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PERFORMANCE OF EXCHANGE-TRADED FUNDS IN THE NORDIC MARKET

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Vaikka vaihtokaupparahasto (ETF) on suhteellisen uusi rahasto-sidonnainen väline, sen suosio on kasvanut merkittävän nopeasti. Rahastona se tarjoaa kätevän tavan monipuolistaa osakesalkkua ja kasvattaa kanssakäymistä ulkoisiin markkinoihin. Osakkeena sitä voi vaihtaa vapaasti. Viime vuosina kiinnostus vaihtokaupparahastoihin sijoituslähteinä on kasvanut, ja siten tämän rahallisen työkalun tehokkuus on keskustelun arvoinen asia.

Tämän opinnäytetyön tavoite on seurata vaihtokaupparahaston tehokkuutta pohjoismaisessa kaupassa, keskittyen erityisesti pääoma indeksiin. Painopiste tulee olemaan sen tehokkuus kiintopiste vertailuissa. Opinnäyte pohtii myös eroa synteettisen ja fyysisen vastaus-metodin välillä, sekä tutkii vaikutusvaltaisten vaihtokaupparahastojen ainutlaatuisia ominaisuuksia. Opinnäytteessä kerättiin sijoitus- hinta- ja muita tietoja viiden vuoden ajalta, joita analysoitiin käyttäen kvantitatiivista metodia. Tutkimuksessa on käytetty julkisia ja yksityisiä tietolähteitä.

Lopputulokset osoittavat, että suurin osa vaihtokaupparahastoista alittaa kiintopiste marginaalin, vaikka selvää kuviota ei rahastoissa ole havaittavissa. Ilman kiintopistevertailua, huomasimme käänteisen korrelaation rahaston riskipainotetun suorituskyvyn, ja juoksevien kulujen välillä. Myöskään, vaikutusvaltainen vaihtokauppakauppa rahasto ei ole kannattava pitkä-aikainen sijoitus verrattuna perinteiseen vaihtokauppa rahastoon. Lopputulos osoittaa myös synteettisen vaihtokaupparahaston alittavan kiintopiste tavoitteen, ja osoitta vääräksi väitteen, jonka mukaan synteettinen vaihtokaupparahasto olisi parempi keino säästää kuluista kuin fyysinen vaihtokaupparahasto.

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ABSTRACT

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Exchange-traded Fund (ETF) is one of the newer financial derivative products, yet its growth and popularity have been expansive at a remarkable rate. As a fund, it offers a convenient way to diversify the portfolio and gain exposure to foreign markets. As a stock, it holds the simplicity of being tradable on an exchange. In recent years, ETF has gained increasing interest as the next investment tool. The performance of this financial instrument is therefore worthy of discussion.

The aim of this thesis was to investigate the performance of ETFs traded in the Nor-dic market, with a focus on the funds tracking equity indexes. In particular, the performance was evaluated against the underlying benchmark indexes. The thesis also addressed the differences between two replication methods: synthetic and physical, and the unique characteristics of leveraged ETF.

The thesis followed a quantitative approach, using collected data of historical price and other variables within a 5-year period as inputs for analysis. The sources of data were both public and private, and the analysis was mainly performed using the Eviews software.

The result showed that most ETFs underperform the benchmark indexes, even though there is not a clear pattern in the performance among the funds. Without consideration of the benchmark, an inverse correlation was noticed between the funds' risk-adjusted performance and total expense ratio. It was also found that leveraged ETF is not an attractive long-term investment compared to traditional ETF. Regarding the replication method, the result confirmed a lower tracking error in synthetic ETF, but rejected the claim that synthetic ETF is a better cost-saving option than physical ETF.

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LIST OF ABBREVIATIONS

AP	Authorized Participant
CAPM	Capital Asset Pricing Model
ESMA	European Securities and Markets Authority
ETF	Exchange-traded Fund
LETF	Leveraged Exchange-traded Fund
MPT	Modern Portfolio Theory
NAV	Net Asset Value
SML	Security Market Line
TER	Total Expense Ratio
UCITS	Undertakings for Collective Investment in Transferable Securities Directives

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1. INTRODUCTION

1.1 Background and Recent Developments of Exchange-traded Funds

Exchange Traded Funds (ETFs) belong to the group of derivative financial products that track a market index, bonds or multiple other assets. Similar to other index funds, ETFs act as a replication form of the underlying group of assets they represent. The straight-forward purpose of ETFs is to give investors the option of diversifying their portfolio by investing passively in baskets comprised of large number of assets, instead of buying each independent asset the traditional way. Demand for ETFs and index funds in general also stems from the wish of domestic investors to gain exposure to other markets outside their home exchanges. In recent development, many investors have started to shift their focus to markets across the world where growth in size and sophistication of financial product may occur faster than the limited home market (Woods, 2009). Foreign ETFs are created to be listed on one exchange but track the market indexes from other parts of the world, which makes it easier to hold shares from high-return foreign companies or other restricted assets and commodities without the risks and high costs when buying shares on foreign exchanges.

Since the inception of the first ETF tracking the S&P500 index (SPDR S&P 500: NYSEARCA:SPY), which was introduced in 1993, the growth of this financial vehicle has been exponential. As of September 2015 there are 3601 functioning ETFs globally, holding a total of $2.7 trillion in assets - a growth of approximately 575% as compared to data from 2005 (Deutsch Bank Markets Research, 2015). The vast majority of ETFs are created and traded in the US market, as described in Figure 1.

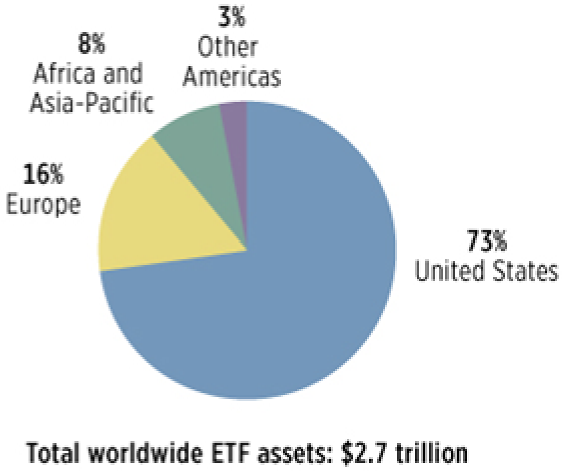

Figure 1. Percentage of total net assets, year-end 2014 (Investment Company Institute and ETFGI, 2014).

Following the success in the US, the ETFs industry in Europe has also experienced substantial development in recent years. The first European ETF was launched on April 11, 2000 on the Deutsche Börse and since then, the market for ETFs has continued growing despite recent economic and geopolitical struggles. By the end of 2014, assets in European ETFs account for 3.3% of the continent's total fund industry with €357.3 billion in assets under management (Deutsche Asset and Wealth Management, 2015).

ETF is of researchers' interest due to its rapid growth and being a highly innovative product. It has been cited as the groundwork for future evolution of the mutual fund industry (Poterba and Shoven, 2002). Many studies have attempted to compare the performance between ETFs and other financial derivatives. Agapova (2011) found that ETFs haven't yet substituted traditional index funds, but rather provide variability to the market through new features previously unavailable. Guedj and Huang (2008) also conclude that ETFs and other open-end funds (e.g. mutual funds) can complete the market having their own clienteles, while ETFs have better performance tracking less liquid indexes.

When isolating the performance of ETFs within their own universe, one curious aspect often investigated is the evaluation of their performance against the underlying index. The idea of a product tracking the index is inspired from the works of Modern Portfolio Theory, which claims that the market portfolio is always optimal and therefore, a portfolio imitating the market should also be optimal. Practical evidences on how closely ETFs can match with the index have been included in many academic papers. Adjei (2009) found no significant divergence between the performance of ETFs and the S&P 500 index. Svetina (2010), on the other hand, argues that ETFs underperform their indexes on average and tracking error is a persistent issue. Minolas and Rompotis (2006) examined the performance of European ETFs and found that, ETFs which do not adopt the full replication method are exposed to greater risk and tracking error. In general, the evaluation on risk and performance of ETFs has received mixed opinions across academics.

The universe of ETFs is diverse and exhibits many contrasts when comparing different markets. Studies done by Gallagher (2005), Shin (2010) and Blitz et al. (2012) indicate inconsistency in ETF performances between the US, Australia, Europe and Asian markets. The European ETF industry is one prominent example of the lack of homogeneity. Mussavian and Hirsch (2002) note the exquisite characteristics of European ETFs in its regulatory and market situation, emphasizing on how one index can be tracked by multiple ETFs and the fund's ability of being listed in one country and marketed across the union. Throughout this thesis, many aspects of the structure and regulation of European ETF will also be discussed in details. However, the empirical focus of the thesis will be on the performance of ETFs in the particular Nordic market, since little research exists on this market scale.

1.2 Research Problems

The thesis aims to answer the following questions:

- How is the performance of Nordic ETFs as compared to the underlying index and how closely can they match with the index performance?
- Is there any difference between funds adopting the physical and synthetic replication method?

- Is leveraged ETFs a good long-term investment?

1.3 Research Hypotheses

The purpose of constructing hypotheses is to create a foundation for further analysis with the aim of answering the research questions and providing extensive meaningful findings from the available data. The hypotheses are listed below.

H-1 Alpha value equals zero

H-2 Alpha value before total expense ratio equals zero

H-3 Leveraged ETFs have lower Sharpe ratio than non-leveraged ETFs

H-4 Leveraged ETFs tracking error persist over different time horizons

H-5 Synthetic ETFs have lower tracking error than Physical ETFs

H-6 Synthetic ETFs have lower total expense ratio than Physical ETFs

H-7 ETFs liquidity affects Price - Net Asset Value deviation

2. THEORETICAL FOUNDATION

2.1 Structure of Exchange-traded Funds

2.1.1 Developments of the Structure of ETFs

Exchange Traded Fund is an innovative financial product as it is organized similarly to a mutual fund, but technically functions as a stock. ETFs shares are listed on an exchange and can be bought or sold short in the secondary market throughout the trading day (Ferri, 2009).

On its first introduction, ETFs were regulated under the same provisions that governed both open-end and closed-end funds as a unit investment trust. A major disadvantage of the unit trust structure is the possibility of a “cash drag”, where dividends are not allowed to be immediately reinvested but rather accumulated in a safe account until they are paid to the investors periodically in the form of cash. Modern ETFs are, however, mostly using the open-end structure which eliminates the cash drag issue as dividends can be reinvested on a daily basis. Open-end funds can also use the sampling technique which allows the fund to sample the most representative components of an index and save costs from otherwise full replication (Meziani, 2006).

Despite being often compared to its counterpart “open-end mutual funds”, ETFs provide a substantially different approach to how investors can invest in a market index. As mentioned earlier, ETFs can be continuously traded during market hours, usually at a discount or premium to its Net asset value (NAV), while mutual funds have no intraday price and can only be traded at the day end’s price. The NAV of ETFs is still calculated in the same way as that of mutual funds i.e. once per day, while intraday value, which is a closely estimated NAV, is provided every 15 seconds by an Authorized Participant. The intraday value is considered to give guiding information on the price area where an ETF should be traded. The market price, which is the actual price that investors may execute their order at, is however independent of its intraday value and is dictated by general market support and demand (Ferri, 2009).

The NAV formula (Ferri, 2009) is calculated in eq. (1)

$$\frac{Underlying\ value\ of\ a\ fund}{Number\ of\ shares\ outstanding} = NAV$$

The ETF Market Price Discount/Premium (Ferri, 2009) is calculated in eq. (2)

$$\frac{Market\ Price - NAV}{NAV} = Discount\ \ (< 0) or\ Premium (> 0)$$

The discrepancy in live trading price and the underlying asset value is a well-known issue for ETFs and other closed-end funds. However, it has been argued that the NAV figures do not always represent the most accurate value of a portfolio consisting of continuously traded securities, particularly those ETFs that track the international market where a foreign stock exchange may have significantly different trading session and the NAV calculation is several hours old as compared to the actively trading market price (Wiandt and McClatchy, 2002). Furthermore, it has been observed that ETFs do not suffer as greatly from price and NAV difference as compared to equivalent closed-end funds due to high liquidity, which results from the liquidity of the underlying assets. The high degree of liquidity also means that investors would face a lower bid-ask spread (the difference between the ask price and the bid price) when forming an order with ETFs. (Anderson, Born and Schnusenberg, 2009).

2.1.2 Creation and Redemption Process

The open-end structure of ETFs implies that the funds are allowed to receive new capital to issue new shares after its initial public offering. The ability to create additional shares at or close to NAV is what facilitates liquidity and keep the performance of the funds close to that of the index (Hehn, 2006). Without following the traditional approach where new shares are announced occasionally, ETFs make use of a unique process called "Creation and Redemption" where shares issuance happens continuously throughout the trading day (Abner, 2010). The process involves the funds and the Authorized Participant (AP) issuing a large block of new shares from individual stocks to be sold to buying investors and oppositely turning selling orders back into individual stocks.. The details of the process are illustrated in Figure 2 and 3 (Gastineau, 2010).

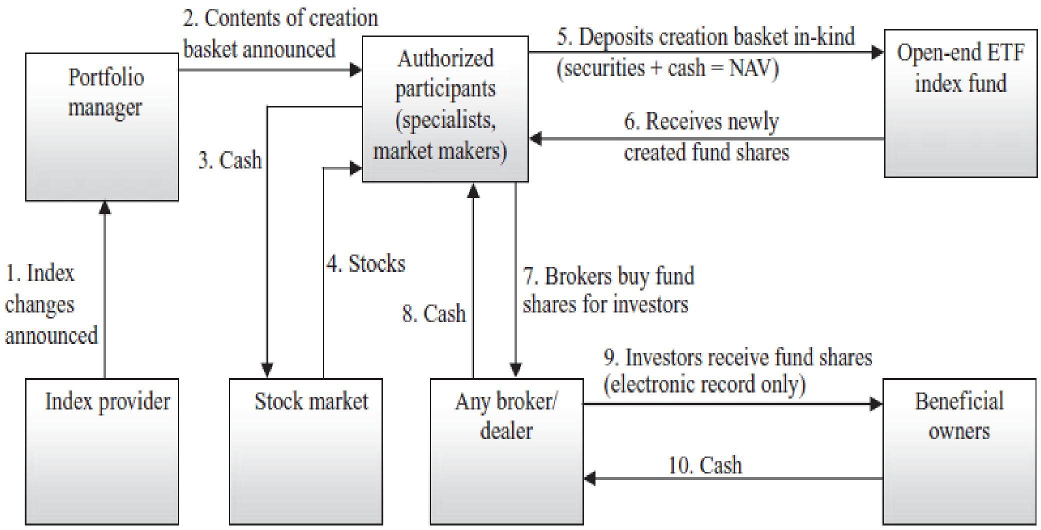

Figure 2. Standard Open-End ETF Share Creation Process.

The creation process consists of multiple steps and transactions in which the AP plays the center role. It starts with the announcement of changes in index composition by the index provider, upon which the ETF portfolio manager proceeds to make necessary trade orders for the purpose of keeping the funds in good reflection of the underlying index. Consequently, the portfolio manager will make an announcement of the list of components that makes up the particular ETF, which comes in the form of a basket of securities considered exemplary for the sampling of the current index. Once the basket content is acknowledged and the required quantity of securities is bought from the stock market by the AP, an agreement to an "in kind" exchange is then made between the AP and the issuer of the ETF. The AP is allowed to deposit securities plus a cash balance amount which in total equal to the NAV of a large block of shares called "creation unit". New ETF shares are subsequently created and delivered in the opposite direction to the AP, who directly or indirectly through a broker/dealer sells the shares to beneficial owners in the final transaction (Gastineau, 2010).

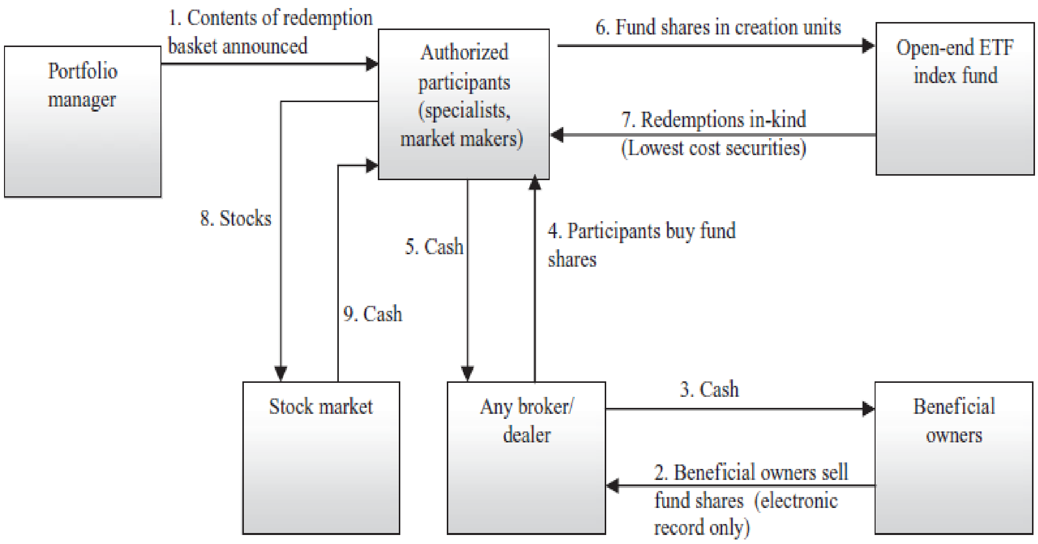

Figure 3. Standard Open-End ETF Share Redemption Process.

The redemption process is in essence the reverse of the creation process. Fund shares can be redeemed through sell order made by beneficial owners to the AP, who presents the number of ETF shares to the ETF provider in exchange for the basket of securities plus a balancing cash amount that mirrors the creation basket. Finally, the received securities may be sold back on the secondary market for an equivalent amount of cash. Since the number of APs is limited by permission from ETFs providers and the size of a creation unit is usually large in these transactions, it is easy for the creation and redemption activities to be monitored. Transaction costs incurred from assembling the basket creation and selling them back to the stock market are always borne by the APs instead of retail traders (Gastineau, 2010).

From the illustration of the creation and redemption process, the importance of the APs can be perceived as every major transaction requires their involvement to an extent. The APs are typically large financial institutions who enter into a legal contract with an ETF and have the exclusive rights to create and redeem shares which serve the purpose of reducing the spread between market price and NAV whenever they diverge too far. If ETF shares are selling at a premium, the AP can use their ability to buy the underlying securities, exchange them for a creation unit and then sell the ETF shares at a higher price than what they have spent for the actual securities, which in essence is a risk-free arbitrage opportunity. Conversely, if ETF shares are trading at a discount, the AP can sell the underlying securities on the stock market for a profit, buy ETFs share at a low price and exchange them for the actual securities so that the initial sold securities are back into their hand again with an arbitrage profit. The APs can perform their privilege repeatedly until there is no more arbitrage opportunity, while the ETFs are again efficiently priced to their intraday value (Ferri, 2009).

2.1.3 Physical versus Synthetic ETFs

One of the principle investment objectives of ETF is to replicate the return of the index it is tracking. Structurally, there are two distinctive methods of tracking the benchmark a fund issuer can decide upon. The more direct and transparent structure is “physical ETF”, where the fund simply tries to hold all or a representative sample of the underlying securities that make up the index. There is however another replication strategy which has seen an increasing usage, namely “synthetic ETF”. Without holding the actual underlying securities, synthetic ETFs enter into swap contract with one or more counterparties and put their investment in derivative instruments provided by such parties, who promise to pay the funds the return of the index replicated (Vanguard Research, 2013).

It is worth noting that while nearly all ETFs in the United States are physical ETFs, synthetic ETFs are more popular in Europe due to differences in regulation, tax regimes and the need of investing in ill-liquid markets. Since synthetic ETFs don’t have to physically hold the securities, investors may find it easier to diversify their portfolio by investing in less known markets or markets where regulatory restrictions may prevent access to investment. Similarly, some funds strategies may be overly complex or costly to implement using the physical structure wherein synthetic ETFs can be introduced as a solution. An example to that is leveraged ETFs, where the funds seek to replicate double or triple the performance of the benchmark index (Vanguard Research, 2013).

Investors who invest in synthetic ETFs have an exposure to counterparty risk. Even though counterparties are usually large investment banks, relying on such entities to honor the contract is riskier, as seen in the case of US giant Lehman Brothers, where a large bank can collapse and take down all the funds that had investments in their derivative products. However, the risk associated with synthetic can sometimes be exaggerated in comparison to its opportunity and in several cases, investors simply decide that physical ETFs have a structure that is easier to understand, thus is less risky (Stevenson, 2013).

2.1.4 Leveraged and Inverse ETFs

Leveraged ETF (LETF) is a relatively young derivative form of the ETF family. The Swedish group XACT Fonder was the first investment company in the world to offer leveraged ETFs in 2005 (XACT press release, 2010). In 2006, Proshares popularized the first generation of LETF, which were designed to magnify investor's exposure to an underlying market index (Profunds Group, 2010). Fund's manager operates LETF by borrowing additional capital besides the underlying equity to create the leverage effect on fund's return (Guedj, Li & McCann, 2010). For example, if the price of a market index advances 1%, a 200% LETF tracking said index promises to increase its NAV by 2%, doubly the index's return. However, in most cases the objective of LETF is to deliver the multiplied return only on a daily basis, which means that in long-term, the performance of these funds will not match with the advertised leverage factor. Due to this daily rebalancing, LETF has been considered suitable only for short-term day traders, who generally hold stock position for less than 1 day (Hill & Foster, 2009).

Besides normal LETFs that track more than the index's return, there are also inverse ETFs for tracking the opposite direction of the index, with or without leverage. This type of ETFs allows investors to replicate a short sale of normal ETFs by buying the inverse version. If the market experiences negative movement, the inverse ETF will earn positive return and vice versa (Guedj et al., 2010). The benefit of inverse ETFs is that the shorting responsibility, which can be a burden to some investors, is passed onto the fund manager, allowing the investors to simply hold a long position (Elston, Frank, and Choi, 2009).

Since the introduction of LETFs, researchers have been curious about their performance and validity as a reliable instrument. Charupat and Miu (2011) found that LETFs have problems replicating the promised return, especially during a longer period. This issue is described as tracking error, and is supported by many other researches. Lu, Wang and Zhang (2009) particularly noted how some LETFs are able to mitigate the deviation during a holding period less than 1 year, while others usually show significant tracking error if the period is over 1 month. However, despite the greater risk compared to traditional ETFs, the profitability of LETFs has also been praised. Bansal and Marshall (2015) argued that the tracking error of LETFs is not a negative factor if the market is in an uptrend, and that they should be considered as a valid component for aggressive portfolios. Giese (2010) found that investors can benefit in the long run if the leverage is appropriately chosen, and that in a bullish market, the optimal leverage factor can be higher.

2.2 Market Regulations

ETFs are, first and foremost, categorized as funds; therefore they have to be registered for marketing in a country's jurisdiction. An ETF can be registered in various countries across Europe; however the registration process and the extent to which the product can be marketed may differ in each country. As a result, issuers of ETFs need to assess their strategy on which country should they introduce their products, even though an ETF cross-listed on various exchanges provides a broader market penetration (Hehn, 2005).

Due to its characteristic of being a hybrid product, ETFs also trade on the secondary market through market makers. Issuers of ETFs are therefore subjected to the specific rules and regulations of the exchange, which also vary from one to another in their practices. In many cases, the funds management does not have any direct communication with the average retail investors since the contractual relationship for product sale is between the brokers/dealers and the end-buyers, while the exchange usually play the role of providing educational information and marketing materials on the products (Hehn, 2005).

When making a comparison to the ETF industry in United Sates, there are many striking differences in the structure and development of ETF in Europe. Hill et al. (2015) indicated that the differences are mainly caused by fragmentation between European countries, each having their own exchange, tax and regulatory regime. In 1985, European Union introduced the UCITS (Undertakings for Collective Investment in Transferable Securities Directives) with the aim of creating a collective regulation system for open-end funds in every Member State. Investment funds in compliant with the Directive are regulated at the European level and currently make up around 75% d of all collective investments by small investors in Europe (European Commission, 2015).

The advantage of being UCITS-compliant for ETFs is that they can be authorized in one single Member State and marketed across every Member States. In this regard, the UCITS Directive can be considered an ideal “passport” for ETFs with the goal of attracting European investors (Hehn, 2005). An ETF can be declared UCITS-compliant if it meets the following conditions:

1. The sole investment objective of the fund is to collectively invest in transferable securities or other liquid financial instruments listed in the Directive, using capital raised from the public.

2. The fund operates on the principle of risk-spreading.

3. Repurchase or redemption of fund’s shares at the request of its holders is, directly or indirectly, out of the fund’s assets.

(European Commission, 2009)

The third development of UCITS which was adopted in 2001 and came into effect in 2007 introduced several changes that brought direct impact on ETFs:

1. Sophisticated investment vehicles including ETFs were distinguished from unsophisticated ones such as mutual funds.

2. A UCITS must provide investors with a prospectus stating the risks of investing into such vehicle.

3. A UCITS's investment into a single security must not exceed 10% of its NAV; with the aggregate of securities exceeding 5% capped at 40% of NAV.

4. An individual investment in a group of funds cannot exceed 20% of the UCITS's assets.

5. Sophisticated funds can use leverage up to 200% of NAV.

6. A UCITS must provide regularly accurate report on the fund's portfolio, including measurements of risks from invested securities.

7. The UCITS's portfolio needs to be liquid and negotiable.

8. Counterparty risk cannot exceed 10% of NAV if the counterparty is a bank, otherwise 5%.

(Groves, 2011)

Following the implementation of UCITS, the most important development in European ETFs regulatory of recent years has been the European Securities and Markets Authority (ESMA) guidelines on ETFs and other UCITS issues, which took effect from February 2013. The guidelines are based on the principles of the UCITS and focus on enforcing a more transparent disclosure model on European issuers, with the aim of providing investors with comparable information and comprehensive understanding of the funds' characteristics and risks. One of the ESMA's requirements is the inclusion of the "UCITS" label in the name of all UCITS-compliant ETFs. Other requirements include an increase in diversification of collateral held and more transparent documentation on replication method, counterparties, leverage and indices tracked (Morningstar Manager Research, 2014).

2.3 Index

Market indices have long become an integral part of evaluating and measuring the financial market. An index tracks the performance of multiple financial securities by adding their prices together in proportions based on specific weighting methods. Market watchers use indices as indicators to extract the information on the value of a section of the market. An index can be designed to track global, national or a particular stock exchange. There is however an infinite number of ways an index provider can construct their method of index creation, considering how big the securities universe currently is. Due to increasing usage and demand for different purposes from performance measurement to derivative products, more and more indices are being calculated and introduced to reflect particular market segments of investors' interests. It is estimated that more than 600 market indices are being published around the world, while the number could go up to 10000 if sub-indices or narrower indices segments are to be considered (Shilling, 1996).

Since most ETFs are designed to track the movement of market indices, understanding their origins and purposes is essential to the analysis of ETFs. According to Ferri (2009), there are two basic categories of index that ETFs speculators should be concerned about: benchmark index and strategy index. Though the distinction between the two is usually not enunciated clearly by index providers, their intrinsic purposes can be very different from each other. Benchmark indexes often have a broad selection when picking the stocks or other securities to be included in the basket. The index size can be as large as all of the securities on the trading market or is subjected to certain criteria that recruit only a selected sample population. Even when sampling method is used, the aim of a good benchmark index should be to capture the broadest possible character of the market. Its value is therefore meaningful for understanding the economy status and making economic decisions, including portfolio asset allocation. Strategy indexes, on the other hand, focus on creating an index that has sophisticated methodology in choosing components. The aim of strategy index providers is to identify and include only securities deemed promising and thus, these indexes cannot be represented as a measurement of the market value. ETFs tracking strategy indexes also carry very different risk and return characteristics, which are subjective to the philosophy and style of the index providers.

2.4 Modern Portfolio Theory

Modern Portfolio Theory (MPT) is an investment theory developed by Harry Markowitz and was introduced in his seminal publication "Portfolio Selection" in 1952. The main idea of the theory is that it is not optimal to construct a portfolio based only on the characteristic of each selected security. Instead, investors should examine the correlation among all the securities when picking components for the optimal portfolio, so that the risk factor is minimized while expected return is constant (Elton and Gruber, 1997). Before Markowitz (1952), investors had been practicing diversification as a useful tool when building a portfolio, despite the limited understanding of how it actually works for their benefits. The introduction of portfolio theory and optimization was such critical that it has been integrated into every portfolio since then (Kono, 2008).

Diversification was the foundation of MPT, however it shouldn't be mistaken for random diversification or naïve diversification. A portfolio can be diversified by adding randomly selected securities with limited knowledge about the relationship between them, so that the portfolio's systematic risk is reduced (Maheshwari, 2008). Systematic risk is market risk that affects the whole financial market and is unavoidable. The 9/11 World Trade Center terrorist attack and 2008 recession are examples of systematic change that cause damages across all industries in the US and many other countries, while events that happened elsewhere such as the 1997 Asian Financial Crisis also brought heavy impact to the involved markets (Friedberg, 2015). Because of its unavoidable effect to nearly all securities in the same class, systematic risk will always be present in a portfolio no matter how diversified it is. It also explains the differences in returns between types of asset, with high return securities to be more likely associated with high market risk exposure, while assets unaffected by market changes such as cash will have zero market risk and offer the lowest returns (Northcott, 2011). The portfolio management of systematic risk is also discussed under the name of asset allocation, where the investor creates a portfolio of multiple asset classes with the hope that unpredictable market events would influence different classes of asset in different ways, thus alleviate the overall impact the portfolio would have to suffer. For example, a portfolio consisted of stocks, bonds and cash would experience a less major change under specific events because of the different levels of risk and return, which means the falling in bond price may not be as serious as in stock's, while cash value would be relatively stable (Friedberg, 2015).

In addition to the market systematic risk, each individual asset within a portfolio also carries a specific risk, which is the asset's return deviation not related to the total market performance. This unique variance contributes to the portfolio's unsystematic risk, or risk that associates with the invested assets' characteristics and concerns the uncertain events on a firm scale rather than the market scale. According to MPT, unsystematic risk is considered insignificant under a well diversified portfolio, which leaves the assumption that if several different securities are put together, the portfolio's risk will be a measurement of its systematic risk within the market portfolio of risky assets (Reilly and Brown, 2011).

The MPT emphasizes that under the Markowitz diversification, it is possible to eliminate any unsystematic risk from the portfolio without holding a large variety in asset. Instead of focusing on the number of securities, MPT prefers having in the portfolio securities that have strong negative covariance. A portfolio which consists of only two securities with perfect negative correlation has the potential to achieve the zero risk level, while adding more securities tends to bring the portfolio's risk closer to the systematic risk threshold (Khan and Jain, 2007). To find the covariance and the optimal portfolio, using the mean variance theory, the investor needs to estimate the mean and variance of each security's return, which are used to make calculations on the correlations and covariances for all pairs of securities included in the portfolio over a single period (Elton et al, 1997).

One important implementation of MPT is the construction of the efficient frontier. The theory implies that if expected returns, volatilities and constraints on investment options are given, it is possible to perform a mean-variance optimization to construct the most efficient selection of portfolios which is the efficient frontier. Every single point which lies on the frontier curve is the optimal portfolio that yields the highest return for the corresponding level of risk, or carries the least amount of risks given the level of expected return (Fabozzi, Gupta and Markowitz, 2002).

Figure 4 illustrates the efficient frontier of risky securities in relation with the risk-return trade-off. All portfolios below the line of the frontier are inefficient portfolios, since for the level of risk that each sub-optimal portfolio carries; it is always possible to plot an efficient portfolio that has the same amount of risks while offers greater returns. It is also implied that since the efficient frontier contains all the optimal portfolios, every portfolios that lie above the frontier are impossible to achieve sustainably over a long-term. The frontier curve starts from the minimum variance portfolio, which is the most profitable portfolio that also carries the least amount of risks, and extends to the right as both risk and return increase in value. When constructing a portfolio, the choice of where to plot the portfolio on the efficient frontier depends on the investor's risk tolerance (Pandey, 2005).

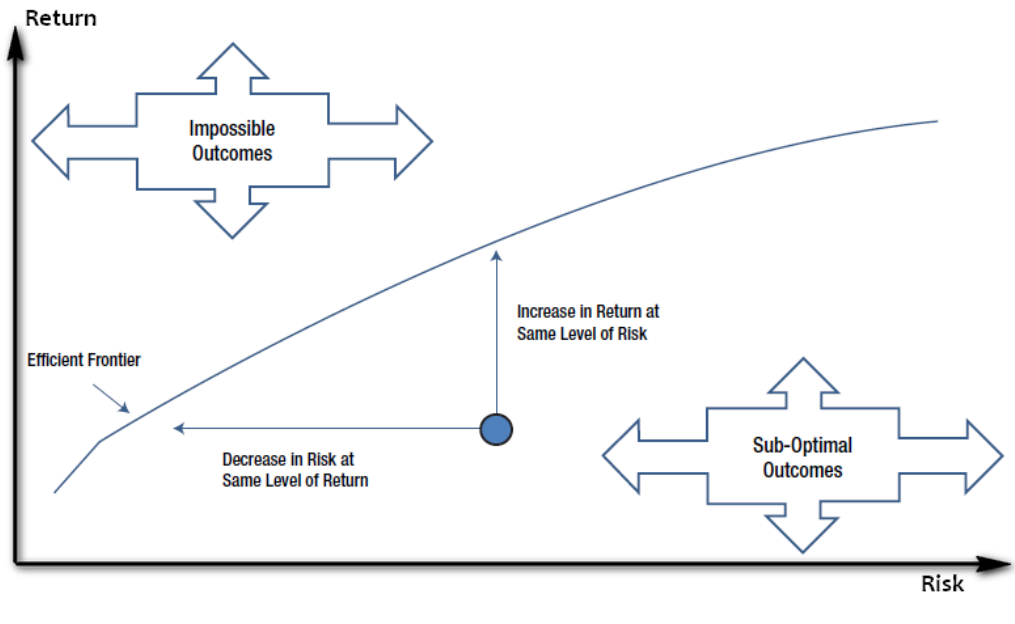

Figure 4. Efficient Frontier (Schlachter, 2013).

The efficient portfolio theory has a close relationship with diversification. Optimal portfolios tend to be highly diversified. Sharpe (1970) notes the superiority of the market portfolio in achieving the highest possible return given the standard deviation or total risk, and attributes it to the development of investment products trying to imitate the market portfolio performance. In regards to ETFs, Kono et al.

(2007) found that an optimal portfolio can consist of a small number of ETFs to achieve the market's return versus risk level, since it is in essence an already well diversified security.

2.5 Capital Asset Pricing Model

The Capital Asset Pricing model (CAPM) is a financial model that attempts to mathematically describe the relationship between risk and return for diversified portfolios and individual securities (Kumar, 2015). The model was built on the foundation of earlier works on MPT and was developed separately by four economists – Jack Treynor (1961, 1962), William Sharpe (1964), John Lintner (1965) and Jan Mossin (1966), with William Sharpe awarded the 1990 Nobel Prize in economic science for his influence (Sullivan, 2006). The CAPM was a revolution in the investment field in that it changed the perception of investors on risk and portfolio selection. The focus when choosing components for a portfolio is shifted from firm-specific volatility, or standard deviation of individual securities, to the risk of such securities in correlation to the market (Allen and Yago, 2010).

The history of CAPM dates back to the original model developed by Treynor in his unpublished papers (Treynor, 1961, 1962). Treynor (1962) splits the estimation of security or portfolio expected return into two components, the risk-free rate and adjusted risk premium (Frencha, 2003). The market risk-free rate refers to the expected return on a risk-less asset and should have negative correlation to all risky investments (Damodaran, 2008). In order to be accepted as a valid risk-free asset, the security must not carry any default risk and reinvestment risk. The conditions imply that only government-issued securities which pay no interest for the duration of the research, thus are exempt from reinvestment risk, can be considered an appropriate risk-free measure (Damodaran, 1999).

The second component that contributes to the CAPM is risk premium of the investment. Fama and French (2004) describes risk premium as the product of the asset's beta (β) and the market risk premium, which is the broad market average returns minus the risk-free rate. The risk premium tells the expected demand for excess return from investing in a risky security or portfolio over another investment in risk-free assets (Feibel, 2003). Using the market return and the risk-free rate as references, the CAPM is capable of hypothesizing the performance of an investment given their correlation with the market. The theory is consistent with empirical findings in Sharpe (1964), where the author suggested that investors should expect a higher return when investing in securities that response strongly to market volatility, and vice versa.

The assumptions of the CAPM are:

1. Investors are rational, risk-averse and aim to achieve an efficient portfolio.

2. Investors have homogenous expectation.

3. Only public securities are traded and all information is publicly available.

4. Investors can borrow or lend at a common risk-free rate.

(Kumar, 2015).

One implication of the CAPM from its assumptions is that investors only hold diversified portfolios. As mentioned earlier, a diversified portfolio can eliminate all unsystematic risk, resulting in market-related systematic risk being the only relevant risk investors are exposed to, and thus, are rewarded with the risk premium compensation (Luecke, 2002). This implication has led to the popularity of market portfolio investments e.g. index funds and ETFs, where the funds hold a broad selection of securities in market proportion (Pennacchi, 2008).

Mathematically, the CAPM formula (Bhat, 2009) is expressed in the eq. (3)

$$E(R) = R_f + \beta(E(R_m) - R_f)$$

Where:

E(R) is the expected return

β is the asset's market sensitivity

R_f is the risk-free rate

$E(R_m)$ is the expected market return.

Visually, the CAPM equation can be described using the concept of Security market line (SML), as expressed in Figure 5. The SML plots the expected return of an asset in relation to its β. The upward slope of the line is determined by the level of β and a constant intercept using the risk-free rate. Higher β results in greater expected return and a security or portfolio with a β of 1 is expected to yield the market return (Bhat, 2009).

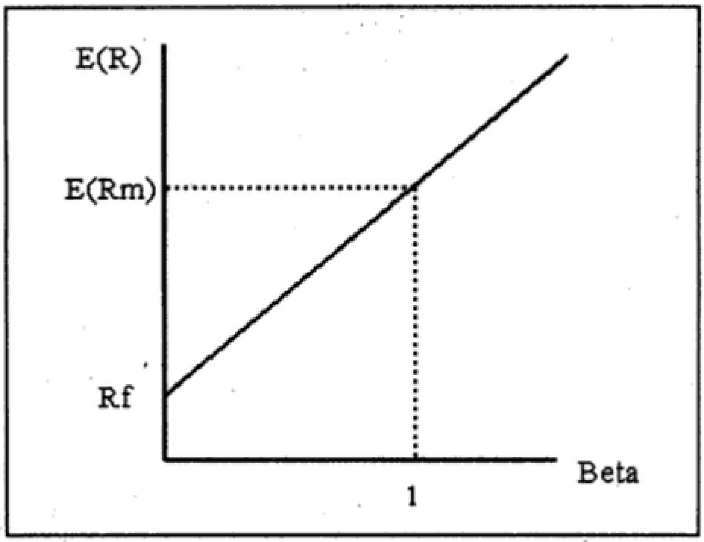

Figure 5. Security market line (Bhat, 2009).

2.6 Performance and Risk Measurements

2.6.1 Beta

In CAPM, β is defined as the volatility modifier of the portfolio's undiversified risk in relation to the total market, and act as a measure for portfolio's responsiveness to changes in the market. A portfolio with a β of 1 is expected to move in tandem with the market portfolio, which contains the broadest security population. A β greater than 1 indicates that the portfolio is more volatile than the market and the portfolio's return will increase or decrease at a greater rate than the market's return. A β less than 1 indicates that market changes have a smaller impact on the portfolio and a decrease or increase in value of the market does not guarantee the same direction change in the portfolio's return. If the portfolio's β is zero, it is assumed to have no correlation with the market (Chincarini, 2006).

Bacon (2008) demonstrates the relationship between β, covariance and correlation in eq. (4) and eq. (5):

$$\rho_{(p,m)} = \frac{Covariance}{\sigma_p . \sigma_m}$$

$$\rho_{(p,m)} = \frac{Systematic\ risk}{Total\ risk} = \frac{\beta_p . \sigma_m}{\sigma_p}$$

Where:

$\rho_{(p,m)}$ is the correlation between the portfolio and the market

σ_p and σ_m are the portfolio and market's standard deviation

β_p is the portfolio's beta

2.6.2 Jensen's Alpha

In his paper on the performance of mutual funds, Jensen (1968) invented a risk-adjusted measure of portfolio performance based on the CAPM theory. The paper investigated 115 mutual fund managers during a period of ten years and performed calculation on their ability to earn excess return over the expected return according to the fund-specific level of risk. The measurement used in the paper became Jensen's alpha as we know today. Jensen's Alpha can be described as the difference between the actual portfolio return and the theoretical expected return derived from the CAPM equation (Travers, 2004). The Jensen's alpha formula (Travers, 2004) is expressed in eq. (6).

$$\alpha_p = R_p - E(R_p)$$

Where:

α_p is the portfolio's alpha

R_p is the actual portfolio's return

$E(R_p)$ is the expected portfolio's return derived from the CAPM equation.

A positive alpha is an indication that the portfolio manager has outperformed the benchmark return more than its beta suggested. However, according to many academics, a continuously positive alpha is contradictory to the CAPM's assumption that the market is efficient, or it is impractical to expect a portfolio to have positive alpha with great deviation from zero (Gerber and Hens, 2009).

2.6.3 R-Squared

R-squared is a statistical value that measures the correlation between the variance in fund's return and in benchmark's return (Bacon, 2008). R-squared is closely linked to the reliability of beta and alpha value, since it shows how similar the fund is to the market movements. An R-squared value of 1 indicates that all changes in portfolio can be explained by changes in benchmark. A low R-squared value indicates that the relationship is scattered and not fitted, which in turn invalidates the usefulness of calculated alpha and beta values (Bacon, 2008).

The equation for calculating R-squared is expressed in e.q (7):

$$R^2 = \frac{Systematic\ variance}{Total\ variance}$$

The threshold value for R-squared in a financial model is subjective and depends on the purpose of the analysis. According to Morningstar Inc (2004), funds with an R-squared lower than 70% do not behave like the index. For investments trying to replicate the benchmark's return like ETF, the R-squared value is even more critical when analyzing the performance against the index.

2.6.4 Sharpe Ratio

The Sharpe ratio was devised by William Sharpe in his paper (Sharpe, 1966), at which time it was referred to as the reward-to-variability ratio. The original Sharpe ratio was designed as an ex ante, that is, using the expected value of the ratio to make future forecasts and decisions (Sharpe, 1994). Sharpe ratio measures the excess return the portfolio consisting of risky assets is expected to generate per unit of risk. Throughout its development, the ratio became an ex post, which means that expected values are replaced by actual historical return in calculating the equation (Kidd, 2011). Sharpe ratio is often cited as a useful risk-adjusted performance measure for comparing between portfolios. A higher Sharpe ratio indicates superior performance; however, when all of the compared ratios produce negative values and the excess returns are similar, the interpretation should be reversed. It is also noteworthy that the measure uses total risk instead of systematic risk; hence, comparison involving a diversified portfolio, where unsystematic risk is mitigated, is considered less effective (McMillan et al., 2011).

The Sharpe ratio formula (Bacon, 2008) is expressed in eq. (8):

$$SR = \frac{R_p - R_f}{\sigma_p}$$

Where:
SR is Sharpe ratio
R_p is portfolio's return
R_f is risk-free rate
σ_p is portfolio's standard deviation

2.6.5 Tracking Error

One of the important properties when determining the performance of ETFs and other index-tracking investments is tracking error. ETF managers that follow passive investment strategy aim to imitate the performance behaviors of the indexes. There is however a number of reasons that keeps an ETF from exactly replicating the index performance and therefore creates tracking error. Ferri (2009) explains the most prominent factors that lead to such divergence. The cash drag issue is typical for ETFs organized as unit investment trusts, since dividend is not reinvested on the same day as assumed by the index providers. An index also does not hold a cash proportion as opposed to most funds, which require an amount of ready cash to pay administrative costs, making it difficult to replicate the actual content of an index.

Furthermore, an ETF may deviate from the index due to the fund manager's inability to buy illiquid securities. Some regulations, as mentioned earlier, also prevent the fund manager from investing in a security exceeding the percent of NAV limit, which becomes a challenge when there is a dominant position in the index (Ferri, 2009).

The opinions on the definition of tracking error are interestingly different in some situations. Academics often describe tracking error as the annualized standard deviation of the variation between portfolio's return and index's return (Gastineau, 2010). A more frequently used version chooses the net asset value return instead of normal return, as described in eq. (9) (Jones, Vardharaj and Fabozzi, 2004):

$$TE = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(R_{p,t} - R_{i,t})^2}$$

Where:

TE is tracking error

$R_{p,t}$ is the return of the ETF's NAV

$R_{i,t}$ is the return of the index

T is the number of observations

In addition to the academics' understanding, there exists a simpler definition mostly used by fund analysts for publishing and communicating with investors. In this version, tracking error is calculated by finding the difference between the return of the fund and the return of the index (Gastineau, 2010). It is sometimes referred to as tracking difference. The principal difference between two presentations is that, when using standard deviation as a measure, the outcome will always be a positive value, whereas tracking difference can be negative and reflect a better or worse performance in relation to the index. In reality, the tracking difference has been found to be usually negative, indicating that the funds tend to underperform the index (Morningstar ETF Research, 2013). When interpreting tracking error obtained from any of the above methods, a value closer to zero is preferred as it indicates better management in matching the fund with the index.

3. METHODOLOGY

3.1 Research Method

Research methods refer to the systematic approach in data collection through historical information, surveys, field experiments and case studies; and are supported by research techniques which are specific procedures and techniques used in extracting and analyzing collected data in order to answer a particular research question (Ghauri and Grønhaug, 2005).

Quantitative and qualitative are two primary research methods used when conducting a scientific research. Quantitative research uses techniques to quantify data and study the relationship between statistical groups in order to prove the hypotheses and draw conclusions. Qualitative research, on the other hand, is more concerned on gathering knowledge and insights from individuals than on statistical measurements (Bell, 2005).

Quantitative research is chosen to support conducting this research. The performance of ETFs in Nordic market will be investigated based on quantitative techniques and measurements. The supported data are collected from both public and private sources. Data analysis will be done using the Eviews software and hypothesis testing will be conducted to prove or disprove the proposed hypotheses. The appropriate test statistic for the purpose of this thesis is the independent-groups t-test. The t-test is a statistical test used to confirm the difference or similarity between the performances of two separate samples (Jackson, 2010).

3.2 Data Collection

The research aims to investigate equity ETFs traded in the Nordic market during a 5-year period, starting from January 01 2011 until December 31 2015. A total of 29 funds were selected based on the above criteria, with 24 funds listed on NASDAQ Stockholm, 4 funds on Oslo Stock Exchange and 1 fund on NASDAQ Helsinki.

Regarding the selection process, the ETF listings page on NASDAQ OMX NORDIC was used to determine the sample dataset. Only ETFs that track an equity index were selected, which means that bond, currency, commodity and active ETFs as well as other Exchange traded products were omitted from the sample. The qualified ETFs must also have an adequate historical activity in order to produce a reliable analysis. All selected funds were listed and traded before 2011, with 3 exceptions being the Spotr ETFs provided by SEB Equities, which were listed only from March 16 2011. Information in details of the funds is included in Appendix 1.

Following the formation of the list of funds, the collection of data for relevant variables is carried out. The data are collected from multiple sources as explained below:

1. NASDAQ OMX NORDIC and Oslo Stock Exchange web page: provided the historical daily closing price and other information to describe the funds, e.g. the daily volume, total expense ratio, name of issuer and country of registration, replication method and leverage multiplier. In addition, the exchange knowledge base also provided description and historical data for many accompanying indexes, as well as one benchmark index for the purpose of comparing some quantitative figures. The chosen benchmark index is the VINX Benchmark Cap. The index is designed to represent all stocks listed on the Nordic exchanges under the free float condition, that is, only the tradable portion of the shares is taken into account when constructing the index (NASDAQ Index Research and Resources, 2014). Since the number of components is considerably large enough to capture the Nordic market situation, it is appropriate to be used as benchmark for comparing financial ratios. The capped version was selected due to the limitation in weight of each stock component, which is in compliant with UCITS and ensures compatibility with the researched ETFs.

2. Funds' public and private data: the NAV for each fund was collected either through the fund's web site or personal request. Data for underlying indexes that cannot be found on Nordic exchanges are also collected from the funds.

3. Funds' prospectus and notices: was used for the purpose of clarifying and improving the accuracy of data. For instance, ETF issuer XACT announced new management fee for 3 ETFs on 10 April 2016, which falls outside the range of the research period, hence the use of the old rate.

4. Morningstar web page: provided additional information on the funds, e.g. the inception date and equity style (market capitalization and valuation). The Fund size on 15 April 2016 was also collected for each fund and converted to USD for comparison using Bloomberg spot exchange rates on the same date.

5. Euribor website: provided the historical daily 1-month Euribor rate for the research period. The Euribor rate is chosen to represent the risk-free asset.

After the required data have been collected, the next step involved data processing and creating data sets. For non leveraged ETFs, the daily price is converted into monthly price by calculating the average value for each month. For leveraged ETFs, the daily price is used without conversion due to the daily rebalancing mechanism, which means that using data for lower time frequency will result in less reliable analysis. Consequently, the data for daily 1-month Euribor rate is also processed in the same manner for both groups. However, since the published Euribor rate is annualized, each data point will be divided by 12 (for ETFs) and 252 (for leveraged ETFs) to obtain comparable values.

3.3 Time Series and Cross-sectional Analysis

In financial analysis, there are two common types of data. A time series data consists of observations for one or multiple variables during a time unit (e.g. month, year) (Hirsch, 2000). An example would be the daily closing price of a stock during a 3-year period. Cross-sectional data, on the other hand, consists of several observations for each variable at one single period of time (Hirsch, 2000). Example of cross-sectional data would be the average return for 10 different stocks in the previous year.

This thesis will employ the use of both types of data. For analysis which concerns the correlation between variables over time, the time series data will be used to obtain the coefficient(s) and constant value, using a method called least squares regression. The least squares regression analysis is a statistical tool which is used to predict the relationship between one dependent variable and other independent variables (Kinney and Raiborn, 2010). While it is more usual to analyze serial correlation in time series data, there are situations where the need to understand cross-sectional relationship prevails, for instance when testing the correlation between variables attributed to a list of funds.

3.4 Validity and Reliability

Validity of measuring instrument refers to the degree to which the instrument can measure the initial concept it was designed to do (Sekaran, 2003). There are three groups of validity tests. Content validity ensures that the selected group of measurement items is able to represent the domain or universe of the measured concept. A panel of experts in the field of test can judge the degree of content validity (Sekaran, 2003). Criterion-related validity refers to the ability of the measure to differentiate and notice the presence or absence of individual criterion, and construct validity refers to how closely the test results relate to the theory (Sekaran, 2003).

Reliability of the measure refers to the extent to which the measure can ensure consistency across time and various items on repeated trials. A reliable measure indicates stability and consistency and is highly appreciated when measuring a concept (Sekaran, 2003).

The sample chosen for this study is based on a number of criteria. Due to the availability of meaningful data and the limited scope, many members of the overall Nordic market were not included, thus the customized sample may not fully represent the bigger population. The measurements used for testing are designed to notice differences between individual variable and tackle the research problems. The measurements are also constructed based on the previous literature findings; therefore relationship with theoretical framework is ensured.

Regarding reliability, the data used for this study was collected from different sources and crosschecked when possible. However a large part of data is collected directly from the funds without third party verification, thus reliability will depend on the transparency of the funds themselves.

4. EMPIRICAL RESULTS

4.1 Descriptive Statistic

The descriptive statistics for 21 ETFs and 8 LETFs are summarized in Table 1 and Table 2. The statistics are based on the monthly average returns for ETFs and daily returns for LETFs, with the purpose of analyzing the distribution and general characteristics of the studied sample's return.

On average, the mean values of ETFs are approximately 0.58%, with only one fund experiencing negative average return. The same average statistic for LETFs is 0.00% as expected, since there are four pairs of LETFs each tracking the same index but in opposite direction, which means that their returns should cancel each other out. All four normal LETFs have a positive return, while the remaining four inverse LETFs perform negatively, which indicates that the underlying indexes were in a bullish market for the studied period. The average maximum return for all funds is 10.24%, while the minimum value deviates far greater from zero at -12.82% on average, and concentrates in August 2011 when there was a sharp decline in stock markets around the world.

The standard deviation examines total risk property of the funds and was annualized by multiplying with $\sqrt{12}$ (ETFs) and $\sqrt{252}$ (LETFs) to obtain a comparable value. On average, the standard deviation of ETFs is 14.81%, while the corresponding value for LETFs is considerably higher (35.10%).

The skewness and kurtosis statistics measure the distribution of the return series. The skewness value for all funds is -0.5 while the kurtosis value is 5.1. A negatively skewed distribution can be interpreted as a sign of extreme deviation from expected value clustering more on the negative side during the investing period. Similarly, a distribution with kurtosis value higher than 3 is said to be leptokurtic; and investors should expect to obtain extreme values more frequently compared to a normal distribution.

In addition to the above statistics, the p-value from Jarque-Bera test was also included to confirm the deviation of the funds from a normal distribution. The

Jarque-Bera test states a null hypothesis as a combination of the skewness being zero and the kurtosis being 3, which are the values of a normal distribution. For ETFs, the p-value is lower than 0.05 for the majority of funds, which indicates that the null hypothesis can be rejected and that the fund's return does not follow a normal distribution. On the other hand, the distribution for all LETFs' return was significantly different from a normal distribution.

ETFs							
Fund name	Mean	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
Db X-trackers MSCI AC Asia ex Japan	0.41%	9.61%	-9.99%	14.61%	-0.2830	2.6589	0.7519
Db X-trackers MSCI Brazil	-1.24%	17.79%	-14.77%	21.58%	0.1474	3.6152	0.9556
Db X-trackers DAX	0.88%	8.89%	-17.54%	16.88%	-1.0778	5.3338	0.0000
Db X-trackers MSCI Emerging Market	0.03%	9.24%	-12.00%	15.48%	-0.3175	2.9050	0.8345
Db X-trackers MSCI Europe	0.77%	7.82%	-12.11%	11.63%	-1.2761	5.8713	0.0057
Db X-trackers Euro Stoxx 50	0.68%	8.50%	-15.46%	14.85%	-1.1009	5.1584	0.0005
Db X-trackers Europe 600 Banks	0.24%	10.56%	-20.44%	18.49%	-0.8695	5.6517	0.0794
Db X-trackers FTSE China 50	0.46%	19.46%	-10.75%	20.85%	0.4226	3.3062	0.2739
Db X-trackers MSCI Japan	0.80%	8.03%	-9.76%	14.87%	-0.2277	2.6183	0.4041
Db X-trackers NIFTY 50	0.43%	12.38%	-11.15%	18.95%	-0.0021	2.6308	0.8652
Db X-trackers MSCI Pacific ex Japan	0.51%	7.38%	-11.30%	13.03%	-0.9509	4.2415	0.3472
Db X-trackers S&P 500	1.41%	8.17%	-10.52%	11.18%	-0.7111	5.2194	0.0000
Db X-trackers MSCI USA	1.40%	7.96%	-11.00%	11.42%	-0.8043	5.3956	0.0000
Db X-trackers MSCI World	1.05%	6.62%	-8.99%	10.57%	-0.6903	4.4380	0.0000
DNB Obx	0.55%	7.91%	-12.44%	12.93%	-0.7202	4.1280	0.4880
Seligson & Co Omx Helsinki 25	0.57%	8.74%	-15.88%	16.72%	-0.8852	4.4569	0.0013
Spotr Omxs 30	0.83%	9.18%	-14.51%	13.05%	-1.1363	6.4208	0.0000
XACT Norden 30	0.80%	8.43%	-14.08%	13.08%	-1.1793	5.8841	0.0000
XACT Obx	0.56%	7.88%	-12.65%	12.89%	-0.7714	4.2734	0.0075
XACT Omxs 30	0.63%	9.42%	-14.48%	13.61%	-1.0160	5.6338	0.0000
XACT Omxsb Div	0.42%	9.37%	-14.99%	14.29%	-0.9606	5.1079	0.0000

Table 1. Descriptive Statistics for ETFs.

Leveraged ETFs							
Fund name	Mean	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
Spotr BEAR Omxs 30	-0.09%	15.53%	-13.44%	38.22%	0.3149	7.3513	0.0000
Spotr BULL Omxs 30	0.09%	11.15%	-14.77%	38.00%	-0.4712	7.5883	0.0000
XACT BEAR	-0.05%	10.86%	-8.82%	28.54%	0.2904	6.2029	0.0000
XACT BEAR 2	-0.07%	15.07%	-11.98%	38.30%	0.3114	6.3847	0.0000
XACT BULL	0.05%	8.71%	-11.10%	28.66%	-0.2993	6.2689	0.0000
XACT BULL 2	0.07%	11.72%	-14.83%	38.23%	-0.3085	6.3002	0.0000
XACT Derivat BEAR	-0.05%	11.81%	-9.41%	35.40%	0.2338	5.9199	0.0000
XACT Derivat BULL	0.04%	8.80%	-12.64%	35.46%	-0.2570	6.0788	0.0000

Table 2. Descriptive Statistics for LETFs.

4.2 Logarithmic Return

Return on investment is a popular analysis when evaluating the performance of a security. A high rate of return is usually a good indication of the security's efficiency in generating profits over time. Nevertheless, investors are often troubled when choosing the appropriate approach to compute the return for a period. In the context of this research, the focus is on analyzing and comparing financial values across different securities, whose prices are generally not normally distributed, as noted in the previous part. According to Hudson and Gregoriou (2015), there are a few benefits when using logarithmic return to analyze financial models, including the ease in deriving time series properties of multi-period returns and the advantageous normally-distributed property of log return. Therefore, instead of using the arithmetic simple return, the logarithmic method will be used to compute ETF's return, compounded over a 5-year period.

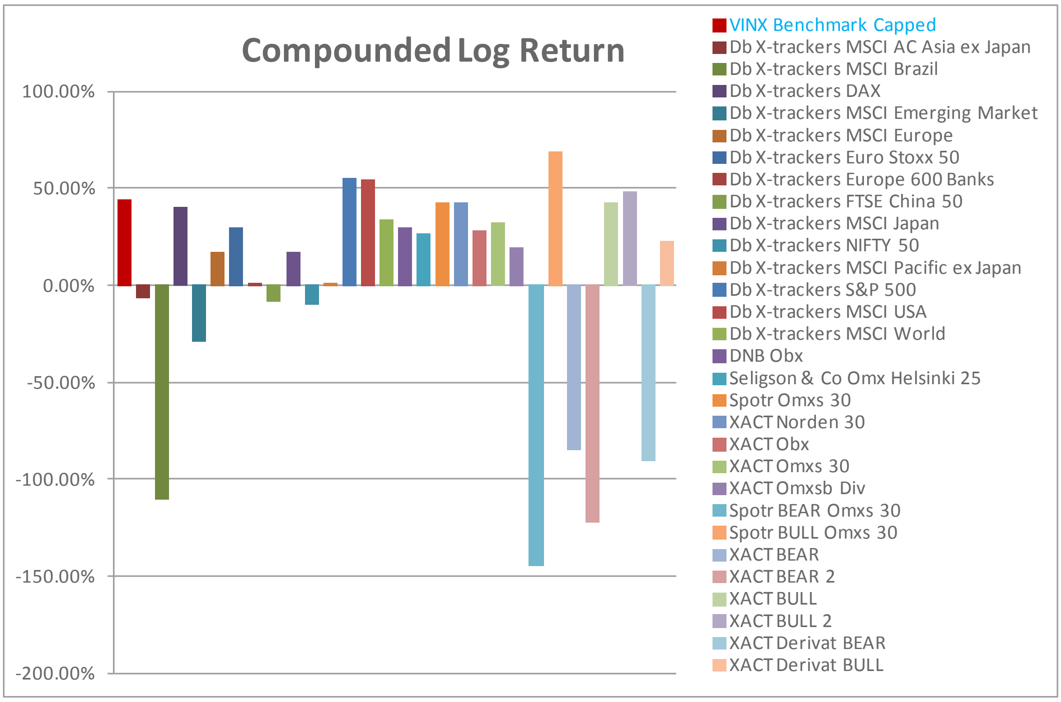

Figure 6. Compounded Log Return.

The result is demonstrated in Figure 6. When compared to the VINX Benchmark Cap index, which has a growth of 44.24%, only 4 funds were able to generate higher return, two of which use leverage to track doubly the return of OMX

Stockholm 30. At the same time, the inverse version of those LETFs also experienced the heaviest compounded loss, followed by db X-trackers MSCI Brazil. It is also worth noted that comparing to the mean return, 4 more ETFs produce negative return under the logarithmic approach.

4.3 Total Expense Ratio

The data for total expense ratio is summarized in Table 3 below. The ratio describes the annual cost associated with management and trading fees that investors have to bear. The ratio varies between funds with an average number of 0.45%. The fund charging the highest fee is db x-trackers NIFTY 50 at 0.85%, while the same provider also offers two funds with the lowest fees which track the DAX and Eurostoxx 50 indexes. According to Investment Company Institute (2015), the average expense ratio for mutual funds in 2014 is 0.7%, which can only be matched by 3 ETFs in this study.

Fund name	Total Expense Ratio	Fund name	Total Expense Ratio
Db X-trackers DAX	0.09%	DNB Obx	0.30%
Db X-trackers Euro Stoxx 50	0.09% (0% before 03/2014)	Seligson & Co Omx Helsinki 25	0.17%
		Spotr BEAR Omxs 30	0.50%
Db X-trackers Europe 600 Banks	0.30%	Spotr BULL Omxs 30	0.50%
Db X-trackers FTSE China 50	0.60%	Spotr Omxs 30	0.20%
Db X-trackers MSCI AC Asia ex Japan	0.65%	XACT BEAR	0.60%
Db X-trackers MSCI Brazil	0.65%	XACT BEAR 2	0.60%
Db X-trackers MSCI Emerging Market	0.65%	XACT BULL	0.60%
Db X-trackers MSCI Europe	0.30%	XACT BULL 2	0.60%
Db X-trackers MSCI Japan	0.50%	XACT Derivat BEAR	0.80%
Db X-trackers MSCI Pacific ex Japan	0.45%	XACT Derivat BULL	0.80%
Db X-trackers MSCI USA	0.30%	XACT Norden 30	0.40%
Db X-trackers MSCI World	0.45%	XACT Obx	0.30%
Db X-trackers NIFTY 50	0.85%	XACT Omxs 30	0.30%
Db X-trackers S&P 500	0.20%	XACT Omxsb Div	0.30%

Table 3. Total Expense Ratio.

4.4 Alpha Value

Using the equation adapted from the CAPM, we run a least squares regression on each ETF return against the underlying benchmark return using Eviews to extract the alpha, beta and r-squared values. In this case the fund's log return minus risk-free rate is the dependent variable and the benchmark's log return minus risk-free rate is the independent variable. For LETFs, the regression model was modified in which the benchmark return was multiplied with the according leverage factor to match with the amplified fund's return. In addition, a second regression was also performed where the corresponding total expense ratio (TER) was added to the ETF return for further analysis.

The result on the alpha values, which are annualized, is illustrated in the Figure 7, while the numerical values of alpha, beta and R-squared can be found in Appendix 3. It can be observed that the majority of funds have a negative alpha before adding TER. The first remarkable observation is that most LETFs have substantially negative alpha, which signifies a highly concerning underperformance against the indexes. In particular, inverse LETFs suffer much higher underperformance, with XACT BEAR 2 showing an extreme alpha value of -16.53%. At the same time, two XACT LETFs tracking the bullish side of Omxs Stockholm 30 show an unusually high alpha value, even when comparing to non-leveraged ETFs.

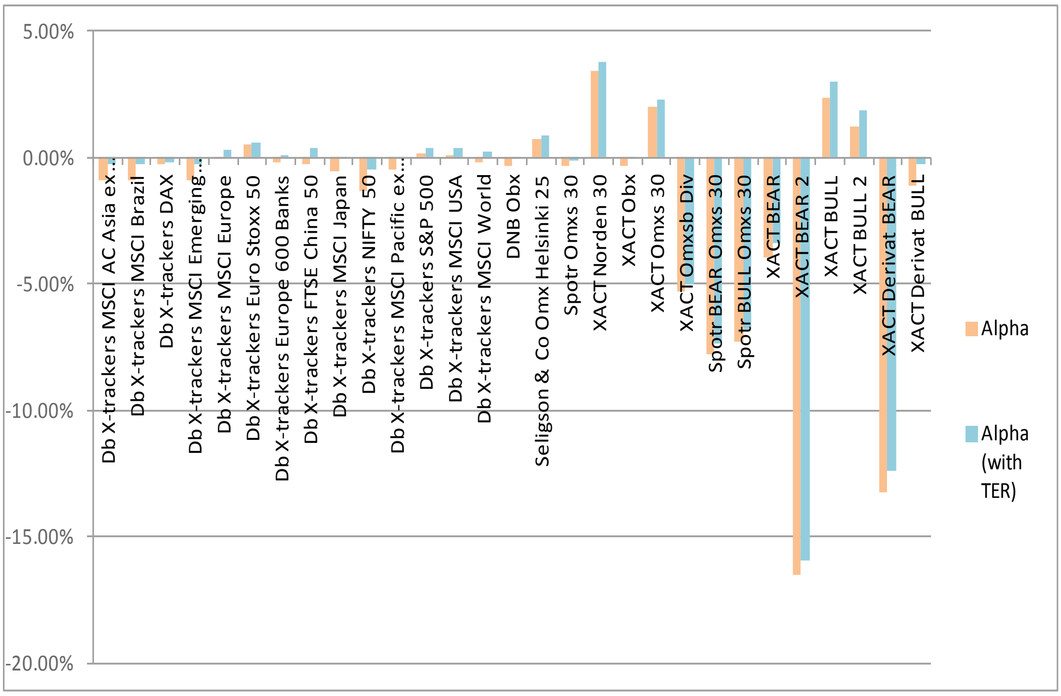

Figure 7. Alpha with and without total expense ratio.

Regarding non-leveraged ETFs, the highest alpha values are found in XACT Norden 30 and XACT Omxs 30 at 3.41% and 1.99% respectively, however, it should be noted that the r-squared values for XACT Norden 30 is noticeably lower than the average, which means that interpretation from the alpha of this fund is less reliable. On the other hand, among the negatively performed ETFs, XACT Omxsb, which is the only ETF in this sample that pays dividend, produced the lowest alpha value at -5.29% despite showing a fairly high compounded return previously. The impact of dividend to stock price is noted in Fontanills and Gentile (2003), where the share price intentionally drops once dividend is paid in order to prevent arbitrage from buying a share only to receive dividend. When tracing the data for this fund against the index, there is evidence that the fund always underperformed by a large degree in June, when dividend is paid out annually. Thus it can be assumed that the distribution of dividend is a contributing factor to the underperformance of the fund against the index.

4.5 Sharpe Ratio Value

The Sharpe ratio was calculated from the funds' time series, annualized by multiplying with $\sqrt{12}$ (ETFs) and $\sqrt{252}$ (LETFs) and illustrated in Figure 8. One distinctive observation is that the distribution of Sharpe values is highly correlated to the compounded log return, except when considering the leveraged ETFs. Both normal and inverse LEFTs show a closer spread from zero, which indicates that the high value of standard deviation has an impact on the risk-adjusted performance of these funds and makes LETFs less attractive under the Sharpe approach.

Since Sharpe ratio measures general risk without regard to the fund's specific index, the obtained values can be compared against that of the VINX Benchmark Cap index. The average Sharpe ratio is 0.26 for non-leveraged ETFs and -0.19 for LETFs. A total of 5 funds were able to outperform the Benchmark index with ratios higher than 0.61. The best funds were two ETFs offered by db x-trackers which track the S&P 500 and MSCI USA indexes, both have a Sharpe ratio higher than 1.00. The worst performing fund is db x-trackers MSCI Brazil with a value of -1.01. Excluding the inverse LETFs, there were 7 funds experiencing negative

Sharpe ratio, which means that these funds underperformed the risk-free assets. When tracing the Sharpe ratio against the standard deviation and mean return, we found an interesting fact that the top 3 performing ETFs also show the lowest standard deviation and highest return.

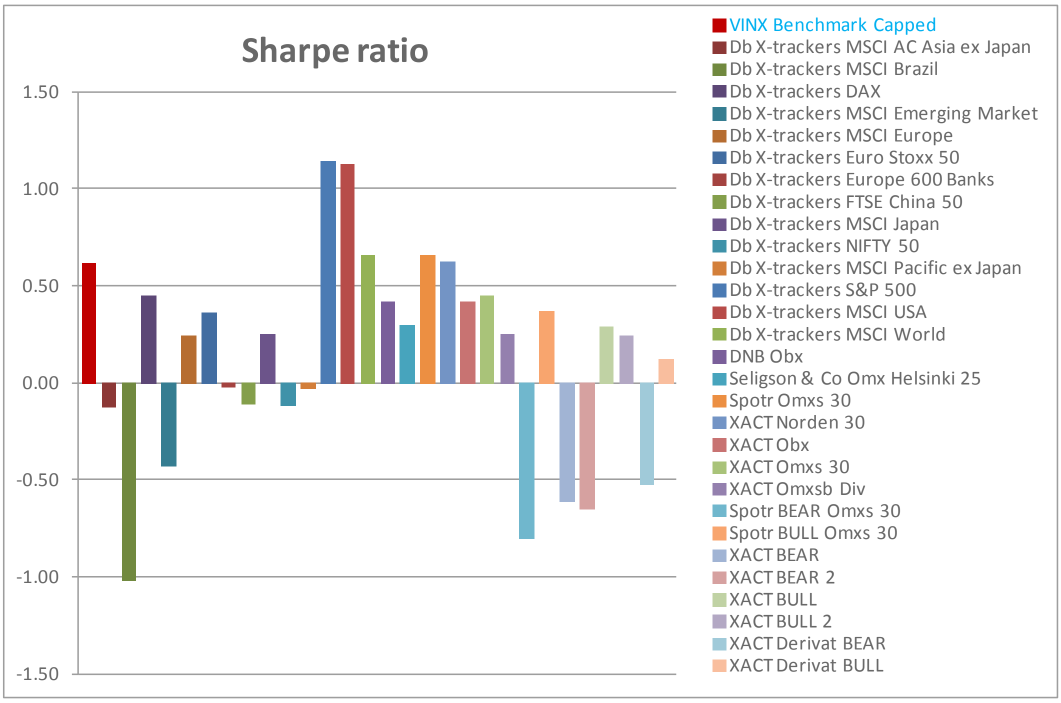

Figure 8. Sharpe ratio.

4.6 Tracking Error

During the period specified in this research, many ETFs issued by db x-trackers were announced a change in replication method, e.g. switching from synthetic replication to physical replication. Therefore, the data series were manipulated when computing tracking error for the purpose of hypothesis testing between synthetic and physical ETFs. For instance, the ETFs which saw a switch were divided into two separated series; each represents a distinctive replication method. The date of switching can be found in Appendix 1.

Technically, tracking error is the standard deviation of the difference between ETF's return and benchmark's return; hence the annualizing of the results followed the same manner when computing individual ETF's standard deviation.

The result is illustrated in Figure 9 for leveraged ETFs and Figure 10 for non-leveraged ETFs. The distinction between synthetic and physical ETFs is marked by different color. For LETFs, the tracking error for 1-year period, starting from January 2015 until December 2015 is also included besides the 5-year period. It should be noted that the formula used to calculate tracking error for LETFs was modified through multiplying the index return with the corresponding leverage ratio.

The first remark from the results is that LETFs have significantly larger tracking error, which is 9.04% on average. This result is consistent with previous studies, which stated that the use of leverage in ETF greatly affects the precision in tracking the promised return. Among the analyzed LETFs, the BULL and BEAR version of SpotR Omxs 30 suffer greatly from tracking error, while two LETFs with a less aggressive leverage multiplier (XACT BULL and BEAR) have the lowest tracking error. The 1-year tracking error is more prominent than the 5-year measure in 4 LETFs, while the remaining 4 funds produce greater error during the longer time range.

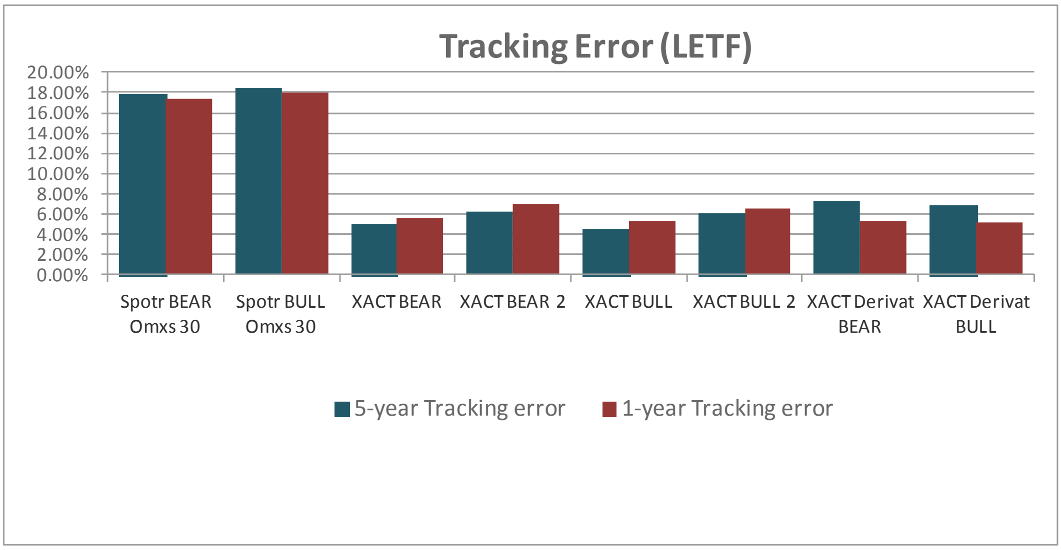

Figure 9. Tracking Error of leveraged ETFs.

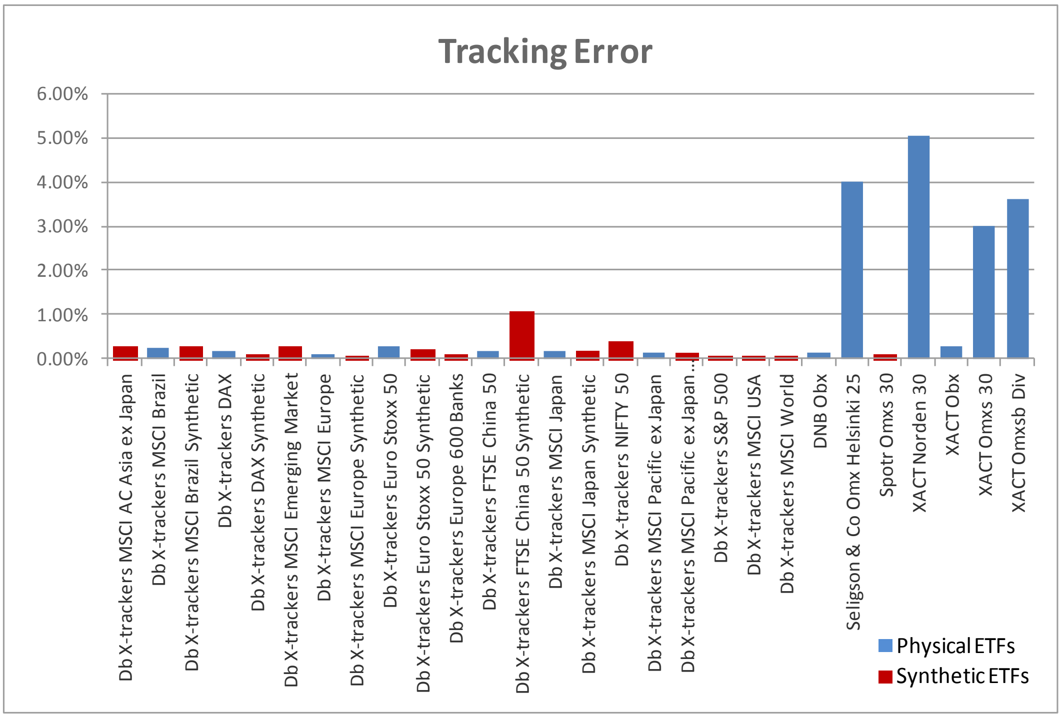

Figure 10. Tracking Error of non-leveraged ETFs.

Regarding the non-leveraged ETFs, tracking error is kept below 1.00% for most funds. The average value is 0.74%, with 4 funds showing an anomaly by exceeding the 3.00% level, which is a great deviation from the sample mean. An extreme case is found in XACT Norden 30 where the tracking error is even greater than two LETFs, calculated at 5.06%.

4.7 Pricing Efficiency

The pricing efficiency of ETF is calculated from the daily difference in percentage between ETF's closing price and Net Asset Value (NAV) announced at the end of the trading day. A positive value indicates that the ETF tend to trade at premium above the true fund value and vice versa. Since ETF has an effective mechanism of creation and redemption, the deviation of market price from NAV is expected to be close to zero. While ETF's performance and risk are analyzed and published using the NAV data, investors can only interact with the market price. Therefore from the investor point of view, analysis of a fund is considered less useful when there exists a large and persistent discrepancy between market price and NAV.

As illustrated in Figure 11, Nordic ETFs tend to trade close to their NAV at premium, with an average deviation of 0.04%. The fund which deviates farthest from zero is db x-trackers Europe 600 Banks at 0.71%. It is remarkable that many funds offered by db x-trackers, the only issuer whose location is outside a Nordic country, tend to trade at a large discount or premium.

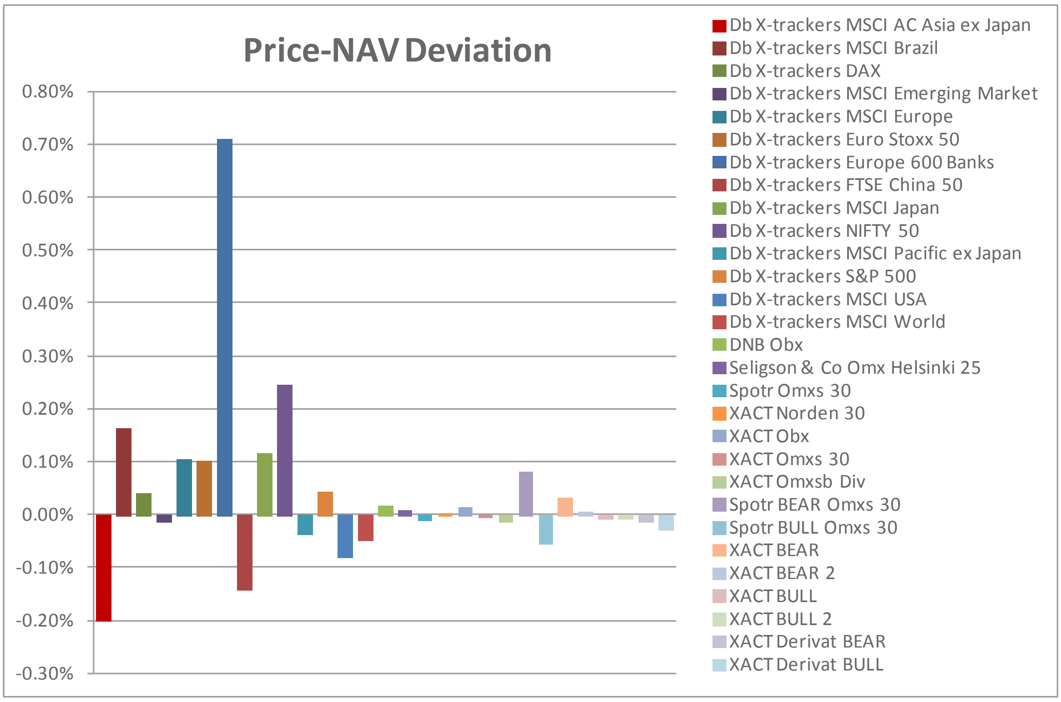

Figure 11. Price-NAV Deviation.

5. ANALYSIS

The purpose of this section is to provide analysis on the quantitative findings. The analysis will address the problems stated at the beginning of this thesis by conducting a number of different hypothesis testing.

5.1 Testing the Abnormal Return

The ETFs included in this research employ a passive investment strategy, as opposed to active ETFs where the fund manager purposefully selects components to be included in the fund. Since the goal of passively-managed ETF is to provide investor the opportunity to earn the index' return, excess return is usually not an objective for fund managers. The implication is that, if an ETF is run efficiently, abnormal return versus the index should be absent, which in turn means that the alpha value should approach zero. However, since expenses and fees are accrued daily and taken into account when determining NAV, the alpha value is expected to be lower than zero by the amount of total expense ratio (TER).

Two hypotheses were formed, each testing constant value (alpha) of the regression for each fund with and without the total expense ratio added. The hypotheses are expressed as followed:

H-1 Alpha value equals zero

H_0: $\mu_{alpha} = 0$

H_1: $\mu_{alpha} \neq 0$ (where μ_{alpha} is the mean of all observed alpha values of one fund)

And:

H-2 Alpha value before total expense ratio equals zero

H_0: $\mu_{alpha} = 0$

H_1: $\mu_{alpha} \neq 0$ (where μ_{alpha} is the mean of all observed alpha values of one fund when TER is concerned)

The testing at 95% confidence level was performed in Eviews and results for t-values and p-values are summarized in Appendix 3. Individually, there were only

5 ETFs and 4 LETFs showing a p-value larger than 0.05, which means that for the majority of funds, the null hypothesis (H_0) can be rejected and there are abnormal returns, both positively and negatively.

For the funds that have a negative alpha, a similar test for the second hypothesis was conducted to determine if the new alpha would approach zero when adding TER into the equation. Looking at the result, the p-value raised above 0.05 in only 3 ETFs which previously showed abnormal negative return. The assumption is that in many funds, fees and expenses cannot explain the negative alpha, which could be caused by other factors.

In addition to the tests on each single fund, a group test for non-leveraged ETFs was also conducted on the sample mean. The sample consists of 19 ETFs, from which 2 disqualified funds have been excluded. XACT Norden 30 was not selected because of the low r-squared value, and XACT Omxsb was omitted due to the impact of dividend payment on alpha value. The result is collected in Table 4 and Table 5.

Test of Hypothesis: Mean = 0.000000

Sample size: 19
Sample Mean = -0.001857
Sample Std. Dev. = 0.007210

Method	*Value*	*Probability*
t-statistic	*-1.122968*	*0.2762*

Table 4. Group alpha test without TER.

Test of Hypothesis: Mean = 0.000000

Sample size: 19
Sample Mean = 0.002011
Sample Std. Dev. = 0.006071

Method	*Value*	*Probability*
t-statistic	*1.443739*	*0.1660*

Table 5. Group alpha test with TER.

For a confidence level of 95%, the p-value in both tests is higher than 0.05. Therefore the null hypothesis cannot be rejected. It can be concluded that collectively, ETFs traded in the Nordic market have not produced statistically significant abnormal return against the underlying indexes. Furthermore, management fees and other expenses also contribute little to the performance of funds' alpha.

5.2 Testing the Performance of Leveraged ETFs

While LETF is known as an effective instrument for short-term traders who wish to cash in on quick market movements, it is interesting to investigate its long-term performance relative to the traditional ETF product. To achieve that purpose, we conducted a one-tailed two-sample t-test on the equality of means between the Sharpe ratio of selected ETFs and LETFs. To increase the relevance of the comparison, the two samples should have a common objective, e.g. tracking the similar indexes. Hence, the ETF sample (Sample 1) consists of 4 funds tracking the OMX Stockholm 30 and OBX index. The LETF sample (Sample 2) also consists of 4 funds tracking the same indexes with leverage higher than 100%, which means that inverse LETFs were left out. The formulation of hypothesis is as followed:

H-3 Leveraged ETFs have lower Sharpe ratio than non-leveraged ETFs

H_0: $\mu_{etf} \leq \mu_{letf}$

H_1: $\mu_{etf} > \mu_{letf}$ (where μ_{etf} is the mean of Sample 1 population and μ_{letf} is the mean of Sample 2 population.)

The test was performed with the help of Eviews and the result is shown in Table 6. Firstly, the p-value is lower than 0.05, thus it can be stated that there is a significant difference between the means of two samples. The one-tailed critical t-value for a 6 degree of freedom and 95% confidence interval is 1.9432, which is obtained from the t-value table. Since the observed t-value is higher than the critical t-value, the null hypothesis (H_0) can be rejected. It can be concluded that ETFs have a significantly better Sharpe ratio compared to LETFs tracking the same index.

Test of Hypothesis: Difference of Means = 0.00000

	Size	*Mean*	*Std. Dev.*
Sample 1	*4*	*0.483321*	*0.113515*
Sample 2	*4*	*0.254967*	*0.105893*

Method	*Value*	*Probability*
t-statistic	*2.941987*	*0.0259*

Comparison with critical value of t with degree of freedom = 6 and 95% confidence interval

$t_{critical} = 1.9432 < 2.941987$

Table 6. Sharpe test.

To further investigate the characteristics of LETFs, another test was conducted to address a commonly cited problem regarding the ability of LETF in tracking the index during different time frames. The test is designed to confirm the difference between the mean tracking error during 5-year period and 1-year period. If LETF's tracking error worsen in the long run, there should be a significant difference. The sample for this test is all the LETFs concerned in this study, divided into 2 testing samples (Sample 1 refers to 1-year tracking error and Sample 2 refers to 5-year tracking error). The hypothesis is stated as followed:

H-4 Leveraged ETFs tracking error persists over different time horizons

H_0: $\mu_{1year} = \mu_{5year}$

H_1: $\mu_{1year} \neq \mu_{5year}$ (where μ_{1year} is the mean of Sample 1 population and μ_{5year} is the mean of Sample 2 population.)

The result is presented in Table 7. The observed p-value is 0.9869, which is significantly higher than 0.05 for a 95% confidence level. The null hypothesis H_0, thus, cannot be rejected. We conclude that for LETFs, there is no difference in tracking error between a long-term period and a short-term period.

Test of Hypothesis: Difference of Means = 0.00000			
	Size	*Mean*	*Std. Dev.*
Sample 1	*8*	*0.355147*	*0.199608*
Sample 2	*8*	*0.356823*	*0.201964*
Method	*Value*	*Probability*	
t-statistic	*-0.016697*	*0.9869*	

Table 7. Tracking error (LETFs) test.

5.3 Testing the Characteristics of Synthetic ETFs

The Nordic ETF market is made up of both physical and synthetic ETFs. Due to the strikingly difference in replication methodology, the two groups are expected to have different characteristics. The swap-based mechanism transfers the responsibility of maintaining the index's return onto the swap-party; and under the condition that the swap contract is being honored, synthetic ETFs should be more precise at tracking the index and thus, tracking error should be lower compared to physical ETFs. Based on that assumption, we conducted a one-tailed two-sample t-test to analyze if there is any difference in tracking error between two replication methods. Sample 1 consists of 15 synthetic ETFs and Sample 2 consists of 13 physical ETFs. It should be noted that some db x-trackers ETFs were included in both samples due to changes in replication method. No LETF was included in the test. The hypothesis is formulated as followed:

H-5 Synthetic ETFs have lower tracking error than Physical ETFs

H_0: $\mu_{syn} \leq \mu_{phy}$

H_1: $\mu_{syn} > \mu_{phy}$ (where μ_{syn} refers to the mean of Sample 1 population and μ_{phy} refers to the mean of Sample 2 population.)

The test result is presented in Table 8. Through testing at 95% confidence interval, the p-value is 0.0277, which is lower than 0.05 and signals the difference in mean values between two samples. For one-tailed test, the critical t-statistic value extracted from the t-value table is 1.7056. We found that the observed t-value is negative and less than the critical t-value, which means that the null hypothesis (H_0) cannot be rejected. It is therefore concluded that synthetic ETFs have a lower tracking error compared to physical ETFs.

Test of Hypothesis: Difference of Means = 0.00000

	Size	*Mean*	*Std. Dev.*
Sample 1	*15*	*0.002261*	*0.002579*
Sample 2	*13*	*0.013416*	*0.018374*

Method	*Value*	*Probability*
t-statistic	*-2.331789*	*0.0277*

Comparison with critical value of t with degree of freedom = 26 and 95% confidence interval

$t_{critical} = 1.7056 > -2.3318$

Table 8. Tracking error (Synthetic ETF versus Physical ETF) test.

Having lower tracking error is an advantage for synthetic ETFs; however, investors at times are still cautious with the counter-party risk that comes along. In order to mitigate this downside effect, synthetic ETFs have been known for charging lower management fees to attract investors. Therefore, the next hypothesis is constructed to test the difference in total expense ratio (TER), of which management fee is a major component, between synthetic and physical ETFs. The samples from previous hypothesis test were re-used, this time considering TER instead of tracking error. The hypothesis formulation is as followed:

H-6 Synthetic ETFs have lower total expense ratio than Physical ETFs

H_0: $\mu_{syn} \leq \mu_{phy}$

H_1: $\mu_{syn} > \mu_{phy}$ (where μ_{syn} refers to the mean of Sample 1 population and μ_{phy} refers to the mean of Sample 2 population.)

Using 95% confidence interval, the p-value was found to be 0.3905, higher than 0.05. Therefore, we do not reject the null hypothesis (H_0) and conclude that there is no significant difference in TER between synthetic and physical replication. The implication is that synthetic ETFs do not offer more attractive expense saving to compensate for its counter-party risk.

Test of Hypothesis: Difference of Means = 0.00000

	Size	*Mean*	*Std. Dev.*
Sample 1	*15*	*0.004127*	*0.002403*
Sample 2	*13*	*0.003423*	*0.001748*

Method	*Value*	*Probability*
t-statistic	*0.873230*	*0.3905*

Comparison with critical value of t with degree of freedom = 26 and 95% confidence interval

$t_{critical} = 1.7056 > 0.8732$

Table 9. Total Expense Ratio test.

5.4 Testing the Cause of Market Price Deviation

For every ETF, a number of Authorized Participants (AP) is given permission to initialize the creation and redemption process to keep the market price close to Net Asset Value (NAV). However, the AP can only do so if they are able to trade the funds' underlying securities. In an illiquid market where counter parties to the trade is hard to find, the AP might not be able to take advantage of the arbitrage mechanism. Therefore we hypothesized that liquidity is a major reason causing substantial price deviation. To test the hypothesis, we conducted a two-sample t-test comparing the mean of price deviation between illiquid funds and high-liquid funds. The sample consists of all 29 ETFs in this study, divided into two testing samples. Sample 1 includes the funds with average trade volume lower than 50000, and Sample 2 absorbs the remaining funds. It is important to note that the price deviation data are converted into absolute number, since we only want to investigate the distance from zero and not the direction. The hypothesis formulation is:

H-7 ETFs liquidity affects Price - Net Asset Value deviation

H_0: $\mu_{low} \leq \mu_{high}$

H_1: $\mu_{low} > \mu_{high}$ (where μ_{low} refers to the mean of Sample 1 population and μ_{high} refers to the mean of Sample 2 population.)

Table 10 summarizes the result from the test. The equality of means can be rejected as p-value is lower than 0.05 for 95% confidence interval. Further testing the t-value against the critical t-value showed that the null hypothesis (H_0) can be rejected with significance. We conclude that liquidity affects the market price deviation from NAV and that illiquid funds have higher degree of deviation.

Test of Hypothesis: Difference of Means = 0.00000

	Size	*Mean*	*Std. Dev.*
Sample 1	*15*	*0.001364*	*0.001731*
Sample 2	*14*	*0.000195*	*0.000224*

Method	*Value*	*Probability*
t-statistic	*2.504165*	*0.0186*

Comparison with critical value of t with degree of freedom = 27 and 95% confidence interval

$t_{critical} = 1.7033 < 2.5041$

Table 10. Price deviation test.

5.5 Regression Analysis on Sharpe Ratio

In addition to the above analyses, we were also interested in finding possible relationship between the Sharpe ratio of non-leveraged ETFs and other variables. To accomplish that purpose, we chose to use the least squares method on a cross sectional regression. Specifically, we constructed a table of data which includes many different variables attributed to each of the 21 ETFs. The dependent variable is Sharpe ratio, while other independent variables are the fund’s age, size, equity style and total expense ratio. The collected data on these variables can be found in Appendix 1.

Dependent Variable: Sharpe_ratio
Method: Least Squares
Observations: 21

Variable	*Coefficient*	*t-Statistic*	*Probability*
C	*1.139609*	*2.048407*	*0.0573*
AGE	*-0.027164*	*-0.716290*	*0.4841*
SIZE	*-2.13E-05*	*-0.292770*	*0.7735*
STYLE	*0.022881*	*0.151030*	*0.8818*
TER	*-165.3004*	*-3.115384*	*0.0067*

R-squared	*0.431816*
Adjusted R-squared	*0.289770*
S.E. of regression	*0.410687*
F-statistic	*3.039976*
Prob(F-statistic)	*0.048385*

Table 11. Sharpe regression.

The regression was performed in Eviews and the results are summarized in Table 11. Without regard to the constant variable (C), it can be observed that only one variable (TER), which represents total expense ratio, has a p-value lower than 0.05. In this test, the p-value can be interpreted as the probability that the coefficient between the dependent variable and the independent variable equals zero. Since p-value is significantly small, we can conclude that a change in total TER will highly influence the Sharpe ratio. Furthermore, a negative coefficient means that ETFs with smaller TER tend to have a higher Sharpe ratio.

Regarding other tested variables, we can conclude from their high p-values that age, size and equity styles do not influence the Sharpe performance of an ETF.

6. CONCLUSION

The objective of this research is to investigate the performance of Exchange-Traded Funds (ETFs) in the Nordic market, focusing on the group tracking equity market indexes. The collected data has a range of five years and represents a total of 29 funds to be included in this research. The Nordic ETF market, despite the small size and quantity, maintains a rather diverse structure. The studied population can be divided by different variables, for instance by the use of leverage or by the distinctive synthetic/physical replication method. The research questions, therefore, were extended to include the exploration of these variables through the use of quantitative techniques.

The research analysis followed the quantitative approach, using the processed and calculated performance and risk measurements to formulate hypotheses and conduct quantitative testing, in order to answer the stated problems.

The first research question concerns the relative performance of ETFs to that of the underlying benchmark index. To answer this question, calculation and analysis based on the CAPM model were performed to test if ETFs traded in the Nordic region exhibit abnormal return, and whether or not fees and expenses is the major influence of such deviation. The result points out that, individually, many ETFs tend to produce, both negatively and positively, abnormal returns which cannot be explained by fees and expenses. On the other hand, the collective result claims that ETFs' return do not show a significant divergence from the benchmark return. Due to the difference, the group conclusion should be considered with caution, and one can only claim that the Nordic ETF market is still a high risk market with high fluctuation among the performance of funds.

The second research question aims to compare the two replication methods used in the operation of ETFs. The conceptual difference between synthetic and physical ETFs presents a choice for both fund manager and investor. Synthetic ETFs take advantage of the swap mechanism, which seems to benefit fund managers but put investors at a higher risk, therefore some form of compensation is expected. The result from our analysis suggests that while tracking error is statistically lower in synthetic ETFs, there is no difference in total expense ratio compared to physical ETFs, which means that it is not cheaper to invest in synthetic ETFs. Whether the lower risk of deviation from the benchmark index can outweigh the risk of default by counter-party is however subjective to each investor's risk profile.

The third research question investigates the unique derivative form of ETF, which is leverage ETF (LETF). Based on previous researches that claimed the long-term viability of LETFs, we proceeded testing the Sharpe ratio of selected LETFs against the equivalent ETFs tracking the same indexes. The result points out a significant underperforming of LETFs compared to ETFs. Our interpretation is that LETF in Nordic exchanges is not an optimal long-term investment. Further testing LETF's tracking error over 1-year and 5-year period shows that there is a consistency of tracking error independent of the holding period. This finding also consolidates the claim that Nordic LETFs is only suitable for short-term trading.

In addition to the main research questions, two correlation tests were also performed to investigate the cause of market price deviation from NAV and which variables influence the Sharpe ratio value. For the first test, our result confirms that liquidity is highly correlated to price deviation and analysis will be less useful to investors when considering funds with a low trade volume. For the second regression test, it was found that total expense ratio has a significant correlation to Sharpe ratio and that funds with lower management expenses have a better risk-adjusted performance.

7. DISCUSSION

Exchange-traded fund (ETF) is a relatively young financial derivative in the Nordic region. The oldest fund in this research's sample population was only founded in 2000. The areas for development are therefore abundant and filled with potential, considering the speed of global growth. During the period of writing this thesis, there was an impression that the ETF market in the Nordic region has not been fully appreciated. Out of the top five ETF providers by market share in Europe (Morningstar Manager Research, 2014), only db X-trackers lists its share on a Nordic stock exchange. Nevertheless, these db X-trackers ETFs are mostly illiquid and suffer from market price deviation from NAV, while other ETFs tracking the domestic indexes all have significantly higher trade volume. It would be interesting to do a research on the perception and demand of Nordic investors regarding ETF products.

The research design of this thesis is purely quantitative, using available data to interpret results. The disadvantage of this approach is that there is no newly generated data. The results obtained from the research also cannot reflect the qualitative characteristics of the funds, for instance the structure, philosophy and other differentiation factors. It is therefore also suggested that future research pays more attention to these variables, in order to gain a more complete understanding of the market.

Regarding the quantitative quality, since the aim of this thesis is to give an overview analyzing of the market, the depth of each analysis might not be satisfied. Future researches are encouraged to focus on more specific problems, for instance one dependent variable can be tested against more independent variables to find possible correlation.

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APPENDIX 1

Fund name	Issuer	Inception Date	Leverage	Replication method	Equity Style	Fund size (Mil. USD)	Daily Average Volume
Db X-trackers DAX	db X-trackers	01/2007	100%	Synthetic until 05/02/2014	Large Cap Blend	4720.23	2933
Db X-trackers Euro Stoxx 50	db X-trackers	08/2008	100%	Synthetic until 17/03/2014	Large Cap Value	5624.44	4306
Db X-trackers Europe 600 Banks	db X-trackers	06/2007	100%	Synthetic	Large Cap Value	167.16	2060
Db X-trackers FTSE China 50	db X-trackers	06/2007	100%	Synthetic until 25/09/2014	Large Cap Value	225.98	4018
Db X-trackers MSCI AC Asia ex Japan	db X-trackers	01/2009	100%	Synthetic	Large Cap Blend	645.84	3858
Db X-trackers MSCI Brazil	db X-trackers	06/2007	100%	Synthetic until 03/09/2014	Large Cap Value	84.32	3612
Db X-trackers MSCI Emerging Market	db X-trackers	06/2007	100%	Synthetic	Large Cap Blend	1574.83	3215
Db X-trackers MSCI Europe	db X-trackers	01/2007	100%	Synthetic until 04/03/2014	Large Cap Blend	3180.74	3111
Db X-trackers MSCI Japan	db X-trackers	01/2007	100%	Synthetic until 07/10/2014	Large Cap Blend	1977.43	5250
Db X-trackers MSCI Pacific ex Japan	db X-trackers	01/2009	100%	Synthetic until 18/09/2014	Large Cap Blend	482.27	2496
Db X-trackers MSCI USA	db X-trackers	01/2007	100%	Synthetic	Large Cap Blend	1948.66	4264
Db X-trackers MSCI World	db X-trackers	04/2010	100%	Synthetic	Large Cap Blend	2209.32	10811
Db X-trackers NIFTY 50	db X-trackers	07/2007	100%	Synthetic	Large Cap Growth	231.28	835
Db X-trackers S&P 500	db X-trackers	03/2010	100%	Synthetic	Large Cap Blend	2427.29	5029
DNB Obx	DNB ASA	03/2005	100%	Physical	Large Cap Value	127.91	131409
Seligson & Co Omx Helsinki 25	Seligson & Co	02/2002	100%	Physical	Large Cap Value	187.49	36703
Spotr BEAR Omxs 30	SpotR	03/2011	-200%	Synthetic		3.85	113115
Spotr BULL Omxs 30	SpotR	03/2011	200%	Synthetic		8.85	70744
Spotr Omxs 30	SpotR	03/2011	100%	Synthetic	Large Cap Value	35.47	195134
XACT BEAR	Xact	02/2005	-150%	Physical		86.36	1593965
XACT BEAR 2	Xact	11/2009	-200%	Physical		87.09	799493
XACT BULL	Xact	02/2005	150%	Physical		46.87	260726
XACT BULL 2	Xact	11/2009	200%	Physical		102.47	395993
XACT Derivat BEAR	Handelsbanken	01/2008	-200%	Physical		77.7	635055
XACT Derivat BULL	Handelsbanken	01/2008	200%	Physical		66.85	1074450
XACT Norden 30	Xact	05/2006	100%	Physical	Large Cap Growth	82.28	166137
XACT Obx	Handelsbanken	04/2005	100%	Physical	Large Cap Value	157.52	94106
XACT Omxs 30	Xact	10/2000	100%	Physical	Large Cap Value	977.36	1029121
XACT Omxsb Div	Xact	06/2003	100%	Physical	Large Cap Blend	295.56	69043

APPENDIX 2

Market Index	
DAX Gross Total Return	MSCI USA Net Total Return
Eurostoxx 50 Net Total Return	MSCI World Net Total Return
STOXX® Europe 600 Banks Net Total Return	CNX Nifty Net Total Return
FTSE China 50 Net Total Return	S&P 500 Net Total Return
MSCI AC Asia ex Japan Net Total Return	OBX
MSCI Brazil Net Total Return	Omx Helsinki 25
MSCI Emerging Market Net Total Return	OMX Stockholm Gross 30
MSCI Europe Net Total Return	OMX Stockholm 30
MSCI Japan Net Total Return	VINX30
MSCI Pacific ex Japan Net Total Return	OMX Stockholm Benchmark Gross

APPENDIX 3

Fund name	CAPM Test			CAPM Test with TER			R-squared	Beta
	Alpha	t-stats	p-value	Alpha	t-stats	p-value		
Db X-trackers MSCI AC Asia ex Japan	-0.90%	-70.7193	0.0000	-0.25%	-19.7109	0.0000	1.0000	1.00
Db X-trackers MSCI Brazil	-0.90%	-23.2681	0.0000	-0.25%	-6.3877	0.0000	1.0000	1.00
Db X-trackers DAX	-0.27%	-5.2590	0.0000	-0.18%	-3.4764	0.0010	1.0000	1.00
Db X-trackers MSCI Emerging Market	-0.91%	-63.6921	0.0000	-0.26%	-18.2367	0.0000	1.0000	1.00
Db X-trackers MSCI Europe	-0.01%	-0.2801	0.7804	0.29%	6.4913	0.0000	0.9999	1.00
Db X-trackers Euro Stoxx 50	0.48%	5.6851	0.0000	0.57%	6.7470	0.0000	0.9999	1.00
Db X-trackers Europe 600 Banks	-0.19%	-6.3390	0.0000	0.11%	3.5028	0.0009	1.0000	1.00
Db X-trackers FTSE China 50	-0.26%	-0.6108	0.5438	0.34%	0.8070	0.4230	0.9976	1.00
Db X-trackers MSCI Japan	-0.54%	-21.1511	0.0000	-0.04%	-1.5747	0.1209	1.0000	1.00
Db X-trackers NIFTY 50	-1.31%	-24.7558	0.0000	-0.46%	-8.6789	0.0000	1.0000	1.00
Db X-trackers MSCI Pacific ex Japan	-0.49%	-24.8226	0.0000	-0.04%	-2.0726	0.0427	1.0000	1.00
Db X-trackers S&P 500	0.17%	8.5599	0.0000	0.37%	18.5375	0.0000	1.0000	1.00
Db X-trackers MSCI USA	0.08%	2.6623	0.0101	0.38%	12.6023	0.0000	1.0000	1.00
Db X-trackers MSCI World	-0.19%	-12.1427	0.0000	0.26%	16.7218	0.0000	1.0000	1.00
DNB Obx	-0.36%	-8.5361	0.0000	-0.06%	-1.4519	0.1520	1.0000	1.00
Seligson & Co Omx Helsinki 25	0.72%	0.3967	0.6931	0.89%	0.4901	0.6259	0.9461	1.01
Spotr Omxs 30	-0.30%	-95.8669	0.0000	-0.10%	-32.2638	0.0000	1.0000	1.00
XACT Norden 30	3.41%	1.5854	0.1184	3.81%	1.7713	0.0819	0.8760	0.88
XACT Obx	-0.35%	-2.7758	0.0074	-0.05%	-0.3951	0.6942	0.9996	1.00
XACT Omxs 30	1.99%	1.4873	0.1424	2.29%	1.7110	0.0925	0.9552	1.01
XACT Omxsb Div	-5.29%	-3.5219	0.0009	-4.99%	-3.3223	0.0016	0.9505	1.05
Spotr BEAR Omxs 30	-7.81%	-4.5506	0.0000	-7.33%	-4.2597	0.0000	0.9908	1.01
Spotr BULL Omxs 30	-7.28%	-4.8194	0.0000	-6.80%	-4.4889	0.0000	0.9929	0.99
XACT BEAR	-3.96%	-3.912988	0.0001	-3.35%	-3.3178	0.0009	0.9967	1.33
XACT BEAR 2	-16.53%	-6.0413	0.0000	-15.93%	-5.8219	0.0000	0.9749	0.97
XACT BULL	2.38%	1.1946	0.2325	2.97%	1.4956	0.1350	0.9780	1.00
XACT BULL 2	1.24%	0.4669	0.6406	1.84%	0.6921	0.4890	0.9779	1.00
XACT Derivat BEAR	-13.23%	-0.8823	0.3778	-12.42%	-0.8289	0.4073	0.9673	0.91
XACT Derivat BULL	-1.09%	-0.0724	0.9423	-0.29%	-0.0195	0.9845	0.9702	0.92

APPENDIX 4

Fund name	Log return	Sharpe ratio
VINX Benchmark Capped	44.24%	0.61
Db X-trackers MSCI AC Asia ex Japan	-6.32%	-0.12
Db X-trackers MSCI Brazil	-109.57%	-1.01
Db X-trackers DAX	40.31%	0.45
Db X-trackers MSCI Emerging Market	-28.71%	-0.42
Db X-trackers MSCI Europe	17.18%	0.24
Db X-trackers Euro Stoxx 50	30.08%	0.36
Db X-trackers Europe 600 Banks	0.60%	-0.01
Db X-trackers FTSE China 50	-7.75%	-0.10
Db X-trackers MSCI Japan	17.21%	0.25
Db X-trackers NIFTY 50	-8.95%	-0.11
Db X-trackers MSCI Pacific ex Japan	0.15%	-0.02
Db X-trackers S&P 500	55.20%	1.14
Db X-trackers MSCI USA	54.55%	1.13
Db X-trackers MSCI World	34.22%	0.65
DNB Obx	29.68%	0.42
Seligson & Co Omx Helsinki 25	26.37%	0.29
Spotr Omxs 30	42.99%	0.65
XACT Norden 30	42.64%	0.63
XACT Obx	28.45%	0.42
XACT Omxs 30	32.20%	0.45
XACT Omxsb Div	19.41%	0.25
Spotr BEAR Omxs 30	-143.92%	-0.80
Spotr BULL Omxs 30	69.02%	0.37
XACT BEAR	-84.55%	-0.61
XACT BEAR 2	-121.38%	-0.65
XACT BULL	43.04%	0.29
XACT BULL 2	48.07%	0.24
XACT Derivat BEAR	-89.55%	-0.52
XACT Derivat BULL	22.39%	0.12

APPENDIX 5

Non-leveraged ETF			
Fund name	5-year Tracking error	Physical period	Synthetic period
Db X-trackers MSCI AC Asia ex Japan	0.27%		
Db X-trackers MSCI Brazil	0.26%	0.24%	0.28%
Db X-trackers DAX	0.14%	0.17%	0.11%
Db X-trackers MSCI Emerging Market	0.27%		
Db X-trackers MSCI Europe	0.10%	0.12%	0.08%
Db X-trackers Euro Stoxx 50	0.25%	0.29%	0.20%
Db X-trackers Europe 600 Banks	0.09%		
Db X-trackers FTSE China 50	0.64%	0.19%	1.08%
Db X-trackers MSCI Japan	0.18%	0.19%	0.16%
Db X-trackers NIFTY 50	0.40%		
Db X-trackers MSCI Pacific ex Japan	0.15%	0.14%	0.15%
Db X-trackers S&P 500	0.06%		
Db X-trackers MSCI USA	0.07%		
Db X-trackers MSCI World	0.06%		
DNB Obx	0.15%		
Seligson & Co Omx Helsinki 25	4.00%		
Spotr Omxs 30	0.09%		
XACT Norden 30	5.06%		
XACT Obx	0.30%		
XACT Omxs 30	3.00%		
XACT Omxsb Div	3.61%		

Leveraged ETF		
Fund name	5-year Tracking error	1-year Tracking error
Spotr BEAR Omxs 30	17.83%	17.33%
Spotr BULL Omxs 30	18.46%	18.01%
XACT BEAR	4.94%	5.65%
XACT BEAR 2	6.28%	7.01%
XACT BULL	4.61%	5.33%
XACT BULL 2	6.06%	6.52%
XACT Derivat BEAR	7.26%	5.32%
XACT Derivat BULL	6.91%	5.12%

APPENDIX 6

Fund name	Price-NAV Deviation
Db X-trackers MSCI AC Asia ex Japan	-0.20%
Db X-trackers MSCI Brazil	0.16%
Db X-trackers DAX	0.04%
Db X-trackers MSCI Emerging Market	-0.01%
Db X-trackers MSCI Europe	0.10%
Db X-trackers Euro Stoxx 50	0.10%
Db X-trackers Europe 600 Banks	0.71%
Db X-trackers FTSE China 50	-0.14%
Db X-trackers MSCI Japan	0.12%
Db X-trackers NIFTY 50	0.25%
Db X-trackers MSCI Pacific ex Japan	-0.04%
Db X-trackers S&P 500	0.04%
Db X-trackers MSCI USA	-0.08%
Db X-trackers MSCI World	-0.05%
DNB Obx	0.02%
Seligson & Co Omx Helsinki 25	0.01%
Spotr Omxs 30	-0.01%
XACT Norden 30	0.00%
XACT Obx	0.01%
XACT Omxs 30	0.00%
XACT Omxsb Div	-0.01%
Spotr BEAR Omxs 30	0.08%
Spotr BULL Omxs 30	-0.05%
XACT BEAR	0.03%
XACT BEAR 2	0.01%
XACT BULL	-0.01%
XACT BULL 2	-0.01%
XACT Derivat BEAR	-0.01%
XACT Derivat BULL	-0.03%