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THE EFFECT OF LIQUIDITY AND TIME-LAG ON ETF DISCOUNTS AND ETF RETURN PREDICTABILITY

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ABSTRACT

The purpose of the thesis is to discover if liquidity and time-lag between the ETF market and its NAV market affects the ETF discount. Also if ETF discounts are able to predict future ETF returns. Previous studies have focused on showing the relation between ETF discounts and future ETF returns as well as to specifically examine the ETF discount, its informational value and reasons to cause it. None of the previous studies have, however, directly studied liquidity´s or time-lag´s impact on the ETF discount or on the phenomenon how the ETF return/discount relation changes when the time-lag increases. As data in this thesis is used 8 international ETFs traded in the New York Stock Exchange. The period for the study is July 14, 2000 – January 19, 2011. The data is daily data excluded days, when the exchange either in the ETF market or its NAV market has been closed. The results from the empirical part show, that liquidity has no significant effect on the ETF discount. Also discovered, that the ETF discount is not directly correlated with the increasing time-lag. Instead is discovered, that lagged ETF discounts can explain future ETF returns. Lagged ETF discounts are found to be a positive predictor for the future ETF returns at time *t-1*. However, the more lag is involved, the less the ETF discount acts as a positive predictor for the future ETF returns.

KEYWORDS: Exchange-Traded Fund, time-lag, ETF discount, liquidity

1. INTRODUCTION

Among studies Exchange Traded Funds have proven their efficiency in finance. It is not wonder why their popularity has boomed in recent years. The first ETF was introduced in 1993, and in 2001 ETFs held 2,4 per cent of assets in all equity mutual funds (Poterba & Shoven 2002: 422). Advantages to invest in ETFs are many. Instead of investing in individual company shares, investing in ETFs investor gets diversified portfolio even if only one ETF share is bought. The investor only has to decide the area of market to invest in. When compared with traditional mutual funds, ETFs are cheaper. When investing to foreign markets, ETFs are also a great option. For example iShares offers great range of ETFs investing abroad. These international ETF shares can be bought from New York Stock Exchange in dollars. ETFs can also be traded throughout day and sold short like individual shares.

Previous studies about ETF investing exist quite a bit. Martinez & Tse (2006) have studied the main reason to drive international ETF prices. Also Klibanoff, Lamont & Wizman (1998) have studied the same phenomenon and how investors react on news events. Lai, Tze Chua & Wu (2008) have studied the predictability of international fund prices and developed a new method to better understand the future prices of ETFs. Jares & Lavin (2004) have studied if different trading hours between the ETF market and its NAV market affect the ETF returns and create profit opportunities.

This thesis is based on studies mentioned before. The data consists from eight ETFs in different time zones. The data covers period between July 14, 2000 and January 19, 2011. The funds are iShares´ international Exchange-Traded Funds, that are all listed in New York Stock Exchange. This study diverges from the previous ones so, that it concentrates on how liquidity and time difference affect the ETF discount between the ETF market price and its net asset value. Also studied if ETF discounts can help to predict the future ETF returns.

What makes this thesis interesting is, that if discovered a ETF discount/liquidity/time-lag relation and if found that ETF discounts can predict the future ETF returns, then the investor would know which international ETFs are the most profitable to invest in. Investors would know if it is more profit-

able, in light of these results, to buy more liquid ETFs with greater time-lag or not. In other words, this thesis would be able to suggest from where it is possible to find the best profit opportunities when investing in international Exchange-Traded Funds.

1.1. Problem statement

Exchange-Traded Funds are one of the most interesting investment options at the present market. Their easiness to invest in foreign countries, great diversification and transparency compared with traditional mutual funds are remarkable. However, when the fund has an underlying market and it is sort of a "derivative" to some fundamental, there are issues that diverges it from ordinary security trading.

Many of the papers are published mainly focused on the ETF return predictability, ETF volatility, liquidity and discounts related. Common thought in all these seem to be the size of the actual ETF discount, reasons to cause it, and how the investor could best benefit from all that information. What is not studied much is the time-lag´s affect on the ETF related factors. There are studies about it, but majority of them concentrates on domestic ETFs or other factors. One of the reasons for this could be, that international ETFs have presented quite recently in the history of finance.

The purpose of this thesis is to discover if ETF´s liquidity and time-lag between the ETF market and its NAV market affects the ETF discounts and if these discounts can predict the future ETF returns. The main goal is to find a pattern, whereby greater liquidity leads to a smaller ETF discount and greater time-lag between the ETF market and its NAV market leads to greater discounts in the ETF prices. If the pattern exists, and is found that time-lag and liquidity affect the ETF discount and that ETF returns can be predicted by ETF discounts, then the investor would know which ETFs are the most profitable to invest in.

The first hypothesis concentrates on simply finding a relation between the ETF´s liquidity and its discount. The hypothesis assumes, that the ETF liquidity correlates with the ETF discount. The basic idea behind this hypothesis is, that

when an ETF is actively traded, its market price and the underlying asset price should trade at same prices.

In the second hypothesis time-lag´s effect on the ETF discount is studied. According to the hypothesis 2, the increase in the time-lag explains the increase in the ETF discount. The basic idea behind this assumption is, that when markets do not trade simultaneously, the price deviation between the ETF share and its underlying share increases. For example, if Mexico´s market index is an underlying asset to an ETF traded in the NYSE, the possible shock news and their information would reach the American market immediately since these markets trade at almost simultaneous hours. But, if considered the Australian market, where the exchange is opened at totally different time than the U.S. market, the information released in Australia would reach the U.S. market not earlier than the next day when the U.S. market opens again.

The third aspect in the thesis is to study if possible discounts in ETF prices can predict the ETF´s future returns. This assumption is based on the previous studies where is noticed, that ETF discounts can predict ETF returns. The reason why this phenomenon is tested in this thesis is, that if discovered that some ETFs with greater liquidity and time-lag have bigger discounts than others, and that the ETF discounts are able to predict the future ETF returns, then this study would deliver valuable information to the investor so that he would know what ETFs to invest in. If for example is noticed, that greater liquidity and smaller time-lag causes smaller ETF discount, and that smaller ETF discount means smaller ETF returns, an investor could choose ETFs that has smaller liquidity and greater time-lag to achieve bigger ETF returns.

1.2. Previous studies

Studies behind this thesis are many. For example Jares et al. (2004), where is showed that asynchronous trading hours between the ETF market and its NAV market give rise to frequent discounts and premiums. Jares et al. (2004) study also the predictability of ETF returns with ETF discounts. Chan et al. (2008) have studied ADRs and noticed, that the more liquid the ADR is, the bigger is the premium. This means that less liquid product should have smaller premium, or, bigger discount. Lai et al. (2008) have developed a new method to

predict the international ETF prices. Instead of adjusting prices at fund level, they adjust the prices at individual security level. According to Lai et al. (2008) their method produces the most accurate predictions of fund prices at the next-day open. Martinez et al. (2007) concentrate on ETF variances and discover that the Asian and European ETFs have lower daytime variance while the American ETFs have higher daytime variance. This indicates that the ETF prices are mainly driven by information released in the local market´s trading hours. Martinez el al. (2007) also find, that the ETFs have higher price variance than the NAVs and that the ETF prices reflect all NAV information. Klibanoff et al. (1998) study Closed-End Funds instead of ETFs and also discover that prices are mainly driven by information releases in the local market. Kim, Mathur & Szakmary (1999) focuse on ADRs and notice that the most price responses in the ADR market occur on the same calendar day and that the ADR returns under-react to contemporaneous underlying security and exchange rate. ADR returns, however, overreact to the U.S. market returns. Kim et al. (1999) also notice that deviations between the ADRs and their NAVs are slight.

2. EXCHANGE-TRADED FUNDS

Exchange-Traded Funds are "offshoots of mutual funds that allow investors to trade index portfolios just as they do shares of stocks." (Bodie, Kane & Marcus 2009: 110).

The history of ETFs starts from 1993, when the concept Exchange-Traded Fund was introduced. The very first ETF was called SPDR, nicknamed as "spider" and it was generated to track the S&P 500 index. These "spiders" gave rise to many other similar products, and a bunch of ETFs were developed to track indexes such as NASDAQ 100 and DOW JONES (Bodie et al. 2009: 110). Attractiveness of the ETFs among investors can be explained by the fact, that since their introduction in 1993 by the end of 2001 there were $79 billion in assets invested in Exchange-Traded Funds. This amount covers 2,4 per cent of total assets in all equity mutual funds. In 2001 the assets held through ETFs rose nearly 50 per cent (Poterba & Shoven 2002: 422).

The reasons to ETFs´ popularity are many. ETFs are very easy to use, since they can be bought and sold in exchanges in a same way as individual shares. ETFs are also low cost funds, very transparent, tax efficient and flexible while they offer the investor risk management options and easy diversification. In other words, ETFs have characteristics from both individual company shares, and mutual funds. ETFs offer also great range of alternatives. In 2007 there were more than 450 ETFs on the market and more than a hundred in the pipeline. Buying ETF shares is also a good option when investing abroad. Since they offer a great diversification, the investor does not have to pick any particular share from the market but just to decide the area of the market to invest in (Delfeld 2007: 1).

Not only ETFs are tied to stock market indexes but to commodity indexes as well. In 2007 there were 14 ETFs that provided exposure to currencies and commodities such as gold, silver and oil (Delfeld 2007: 2).

What is also often pointed out when talked about ETFs is the taxation. Here, for example, ETFs beat Closed-End Funds remarkably. Since mutual funds often distribute large amounts of capital gains to shareholders, in ETFs these distribu-

tions are rare. Securities in ETFs change only if the underlying index changes. This means lower tax burden to ETFs (Delfeld 2007: 2). ETF taxation will be explained more detailed in the next paragraphs.

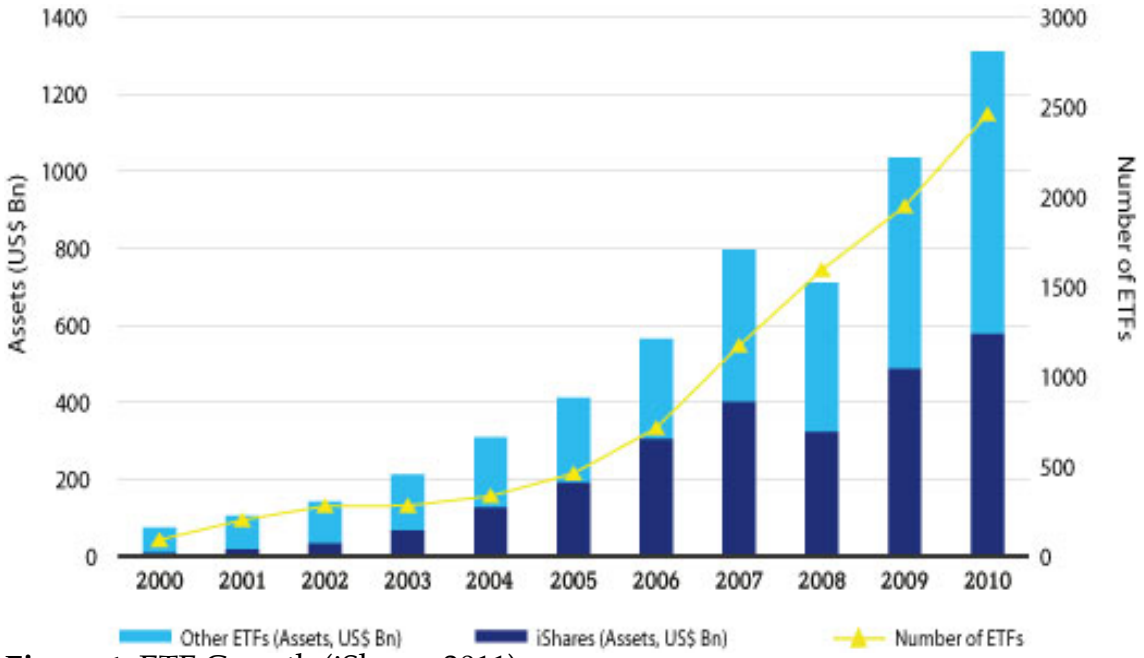

Figure 1. ETF Growth (iShares 2011).

2.1. Mechanics

ETF is a basket of securities from the index it is designed to track. ETFs, unlike mutual funds, can also be traded like normal company shares throughout the day (Hyman, Rosenburg, & Weintraub 2008: 2). Well said in the article made by Poterba et al. (2002: 422): "It is a claim on a trust that holds a specific pool of asset".

ETFs are born when authorized financial institution deposits a portfolio of securities with the trustee and receives ETF shares in return (Ferri 2008: 22). A simple example from this could be following: There exists an index based on thousand companies. Instead of buying each company´s individual shares, the investor could buy an ETF share(s) based on this index constructed on these thousand shares. This enables also small investors to get the advantage of greater diversification with relatively small amount of money.

Because ETFs trade like individual company shares in the market, they can be considered as shares with the advantages, or disadvantages, of multiple shares. It is also very important to understand that ETF share prices may diverge from the underlying net asset value (NAV) of the securities held in the trust. The divergence is restricted by the capacity of authorized financial institutions to create and redeem the ETF shares. This is the tool to control price changes and to hold the price of an ETF share as close as possible with the stock prices in the asset pool to avoid the discount between the ETF shares and the underlying assets. This mechanism is called as "in-kind" mechanism. (Hyman et al. 2008: 50).

Exchange-Traded Funds grow by exchanging new fund shares for portfolio securities that are deposited with the fund. Like mentioned before, the fund shares are traded in the exchange by investors. If investors are willing to sell their shares, dealers buy these ETF shares and turn them in to the fund in exchange for portfolio securities. This is the process that lets ETF managers to take full advantage of the redemption in-kind provision by delivering their lowest cost tax lots without realizing gains that must be distributed to the fund´s shareholders. Rules for ETF redemption permit the fund manager to remove a high-cost tax lot from the redemption basket and sell it for cash to realize losses inside the fund (Gastineau 2010: 8).

This in-kind mechanism in ETFs is said to be very efficient way to reduce the problems that are related with mutual funds, especially it makes the funds more tax-efficient. Maybe that is why many of the fund industry observers believe that ETF structure will eventually replace the conventional mutual funds (Gastineau 2010: 9).

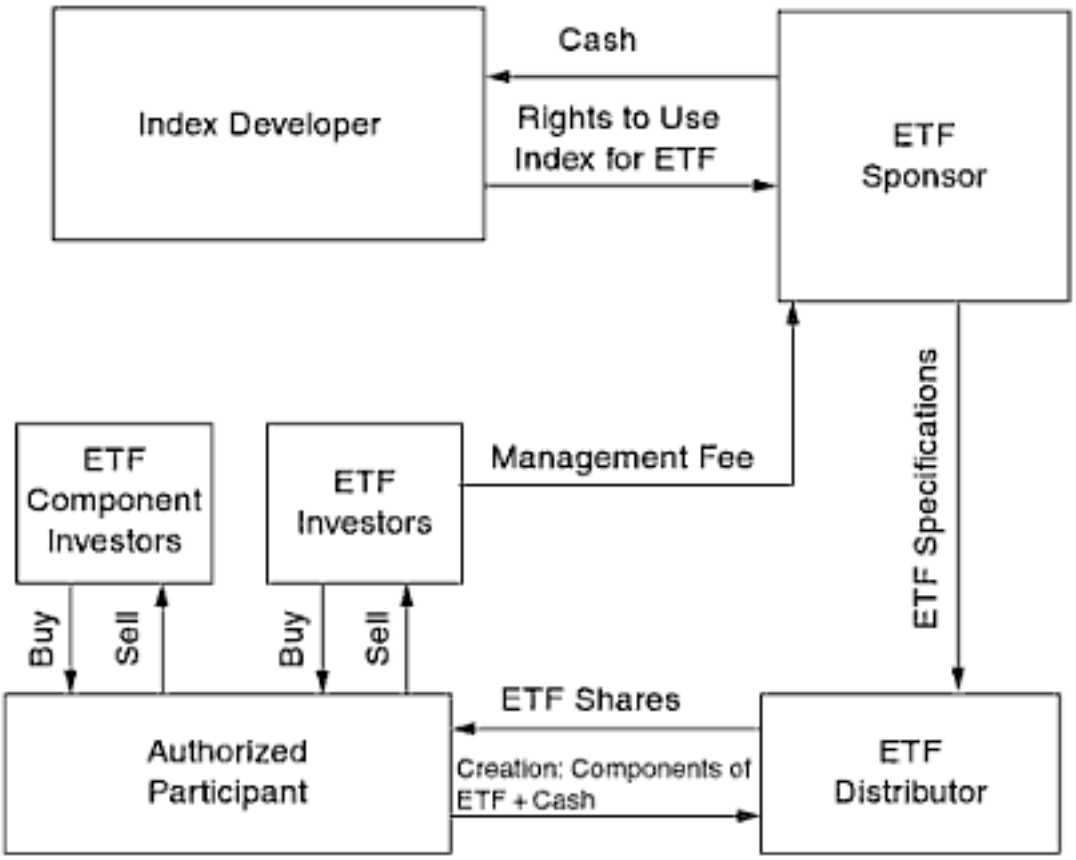

Figure 2. ETF mechanics (Hyman et al. 2008: 50).

2.2. Net asset value (NAV)

Net asset value represents the underlying asset of an ETF or mutual fund (McClatchy & Wiandt 2002: 18). ETF´s net asset value is always calculated from the previous day´s closing price. The actual calculation is done as following: Total assets of the ETF minus liabilities divided by the number of ETF shares outstanding. It is usually expressed as a value per share and calculated once a day for most U.S. funds based ETFs on closing time (4:00 pm) Eastern time (Ferri 2008: 38).

When ETFs trade in domestic market and represents domestic underlying assets the difference between the NAV and the ETF share price should remain relatively low. This difference is called the ETF discount. Problems arise, for

example, when the underlying asset for an U.S. based ETF is from another country with different trading hours. This causes a situation where the value of the underlying asset is many hours old and reflects old information while the ETF share market is open and the ETF share price reflects today´s news. (McClatchy et al. 2002: 19). This issue will be taken under more specific evaluation in the later chapters. To be noticed here, diverging trading hours are not the only reason to cause the ETF discount.

2.3. Tracking error

When using ETFs as an investment vehicle, one thing that has to be taken into account is how strictly the fund´s net asset value tracks its benchmark index. It is good to notice here, that when talked about tracking error is meant the deviation between the fund´s NAV and its benchmark index unlike in ETF discount when the deviation between the NAV and the ETF share price is observed (Clarke, Krase & Statman 1994: 1). For example, if the ETF´s NAV has a correlation of 95% with the index it tracks, the tracking error is 5%. The reasons that creates such a phenomenon in ETFs can arise for example from rounding of prices, failure of a sample to match the target index, or fees and expenses the index does not have (Hyman et al. 2008: 99).

There are many different ways of measuring the tracking error. Main idea still remains the same, in other words, in all methods to calculate the tracking error the purpose is to measure the deviation between the performance of ETF´s NAV and its benchmark index (Shin & Soydemir 2010: 218).

The first and simplest method to estimate the tracking error is by measuring the average absolute differences between the return on NAV and its benchmark index:

(1) $$TE_1 = \sum_{t=1} \frac{(NR_{i,t} - IR_{i,t})}{n}$$

Where,

TE_1 = The average daily tracking errors based on the absolute difference between the return on ETFs NAV and its benchmark
$NR_{i,t}$ = The return on ETFs NAV at time t
$IR_{i,t}$ = The return on benchmark index at time t

The second method in estimating the tracking error is to use standard errors from the regression analysis using daily return on each NAV and its benchmark index:

(2) $$NR_{i,t} = a_i + b_i * IR_{i,t} + E_{i,t}$$

Where,

a_i = NAV´s possible excess return above its benchmark
b_i = Systematic risk and ETF´s replication strategy (coefficient closer to 1, ETF replicates its benchmark well)
$E_{i,t}$ = Error term

Alpha and beta should not be acquired from the regression model. In this model the standard errors from the regression proxy tracking errors. The standard deviation from the regression must be zero if NAVs follow their benchmark perfectly (Shin et al. 2010: 218).

The third method is where the tracking error is measured by equating the standard deviations of differences between returns on NAVs and their benchmark indexes:

(3) $$TE_1 = \sqrt{\sum_{t=1}^{N} \frac{(ND_{i,t} - \overline{ND_i})^2}{n-1}}$$

Where,

$ND_{i,t}$ = Difference between the return on ETF´s NAV and its benchmark at day t
When average tracking error is closer to zero the better the NAV replicates its benchmark (Shin et al. 2010: 218).

The first method presented above, where the absolute difference between the return of the ETF and its benchmark is compared is the simplest one of these three, but may underestimate the tracking error because the differences can cancel each other out. To get the best result one should calculate the tracking error by using all three methods presented above. There exists plenty more methods to calculate the tracking error but these three are the most common and used ones. Also Shin et al. (2010) used all of these three methods to calculate the tracking error in their study.

2.4. American Depositary Receipt (ADR)

ADRs are investment vehicles that represent U.S. investor ownership of non-U.S. company shares. They are issued by U.S. depositary banks and are deposited in the country of issuance. ADRs give their holder a right to acquire the actual share, but in practice this nearly never happens. ADRs are priced in U.S. dollars and also the dividends are paid in U.S. dollars. ADRs can be purchased in U.S. exchange or in the original market and then depositing them with a bank in exchange for a new ADR, or swapping the shares for existing ADR (Stowell 2010: 151).

The idea of the ADRs is to give the investor a possibility to invest in foreign market without a need to buy the actual share from the foreign market in a foreign currency. ADRs have a lot in common with international ETFs when it comes to price formulation of these products. Plenty of studies executed with ADRs as data can be, and are, used to compare the phenomena in ETFs (Stowell 2010: 151).

2.5. ETF discount

Like mentioned in the earlier chapter, what distinguishes tracking error from ETF discount is, that tracking error represents the difference between the NAV and its target index while ETF discount represents the difference between the NAV and the ETF share price. The reasons that lead to the ETF discount, however, are different. In funds that trade in the same time zone with their NAV, the main reason to cause ETF discount or premium is the late market activity.

For example, in the end of the trading day someone buys a very large amount of ETF shares. This means that only the price of the ETF changes because of the demand of shares increases heavily. At the same time the ETF price does not have time to get back to the same level with the NAV because the market closes. Normally the price of an ETF adapts to the price of its NAV but temporary "price shocks" may arise because of significant buying or selling of ETF shares. Also noticed that spreads between the NAV and the ETF share price widen to prevent the occurrence of exposures that will have to be held overnight (Abner 2010: 84).

ETF discount:

$$ETF_D = \frac{NAV_t - ETF_t}{NAV_t} \quad (4)$$

Where,

ETF_D = ETF discount at time t
NAV_t = Net Asset Value at time t
ETF_t = ETF price at time t

In the study made by Delcoure & Zhong (2007), that concentrates on the premiums and discounts of 20 iShares, is stated, that international iShares funds trade at significant premium and exhibit excess volatility relative to their NAV returns (Delcoure et al. 2007: 184). However, the premiums are only temporary. This supports the results from the other studies.

By running a regression to incorporate both the time-series and cross-sectional variations of the premiums, Delcoure et al. (2007) find that reasons to cause the premium in these particular funds are, for example, lower institutional ownership, higher bid–ask spread, higher level of trading volume, higher exchange rate volatility, regional political, economic, and financial instability. Also stronger correlation between the U.S. and home-country market was stated to affect the premium (Delcoure et al. 2007: 185).

However, these factors mentioned only explain the premiums partially. For future research Delcoure et al. (2007) suggest to study the power of behavioral finance as an explanatory factor to the premiums.

ETF discounts are also stated to create arbitrage opportunities, in theory at least. To benefit from the ETF discount, or premium, the investor would have to swap units of ETFs and their underlying stocks. This, however, can be done by Authorized Participants only. If the ETF is trading at premium, arbitrageurs could buy the underlying securities, swap them for creation units of ETFs and sell the ETFs on the open market. If the ETF is trading at discount, the operation is reversed: buying ETF shares on the open market, form redemption units, swap them for the underlying securities and sell them on the market (Lofton 2007: 32).

Premiums and discounts for ETFs, however, are often very small and arbitrage is only profitable in theory or when traded very large amounts of shares. ETF discounts are said to be smaller in the domestic markets where both ETF shares and underlying shares trade at the same market, and bigger when the underlying assets are from another time zone (Lofton 2007: 33).

2.5.1. ETF discount´s informational value

First is good to notice how numerous studies suggest that ETF discounts are nearly always very marginal and that realistic profit opportunities for an individual investor do not exist. In the paper made by Comer, Elton, Gruber & Li (2002) is noticed, that the return of the S&P500 tracking ETF from the whole sample period was 21,91% while its NAV´s return was 21,89%. In this thesis, even if the sample period is over ten years, the maximum difference between the cumulative returns of an ETF and its NAV is approximately 8% and the smallest less than 1%. And even if the ETF discounts do exist, they are noticed to disappear in one day because of the in-kind mechanism and arbitrage related (Comer et al. 2002: 463). This is very different from, for example, closed-end funds that can sell at a discount of 20% compared to the underlying value (Ching-Chung, Hsinan & Shih-Ju 2005: 65). According to the studies presented, the ETF discount´s informational value is only that ETFs trade at lower price than their NAVs. In theory, if the ETF price is lower than its NAV, and an indi-

vidual investor could buy the ETF shares on the open market, form redemption units, swap them for the underlying securities and sell the securities on the market, there would exist a possibility to make profit. In practice, however, this is not possible since the process can be done only by Authorized Participants (Lofton 2007: 32). This creation/redemption characteristic exists to limit the premiums/discounts and to make sure, that investors can buy ETF shares at fair prices (Dellva 2001: 8).

According to Jares et al. (2004), however, it is profitable to buy ETF shares when their market price is lower than the NAV price. The study shows, in lights of tests for trading rule versus buy-and-hold strategy, that cumulative returns for Japan and Hong Kong iShares ETFs were 542,25% and 12,119%. Even greater results were achieved when compared to buy-and-hold strategy that returned -41,79% and -12,24% (Jares et al. 2004: 69). In this, one has to remember that the strategy is proved to be efficient when using these particular trading strategies, and that this does not necessarily mean that buying discounted ETF shares is always profitable.

2.5.2. Behavioral finance, informative trading and ETF discount

In a world, where all investors are rational and Efficient Market Hypothesis (EMH) can be trusted, there are no free lunches and arbitrage is not possible (Thaler 2005: 3). This also indicates that ETF discounts, or premiums, do not exist. However, as many studies have shown, they do exist.

According to the informational efficiency in finance, all prices of investments are based on the information available. The assumption of the efficient market can be divided in three different levels:

1. Weak-form efficiency where all information contained in past price movements is fully reflected in current market prices.
2. Semistrong-form efficiency where current market prices reflect all publicly available information.
3. Strong-form efficiency where current market prices reflect all pertinent information.

If prices reflect existing information and adjust quickly when new information becomes available, the market can be said to be informational efficient (Besley & Brigham 2009: 72).

If now observed how behavioral finance, informational finance and ETF discounts are related, it is pretty obvious to see that there is no one particular reason why the ETF discounts are born. They can be borned, for example, because an institutional investor panics and sells a big amount of ETF shares on the market. This would mean that the price of the ETF diverges from its NAV by behavioral reasons.

Lee, Shleifer & Thaler (1990) have studied anomalies associated with Closed-End Mutual Funds. Unlike the efficient market hypothesis assumes, there exists a phenomenon in finance that cannot be explained by investor´s rational activity (Lee et al. 1990: 153). In the discussion of the study Lee et al. (1990) state, that the mispricing of the CEFs occurs because no riskless arbitrage opportunity exists, and because the supply of rational investors willing to make long-term bets against the prevailing investor sentiment is limited. Like mentioned in the previous chapter, the demand and supply of the CEFs, ETFs or shares, can influence the price even if the demand/supply bases on irrational beliefs. Lee et al. (1990) results the same conclusion: "It is important to remember that statement *price is equal to intrinsic value* is a testable proposition, not an axiom" (Lee et al. 1990: 163).

On the other hand dividends and capital gains in the underlying assets may cause ETF discounts and premiums (Ackert & Tian 2000: 73). The time difference between the ETF trading market and its NAV market may also be one reason for diverging prices. When the ETF market is closed, trading with its underlying shares may occur in the NAV market (Engle & Sarkar 2006: 35). Or, like mentioned in the study executed by Delcoure et al. (2007), there a numerous other factors to cause ETF discounts.

A study made by Kavali (2007) examines the ETF discount in Dow Jones Istanbul 20 ETF. The purpose of the study is to reveal the discounts or premiums in this particular fund. The data consists on quite a short period: January 14, 2005 – December 30, 2005. To discover if there exists a relation between the two price

series of the fund and if the fund trades at premium or discount, Kavali runs a regression model.

The empirical test reveals, that the NAV of the fund is closely related to the ETF market price the fund trading at a slight discount. Large deviations are noticed only a few, so the discount is very small on average. Also noticed from the regression analysis, that deviations between the ETF and its NAV disappear within two days (Kayali 2007: 22).

The in-kind mechanism in ETFs, which means that buying or selling the ETF shares can be done by using the underlying securities instead of cash, should keep the ETF price very close to its underlying value. If ETF discounts exist, they are repaired by this operation. In these cases Authorized Participant (AP) conducts a risk-free arbitrage trade, which allows the AP to exchange individual securities for large blocks of ETF shares. This act brings the ETF price to the same level with the underlying value while it brings the AP a small profit (Ferri 2008: 267).

3. PORTFOLIO PERFORMANCE EVALUATION

In principle, the portfolio performance evaluation is to measure the portfolio´s return under a certain period of time (Aragon & Ferson 2006: 5). In this thesis the ETF´s and traditional mutual fund´s performance are compared with each other. In the case of mutual funds and ETFs in general, the performance of the funds is often compared to the performance of the underlying asset.

When measuring the portfolio performance, one has to have mathematical models to show what wanted to achieve. Some of the models are portfolio based and they measure the performance of the portfolio. In these cases funds are not compared with each other.

However, regardless on what is studied, it is required to have asset pricing models. Asset pricing models and portfolio performance measurement are usually linked in the same context. Such models are for example the CAPM (capital asset pricing model) and Jensen´s alpha (Aragon et al. 2006: 6).

When the portfolio performs better than its benchmark in after-tax base, it is said to be "adding value" to the investor. When the portfolio beats its benchmarks on before-tax base, portfolio manager is said to have "investment ability" (Aragon et al. 2006: 7). The focus is, that in the case of trading ETFs and mutual funds, trading costs always occur and they are a significant factor on the portfolio performance.

One important fact that also affects the portfolio performance is the market timing. A well skilled portfolio manager has the ability to time purchases and sales of assets in a favourable time. Before the market goes up, more market exposure is taken and before the market goes down, less market exposure is taken. However, in the study made by Treynor & Mazuy (1966) such a phenomenon does not exist. They studied 57 mutual funds and their manager´s ability to outguess the market movements, but no statistical evidence about the good market timing was found (Mazuy et al. *1966: 135*).

3.1. Sharpe ratio

Maybe the most common risk-adjusted performance measure is the Sharpe ratio. It measures the portfolio return related to the portfolio´s standard deviation. It is said to make most sense to an investor measuring the portfolio performance because the normal assumption is, that investors care only about the volatility of the portfolio (Aragon et al. 2006: 10).

(5) $$SR_p = \frac{E(r_p)}{\sigma(r_p)}$$

Where,

SR_p = Portfolio Sharpe ratio
$E(r_p)$ = Return of the portfolio
$\sigma(r_p)$ = Standard deviation of the portfolio

3.2. Jensen´s alpha

Another widely used performance measure is the Jensen´s alpha. Jensen´s alpha measures the abnormal actual return of the portfolio compared to the expected, theoretical return. Usually the model used to calculate the expected return is the CAPM (Capital asset pricing model). Jensen´s alpha is criticized for that it does not take the nonsystematic risk into account (Aragon et al. 2006: 11).

(6) $$a_i = R_i - \left[R_f + \beta_{i,M} * \left(R_M - R_f\right)\right]$$

Where,

α_j = Jensen´s alpha
R_i = Portfolio return
R_f = Risk-Free rate
β_{iM} = Portfolio beta
R_M = Market return

3.3. Treynor ratio

The Treynor ratio measures the return related to the portfolio´s beta. It is similar with the Sharpe ratio otherwise, but portfolio´s beta is used as a risk factor instead of portfolio´s standard deviation (Aragon et al. 2006: 12).

(7) $$T_p = \frac{E(r_p)}{\beta_p}$$

Where,

T_p = Treynor ratio
$E(r_p)$ = Return of the portfolio
β_p = Beta of the portfolio

3.4. Treynor-Black appraisal ratio

The Treynor-Black appraisal ratio can be used as a measure of the portfolio manager´s ability to use the information available in purchasing individual securities in the portfolio. Unlike Jensen´s alpha, the Treynor-Black appraisal ratio is invariant to amount of benchmark risk and leverage used in the portfolio. Sometimes the ability in market timing may cause changes in the leverage used and the market risk in the portfolio (Aragon et al. 2006: 12).

(8) $$A_{r_i} = \left(\frac{a_i}{\sigma(u_i)}\right)^2$$

Where,

A_{r_i} = The Treynor-Black appraisal ratio
a_i = Alpha of a security i
$\sigma(u_i)$ = Standard deviation of the residual for security i

3.5. Merton-Henriksson market timing measure

The Merton-Henriksson market timing –model assumes that weights in the portfolio are shifted discretely, which leads to convexity that can be modelled with call or put options.

$$R_{pt+1} = a_p + b_p r_{mt+1} + \Lambda_p Max(r_{mt+1},0) + u_{i+1} \quad (9)$$

Where $\boldsymbol{\Lambda}_p$ measures the market timing ability and if $\boldsymbol{\Lambda}_p = \boldsymbol{0}$, the regression reduces to market model regression used to measure Jensen´s alpha. If $\boldsymbol{\Lambda}_p$ is not zero, the interpretation of intercept $\boldsymbol{a}_p$ is different (Aragon et al. 2006: 13).

3.6. Treynor-Mazuy market timing measure

Treynor and Mazuy suggest that $\boldsymbol{\Lambda}_p > \boldsymbol{0}$ indicates market timing ability. Treynor´s and Mazuy´s basic assumption is, that when the market rises the fund rises relatively more and when the market plunges, the fund plunges relatively less (Aragon et al. 2006: 14).

Treynor-Mazuy market-timing model is a quadratic regression as seen below:

$$R_{pt+1} = a_p + b_p r_{mt+1} + \Lambda_p r_{mt+1}^2 + v_{t+1} \quad (10)$$

3.7. Multibeta models and Weight-based performance measures

When measuring the portfolios performance, there can be seen used multibeta models in addition to these previously introduced. These models arise when investors optimally hold combinations of a mean variance efficient portfolios and hedge portfolios for other risks (Aragon et al. 2006: 14). The simplest multibeta models are derived straight from the Jensen´s alpha as following:

$$r_p = a_P^M + \sum_{j=t\ldots K} \beta_{pj} r_j + v_p \quad (11)$$

Where,

$R_{j,j} = 1,\ldots,K$ are the excess returns of the K hedge portfolios (j = 1 can be a market index)

$$aM = E\,[rp] - \sum_{P} \beta_{pj} E\,[rj]$$

3.8. ETFs compared to mutual funds and conventional index funds

When buying ETF shares it must be done through brokerage firms, which naturally contains commission costs similarly when trading individual shares. ETFs can also be bought on margin and sold short exactly like shares. ETFs pay dividends directly to the investor unlike mutual funds where dividends are reinvested on the fund (American Exchange 2010). For example these features distinguish ETFs from traditional equity mutual funds and make them more similar with individual company shares. ETFs are also more liquid assets than traditional mutual funds because they can be traded at any point during the day.

Conventional Index Funds are very similar to Exchange-Traded Funds. They both are built to track an index in the market and they both suffer from tracking error (Poterba et al. 2002: 423). However, things that distinguish conventional index funds from ETFs do exist.

When ETFs are traded through the exchanges, shares of index funds are bought directly from the trust issuing company. The value of a conventional index fund is determined once a day similarly with a actively managed mutual fund and unlike with an ETF. As seen in the table 1, administration fees in index funds are also higher than in ETFs. Dividends are reinvested into the fund automatically in case of the index funds what can be seen very rarely with the ETFs (Ferri 2007: 69).

Table 1. ETF and Index Fund Fees (Ferri 2007: 3).

MSCI U.S. Indexes	Fund Name	Class	Fee	Symbol	Minimum
Broad Market	Vanguard Total Stock Market	Open-End	0,19	VTSMX	3
Broad Market	Vanguard Total Stock Market ETF	ETF	0,07	VTI	None
Prime Market 750	Vanguard Large-Cap Index	Open-End	0,2	VLACX	3
Prime Market 750	Vanguard Large-Cap ETF	ETF	0,07	VV	None
Prime Market Growth	Vanguard Gowth Index Fund	Open-End	0,22	VIGRX	3
Prime Market Growth	Vanguard ETF	ETF	0,11	VUG	None
Prime Market Value	Vanguard Valuen Index Fund	Open-End	0,22	VIVAX	3
Prime Market Value	Vanguard Value ETF	ETF	0,11	VTV	None
Mid Cap 450	Vanguard Mid-Cap Index	Open-End	0,22	VIMSX	3
Mid Cap 450	Vanguard Mid-Cap ETF	ETF	0,13	VO	None
Mid Cap 450 Growth	Vanguard Mid-Cap Growth Index	Open-End	0,25	VMGX	3
Mid Cap 450 Growth	Vanguard Mid-Cap Growth ETF	ETF	0,13	VOT	None
Mid Cap 450 Value	Vanguard Mid-Cap Value Index	Open-End	0,25	VMVIX	3
Mid Cap 450 Value	Vanguard Mid-Cap Value ETF	ETF	0,13	VOE	None
Small Cap 1750	Vanguard Small-Cap Index	Open-End	0,23	NAESX	3
Small Cap 1750	Vanguard Small-Cap ETF	ETF	0,1	VGR	None
Small Cap Growth	Vanguard Small Cap Growth Index	Open-End	0,23	VISGX	3
Small Cap Growth	Vanguard Small-Cap Growth ETF	ETF	0,12	VBK	None
Small Cap Value	Vanguard Small-Cap Value Index	Open-End	0,23	VISVX	3
Small Cap Value	Vanguard Small-Cap Value ETF	ETF	0,12	VBR	None

Table 2. The main differences between mutual funds and ETFs (Hyman et al. 2008:43).

Characteristic	Mutual Funds	ETF
Method of Purchase	Buy from brokers, directly from funds, and other financial institutions. Mutual funds generally create and sell new shares to accommodate new investors.	Trades like a stock. Can buy only through a broker.
Pricing	Price = net asset value (NAV) + any sales charges. Only priced at end of day based on NAV of portfolio. Can buy only at this price.	Continuous pricing and trading throughout the day.
Short	Cannot go short.	Can go short.
Tax efficiency	Actively managed funds are tax inefficient.	Potential for high efficiency.
Redemption	Investors buy directly from the mutual fund and redeem (sell) their shares back to the mutual fund.	Retail investors cannot redeem their shares. They must sell them in the open market. Redemption available for holders of large baskets of stock.
Costs	Variable	Low
Liquidity	Can´t enter or exit during the day.	Can trade throughout the day.
Invest outside of securities	No	Yes
Options	No	Yes
Transparency	Modest	High
Management	Active and passive	Passive to date
Leverage	No	Yes
Strategic Applications	No	Yes, Replicate hedge fund strategies. Capability of taking market-neutral positions. Create synthetic positions.

As mentioned in the previous chapter, there are many things in common with ETFs, index funds, and mutual funds but so are distinguishing matters. In this chapter the advantages and disadvantages of the ETFs will be explained more specifically. The first advantage of an ETF is the liquidity. The mutual fund´s net asset value is quoted once a day making the trading more non-liquid compared to an ETF, whose price is determined continuously during the day. Like mentioned before, ETFs can also be sold short and purchased on margin. These features are naturally advantages for ETFs (Ferri 2008: 39).

But maybe the most important advantage in ETFs is the taxation. When mutual fund investors are willing to redeem their shares, the fund is obligated to sell securities to meet the redemptions causing capital gain taxes which are passed

through and must be paid by remaining shareholders. In contrast in case of an ETF, the investor can simply sell the ETF shares to another investor in the market with no need for fund to sell any of the underlying assets in the portfolio. In case of larger investors or arbitrageurs, ETFs use a technique called "Redemption in kind" to avoid capital-gain tax liability for the investor. When these investors are willing to redeem ETF shares from the trust, the trustee has an option of distributing the underlying securities to the investor instead of cash. It is important to notice that ETFs do not eliminate investor´s tax liability but delays it (Poterba et al. 2002: 426).

It is also cheaper to invest in ETFs than in mutual funds. First reason is that when ETFs are traded through brokers instead of buying directly from the fund, the fund saves the costs of marketing itself to the investor. Reduction in the expenses reflects directly to the management fees (Bodie et al. 2009: 104). Another reason why it is cheaper to use ETFs is that since they are passively managed funds, their management fees are lower than in actively managed mutual funds. Passively managed fund means, that investments are made directly by weights of an index basket unlike in mutual funds, where the portfolio manager decides the weights and manages the fund actively (Nordnet 2010).

As disadvantages for ETFs can be mentioned at least two things. First, because ETFs are traded like any other securities, there is a possibility that the price of an ETF share can depart by small amounts from the net asset value before arbitrage activity restores equality. Even small discrepancies can destroy the cost advantages over mutual funds. Secondly, when mutual funds can be bought from no-load funds with no fees, ETFs purchased through dealer entails always a fee. But, one should remember that not all mutual funds are no-load funds (Bodie et al. 2009: 105).

As a conclusion can be said, that choosing between an ETF, a traditional mutual fund and a index fund is not so black and white as one might assume. Most of all it depends on investor´s preferences, and every investor should make the decision by defining his own aims. A good comparison between the ETFs and mutual funds should include at least a consideration of expense ratio, bid/ask spread, expected performance and turnover, amount invested, horizon of investment, brokerage fees and tax rate (Nasdaq 2010).

3.8.1. ETF and mutual fund performance problem

When studying Exchange-Traded Funds and Conventional Index Funds, one major issue when compared these two is the performance problem. As said in the research by Gastineau (2004), most of the comparison in this matter is based on expense ratios and tax efficiency of the ETFs, and studying this subject can be very problematic. In a nutshell the problem arises when the NAV of a fund, Conventional Index Fund or ETF, cannot deliver as high profits as the actual index did because of the expenses it is suffering from. This phenomenon is measured by tracking error, as described before (Gastineau 2004: 423).

Harper, Madura & Schnusenberg (2006) have compared the risk and return performance of the Exchange-Traded Funds and Closed-End Funds. As data they use ETFs and CEFs between April 1996 and December 2001. They discover that tracking errors in these particular ETFs are very low and statistically insignificant and that ETFs result higher risk-adjusted returns than CEFs. From this Harper et al. (2006) conclude, that a passive investment activity provides better risk-adjusted returns than an active one. According to them, the reason why the ETFs also exhibit greater mean returns than the CEFs is, that the expense ratios are lower in the ETFs. This confirms the statement, that one of the main reasons to cause performance weaknesses in both ETFs and CEFs are the expenses arising from trading (Harper et al. 2006: 120).

As often heard, ETFs should be the most cost-efficient fund products on the market. Even the comparison between the ETFs and the Index Funds in the table 1 confirms that statement. However, it is very interesting to notice that this might not be the absolute truth. ETFs may be cost efficient and beat the competing products on after-tax basis, but the ability to track the index is not always as optimal as assumed.

Table 3 presents performance of two different funds. What can be observed is, that when measured the tracking error of a conventional index fund and an ETF, that are both designed to track the Russel 2000 index, the tracking error in the ETF has actually been negative and lead to worse performance than the Conventional Index Fund.

Table 3. ETF performance in Russell 2000 Index (Gastineau 2004: 98).

Fund performance and Tracking Error for Two Russel 2000 Funds	**2001**		**2002**	
	Performance	**Tracking Error**	**Performance**	**Tracking Error**
Vanguard Small Cap Investor Shares	3,10 %	0,61 %	20,02 %	0,46 %
Russell 2000 Index	2,49 %	-	-20,48 %	-
iShares Russell 2000 ETF	1,96 %	-0,53 %	-20,52 %	-0,04 %
Vanguard Outperformance of iShares		**1,14 %**		**0,50 %**

As can be noticed, the Vanguard Small Cap Investor Shares- index fund beat the iShares Russell 2000 ETF two years in a row. First by 1,14 per cent, and then by 0,50 per cent.

Another example can be seen in the table 4 below. The ETF has managed to beat the index and the conventional index fund only twice during the years 1994-2002. Altogether the ETF was beaten by the Index by 236 basis points and by the conventional index fund by 117 basis points.

As a conclusion can be said, that even if ETFs are suffering less from the performance problem and their theoretical returns are better than in CEFs, there are cases where ETFs are beaten by CEFs.

Table 4. ETF SPDR and Conventional Vanguard 500 index fund Performance (Gastineau 2004: 98).

Annual Pre-Tax Returns on S&P 500				
Fund:	**SPDRs**	**iShares 500**	**Vanguard 500**	**S&P 500 Index**
Symbol:	**SPY**	**IVV**	**VFINX**	**SPX**
Year				
1994	0,47 %		1,22 %	**1,32 %**
1995	**38,03 %**		37,42 %	37,52 %
1996	22,56 %		22,88 %	**22,95 %**
1997	**33,50 %**		32,87 %	33,35 %
1998	29,10 %		**29,61 %**	28,57 %
1999	20,39 %		**21,04 %**	**21,04 %**
2000	-9,73 %		**-9,06 %**	-9,10 %
2001	-11,98 %	-11,95 %	-12,09 %	**-11,88 %**
2002	-21,57 %	**-21,48 %**	-22,15 %	-22,09 %

The reasons to drag down the performance of ETFs are a few. According to the paper made by Gastineau (2004), the structural weakness in ETFs may be one of the reasons. If the ETF portfolio management policy would be changed, the ETF could, by tracking the same index, perform similarly with conventional index fund and most likely beat it on the after-tax basis. The change would allow the ETF portfolio managers to time their trades to recapture some of the transaction costs embedded in the benchmark index modification process exactly like in the case of conventional index fund managers (Gastineau 2004: 427).

Another important reason that affects the performance of an ETF is the service charge. Service charge is paid to cover the fees that occur from creation and redemption of the ETF shares. The fund itself does not usually have any transaction costs or other variable costs (Gastineau 2004: 426).

As the ETFs are designed to track some index as strictly as possible, it is very important that they consist on exactly, or as close as possible, on those assets that exist in the index itself. When ever the content of an index changes, so has to change the content of an ETF. And the way when, and how, the portfolio manager handles the trade with assets to reflect the index again, causes costs that contributes the performance of an ETF.

4. ETF PRICE DISCOVERY

Understanding the pricing formulation of an international ETF, or any other investment vehicle is very important. How do changes in the underlying assets affect the price of a investment product registered in another country? What is the efficacy of information released in the local market to an investment product in a country where the product is registered? For example these questions will be discussed here based on studies executed about the subject. In addition to the studies presented with ETFs , papers about mutual funds and ADRs will also be reviewed.

A very interesting study made by Martinez & Tse (2006) studies the price discovery process and information transmission of the international ETFs using 24 international iShares international funds. As said in the beginning of the study, trading of these funds in the U.S. market is driven by information released under the local markets trading hours, not the U.S. trading hours (Martinez et al. 2007: 1).

The first step in the study is to estimate the daily variances from both daytime and overnight returns. The expectation based on the previous literature is that the return´s variance is higher during the trading hours than during non-trading hours. Martinez et al. (2006) got the same results. Average daytime variance for the European region ETFs and Asian region ETFs is 77% of overnight variance while the daytime variance for ETFs that track the American Index country funds is 1.87 of the overnight variance on average. From this one can conclude that the markets are primarily driven by public information released during the local market´s trading hours. When compared the NAV price variance and the ETF price variance is discovered, that the prices of ETFs vary more than the NAV prices. The variation is biggest in the Asian market, which can be possibly explained by the fact that U.S. investors speculate more in the Asian market than in the U.S. or European market (Martinez et al. 2006: 8). When examined the correlation between the U.S. iShares and the international iShares is found that the correlation between the U.S. iShares and the Asian region iShares is 0,51, the correlation between the U.S. iShares and the European region iShares is 0,65 and the correlation between the U.S. iShares and the

American region iShares is 0,52. These results indicate that diversification benefits from these funds are limited.

Next Martinez et al. (2006) evaluate if changes in the ETF price returns fully reflect the NAV information. Means are 0,98 for Asia, 0,97 for Europe and 0,96 for America. Among this study the ETF prices fully reflects the NAV information. Results are as expected. The prices are efficient and reflect the true value of the underlying asset. Also found in the study that lagged ETF premiums help to predict the ETF future returns (Martinez et al. 2006: 9).

In the last part Martinez et al. (2006) show how much information the prices and NAVs contribute to the price discovery process for each iShares. The contribution is made by using iShares´ closing prices from the U.S. market, the NAV for each country and regional iShares index at time of the local market close. The study indicates, that the greater the difference between the trading hours between the U.S. market and the local market, the more price discovery is contributed by the ETF closing price than the local market NAV´s closing price. For the Asian market ETF trade prices contribute approximately 66% of the information while the NAV contributes only 34%. For the European market numbers are 57% for the ETF trade prices and 43% for the NAV. For the American market the ETF trade prices contribute 54% of the information and NAV 46% of the information (Martinez et al. 2006: 11). These results show that there is a difference between the trading hours and information contribution between the ETF trade price and the NAV.

4.1. Fund price respond to changes in underlying values

As said in the study executed by Martinez et al. (2006), the main reason to drive the ETF prices is the information released during the local markets trading hours (Martinez et al. 2006: 14). According to this, all negative news, and by contrast, positive news in the underlying asset affect the ETF price. But how does this information affect? Does the change in the price happen immediately when the ETF market opens and how long does the effect lasts? Hughen & Mathew (2009) have studied this subject by using both ETFs and CEFs as data. Their data collection consists on ETFs and CEFs that invest in non-US equities. The sample period is March 31, 2000 – March 31, 2004. They conclude three

main findings. First, the prices of the CEFs and the ETFs are slow to reflect on the changes in their underlying value, and the ETF returns are more closely related to the underlying asset returns than the CEFs. The study also shows, that the changes in the NAVs explain 78% of the 5-day forecast error variance in the case of ETFs, but only 54% in the case of CEFs. Also shocks in the NAVs affect positively on the fund prices, still only 3 out of 5 days in 79% in CEFs and 2 out of 5 days in ETFs.

Second, the ETF and CEF prices underreact to the NAV returns but overreact to the domestic stock market returns. Third, while the changes in the exchange rates and the UC indexes are more widely reported, these variables are not generally significantly related to the fund returns since they are subsumed in the NAV returns (Hughen et al. 2009: 49).

Another study made by Kim, Mathur & Szakmary (1999) gives parallel results. The difference in the data is, that Kim et al. (1999) use ADRs. These results can still be dissected here, since the underlying assets´ information impact on the investment vehicle´s price, both in ADRs and ETFs, acts very similarly. As in the previous study, researchers use vector autoregression model (VAR) as well as regression (SUR) approach to figure out the importance and the speed of adjustment of ADR prices to the underlying assets. As data they use Japanese, British, Dutch, Swedish and Australian firm shares and their ADRs from January 4, 1988 to December 31, 1991. The findings are, that changes in the underlying asset can be seen in the price of an ADR during the same calendar day. Also found in the study that while the underlying asset is the main driver for the ADR prices, the exchange rate between the foreign currency and the U.S. dollar is becoming a greater factor in pricing the ADRs.

ADRs also underreact to the underlying asset returns, but overreact to the U.S. market returns. This same result was discovered when studied CEFs and ETFs in the previous chapter. More similarity between the ADRs and ETFs is also found; they both have a very slight difference between the fundamental value and the investment vehicle´s price. By contrast, the deviation is greater in the case of CEFs (Kim et al. 1999: 1380).

From the facts presented above one can conclude that the difference between the ETF and ADR price is slight compared to the underlying value. Also that

the affect of information released in the market of the underlying asset lasts for 2 days in the case of an ETF and 3 days in the case of a CEF. Both ADRs and ETFs also seem to underreact to the foreign market changes but overreact to the domestic, in this case U.S. market changes. The only conflicting result in these studies is, that in the case of ETFs and CEFs the information transmission from the underlying asset to the investment vehicle´s price is said to be slow when in the case of ADRs it is said to happen during the same calendar day.

4.1.1. Investor reaction in changes of the underlying asset

When the local market information releases´ effect on the fund price is observed from the investor´s point of view, a study made by Klibanoff et al. (1998) is a great approach. In their paper 39 U.S. based mutual funds from 25 countries are studied. The hypothesis of the study is that news events lead some investors to react more quickly. The results of the study are consistent with the hypothesis (Klibanoff et al. 1998: 673).

The first finding in the paper is, that if some investors react more to fundamentals after an important and well-publicized news event and the focus attentions on the host country, the prices will react more to the NAV. However, the price returns in funds are sticky in a way, that they display dependence on the past changes in fundamentals in addition to the current ones. The second finding is, that using country-specific news events as a measure of prominent news, regression results suggest that the reaction to the changes in fundamentals is quicker after news events meaning that the short-run elasticity of prices temporarily rises (Klibanoff et al. 1998: 691).

The fact that news weeks are accompanied with high volume and volatility in the stock market are related in this study. However, they are not affecting only on volume and volatility but on other factors as well. In case that the NAV was not an accurate measurement of fundamentals, Klibanoff et al. (1998) use publicly observable foreign stock market indexes and foreign exchange rates as a measure of fundamental value and they find that the reaction of prices to foreign indices also rises significantly in news weeks. Evidence, however, suggests that the NAV is a good measure of fundamental value (Klibanoff et al. 1998: 691).

4.2. Predicting the international fund prices

Lai et al. (2008) have studied the pricing of international funds and actually created a new method to better predict the fund prices. As data they use 16 synthetic mutual funds whose characteristics are extracted from the U.S. based Japanese mutual funds. The sample period is January 6, 1993 – December 31, 2001. Even if ETFs are not used, the results can still be compared with the price predictability with ETFs whose underlying assets are abroad (Lai et al. 2008: 2315). Instead of adjusting prices at fund level, as done in the previous studies, Lai et al. (2008) use price adjustment at individual security level in the funds, what they state to be the most successful method to estimate the fair prices of international funds (Lai et al. 2008: 2307). Their method to predict the prices is to run a stepwise regression for each share in a fund and to use comprehensive public economical information in the local market. Once the optimal set of factors is selected from the stepwise regression, they use estimated parameters to estimate the price (Lai et al. 2008: 2315).

Using method where the prices are adjusted at individual share level, Lai et al. (2008) get the most accurate prediction of the fund prices at next day Japan open. The method outperforms all the existing ones at 5% significance level. Lai et al. (2008) also notice that while the existing methods remove much of the daily return predictability resulting from stale pricing, they remain highly vulnerable to exploitation by market timers. The most interesting finding here is, that by the new method the excess returns over existing ones can be noticed to be 25% in the case of the S&P 500 and 22% in the case of the Nikkei 225, annually. The best alternative method using both the S&P 500 and the Nikkei 225 is beaten by 12%, annually. Their method also seems to be the most successful method in preventing profitable strategic exploitation in that none of the competing methods can significantly profit from their stated prices. The method beats also existing ones regardless the fund characteristics including turnover ratio, stock size, number of stocks in a fund, and book-to market ratio (Lai et al. 2008: 232).

4.2.1. ETF discounts and future returns

One of the hypotheses in this thesis focuses on the ETF return predictability with ETF discounts and premiums. Jares et al. (2004) have studied this relation and found that the ETF discounts act as predictors for future returns in ETFs. Quite a few researchers in addition to Jares et al. (2004) have studied the same subject. Some of the studies are executed with ETFs and some of them with CEFs, index funds or ADRs. The next chapter will present a few more studies about the subject to strengthen the assumption of the relation between the discounts and returns.

The study made by Cherry (2004) assumes, that ETFs trade away from their NAVs, ETF discounts vary substantially over time, and that ETF discounts are a significant explanatory of future ETF returns. He also states that ETFs are 17 per cent more volatile than their NAVs (Cherry 2004: 1).

To prove the statements, Cherry (2004) studies 83 ETFs´ daily prices listed in the American Stock Exchange. The period for the study is the inception day of the fund – February 3, 2004 excluded those funds that are incepted less than 100 days before the February 3, 2004. Cherry (2004) uses regression model to analyze the excess volatility in the funds and time series analysis to analyze the power of the discounts to explain the future returns. It is good to notice here, that if the fund´s discount has a predictive power to the future returns, then the funds prices are not informational efficient (Cherry. 2004: 8).

What Cherry (2004) discovers is consistent with the assumptions of the study. The results suggest, that lagged discount explains an economically significant part of the variation in the daily returns meaning, that 1 per cent rise in the lagged discount lowers the next day´s ETF return by 68 basis points. Also discovered, that NAV returns are positively related to the ETF discounts (Cherry. 2004: 10). As well noticed that tested arbitrage strategy generates 15% excess returns per annum. Excess returns in this strategy, however, are lower cross-sectionally for the funds with higher volumes, higher variations of discounts, and when the funds hold international securities. The study also suggests, that investors are irrational and that the ETF price formulation is inconsistent with the efficient market hypothesis (EMH) (Cherry. 2004: 16).

Another study made by Rompotis (2009) results similarly with for example Jares et al. (2004), and Cherry (2004). The purpose of the study is to estimate the premium in ETF trading prices and its affect on the ETF future returns.

In the study is discovered, that studied ETFs trade at 0,015 per cent premium on average. The premium, however, is noticed to disappear in one day. This result is parallel with the study by Kayali (2007), which shows, that the discounts disappear in two days. Rompotis´s (2009) study also reveals that ETF returns are positively affected by the contemporaneous premium and negatively affected by the lagged premium (Rompotis 2009: 1). This observation indicates that ETF pricing is inconsistent with the efficient market hypothesis as noticed also in Cherry´s (2004) study.

Zweig (1973) studies the affect of investor´s expectation to the CEF prices. By observing CEFs from December 31, 1965 – January 1, 1971 he finds consistently with the expectations, that prices move in a random walk and that the investor´s expectations do not affect the price (Zweig 1973: 77). This result is interesting since numerous other studies suggest, that behavioral finance has an impact on the ETF prices, and through that to ETF discounts that are revealed to predict the future returns in ETF prices.

As a conclusion can be said, that a relation between the discounts and the future returns does exist when examining ETFs. In CEFs, in light of studies presented, the relation is not that clear.

4.3. Trading hours´ impact on the ETFs´ price and potential profit opportunities

Jares et al. (2004) have studied how trading hours affect the ETF price and if asynchronous trading hours cause potential profit opportunities. The mechanism of an ETF is designed to minimize the deviation between the NAV and the ETF price, but asynchronous trading hours between the NAV market and the ETF market extends this deviation creating profit opportunities (Jares et al. 2004: 57).

As data Jares et al. (2004) use NAV and market price of Hong Kong´s and Japan´s iShares between March 18, 1996 and December 6, 2001. In the study is executed three different methods to reveal the results: discount/premium summary, return analysis and trading strategy analysis. As a result Jares et al. (2004) find that the market zeal to trade with international ETFs in the U.S. market lead to a predictable relation between the ETF discounts and the future ETF returns. Also found in the study that there exists an overreaction between the lagged and contemporaneous discounts and returns in ETFs of both countries. What comes to the regression analysis, is found that the contemporaneous discount is a negative and the lagged discount a positive predictor to the daily returns on both Japan and Hong Kong iShares. When compared trading rule to buy and hold –strategy, the difference and profits are remarkable. When the market price is less than the NAV one should buy the ETF shares and when the market price is greater than the NAV one should sell them. This trading strategy has produced cumulative returns of 542,25% for Japan and 12,119% for Hong Kong during the observation period. When compared to buy and hold strategy, profits are even greater. Buy and hold produced –41,79% for Japan and –12,24% for Hong Kong (Jares et al. 2004: 68).

What is also interesting to notice is that the standard deviation for the trading rule is smaller than for the buy and hold –strategy. This indicates that the return to risk rate is remarkably greater in the case of the trading rule. What can be concluded is that when ETFs and their underlying assets do not trade synchronously, profit opportunities do exist (Jares et al 2004: 69).

For comparison, Pontiff (1995) has also studied the discount/return relation. The difference between Jares et al. (2004) and Pontiff (1995) is, that Pontiff uses Closed-End Funds as data. The period for the study is July 1965 and July 1985. 68 funds are observed. Pontiff (1995) finds a positive relation between the bid–ask spread and the expected returns. He also finds, that the CEF premium predicts the future return even better that the bid–ask spread (Pontiff 1995: 366).

4.4. The relation between ETF discount, tracking error and liquidity

Chan et al. (2008) have studied the relation between the premium and liquidity in ADR market. Their study states, that a higher ADR premium is associated with a higher liquidity in the ADR market and a lower liquidity in the home shares. The paper is interesting since the price formulation and structure of the ADRs is quite similar with international ETFs, as mentioned earlier in this thesis.

As data Chan et al. (2008) use daily data from 401 ADRs in 23 countries between January 1981 and December 2003. In addition to summary statistics of the sample Chan et al. (2008) present regression analysis about the liquidity effects of the ADRs and a test of robustness (Chan et al. 2008: 949).

The conclusions of the study are much consistent with the hypotheses. In the study is discovered that an increase in the premium is associated with the increase in the liquidity. The increase in the premium also affects the home share liquidity by decreasing it. The robustness test results that the liquidity remains strong even after the ADR market size is controlled as well as investors´ expectations regarding the future exchange rate movements, home stock market performance and various measures of country characteristics (Chan et al. 2008: 958). However, the study highlights interesting questions concerning the liquidity and its transfer from one market to another. Does, for example, time difference affect the liquidity and does this possibly create arbitrage opportunities?

These results are interesting to notice and will be used as a base for the study executed in this particular thesis. Especially the relation between the time difference and liquidity appears to be an interesting approach.

5. DATA DESCRIPTION AND METHODOLOGY

The next chapter introduces the data sample and research methods for the empirical study. The empirical part will concentrate on studying the time-lag´s and liquidity´s impact on the ETF discount as well as the predictability of ETF future returns with ETF discounts.

First the data is described in detail and methods to the actual study presented. Also a table for the main characteristics for the used iShares ETFs and the hypotheses for the empirical part are presented.

5.1. Data

The data consists from international iShares Exchange-Traded Funds between 14 July, 2000 and 19 January, 2011. Since the idea of the thesis is to observe different time zones, one ETF from each possible time zone is included in the data. The funds used in the thesis are: iShares MSCI Mexico (EWW, GMT -6), iShares MSCI S&P500 (IVV, GMT -5), iShares MSCI Brazil (EWZ, GMT -3), iShares MSCI United Kingdom (EWU, GMT +0), iShares MSCI Sweden (EWD, GMT +1), iShares MSCI Hong Kong (EWH, GMT +8), iShares MSCI South Korea (EWY, GMT +9), iShares MSCI Australia (EWA, GMT +10). 8 international ETFs are used in total. The study contains 21058 observations from 8 international Exchange-Traded Funds in approximately ten year´s time period. The reason to use only 8 different ETFs is, that it is the maximum amount of ETFs listed in the same U.S. exchange from different time zones. For example adding Japan iShares ETF to data would not make any difference in this thesis since its NAV is from the same time zone as South Korea´s. ETF closing prices, NAV closing prices, ETF volumes and index levels are used to get the needed results. The time period for the data is chosen to be approximately ten years since it is the longest period the data was available even for those ETFs latest launched.

The data is acquired from the iShares´ homepage (us.ishares.com) and from Google finance (www.google.com/finance). The data is daily data and days, when the exchange either in the ETF market or in the NAV market have been closed are removed.

Table 5 presents the ETFs used in this thesis. Key factors such as, name, Inception date, target index, total assets, expenses, returns and price to earnings ratios are introduced. As can be noticed the size of the funds vary remarkably but, for example, the operating expenses remain relatively low in all funds. The inceptions of the funds can be divided in two categories, the most of them are incepted in 1996 but some of the funds are incepted in 2000.

Table 5. iShares international ETFs (iShares 2011).

ETF	Inception date	Target index	Total assets	Operating expenses	Total return from inception	P/E
iShares MSCI Mexico, EWW	12.3.1996	MSCI Mexico Investable Market Index	$1,62 billion	0,53% p.a.	15,10 %	20,7
iShares MSCI S&P 500, IVV	15.5.2000	S&P 500 Index	$27,03 billion	0,09% p.a.	0,95 %	19,44
iShares MSCI Brazil, EWZ	10.7.2000	MSCI Brazil Index	$13,2 billion	0,61% p.a.	16,57 %	14,9
iShares MSCI United Kingdom, EWU	12.3.1996	MSCI United Kingdom Index	$1,34 billion	0,53% p.a.	6,15 %	16
iShares MSCI Sweden, EWD	12.3.1996	MSCI Sweden Index	$0,63 billion	0,53% p.a.	10,48 %	16,98
iShares MSCI Hong Kong, EWH	21.3.1996	MSCI Hong Kong Index	$1,85 billion	0,53% p.a.	5,49 %	15,53
iShares MSCI South Korea, EWY	9.5.2000	MSCI Korea Index	$4,83 billion	0,61% p.a.	11,89 %	18,51
iShares MSCI Australia, EWA	12.3.1996	MSCI Australia Index	$3,22 billion	0,53% p.a.	10,47 %	18,06

5.2. Methodology

To test the first hypothesis is required to calculate the ETF discount. To calculate the ETF discount is required to acquire the fund´s NAV´s closing prices and ETF´s closing prices. In this study the ETF discount is calculated from the

lagged NAV prices and lagged ETF closing prices (t-1, t-7, t-14, t-28, t-56). The formula used to calculate the ETF discount is following:

$$ETF_D = \frac{NAV_t - ETF_t}{NAV_t} \quad (12)$$

Where,

$\boldsymbol{ETF}_D$ = ETF discount at time t
$\boldsymbol{NAV}_t$ = Net Asset Value at time t
$\boldsymbol{ETF}_t$ = ETF price at time t

If the result from this formula is negative (positive) ETF trades at premium (discount). In this study is used the same method to calculate the ETF discount as in Jares et al. (2004), but it could as well have been calculated as in Charupat & Miu (2010). In Charupat´s & Miu´s (2010) the way of calculating the discounts is opposite for Jares et al´s. (2004) meaning, that if the result from the formula is negative (positive) ETF trades at discount (premium).

To discover if ETF discounts increase or decrease with liquidity, a Pearson´s correlation test is used. The assumption is, that the ETF discount correlates with the fund´s trading volume. This assumption is based on the Chan et al. (2008) who discovered that increasing premium in the ADR market is associated with the increasing liquidity.

The second hypothesis is tested by setting dummy variables for each time zone and with regression analysis to discover if ETF discounts correlate with the time-lag. The assumption is, that the ETF discount increases when time difference between the ETF market and its NAV market increases. This assumption is based on the Martinez et al. (2007) who state that ETF prices are mainly driven by information released during the each local market's trading session. First the calculated ETF discounts are combined and then set one after another in Microsoft Excel. Then for each time zone is set a dummy variable so, that it is one for the country to what the coefficient for the discount will be examined, and zero for others. The coefficients resulted from the regression analysis will then be compared with each other and examined if the coefficients vary with the time

zone difference or not. The result will show if dummy coefficients explain the change in the ETF discounts when time zone changes.

The third hypothesis will be tested with a return analysis. It is the same method as used in the Jares et al. (2004) to find if the changes in the ETF discounts from previous day´s NAV can predict the ETF returns. The only difference for Jares et al. (2004) is that in this thesis instead of both contemporaneous and lagged discounts only the lagged ETF discounts will be used as explanatory factors for the ETF returns. Lagged discounts at times *t-1*, *t-7*, *t-14*, *t-28* and *t-56* will be used to predict the ETF returns at time *t*. The model used is following:

(13) $$RETURN_{ft} = (DISCOUNT_{f,t})$$

Where,

RETURNft = Return for ETF from time t-1 to time t
DISCOUNTf,t = Discount from NAV for ETF at time t

The coefficients from the regression analysis will be used as predictors for the future ETF returns. Jares et al. (2004) found, that the previous day´s ETF discount is a positive predictor for the future ETF return meaning, that when negative information concerned the particular country´s ETF is released, the price of the ETF will decrease causing a discount since the ETF market is opened and the NAV market is closed. According to Jares et al. (2004: 63) the U.S. market overreacts to this information, and the discount is so remarkable that it creates profit opportunities for the next day. In other words the ETF price decreases "too much" creating positive returns for the next day.

5.3. Hypotheses

The hypotheses are based on the previous studies but in this thesis the effect of the time-lag to the ETF discount is highlighted. The purpose of the study is to discover if changes in the fund´s liquidity correlate with the ETF discount. Also if different trading hours´ affect the ETF discount. The last assumption is, that ETF discounts are able to predict the future ETF returns.

The first pair of hypotheses assumes, that ETF liquidity correlates with the ETF discount. If the null hypothesis is rejected, it means that the increase of the ETF´s liquidity has no affect on the ETF discount. The first hypothesis concentrates on discovering if high trading volume keeps the ETF´s price and its NAV´s price deviation in minimum or if low trading volume extends the deviation.

H0: ETF trading volume correlates with the ETF discount.

H1: ETF trading volume does not correlate with the ETF discount.

The second pair of hypotheses concentrates on finding a relation between different trading hours and ETF discounts. The null hypothesis assumes, that the changes in the time zone can explain the changes in the ETF discounts in a country level. If the null hypothesis is rejected, then different trading hours have no affect on the size of the ETF discount.

H0: Time zone difference affects the ETF discount.

H1: Time zone difference does not affect the ETF discount.

The third pair of hypotheses states, that the lagged ETF discounts are able to predict the future ETF returns. This assumption is based on the Jares et al. (2004) who have noticed that lagged returns at time *t-1* act as positive predictors to the future ETF returns. Now this same assumed phenomenon is tested in this thesis with different data sample. If the null hypothesis is rejected, it indicates that a relation between the lagged ETF discount and the future ETF return is not found.

H0: Lagged ETF discounts can predict the ETF returns.

H1: Lagged ETF discounts cannot predict the ETF returns.

6. EMPIRICAL RESULTS

The next part of the thesis concentrates on reviewing the empirical evidence about international the Exchange Traded Funds presented in the previous chapter. The research executed in this chapter is based on the previous studies reviewed earlier in the thesis but the perspective to the subject is slightly different. In this thesis the main concentration will be focused on the liquidity´s and time lag´s impact on the ETF discounts and the discounts´ ability to predict the future ETF returns.

The idea of this study is to pay attention on the matter how the asynchronous trading hours and varying ETF discounts affect the returns of the ETFs. Is it, for example possible to benefit from the time-lag or does it affect anything at all. These are the baselines for this thesis and through various tests and measurements answers for these questions will be found.

There are a lot of studies about this subject and most of them are concentrated on predicting the future prices of the ETFs and finding out how much ETFs reflect information in their NAVs. Also studied if the ETF discounts can lead to profit opportunities. Still none of the previous studies directly show, if liquidity and time-lag affect the ETF discounts and if the ability to explain the future ETF returns with increasing lagged discounts strengthens or weakens.

The next chapter will present the results from tests executed. The data is first organized with Microsoft Excel and the actual tests done with SPSS. The hypotheses presented in the earlier chapter are tested by Pearson´s correlation test, regular regression analysis, and regression analysis with Dummy variables.

The data is introduced more specifically in the descriptive statistics tables. Key factors such as volume, ETF closing price and NAV closing price are presented. Each fund covers approximately 2600 observations from the years 2000 – 2011. For clarifying the difference between the fund´s target index, its NAV and the actual ETF share price, figures from the performance of these factors are presented also graphically.

Tables 6 & 7 show that the average ETF discounts, that indicate the difference between the ETF and its NAV, are relatively small. United Kingdom by the biggest mean value trades at 0,38 per cent premium on average. Mexico, by the only fund trading at a discount, trades at 0,04 per cent discount on average. Other funds trade at premium, making their ETF share prices overvalued.

Tracking error values, that indicate the difference between the target index and the fund´s NAV, result very small on average but as can be seen in the figures that represent the cumulative Index, NAV and ETF returns, the difference between the index compared to the NAV and ETF returns is remarkably greater. This phenomenon can be explained by management fees, transaction costs and other expenses. The reason why the index results remarkably better than its NAV or the ETF may also be caused since the indexes are unmanaged. The index returns are also measured by including both security price movements and dividend payments into the performance while the NAV and ETF returns contain only security price movements excluding dividend payments (iShares 2011).

Table 6. Descriptive statistics.

	N	Minimum	Maximum	Mean	Std. Deviation
Mexico ETF Volume	2641	200	11079110	1569480,23	1806636,020
Mexico ETF Close	2641	11,20	64,77	32,4253	16,86826
Mexico NAV Close	2641	11,34	64,34	32,4341	16,86538
Mexico Tracking Error	2640	-,038840	,016391	-,00007975	,002239460
Mexico ETF Discount f, t-1	2640	-,055486	,051243	,00042894	,007724988
S&P500 ETF Volume	2641	6500	20445823	1816613,96	2397398,803
S&P500 ETF Close	2641	68,19	156,79	117,4498	18,50408
S&P500 NAV Close	2641	68,24	156,65	117,4456	18,50732
S&P500 Tracking error	2640	-,007637	,005350	-,00007301	,000595488
S&P500 ETF Discount f, t-1	2640	-,015313	,021826	-,00004327	,001579527
Brazil ETF Volume	2609	0	55565488	6893032,20	8841311,060
Brazil ETF Close	2609	5,35	100,47	37,1342	25,51270
Brazil NAV Close	2609	5,71	100,57	37,0547	25,42040
Brazil Tracking error	2608	-,108845	,089184	-,00016091	,007955664
Brazil ETF Discount f, t-1	2608	-,078170	,108717	-,00137252	,011548521
United Kingdom ETF Volume	2640	1800	17010106	534765,96	964297,551
United Kingdom ETF Close	2640	9,00	27,22	17,1727	3,90524
United Kingdom NAV Close	2640	9,08	27,13	17,1097	3,89882
United Kingdom Tracking error	2639	-,048541	,002954	-,00016568	,001993262
United Kingdom ETF Discount f, t-1	2639	-,103806	,061527	-,00381168	,009242080

Table 7. Descriptive statistics.

	N	Minimum	Maximum	Mean	Std. Deviation
Sweden ETF Volume	2618	100	4456700	129308,23	221565,738
Sweden ETF Close	2618	7,45	39,19	20,9053	7,50644
Sweden NAV Close	2618	7,56	39,00	20,8844	7,50303
Sweden Tracking error	2617	-,185780	,039078	-,00012998	,004422581
Sweden ETF Discount f, t-1	2617	-,099211	,063884	-,00111413	,011338405
Hong Kong ETF Volume	2640	2300	26168316	2539108,38	3318141,371
Hong Kong ETF Close	2640	6,57	24,10	12,8418	3,69877
Hong Kong NAV Close	2640	6,61	23,90	12,8370	3,69465
Hong Kong Tracking error	2639	-,033559	,031738	-,00012419	,001782775
Hong Kong ETF Discount f, t-1	2639	-,082389	,089239	-,00039035	,013521233
South Korea ETF Volume	2637	100	13001900	1423901,06	1825869,723
South Korea ETF Close	2637	10,81	74,76	34,9416	15,75068
South Korea NAV Close	2637	5,98	73,25	34,9279	15,75117
South Korea Tracking error	2636	-,795014	2,925950	,00084584	,060922977
South Korea ETF Discount f, t-1	2636	-2,904682	,408922	-,00157776	,062291099
Australia ETF Volume	2639	100	19465744	1338418,62	2030907,023
Australia ETF Close	2639	7,60	34,71	17,1628	6,67245
Australia NAV Close	2639	7,61	34,16	17,1340	6,67000
Australia Tracking error	2638	-,064428	,012176	-,00013958	,002435923
Australia ETF Discount f, t-1	2638	-,115385	,085172	-,00193449	,012453734
Valid N (listwise)	2608				

Figures below represent the differences between the ETF´s target index, its NAV and the actual ETF price. The figures are derived by calculating the cumulative returns between 14 July, 2000 and 19 January, 2011. As can be seen in the figures 3-10, the difference between the ETF share price and its NAV is very small. In other words, ETFs trade at quite a small discount/premium. The greatest average deviation can be seen in United Kingdom that trades at 0,38 per cent premium and smallest in S&P 500 trading at 0,004 per cent premium on average. Tracking error is greater, as expected. Like mentioned before, fees and other expenses as well as dividend payments improve the indexes´ performance compared to the NAV and the ETF.

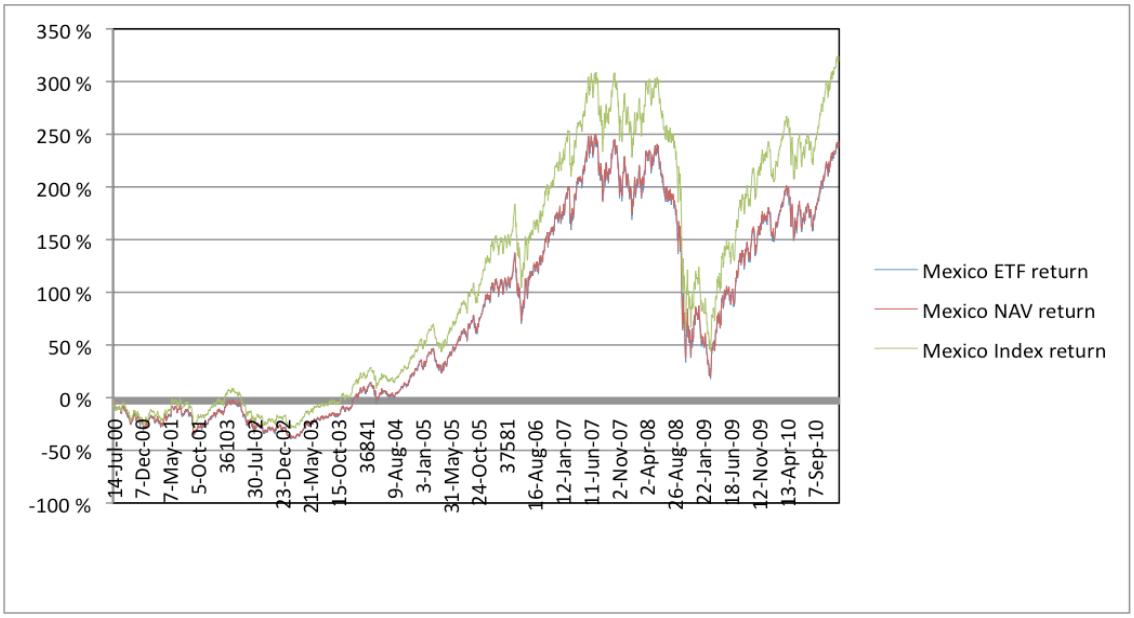

Figure 3. Cumulative returns Mexico 2000-2011.

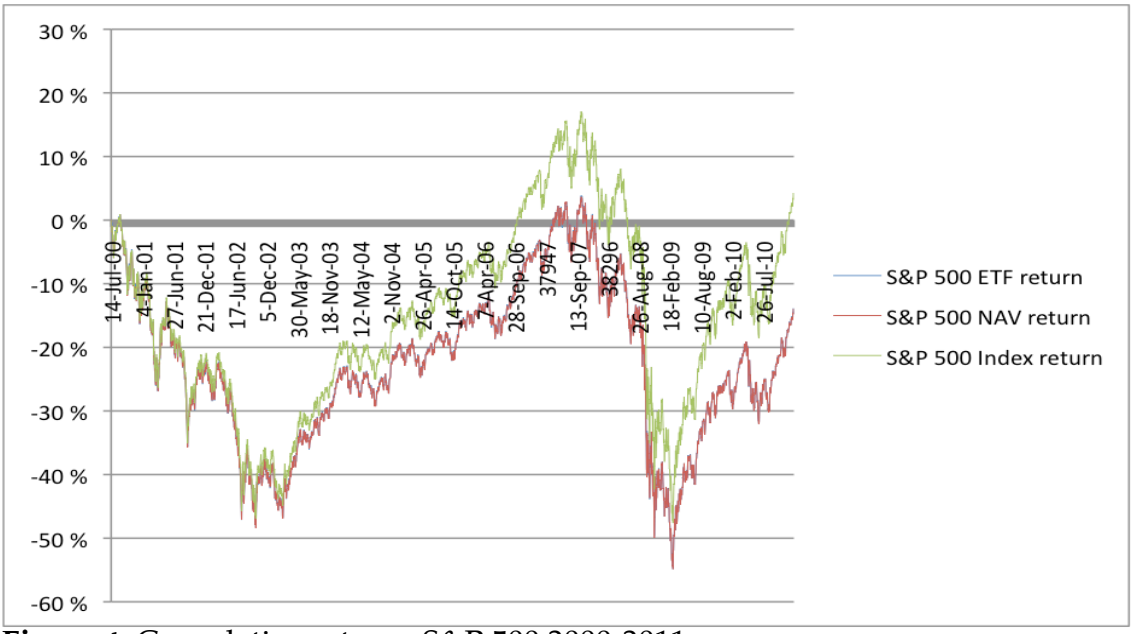

Figure 4. Cumulative returns S&P 500 2000-2011.

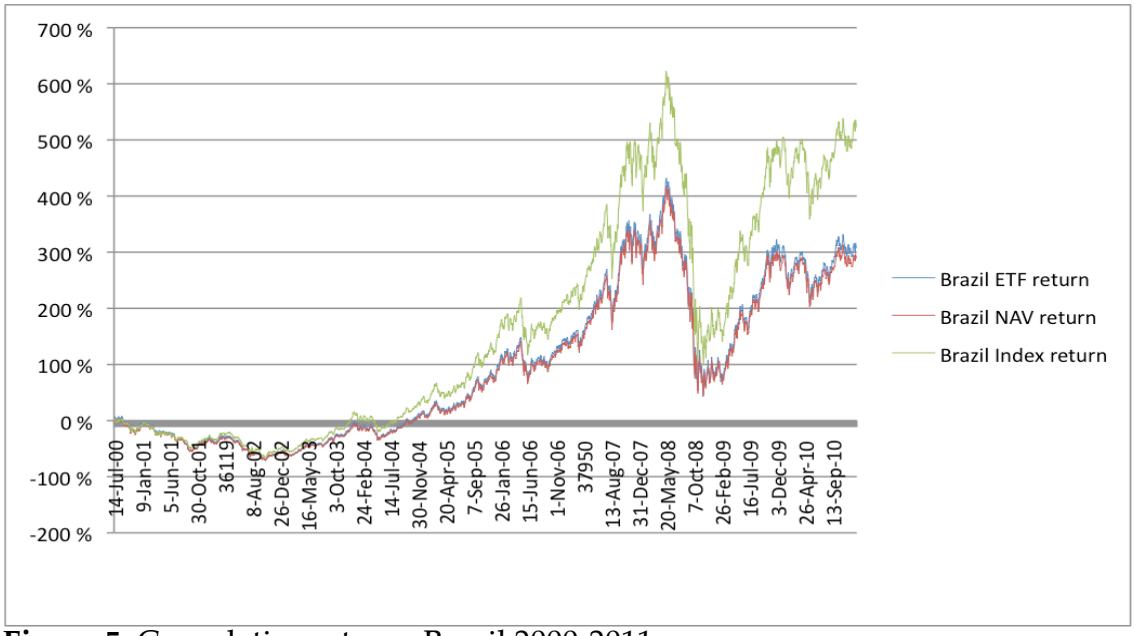

Figure 5. Cumulative returns Brazil 2000-2011.

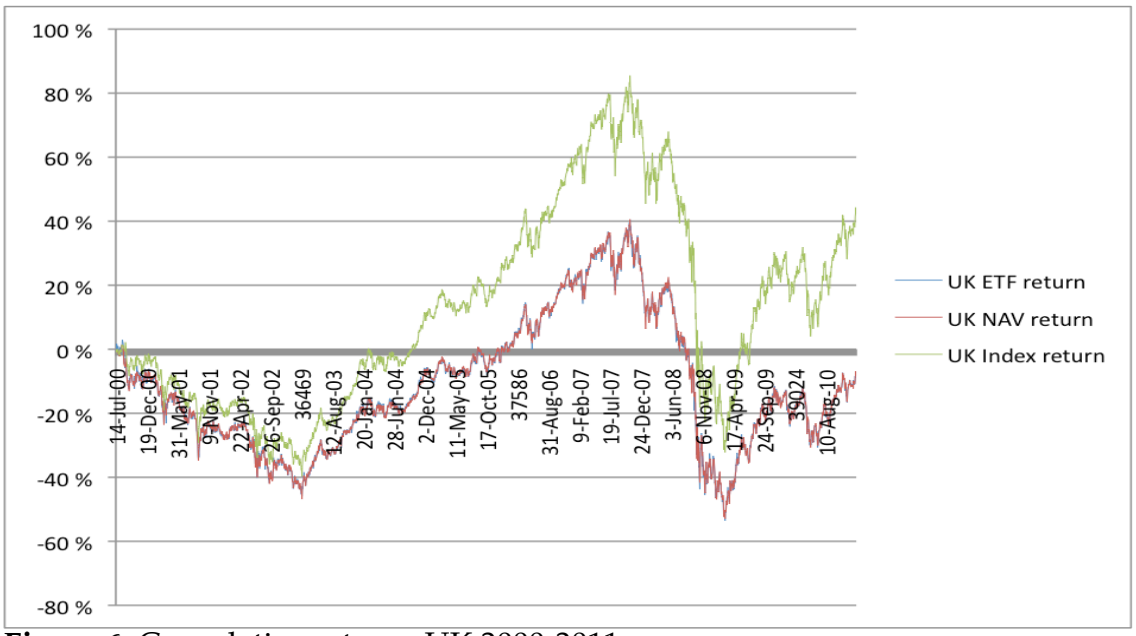

Figure 6. Cumulative returns UK 2000-2011.

Figure 7. Cumulative returns Sweden 2000-2011.

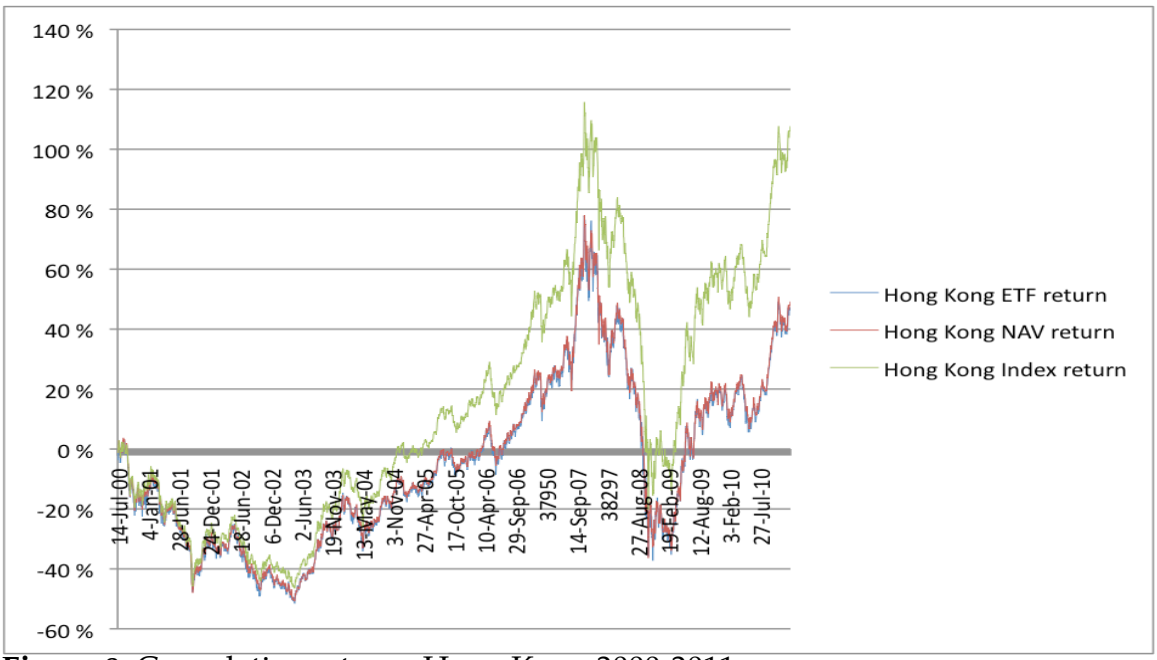

Figure 8. Cumulative returns Hong Kong 2000-2011.

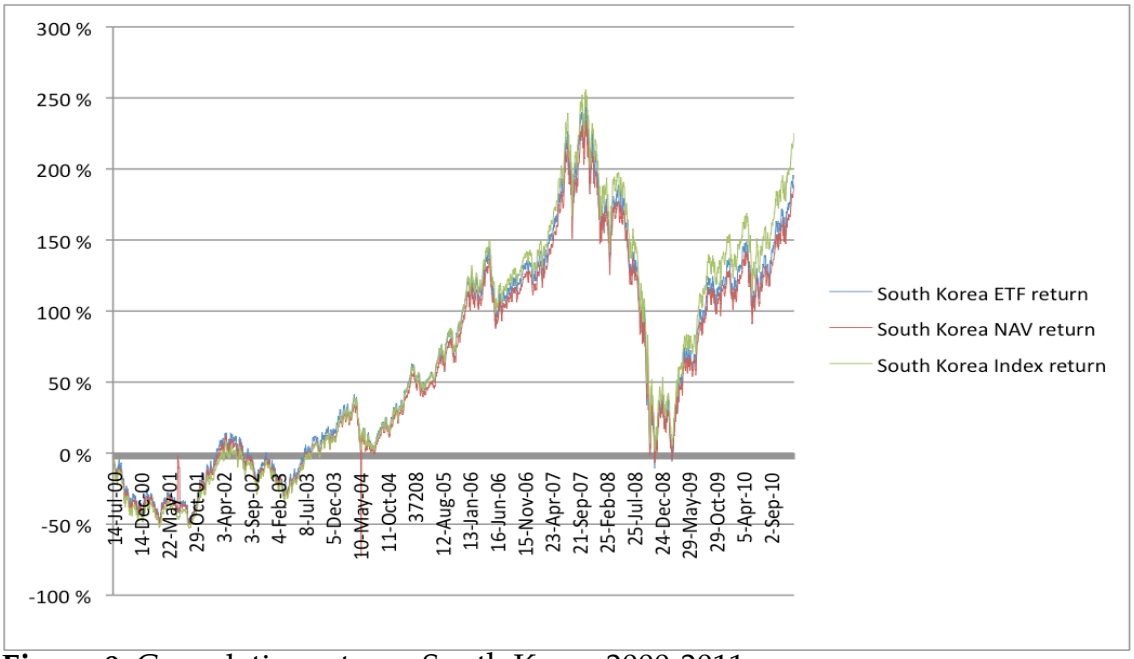

Figure 9. Cumulative returns South Korea 2000-2011.

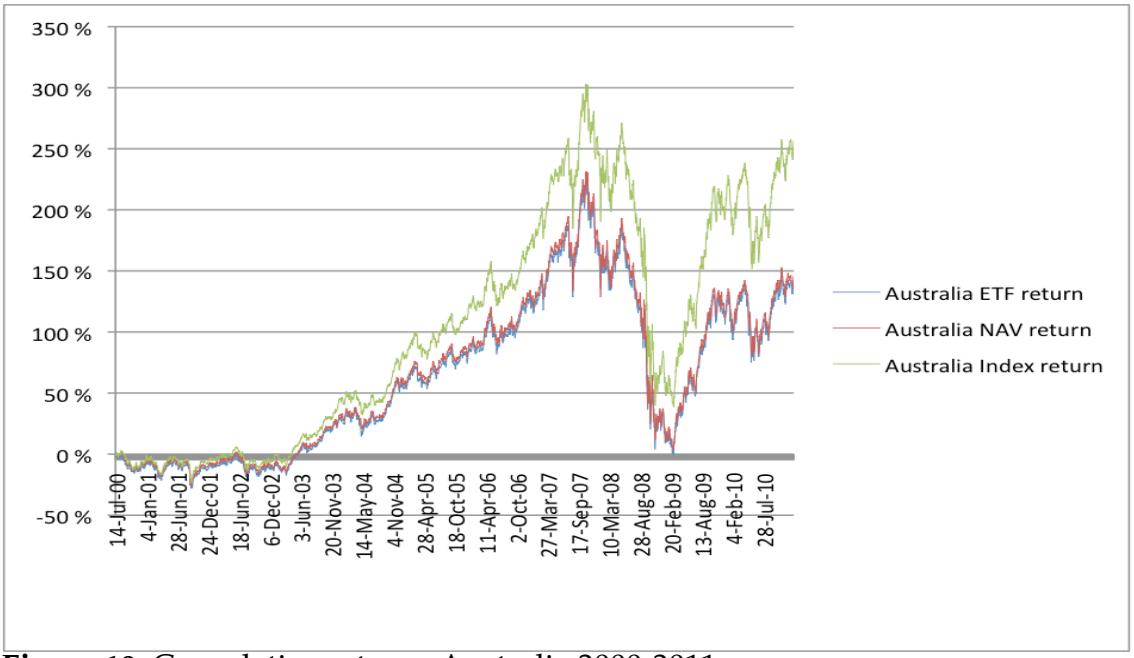

Figure 10. Cumulative returns Australia 2000-2011.

6.1. Liquidity and ETF discount

The purpose of the first test is to discover if there exists a correlation between the liquidity and the ETF discount. The problem is examined by running a Pearson´s correlation test for observations. The correlation is measured from all individual funds separately as well as jointly.

The test shows, that there is no correlation between the liquidity and the ETF discounts. In other words, the null hypothesis in the first pair of hypotheses can be rejected. When examined the results in individual fund level is found, that only Australia provides statistically significant results at 0,05% significance level. However, the liquidity´s affect on the ETF discount remains small in this fund too. Australia´s Pearson correlation coefficient is 0,084 meaning that if the liquidity increases 1 per cent, the ETF discount decreases 0,084 per cent. As there can be noticed, the results are parallel with the first hypothesis but not statistically significant. Correlation tests for individual funds separately can be found in the appendix part.

Table 8. Correlations for liquidity and ETF discount.

		Total ETF Volume	Total ETF Discount f, t-1
Total ETF Volume	Pearson Correlation	1	,008
	Sig. (2-tailed)		,260
	N	21058	21057
Total ETF Discount f, t-1	Pearson Correlation	,008	1
	Sig. (2-tailed)	,260	
	N	21057	21057

6.2. Time-lag and ETF discount

The second hypothesis states, that when the time-lag between the ETF market and its NAV market changes, the ETF discount changes with it. According to the tests executed by Dummy variable regression model, is found that time difference has no influence on the ETF discount in these particular iShares funds. The result is discovered by comparing the dummy variable regression coefficients with each other. As can be seen in the table 9, Mexico, S&P 500, UK,

Hong Kong and Australia (constant) give statistically significant results. When examined the result of these statistically significant factors can be noticed, that Mexico´s ETF discount is 0,002 units greater than others. S&P 500´s ETF discount, however, is also 0,002 units greater than others as well as Hong Kong´s. Instead, United Kingdom´s ETF discount is 0,002 units smaller than others but so is Australia´s (constant) ETF discount.

What can be concluded from this is that even if the ETF discounts vary, they do vary for some other reason than because of the change in the time zone. A clear pattern, where the ETF discount is increasing/decreasing with the time-lag is not found.

Table 9. Regression for time zone difference and ETF discount.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-,002	,000		-4,129	,000
	Mexico Dummy	,002	,001	,032	3,568	,000
	S&P500 Dummy	,002	,001	,026	2,855	,004
	Brazil Dummy	,001	,001	,008	,846	,398
	UK Dummy	-,002	,001	-,026	-2,833	,005
	Sweden Dummy	,001	,001	,011	1,236	,217
	Hong Kong Dummy	,002	,001	,021	2,331	,020
	South Korea Dummy	,000	,001	,005	,538	,590

a. Dependent Variable: Total ETF Discount f, t-1

The test´s R describing the ability to explain the model results quite a weak coefficients (R=0,051) and (R^2=0,003) while the F-test coefficient for the whole data sample is 7,931 and statistically significant (Sig. 0,000) meaning, that variables in the model are able to explain the results.

6.3. ETF return predictability

The third pair of hypotheses is about the ETF return predictability by ETF discounts. The method to examine this phenomenon is to run a regression model where as explicable factor is the ETF daily return and as explanatory factors are the ETF discounts at times *t-1, t-7, t-14, t-28* and *t-56*. The method is the same as used in Jares et al. (2004).

The regression analysis results that there exists a relation between the ETF returns and the ETF discounts. The discount at time *t-1* seems to be a positive predictor for the future ETF returns, which means that when the fund is trading at 1 per cent discount at time *t-1*, its return for the next day is positive by 0,054 per cent. Another statistically significant result was acquired at time *t-14*. At *t-14* the coefficient was 0,017 meaning that if the fund trades at 1 per cent discount its return for the ETF is +0,017 per cent at time *t*. Other time-lags did not result statistically significant results but as can be seen in the figure 12, it is interesting to notice that the ETF returns seem to be explained best by the *t-1* discounts, and the more lag is involved, the less the ETF discounts are able to explain the future ETF returns.

Table 11 presents the discount coefficients between the countries. What can be concluded from the results is that every ETF that has fundamentals in some other time zone than the actual ETF is trading, has a positive relation between the ETF returns and the lagged ETF discounts at time *t-1*. However, when tried to predict the future ETF returns from longer time period is noticed, that the relation moves closer to zero and actually turns negative yet in one week (*t-7*). This means that the more lag is involved, the more negative relation is involved. To be noticed here, only results at time *t-1* are statistically significant at 0,05% level.

The regression analysis shows that the strongest statistically significant positive relation between the ETF discounts and the ETF returns is found in Mexico by coefficient 0,362 at time *t-1*, while the strongest negative relation is also found in Mexico by coefficient -0,102 at time *t-28*. The weakest relations were found in South Korea (0,016) at time *t-14* and in United Kingdom (-0,091) at time *t-28*.

However, a clear pattern about that, if coefficients increase/decrease with the time-lag cannot be found at least from statistically significant results. If, however observed the figure 13, it is very interesting to see that it seems that the greater is the time-lag between the ETF market and its NAV market, the smaller seems to be the predictive power of the ETF discounts for the future ETF returns. Also noticed in the figures 11 & 12 that the longer is the period the ETF returns are tried to be predicted from, the smaller is the relation between the ETF discounts and the future ETF returns. This result is consistent with the previous studies that state, that ETF discounts should disappear in a few days.

Table 10. ETF return analysis.

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	,001	,000		3,926	,000
	Total D, t-1	,054	,006	,063	8,939	,000
	Total D, t-7	,009	,006	,010	1,470	,142
	Total D, t-14	,017	,006	,020	2,809	,005
	Total D, t-28	-,010	,006	-,012	-1,696	,090
	Total D, t-56	-,002	,006	-,002	-,357	,721
a. Dependent Variable: Total ETF daily return						
R=0,068	R2=0,005	F-test=18,959 (Sig. 0,000)		df=20395		

Figure 11 shows that the relation between the positive ETF returns and the ETF discounts decreases when the time-lag increases. As can be noticed, the discounts at time *t-1* are the greatest positive predictors for the future ETF returns while the discounts at time *t-28* are the greatest negative predictors. From the figure 11 only *t-1* and *t-14* results statistically significant results, but even from these ones it is possible to see the downward trend in the power of ETF discounts as explanatory factors for the positive future ETF returns.

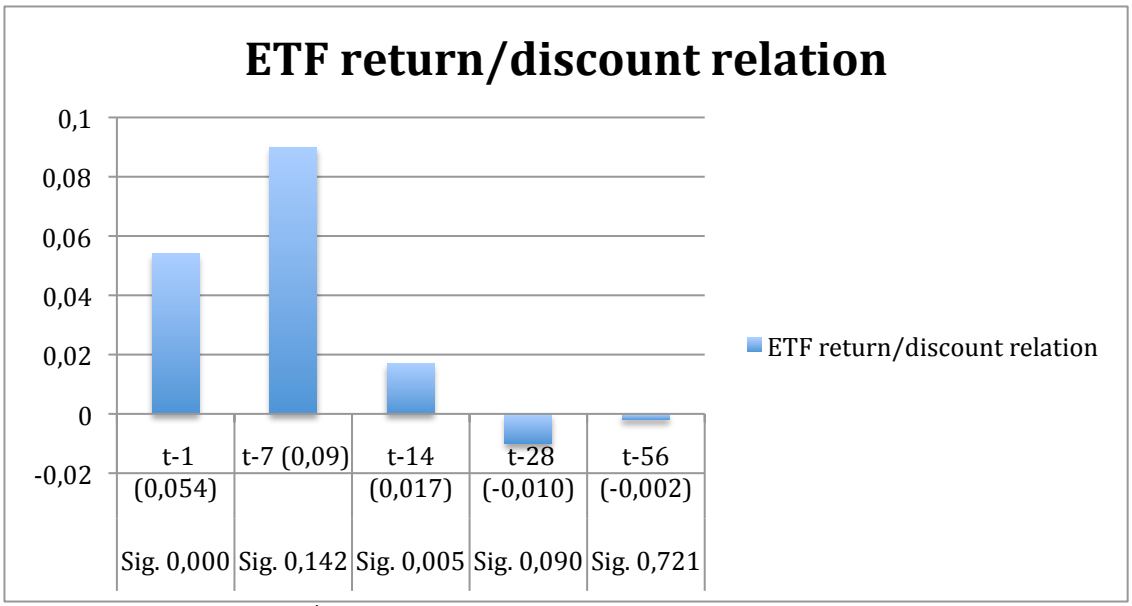

Figure 11. ETF return/discount relation**.**

Table 11 presents the coefficients for all countries tested in this thesis. As noticed, only *t-1* results statistically significant results. Also few other countries from other time periods result statistically significant results, but mainly all other results are not statistically significant. The explanatory power (*R&R2*) of the regression model is quite poor so the tests can be held more as suggestive results than as absolute truths. F-test, however, suggests that variables can be used to test the hypothesis.

Table 11. Coefficients for return analysis.

	Mexico -6	S&P500 -5	Brazil -3	UK 0	Sweden +1	Hong-Kong +8	South-Korea +9	Australia +10
Discount f, t-1	0,362 *	0,009	0,331*	0,212*	0,322*	0,343*	0,012	0,171*
Discount f, t-7	,081	0,055	-0,069	0,058	0,084*	-0,003	0,002	0,044
Discount f, t-14	0,047	0,129	-0,003	0,011	-0,033	0,007	0,016*	0,015
Discount f, t-28	´-0,102*	0,259	0,033	´-0,091*	0,004	-0,044	-0,009	-0,009
Discount f, t-56	0,103*	-0,222	-0,048	-0,009	-0,015	0,002	-0,004	0,037
R	0,158	0,043	0,134	0,134	0,164	0,241	0,055	0,120
R2	0,025	0,002	0,018	0,018	0,027	0,058	0,003	0,014
F-test	13,106*	0,924	9,338*	9,324*	14,093*	31,347*	1,540	7,407*
df	2552	2552	2552	2552	2552	2552	2552	2552
** Sig. At 0,05% level*								

Figure 12 is interesting and illustrates well how the ETF return/discount relation develops with time. Even if all the results used to form the figure are not statistically significant, one can observe the direction of the relation in the figure below as well as in the figure 11. As can be seen, it seems that the strongest relations occur at time *t-1*. This is consistent with the other studies that suggest that ETF discounts are the greatest in the first two days and after these two days they disappear. Similarly seems to happen for the predictors of the ETF returns also. Yet at time *t-7* the coefficients remain remarkably closer to zero and at time *t-28* most of them are negative while again at time *t-56* very close to zero. This result is as expected. While time passes by, the market has time to redress the disparities in pricing and the discounts no longer act neither as positive or negative predictors for the future ETF returns.

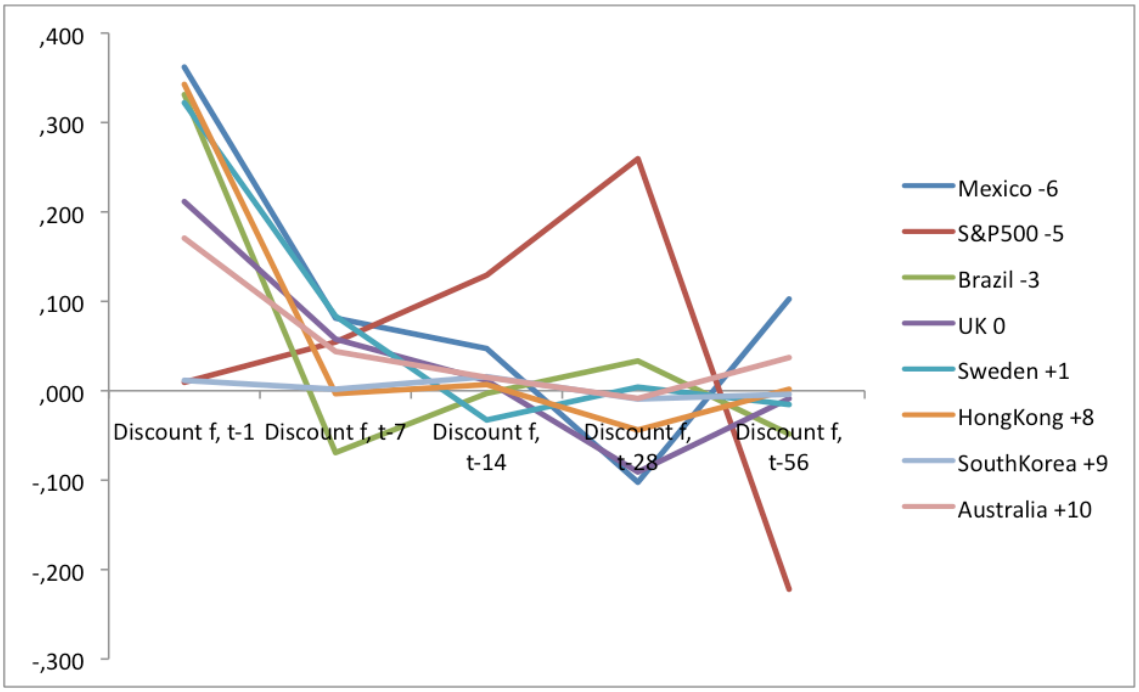

Figure 12. ETF return/discount relation development by time-lag.

Figure 13 gives a little support for the hypothesis 2, that states that ETF discounts correlate with the time difference. As reviewed in the dummy-regression analysis, there is no correlation between the ETF discounts and increasing time-lag. Figure 13, however, suggests that there might exist a slight connection between the ETF return/discount coefficients. One has to notice here that this figure does not contain only statistically significant factors but major of them are not statistically significant. Still, according to the figure 13 it seems, that the greater is the time difference between the ETF market and its NAV market, the smaller is the power of the relation between the ETF returns and the ETF discounts. In other words, in the time zones -6 and -5 the deviation is remarkably greater than in the time zones +8 and +9 meaning, that the closer the ETF´s NAV exists the ETF market, the more it acts as a positive or negative predictor for the future ETF returns while when the time difference between the markets increase, the less the ETF discount seems to explain the ETF returns. The market (NYSE Arca) where the tested ETFs are traded exists at time zone -5.

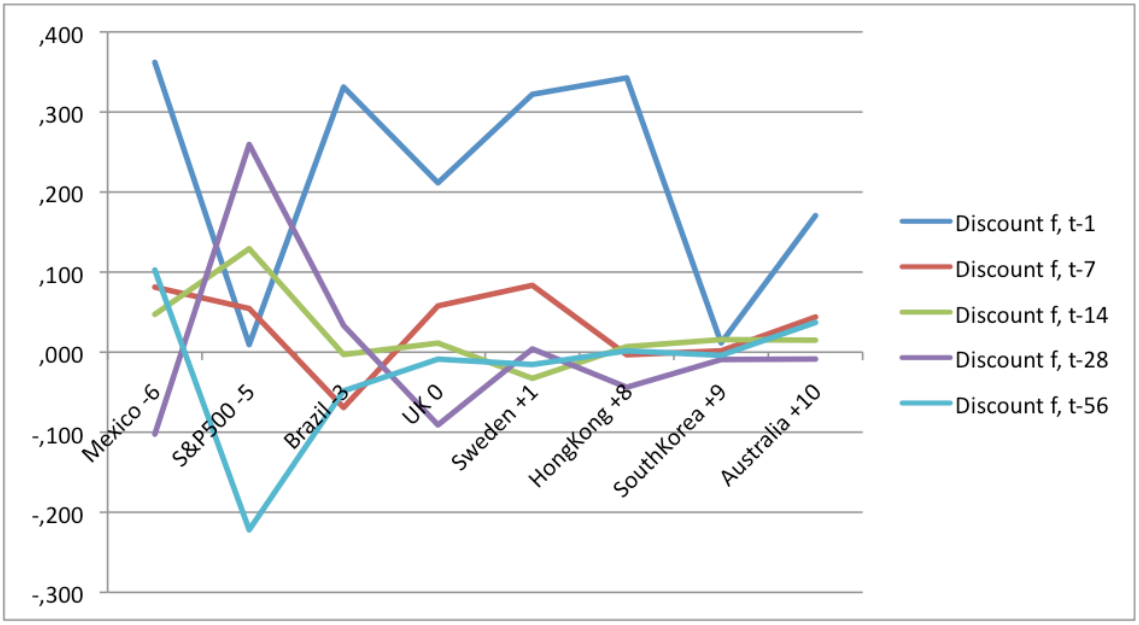

Figure 13. ETF return/discount relation development by countries.

6.4. Summary of results

As a conclusion from the results can be said that expected results about the liquidity/ETF discount relation and time-lag/ETF discount relation are not found. The results from the first test are parallel with the hypothesis but the degree the ETF discount changes with the liquidity is so small, that it does not have any statistical, or true value to an investor. The time difference between the ETF market and its NAV market cannot either explain the change in the ETF discounts. Any statistically significant dependence between the time difference and the ETF discount is not discovered. Instead, figure 13 shows that the deviation in the ETF discounts as predictors to the future ETF returns seems to decrease while the time-lag between the ETF market and its NAV market increases. This result is discovered in all other time periods but at time *t-1*. However, the figure 13 contains mostly statistically insignificant factors and can be held only as a suggestive result.

What is also discovered is that ETF discounts from the previous day can predict the ETF returns next day. Lagged ETF discounts at time *t-1* were noticed to act as positive predictors for the future ETF returns as expected. The capability to explain the ETF returns from jointly data is marginal but the regressions done

in individual fund level discovered strong relations between the ETF discounts and the ETF returns in some countries. When observed the ability to explain the future ETF returns from longer period of time is noticed first, that most of the results are not statistically significant and yet the ones that are, suggest that the relation between the ETF discounts and positive ETF returns seems to disappear. As can be seen in the table 11 and in the figure 12, the longer is the time period the ETF returns are tried to be predicted from, the weaker is the relation between the ETF discounts and the positive ETF returns. Actually yet at time *t-56* most of the results suggest that the relation is negative. The main finding here is, however, that the ETF discounts can be used to predict the future ETF returns at time *t-1* or, at max at time *t-3* since after this the relation between the returns and discounts is approximately zero.

What the study is not able to show neither in light of statistically significant results is that the time zone difference between the ETF market and its NAV market affects the ETF return/discount relation. In here is also interesting to observe the figure 13 which seem to show that the relation gets weaker as the time-lag between the markets increases. This, however, is only a suggestive result since the factors used to form the figure are mostly statistically insignificant.

Also noticed in the study, as expected, that the index returns vary significantly from the NAV-, and ETF returns and this is caused by the transaction costs and fees the index itself does not have. Also because the index returns include dividend payments that are excluded in the ETF and NAV returns.

7. CONCLUSIONS

ETFs as an investment vehicle are relatively new form of investing but their popularity have grown significantly year after year. The first ETF was launched in 1993 and in eighteen years assets held in them have multiplied phenomenally. This may be one of the reasons why ETFs are also studied quite a bit. There are various books written of them and even more articles published in scientific journals. They have stated to be better than traditional mutual funds containing advantages from the stock market but as discussed previously in this thesis, critics against the ETF investing exists also. However, the majority of the studies show, that ETFs are, and will be, one of the most important forms of investing in the financial markets.

This thesis focuses on discovering a relation between ETF discounts, ETF returns, liquidity and time-lag between the ETF market and its NAV market. The purpose is to be able through various tests to show, that trading volume and asynchronous trading hours correlate with the ETF discount. Another aspect for this study is to find a relation between the ETF discounts and the ETF returns. A thought behind the whole thesis is an ambition to be able to find a pattern, from which the investor could benefit when investing in international ETFs. After examining various books, researches, and scientific articles the main idea of the thesis condenses on three hypotheses presented previously. Assumptions presented in this study have been studied before, but none of the previous studies have directly concentrated on the subject in a same way as done in this thesis.

The empirical part of the thesis concerning the first hypothesis shows, that there is no significant correlation between the ETF trading volume and the ETF discounts. In other words, when the ETF´s liquidity increases, it does not decrease the ETF discount and vice versa. The test result for all countries jointly shows, that there exists a slight positive correlation between the ETF trading volume and the ETF discount, but this result is not statistically significant. When correlation tests are done in individual fund level, only Australia results statistically significant results at 0,05% significance level. Australia´s correlation coefficient is 0,084 meaning that if the ETF liquidity increases 1 per cent, the ETF discount decreases (moves closer to zero) by 0,084 per cent.

The second hypothesis, which states, that the ETF discount correlates with the changing time-zones, can also be rejected. The results are statistically significant at 0,05% level excluded South Korea, Sweden and Brazil. The regression analysis where dummy variables are used as explanatory factors to explain the change in the ETF discount suggests, that the ETF discount does not correlate with the changing time-lag. In the tests is discovered, that Mexico´s, S&P 500´s and Hong Kong´s dummy coefficients are the same (0,002) while UK and Australia both have same coefficients with each other (-0,002). What can be said is that ETF discounts vary within countries, but they do not increase/decrease in a linear fashion with the different time zones.

Tests about the ETF return predictability by ETF discounts results, that there exists a relation. When examined this relation by a regression analysis where the ETF returns are used as explicable factors and the ETF discounts at time *t-1*, *t-7*, *T-14*, *t-28* and *t-56* as explanatory factors is found, that the ETF discounts at time *t-1* act as the strongest predictors to the next day´s ETF returns by coefficient 0,054. The relation in all countries jointly at time *t-1* is not that strong as for example in Jares et al. (2004), but when examined the relation in individual fund level is found stronger relations. For example, Mexico results 0,362 coefficient between the returns and the discounts at time *t-1*. Also Hong Kong, Brazil and Sweden result coefficients greater than 0,3. All results from the third hypothesis at time *t-1* are significant at 0,01% level excluded the S&P 500 and South Korea.

When testing the same phenomenon with greater lags, is found that the bigger is the lag between the return and the discount, the weaker is the relation between these two. Figure 12 illustrates well what happens to the ability of the ETF discount to predict the future ETF returns. While at time *t-1* the discounts act as strong positive predictors to the next day´s ETF returns, yet at time *t-14* they all remain remarkably close to zero. The previous studies have showed, that the difference between the ETF share price and its NAV price should disappear in two days. The results got from this thesis are similar. Even if not all results with greater lags are statistically significant it is still possible to see the downward trend between the ETF returns and the ETF discounts from the table 11 and figure 12. Also interesting to notice that as can be seen in the figure 13, it seems that the relation between the ETF returns and the ETF discounts de-

creases when the time-lag between the ETF market and its NAV market increases.

As a conclusion can be said, that valuable information to investors about international ETFs could not be discovered. Idealistic outcome from the study would have resulted information that helped the investor to select the most profitable ETFs from the data sample examined. This outcome would mean in practice a situation where had noticed that more liquid ETFs with most asynchronous trading hours result also strongest relations in the ETF return predictability. This information, however, cannot be acquired based on the results from this thesis. Many of the tests suggest parallel results with the hypotheses but they do not contain statistically significant information. However, this thesis may act as an inspiration for further studies since, for example, is discovered that the ETF return/discount relation seems to decrease while the time-lag increases between the ETF market and its NAV market. For further studies would be interesting to test more asynchronous trading hours possibly with wider data range and from longer time period. Also other methods for testing could be used to acquire more accurate and significant results.

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APPENDICES

Appendix 1. Correlations for Mexico, S&P 500 & Brazil.

		Mexico ETF Volume	Mexico ETF Discount f, t-1	S&P500 ETF Volume	S&P500 ETF Discount f, t-1	Brazil ETF Volume	Brazil ETF Discount f, t-1
Mexico ETF Volume	Pearson Correlation	1	,032	,698	,029	,689	-,004
	Sig. (2-tailed)		,095	,000	,139	,000	,853
	N	2641	2640	2641	2640	2609	2608
Mexico ETF Discount f, t-1	Pearson Correlation	,032	1	,059	-,041	-,004	,076
	Sig. (2-tailed)	,095		,002	,035	,831	,000
	N	2640	2640	2640	2640	2608	2608
S&P500 ETF Volume	Pearson Correlation	,698	,059	1	,025	,681	-,022
	Sig. (2-tailed)	,000	,002		,200	,000	,251
	N	2641	2640	2641	2640	2609	2608
S&P500 ETF Discount f, t-1	Pearson Correlation	,029	-,041	,025	1	,032	,017
	Sig. (2-tailed)	,139	,035	,200		,099	,376
	N	2640	2640	2640	2640	2608	2608
Brazil ETF Volume	Pearson Correlation	,689	-,004	,681	,032	1	-,016
	Sig. (2-tailed)	,000	,831	,000	,099		,422
	N	2609	2608	2609	2608	2609	2608
Brazil ETF Discount f, t-1	Pearson Correlation	-,004	,076	-,022	,017	-,016	1
	Sig. (2-tailed)	,853	,000	,251	,376	,422	
	N	2608	2608	2608	2608	2608	2608

Appendix 2. Correlations for UK, Sweden & Hong Kong.

		United Kingdom ETF Volume	United Kingdom ETF Discount f, t-1	Sweden ETF Volume	Sweden ETF Discount f, t-1	Hong Kong ETF Volume	Hong Kong ETF Discount f, t-1
United Kingdom ETF Volume	Pearson Correlation	1	,024	,277	,018	,437	,015
	Sig. (2-tailed)		,219	,000	,345	,000	,449
	N	2640	2639	2618	2617	2640	2639
United Kingdom ETF Discount f, t-1	Pearson Correlation	,024	1	,011	-,030	,078	,481
	Sig. (2-tailed)	,219		,569	,124	,000	,000
	N	2639	2639	2617	2617	2639	2639
Sweden ETF Volume	Pearson Correlation	,277	,011	1	,026	,390	-,007
	Sig. (2-tailed)	,000	,569		,176	,000	,735
	N	2618	2617	2618	2617	2618	2617
Sweden ETF Discount f, t-1	Pearson Correlation	,018	-,030	,026	1	,028	-,030
	Sig. (2-tailed)	,345	,124	,176		,150	,130
	N	2617	2617	2617	2617	2617	2617
Hong Kong ETF Volume	Pearson Correlation	,437	,078	,390	,028	1	,028
	Sig. (2-tailed)	,000	,000	,000	,150		,144
	N	2640	2639	2618	2617	2640	2639
Hong Kong ETF Discount f, t-1	Pearson Correlation	,015	,481	-,007	-,030	,028	1
	Sig. (2-tailed)	,449	,000	,735	,130	,144	
	N	2639	2639	2617	2617	2639	2639

Appendix 3. Correlations for South Korea & Australia.

		South Korea ETF Volume	South Korea ETF Discount f, t-1	Australia ETF Volume	Australia ETF Discount f, t-1
South Korea ETF Volume	Pearson Correlation	1	,037	,724	,117
	Sig. (2-tailed)		,059	,000	,000
	N	2637	2636	2637	2636
South Korea ETF Discount f, t-1	Pearson Correlation	,037	1	,015	-,020
	Sig. (2-tailed)	,059		,449	,305
	N	2636	2636	2636	2636
Australia ETF Volume	Pearson Correlation	,724	,015	1	,084
	Sig. (2-tailed)	,000	,449		,000
	N	2637	2636	2639	2638
Australia ETF Discount f, t-1	Pearson Correlation	,117	-,020	,084	1
	Sig. (2-tailed)	,000	,305	,000	
	N	2636	2636	2638	2638

Appendix 4. Return analysis for all countries.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,068[a]	,005	,004	,02112935836948

a. Predictors: (Constant), Total D, t-56, Total D, t-14, Total D, t-1, Total D, t-28, Total D, t-7

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,042	5	,008	18,959	,000[a]
	Residual	9,103	20390	,000		
	Total	9,145	20395			

a. Predictors: (Constant), Total D, t-56, Total D, t-14, Total D, t-1, Total D, t-28, Total D, t-7

b. Dependent Variable: Total ETF daily return

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,001	,000		3,926	,000
	Total D, t-1	,054	,006	,063	8,939	,000
	Total D, t-7	,009	,006	,010	1,470	,142
	Total D, t-14	,017	,006	,020	2,809	,005
	Total D, t-28	-,010	,006	-,012	-1,696	,090
	Total D, t-56	-,002	,006	-,002	-,357	,721

Appendix 5. Return analysis for Mexico.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,158[a]	,025	,023	,0199291381036

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-7, ETF Discount f, t-28, ETF Discount f, t-14, ETF Discount f, t-1

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,026	5	,005	13,106	,000[a]
	Residual	1,012	2547	,000		
	Total	1,038	2552			

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-7, ETF Discount f, t-28, ETF Discount f, t-14, ETF Discount f, t-1

b. Dependent Variable: Mexico Daily return

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,000	,000		1,253	,210
	ETF Discount f, t-1	,362	,051	,139	7,031	,000
	ETF Discount f, t-7	,081	,051	,031	1,578	,115
	ETF Discount f, t-14	,047	,051	,018	,927	,354
	ETF Discount f, t-28	-,102	,051	-,039	-2,017	,044
	ETF Discount f, t-56	,103	,050	,040	2,037	,042

Appendix 6. Return analysis for S&P 500.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,043[a]	,002	,000	,0136376933254

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-7, ETF Discount f, t-1, ETF Discount f, t-28, ETF Discount f, t-14

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,001	5	,000	,924	,464[a]
	Residual	,474	2547	,000		
	Total	,475	2552			

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-7, ETF Discount f, t-1, ETF Discount f, t-28, ETF Discount f, t-14

b. Dependent Variable: S&P 500 Daily return

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,000	,000		,099	,921
	ETF Discount f, t-1	,009	,171	,001	,055	,956
	ETF Discount f, t-7	,055	,171	,006	,319	,750
	ETF Discount f, t-14	,129	,171	,015	,756	,450
	ETF Discount f, t-28	,259	,170	,030	1,523	,128
	ETF Discount f, t-56	-,222	,169	-,026	-1,314	,189

Appendix 7. Return analysis for Brazil.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,134[a]	,018	,016	,02727477808092

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-1, ETF Discount f, t-28, ETF Discount f, t-7, ETF Discount f, t-14

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,035	5	,007	9,338	,000[a]
	Residual	1,895	2547	,001		
	Total	1,929	2552			

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-1, ETF Discount f, t-28, ETF Discount f, t-7, ETF Discount f, t-14

b. Dependent Variable: Brazil ETF Daily return

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	,001	,001		2,324	,020
	ETF Discount f, t-1	,331	,052	,137	6,428	,000
	ETF Discount f, t-7	-,069	,051	-,029	-1,347	,178
	ETF Discount f, t-14	-,003	,052	-,001	-,058	,954
	ETF Discount f, t-28	,033	,051	,014	,660	,509
	ETF Discount f, t-56	-,048	,048	-,020	-,999	,318

Appendix 8. Return analysis for United Kingdom.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,134[a]	,018	,016	,0166324436326

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-1, ETF Discount f, t-28, ETF Discount f, t-14, ETF Discount f, t-7

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,013	5	,003	9,324	,000[a]
	Residual	,705	2547	,000		
	Total	,717	2552			

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-1, ETF Discount f, t-28, ETF Discount f, t-14, ETF Discount f, t-7

b. Dependent Variable: UK ETF Daily return

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	,001	,000		1,812	,070
	ETF Discount f, t-1	,212	,036	,117	5,871	,000
	ETF Discount f, t-7	,058	,036	,032	1,589	,112
	ETF Discount f, t-14	,011	,036	,006	,318	,751
	ETF Discount f, t-28	-,091	,036	-,050	-2,557	,011
	ETF Discount f, t-56	-,009	,036	-,005	-,245	,807

Appendix 9. Return analysis for Sweden.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,164[a]	,027	,025	,0231742354944

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-28, ETF Discount f, t-7, ETF Discount f, t-14, ETF Discount f, t-1

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,038	5	,008	14,093	,000[a]
	Residual	1,368	2547	,001		
	Total	1,406	2552			

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-28, ETF Discount f, t-7, ETF Discount f, t-14, ETF Discount f, t-1

b. Dependent Variable: Sweden ETF Daily return

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,001	,000		1,799	,072
	ETF Discount f, t-1	,322	,040	,156	7,956	,000
	ETF Discount f, t-7	,084	,040	,041	2,069	,039
	ETF Discount f, t-14	-,033	,040	-,016	-,810	,418
	ETF Discount f, t-28	,004	,040	,002	,101	,919
	ETF Discount f, t-56	-,015	,040	-,008	-,384	,701

Appendix 10. Return analysis for Hong Kong.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,241[a]	,058	,056	,0189752552042

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-14, ETF Discount f, t-28, ETF Discount f, t-7, ETF Discount f, t-1

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,056	5	,011	31,347	,000[a]
	Residual	,917	2547	,000		
	Total	,974	2552			

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-14, ETF Discount f, t-28, ETF Discount f, t-7, ETF Discount f, t-1

b. Dependent Variable: Hong Kong ETF Daily return

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,000	,000		1,325	,185
	ETF Discount f, t-1	,343	,028	,239	12,371	,000
	ETF Discount f, t-7	-,003	,028	-,002	-,119	,905
	ETF Discount f, t-14	,007	,028	,005	,249	,803
	ETF Discount f, t-28	-,044	,028	-,031	-1,596	,111
	ETF Discount f, t-56	,002	,027	,001	,061	,951

Appendix 11. Return analysis for South Korea.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,055[a]	,003	,001	,0254719252388

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-1, ETF Discount f, t-14, ETF Discount f, t-28, ETF Discount f, t-7

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,005	5	,001	1,540	,174[a]
	Residual	1,653	2547	,001		
	Total	1,658	2552			

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-1, ETF Discount f, t-14, ETF Discount f, t-28, ETF Discount f, t-7

b. Dependent Variable: South Korea ETF Daily return

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	,001	,001		1,709	,088
	ETF Discount f, t-1	,012	,008	,029	1,454	,146
	ETF Discount f, t-7	,002	,008	,004	,217	,828
	ETF Discount f, t-14	,016	,008	,039	1,970	,049
	ETF Discount f, t-28	-,009	,008	-,023	-1,156	,248
	ETF Discount f, t-56	-,004	,008	-,010	-,494	,621

Appendix 12. Return analysis for Australia.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,120[a]	,014	,012	,0193313888068

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-7, ETF Discount f, t-28, ETF Discount f, t-14, ETF Discount f, t-1

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,014	5	,003	7,407	,000[a]
	Residual	,952	2547	,000		
	Total	,966	2552			

a. Predictors: (Constant), ETF Discount f, t-56, ETF Discount f, t-7, ETF Discount f, t-28, ETF Discount f, t-14, ETF Discount f, t-1

b. Dependent Variable: Australia ETF Daily return

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,001	,000		2,596	,009
	ETF Discount f, t-1	,171	,031	,110	5,585	,000
	ETF Discount f, t-7	,044	,030	,028	1,441	,150
	ETF Discount f, t-14	,015	,031	,010	,489	,625
	ETF Discount f, t-28	-,009	,030	-,006	-,281	,779
	ETF Discount f, t-56	,037	,030	,024	1,219	,223