickly revealed that many of the funds did not invest all their assets to stocks in the benchmark. Especially, many index mutual funds have an objective to invest at least 80% of their assets. If the study had ruled out all funds other than those that invest all their assets, the sample for the study would have been notably smaller. The results are interpreted in a way that takes these different objectives into consideration.

Lastly, the study eliminates six index mutual funds, which prices were not updated daily in Thomson Reuters Datastream. Because the study utilizes daily data to calculate all the measures, the values of these funds were clearly not in line with the rest of the dataset. The total number of ETFs included in the study is 11 and the same number for index mutual funds is 30. The history of index mutual funds is longer than that of ETFs and even by this day more index mutual funds were found than ETFs. However, nowadays there are more ETFs available than those represented in this study, since after 2011 many ETFs have been established.

Index mutual funds of the study are separated in two categories that include funds for individual investors and institutional investors. It is necessary to perform the separation since the expense ratios for the two types of index funds differ considerably from one another. Funds specifically structured for individual investors generally carry higher fees than those structured for institutional investors (Chen 2020b). The results are therefore expressed in a manner where the two classes can be separated from one another. The expense ratio for each fund is acquired from each provider's web page. The expense ratios are stated in the prospectus since the access to historical data was out of access for this study. Many of the funds included in the study are issued by the largest providers in the United States such as The Vanguard Group, BlackRock, and the State Street Global Advisors. There are also some relatively smaller providers included. Especially in the S&P 500 Composite, which is one of the most followed indexes, there is a broad selection of funds available. The risk-free rate chosen for the study is the 13 weeks US Treasury Bill, which is gathered from the webpage of U.S. Department of the Treasury. Treasury Bills (T-Bills) are short-term debt obligations, which are backed up by the U.S. Treasury Department. Most common maturities for T-Bills are

4,8,13,26, and 52 weeks. The longer maturities offer higher interest rates to investors. T-Bills are widely viewed as secure, low-risk investments which is also why this study chose a T-Bill to represent the risk-free rate. (Chen 2020c)

3.1.1 Benchmark indexes and pairing of funds

The chosen benchmark indexes along with the ETFs and index mutual funds matched with those are shown in Table 1, Table 2, and Table 3.

Table 1. ETFs and index mutual funds following S&P 500 Composite

Category: Large Cap	**Symbols**
Benchmark index	
S&P 500 COMPOSITE	^GSPC
ETFs	
SPDR Portfolio S&P 500 ETF	SPLG
iShares Core S&P 500 ETF	IVV
Vanguard S&P 500 ETF	VOO
Index mutual funds	
Schwab S&P 500 Index Fund	SWPPX
*State Street S&P 500 Index Fund Class N	SVSPX
BNY Mellon S&P 500 Index Fund	PEOPX
*Invesco VI S&P 500 Index Fund Class I	VMVSPXV
Invesco S&P 500 Index Fund Class A	SPIAX
Nationwide S&P 500 Index Fund Class A	GRMAX
Principal LargeCap S&P 500 Index Fund Class A	PLSAX
MainStay MacKay S&P 500 Index Fund Investor	MYSPX
*Sei Index Fund S&P 500 Index Fund Class I	SPIIX
*Principal LargeCap S&P 500 Index Fund Institutional Class	PLFIX
GREAT-WEST S&P 500 Index Fund Investor	MXVIX
Vanguard 500 Index Fund Investor Shares	VFINX
Vanguard 500 Index Fund Admiral Shares	VFIAX
*Vanguard Institutional Index Fund Institutional Plus Shares	VIIIX
*BNY Mellon Institutional S&P 500 Stock Index Fund	DSPIX
*Nationwide S&P 500 Index Fund Institutional Service Class	GRISX

** for Institutional otherwise individual*

The S&P 500 Composite represents the 500 of the largest publicly traded companies in United States. There are many funds tracking the performance of S&P 500, since the index is regarded to be one of the best gauges of large-cap U.S. equities (Kenton 2020).

Table 2. ETFs and index mutual funds following S&P 400

Category: Mid Cap	Symbols
Benchmark index	
S&P 400	^SP400
ETFs	
SPDR Portfolio S&P 400 Mid Cap ETF	SPMD
Vanguard S&P Mid-Cap 400 ETF	IVOO
iShares Core S&P Mid-Cap ETF	IJH
Index mutual funds	
*Principal MidCap S&P 400 Index Fund Institutional Class	MPSIX
*Vanguard S&P Mid-Cap 400 Index Fund Institutional Shares	VSPMX
BNY Mellon MidCap Index Fund Investor Shares	PESPX
Columbia Mid Cap Index Fund Class A	NTIAX
*Columbia Mid Cap Index Fund Institutional	NMPAX
Nationwide Mid Cap Market Index Fund Class A	GMXAX

** for Institutional otherwise individual*

Similar to S&P 500 Composite, S&P 400 is also an index published by Standard & Poor's. The S&P 400 includes 400 U.S. publicly traded companies with midrange capitalization (Scott 2019).

Table 3. ETFs and index mutual funds following Russell 2000 and S&P 600

Category: Small Cap	Symbols
Benchmark index	
RUSSELL 2000	^RUT
ETFs	
iShares Russell 2000 ETF	IWM
Vanguard Russell 2000 ETF Shares	VTWO
Index mutual funds	
*Vanguard Russell 2000 Index Fund Institutional Shares	VRTIX
iShares Russell 2000 Small-Cap Index Fund Investor A Shares	MDSKX
*iShares Russell 2000 Small-Cap Index Fund Institutional Shares	MASKX
Nationwide Small Cap Index Fund Class A	GMRAX
Schwab Small Cap Index Fund	SWSSX
Benchmark index	
S&P 600	^SP600
ETFs	
SPDR S&P 600 Small Cap ETF	SLY
Vanguard S&P Small-Cap 600 ETF	VIOO
iShares Core S&P Small-Cap ETF	IJR
Index mutual funds	
*Vanguard S&P Small-Cap 600 Index Fund Institutional Shares	VSMSX
Great-West S&P Small Cap 600® Index Fund Investor Class	MXISX
BNY Mellon Small Cap Stock Index Fund Investor Shares	DISSX

** for Institutional otherwise individual*

Russell 2000 is an index created by Frank Russell Company, which measures the performance of approximately 2000 American smallest-cap companies (Chen 2020a). Similarly, S&P 600 is an index measuring the performance of small-sized companies. However, S&P 600 covers a narrower range of assets compared to the Russell 2000. The S&P 600 is managed by Standard and Poor's (Chen 2019). In contrast to the large-cap and mid-cap categories, this study chose two benchmark indexes for the small-cap category. This is to obtain more funds to represent the small-cap category, and thereby get more comprehensive results. More specifically, the Russell 2000 was chosen to complement the S&P 600, which only included two ETFs by itself.

3.2 CAPM and volatility

In this study the Capital Asset Pricing Model (CAPM) is introduced as the foundation for beta and alpha, which formulas are presented later. The alpha is calculated in relation to the CAP model. Additionally, the same criticism that concerns the CAPM also applies to alpha. Therefore, the fundamentals of the model are discussed briefly. The CAPM was presented by Sharpe (1964), Lintner (1965) and Moss (1966) who introduced the idea of the relationship between risk and expected return. The CAPM is based on the Markowitz's (1952) modern portfolio theory, which indicates that there are two types of risk in the market: systematic risk and unsystematic risk. If the amount of systematic risk of an investment objective is known, the expected return of an investment objective can be calculated using the CAPM. Systematic risk comprehends the part of total risk that cannot be controlled by the investor and therefore cannot be diversified. For instance, inflation and interest rate levels count for the systematic risk. In contrast, the unsystematic risk, also referred to as idiosyncratic risk, indicates the risks that originated from the company itself. Possibility of bankrupt is an example of the idiosyncratic risk. The systematic risk of the market is measured by beta. When the value of beta is one, the market risk of an investment objective equals to the systematic risk. When the value of beta is more than one, the systematic risk of the investment objective is greater than that of the market. Likewise, if the value of beta is under one, the systematic risk of the investment is less than the market's risk. Because the portfolio is assumed to be efficiently diversified, the CAPM does not include the idiosyncratic risk. According to the CAPM, the expected return of an investment objective depends on the risk-free rate, the market risk premium, and the beta coefficient (Elton, Gruber, Brown & Goetzmann 2003, 299). Formula (1) shows the CAP model.

$$E_{ri} = r_f + \beta_i[E(r_m) - r_f] \quad \textbf{(1)}$$

where

E_{ri} = expected return of investment

r_f = risk-free rate

$E(r_m)$= expected return of the market

β_i = beta of investment

$[E(r_m) - r_f]$ = market risk premium

The CAPM suggests that an investment objective which carries risk should have a greater return than that of a risk-free investment objective. (Niskanen & Niskanen 2007, 185). The risk-free rate is usually represented as the returns of a treasury bond since they are generally considered as a risk-free investment objective. The market risk premium is calculated by subtracting the risk-free return from the portfolio of the market. The expected return of an investment objective is determined by the beta coefficient. According to McGraw-Hill (2008) the beta consists of the covariance between the return of the share and return of the market portfolio divided by the variance of the market portfolio. Formula (2) presents the calculation of beta, which also the study uses.

$$\beta_i = \frac{cov(r_i, r_m)}{\sigma^2{}_m} \quad \textbf{(2)}$$

where

β_i = beta of investment

$cov(r_i, r_m)$ = covariance on the return of an individual stock r_i and the return on the overall market r_m

$\sigma^2{}_m$ = variance of the overall market

According to Blitz, Falkenstein and Van Vlietin (2014) the CAPM makes assumptions that frequently are not fulfilled in real world situations. These assumptions are i) the investor's objective is to maximize their expected return and avoid taking risk, while the only matter they are concerned is the average return and its variance, ii) there is no regulation concerning trading, iii) there is only one time period that all investors share, iv) trading occurs in an environment that is similar to a perfect market, v) information available is perfect and utilized rationally. Another criticism towards the CAPM is its high dependence on the assumption that the returns of the shares are normally distributed. Normally distributed returns indicate that all the daily returns of the shares are relatively close to their average. In other words, the daily returns only vary around the amount of

tree standard deviations. However, the previous financial crises have shown that this may not be the truth and extreme occurrences in the stock market are more probable than investors might think. (Nath 2015) Because in many real-life situations the assumptions listed above are not realistic, the CAPM needs to be used carefully.

3.3 Risk-adjusted returns

For calculating the risk-adjusted returns for each fund the study utilizes Jensen's alpha, Sharpe Ratio and Treynor Ratio.

Jensen's alpha is an absolute measure of performance based on the CAP model discussed in chapter 3.2. The actual return of the investment is compared to the expected return given by the CAPM. The difference between these two values indicates the potential excess return of the investment. In other words, if the alpha gives positive values, the investment has performed better than predicted. The alpha can also be negative, which indicates that the investment has underachieved the market. (Jensen 1968) In the long run the alpha should be zero in an efficient market since there should be no pricing errors. Same criticism concerning the CAMP also apply for the Jensen's alpha. The formula used to calculate the Jensen's alpha is shown below (3). This is also the formula, which this study uses to calculate alpha for each investment.

$$\alpha_i = r_i - r_f - \beta_i(r_m - r_f) \quad \textbf{(3)}$$

where

r_i = return of investment

r_f = risk-free rate

β_i = beta of investment

r_m = return of the market

Sharpe ratio is one of the most known and employed indicators for measuring the success of an investment (Pätäri 2000, 27). Sharpe (1966) developed an indicator to illustrate the relationship between return and risk. The ratio indicates the return of the investment in excess of the risk-free rate per unit of standard deviation. Standard deviation represents volatility of the investment. The higher the Sharpe ratio of an investment, the better the investment has performed adjusted to the risk it has taken. Compared to the CAPM, the advantage of Sharpe ratio is that it includes both

systematic risk and unsystematic risk (Pätäri 2000, 28). This study calculates standard deviation by taking a square root of the variance. The standard deviation is a measure of risk, which estimates the extent to which the actual outcome likely diverges from the expected outcome (Sharpe & Bailey 1999, 15). According to Sharpe (1994) one should choose the investment which has the higher Sharpe ratio, but also consider the correlation between the investments, as well as the other investment objectives one owns. The Sharpe ratio is calculated as shown in formula (4).

$$S_i = \frac{r_i - r_f}{\sigma_i} \quad \textbf{(4)}$$

where r_i = return of investment

r_f = risk-free rate

σ_i = standard deviation of investment

Results on Sharpe ratio can also be negative. This is possible if the return of the investment fails to reach the return of the risk-free rate (Sharpe, Alexander, Bailey 1999, 846). When utilizing the Sharpe ratio, it is important to consider the time period. The time period should be same for both investments that are being compared to each other. This is important because all the factors contributing to the total risk should be taken into consideration for both ratios that are being compared (Sharpe 1994). Similar to the CAPM model, also the Sharpe ratio depends on the assumption of normally distributed returns. Therefore, it is reasonable to utilize logarithmic returns for the calculations.

This study utilizes daily returns to calculate the risk-adjusted returns of the funds. The daily returns are calculated using a natural logarithm function. This is done by diving the price of the day P_t with the previous price of the day P_{t-1} and taking a natural logarithm of the result. This is shown in formula (5).

$$R_{p_t} = \ln(\frac{P_t}{P_{t-1}}) \quad \textbf{(5)}$$

where R_{p_t}= logarithmic return of the investment in period t

P_t = value of the investment in day t

P_{t-1} = value of the investment in day $t-1$

Another well-known indicator to calculate the success of an investment is the Treynor ratio, which was introduced by Treynor (1965) as a quantitative method to analyse the management of investments. Similar to Sharpe ratio, the Treynor ratio indicates the return of an investment in excess of the risk-free rate. However, unlike Sharpe ratio, Treynor ratio uses the systematic risk as the denominator. The systematic risk is represented as beta. (Vaihekoski 2004, 261) Applying beta can be justified with an efficiently diversified portfolio, because then the unsystematic risk should have a very insignificant role. Treynor (1965) and Sharpe (1966) have suggested that the Treynor ratio is superior to the Sharpe ratio as a future performance measure of investments. In contrast, the Sharpe ratio would be a better measure of past performance. Sharpe (1966) explains this by the deficiency of diversification possibilities that Treynor ratio includes in its formula. The bigger the Treynor ratio, the better the investment has performed in relation to its systematic risk. Treynor ratio can also give negative values if the investment has returned less than the return of the risk-free rate. Formula (6) shows how the Treynor ratio is calculated.

$$T_i = \frac{r_i - r_f}{\beta_i} \quad \textbf{(6)}$$

where r_i = return of investment

r_f = risk-free rate

β_i = beta of investment

This study calculates the beta in Treynor ratio identical to formula (2). Inputs for the covariance are the daily returns of the funds and the daily returns of the benchmark index. The input for the variance is the daily returns of the benchmark index. All the daily returns are calculated by the natural logarithm function, which is shown in formula 5. For the Sharpe ratio and Treynor ratio this study utilizes the coupon equivalent values of the 13 weeks US Treasury Bill as the risk-free rate. The risk-free rate is presented as annual values in the web page of U.S. department of the treasury. The annual values are modified to daily values with the following formula (7) (Vaihekoski 2004, 195).

$$i^{daily} = \ln\left(\frac{360 + i^{pa} \times 30}{360 + i^{pa} \times 29}\right) \quad \textbf{(7)}$$

where i^{daily} = daily value of the risk-free rate

i^{pa} = annual value of the risk-free rate

3.4 Tracking error measurements

Tracking error indicates the difference between the return of an investment portfolio and the return of its benchmark index. In other words, the measure shows how well a portfolio has tracked its benchmark index. (Vaihekoski 2004, 259) Similarly, the tracking error is seen as the part of portfolio's volatility which cannot be explained by the volatility of its benchmark index. Therefore, it also indicates about the ability of portfolio managers to time the market. (Petäjistö 2013). In this study the tracking error is an important measure on finding the differences between ETFs and index mutual funds on how successfully they have achieved their goal: tracking their benchmark index. There is no unequivocal definition of the tracking error in the literature of today. The simplest definition of the tracking error can be expresses by subtracting the return of the benchmark from the portfolio's return. Another common way to calculate the tracking error, which this study utilizes, is to compute the average absolute difference between the daily return on the fund and that of the benchmark index (Charup and Miu 2013). This is shown in formula (8).

$$\mathrm{TE}_{1_i} = \frac{1}{\mathrm{T}} \sum_{\mathrm{t}=1}^{\mathrm{T}} |r_t^i - r_t^m| \quad \textbf{(8)}$$

where r_t^i = return of portfolio on day *t*

r_t^m = return of the underlying benchmark index on day *t*

T = length of time period

By interpreting formulas (8), (9) and (10) it can be seen that the lower the values of TE, the closer the portfolio tracks its benchmark index. In contrast, high values of TE indicate that the portfolio has failed to mimic its benchmark closely. Charup and Miu (2013) conclude that there are many factors affecting the magnitude of tracking errors. For example, management fees and transaction costs as well as dividends of funds affect the result of tracking error. Charup and Miu (2013) show

other commonly adopted tracking error measures, of which this study will also be using. The first one is based on the root mean-square deviation of the return on the fund from that of the index. The second one is based on the standard deviation of the difference between the return on the fund and that of the benchmark. These two tracking error measures are shown in formulas (9) and (10). The length of time period (T), for this study is the total number of days included in the studying period. The studying period comprises of the first day of 2011 to the last day of 2019. This results in 2346 days, which is the T for this study.

$$TE_{2_i} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(r_t^i - r_t^m)^2} \quad \textbf{(9)}$$

where r_t^i = return of portfolio on day t

r_t^m = return of the underlying benchmark index on day t

T = length of time period

$$TE_{3_i} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}[(r_t^i - r_t^m) - (\overline{r_t^i} - \overline{r_t^m})]^2} \quad \textbf{(10)}$$

where r_t^i = return of portfolio on day t

r_t^m = return of the underlying benchmark index on day t

$\overline{r_t^i}$ = sample mean returns on the portfolio

$\overline{r_t^m}$ = sample mean returns on the underlying benchmark index

T = length of time period

3.5 Information ratio

Information ratio indicates the returns of a portfolio that are beyond the returns of a benchmark per unit of tracking error. In other words, information ratio tells about the portfolio manager's ability to generate excess returns relative to the benchmark index (Murphy 2020). The measure is often used to compare fund managers that employ similar investment strategies (Vaihekoski 2004,

261). Information ratio also indicates the consistency of the performance to track its benchmark index. A high information ratio implies a higher level of consistency and vice versa. Similar to other risk-adjusted return measures, the interpretations on information ratio can vary depending on the investor. (Murphy 2020) In addition to tracking error, this study utilizes information ratio to spot potential differences on how well managers of ETFs and index funds have been implicating the benchmark index. Information ratio can be calculated by the subtraction of the return of the portfolio and the return of the benchmark index divided by tracking error. (Vaihekoski 2004, 261). This is shown in formula (11).

$$IR = \frac{r_i - r_m}{TE} \quad \textbf{(11)}$$

where r_i = return of portfolio

r_m = return of benchmark index

TE = tracking error (formula 8,9, or 10)

4. Results

In this section results of the measures will be analysed and interpreted. Findings on the differences between ETFs and index mutual funds are shown in separate chapters: annual average of profit and risk measures; risk-adjusted returns; tracking error and information ratio and lastly, the expense ratio. All the measures in this study are calculated using daily data gathered from the years 2011 to 2019. It should also be noted, that since all measures used in the study are calculated using historical data, they do not guarantee future performance.

4.1 Results on annual average of profit and risk measures

After dividing the funds for each category, the study will be testing their differences. The annual average of profit is calculated as follows. The profit of a fund is its loss or gain divided by its original value. However, instead of utilizing calendar years as the time window, the study uses a so-called rolling window. That is, each daily value will have a 250 -day window of its own. The median presented in table 4 is calculated from the annual average of profit for the whole period of the study.

Table 4. Results on Annual Average of Profit and Risks

Large Cap	Annual average of profit	Annual median of profit	Max of annual profit	Min of annual profit	Variance of annual profit	Standard deviation of annual profit	Beta (Daily)
^GSPC	13.55%	15.00%	39.91%	-10.92%	0.00760	8.72%	
SPLG	13.42%	14.82%	40.83%	-11.65%	0.00799	8.94%	0.8480
IVV	13.49%	14.95%	39.79%	-11.01%	0.00759	8.71%	0.9967
VOO	13.51%	14.98%	40.05%	-11.00%	0.00760	8.72%	0.9934
SWPPX	12.93%	14.02%	39.88%	-12.84%	0.00784	8.85%	0.9937
SVSPX*	15.18%	16.62%	67.67%	-12.61%	0.00873	9.34%	1.0026
PEOPX	13.01%	14.49%	39.28%	-11.36%	0.00755	8.69%	0.9999
VMVSPXV*	13.13%	14.56%	39.34%	-11.21%	0.00754	8.69%	1.0010
SPIAX	12.55%	13.67%	39.14%	-11.44%	0.00727	8.53%	1.0017
GRMAX	12.62%	14.00%	39.09%	-12.26%	0.00747	8.64%	1.0001
PLSAX	12.97%	14.39%	39.31%	-11.35%	0.00746	8.64%	0.9988
MYSPX	11.66%	13.05%	36.63%	-12.90%	0.00743	8.62%	0.9956
SPIIX*	11.94%	13.35%	38.50%	-12.68%	0.00796	8.92%	0.9979
PLFIX*	13.36%	14.79%	39.71%	-11.02%	0.00753	8.68%	0.9969
MXVIX	12.16%	13.58%	39.21%	-11.50%	0.00699	8.36%	1.0000
VFINX	12.54%	14.00%	38.81%	-11.64%	0.00741	8.61%	0.9981
VFIAX	13.44%	14.87%	39.21%	-10.94%	0.00750	8.66%	0.9999
VIIIX*	13.41%	14.87%	39.89%	-10.91%	0.00738	8.59%	0.9997
DSPIX*	13.38%	14.77%	39.72%	-11.07%	0.00753	8.68%	1.0005
GRISX*	12.79%	14.13%	39.34%	-12.20%	0.00746	8.64%	0.9996
	13.48%	**14.92%**			**0.00773**	**8.79%**	**0.9460**
	12.94%	**14.32%**			**0.00757**	**8.70%**	**0.9991**

* for Institutional otherwise individual

Mid-Cap	Annual average of profit	Annual median of profit	Max of annual profit	Min of annual profit	Variance of annual profit	Standard deviation of annual profit	Beta (Daily)
^SP400	11.89%	12.86%	39.68%	-16.44%	0.01233	11.10%	
SPMD	11.67%	11.80%	43.21%	-21.00%	0.01614	12.70%	0.9256
IVOO	11.74%	12.73%	39.40%	-16.59%	0.01231	11.09%	0.9702
IJH	11.80%	12.78%	39.65%	-16.46%	0.01232	11.10%	0.9954
MPSIX*	11.63%	12.59%	39.23%	-16.63%	0.01221	11.05%	0.9966
VSPMX*	11.63%	12.53%	39.60%	-16.49%	0.01222	11.06%	0.9985
PESPX	11.34%	12.32%	39.02%	-17.07%	0.01229	11.08%	1.0009
NTIAX	11.08%	12.34%	39.04%	-17.85%	0.01288	11.35%	1.0010
NMPAX*	11.32%	12.63%	39.37%	-17.81%	0.01302	11.41%	1.0013
GMXAX	10.95%	11.75%	38.86%	-17.27%	0.01222	11.06%	1.0003
	11.74%	**12.43%**			**0.01359**	**11.63%**	**0.9637**
	11.32%	**12.36%**			**0.01247**	**11.17%**	**0.9998**

* for Institutional otherwise individual

Small Cap	Annual average of profit	Annual median of profit	Max of annual profit	Min of annual profit	Variance of annual profit	Standard deviation of annual profit	Beta (Daily)
^RUT	11.38%	11.64%	46.55%	-20.93%	0.01824	13.50%	
IWM	11.41%	11.69%	46.51%	-20.86%	0.01823	13.50%	0.9804
VTWO	11.39%	11.65%	46.68%	-20.91%	0.01821	13.49%	0.9577
VRTIX*	11.44%	11.73%	46.72%	-20.86%	0.01822	13.50%	0.9995
MDSKX	10.94%	10.96%	46.50%	-21.09%	0.01832	13.53%	0.9998
MASKX*	11.17%	11.20%	46.73%	-20.98%	0.01845	13.58%	0.9990
GMRAX	10.31%	10.39%	46.07%	-21.77%	0.01789	13.38%	0.9998
SWSSX	11.06%	11.05%	46.51%	-21.78%	0.01814	13.47%	0.9893
	11.40%	**11.67%**			**0.01822**	**13.50%**	**0.9690**
	10.98%	**11.07%**			**0.01820**	**13.49%**	**0.9975**
^SP600	13.04%	12.26%	48.93%	-16.93%	0.01703	13.05%	
SLY	12.93%	12.31%	47.95%	-17.09%	0.01697	13.03%	0.9361
VIOO	12.92%	12.16%	48.74%	-17.13%	0.01702	13.05%	0.9070
IJR	13.01%	12.32%	48.96%	-17.03%	0.01705	13.06%	0.9849
VSMSX*	12.86%	12.23%	48.77%	-17.82%	0.01743	13.20%	0.9998
MXISX	11.04%	10.21%	43.11%	-17.29%	0.01563	12.50%	1.0044
DISSX	12.53%	11.70%	48.31%	-17.27%	0.01684	12.98%	0.9999
	12.96%	**12.26%**			**0.01701**	**13.04%**	**0.9427**
	12.14%	**11.38%**			**0.01664**	**12.89%**	**1.0013**

* for Institutional otherwise individual

On average ETFs seem to have closer annual profits with the S&P 500 Composite benchmark compared to index mutual funds. Also, the best performer in this category seems to be an ETF. The best performer is the fund with the closest value of annual profit with that of its benchmark. The variation of annual profits is greater for index mutual funds, which is also shown as a lower total average. The worst performer also seems to be an index mutual fund; MYSPX has an annual profit of 11.66% which differs almost 2 percent from that of its benchmark. The worst performer is the fund which has the annual profit furthest away from that of its benchmark. The results above concern the large-cap category. For the mid-cap and small-cap category results seem to be similar. On average ETFs offer closer annual profits to that of its benchmark. Also, the best performers in both categories are ETFs and the worst performers are index mutual funds. These results suggest that in terms of annual profit, ETFs outperform index mutual funds. However, the differences are minimal.

Variances for all ETFs and index mutual funds seem to be close to those of their benchmark's. This indicates that the funds' spread of prices are similar to the spread of their benchmark's prices. In the large-cap and mid-cap categories index mutual funds have closer variances with that of their benchmark's. However, on average ETFs have a closer variance with its benchmark in the small-cap category that comprises of the Russell 2000. For the other benchmark in the small-cap category, the

S&P 600, there is no difference between ETFs and index mutual funds. Overall, the results seem to indicate that in terms of variance there is no clear winner between ETFs or index mutual funds.

Perhaps a more interesting measure is the standard deviation, which investors use to measure the risk of an investment vehicle. In the sample, standard deviation of each fund should be close to that of its benchmark. This is rational, because the risk of a passively managed fund should be very close to the risk of the market. The standard deviations in table 4 are calculated using the annual profits. The results on standard deviation are not very straightforward. On average, the large-cap category index mutual funds seem to have a closer standard deviation to that of its benchmark. However, there are exceptions to the rule. The best performer is an ETF, which has the same exact standard deviation as the S&P 500 Composite. In contrast, the worst performer is an index mutual fund. In the mid-cap category index mutual funds outperform ETFs on average. Still, the best performer is an ETF, which once again is able to offer the same standard deviation as its benchmark. The worst performer is also an ETF; the standard deviation of SPMD differs from its benchmark by 1.6 percent. The results in the small-cap category are not any clearer. On average, ETFs have closer standard deviations to their benchmark. The worst performers are index mutual funds for both Russell 2000 and S&P 600. The best performer tracking S&P 600 is an ETF. However, the best performer tracking Russell 2000 is both an ETF and an index mutual fund. All in all, the results on standard deviation do not form a clear pattern for the winner.

The beta seems to give clearer results than the standard deviation. A beta with a value of one indicates that the price development of a fund is strongly correlated with the market. The market is represented by a benchmark index, which in this study are the S&P 500, S&P 400, Russell 2000 and S&P 600. The closer the fund's beta is to one, the better it has achieved its objective. That is to replicate the benchmark index. All the betas are calculated using the natural logarithmic daily returns. On average, index mutual funds are able to reach closer to the desired value one in each category. On top of this, the best performers in all the three categories are index mutual funds. The worst performers, that is the funds with a beta furthest away from one, are ETFs. This suggests that the prices of index mutual fund tend to move slightly closer with the market, compared to the prices of ETFs. On the other hand, all the ETFs in the sample have beta values slightly under one. In contrast, eleven out of thirty index mutual funds have beta values over one. This could suggest that the ETFs in the sample are likely to be less volatile than the market. Still, the differences found are small.

The total averages in the bottom of the tables include all the funds in the specific category. It needs

to be noted that some of the funds have slightly different objective with one another and this might affect the results. This is discussed in the *Data* chapter. The funds in the sample can be divided to those which invest all their assets in stocks that are included in the benchmark index, and to those which invest at least 80% of their assets. Objectives of all the funds are listed in a table found in the attachments. Not surprisingly the funds that invest all their assets have a closer annual profit with their benchmark. However, this does not change the overall results which suggested that ETFs outperform index mutual funds in terms of annual profit. Even the ETFs that invest at least 80% of their assets beat the index mutual funds that invest all their assets, on average. This goes for all categories. For example, in the large-cap category the average of annual profit for ETFs that invest 80% of their assets is 13.42%. Similar average for ETFs that invest all their assets is 13.51%. For index mutual funds these averages are 12.68% and 13.26% respectively. Thus, ETFs outperform index mutual funds in all comparisons. Also, the results of standard deviation do not change when considering the different objectives. Lastly, the beta still speaks in favour of index mutual funds even when considering the different objectives. For example, in the mid-cap category the average beta for ETFs that invest at least 80% is 0.9256. The same average for ETFs that invest all their assets is 0.9702. For index mutual funds the similar results are 0.9998 and 0.9997 respectively. Thereby, index mutual funds have beta values closer to one in all comparisons.

4.2 Results on risk-adjusted returns

Table 5. Results on Risk-Adjusted Returns

	Large Cap			
	^GSPC	**Sharpe Ratio**	**Treynor Ratio**	**Alpha**
ETFs	SPLG	0.05120	0.000537	0.000064
	IVV	0.05173	0.000462	-0.000001
	VOO	0.05201	0.000464	0.000002
Index mutual funds (IMFs)	SWPPX	0.04978	0.000446	-0.000016
	SVSPX*	0.05928	0.000587	0.000125
	PEOPX	0.04911	0.000438	-0.000024
	VMVSPXV*	0.05018	0.000447	-0.000015
	SPIAX	0.04809	0.000429	-0.000033
	GRMAX	0.04822	0.000430	-0.000032
	PLSAX	0.04962	0.000443	-0.000019
	MYSPX	0.04418	0.000397	-0.000065
	SPIIX*	0.04601	0.000411	-0.000051
	PLFIX*	0.05118	0.000457	-0.000005
	MXVIX	0.04661	0.000416	-0.000046
	VFINX	0.04832	0.000433	-0.000029
	VFIAX	0.05130	0.000457	-0.000005
	VIIIX*	0.05143	0.000458	-0.000004
	DSPIX*	0.05118	0.000456	-0.000006
	GRISX*	0.04890	0.000436	-0.000026
Average for ETFs		**0.05165**	**0.000488**	**0.000022**
Average for IMFs		**0.04959**	**0.000446**	**-0.000016**

** for Institutional otherwise individual*

Mid-Cap

	^SP400	Sharpe Ratio	Treynor Ratio	Alpha
ETFs	SPMD	0.03644	0.000408	0.000018
	IVOO	0.03763	0.000393	0.000005
	IJH	0.03806	0.000387	-0.000001
Index mutual funds (IMFs)	MPSIX*	0.03745	0.000381	-0.000007
	VSPMX*	0.03732	0.000379	-0.000009
	PESPX	0.03635	0.000369	-0.000019
	NTIAX	0.03439	0.000350	-0.000039
	NMPAX*	0.03509	0.000357	-0.000031
	GMXAX	0.03501	0.000356	-0.000033
Average for ETFs		**0.03738**	**0.000396**	**0.000007**
Average for IMFs		**0.03594**	**0.000366**	**-0.000023**

** for Institutional otherwise individual*

Small Cap

	^RUT	Sharpe Ratio	Treynor Ratio	Alpha
ETFs	IWM	0.03067	0.000359	0.000008
	VTWO	0.03086	0.000368	0.000015
Index mutual funds (IMFs)	VRTIX*	0.03013	0.000352	0.000001
	MDSKX	0.02858	0.000335	-0.000017
	MASKX*	0.02931	0.000343	-0.000008
	GMRAX	0.02703	0.000316	-0.000035
	SWSSX	0.02994	0.000351	-0.000001
Average for ETFs		**0.03076**	**0.000364**	**0.000012**
Average for IMFs		**0.02900**	**0.000339**	**-0.000012**

	^SP600			
ETFs	SLY	0.03717	0.000434	0.000022
	VIOO	0.03755	0.000447	0.000033
	IJR	0.03671	0.000417	0.000006
Index mutual funds (IMFs)	VSMSX*	0.03537	0.000401	-0.000010
	MXISX	0.03027	0.000346	-0.000065
	DISSX	0.03484	0.000395	-0.000016
Average for ETFs		**0.03715**	**0.000433**	**0.000020**
Average for IMFs		**0.03349**	**0.000380**	**-0.000031**

** for Institutional otherwise individual*

Risk-adjusted returns used to compare the performance of index mutual funds and ETFs are the Sharpe ratio, Treynor ratio and Jensen's alpha. The results are shown in table 5. The average of Sharpe ratio seems to be slightly higher for ETFs than index mutual funds in each category. The higher the value of Sharpe ratio, the more attractive the risk-adjusted return of an investment is. On average, ETFs seem to outperform index mutual funds. However, there are exceptions in the pattern. The highest Sharpe ratio and therefore the best performer in the large-cap category is actually an index mutual fund. Also, the lowest value and thereby the worst performer, is an index mutual fund in the same category. For the mid-cap and small-cap categories the best performer is an ETF and worst performer an index mutual fund.

Similar to Sharpe ratio the bigger the Treynor ratio the more attractive investment. The results of Treynor ratio show same results as Sharpe ratio. On average, ETFs outperform index mutual funds in each category. However, there are some exceptions to the rule. In the large-cap category, both the best and worst performers are index mutual fund. For the mid-cap and small-cap categories, the best performers are ETFs and worst performers index mutual funds. Both Treynor ratio and Sharpe ratio, which use different measures to indicate the risk, favour ETFs on average. Treynor ratio utilizes beta as the divisor, which indicates the systematic risk. Sharpe ratio utilizes standard deviation, which includes both systematic risk and unsystematic risk. These results indicate that in terms of both systematic and unsystematic risk ETFs offer a better return adjusted to these risks. Similar to earlier results, all the differences found on Sharpe ratio and Treynor ratio are small.

Since the Jensen's alpha indicates how much the fund returns in comparison to the overall market, the study expects all the alphas to be close to zero. The closer the alpha is to zero, the better the fund has been able to achieve its goal – tracking the benchmark. All the funds in the sample follow a passive investment strategy. Thus, the managers of the funds do not try to beat the market. All the alphas indicate that both index mutual funds and ETFs have managed to replicate their benchmark indexes well. In each category the average alpha for ETFs is slightly positive. On the other hand, all the alphas for index mutual funds are slightly negative. These results indicate that most of the ETFs in the sample are slightly outperforming the return of the benchmark index. Index mutual funds are slightly underperforming. The closest values to zero are -0.000001 and 0.000001. Two out of eleven ETFs reach these values, as well as two out of thirty index mutual funds. The alphas that are furthest away from zero are provided by an index mutual fund in each category. Three out of four of these values are also negative. Overall, all the risk-adjusted returns speak in favour of ETFs. Although, there are exceptions to break the patterns and the differences are small.

It might be reasonable to briefly investigate the performance differences between ETFs and index mutual funds offered by only one provider. By comparing ETFs and index mutual funds provided by the same institution, the differences could indicate more about the actual differences between index mutual funds and ETFs. Thus, any external factors related to the differences between different providers do not affect the results. The study will concentrate on the funds provided by Vanguard, since it is best represented in the sample. For all large-cap, mid-cap and small-cap categories ETFs slightly outperform index mutual funds in Sharpe ratio and Treynor ratio. Also, in the large-cap and mid-cap category ETFs have slightly better alphas, that is closer to zero. However, in the small-cap category index mutual funds outperform ETFs in terms of alpha. These results seem to support the

results given by the whole sample, that suggested ETFs slightly outperform index mutual funds in terms of performances.

Similar to chapter 4.1 the study tests the impact of the different objectives of funds that invest all their assets versus funds that invest 80%. In terms of Sharpe ratio and Treynor ratio ETFs still outperform index mutual funds in every category. For example, the average Sharpe ratio for ETFs that invest at least 80% is 0.03717. Similar value for ETFs that invest all their assets is 0.03755. For index mutual funds the same values are 0.030271 and 0.035104 respectively. These values are for the funds following the S&P 600. In both comparisons, ETFs offer higher values of Sharpe ratio. Same goes for Treynor ratios. The funds whose objective is to invest all their assets to stocks included in the benchmark, have alpha values closer to zero compared to funds which invest 80%. This is rational, since alpha shows how much the fund returns compared to the overall market. If comparing the ETFs that invest all their assets to index mutual funds with a similar objective, the results do not show a clear pattern for the winner. In the large-cap category there is no difference between the alpha values of ETFs and index mutual funds. In the mid-cap category the ETFs slightly outperform index mutual funds. Lastly, in the small-cap category index mutual funds have alpha values slightly closer to zero. Thus, the results do not indicate a clear winner for alpha.

4.3 Results on tracking error and information ratio

The tracking error (TE) is calculated using three different formulas. Also, the information ratio (IR) is calculated using all these three tracking errors as their divisors. By looking at the tracking errors in table 6, TE1 seems to give smaller results than the TE2 and TE3. TE1 is calculated as the average absolute difference between the return on the fund and that of the benchmark (formula 8). TE2 and TE3 are more informative ways to calculate the tracking error. TE2 uses the root mean-square deviation of the return on the fund and that of the index (formula 9), and TE3 takes the standard deviation of the similar returns (formula 10). TE2 and TE3 seem to have very similar results with one another and most of the time they are identical with the degree expressed to four decimal places. Since the tracking error indicates how much the return of a fund differs from the return of its benchmark index, the study expects the results to be close to zero. All the funds in the sample have an objective to track their benchmark. Therefore, the closer TE is to zero, the more efficient the fund has been able to achieve its goal. In this study all the tracking errors of the funds are calculated using the daily returns.

Table 6. Results on TE and IR

		Objective	**TE1**	**TE2**	**TE3**	**IR1**	**IR2**	**IR3**
	Large Cap							
	^GSPC							
ETFs	SPLG	*Invests substantially all, but at least 80%*	0.2738 %	0.4893 %	0.4893 %	-0.00244	-0.00137	-0.00137
	IVV	*Invests at least 90%*	0.0366 %	0.0545 %	0.0545 %	-0.00568	-0.00382	-0.00382
	VOO	*Invests substantially all*	0.0345 %	0.0520 %	0.0520 %	-0.00356	-0.00236	-0.00236
Index mutual funds (IMFs)	SWPPX	*Invests at least 80%*	0.0156 %	0.0894 %	0.0894 %	-0.12421	-0.02168	-0.02168
	SVSPX*	*Invests substantially all*	0.0281 %	0.4346 %	0.4344 %	0.44966	0.02911	0.02912
	PEOPX	*Invests substantially all*	0.0083 %	0.0327 %	0.0326 %	-0.29423	-0.07499	-0.07520
	VMVSPXV*	*Invests at least 80%*	0.0212 %	0.0330 %	0.0330 %	-0.06857	-0.04404	-0.04408
	SPIAX	*Invests at least 80%*	0.0173 %	0.0422 %	0.0421 %	-0.18831	-0.07736	-0.07759
	GRMAX	*Invests at least 80%*	0.0249 %	0.0442 %	0.0441 %	-0.12906	-0.07275	-0.07294
	PLSAX	*Invests at least 80%*	0.0270 %	0.0645 %	0.0644 %	-0.07268	-0.03048	-0.03050
	MYSPX	*Invests at least 80%*	0.0160 %	0.1112 %	0.1110 %	-0.42197	-0.06055	-0.06066
	SPIIX*	*Invests substantially all*	0.0123 %	0.0604 %	0.0602 %	-0.42695	-0.08658	-0.08690
	PLFIX*	*Invests at least 80%*	0.0269 %	0.0648 %	0.0648 %	-0.02435	-0.01012	-0.01012
	MXVIX	*Invests at least 80%*	0.0250 %	0.0728 %	0.0727 %	-0.18285	-0.06270	-0.06283
	VFINX	*Invests substantially all*	0.0236 %	0.1080 %	0.1079 %	-0.12484	-0.02732	-0.02733
	VFIAX	*Invests substantially all*	0.0030 %	0.0143 %	0.0143 %	-0.17607	-0.03699	-0.03702
	VIIIX*	*Invests substantially all*	0.0028 %	0.0143 %	0.0143 %	-0.14710	-0.02917	-0.02918
	DSPIX*	*Invests at least 95%*	0.0096 %	0.0220 %	0.0220 %	-0.06283	-0.02741	-0.02742
	GRISX*	*Invests at least 80%*	0.0258 %	0.0467 %	0.0466 %	-0.10151	-0.05618	-0.05627
Average for ETFs that invests all			**0.0345 %**	**0.0520 %**	**0.0520 %**	**-0.00356**	**-0.00236**	**-0.00236**
Average for ETFs that invests at least 80%			**0.2738 %**	**0.4893 %**	**0.4893 %**	**-0.00244**	**-0.00137**	**-0.00137**
Average for all ETFs together			**0.1150 %**	**0.1986 %**	**0.1986 %**	**-0.00390**	**-0.00252**	**-0.00252**
Average for IMFs that invests all			**0.0130 %**	**0.1107 %**	**0.1106 %**	**-0.11992**	**-0.03766**	**-0.03775**
Average for IMFs that invests at least 80%			**0.0222 %**	**0.0632 %**	**0.0631 %**	**-0.14595**	**-0.04843**	**-0.04852**
Average for all IMFs together			**0.0180 %**	**0.0784 %**	**0.0784 %**	**-0.13099**	**-0.04307**	**-0.04316**

** for Institutional otherwise individual*

		Objective	**TE1**	**TE2**	**TE3**	**IR1**	**IR2**	**IR3**
	Mid-Cap							
	^SP400							
ETFs	SPMD	*Invests at least 80%*	0.2722 %	0.4438 %	0.4438 %	-0.00390	-0.00239	-0.00239
	IVOO	*Invests substantially all*	0.0994 %	0.2415 %	0.2415 %	-0.00692	-0.00285	-0.00285
	IJH	*Invests at least 90%*	0.0421 %	0.0644 %	0.0644 %	-0.00701	-0.00458	-0.00458
Index mutual funds (IMFs)	MPSIX*	*Invests at least 80%*	0.0202 %	0.0690 %	0.0690 %	-0.04214	-0.01236	-0.01236
	VSPMX*	*Invests substantially all*	0.0038 %	0.0268 %	0.0267 %	-0.25662	-0.03687	-0.03689
	PESPX	*Invests substantially all*	0.0102 %	0.0155 %	0.0154 %	-0.18506	-0.12185	-0.12277
	NTIAX	*Invests at least 80%*	0.0246 %	0.0656 %	0.0655 %	-0.15494	-0.05816	-0.05825
	NMPAX*	*Invests at least 80%*	0.0251 %	0.0695 %	0.0694 %	-0.12239	-0.04428	-0.04432
	GMXAX	*Invests at least 80%*	0.0203 %	0.0322 %	0.0320 %	-0.16064	-0.10127	-0.10179
Average for ETFs that invests all			**0.0994 %**	**0.2415 %**	**0.2415 %**	**-0.00692**	**-0.00285**	**-0.00285**
Average for ETFs that invests at least 80%			**0.2722 %**	**0.4438 %**	**0.4438 %**	**-0.00390**	**-0.00239**	**-0.00239**
Average for all ETFs together			**0.1379 %**	**0.2499 %**	**0.2499 %**	**-0.00594**	**-0.00327**	**-0.00327**
Average for IMFs that invests all			**0.0070 %**	**0.0211 %**	**0.0211 %**	**-0.22084**	**-0.07936**	**-0.07983**
Average for IMFs that invests at least 80%			**0.0226 %**	**0.0591 %**	**0.0590 %**	**-0.12003**	**-0.05402**	**-0.05418**
Average for all IMFs together			**0.0174 %**	**0.0464 %**	**0.0463 %**	**-0.15363**	**-0.06246**	**-0.06273**

** for Institutional otherwise individual*

		Objective	TE1	TE2	TE3	IR1	IR2	IR3
	Small Cap							
	^RUT							
ETFs	IWM	*Invests at least 90%*	0.0598 %	0.0811 %	0.0811 %	0.00106	0.00078	0.00078
	VTWO	*Invests substantially all*	0.0927 %	0.2277 %	0.2277 %	0.00063	0.00026	0.00026
Index mutual funds (IMFs)	VRTIX*	*Invests substantially all*	0.0038 %	0.0095 %	0.0095 %	0.00980	0.00394	0.00394
	MDSKX	*Invests at least 80%*	0.0242 %	0.0671 %	0.0671 %	-0.07027	-0.02534	-0.02535
	MASKX*	*Invests at least 80%*	0.0236 %	0.0648 %	0.0648 %	-0.03719	-0.01354	-0.01354
	GMRAX	*Invests at least 80%*	0.0277 %	0.0510 %	0.0509 %	-0.12783	-0.06951	-0.06968
	SWSSX	*Invests at least 80%*	0.0226 %	0.0634 %	0.0634 %	-0.02153	-0.00769	-0.00769
Average for ETFs that invests all			**0.0927 %**	**0.2277 %**	**0.2277 %**	**0.00063**	**0.00026**	**0.00026**
Average for ETFs that invests at least 80%			-	-	-	-	-	-
Average for all ETFs together			**0.0763 %**	**0.1544 %**	**0.1544 %**	**0.00084**	**0.00052**	**0.00052**
Average for IMFs that invests all			**0.0038 %**	**0.0095 %**	**0.0095 %**	**0.00980**	**0.00394**	**0.00394**
Average for IMFs that invests at least 80%			**0.0245 %**	**0.0616 %**	**0.0616 %**	**-0.06420**	**-0.02902**	**-0.02906**
Average for all IMFs together			**0.0204 %**	**0.0512 %**	**0.0511 %**	**-0.04940**	**-0.02243**	**-0.02246**
	^SP600							
ETFs	SLY	*Invests substantially all, but at least 80%*	0.1546 %	0.2800 %	0.2800 %	-0.00275	-0.00152	-0.00152
	VIOO	*Invests substantially all*	0.1560 %	0.3471 %	0.3471 %	-0.00365	-0.00164	-0.00164
	IJR	*Invests at least 90%*	0.0538 %	0.0741 %	0.0741 %	-0.00112	-0.00081	-0.00081
Index mutual funds (IMFs)	VSMSX*	*Invests substantially all*	0.0040 %	0.0301 %	0.0301 %	-0.26115	-0.03437	-0.03439
	MXISX	*Invests at least 80%*	0.0404 %	0.1525 %	0.1523 %	-0.15717	-0.04168	-0.04172
	DISSX	*Invests substantially all*	0.0135 %	0.0179 %	0.0178 %	-0.12119	-0.09159	-0.09198
Average for ETFs that invests all			**0.1560 %**	**0.3471 %**	**0.3471 %**	**-0.00365**	**-0.00164**	**-0.00164**
Average for ETFs that invests at least 80%			**0.1546 %**	**0.2800 %**	**0.2800 %**	**-0.00275**	**-0.00152**	**-0.00152**
Average for all ETFs together			**0.1214 %**	**0.2337 %**	**0.2337 %**	**-0.00251**	**-0.00132**	**-0.00132**
Average for IMFs that invests all			**0.0087 %**	**0.0240 %**	**0.0239 %**	**-0.19117**	**-0.06298**	**-0.06318**
Average for IMFs that invests at least 80%			**0.0404 %**	**0.1525 %**	**0.1523 %**	**-0.15717**	**-0.04168**	**-0.04172**
Average for all IMFs together			**0.0193 %**	**0.0668 %**	**0.0667 %**	**-0.17984**	**-0.05588**	**-0.05603**

** for Institutional otherwise individual*

Apart from the earlier measures, the values of tracking error depend greatly on the different objectives of the funds. Therefore, the objectives are also included in the table. The objectives indicate the percentage which the fund invests its assets to stocks included in the benchmark. The averages shown in the bottom of the tables are divided separately to the funds that invest all their assets to stocks included in the benchmark, and to those which invest at least 80% of their assets. Additionally, the third average shown in the table indicates the overall average for ETFs or index funds in each category. This separation makes the results comparable and therefore more reliable.

Naturally, the funds which invest all their assets have lower tracking errors compared to funds which invest at least 80%. In all categories and for both funds that invest all their assets and funds that invest 80%, ETFs have higher tracking errors. This concerns TE1. For TE2 and TE3 the results are quite similar. In the mid-cap and small-cap categories ETFs have higher values of tracking errors. However, in the large-cap category there is one exception in the index mutual funds: The SVSPX* has a tracking error of 0.4346%. This is exceptionally high compared to the other index mutual funds affecting the results. Still, when comparing the overall averages index mutual funds outperform ETFs. The best performer, that is the fund with the lowest tracking error is an index mutual fund in

each category. In contrast, the worst performers are ETFs. These results suggest that index mutual funds outperform ETFs. It is noteworthy, that in the mid-cap and small-cap category there is a difference of one decimal place between the averages of index mutual funds and ETFs that invest all their assets. In contrast to earlier results that have shown very marginal differences, the differences in tracking errors are relatively higher.

When comparing the funds with the highest tracking errors to the ones with the lowest values, it can be noticed that for the former the alphas are higher. What is more, the variances and standard deviations of the funds with the lowest tracking errors are notably closer to those of its benchmark. This indicates that the spread of prices for these funds is nearly the same to that of its benchmark. This explains the low tracking error values. The spread of prices is much higher for the funds that have the highest tracking errors. In addition, the average of beta for index mutual funds is slightly closer to one, which indicates that their prices move closer with the marker. All in all, index mutual funds track their benchmark index closer in comparison to ETFs.

Since the information ratio indicates how much the fund has exceeded its benchmark index, the study expects the values of information ratio to be close to zero. Because the study is looking for the differences between ETFs and index mutual funds, it will try to spot any regularity showing that the other investment vehicle has information ratios closer to zero. The study also detects whether an ETF or an index mutual fund has more positive values of information ratio. The higher the information ratio, the better the consistency of the performance of the fund.

Looking at the values of all IR1, IR2 and IR3 it can be said that most of the values are negative. This can be explained by the numerator of the formula which resembles of alpha. The alpha is negative to almost every fund. This means that most of the funds have slightly underperformed their benchmarks. Only few of the funds have a positive information ratio: the index mutual funds SVSPX* and VRTIX*, as well as the ETFs IWM and VTWO. Overall, the information ratio is close to zero for all the funds, which was expected. Since most of the values are negative, the study concentrates on finding the average which is closer to zero and thus is closer to having a positive value. In all categories ETFs have closer information ratio values to zero compared to index mutual funds. This concerns all the three different averages: “Average for ETFs/IMFs that invest all”, “Average for ETFs/IMFs that invest at least 80%”, and “Average for all ETFs/IMFs together”. The best performers in each category are ETFs. In contrast, the worst performers are index mutual funds. This suggests that ETFs outperform index mutual funds in terms of information ratio. This can be explained by looking at the numerator of the information ratio. Even though, the average of tracking

error is lower to index mutual funds, the alpha shows more negative numbers. In contrast, the average of alpha is positive for ETFs.

The information ratio is used to compare funds that have a similar style of management. All the fund in the sample represent the passive management strategy. However, the information ratio is generally used to identify the skills of an active manager. Thus, the results of the information ratio should be interpreted sceptically. In addition, the information ratio is not interpreted in the usual way. That is, if the information ratio gives a negative value for a fund, that fund is usually ruled out. Since in this study the information ratio is used to evaluate passively managed funds that replicate the benchmark, both the numerator and denominator of the ratio are low. Therefore, the information ratio is very sensitive in this use. The study still includes the measure, because for all the funds in the sample, the alpha and tracking error used in the formula are low and therefore the information ratio will still indicate the relative differences. The absolute values of the information ratios cannot be used to compare to those of actively managed funds. All in all, the results on tracking error and information ratio suggests that index mutual funds track their benchmark slightly better, yet ETFs might be able to perform more efficiently when adjusted to their risk.

4.4 Differences in expense ratios

One important factor investors will take into consideration are the expenses. This study includes the management fees but leaves out other expenses. This is a cause of data restrictions. However, the management fees, also referred as the expense ratio, is a very visible component in each provider's web page. Providers use the expense ratio as a way to compete with other providers. Because the expense ratio of the funds is well promoted it has a big impact on investors decision choosing a specific fund. Also, since the performance differences between the ETFs and index mutual funds are generally very small, the role of expenses needs to be highlighted. Table 7 shows that the magnitude of expense ratios for all funds are relatively low. This is a cause of the funds being passively managed. In contrast, funds that are actively managed generally have higher expenses. This is rational, since they require more amount of work in terms of decision-making from the manager. All the funds in the sample have an expense ratio under one percent. By looking at the averages of the funds, it can be noticed that ETFs are able to offer lower expense ratios compared to both institutional and individual index mutual funds. Additionally, the expense ratio for institutional investors is considerably lower than that of individual investors. This can be explained by the large quantities' institutional investors trade on.

Table 7. Expense ratios

ETFs	Expense ratio
SPLG	0.03%
IVV	0.03%
VOO	0.03%
SPMD	0.05%
IVOO	0.10%
IJH	0.05%
IWM	0.19%
VTWO	0.10%
SLY	0.15%
VIOO	0.10%
IJR	0.06%

Average	Min	Max
0.08%	0.03%	0.19%

Index mutual funds	Expense ratio
SWPPX	0.02%
SVSPX*	0.16%
PEOPX	0.50%
VMVSPXV*	0.41%
SPIAX	0.54%
GRMAX	0.64%
PLSAX	0.46%
MYSPX	0.29%
SPIIX*	0.65%
PLFIX*	0.17%
MXVIX	0.52%
VFINX	0.14%
VFIAX	0.04%
VIIIX*	0.02%
DSPIX*	0.20%
GRISX*	0.45%
MPSIX*	0.23%
VSPMX*	0.08%
PESPX	0.50%
NTIAX	0.45%
NMPAX*	0.20%
GMXAX	0.68%
VRTIX*	0.08%
MDSKX	0.37%
MASKX*	0.12%
GMRAX	0.70%
SWSSX	0.04%
VSMSX*	0.08%
MXISX	0.56%
DISSX	0.50%

Average*	Average	Min*	Min	Max*	Max
0.22%	0.41%	0.02%	0.02%	0.65%	0.64%

** for Institutional otherwise individual*

On average ETFs offer lower expense ratios compared to index mutual funds. However, there are exceptions to the rule; the lowest expense ratio in the sample is offered by an index mutual fund. Another research question of the study is to investigate how the level of expense ratios affect the performance of the funds. First the study begins by analysing the ETFs with the lowest expense ratios of 0.03% and the highest expense ratios of 0.19% and 0.15%. One of the three ETFs with the lowest expense ratio (VOO) seem to have the closest annual average of profit compared to the benchmark's annual average of profit. However, the ETF with the highest expense ratio (IWM) seems to also reach very close to its benchmark's annual average of profit. The index mutual funds with the lowest expense ratios of 0.02% (VIIIX*, SWPPX) also both track their benchmark index well. The index mutual fund with the highest expense ratios of 0.68% (GMXAX) has the lowest annual average of profit in its category. Also, SPIIX with an expense ratio of 0.65% seems to have the second lowest annual average of profit in its category. The values of annual average of profit are presented in table 4.

The ETFs with the lowest expense ratios SPLG, IVV, VOO seem to have the highest values of Sharpe ratio and Treynor ratio in their category. There is one index mutual fund that outperforms these ETFs, this is the SVSPX*. All the same, the ETF with the highest expense ratio also does well in these measures compared to its category. The index mutual funds with the lowest expense ratios (VIIIX*, SWPPX) both perform relatively well in terms of the risk-adjusted returns. It needs to be noted, that most of the funds with the lowest expense ratios are offered from the same provider – Vanguard. Vanguard offers low expense ratios for both ETFs and index mutual funds. There seems to be a clearer pattern between the provider and the performance of the fund compared to merely the low expense ratio. The VIIIX* provided by Vanguard outperforms the SWPPX, which has the same expense ratio. In addition, the ETF provided by Vanguard (VOO) outperforms other ETFs in its category, even though they all have the same expense ratio. Still, the index mutual fund with the highest expense ratio (GMXAX) has the second lowest Sharpe ratio and Treynor ratio. The lowest values in its category are provided by NTIAX, which has an expense ratio of 0.45%. This is neither the highest expense ratio nor the lowest expense ratio in its category. The Sharpe ratio and Treynor ratio for each fund in presented in table 5.

5. Summary and conclusions

The study seeks to find the potential differences between the two competing investment products: index mutual funds and ETFs. By studying the differences, the thesis will provide essential information to ease investor's decision making between choosing a suitable passively managed product. The study concentrates on finding the differences in terms of performance, risk, and tracking ability. The research also includes the comparison of expense ratios. The studied benchmark indexes and funds are from the U.S. market, which is also the world's largest ETF provider. The benchmark indexes of the study represent a wide range of the U.S. Market. They cover the markets for all large-cap, mid-cap and small-cap companies. The time range for the study is from 2011 to 2019.

The summary tables of the results are presented next. Table 8 shows the results on annual average of profit, standard deviation, and beta. The best performer in terms of annual average of profit and standard deviation is the fund, which has the closest values to those of its benchmark. The closer the values are to those of its benchmark, the better the fund has succeeded. The best performer in terms of beta is the fund which has the closest value to one. This indicates that the prices of the fund move similarly with the benchmark.

Table 8. Summary table on annual average of profit and risks measures

	Large Cap	Annual average of profit	Standard deviation of annual profit	Beta (Daily)	Mid Cap	Annual average of profit	Standard deviation of annual profit	Beta (Daily)
Benchmark index	**S&P 500**	13.55%	8.72%		**S&P 400**	11.89%	11.10%	
Avg. for ETFs		13.48%	8.79%	0.9460		11.74%	11.63%	0.9637
Avg. for index mutual funds		12.94%	8.70%	0.9991		11.32%	11.17%	0.9998
Best performer		ETF (13.51%)	ETF (8.72%)	IMF (1.0000)		ETF (11.80%)	ETF (11.10%)	IMF (1.0009)
Worst performer		IMF (11.66%)	IMF (9.34%)	ETF (0.8480)		IMF (10.95%)	ETF (12.70%)	ETF (0.9256)

	Small Cap	Annual average of profit	Standard deviation of annual profit	Beta (Daily)	Small Cap	Annual average of profit	Standard deviation of annual profit	Beta (Daily)
Benchmark index	**Russell 2000**	11.38%	13.50%		**S&P 600**	13.04%	13.05%	
Avg. for ETFs		11.40%	13.50%	0.9690		12.96%	13.04%	0.9427
Avg. for index mutual funds		10.98%	13.49%	0.9975		12.14%	12.89%	1.0013
Best performer		ETF (11.39%)	ETF (13.50%)	IMF (0.9998)		ETF (13.01%)	ETF (13.05%)	IMF (0.9999)
Worst performer		IMF (10.31%)	IMF (13.38%)	ETF (0.9577)		IMF (11.04%)	IMF (12.50%)	ETF (0.9070)

In each category ETFs have closer annual profits with their benchmark on average. In addition, the best performers in all categories are ETFs and the worst performers are index mutual funds. In terms of risk measures, index mutual funds seem to replicate the risk of the market better than ETFs. Especially, the average of beta for index mutual funds is closer to one in each category. This indicates that the prices of the funds move closer with the prices of the benchmark. The results of standard deviation are not as clear. In the first two categories index mutual funds have closer standard deviation with their benchmarks on average. However, in the small-cap category ETFs seem to outperform index mutual funds. Still, the differences are very small. The study includes funds which objectives differ from each other: funds that invest all their assets to stocks included in the benchmark, and funds that invest at least 80% of their assets to these stocks. These different objectives however do not have an impact on the results. They still suggest that ETFs slightly outperform index mutual funds in terms of annual profit and index mutual funds slightly outperform ETFs in terms of beta.

Table 9. Summary table on risk-adjusted returns

Large Cap	S&P 500	Sharpe Ratio	Treynor Ratio	Alpha
Avg. for ETFs		0.05165	0.000488	0.000022
Avg. for index mutual funds		0.04959	0.000446	-0.000016
Best performer		IMF (0.05928)	IMF (0.000587)	ETF (-0.000001)
Worst performer		IMF (0.04418)	IMF (0.000397)	IMF (0.000125)

Mid-Cap	S&P 400	Sharpe Ratio	Treynor Ratio	Alpha
Avg. for ETFs		0.03738	0.000396	0.000007
Avg. for index mutual funds		0.03594	0.000366	-0.000023
Best performer		ETF (0.03806)	ETF (0.000408)	ETF (0.000005)
Worst performer		IMF (0.03439)	IMF (0.000350)	IMF (-0.000039)

Small Cap	Russell 2000	Sharpe Ratio	Treynor Ratio	Alpha
Avg. for ETFs		0.03076	0.000364	0.000012
Avg. for index mutual funds		0.02900	0.000339	-0.000012
Best performer		ETF (0.03086)	ETF (0.000368)	IMF (0.000001)
Worst performer		IMF (0.02703)	IMF (0.000316)	IMF (-0.000035)

Small Cap	S&P 600	Sharpe Ratio	Treynor Ratio	Alpha
Avg. for ETFs		0.03715	0.000433	0.000020
Avg. for index mutual funds		0.03349	0.000380	-0.000031
Best performer		ETF (0.03755)	ETF (0.000447)	ETF (0.000006)
Worst performer		IMF (0.03027)	IMF (0.000346)	IMF (-0.000065)

Next, table 9 summarizes the results on risk-adjusted returns. In terms of risk-adjusted returns ETFs seem to outperform index mutual funds on average: in each category the average of Sharpe ratio and Treynor ratio is higher for ETFs. This indicates that ETFs might have a more attractive risk-adjusted return on average. However, there are exceptions to the rule. For example, the best Sharpe ratio and Treynor ratio is given by an index mutual fund in the large-cap category. On average all the ETFs in each category have positive values of alpha. In contrast, all index mutual funds have a negative value of alpha on average. Since alpha indicates how much the fund returns in comparison to the overall market, the study expects all alphas to be close to zero. The results indicate that most of the ETFs in the sample slightly beat the market and index mutual funds underperform. Because ETFs provide a positive alpha which is also closer to zero in most categories, the alpha speaks for ETFs. However, all the differences found are small. These results are also in line with the previous literature. Elton, Gruber and Souza (2019) found that on average ETFs pre-expenses slightly outperform their benchmark index. In contrast, index mutual funds slightly underperform. These authors studied the passive investment market in the United States. The results of this thesis are also similar to the ones from the research of Rompotis (2011). The author investigated the U.S. market, and showed that ETFs were able to beat the market. In addition, Wu, Xiong and Gao (2020) also found that on average ETFs perform better than index mutual funds pre-expenses. However, their study concerned the Chinese market, which might also affect the results.

The results on risk-adjusted returns do not change if considering the different objectives of the compared funds. They still indicate that ETFs offer a more attractive risk-adjusted return on average.

To answer the first sub-question (Are there differences in terms of performance between the two investment types?) ETFs seem to outperform index mutual funds on average. This is shown by the annual average of profit and the risk-adjusted returns. However, there are exceptions to the rule and the differences found are minimal.

Table 10. Summary table on TE and IR

*Objective: Invests substantially **all** of their assets*

	TE2	IR2
Large Cap		
S&P 500		
Avg. for ETFs	0.0520 %	-0.0024
Avg. for index mutual funds	0.1107 %	-0.0377
Best performer	IMF (0.0143%)	ETF (-0.0024)
Worst performer	IMF (0.4346%)	IMF (-0.0866)

	TE2	IR2
Mid Cap		
S&P 400		
Avg. for ETFs	0.2415 %	-0.0028
Avg. for index mutual funds	0.0211 %	-0.0794
Best performer	IMF (0.0155%)	ETF (-0.0028)
Worst performer	ETF (0.2415%)	IMF (-0.1219)

	TE2	IR2
Small Cap		
Russell 2000		
Avg. for ETFs	0.2277 %	0.0003
Avg. for index mutual funds	0.0095 %	0.0039
Best performer	IMF (0.0095%)	ETF (0.00026)
Worst performer	ETF (0.2277%)	IMF (0.0039)

	TE2	IR2
Small Cap		
S&P 600		
Avg. for ETFs	0.3471 %	-0.0016
Avg. for index mutual funds	0.0240 %	-0.0630
Best performer	IMF (0.0179%)	ETF (-0.0016)
Worst performer	ETF (0.3471%)	IMF (-0.0916)

*Objective: Invests at least **80%** of their assets*

	TE2	IR2
Large Cap		
S&P 500		
Avg. for ETFs	0.4893 %	-0.0014
Avg. for index mutual funds	0.0632 %	-0.0484
Best performer	IMF (0.0330%)	ETF (-0.00137)
Worst performer	ETF (0.4893%)	IMF (-0.0774)

	TE2	IR2
Mid Cap		
S&P 400		
Avg. for ETFs	0.4438 %	-0.0024
Avg. for index mutual funds	0.0591 %	-0.0540
Best performer	IMF (0.0322%)	ETF (-0.00239)
Worst performer	ETF (0.4438%)	IMF (-0.1013)

	TE2	IR2
Small Cap		
Russell 2000		
Avg. for ETFs	-	-
Avg. for index mutual funds	0.0616 %	-0.0290
Best performer	-	-
Worst performer	-	-

	TE2	IR2
Small Cap		
S&P 600		
Avg. for ETFs	0.2800 %	-0.0015
Avg. for index mutual funds	0.1525 %	-0.0417
Best performer	IMF (0.1525%)	ETF (-0.0015)
Worst performer	ETF (0.2800%)	IMF (-0.0417)

Results on tracking error and information ratio are divided to two tables. Table 10 show the results separately for the funds that invest all their assets to stocks in the benchmark, and those that invest at least 80%. This is to make the comparison unbiased. Additionally, the table only represents one of the three tracking error measures. TE2 (formula 9) is calculated using the root mean square deviation and is chosen for the table, since it has almost identical values to the one calculated by standard deviation. TE2 is also more informative than the tracking error calculated from the average absolute difference between the fund's return and the benchmark's return. For Russell 2000, there is no ETFs that invest at least 80% of their assets in this study sample, which is why there are values missing from the table.

Since tracking error indicates how much the return of a fund differs from the return of its benchmark, the study expects the results be close to zero. The closer tracking error is to zero, the more efficient the fund has been able to achieve its goal – tracking the benchmark. The tracking error speaks in favour of index mutual funds both on average and in terms of the best performer. This indicates that the index mutual funds in the sample have been able to replicate their benchmark closer. This can be seen from both categories that represent the different objectives of the funds. In contrast to earlier results, the differences found in tracking error are considerably higher. In many cases the difference between ETFs and index mutual funds is up to one decimal place. On the other hand, ETFs have outperformed index mutual funds in terms of information ratio. The information ratio indicates how much the fund has exceeded its benchmark. ETFs in each category have higher values, that is values closer to zero. These results are also in line with previous literature. Aber, Li and Luc (2009) found differences in the tracking abilities of ETFs and index mutual funds in the U.S. market. They show that on average the conventional index mutual funds beat their corresponding ETF competitors in terms of tracking error.

These results on volatility and performance measures might suggest that even though the index mutual funds have been tracking their benchmarks closer on average, ETFs have been able to provide returns beyond those of its benchmark compared to their volatility. To answer the second sub-question (Are there differences in terms of risk and tracking ability?) index mutual funds seem to outperform ETFs. In terms of risk measures index mutual funds outperform ETFs on average. Especially, the values of beta are closer to one, that is closer to the volatility to the market. The tracking-error measure speaks in favour of index mutual funds, which indicate that they have been able to replicate their benchmark closer. However, all the differences found are very small. It is noteworthy, that all these measures used in the study have downsides that are related to the

assumptions they make as well as the usage of historical prices in their calculations.

Table 11. Summary table on expense ratio

	ETFs	Index mutual funds*	Index mutual funds
Average	0.08%	0.22%	0.41%
Min	0.03%	0.02%	0.02%
Max	0.19%	0.65%	0.64%

** for Institutional otherwise individual*

The next sub-question of the study is to investigate whether the expense ratios differ between index mutual funds and ETFs. A summary of the expense ratios is shown in table 11. On average, expense ratios of ETFs are lower than those of index mutual funds. This applies for both index mutual funds for institutional and individual investors. However, there are exceptions to the rule. The lowest expense ratio in the sample is offered by an index mutual fund. Another sub-question of this study is to investigate how the level of expenses affect the performance of the funds. It seems that there is a clearer pattern between the provider and the performance of the fund compared merely to the low expense ratio. It needs to be noted that the expense ratio is only one component in terms of expenses of ETFs and mutual funds.

Table 12. Summary table on the structural differences

	Buy and sell characteristics
ETF	ETFs trade throughout the day, which enables investors to sell or buy them at any point of the day The price which ETFs trade might differ from their NAV Many ETFs have low minimum investment levels (see the attachments)
IMF	Index mutual funds are priced at their NAVs at the end of the day Investors may not attempt to take advantage of the movements of the market by forecasting those Many mutual funds have higher minimum investment levels (see the attachments)
	Tax efficiency
ETF	ETFs rarely distribute capital gains, since they can create and redeem their shares in kind, rather than in cash
IMF	IMFs do not have a similar creation and redemption process and rather many need to distribute year-end capital gains
	Expenses
ETF	Investors are affected by similar costs originated from trading stocks: bid-ask spreads, brokerage fees and commissions Since ETFs are traded on exchange the issuers do not need to provide any services on transfer agency to unit holders ETFs tend to attract lower transaction costs, because of the in-kind creation and redemption process Because ETFs are purchased on the secondary market, investors must pay a commission for the brokage house
IMF	Mutual funds offers the possibility to purchase shares directly from the fund company at no costs The issuers have to provide services on transfer agency to unit holders. Majority of index mutual funds are no-load, which means they do not charge commissions on transactions

This chapter aims to answer the last sub-question: Should there be differences, could investors use these differences for a more informed investment decision? In the perspective of an investors who is deciding between the two competing products, there might not be a clear answer in terms of the performance and volatility of these funds. On average one investment product might outperform the other, but there are exceptions in the rule. In addition, the differences are very small. This suggests that the investor should emphasize the structural differences of the products rather than performance or volatility differences. Also, the role of expenses is highlighted. These differences in the nature and design of ETFs and index mutual funds are shown in table 12. The differences in buy and sell characteristics suggests that ETFs might be more suitable for investors that value flexible trading and market timing. On the other hand, some investors might consider the feature of not being charged any commissions on transactions more important. In this case, the investor would choose an index mutual fund. The tax efficiency of ETFs might attract investors to its side. Many of the index mutual funds also have a minimum initial investment requirement. Thus, if an investor prefers lower investment minimums, ETFs might be more suitable. All these factors indicate that the investor's own personal preferences have great impact on whether an ETF or and index fund is more suitable for the investor. Thus, the structural differences and the different product features are more likely to explain the simultaneous existence of the two vehicles rather than the performance and volatility differences.

5.1 Future research opportunities and credibility of the results

Future research on the differences between index mutual funds and ETFs could include some of the characteristics this study eliminates from its subject. These limitations of this study include the dividend and taxation policies. On top of this, the impact of transaction cost should be studied more carefully. In addition, it might be justifiable to include measurement that do not entirely lie on historical prices. This might affect the credibility of the results of this study. It is also noteworthy, that the choice of 2011 as the starting point might affect the results. For instance, it is possible that on this day there are new passively managed funds that offer slightly different features.

One interesting future research opportunity might be to study how the differences between ETFs and index mutual funds have evolved over time since the release of these funds. For instance, has index mutual funds adapted some product features that ETFs offers over time? Have the differences between the two investment vehicles diminished over time since the competition has

increased? This could indicate about the future of ETFs and index mutual funds. Could it be seen that in the future, there will only be one passively managed investment product left standing?

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Attachments:

Table 13: ETFs and index mutual funds for the study

Category: Large Cap	Symbols	Total Net Assets	Minimun initial investment (USD)	Objective of the fund
Benchmark index				
S&P 500 COMPOSITE	^GSPC			
ETFs				
SPDR Portfolio S&P 500 ETF	SPLG	$7.57bn	-	The fund generally invests substantially all, but at least 80%, of its assets in the securities comprising the index.
iShares Core S&P 500 ETF	IVV	$234.70bn	-	The fund generally invests at least 90% of its assets in securities comprising the index.
Vanguard S&P 500 ETF	VOO	$557bn	-	The fund generally invests substantially all of its assets in the securities comprising the index.
Index mutual funds				
Schwab S&P 500 Index Fund	SWPPX	$49.36bn	-	The fund generally invests at least 80% of its assets in securities comprising the index.
*State Street S&P 500 Index Fund Class N	SVSPX	$1.35bn	10 000	The fund seeks to replicate as closely as possible the performance of the underlying index.
BNY Mellon S&P 500 Index Fund	PEOPX	$2.30bn	2500	The fund generally invests substantially all of its assets in the securities comprising the index.
*Invesco VI S&P 500 Index Fund Class I	VMVSPXV	$0.086bn	-	The fund generally invests at least 80% of its assets in securities comprising the index.
Invesco S&P 500 Index Fund Class A	SPIAX	$1.08bn	1000	The fund generally invests at least 80% of its assets in securities comprising the index.
Nationwide S&P 500 Index Fund Class A	GRMAX	$0.13bn	2000	The fund generally invests at least 80% of its assets in securities comprising the index.
Principal LargeCap S&P 500 Index Fund Class A	PLSAX	$0.47bn	1000	The fund generally invests at least 80% of its assets in securities comprising the index.
MainStay MacKay S&P 500 Index Fund Investor	MYSPX	$1.10bn	1000	The fund generally invests at least 80% of its assets in securities comprising the index.
*Sei Index Fund S&P 500 Index Fund Class I	SPIIX	$0.82bn	100000	The fund generally invests substantially all of its assets in the securities comprising the index.
*Principal LargeCap S&P 500 Index Fund Institutional Class	PLFIX	$5.78bn	-	The fund generally invests at least 80% of its assets in securities comprising the index.
GREAT-WEST S&P 500 Index Fund Investor	MXVIX	$2.60bn	-	The fund generally invests at least 80% of its assets in securities comprising the index.
Vanguard 500 Index Fund Investor Shares	VFINX	$557.01bn	3000	The fund generally invests substantially all of its assets in the securities comprising the index.
Vanguard 500 Index Fund Admiral Shares	VFIAX	$557.01bn	3000	The fund generally invests substantially all of its assets in the securities comprising the index.
*Vanguard Institutional Index Fund Institutional Plus Shares	VIIIX	$231.63bn	100000000	The fund generally invests substantially all of its assets in the securities comprising the index.
*BNY Mellon Institutional S&P 500 Stock Index Fund	DSPIX	$2.77bn	1000	The fund generally invests at least 95% of its assets in securities comprising the index.
*Nationwide S&P 500 Index Fund Institutional Service Class	GRISX	$1.09bn	50000	The fund generally invests at least 80% of its assets in securities comprising the index.

** for Institutional otherwise individual*

Category: Mid Cap	Symbols	Total Net Assets	Minimun initial investment (USD)	Objective of the fund
Benchmark index				
S&P 400	^SP400			
ETFs				
SPDR Portfolio S&P 400 Mid Cap ETF	SPMD	$2.62bn	-	The fund generally invests at least 80% of its assets in securities comprising the index.
Vanguard S&P Mid-Cap 400 ETF	IVOO	$2.05bn	-	The fund generally invests substantially all of its assets in the securities comprising the index.
iShares Core S&P Mid-Cap ETF	IJH	$44.01bn	-	The fund generally invests at least 90% of its assets in securities comprising the index.
Index mutual funds				
*Principal MidCap S&P 400 Index Fund Institutional Class	MPSIX	$1.00bn	-	The fund generally invests at least 80% of its assets in securities comprising the index.
*Vanguard S&P Mid-Cap 400 Index Fund Institutional Shares	VSPMX	$2.05bn	5000000	The fund generally invests substantially all of its assets in the securities comprising the index.
BNY Mellon MidCap Index Fund Investor Shares	PESPX	$2.01bn	2500	The fund generally invests substantially all of its assets in the securities comprising the index.
Columbia Mid Cap Index Fund Class A	NTIAX	$2.88bn	2000	The fund generally invests at least 80% of its assets in securities comprising the index.
*Columbia Mid Cap Index Fund Institutional	NMPAX	$2.88bn	2000	The fund generally invests at least 80% of its assets in securities comprising the index.
Nationwide Mid Cap Market Index Fund Class A	GMXAX	$0.71bn	2000	The fund generally invests at least 80% of its assets in securities comprising the index.

** for Institutional otherwise individual*

Category: Small Cap	Symbols	Total Net Assets	Minimun initial investment (USD)	Objective of the fund
Benchmark index				
RUSSELL 2000	^RUT			
ETFs				
iShares Russell 2000 ETF	IWM	$40.71bn	-	The fund generally invests at least 90% of its assets in securities comprising the index.
Vanguard Russell 2000 ETF Shares	VTWO	$2.46bn	-	The fund generally invests substantially all of its assets in the securities comprising the index.
Index mutual funds				
*Vanguard Russell 2000 Index Fund Institutional Shares	VRTIX	$2.46bn	5000000	The fund generally invests substantially all of its assets in the securities comprising the index.
iShares Russell 2000 Small-Cap Index Fund Investor A Shares	MDSKX	$2.15bn	1000	The fund generally invests at least 80% of its assets in securities comprising the index.
*iShares Russell 2000 Small-Cap Index Fund Institutional Shares	MASKX	$2.15bn	2000000	The fund generally invests at least 80% of its assets in securities comprising the index.
Nationwide Small Cap Index Fund Class A	GMRAX	$0.218bn	2000	The fund generally invests at least 80% of its assets in securities comprising the index.
Schwab Small Cap Index Fund	SWSSX	$3.99bn	-	The fund generally invests at least 80% of its assets in securities comprising the index.
Benchmark index				
S&P 600	^SP600			
ETFs				
SPDR S&P 600 Small Cap ETF	SLY	$1.02bn	-	The fund generally invests substantially all, but at least 80%, of its assets in the securities comprising the index.
Vanguard S&P Small-Cap 600 ETF	VIOO	$2.21bn	-	The fund generally invests substantially all of its assets in the securities comprising the index.
iShares Core S&P Small-Cap ETF	IJR	$41.70bn	-	The fund generally invests at least 90% of its assets in securities comprising the index.
Index mutual funds				
*Vanguard S&P Small-Cap 600 Index Fund Institutional Shares	VSMSX	$2.21bn	5000000	The fund generally invests substantially all of its assets in the securities comprising the index.
Great-West S&P Small Cap 600® Index Fund Investor Class	MXISX	$0.694bn	-	The fund generally invests at least 80% of its assets in securities comprising the index.
BNY Mellon Small Cap Stock Index Fund Investor Shares	DISSX	$1.43bn	2500	The fund generally invests substantially all of its assets in the securities comprising the index.

** for Institutional otherwise individual*