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Long-term performance of European leveraged and inverse ETF

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Abstract:

Leveraged ETFs attracted a lot of attention when they were launched in 2006. In addition, the question of the holding period for this type of financial instrument quickly became the subject of debate. This paper analyzes the performance of LETFs based on European indices over a long-term holding period. Studies on LETFs have shown that the performance of this type of instrument decreases as the holding period increases. Numerous studies have shown that the best measure of performance for this type of financial instrument is the tracking error. The compounding effect caused by the daily rebalancing of LETFs has often been cited in the literature as the reason for the underperformance of LETFs for holding periods longer than one month. The results of this Master thesis show that LETFs based on European indices tend to underperform their American counterparts, mainly due to the management effect and the financing effect.

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Glossary

AUM Asset under management

Bear LETF Leveraged Exchange Traded Fund with a negative leverage multiple

Bull LETF Leveraged Exchange Traded Fund with a positive leverage multiple

ELETF Leveraged Exchange Traded Fund tracking European benchmark

ETF Exchange Traded Fund, by abuse of language we use ETF to refer to ETP

ETP Exchange Traded Product

LETF Leveraged Exchange Traded Fund, by abuse of language we use LETF to refer to LETP

LETP Leveraged Exchange Traded Product

NAV Net Asset Value

plain vanilla ETF Classic ETF, i.e. ETF without leveraged

SEC The Securities and Exchange Commission

TE1 Tracking Error 1

TE2 Tracking Error 2

1 Introduction:

1.1 Context of the research and motivation

ETFs have experienced strong growth in recent years. The first ETF was launched in the United States in 1993 with the well-known SPY. It was created by State Street Global Advisor to track the S&P 500 and still exists today (Hamon, 2013). By 2022, there were more than 8,700 ETFs worldwide with more than $10 trillion in AUM, up from just 276 ETFs in 2003 (Statista, 2023). An ETF, or exchange-traded fund, is an investment fund that operates like a mutual fund. The main feature that distinguishes ETFs from other mutual is that they are traded on a public market (just like a stock). Most of the time ETF are designed to closely track a pre-selected index, whether it is a stock index, bond index, commodity index, volatility index, etc. ETFs often have much lower fees than mutual funds, in particular because they passively track indexes (Leung & Santoli, 2016). The financial literature on plain vanilla ETFs is well developed, although the issue of retail investor performance with this type of instrument could be further developed (D'hondt et al., 2021).

Since the late 2000s, a new type of ETF has emerged: leveraged ETFs (LETF). This new financial instrument can be defined as an investment fund that aims to provide a multiple (2, 3 or 4) or a negative multiple (-1, -2, -3, -4) of the daily returns of an index, commodity, bond or asset. Like ETFs, they are traded on exchanges. LETFs attracted a lot of attention when they were launched in 2006. In addition, the issue of the holding period for this type of financial instrument quickly became the subject of debate. In 2009, Lu et al. published a paper on the subject, arguing that leverage was no longer applicable for a holding period of more than one month. In the early 2010s, other researchers also published papers on the subject of LETF holding periods. However, not all authors agree on the performance of LETFs over a long holding period (see section 2.3.1.).

Furthermore, none of the articles published on the performance of LETFs over a long holding period focus on European indices (ELETFs). There are two reasons for this. First, most LETF researchers are American and therefore focus on local

indices. Second, the first LETFs tracking the European market appeared a few years after the launch of the first LETFs based on US indices (in the early 2010s).

In addition, this financial instrument is still often misunderstood by retail investors, as shown by the Investor Alert issued by the SEC in 2009 (SEC.gov, 2023). This thesis aims to help investors better understand LETFs and, in particular, why financial institutions strongly recommend holding this financial product for a short period of time.

The glaring lack of publications on the long-term performance of ELETFs can only whet the appetite of those interested in this financial instrument. This is exactly what I intend to do in this master thesis.

1.2 Structure of the Master's thesis

The remainder of the paper is organized as follows.

- **Section 2** reviews the existing literature on the subject. The first step is to define a LETF and understand how it works. This section will then analyze the advantages and disadvantages of this instrument, while attempting to understand whether or not LETFs should be held. Finally, the question of the holding period will be discussed.

- **Section 3** focuses on the research question and hypothesis of this master thesis.

- **Section 4** describes the methodology used in the thesis. The first part will introduce the different data and the choice of them. The second part will explain the different model used to answer the research question.

- **Section 5** discuss of the result of my research. More traditional analysis, tracking error analysis and understanding the compounding effect will be covered.

- **Section 6** concludes the thesis. The implications of the findings and the limits of this master thesis will be discussed. Suggestions for future research will also be presented.

2 Literature review

The purpose of this section is to provide a clear overview of the existing literature on the subject of this thesis. More specifically, the beginning of this section describes how LETFs work in general, with the history of this financial product, its advantages, and disadvantages. From point 2.3.1 onwards, the focus shifts to the central question of this thesis, namely the performance of leveraged and inverse ETFs over an extended holding period.

2.1 Definition of a leveraged and inverse

A leveraged exchange-traded is a type of investment fund that trades on a stock exchange, just like a plain vanilla ETF. It aims to provide a multiple (2, 3 or 4) or a negative multiple (-1, -2, -3, -4) of the daily returns on some index, commodities, bonds, or assets (Charupat & Miu, 2011). It is important to note that the leverage in these LETFs only applies to daily returns and is reset daily. So, the leverage promised by the LETF provider (ProFund, Direxion, Wisdomtree, ...) remains constant over the days because it is adjusted daily in line with market movements. Leverage can be created by borrowing or lending money, but it is usually created through derivatives such as futures contracts, forward contracts and total return swaps (Charupat & Miu, 2014).

Daily rebalancing creates a compounding effect, making it impossible for ETF providers to guarantee leverage over a period longer than 1 day (Charupat & Miu, 2011) (see 2.4 for more information). For this reason, several researchers have pointed out that LETS are short-term financial instruments and strongly advise against holding these financial products for long periods (more than 1 week) (Lu et al., 2009) (Guedj et al., 2010).

2.1.1 History of LETF

The first LETFs were launched by ProShares in the summer of 2006. The first 4 were bull LETFs focused on the major US indices, while the next 4 were bear LETFs (see Figure 1) (Davies, 2022). The Securities and Exchange Commission (SEC) took

6 years to approve the introduction of this type of instrument by ProShares (Yates, 2023). For 2 years, ProShares had a monopoly on the LETF market as no competitor had launched a leveraged fund. In 2008, Direxion launched its first LETFs tracking the S&P500 and Russell 2000 (Pessina & Whaley, 2020). There are currently more than 230 different LETFs in the US, covering equity (188), commodities (15), bonds (15), etc., with total assets under management (AUM) of more than USD 91 billion (see Table 1). Currently, the largest LETF is ProShares UltraPro QQQ (TQQQ), which provides 3X daily long exposure to the Nasdaq 100 index, with AUM of USD 19 billion (Comtois, s. d.). More than 230 ETFs have been created over a period of 17 years, which represents a very significant growth for a financial product that is often criticized. However, if we compare this with the data provided by Pessina & Whaley for 2020 (see Figure 2), we see that the number of LETFs has fallen by 14%, but total AUM has risen by 78% in three years.

Figure 1: LETFs launched by Proshares during 2006

Fund Name	Daily Objective	Ticker
Panel A. ETFs Announced on June 21, 2006		
Ultra QQQ ProShares	Double the NASDAQ-100 Index	QLD
Ultra S&P 500 ProShares	Double the S&P 500 Index	SSO
Ultra Dow30 ProShares	Double the Dow Jones Industrial Average	DDM
Ultra MidCap400 ProShares	Double the S&P MidCap 400	MVV
Panel B. ETFs Announced on July 13, 2006		
UltraShort QQQ ProShares	Double the inverse of the NASDAQ-100 Index	QID
UltraShort S&P 500 ProShares	Double the inverse of the S&P 500 Index	SDS
UltraShort Dow30 ProShares	Double the inverse of the Dow Jones Industrial Average	DXD
UltraShort MidCap400 ProShares	Double the inverse of the S&P MidCap 400	MZZ

Source: (Davies, 2022)

Table 1: Current situation of Leveraged ETF in U.S

Asset class	**# of LETFs**	**Total assets under management**	**% of AUM**
Equity	188	82 013 825 097,00	90,37%
Commodity	15	2 992 283 930,00	3,30%
Volatility	6	1 195 424 290,00	1,32%
Bond	15	3 933 971 152,00	4,33%
Real Estate	6	393 678 500,00	0,43%
Multi-Assset	1	19 472 800,00	0,02%
Currency	5	203 585 640,00	0,22%
Alternatives	1	491 302,00	0,00%
Total	237	90 752 732 711,00	100,00%

Source: (Young, s. d.)

Figure 2: Universe of U.S. levered and inverse exchange-traded products (ETPs) by asset class as of March 13, 2020.

Asset class	No. of ETPs	Total assets under management	Percent of AUM	Average dollar volume	Turnover	Holding period
Equity	191	42,115,083,000	83.2%	7,133,238,098	16.9%	5.90
Commodity	26	3,106,084,200	6.1%	1,591,937,806	51.3%	1.95
Volatility	5	2,513,256,300	5.0%	2,866,578,888	114.1%	0.88
Bond	22	1,524,422,600	3.0%	153,728,289	10.1%	9.92
Real Estate	9	866,891,600	1.7%	13,355,573	1.5%	64.91
Multi-Asset	4	285,840,600	0.6%	3,679,366	1.3%	77.69
Currency	19	214,679,300	0.4%	4,419,779	2.1%	48.57
Alternatives	1	4,036,400	0.0%	48,395	1.2%	83.40
	277	50,630,294,000	100.0%			

Source: (Pessina & Whaley, 2020)

During the 2008 financial crisis, LETFs (both bullish and bearish) performed very poorly due to the high volatility of the financial markets (even leveraged inverse ETFs had negative returns as the markets fell), leading to much criticism and even some legal action from investors who claimed they had not been adequately warned about the risks of this type of instrument. More recently, some LETFs have run into trouble. In 2018, Credit Suisse closed its bear LETF on the VIX after it lost more than 95% of its value in a single day (Foerster & Evans, 2018). Two other LETFs (ETCs) also closed in 2020. Citigroup and ProShares decided to close their LETFs (3X and -3X) tracking an oil benchmark. This closure is due to the excessive volatility of these LETFs (Pessina & Whaley, 2020).

In 2009, the SEC launched its first Investor Alert on LETFs, primarily to ensure that investors understand that the promised leverage can only be provided on a daily basis and that returns over a long period of time may differ significantly from their daily performance (SEC.gov, 2023). This warning has been updated frequently in recent years as a result of various discoveries in the field. Nevertheless, it shows the extent to which this instrument is often misunderstood by both retail and professional investors.

In 2017, the SEC first approved a LETF 4X proposed by VelocityShares (Michaels & Dieterich, 2017). However, the SEC backtracked shortly thereafter, withdrawing

its approval after investors complained that the product was too risky (Dierking, 2021). In 2019, the SEC proposed new rules that allowed the use of derivatives to create leverage and replaced a derivatives liquidity rule with a risk management program. From 2021, some LETFs with +5 or -5 leverage will be available, but only in Europe (Leverage shares, 2022).

2.2 How does a LETF work and how does it create the leveraged?

A leveraged ETF has several features in common with a plain vanilla ETF:

- LETFs are listed on stock exchange and prices change throughout the day;
- LETFs are traded like a closed-end fund;
- the market prices track the fund NAV (through the creation redemption process) and they may pay a dividend to investors (D'hondt, 2022).

The main difference between a plain vanilla ETF and a leveraged ETF is of course the leverage effect, as mentioned above. Leverage can be a positive multiple, mainly 2 and 3, or negative, mainly -1, -2 and -3. There are two different ways to create this leverage. Firstly, the most widely used technique is the use of derivatives, mainly total returns swaps on the underlying index, which offer great flexibility. Futures and/or forwards can also be used, but this is less common as they are less customizable and therefore the basis risk (i.e., the risk that arises when 2 positions are not perfectly hedged) is greater (Cheng & Madhavan, 2009) (Nwogugu, 2018). In addition to derivatives the fund manager also holds some securities of the underlying index.

The second technique is to trade physical on margin. This means that, to create the leverage on bull LETF, the fund manager invests βLt (where β represents the leverage ratio and Lt the bull LETF) in the underlying index (via a plain vanilla ETF) and borrows the amount $(\beta - 1)Lt$. For example, to create a +2X LETF, you need to borrow 1 time your exposure and invest in the underlying index. The difference with a bear LETF is that you don't borrow. Instead, you short the positions in the relevant index (Charupat & Miu, 2014) (Cheng & Madhavan, 2009)

(Leung & Santoli, 2016). The problem with this strategy is that the financial cost (of borrowing) or benefit on accrued interest (for short position) will cause the NAV performance to diverge from that of the underlying index. This phenomenon is known as the financing effect. It also exists for the strategy using derivatives but is less significant. The greater the leverage and the higher the interest rate, the greater the financing effect (Charupat & Miu, 2014). It is important to understand that the cost of borrowing or accrued interest is not charged to the customer and is incorporated into the NAV of the fund. As mentioned by Proshares (2022) in its prospectuses.

Another major differences between ETF with leverage and ETF without leverage is in the process of creation/redemption. In fact, with a plain vanilla ETF and a physical replication, the exchange between ETF shares and underlying securities is an 'in-kind' transfer (i.e., it's a transfer that made in the form of securities rather than in cash) between arbitrageur and the ETF provider. For LETFs, since derivatives are used to create leverage, the redemption process is "in-cash". Arbitrage is therefore much easier, but not tax-efficient, as cash is taxed directly, whereas holding securities is not (Charupat & Miu, 2011).

In addition, LETFs often have much higher management fees[1] than passively managed ETFs. This seems quite logical because the management of LETF is more complicated due to daily rebalancing and the use of complex financial instruments (Charupat & Miu, 2014). For example, the management fee of TQQQ is 0.75% (annual basis) and you have to add 0.23% for other expenses, while for the unleveraged Ishares Core S&P 500 ETF (IVV), the management fee is 0.03% and there are no other fees (iShares, s. d.).

Finally, fund performance is usually measured through tracking errors. Tracking error measures the extent to which the NAV of the fund reflects the performance of the underlying benchmark multiplied by the leverage (Charupat & Miu, 2011) (see section 4.2.2).

[1] A management fee refers to the fee imposed by an investment manager for overseeing an investment fund. Its purpose is to remunerate the managers for their time and expertise in meticulously selecting stocks and effectively managing the portfolio (Chen,2021).

There are 7 different factors that affect the size of the tracking error and thus the performance of the fund : the quality of index replication, the frequency of rebalancing (generally daily rebalancing), management fees, the cost of derivatives used, the trend of the underlying benchmark, the volatility of the underlying indexes and the compounding effect (Reddy & Marshall, 2015).

These factors can be linked to the tracking ability, which refers to their ability to closely follow their underlying index, and divided into management effects, financing effect (see above), and compounding effect (see Section 2.4.2) (Charaput & Miu, 2014).

The management effects are directly related to the way the LETF is managed and are controlled by the fund management. Key management effects include: a. Investment advisory and management service fees: i.e. higher expense ratios may result in greater underperformance compared to the underlying index; b. Transaction costs: i.e. costs incurred in generating the target returns, including fees for entering into and modifying derivative contracts, can impact tracking performance; c. Dividend distribution management: i.e. the accumulation of dividends in a cash account prior to distribution may result in an opportunity cost for reinvestment; d. Choice of replication strategy: i.e. the method used to replicate the index (e.g., derivatives like futures, forward or swaps contracts) can affect tracking errors, as it carries risks such as basis risks and correlation risks (Charupat & Miu, 2014).

Fund performance can also be measured using more traditional methods that calculate risk-return metrics. Širůček et al. (2018) evaluate the performance of leveraged and non-leveraged ETFs using various metrics such as: annual return, volatility, Sharpe ratio, Jensen's alpha, Treynor ratio, appraisal ratio and information ratio. Lu et al. (2009), Avellaneda & Zhang (2010), Cheng & Madhavan (2009), Rompotis (2016) and Giese (2010) propose some ad hoc solutions to calculate the return of LETF (see Section 3.2 for more details on the methodology).

2.2.1 The link between plain vanilla ETF and underlying index

It seems clear that there is a link between leveraged ETFs and plain vanilla ETFs that track the same benchmark. Avellaneda & Zhang (2010) show that the following formula describes the relation between the two financial products.

$$\log \text{ret .(LETF)} \approx \beta \log \text{ ret.(ETF)} \tag{1}$$

This relation seems to be more appropriate than the arithmetic relation, which only considers simple compounding.

Cheng& Madhavan (2009) and Lu et al. (2009) show that the relation between ETF and LETF is more complex:

$$\left(1 + R_T^{LETF}\right) = \left(1 + R_T^{index}\right)^x \cdot e^{\frac{\left(x - x^2\right)\sigma^2 T}{2}} \tag{2}$$

Where: x is the leverage, σ is the volatility of the underlying index, T the time and R the return. The last term of the equation is positive and less than one and decreases to 0 when T increases.

The financial literature agrees that the volatility of the underlying index has a significant impact on the performance of LETFs. In particular, when volatility is high, returns can deviate significatively from expected returns (naïve expectation) over a long holding period. This phenomenon is called volatility decay and is mainly related to the compounding effect (created by daily rebalancing) and the holding period, which is longer than one day (Leung & Santoli, 2016b) (Charupat & Miu, 2011) (Lu et al., (2009) (Charupat et al., 2022) (Avellaneda & Zhang, 2010) (Tang & Xu, 2013) (Rompotis, 2012) (Zhang & Judge, 2016). Charupat et al. (2022) have also shown that the return path of the underlying benchmark (upward trending market, downward trending market, with asymmetric volatility, ...) influences the tracking errors and so the performance of the LETFs (more information in section 2.4.3.)

Some authors have also pointed out that LETFs can also affect the underlying benchmark and thus plain vanilla ETFs (Cheng & Madhavan 2009). Indeed, the positions on derivatives securities must be adjusted every day according to movements in the underlying index (daily rebalancing). In order to create the leverage the fund manager, you have to use mainly swap. The problem of this rebalancing and the use of swap is that the swap counterparties (large banks) must hedge their position to the total return swap and so they buy securities of the underlying benchmark when the market is up and sell when the market is down. For example, for bull LETF, when the market increases, they need to increase their exposure of the benchmark and for bear LETF, a market increase leads to the closing of short positions to reduce the exposure (and so to buy back the securities). This daily rebalancing takes place once a day and close to closing time for financial markets (to keep the market price close to the NAV). Shum et al. (2015) have shown that this process can have an impact on the volatility of the underlying index at the close, and that this effect is even stronger during periods of high volatility.

2.3 Advantages and disadvantages of using LETFs as a financial instrument.

Like all financial products, leveraged ETFs have their advantages and disadvantages.

Table 2: Summary of advantages and disadvantages of LETFs

Advantages	**Disadvantages**
Greater exposure to a benchmark at lower cost	A costly financial product
Available on public market	Higher risk
Access to the derivatives market	Complex financial instrument, not always well understood
Can be used to conduct strategic trading	Not adapted for long term investment

The first advantage is that it provides exposure to a given benchmark at a lower cost. In fact, leverage means that you can only buy a limited number of LETF shares, while getting a higher level of exposure. This makes the returns much more attractive (Tun, 2022).

This financial instrument is also available on the stock exchange, making it easy for retail investors to access and trade at any time of the day. In addition, many LETFs are very liquid, which is a very good thing (especially for LETFs available

in the U.S market) (Charupat & Miu, 2011).

Third, the use of leveraged ETFs provides an indirect exposure to the derivatives market, at a time when access to this type of market is very complex for retail investors in Europe, especially after the introduction of the MiFID II regime (ESMA, s. d.).

The last advantage is that it is possible to build portfolios of LETFs in order to gain long exposure to the volatility of an underlying benchmark (as several types of leverage are available for the same index). While remaining insensitive to the return of the benchmark. This technique is demonstrated in an article by Leung & Santoli (2016).

Like all financial products, leveraged ETFs also have their drawbacks. Firstly, they are more expensive than plain vanilla ETFs, as explained in section 2.2. To measure the cost of a fund, we often use the gross expense ratio, which represents all of the fund's management fees and operating costs. The ratio is calculated by dividing the fund's operating expenses by the average total value of all the fund's assets (Maverick, 2021). On average, the expense ratio is equal to 0,2% for ETFs and between 0.5 and 1% for mutual funds. However, for LETFs, the expense ratio often approaches 1% (or exceed for less popular) (see table 3) (Maverick, 2021).

Table 3: Expense ratio for five biggest LETF in U.S

Ticker	**Expense Ratio (percentage of the total investment)**
TQQQ	0,98%
SOXL	0,94%
QLD	0,98%
SQQQ	0,98%
SSO	0,89%

Source: (Young, s.d.)

Secondly, the risk associated with this type of financial instrument is higher than that of plain vanilla ETFs. In fact, Zhang (2018) found that the volatility of LETFs may be higher than suggested by the leverage. Leung & Santoli (2016), for example, showed that as the leverage increases, the eligible risk horizon decreases. In addition, due to the use of equity swaps, LETF holders face liquidity risk, basis risk, timing mismatch and dividend mismatch risk (Nwogugu, 2018).

LETFs are also complex financial products that are often misunderstood by retail investors. This financial instrument is still in its infancy, and documentation on its operation and implications is still scarce. According to D'hondt et al. (2021), users of leveraged ETFs are less educated, pay less attention to information and advice from specialists in the field, and are overconfident in their abilities, despite having higher volatility of their portfolios and lower returns than users of plain vanilla ETFs. These results seem to indicate a poor understanding of this financial instrument. Finally, a large majority of specialists seem to agree that LETFs are a short-term product and should not be held for more than a few days.

2.4 To hold or not to hold LEFTs in the long term?

Financial literature often portrays LETFs as an overly risky financial product that investors should not hold onto for the long term. This is also the approach taken by the SEC in its 2009 Investor Alert, which is still valid today. In this section we will first review the various authors who have warned about the dangers of LETFs, focusing mainly on the dangers of long-term holding. Cheng & Madhavan (2009) were among the first to warn of the dangers of LETFs. Firstly, they explain that daily rebalancing affects the liquidity and volatility of the underlying index. They also point out that investors are not sufficiently aware that the leverage promised by LETFs is only for one day at most, and that the performance of this type of instrument can be highly volatile over longer holding periods. Finally, they point out that this financial instrument can lead to value destruction if held over a long period of time.

Lu et al. (2009) showed that for 2X ETFs, investors can expect to receive 2 times the performance of the underlying index over a period of less than one month. After that, it becomes very difficult to predict LETF returns. According to them, long-term performance is affected by quadratic variation and auto-variation (which becomes the most important factor in the long run). Avellaneda & Zhang (2010) reach the same conclusion. They find that LETFs underperform nominal returns in the long term, and that this is mainly due to volatility. In the same vein, Guedj et al (2010) argue that investors hold this type of financial instrument for too long

and that this leads to value destruction of 50% on an annual basis, compared to a strategy where leverage is created on a margin account.

Charupat & Miu have made an enormous contribution to research in this area. In their first article, published in 2011 (Charupat & Miu, 2011), they show that LETFs can be held for up to one week (as returns after one week are close to those of the underlying benchmark multiplied by leverage). For a period of less than a month, bear LETFs don't perform well because the tracking error is too high. Finally, over a period of more than one month, all LETFs (bear and bull) show poor results.

In a second paper published in 2014, they come to a similar conclusion, but they show that the tracking error is mainly due to the compounding effect (Charupat & Miu, 2014). They also show that even after removing the compounding effect, LETFs can have very different tracking abilities (a difference especially between bear and bull LETFs). This difference is due to the financing effect (see section 2.2). Finally, by removing both the compounding effect and the financing effect, they conclude that the tracking ability of LETFs is worse than that of plain vanilla ETFs. This lack of efficiency is mainly due to the much higher management fees of LETFs.

Finally in a third article published in 2022, they qualify the conclusions of their two previous articles (Charupat et al., 2022). They focus on the performance of a 3X bear and bull LETF. They show that for a bull LETF, the compounding effect is mostly negative (i.e., the LETF underperforms the strategy without daily rebalancing). However, compounding effect can be positive in 3 situations. Firstly, when the underlying index returns are very low; secondly, when returns are high (but with low volatility); and finally, the compounding effect is also positive when returns are very high (regardless of volatility). The compounding effect is also negative on average for bear LETF, except in the case of upward trending markets.

More recently, Zhang & Judge (2016) argue that LETFs are not suitable for long-term investment. Pessina & Whaley (2020) and Zhang (2018) confirm this, arguing that they cannot be a hedging instrument for periods longer than one day. Zhang

(2018) argues that LETFs face too many problems in the event of market turbulence. Finally, Shum et al (2015) show that daily rebalancing can have an impact on the end-of-day volatility of the underlying indices. This impact is larger when volatility is high. This leads to a higher tracking error, as the cost of daily balancing is higher due to this volatility. As a solution, they suggest less frequent rebalancing.

Although most experts argue against holding LETFs for long periods of time due to the many risks associated with this type of financial instrument, there is a body of financial literature that disagrees and shows that the performance of LETFs over a long holding period is quite good. This is particularly the case of Reddy & Marshall (2015), who argue that, on average, the tracking error is not unfavorable to investors holding LETFs over a long period (contrary to the conclusions of the authors cited in the previous section). They argue that in a trending market (up and down), the tracking error is favorable to the investor. In a flat market, however, the opposite is true. Finally, they point out that an increase in volatility is bad for tracking error. Hill & Foster (2009) come to the same conclusion, although they go less far in the necessary market conditions. However, the authors were employed by LETFs sponsors at the time of publication. This makes their results suspect.

Širůček et al (2018) use more conventional methods to measure the performance of LETFs over a holding period of 3 and 6 years, they show that these financial instruments can generate significant returns. While agreeing with the criticisms of LETFs (high volatility, higher expenses, and daily rebalancing), they show that a long-term investment in this financial instrument can be considered, although he points out that the outcome is highly dependent on market dynamics. These results are in line with those published in an article on the Vetafi website (GAVEKAL CAPITAL, 2015). In this article, they compare the ProShares Ultra S&P 500 (SSO), a bull LETF tracking the S&P500, with a leverage of 2 and the Vanguard S&P500 ETF (VOO). They find that the VOO has a better Sharpe and Treynor ratio, but the SSO has a better Jensen's alpha.However, SOO's fees are 18 times higher than VOO's, which should not be overlooked.

2.5 But why LEFTs are considered as short-term financial instruments?

Leveraged ETFs were designed and created as short-term financial instruments. As a result, their long-term performance is not yet well understood and there is no consensus among financial experts (see point above). There are several reasons why LETFs are considered short-term. Firstly, daily rebalancing ensures that the desired leverage is maintained on a daily basis. This rebalancing generates what is known as the compounding effect (sometimes also referred to as "volatility decay"). As a result of this effect, the tracking error increases with the holding period, making it impossible to guarantee the leverage over a period longer than one day. Finally, its dependence on the return path of the underlying benchmark makes it an instrument that cannot correctly track an underlying index.

However, despite all the recommendations made by the SEC and industry experts, Figure 2 shows that LETFs are held for more than 1 day on average (except for volatility LETPs). We can see that the average holding period for equity LETFs is 6 days, while for bond LETPs and currency LETPs, it is 10 and 48 days respectively. Only commodity and volatility LETPs have a holding period close to 1 day. These results are nevertheless much better than those reported by Guedj et al. (2010) (see Figure 3). In this article, the authors only give the average holding period for 5 LETFs, but we can see that it is much higher than the 6 days found by Pessina & Whaley (2020).

Figure 3: Holding periods for five leveraged ETFs.

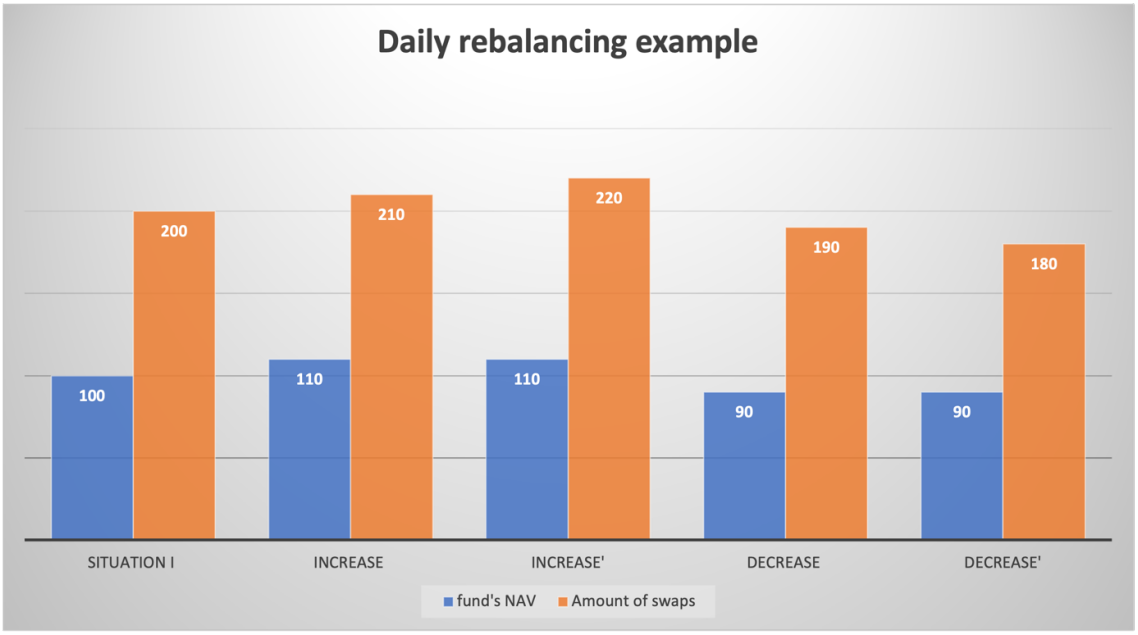
ETF	Average Daily Turnover Ratio	Leverage Ratio	Average Holding Period (days)	Purchases Held for More Than 1 Week	Purchases Held for More Than 1 Month	Purchases Held for More Than 1 Quarter
DPK	18.1%	-3	5.3	16.42%	6.30%	1.22%
TYO	5.5%	-3	12.8	48.02%	16.39%	3.89%
SBB	4.6%	-1	21.4	55.49%	21.62%	8.50%
RHO	2.9%	-2	18.4	61.28%	27.62%	6.58%
UVG	3.7%	2	22.7	54.31%	23.91%	8.90%

Source: (Guedj et al., 2010)

2.5.1 Daily rebalancing

The aim of these funds is to generate the promised multiple only on a daily basis. For this reason, managers of this type of fund proceed to a daily rebalancing. In order to adjust the NAV of the fund to the daily movements of the underlying benchmark, the fund managers need to adjust their positions on derivatives (mainly swaps). This mechanism can be illustrated with a simple example. Taking a bull LETF 2X with a NAV of $100, the required amount of total return swaps is therefore equal to $200 (100*2) (situation I in the figures 4). If the underlying index rises by 5%, the LETF NAV will consequently rise by 10% to $110, increasing the equity swap exposure to $210. However, $210 only represents a 5% increase (increase situation), so we need to increase the fund's swap exposure to $220 in order to have the exposure corresponding to a 5% increase in the underlying index (increase' situation). Let's go back to the baseline and imagine a 5% fall in the underlying index. The NAV of the LETF will therefore fall by 10% for a total of $90, thus reducing the equity swap exposure to $190. However, $190 only represents a 5% decrease (decrease situation), so the fund manager must reduce the fund's swap exposure to $180 in order to have an exposure equivalent to a 5% decrease in the underlying index (decrease' situation) (Cheng & Madhavan, 2009) (Interactive Brokers IBKR Campus, 2023).

Figure 4: Example of daily rebalancing.



2.5.2 Compounding effect

The compounding effect is the main reason for the tracking error (Charupat & Miu, 2014), a measure used by many experts to justify the underperformance of LETFs. The compounding effect is generated by the daily rebalancing described in the previous point. The compounding effect is defined by Charupat & Miu (2014) as the deviation between the return on the LETF and the return on the underlying index multiplied by the promised leverage over a period longer than one day. This difference exists even if there is no daily tracking error. In fact, daily tracking errors are attributed to other factors such as the financing effect (see section 2.2) and the management effect (see section 2.2). There are many formulas in the financial literature to define the compounding effect. However, there is often confusion in the literature between tracking error and compounding effect. In fact, the tracking error for a holding of more than 1 day is not only due to the compounding effect. Both the managing effect and the financing effect have an impact on the daily tracking error, which can add up and contribute to the tracking error over a longer holding period. Although Charupat and Miu (2014) show that the compounding effect is the main contributor to the tracking error, the latter cannot simply be summed up as the compounding effect. The formula that most accurately describes the compounding effect over an N-day holding period is as follows(Charupat et al., 2022).

$$
\begin{aligned}
CE = &\left(\beta^2 - \beta\right) \cdot \left[\sum_{1 \le k_1 < k_2 \le N} \left(i_{t+k_1-1,t+k_1} \cdot i_{t+k_2-1,t+k_2} \right) \right] \\
&+ \left(\beta^3 - \beta\right) \cdot \left[\sum_{1 \le k_1 < k_2 \le k_3 \le N} \left(i_{t+k_1-1,t+k_1} \cdot i_{t+k_2-1,t+k_2} \cdot i_{t+k_3-1,t+k_3} \right) \right] \\
&+ \cdots + \left(\beta^{N-1} - \beta\right) \cdot \left[\sum_{1 \le k_1 < k_2 < \cdots < k_{N-1} \le N} \left(i_{t+k_1-1,t+k_1} \cdot i_{t+k_2-1,t+k_2} \cdot \ldots \cdot i_{t+k_{N-1}-1,t+k_{N-1}} \right) \right] \\
&+ \cdots + \left(\beta^N - \beta\right) \cdot \left[i_{t,t+1} \cdot i_{t+1,t+2} \cdot \ldots \cdot i_{t+N-1,t+N} \right]
\end{aligned}
\tag{3}
$$

Where β is the promised multiple of the LETF and $i_{t+k_1-1,t+k_1}$ is the return of

the underlying index between day $t+kj-1$ and day $t+kj$. The compounding effect is therefore determined by the leverage chosen and the signs and magnitudes of the daily returns of the underlying index.

3 Research questions and Hypothesis

The aim of this thesis is to analyze the long-term performance of LETFs, focusing on European equity indices.

The literature review highlights the fact that this financial instrument is not suitable for a buy-and-hold strategy, even if some researchers do not 100% agree with these conclusions (see section 2.3.1.).

In this regard, the aim of the master's thesis is to answer the following research question.

Research question

How do European leveraged and inverse ETFs perform over a long holding period?

Therefore, the following hypotheses can be formulated:

Hyothesis 1: The tracking error of European leveraged and inverse ETF increase (in absolute value) with the holding period.

Even if the tracking error increases in absolute terms, it's also interesting to know what impact it has.

Hypothesis 2: Tracking error always has a negative impact on ELETF returns.

A first sub-research question will be the following:

Sub-research question 1

What effects influence the performance of European leveraged and inverse ETFs over longer time horizons?

Charupat & Miu (2014) divide the tracking error into three different effects (see sections 2.2 and 2.4.2). It is interesting to understand to what extent these effects affect ELETFs. Understanding these effects allows investors to better understand ELETFs as a whole and to know which strategy to adopt.

A second sub-research question is:

Sub-research question 2

Do European bull LETF outperform European bear LETF?

Except for Charupat & Miu (2014), few researchers have attempted to compare bull and bear LETF. Theoretically, there should be differences between bull and bear ELETFs, given the use of derivatives in the process of creating LETFs (see section 2.2).

4 Methodology and data.

The aim of this section is to present the different datasets and the theoretical framework of the models used in this study. In particular, the section describes how it is possible to measure the performance of ELETFs.

4.1 Data

As mentioned above, the financial literature focuses mainly on LETFs based on US indices. This paper focuses on European indices, and for this purpose, 23 ELETFs were selected from 3 different LETF providers (ProShares, Wisdomtree and Lyxor). The selection criteria were as follows.

Firstly, a fund whose underlying benchmark asset class is equity, and which is based on a European index. The choice of only equity benchmarks was made because most articles on the subject also focus on equity benchmarks, making comparisons easier.

Secondly, it is very important for the fund to have sufficient data available to perform sufficient tests. For this reason, we have only selected funds that have been in existence for more than 7 years. In addition, a certain diversity of underlying benchmarks was important. That's why 6 different indexes were selected, as well as different leverage levels for the same underlying index, which allows for a better analysis. Finally, data availability was also a selection criterion. All these criteria resulted in a selection of 24 ELETFs which are shown in Figure 5. The most striking feature of this table is the huge disparity in expense ratios: funds offered by ProShares and Wisdomtree often have much higher fees than those offered by Lyxor[2]. It's also important to note that I use the gross expense ratio (which doesn't take into account waivers and reimbursements), not the net expense ratio (Moskowitz, 2022).

[2]Nevertheless, the expense ratios indicated by Lyxor seem very low and are questionable compared to the fees charged by competitors. Further research should be carried out to find out more.

Figure 5: Different ELETFs use for dataset.

Fund name	Ticker	Underlying benchmark	Leverage	Fund Provider	Listing currency	Inception date	Expense ratio
Lyxor CAC 40 Daily (-2x) Inverse UCITS ETF - Acc	BX4	CAC40	-2	Lyxor	EUR	2012	0,60%
Lyxor CAC 40 Daily (-1x) Inverse UCITS ETF - Acc	SHC	CAC40	-1	Lyxor	EUR	2012	0,40%
Lyxor CAC 40 Daily (2x) Leveraged UCITS ETF - Acc	LVC	CAC40	2	Lyxor	EUR	2008	0,40%
WisdomTree DAX 3x Daily Short	3DES	DAX	-3	WisdomTree	EUR	2012	2,40%
WisdomTree DAX 3x Daily Leveraged	3DEL	DAX	3	WisdomTree	EUR	2012	2,25%
Lyxor Daily ShortDAX x2 UCITS ETF - Acc	DSD	DAX	-2	Lyxor	EUR	2010	0,60%
WisdomTree EURO STOXX 50® 3x Daily Short	3EUS	EURO STOXX 50	-3	WisdomTree	EUR	2012	1,80%
WisdomTree EURO STOXX 50® 3x Daily Leveraged	3EUL	EURO STOXX 50	3	WisdomTree	EUR	2012	1,35%
Lyxor EURO STOXX 50 Daily (2x) Leveraged UCITS ETF - Acc	LVE	EURO STOXX 50	2	Lyxor	EUR	2007	0,40%
Lyxor EURO STOXX 50 Daily (-1x) Inverse UCITS ETF - Acc	BSX	EURO STOXX 50	-1	Lyxor	EUR	2007	0,40%
Lyxor EURO STOXX 50 Daily (-2x) Inverse UCITS ETF - Acc	BXX	EURO STOXX 50	-2	Lyxor	EUR	2007	0,60%
WisdomTree FTSE 100 3x Daily Leveraged	3UKL	FTSE 100	3	WisdomTree	GBP	2012	2,15%
WisdomTree FTSE 100 3x Daily Short	3UKS	FTSE 100	-3	WisdomTree	GBP	2012	1,10%
WisdomTree FTSE 100 1x Daily Short	SUK1	FTSE 100	-1	WisdomTree	GBP	2013	0,39%
WisdomTree FTSE 100 2x Daily Short	2UKS	FTSE 100	-2	WisdomTree	GBP	2013	0,15%
WisdomTree FTSE 100 2x Daily Leveraged	2UKL	FTSE 100	2	WisdomTree	GBP	2013	2,09%
UltraShort FTSE Europe	EPV	FTSE Developed Europe All Cap Index (ACDER)	-2	ProShares	USD	2009	1,50%
Ultra FTSE Europe	UPV	FTSE Developed Europe All Cap Index (ACDER)	2	ProShares	USD	2010	2,61%
WisdomTree FTSE MIB 3x Daily Leveraged	3ITL	FTSE MIB	3	WisdomTree	EUR	2013	1,35%
WisdomTree FTSE MIB 3x Daily Short	3ITS	FTSE MIB	-3	WisdomTree	EUR	2013	1,10%
Lyxor FTSE MIB Daily (2x) Leveraged UCITS ETF - Dist	LEVMIB	FTSE MIB	2	Lyxor	EUR	2008	0,60%
Lyxor FTSE MIB Daily (-2x) Inverse (Xbear) UCITS ETF - Acc	XBRMIB	FTSE MIB	-2	Lyxor	EUR	2008	0,60%
Lyxor FTSE MIB Daily (-1x) Inverse (Bear) UCITS ETF - Acc	BERMIB	FTSE MIB	-1	Lyxor	EUR	2008	0,60%

Note: The inception date can be defined as the date on which the fund started operations and returns are calculated (« Inception date », 2016)

In order to understand how ELETFs perform against their benchmark, graphs showing the performance of ELETS and the underlying index are shown in Appendix A. Two clear conclusions can be drawn from these comparisons. Firstly, ELETFs follow the performance path of the underlying index. For example, in the first chart on the DAX and its various ELETFs, the DAX experienced a sharp fall in early 2022, which translated into an even sharper fall for the 3X (3DEL) ELETFs, and an increase for the 2X (DSD) and 3X (3DES) ELETFs. Secondly, if we look at the cumulative performance over 5 years, none of the ELETFs has achieved the daily multiple promised by the fund provider. This second observation seems to confirm the findings of Lu et al (2009), Avellaneda & Zhang (2010) and Charupat & Miu (2011), who claim that the performance of LETFs deviates significantly from the performance of the benchmark multiplied by the leverage (promised daily) for holding periods longer than 1 month. All charts are based on the closing prices, which may lead to pricing inefficiencies and small chart errors.

Now that we have the selection of ELETFs, we need some information about them.

4.1.1 Net asset value

The first piece of information we need is the net asset value (NAV). In fact, it is the most important piece of information, as it will allow us to calculate the fund's return. This approach is often used to study the tracking error of ETFs and was also used by Charupat & Miu (2014) to study the tracking error of LETFs. Using NAV rather than market price to calculate fund returns prevents the return from being affected by market price inefficiencies.

Net asset value is the price at which fund shares registered with the U.S. Securities and Exchange Commission (SEC) are traded (Chen, 2023). In other words, the NAV of a fund is comparable to the share price of a corporation's common stock (D'hondt, 2022). NAV is calculated by subtracting total fund liabilities from total fund assets divided by the number of shares outstanding (Chen, 2023).

In this thesis, all historical data on ELETFs (NAV, currency, inception date, expense ratio) comes directly from the fund provider's website. It's important to note that no historical NAVs were available before 1 October 2012 for the LETFs offered by Lyxor, but this is not a problem as we have enough years of existence to carry out our tests (almost 10 years). Also, not all NAVs are expressed in the same currency, but this is not a problem as we focus on NAV returns using the following formula:

$$r^i_{t-1,t} = \frac{NAV^i_t}{NAV^i_{t-1}} - 1 \tag{4}$$

4.1.2 Underlying benchmark information

It is also important to collect information on the underlying indices of the 24 selected LETFs. For this paper, 6 European indices were considered: the DAX, which represents the 40 largest and most liquid companies listed on the Frankfurt stock exchange (Chen, 2022). The CAC40, which also represents the 40 largest and most liquid French companies (Hayes, 2022). The FTSE100 for the 100 largest and most liquid British companies (J. Young, 2023). FTSE MIB for the 40 largest compa-

nies listed on the Milan stock exchange (Chen, 2022b). Euro STOXX 50 for the 50 largest European companies by market capitalization (Chen, 2023b). Finally, the FTSE Developed Europe All Cap Index, which represents the performance of large, medium and small companies in the developed European market, and which is actually a derivative of the FTSE Global Equity Index Series ("FTSE Developed Europe All Cap Index", 2023).

Next, the main data we're interested in for these different indices is the daily price at market close. The data comes from Yahoo Finance for the CAC40, DAX and Euro STOXX 50, and from Investing.com for the three others. Again, not all indexes are denominated in the same currency but this does not matter as we focus on the performance of each index using the following formula:

$$i^i_{t-1,t} = \frac{i^i_t}{i^i_{t-1}} - 1 \tag{5}$$

A more traditional analysis requires a risk-free rate. As a risk-free rate, I choose the 10-year German bund yield, since this paper focuses on European LETFs and German bunds are the least risky European bonds. Moreover, the 10-year rate seems to be the most appropriate and is in line with the existing literature (Širůček et al, 2018). The data on the risk-free rate are taken from the Investing.com website.

4.2 Model.

This section describes the different models used and is divided into three parts. The first part concerns a more classical analysis with a comparison between ELETFs and the underlying benchmark based on the study by Širůček et al (2018). The second part examines the tracking error of ELETFs to measure their performance, drawing on the work of Charupat & Miu (2014). The final part focuses on the compounding effect, the main component of the tracking error, in order to better understand the performance of ELETFs.

4.2.1 Classical analysis.

The aim of this section is to compare the performance of the ELETF with that of its underlying index. To do so, we will mainly use classical risk-return metrics as may have been done in the work of Širůček et al (2018). Such an analysis is the basis of our work to understand the performance of ELETFs over long holding periods. For this purpose, 3 holding periods were selected: 3 months, 6 months and 1 year starting from 01/01/2014 and going up to maximum 31/12/2022. These holding periods were chosen because they are much longer than the recommended holding period for this type of instrument (1 day). Furthermore, longer holding periods would not make much sense, as the majority of studies have shown that LETF results decrease with holding period, and as ELETFs are still a fairly recent product, we didn't have enough data for longer holding periods (even if overlapping techniques were possible).

The first measure of interest is the average annualized yield based on geometric mean (Fabozzi & Markowitz, 2011).

$$r_{\text{annual}} = \left[\prod_{i=1}^{n}(1+r_i)\right]^{\frac{m}{n}} - 1 \tag{6}$$

Where m stands for a one-year time horizon (252 for daily data[3], 52 for weekly data, etc.), n is the number of periods and ri the returns for the selected period. The returns over the selected period are calculated on the basis of NAV using the formula (4).

Then, to measure the volatility, the most widely used method is the standard deviation of returns. Once again, it's important to annualize these results. To do this, simply multiply the formula (7) by an annualization coefficient: $\sqrt[2]{T}$ (where T represents time).

[3]There are on average 252 trading days per year.

$$\sigma = \sqrt{\frac{1}{n-1}\sum_{i'1}^{n}(r_i - \bar{r})^2} \tag{7}$$

Two other measures are also very important in the analysis of ELETFs: Jensen's *alpha* which can be defined as the excess return reduced by the systematic risk (Jensen, 1968) (8). The *beta* coefficient, which in our study represents the effective leverage (different from the daily leverage promise by the fund provider) over the holding period (9).

$$\alpha = r_P - r_F - \beta \cdot (b - r_F) \tag{8}$$

$$\beta = \frac{\text{Cov}\,(r_p, r_m)}{\text{Var}\,(r_m)} \tag{9}$$

Where b and r_m represent the benchmark return (market profit). For each ELETF, we use the underlying index as benchmark. r_p is the return of the LETF. r_f is the risk free rate

Finally, 2 important indicators are the Sharpe ratio (10) and the Treynor ratio (11). Both ratios represent the difference between the return and the risk-free rate per unit of risk. The difference lies in the risk: the first ratio takes into account total risk (σ), while the second focuses on systematic risk (β).

$$SR = \frac{r - r_F}{\sigma} \tag{10}$$

$$TR = \frac{r - r_F}{\beta} \tag{11}$$

This first part already gives us an overview of the performance of ELETFs and allows us to compare them with each other, as well as to make initial comparisons

with LETFs on American indices from the study by Širůček et al (2018). However, these various measures are not specific to LETFs and therefore do not provide an in-depth understanding of the performance of these instruments, which is why more information is provided in the following section.

4.3 Tracking error.

Tracking error is a measure of ETF performance that can also be used for LETFs. However, some nuances need to be applied to LETFs, as they are affected not only by factors under the control of the fund providers (management effect) but also by factors outside their control (compounding effect, financing effect). Tracking error can be defined as the deviation of NAV returns from the returns on the underlying indices, adjusted of leverage (Charupat & Miu, 2014).

A low tracking error suggests that the leveraged ETF is effectively achieving its objective of delivering the amplified returns of the underlying index. On the other hand, a high tracking error indicates that the LETF's performance deviates significantly from the expected leveraged returns, potentially resulting in unexpected gains or losses for investors.

The analysis of tracking error is divided into two parts: a preliminary analysis before going into more detail with a regression analysis. To analyze the tracking error, the models of Charupat & Miu (2014) were used for both the preliminary analysis and the regression analysis, for several reasons (12). Firstly, the formulas for tracking error are those that best allow us to understand the 3 effects that affect tracking error, and the results obtained by the researchers with these formulas are consistent and in line with the existing literature on the subject. Secondly, for the regression equation, the authors start from a base known from the existing literature and adapt it to differentiate the compounding effect from the other 2 effects. This technique allows for a better understanding of the tracking error aspects and thus the long-term performance of LETFs. They also compare the result of their regression equation with the classical one. Finally, the two authors have written several articles on LETFs over the years and have not been criticized for their work.

$$
\begin{aligned}
TE_{1,t,t+N} &= r_{t,t+N} - I_{1,t,t+N} = r_{t,t+N} - \beta \left[\prod_{j=1}^{N} (1 + i_{t+j-1,t+j}) - 1 \right], \\
TE_{2,t,t+N} &= r_{t,t+N} - I_{2,t,t+N} = r_{t,t+N} - \left[\prod_{j=1}^{N} (1 + \beta \cdot i_{t+j-1,t+j}) - 1 \right],
\end{aligned}
\tag{12}
$$

Charupat& Miu (2014) provides the two following formulas to explain the tracking error and separate the compounding effect from the 2 other effects.

Where: N is the length of the holding period, β is the leverage ratio of the LETF, $i_t - 1, t$ is the index return between day $t-1$ and day t and $r_t, t+N$ is return of the LETF during the holding period based on the NAV

Tracking Error 1 (TE1) is a measure of the deviation between an ETF's actual holding-period return and the expected multiple of the underlying index's return over the same period. TE1 encompasses various sources of tracking errors, including those arising from management factors, financial costs, and compounding effects. This is the definition of tracking errors that most investors commonly assume they will experience when investing in a leveraged ETF.

Tracking Error 2 (TE2) measures the difference between the ETF's actual holding-period return and what its compounded return would be if there were no tracking error in the daily returns. In other words, TE2 measures the errors caused by the way the fund is managed (management effect) and the financing costs (financing effect). Both tracking errors, TE1 and TE2, are expected to increase with a longer holding period (N) (Charupat & Miu, 2014).

The next step is to compute the two tracking errors for 3-month, 6-month and 1-year holding period that were generated in the previous section. The tracking errors for 3-month and 1-year holding period are also computed to compare the different retention period and the 6-month holding period allows comparisons with the Charupat & Miu (2014) study. In addition, the average daily return over the period as well as the average daily standard deviation of the underlying benchmark

will enable us to understand how TE1 and TE2 behave under different market conditions.

4.3.1 Compounding effect with numerical example.

In the previous section, we have gained a better understanding of the tracking error as a whole. Charupat & Miu (2014) have shown that the main component of this tracking error is the compounding effect. The aim of this section is to gain a better understanding of this effect, using a series of numerical examples that represent different market conditions as close to reality as possible.

The returns of 2 fictitious LETFs 3X and -3X are examined over a 5-day period in 4 different market situations based on the returns path of the underlying index. Firstly, a sideways market, i.e. the returns of the underlying index move within a certain range but without a clear trend. Secondly, an upward trending market, where returns are not necessarily always positive, but an upward trend can be detected day by day. Also, downward trending is the exact opposite of upward trending. Finally, a downward trending market with asymmetric volatility is closer to the reality that volatility becomes more important in a declining market. For each market situation, 2 different volatilities are used (2% and 8%). The data are purely fictitious and simply allow a clearer understanding of the compounding effect.

5 Empirical result.

This section presents the results obtained by applying the different models presented in the previous section. All the tests were carried out in R studio, the code for which is included in the appendix. The presentation of the results will focus on STOXX50 and FTSE for the 6-month holding period for maximum clarity (except for annualized return which focus only on CAC40), but tables for the other periods and indexes are available in the Appendix. (Appendix B for graph return, Appendix C for table return, Appendix D for table volatility, Appendix E for table β, Appendix F for α, Appendix G for Sharpe ratio, Appendix H for Sharpe ratio) In addition, for all tables relating to the FTSE100, a line has been set at 0.000 and excluded from the calculation of the mean and median. This was done because the values for this period were unusually high due to a change of scale in the daily NAV on 16/05/2014 (the NAV was multiplied by 100). Furthermore, for the Beta, Alpha, Sharpe ratio and Treynor ratio measures, the last period is never available due to the calculations performed in R studio.

5.1 Result of the classical analysis

The first step is to find out more about annualized returns for the different holding period. To do this, we use the daily NAV (see section 4.1.1.). In this section, we will focus on the table and graph of ELETFs linked the CAC40 (tables and graphs of ELETFs linked to other indices can be found in Appendix C). CAC40 returns are positive on average (as is the median), which logically leads to negative returns for ELETFs with negative leverage and positive returns for other ELETFs. The Figure 6 shows that, at first glance, the leverage multiples are similar: bull ELETFs track CAC40 returns in the same direction, while bear ELETFs track CAC40 returns in the opposite direction. However, it seems that bull ELETFs track CAC40 returns to a greater extent than their bear counterparts. This is confirmed by the median of the various funds (see Table 4). Moreover, when the underlying index returns exceed 10% over a 6-month holding period, ELETF returns are positive for bull ELETFs and negative for bears – and vice versa. With a few exceptions, this rule also holds for other indices and holding periods.

Figure 6: Comparison of ELETFs tracking the CAC40 index

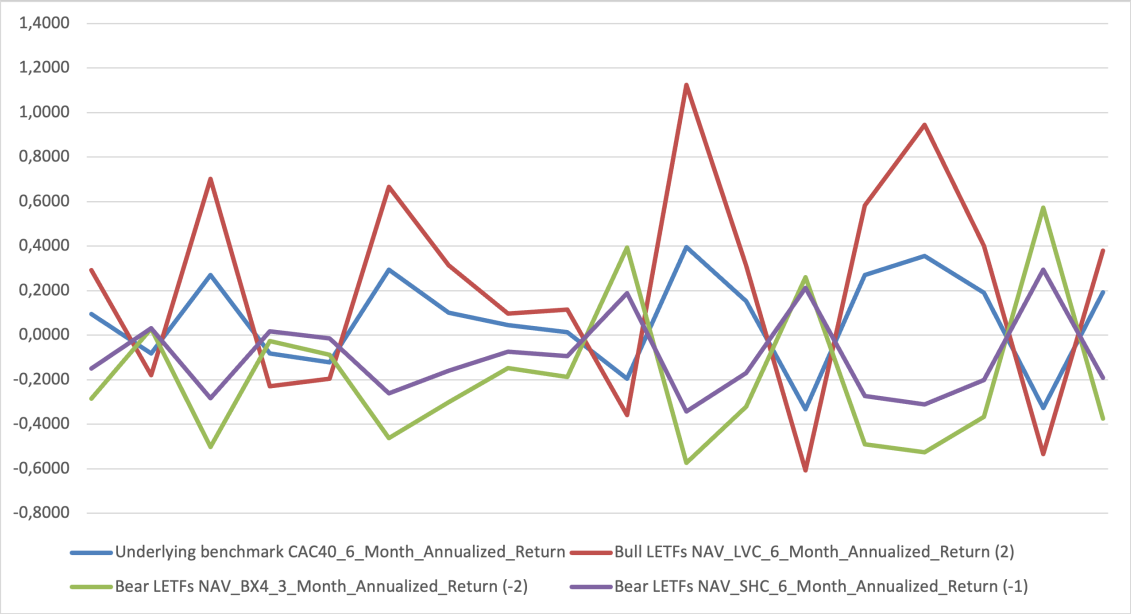


Table 4: Annualized return over 6 month holding period for ELETFs tracking CAC40 index

	Benchmark	**Bull LETFs**	**Bear LETFs**	
Date	CAC40	LVC (2)	BX4 (-2)	SHC (-1)
06-30-2014	0.0947	0.2924	-0.2861	-0.1492
12-31-2014	-0.0827	-0.1797	0.0301	0.0311
06-30-2015	0.2690	0.7015	-0.5025	-0.2834
12-31-2015	-0.0826	-0.2289	-0.0257	0.0169
06-30-2016	-0.1221	-0.1950	-0.0874	-0.0150
12-31-2016	0.2943	0.6652	-0.4625	-0.2612
06-30-2017	0.1000	0.3140	-0.3017	-0.1606
12-31-2017	0.0455	0.0965	-0.1479	-0.0751
06-30-2018	0.0133	0.1154	-0.1875	-0.0947
12-31-2018	-0.1963	-0.3593	0.3929	0.1880
06-30-2019	0.3952	1.1239	-0.5725	-0.3428
12-31-2019	0.1528	0.3127	-0.3204	-0.1689
06-30-2020	-0.3325	-0.6072	0.2607	0.2132
12-31-2020	0.2696	0.5813	-0.4911	-0.2726
06-30-2021	0.3558	0.9438	-0.5254	-0.3104
12-31-2021	0.1912	0.4019	-0.3663	-0.2012
06-30-2022	-0.3265	-0.5335	0.5731	0.2931
12-31-2022	0.1914	0.3785	-0.3750	-0.1909
Mean	0.0683	0.2124	-0.1886	-0.0991
Median	0.0973	0.3025	-0.2939	-0.1549

The second indicator of interest is annualized volatility (Table 5 and 6). This indicator already provides some information on the risk associated with the various ELETFs, compared to the risk of the underlying index. It can be seen that the volatility of the ELETFs is very close, but not equal, to the volatility of the underlying index adjusted by the leveraged multiple. This observation also holds for the

other holding periods and indexes. This observation contradicts the observations of Zhang (2018), who shows in his paper that the volatility of LETFs can be higher than the leverage suggests. The period of highest volatility observed in this sample is the second half of 2020, due to the COVID 19 crisis.

Table 5: Annualized volatility for ELETFs tracking EURO STOXX50 index

	Benchmark	**Bull LETFs**		**Bear LETFs**		
Date	STOXX50E	3EUL (3)	LVE (2)	3EUS (-3)	BXX (-2)	BSX (-1)
06-30-2014	0.0974	0.2893	0.1929	0.3088	0.1931	0.0966
12-31-2014	0.1405	0.4034	0.2780	0.4393	0.2777	0.1387
06-30-2015	0.1406	0.4247	0.2894	0.4508	0.2888	0.1446
12-31-2015	0.1796	0.5041	0.3600	0.5906	0.3599	0.1798
06-30-2016	0.1932	0.5231	0.3847	0.6556	0.3856	0.1925
12-31-2016	0.1009	0.2889	0.1983	0.3190	0.1984	0.0993
06-30-2017	0.0793	0.2540	0.1568	0.2412	0.1581	0.0785
12-31-2017	0.0646	0.1924	0.1310	0.2162	0.1321	0.0653
06-30-2018	0.0990	0.2867	0.1937	0.3000	0.1939	0.0972
12-31-2018	0.0983	0.2902	0.1911	0.2990	0.1905	0.0952
06-30-2019	0.0925	0.2692	0.1778	0.2729	0.1775	0.0887
12-31-2019	0.0915	0.2679	0.1864	0.3055	0.1860	0.0934
06-30-2020	0.2894	0.8366	0.5755	0.8969	0.5773	0.2880
12-31-2020	0.1482	0.4352	0.2911	0.4508	0.2917	0.1461
06-30-2021	0.0942	0.2748	0.1877	0.2884	0.1873	0.0935
12-31-2021	0.1163	0.3342	0.2316	0.3707	0.2254	0.1166
06-30-2022	0.1946	0.5813	0.3852	0.5807	0.3901	0.1925
12-31-2022	0.1331	0.3863	0.2660	0.4225	0.2710	0.1333
Mean	0.1307	0.3801	0.2599	0.4116	0.2602	0.1300
Median	0.1086	0.3122	0.2150	0.3449	0.2119	0.1079

Table 6: Annualized volatility for ELETFs tracking FTSE100 index

	Benchmark	**Bull LETFs**		**Bear LETFs**		
Date	FTSE100	3UKL (3)	2UKL (2)	3UKS (-3)	2UKS (-2)	SUK1 (-1)
06-30-2014	0.0660	0.0000	0.0000	0.0000	0.0000	0.0000
12-31-2014	0.0913	0.2766	0.1844	0.2766	0.1844	0.0922
06-30-2015	0.0985	0.2918	0.1945	0.2918	0.1945	0.0973
12-31-2015	0.1415	0.4281	0.2854	0.4279	0.2853	0.1426
06-30-2016	0.1477	0.4421	0.2948	0.4420	0.2947	0.1473
12-31-2016	0.0787	0.2376	0.1584	0.2375	0.1584	0.0792
06-30-2017	0.0605	0.1848	0.1232	0.1846	0.1231	0.0615
12-31-2017	0.0599	0.1777	0.1185	0.1777	0.1185	0.0592
06-30-2018	0.0878	0.2666	0.1778	0.2666	0.1778	0.0889
12-31-2018	0.0907	0.2720	0.1813	0.2721	0.1814	0.0907
06-30-2019	0.0769	0.2298	0.1532	0.2298	0.1532	0.0766
12-31-2019	0.0884	0.2659	0.1773	0.2659	0.1772	0.0886
06-30-2020	0.2599	0.7846	0.5231	0.7846	0.5231	0.2616
12-31-2020	0.1347	0.4031	0.2687	0.4033	0.2688	0.1344
06-30-2021	0.0928	0.2779	0.1852	0.2780	0.1853	0.0927
12-31-2021	0.0856	0.2547	0.1698	0.2547	0.1698	0.0849
06-30-2022	0.1360	0.4075	0.2717	0.4074	0.2716	0.1358
12-31-2022	0.0915	0.2730	0.1820	0.2730	0.1820	0.0910
Mean	0.1049	0.3220	0.2147	0.3220	0.2147	0.1073
Median	0.0910	0.2730	0.1820	0.2730	0.1820	0.0910

Another very interesting measure is Beta, the set of ELETFs associated with their underlying indices are presented below (Table 7 and 8). Betas have only

been calculated for a 6-month holding period. Overall, the results are quite good, with averages and medians close to the leverage multiple of the various ELETFs. With a few exceptions, such as the following funds: BX4, BXX, DSD, 2UKS. In addition, Beta of bull LETFs is closer to the leverage multiple than the Beta of bear LETFs. This may be due to the covariance between the underlying index returns and the LETF returns, or to the variance of index returns. Since the variance of index returns is the same for all ELETFs, the covariance between bull ELETFs and the underlying index is greater than that between bear ELETFs and the underlying index (in absolute terms). Finally, for certain periods, but quite rarely, the Beta can have a different sign from the multiple of the leverage. This means, for example, that positive returns on the underlying index do not necessarily lead to positive returns for bull ELETFs or negative returns for bear ELETFs.

Table 7: Beta for ELETFs tracking EURO STOXX50 index

	Bull LETFs		**Bear LETFs**		
Date	3EUL (3)	LVE (2)	3EUS (-3)	BXX (-2)	BSX (-1)
06/30/2014	3.8193	2.5409	-2.6573	-1.8818	-1.0479
12/31/2014	1.9553	1.6764	-2.2179	-1.4309	-0.7773
06/30/2015	1.9673	1.8513	-2.1973	-1.4003	-0.7909
12/31/2015	-0.2868	0.7439	-3.0964	-0.0405	-0.0365
06/30/2016	2.9312	2.0227	-2.0247	-1.2337	-0.7219
12/31/2016	2.7497	1.7924	-1.7443	-1.2146	-0.6666
06/30/2017	5.3155	3.0801	-4.0711	-3.0913	-1.6171
12/31/2017	1.9271	0.7705	0.4571	-0.0196	-0.0802
06/30/2018	3.1045	2.3556	-5.0543	-2.9308	-1.4182
12/31/2018	3.1748	2.1149	-2.7298	-1.7983	-0.9445
06/30/2019	4.4118	2.4898	-1.5575	-1.4626	-0.8481
12/31/2019	2.9525	2.1347	-1.3090	-0.9281	-0.6475
06/30/2020	3.0743	2.0528	-1.4773	-1.1150	-0.7054
12/31/2020	4.1489	3.9523	-1.6416	-1.0325	-0.8208
06/30/2021	3.7244	2.6114	-2.0031	-1.4882	-0.9154
12/31/2021	2.4183	1.8160	-2.8110	-1.8684	-0.9450
06/30/2022	2.6587	1.8225	-2.5809	-1.8127	-0.9178
Mean	2.9439	2.1075	-2.2774	-1.4558	-0.8177
Median	2.9525	2.0528	-2.1973	-1.4309	-0.8208

Table 8: Beta for ELETFs tracking FTSE100 index

	Bull LETFs		**Bear LETFs**		
Date	3UKL (3)	2UKL (2)	3UKS (-3)	2UKS (-2)	SUK1 (-1)
06/30/2014	0.0000	0.0000	0.0000	0.0000	0.0000
12/31/2014	3.3035	2.2794	-3.4895	-2.3726	-1.1897
06/30/2015	3.6040	2.3004	-1.8776	-1.5148	-0.8786
12/31/2015	3.1034	2.1142	-2.6294	-1.9038	-1.0078
06/30/2016	5.2860	2.3601	2.0272	0.8923	0.1199
12/31/2016	2.9249	1.8950	-2.2224	-1.5781	-0.8294
06/30/2017	2.6095	1.6602	-1.8228	-1.2914	-0.6748
12/31/2017	3.1026	1.9064	-1.7267	-1.3153	-0.7457
06/30/2018	2.8822	2.0214	-3.5596	-2.3511	-1.1527
12/31/2018	3.1899	2.1069	-2.8596	-1.9699	-1.0078
06/30/2019	3.6696	2.2842	-2.2108	-1.6402	-0.9012
12/31/2019	3.0457	2.0844	-1.6064	-1.4118	-0.8458
06/30/2020	2.9034	2.0136	-1.9489	-1.5813	-0.9061
12/31/2020	5.3133	2.8784	-0.2947	-0.6043	-0.5391
06/30/2021	3.3295	2.1388	-2.3800	-1.7222	-0.9207
12/31/2021	3.3443	2.1159	-2.0553	-1.5759	-0.8963
06/30/2022	3.0261	1.9655	-1.7092	-1.2758	-0.6706
Mean	3.4149	2.1328	-1.8978	-1.4510	-0.8154
Median	3.1467	2.1105	-2.0021	-1.5770	-0.8874

The following tables show Jensen's alphas for 6-month holding period (Table 9 and 10), which measure the propensity of ELETFs to generate excess returns for a given level of risk (i.e., do ELETFs outperform the underlying index given their Beta over the 6-month holding period?). In most periods of the sample, Alpha is close to 0 and even more often negative. Alpha averages are all negative, except for the bull ELETFs replicating the FTSE100. This means that ELETFs are unable to generate excess returns for the same level of risk as their underlying index. In fact, they generate less return than the underlying index. This measure does not argue in favor of holding these financial products. Again, bull ELETFs outperform bear ELETFs for this indicator.

Table 9: Jensen's alphas for ELETFs tracking EURO STOXX50 index

	Bull LETFs		**Bear LETFs**		
Date	3EUL (3)	LVE (2)	3EUS (-3)	BXX (-2)	BSX (-1)
06/30/2014	0.0148	0.0374	-0.2050	-0.1186	-0.0621
12/31/2014	-0.0841	-0.0097	-0.1670	-0.0839	-0.0397
06/30/2015	-0.0878	-0.0335	-0.1621	-0.0821	-0.0338
12/31/2015	-0.2467	-0.1081	-0.2586	-0.0030	0.0058
06/30/2016	0.0804	0.0185	-0.1006	-0.1041	-0.0463
12/31/2016	0.1105	0.0529	-0.1473	-0.1127	-0.0586
06/30/2017	0.0230	0.0090	-0.0678	-0.0486	-0.0261
12/31/2017	0.0206	0.0073	-0.0646	-0.0465	-0.0250
06/30/2018	0.0683	0.0684	-0.2799	-0.1618	-0.0793
12/31/2018	0.0681	0.0350	0.0154	-0.0139	-0.0144
06/30/2019	-0.1805	-0.0449	-0.1622	-0.0475	-0.0126
12/31/2019	-0.0579	-0.0129	-0.1898	-0.0965	-0.0341
06/30/2020	-0.0421	-0.0248	-0.2119	-0.1213	-0.0413
12/31/2020	-0.1862	-0.2590	-0.1728	-0.1145	-0.0141
06/30/2021	-0.0949	-0.0383	-0.1467	-0.0689	-0.0182
12/31/2021	-0.0154	0.0100	-0.1070	-0.0524	-0.0204
06/30/2022	0.0584	0.0239	-0.1154	-0.0843	-0.0443
Mean	-0.0324	-0.0158	-0.1496	-0.0800	-0.0332
Median	-0.0154	0.0073	-0.1621	-0.0839	-0.0338

Table 10: Jensen's alphas for ELETFs tracking FTSE100 index

	Bull LETFs		**Bear LETFs**		
Date	3UKL (3)	2UKL (2)	3UKS (-3)	2UKS (-2)	SUK1 (-1)
06/30/2014	0.0000	0.0000	0.0000	0.0000	0.0000
12/31/2014	0.0219	0.0216	-0.1266	-0.0749	-0.0354
06/30/2015	0.0263	0.0229	-0.1173	-0.0708	-0.0348
12/31/2015	-0.0030	0.0120	-0.1628	-0.0946	-0.0429
06/30/2016	-0.1265	0.0010	-0.4534	-0.2715	-0.1171
12/31/2016	0.0512	0.0341	-0.1089	-0.0686	-0.0360
06/30/2017	0.0539	0.0368	-0.1114	-0.0701	-0.0363
12/31/2017	0.0398	0.0294	-0.1222	-0.0751	-0.0379
06/30/2018	0.0389	0.0305	-0.1360	-0.0831	-0.0414
12/31/2018	0.0659	0.0362	-0.0417	-0.0285	-0.0173
06/30/2019	-0.0002	0.0097	-0.0856	-0.0441	-0.0154
12/31/2019	0.0075	0.0124	-0.0934	-0.0478	-0.0169
06/30/2020	-0.0201	-0.0013	-0.1545	-0.0772	-0.0267
12/31/2020	-0.1770	-0.0597	-0.2361	-0.1203	-0.0371
06/30/2021	0.0047	0.0103	-0.0928	-0.0509	-0.0215
12/31/2021	0.0136	0.0157	-0.1179	-0.0670	-0.0301
06/30/2022	0.0255	0.0214	-0.1375	-0.0831	-0.0417
Mean	0.0014	0.0146	-0.1436	-0.0830	-0.0368
Median	0.0177	0.0185	-0.1200	-0.0728	-0.0357

The next metric is the Sharpe ratio presented in table 11 and 12 for, which expresses the excess returns per unit of volatility. For this metric, there are several extreme values (the occurrence of which is linked to periods of high volatility). It is therefore more interesting to focus on the median rather than the mean for this indicator. Once again, the bull ELETFs seem to perform better than bears. Moreover, if we take a closer look at the ELETF medians for the STOXX50, FTSE100

and FTSE MIB, we can see that the ELETFs with lower leverage perform better. The explanation for the latter probably lies in the fact that lower leverage implies lower volatility.

Table 11: Sharpe ratio for ELETFs tracking EURO STOXX50 index

	Bull LETFs		**Bear LETFs**		
Date	3EUL (3)	LVE (2)	3EUS (-3)	BXX (-2)	BSX (-1)
06/30/2014	-0.0435	0.1319	-1.1329	-0.9040	-0.8398
12/31/2014	-0.0240	0.2858	-0.9489	-0.8082	-0.7397
06/30/2015	-0.0999	0.0956	-0.7689	-0.6569	-0.5387
12/31/2015	-29.3616	-8.9551	0.4817	11.2564	21.8052
06/30/2016	0.2948	0.1855	-0.4274	-0.6346	-0.5134
12/31/2016	1.7372	1.5967	-2.3145	-2.4216	-2.3325
06/30/2017	0.8576	0.8023	-1.3515	-1.3126	-1.3240
12/31/2017	-0.3285	-0.3948	-6.3402	-93.4472	-11.8219
06/30/2018	-0.9891	-0.8643	0.4271	0.4346	0.4327
12/31/2018	0.2434	0.2196	-0.1100	-0.1750	-0.2106
06/30/2019	1.2140	1.5116	-3.2539	-2.2818	-2.0798
12/31/2019	-0.3354	-0.2459	-0.7490	-0.4787	-0.1409
06/30/2020	-0.1544	-0.1453	-0.7373	-0.5410	-0.2557
12/31/2020	3.7060	2.8418	-10.2595	-10.6216	-6.8088
06/30/2021	1.2627	1.4434	-2.9124	-2.4624	-2.0200
12/31/2021	-0.4376	-0.3746	0.1831	0.2353	0.2631
06/30/2022	-0.1992	-0.2387	0.1015	0.0951	0.0929
Mean	-1.3328	-0.1238	-1.7714	-6.1603	-0.4136
Median	-0.0435	0.1319	-0.7689	-0.6569	-0.5387

Table 12: Sharpe ratio for ELETFs tracking EURO STOXX50 index

	Bull LETFs		**Bear LETFs**		
Date	3UKL (3)	2UKL (2)	3UKS (-3)	2UKS (-2)	SUK1 (-1)
06/30/2014	0.0000	0.0000	0.0000	0.0000	0.0000
12/31/2014	-0.7895	-0.6813	-0.6745	-0.4801	-0.4689
06/30/2015	-0.7407	-0.6736	-0.8073	-0.3781	-0.1983
12/31/2015	0.0087	0.0854	-0.7322	-0.5911	-0.5094
06/30/2016	3.5454	5.5245	-11.6083	-17.4797	-65.5009
12/31/2016	1.4030	1.4217	-2.0335	-1.9091	-1.8838
06/30/2017	2.9085	2.9867	-5.4201	-5.0184	-5.0318
12/31/2017	0.9097	0.9967	-2.7763	-2.3292	-2.1205
06/30/2018	-0.6174	-0.5946	0.2997	0.3393	0.3378
12/31/2018	0.1058	0.0822	-0.0653	-0.0647	-0.0833
06/30/2019	0.8533	0.9099	-1.4496	-1.2827	-1.1590
12/31/2019	-0.6143	-0.5890	0.2096	0.3864	0.4870
06/30/2020	-0.4267	-0.3898	-0.0872	0.0938	0.2084
12/31/2020	2.3777	3.1242	-58.3669	-18.3490	-9.9608
06/30/2021	2.3827	2.5223	-3.9228	-3.5342	-3.2795
12/31/2021	-0.0238	0.0326	-0.9134	-0.6565	-0.5064
06/30/2022	-0.1280	-0.0801	-1.0469	-0.7819	-0.7056
Mean	0.6971	0.9174	-5.5872	-3.2522	-5.6484
Median	0.0572	0.0838	-0.9801	-0.7192	-0.6075

Finally, table shows the Treynor ratio for a 6-month holding period. This indicator expresses excess return adjusted by the Beta over 6-month holding period. This time, the bear ELETFs outperform the bull ELETFs. This is because, as shown above, the bear ELETFs often have a lower Beta than the multiple of their leverage.

Table 13: Treynor ratio for ELETFs tracking EURO STOXX50 index

	Bull LETFs		**Bear LETFs**		
Date	3EUL (3)	LVE (2)	3EUS (-3)	BXX (-2)	BSX (-1)
06/30/2014	-0.0670	-0.0336	-0.3919	-0.2744	-0.2638
12/31/2014	0.0047	0.0988	-0.4371	-0.3263	-0.3091
06/30/2015	0.1611	0.1847	-0.7719	-0.7225	-0.6209
12/31/2015	-1.9079	-2.3105	0.6271	0.6893	0.8634
06/30/2016	0.0187	-0.1761	-0.0690	-0.1447	-0.0920
12/31/2016	1.4759	2.2067	-2.3412	-2.3272	-2.1653
06/30/2017	2.8231	0.9881	-3.4250	-3.2861	-3.4045
12/31/2017	0.3818	0.5572	-14.1748	-4.9896	-3.9491
06/30/2018	-0.8472	-0.7162	0.3169	0.3363	0.3363
12/31/2018	0.1510	0.0685	-0.0444	-0.0853	-0.1238
06/30/2019	1.7591	1.4078	-6.3169	-4.1561	-3.6120
12/31/2019	-0.2734	-0.3470	-0.5176	-0.3319	-0.1020
06/30/2020	-0.1137	-0.1468	-0.5465	-0.4063	-0.2008
12/31/2020	7.8041	13.7435	-16.4242	-9.1425	-10.0135
06/30/2021	3.1176	1.8568	-7.2753	-6.6985	-5.8832
12/31/2021	-0.3113	-0.3765	0.1865	0.2050	0.1899
06/30/2022	-0.2031	-0.4506	0.1466	0.1271	0.0995
Mean	0.8220	0.9738	-3.0270	-1.8549	-1.7206
Median	0.0187	0.0685	-0.5176	-0.3319	-0.2638

Table 14: Treynor ratio for ELETFs tracking FTSE100 index

	Bull LETFs		**Bear LETFs**		
Date	3UKL (3)	2UKL (2)	3UKS (-3)	2UKS (-2)	SUK1 (-1)
06/30/2014	0.0000	0.0000	0.0000	0.0000	0.0000
12/31/2014	-0.0164	-0.0138	0.0154	0.0112	0.0118
06/30/2015	-0.0266	-0.0241	0.0299	0.0141	0.0075
12/31/2015	0.0007	0.0073	0.0644	0.0523	0.0458
06/30/2016	0.0455	0.0694	-0.1450	-0.2071	-0.4869
12/31/2016	0.0656	0.0660	0.0983	0.0930	0.0941
06/30/2017	0.0487	0.0504	0.0876	0.0804	0.0786
12/31/2017	0.0278	0.0302	0.0870	0.0734	0.0680
06/30/2018	-0.0470	-0.0454	-0.0226	-0.0255	-0.0252
12/31/2018	0.0157	0.0122	0.0098	0.0098	0.0127
06/30/2019	0.0591	0.0635	0.0971	0.0853	0.0754
12/31/2019	-0.0846	-0.0811	-0.0289	-0.0532	-0.0670
06/30/2020	-0.0717	-0.0654	0.0147	-0.0158	-0.0352
12/31/2020	0.0372	0.0497	0.6722	0.2423	0.1294
06/30/2021	0.0580	0.0614	0.0956	0.0862	0.0800
12/31/2021	-0.0013	0.0018	0.0556	0.0407	0.0334
06/30/2022	-0.0080	-0.0051	0.0579	0.0422	0.0351
Mean	0.0064	0.0111	0.0743	0.0331	0.0036
Median	0.0082	0.0097	0.0567	0.0414	0.0343

All these indicators already provide us with initial answers to our research questions. However, to better understand the performance of this financial instrument, we recommend the use of a specific metric such as tracking error. will give us more answers.

5.2 Result of the Tracking error.

This section focuses on tracking error and its various components (management effect, financing effect, compounding effect). To this end, tracking error 1 and 2 have been calculated for the various ELETFs linked to their respective underlying indices for holding periods of 3 months, 6 months and 1 year. Only the tables containing tracking error 1 and 2 for ELETFs replicating the FTSE100 are shown in this section. The other tracking error tables can be found in Appendix I. Moreover, comparisons are made with Charupat & Miu (2014) study to compare the results of ELETFs with those of LETFs covering the US market. Also, a tracking error close to 0 means that the fund is able to deliver the leverage promised by the fund manager (on a daily basis) over the chosen holding period.

Firstly, the following tables (Table 15 and 16) show the TE1 and TE2 for the various ELETFs for a 6-month holding period. Market conditions are often the same for the different periods selected, with arithmetic mean returns of the underlying index close to 0%, and with low volatility (the highest being 2% during the covid crisis).

Table 15: Tracking error 1 for ELETFs tracking the FTSE100 over 6-month holding periods

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3UKL(3)	2UKL(2)	3UKS(-3)	2UKS(-2)	SUK1(-1)
06-30-2014	0.0011	0.5877	0.0000	0.0000	0.0000	0.0000	0.0000
12-31-2014	-0.0198	0.8138	-4.0922	-2.2141	-5.0293	-2.1190	-0.6863
06-30-2015	-0.0019	0.8772	2.1547	2.1871	-11.8475	-6.8067	-3.0406
12-31-2015	-0.0221	1.2605	-6.1517	-2.8256	-12.4024	-5.8263	-1.9286
06-30-2016	0.0417	1.3156	7.1311	6.5848	-19.8612	-12.6523	-6.0284
12-31-2016	0.0756	0.7013	1.7272	0.8335	-0.9560	-0.8966	-0.7528
06-30-2017	0.0203	0.5387	2.7170	1.8623	-6.6605	-4.0517	-2.0597
12-31-2017	0.0408	0.5336	3.2162	2.0097	-5.3243	-3.3387	-1.7711
06-30-2018	-0.0022	0.7822	4.4048	3.5080	-12.5085	-7.4125	-3.4245
12-31-2018	-0.0957	0.8076	12.8755	8.0849	-13.7216	-8.4564	-4.1909
06-30-2019	0.0819	0.6854	7.8333	4.3067	-1.7016	-1.7845	-1.3379
12-31-2019	0.0199	0.7878	-4.8889	-2.6071	-3.0827	-1.0972	-0.2098
06-30-2020	-0.1332	2.3151	-1.2265	-1.2142	-34.7602	-15.5811	-4.7279
12-31-2020	0.0545	1.2002	-2.9487	-0.5076	-10.3407	-6.0091	-2.6867
06-30-2021	0.0725	0.8271	-2.0419	-1.3445	-0.3507	-0.2346	-0.3138
12-31-2021	0.0425	0.7625	-0.9831	-0.3603	-4.6797	-2.6536	-1.3183
06-30-2022	-0.0165	1.2117	-5.1138	-2.1916	-11.0096	-5.2040	-1.7143
12-31-2022	0.0337	0.8150	-2.7377	-1.0449	-2.2919	-0.5406	0.3418
Median			-0.9831	-0.3603	-6.6605	-4.0517	-1.7711
Volatility			5.2555	3.2448	8.5409	4.2994	1.7268

Table 16: Tracking error 2 for ELETFs tracking the FTSE100 over 6-month holding periods

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3UKL(3)	2UKL(2)	3UKS(-3)	2UKS(-2)	SUK1(-1)
06-30-2014	0.0011	0.5877	0.0000	0.0000	0.0000	0.0000	0.0000
12-31-2014	-0.0198	0.8138	-1.8361	-1.4417	-0.0491	0.3556	0.1301
06-30-2015	-0.0019	0.8772	4.7916	3.0790	-6.4512	-4.0900	-2.1327
12-31-2015	-0.0221	1.2605	-1.2980	-1.1035	-0.3511	0.1381	0.0196
06-30-2016	0.0417	1.3156	13.8182	8.7696	-9.8539	-7.2488	-4.1054
12-31-2016	0.0756	0.7013	1.5198	0.7283	-2.5093	-1.5929	-0.9561
06-30-2017	0.0203	0.5387	3.7127	2.1865	-4.9794	-3.1828	-1.7609
12-31-2017	0.0408	0.5336	3.8913	2.2219	-4.4398	-2.8578	-1.5978
06-30-2018	-0.0022	0.7822	6.6296	4.2585	-7.9801	-5.1348	-2.6634
12-31-2018	-0.0957	0.8076	8.9953	6.7890	-21.1109	-12.2237	-5.4649
06-30-2019	0.0819	0.6854	6.8032	3.9336	-4.6247	-3.1917	-1.7866
12-31-2019	0.0199	0.7878	-2.5382	-1.8430	0.7183	0.8920	0.4814
06-30-2020	-0.1332	2.3151	0.2700	0.0896	-2.6223	-1.3927	-0.7719
12-31-2020	0.0545	1.2002	2.1921	1.1457	-3.2057	-2.1177	-1.2870
06-30-2021	0.0725	0.8271	-1.1780	-1.1143	-0.5394	-0.1865	-0.2476
12-31-2021	0.0425	0.7625	0.9463	0.2493	-2.1041	-1.2559	-0.8157
06-30-2022	-0.0165	1.2117	-0.3810	-0.5407	-0.1496	0.2217	0.0773
12-31-2022	0.0337	0.8150	-0.6143	-0.3698	0.6417	1.0432	0.9083
Median			1.5198	0.7283	-2.6223	-1.5929	-0.9561
Volatility			4.4193	2.9904	5.3512	3.3847	1.6541

A few trends can be identified in relation to TE1. Firstly, a decrease in leverage reduces TE1 (in absolute terms). Bull ELETFs are more likely to have a positive and close to 0 TE1 than bear ELETFs. A positive tracking error is positive for the investor, as it means that he or she is getting a higher return than expected, given the leverage of the ELETFs. Secondly, the TE1 results for the various ELETFs are highly volatile over the various 6-month periods. Finally, when the underlying index is more volatile, TE1s tend to rise (in absolute terms).

For TE2, an individual analysis of each result shows that TE2 is generally closer to 0 than TE1. In addition, the volatility of the results is much lower, with less extreme values than for TE1. This seems to confirm Charupat & Miu's (2014) analysis that the compounding effect is the dominant component of the tracking error. Secondly, periods of high volatility do not necessarily lead to extreme values for TE2 as is the case for TE1. Also, TE2 of ELETFs are more often positive and close to 0 than their bear counterpart. Finally, as with TE1, lower leverage reduces tracking error (in absolute terms).

Another important point is to compare these 2 tracking errors with those of Charupat & Miu (2014), who based their analyses on LETFs tracking US indices

(Figure 7). In their results, the difference between TE1 and TE2 is much larger than our difference between TE1 and TE2. This means that the compounding effect has less impact on the ELETFs chosen and on the selected period. The financing effect and the management effect have a much greater weight for our ELETFs than for the Charupat & Miu (2014) sample. One possible reason for this is that management fees for ELETFs are more important than for LETFs tracking US index (except for Lyxor, but its expense ratios seem somewhat unusual; see 4.1).

Figure 7: Tracking error 1 and 2 for LETFs tracking US indexes over 6-month holding periods

Panel A: Tracking error $TE_1 = r - I_1$

			Bull funds					Bear funds				
6-Month period	Arith. mean of daily index return	Std. dev. of daily index return	SPY (+1x)	SSO (+2x)	RSU (+2x)	UPRO (+3x)	SPXL (+3x)	SH (−1x)	SDS (−2x)	RSW (−2x)	SPXU (−3x)	SPXS (−3x)
2009/07−12	0.165	1.064	−0.09	1.94	2.15	6.82	8.99	2.65	8.53	8.79	17.21	16.28
2010/01−06	−0.047	1.290	−0.03	−1.87	−1.77	−4.23	−3.81	−2.10	−5.86	−5.53	−11.56	−13.29
2010/07−12	0.168	0.961	−0.10	2.59	2.94	9.34	12.39	3.14	9.78	9.76	19.25	18.05
2011/01−06	0.050	0.810	−0.01	−1.30	−1.11	−2.87	−2.24	−0.77	−1.43	−1.39	−2.27	−3.50
2011/07−12	−0.012	1.908	−0.04	−4.70	−4.55	−12.10	−15.17	−4.94	−13.83	−13.76	−26.42	−25.50
2012/01−06	0.076	0.849	−0.08	−0.94	−0.60	−1.85	−3.08	−0.31	−0.11	−0.10	0.40	0.16
2012/07−12	0.049	0.759	−0.08	−1.14	−0.94	−2.31	−3.04	−0.69	−1.34	−1.24	−2.16	−2.27
Median			−0.08	−1.14	−0.94	−2.31	−3.04	−0.69	−1.34	−1.24	−2.16	−2.27

Panel B: Tracking error $TE_2 = r - I_2$

			Bull funds					Bear funds				
6-month period	Arith. mean of daily index return	Std. dev. of daily index return	SPY (+1x)	SSO (+2x)	RSU (+2x)	UPRO (+3x)	SPXL (+3x)	SH (−1x)	SDS (−2x)	RSW (−2x)	SPXU (−3x)	SPXS (−3x)
2009/07−12	0.165	1.064	−0.09	−0.97	−0.76	−1.68	0.49	−0.32	−0.30	−0.04	−0.23	−1.16
2010/01−06	−0.047	1.290	−0.03	−0.53	−0.43	−0.61	−0.19	−0.40	−0.47	−0.14	−0.34	−2.07
2010/07−12	0.168	0.961	−0.10	−1.02	−0.67	−1.58	1.47	−0.28	−0.21	−0.23	−0.17	−1.37
2011/01−06	0.050	0.810	−0.01	−0.74	−0.55	−1.07	−0.44	−0.34	−0.29	−0.25	−0.24	−1.47
2011/07−12	−0.012	1.908	−0.04	−0.61	−0.46	−0.75	−3.82	−0.42	−0.43	−0.36	−0.43	0.49
2012/01−06	0.076	0.849	−0.08	−0.77	−0.43	−1.14	−2.37	−0.32	−0.28	−0.27	−0.24	−0.48
2012/07−12	0.049	0.759	−0.08	−0.70	−0.50	−0.89	−1.62	−0.35	−0.42	−0.32	−0.53	−0.64
Median			−0.08	−0.74	−0.50	−1.07	−0.44	−0.34	−0.30	−0.25	−0.24	−1.16

Source: (Charupat & Miu, 2014)

Thirdly, it is interesting to compare different holding periods to see whether or not the performance of ELETFs increases with the holding period. TE1 and TE2 for a 1-year holding period for LETFs tracking FTSE100 are available in tables 16 and 17. Other indexes and 3-month holding period are presented in Annex I. For the 1-year holding period, the individual results for TE1 and TE2 are higher (in absolute value) than for the 6-month holding period. In addition, the volatility of the results for the 1-year holding period is always higher than for the 6-month holding period (almost double). The medians of the results for each ELETF also follow this trend. ELETFs with a 1-year holding period perform less well than the same ELETFs with a 6-month holding period. When comparing the TE1 and TE2 ELETFs with a 3-month and 6-month holding period, the same conclusions can be drawn as for the previous comparison, but in favor of the 3-month holding period. These results show that ELETFs perform better over shorter holding periods.

Table 17: Tracking error 1 for ELETFs tracking the FTSE100 over 1-year holding periods

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3UKL(3)	2UKL(2)	3UKS(-3)	2UKS(-2)	SUK1(-1)
12-31-2014	-0.0083	0.7128	0.0000	0.0000	0.0000	0.0000	0.0000
12-31-2015	-0.0141	1.0914	-1.7021	1.0284	-26.8947	-14.7116	-6.0357
12-31-2016	0.0589	1.0493	18.0638	12.1732	-11.2854	-9.6716	-6.0549
12-31-2017	0.0306	0.5375	7.8037	4.5955	-8.3361	-5.7451	-3.3463
12-31-2018	-0.0495	0.7967	7.9066	5.1626	-19.0382	-10.3477	-4.6010
12-31-2019	0.0479	0.7393	9.5631	5.6649	-3.9060	-3.5373	-2.4033
12-31-2020	-0.0439	1.8326	-12.8999	-6.5564	-48.7997	-23.9954	-7.9515
12-31-2021	0.0561	0.7969	2.8863	1.1979	0.5834	-0.6962	-1.2437
12-31-2022	0.0090	1.0265	-6.6045	-2.0168	-15.7939	-7.7150	-2.3779
Median			5.3450	2.8967	-13.5396	-8.6933	-3.9737
Volatility			9.8864	5.6208	15.5943	7.2540	2.3003

Table 18: Tracking error 2 for ELETFs tracking the FTSE100 over 1-year holding periods

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3UKL(3)	2UKL(2)	3UKS(-3)	2UKS(-2)	SUK1(-1)
12-31-2014	0.0106	1.3900	-5.1519	-3.2136	-10.1199	-4.6466	-2.7451
12-31-2015	0.0594	1.5865	-5.2344	-6.2655	-6.4269	-3.6204	-2.6647
12-31-2016	-0.0234	1.9083	19.2037	0.7256	-5.9185	-13.2627	-8.0386
12-31-2017	0.0541	0.8747	-1.0111	-10.2426	0.3858	-1.6415	-1.4757
12-31-2018	-0.0632	1.1509	4.2642	-1.6800	-15.5542	-11.2354	-5.8181
12-31-2019	0.1032	0.9325	4.9647	-2.3376	-7.7880	-5.7455	-4.4416
12-31-2020	0.0031	2.1787	3.5273	-2.2011	-0.9427	-4.2835	-3.0569
12-31-2021	0.0857	0.9810	2.6255	2.4879	-10.2021	-6.7375	-4.8009
12-31-2022	-0.0436	1.5563	4.0144	-5.4593	-3.5537	-5.9253	-3.5169
Median			3.5273	-2.3376	-6.4269	-5.7455	-3.5169
Volatility			7.2440	3.8058	4.9684	3.6936	1.9771

As the compounding effect is the most important factor in tracking error, it is interesting to understand it better.

5.3 Numerical example for compounding effect.

To better understand the compounding effect, I have decided to present a fictitious example of 2 LETF (3X) (-3X) using 8 different returns paths that best represent the various possible market situations. This example is based on the paper by Charupat et al. (2022). The results are presented in Figure 8. The column: "constant leverage return 4 days" represents the return on a leveraged fund without daily rebalancing and is calculated by applying the leverage to the column: 4_day Compounded return underlying. The Compounding effect column is calculated as the difference between the 4-day compounded return LETF column and the constant leverage return 4 days column.

Figure 8: Numerical example for compounding effect

+3X LETF

	Underlying index returns						LETF returns						
Path	Day 1	Day 2	Day 3	Day 4	4-day Compounded return	Volatility	Day 1	Day 2	Day 3	Day 4	4-day Compounded return LETF	Constant leverage return 4 days	Compounding effect
1	2,03%	-1,97%	2,03%	-1,97%	0,04%	2,31%	6,09%	-5,91%	6,09%	-5,91%	-0,36%	0,12%	-0,48%
2	7,10%	-6,50%	7,10%	-6,50%	0,28%	7,85%	21,30%	-19,50%	21,30%	-19,50%	-4,65%	0,83%	-5,48%
3	4,04%	-0,23%	4,04%	-0,23%	7,75%	2,47%	12,12%	-0,69%	12,12%	-0,69%	23,98%	23,24%	0,74%
4	9,53%	-5,28%	9,53%	-5,28%	7,63%	8,55%	28,59%	-15,84%	28,59%	-15,84%	17,12%	22,90%	-5,78%
5	0,25%	-4,11%	0,25%	-4,11%	-7,59%	2,52%	0,75%	-12,33%	0,75%	-12,33%	-21,98%	-22,77%	0,79%
6	4,58%	-8,53%	4,58%	-8,53%	-8,49%	7,57%	13,74%	-25,59%	13,74%	-25,59%	-28,37%	-25,48%	-2,89%
7	-3,29%	-3,29%	1,48%	-3,29%	-8,21%	2,39%	-9,87%	-9,87%	4,44%	-9,87%	-23,53%	-24,63%	1,10%
8	-8,07%	-8,07%	6,96%	-8,07%	-16,90%	7,52%	-24,21%	-24,21%	20,88%	-24,21%	-47,38%	-50,70%	3,33%

-3X LETF

	Underlying index						LETF return						
Path	Day 1	Day 2	Day 3	Day 4	4-day Compounded return underlying	Volatility	Day 1	Day 2	Day 3	Day 4	4-day Compounded return LETF	Constant leverage return 4 days	Compounding effect
1	2,03%	-1,97%	2,03%	-1,97%	0,04%	2,31%	-6,09%	5,91%	-6,09%	5,91%	-1,08%	-0,12%	-0,96%
2	7,10%	-6,50%	7,10%	-6,50%	0,28%	7,85%	-21,30%	19,50%	-21,30%	19,50%	-11,55%	-0,83%	-10,72%
3	4,04%	-0,23%	4,04%	-0,23%	7,75%	2,47%	-12,12%	0,69%	-12,12%	0,69%	-21,70%	-23,24%	1,54%
4	9,53%	-5,28%	9,53%	-5,28%	7,63%	8,55%	-28,59%	15,84%	-28,59%	15,84%	-31,57%	-22,90%	-8,67%
5	0,25%	-4,11%	0,25%	-4,11%	-7,59%	2,52%	-0,75%	12,33%	-0,75%	12,33%	24,29%	22,77%	1,52%
6	4,58%	-8,53%	4,58%	-8,53%	-8,49%	7,57%	-13,74%	25,59%	-13,74%	25,59%	17,36%	25,48%	-8,12%
7	-3,29%	-3,29%	1,48%	-3,29%	-8,21%	2,39%	9,87%	9,87%	-4,44%	9,87%	26,74%	24,63%	2,11%
8	-8,07%	-8,07%	6,96%	-8,07%	-16,90%	7,52%	24,21%	24,21%	-20,88%	24,21%	51,62%	50,70%	0,92%

For the first 2 return paths, which represent a sideways market situation with underlying index volatilities of 2% and 8% respectively, the 4-day compounded return is negative for both bull and bear LETFs. What's more, the compounding effect is negative for both paths (for bear and bull LETFs) and diminishes as volatility increases. This example shows that volatility can destroy value in the case of daily rebalancing. In addition, it is advisable not to hold on to your LETFs in the event

of a sideways market forecast.

The next situation is that of an upward trending market (path 3 and 4). The compound return after 4 holding days is positive for bull LETFs and negative for bear LETFs. However, in terms of compounding, only path 3 is positive (for both types of LETFs). In other words, the compounding effect is positive only when the underlying index is low volatility. For a downward-trending market (path 5, 6), the compounding effect will also be positive at low volatility. These 2 examples show that, in the case of clear market trends, it may be worth keeping a LETF for longer than the period recommended by fund providers (1 day). But once again, if volatility becomes too high, the compounding effect becomes negative and it is no longer worth holding LETFs for more than one day.

The last situation to analyze is a downward trending market (path 7 and 8). For bull LETFs, the compounding effect increases as volatility rises (a unique situation compared to the other paths). Nevertheless, the 4-day compound returns of LETFs are very negative due to the market situation. For bear LETFs, the compounding effect diminishes as volatility rises, but LETF compound returns are very positive.

These various examples show that there are few situations where holding a LETF for more than a day is beneficial. However, there are situations where it may be worthwhile to hold this type of financial instrument for longer than the recommendations. Specially, when volatility is low and the return path follows the same trend for several consecutive days. But such situations are very difficult to predict in advance.

6 Conclusion.

Classical analysis provides mixed results, which alone are not sufficient to understand the performance of ELETFs over a longer holding period. Tracking error analysis shows that it is better not to hold ELETFs for long periods of time. Indeed, the tracking error is more often negative and not close to 0, which has a negative impact on the results of the holder of this type of product. In addition, the tracking error increases with the holding period. Finally, the numerical example illustrates the rare cases in which holding ELETs can be worthwhile, and that volatility is a major disincentive to the use of this financial instrument.

6.1 Implication of the study.

This part of the conclusion aims to provide an answer to the research questions and their implications.

The performance of the bull ELETFs seems to be clearly superior to that of the bear ELETFs (subquestion 2) when we look at the clash analysis. In fact, only the Treynor ratio is in favour of the bear. However, these results must be qualified: over the selected period, the returns of the underlying indexes are positive on average (the medians are also positive), which means that the bear ELETFs also have negative returns on average, which logically affects their performance on several metrics. Furthermore, tracking errors are more often positive and close to 0 for bull ELETFs than for bear ELETFs, which is a sign of better performance.

To answer the first sub-question, which is to find out which effects influence the performance of ELETFs. The management effect, the financing effect and the compounding effect are also present for ELETFs. However, the proportions are not the same as for LETFs based on US indices. While the compounding effect dominates the other effects, it seems to have less impact than for American LETFs. What's more, the other two effects have a much stronger impact on ELETFs, as the TE2 analysis shows. A possible explanation could be that management fees are more important for ELETFs than for their American counterparts.

Finally, to answer the central question of this master thesis, which is to understand how ELETFs perform for long periods of detention, let's start by verifying the 2 hypotheses that have been put forward. Firstly, the tracking error does indeed increase as the holding period increases (in absolute terms) for both TE1 and TE2. However, the tracking error is not always negative for the investor. In fact, bull LETFs are more likely to have positive tracking errors. It also seems more difficult to understand the conditions under which the tracking error is positive for ELETFs than for their American counterparts, due to the weaker influence of the compounding effect.

Finally, given the various factors mentioned above, it seems clear that ELETFs perform less well than LETFs based on US indices. This underperformance is mainly due to the management effect and the financing effect. Furthermore, the performance of this financial instrument decreases as the holding period increases, mainly due to the compounding effect. Nevertheless, there are a few situations in which it may be worthwhile to hold the instrument for longer than the recommended period (more than 1 day). In particular, if the investor has evidence that the market will trend (up or down) for several consecutive days with low volatility, then LETFs can generate excess returns.

6.2 Limitations and future research.

The main limitation of this thesis is the lack of analysis of the management effect and the financing effect. Indeed, the focus has been on the compounding effect, but the other 2 effects also play an important role in the performance of ELETFs. An in-depth study of these 2 factors would perhaps allow us to define more precisely the factors influencing TE1 and, in particular, TE2. It therefore would be very interesting for future research to focus on fees and the methods used by fund providers to create leverage, to better understand the management effect in particular.

It would also be interesting, for further research, to use the regression function proposed by Charupat & Miu (2014) to determine more precisely the impact of the compounding effect on LETFs. This regression should be carried out using

overlapping techniques, given the limited statistical experience we have with this financial instrument.

Finally, it could also be interesting to determine the optimal holding period for a given level of leverage under different market conditions.

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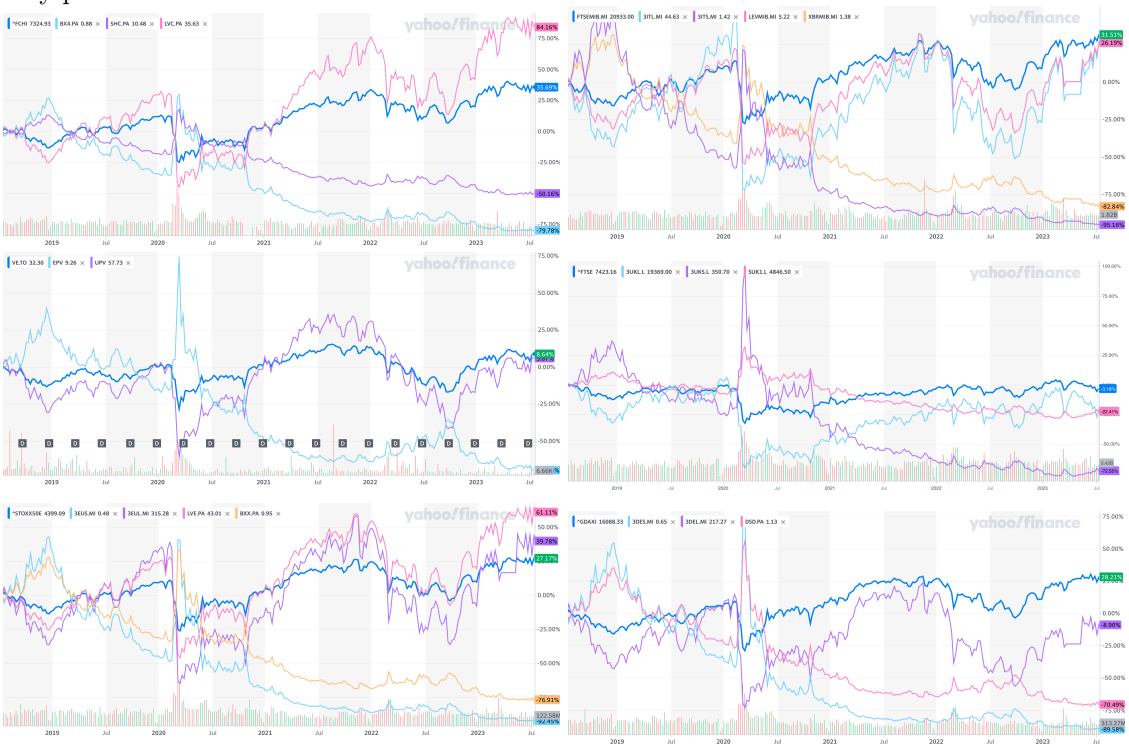
8 Appendix

Appendix A

Appendix A1: Comparison of ELETFs with their underlying indexes.

Figure 9: 5-year performance of LETFs tracking the 6 different with interval of one week based on daily price.



The underlying index for FTSE Developed Europe All Cap Index is VE.TO, it's an ETF which track the FTSE Developed Europe All Cap Index. No information is available on the FTSE Developed Europe All Cap Index on Yahoo Finance.

Appendix B

Appendix B1: Annualized 6-month holding period return for the different ELETFs

Figure 10: Annualized 6-month holding period return for the different ELETFs and their underlying indexes

Appendix C:Returns for different holding period

Appendix C1:Returns for 6-month holding period

Table 19: Returns for LETFS tracking DAX over 6-month holding period

	Benchmark	**Bull LETFs**	**Bear LETFs**	
Date	DAX	3DEL (3)	3DES (-3)	DSD (-2)
06-30-2014	0.0943	0.1053	-0.3855	-0.2176
12-31-2014	-0.0195	-0.2107	-0.1987	-0.0732
06-30-2015	0.2563	0.3890	-0.6919	-0.4522
12-31-2015	-0.0767	-0.3260	-0.1131	-0.0535
06-30-2016	-0.1139	-0.2869	0.2151	0.0382
12-31-2016	0.3792	1.4962	-0.6665	-0.5181
06-30-2017	0.1293	0.4434	-0.3433	-0.2590
12-31-2017	0.0722	0.1969	-0.2539	-0.1763
06-30-2018	-0.0859	-0.3080	0.0765	0.0900
12-31-2018	-0.2556	-0.6080	1.0991	0.6449
06-30-2019	0.3733	1.3597	-0.6777	-0.5127
12-31-2019	0.1196	0.1847	-0.4473	-0.2660
06-30-2020	-0.1542	-0.6101	-0.3570	-0.1846
12-31-2020	0.2520	0.6793	-0.6334	-0.4593
06-30-2021	0.2802	0.7651	-0.6348	-0.4375
12-31-2021	0.0363	-0.0252	-0.2900	-0.1546
06-30-2022	-0.3633	-0.7831	1.5130	0.9393
12-31-2022	0.1809	0.4828	-0.5012	-0.3634
Mean	0.0614	0.1636	-0.1828	-0.1342
Median	0.0832	0.1450	-0.3502	-0.2011

Table 20: Returns for LETFS tracking EURO STOXX50 over 6-month holding period

	Benchmark	**Bull LETFs**		**Bear LETFs**		
Date	STOXX50E	3EUL (3)	LVE (2)	3EUS (-3)	BXX (-2)	BSX (-1)
06-30-2014	0.1026	0.3679	0.3101	-0.4970	-0.3204	-0.1684
12-31-2014	-0.0739	-0.3034	-0.1503	-0.1122	-0.0210	0.0076
06-30-2015	0.2830	0.3636	0.4578	-0.6815	-0.4440	-0.2407
12-31-2015	-0.1156	-0.3767	-0.2751	-0.0261	0.0300	0.0474
06-30-2016	-0.1806	-0.3606	-0.3190	0.2011	0.0329	0.0501
12-31-2016	0.3026	1.2253	0.6974	-0.6183	-0.4744	-0.2702
06-30-2017	0.0780	0.4601	0.2502	-0.3638	-0.2772	-0.1481
12-31-2017	0.0070	0.0474	0.0221	-0.1179	-0.0828	-0.0411
06-30-2018	-0.0641	-0.0899	-0.0333	-0.1485	-0.0814	-0.0355
12-31-2018	-0.2157	-0.5100	-0.3751	0.7855	0.4357	0.2059
06-30-2019	0.3822	1.6271	0.9709	-0.7035	-0.5422	-0.3207
12-31-2019	0.1486	0.3509	0.3113	-0.5010	-0.3133	-0.1676
06-30-2020	-0.2654	-0.7207	-0.5282	-0.0251	0.0565	0.1053
12-31-2020	0.2239	0.6762	0.4363	-0.6166	-0.4375	-0.2334
06-30-2021	0.3002	1.0609	0.7761	-0.6825	-0.4889	-0.2814
12-31-2021	0.1145	0.2559	0.2363	-0.4630	-0.2931	-0.1442
06-30-2022	-0.3639	-0.7536	-0.5864	1.1271	0.7505	0.3667
12-31-2022	0.2103	0.6923	0.4270	-0.5409	-0.4000	-0.2055
Mean	0.0485	0.2229	0.1460	-0.2213	-0.1595	-0.0819
Median	0.0903	0.3034	0.2433	-0.4134	-0.2852	-0.1462

Table 21: Returns for LETFS tracking FTSE100 over 6-month holding period

	Benchmark	**Bull LETFs**		**Bear LETFs**		
Date	FTSE100	3UKL (3)	2UKL (2)	3UKS (-3)	2UKS (-2)	SUK1 (-1)
06-30-2014	0.007764447	0.0000	0.0000	0.0000	0.0000	0.0000
12-31-2014	-0.06841404	-0.1910	0.0187	0.0262	0.0374	-0.1199
06-30-2015	-0.008175287	0.0019	0.0163	-0.1862	-0.1057	-0.0465
12-31-2015	-0.107774896	-0.3342	-0.2078	-0.0030	0.0474	0.0436
06-30-2016	0.139413817	0.4334	0.3220	-0.5437	-0.3766	-0.1941
12-31-2016	0.179167057	0.6766	0.4241	-0.4918	-0.3504	-0.1901
06-30-2017	0.037920985	0.2068	0.1368	-0.2569	-0.1684	-0.0868
12-31-2017	0.086001937	0.3442	0.2209	-0.3284	-0.2225	-0.1166
06-30-2018	-0.002918854	0.0490	0.0442	-0.1994	-0.1181	-0.0545
12-31-2018	-0.205411588	-0.4882	-0.3515	0.6285	0.4185	0.2009
06-30-2019	0.215880017	0.9303	0.5635	-0.5484	-0.3997	-0.2204
12-31-2019	0.012023924	0.0704	0.0600	-0.2155	-0.1288	-0.0589
06-30-2020	-0.341713056	-0.8049	-0.6108	0.4361	0.4597	0.2876
12-31-2020	0.100680376	0.2817	0.2159	-0.4598	-0.3075	-0.1550
06-30-2021	0.146710696	0.5562	0.3576	-0.4692	-0.3292	-0.1763
12-31-2021	0.074131993	0.2833	0.1914	-0.3430	-0.2285	-0.1178
06-30-2022	-0.087501138	-0.2580	-0.1540	-0.0448	0.0126	0.0242
12-31-2022	0.080539463	0.2462	0.1780	-0.3055	-0.1922	-0.0870
Mean	0.014351436	0.1179	0.0838	-0.1944	-0.1148	-0.0628
Median	0.024972454	0.2068	0.1368	-0.2569	-0.1684	-0.0870

Table 22: Returns for LETFS tracking FTSE Developped EU over 6-month holding period

	Benchmark	**Bull**	**Bear**
Date	FTSE_Developped_EU	UPV (2)	EPV (-2)
06-30-2014	0.1070	0.3066	-0.3108
12-31-2014	-0.2325	-0.4282	0.5238
06-30-2015	0.0724	0.2083	-0.2898
12-31-2015	-0.1427	-0.2893	0.2002
06-30-2016	-0.0909	-0.1763	-0.1080
12-31-2016	0.0665	0.1189	-0.1846
06-30-2017	0.2775	0.8112	-0.4829
12-31-2017	0.1625	0.3357	-0.2809
06-30-2018	-0.0961	-0.1776	0.0927
12-31-2018	-0.2279	-0.4782	0.5769
06-30-2019	0.2821	0.7061	-0.4612
12-31-2019	0.1316	0.2654	-0.2677
06-30-2020	-0.2655	-0.5603	0.0084
12-31-2020	0.4619	0.9897	-0.5777
06-30-2021	0.2162	0.5192	-0.4100
12-31-2021	0.0487	0.0694	-0.1579
06-30-2022	-0.4110	-0.6542	1.1266
12-31-2022	0.1406	0.1218	-0.3439
Mean	0.0278	0.0938	-0.0748
Median	0.0694	0.1203	-0.2262

Table 23: Returns for LETFS tracking FTSE MIB over 6-month holding period

	Benchmark	**Bull LETFs**		**Bear LETFs**		
Date	FTSE_MIB	3ITL (3)	LEVMIB (2)	3ITS(-3)	XBRMIB (-2)	BERMIB (-1)
06-30-2014	0.2641	0.8102	0.6253	-0.6764	-0.4866	-0.2722
12-31-2014	-0.2226	-0.6283	-0.4762	0.2987	0.3061	0.1775
06-30-2015	0.3785	0.9862	0.9098	-0.8026	-0.5932	-0.3487
12-31-2015	-0.1285	-0.4356	-0.3842	-0.0381	0.0027	0.0368
06-30-2016	-0.3897	-0.7945	-0.6506	0.9496	0.5141	0.3101
12-31-2016	0.3932	1.4938	0.5576	-0.7285	-0.5718	-0.3353
06-30-2017	0.1067	0.4526	0.2737	-0.4462	-0.3336	-0.1770
12-31-2017	0.0816	0.2645	0.0495	-0.3061	-0.2208	-0.1156
06-30-2018	-0.0199	-0.0609	0.0050	-0.2786	-0.1664	-0.0784
12-31-2018	-0.2687	-0.6274	-0.5458	0.9943	0.5935	0.2774
06-30-2019	0.3419	1.5796	0.9611	-0.7118	-0.5510	-0.3289
12-31-2019	0.2232	0.5809	0.2797	-0.6036	-0.4141	-0.2296
06-30-2020	-0.3393	-0.8367	-0.6414	0.1074	0.1639	0.1749
12-31-2020	0.3228	1.0239	0.5759	-0.6981	-0.5296	-0.3008
06-30-2021	0.2653	0.8272	0.6474	-0.6563	-0.4666	-0.2651
12-31-2021	0.1696	0.4897	0.2666	-0.5657	-0.3896	-0.2128
06-30-2022	-0.4103	-0.8077	-0.6446	1.5276	0.9658	0.4405
12-31-2022	0.2324	0.7674	0.2190	-0.5999	-0.4513	-0.2429
Mean	0.0556	0.2825	0.1127	-0.1797	-0.1460	-0.0828
Median	0.1382	0.4711	0.2428	-0.5060	-0.3616	-0.1949

Appendix C2:Returns for 3-month holding period

Table 24: Returns for LETFS tracking CAC40 over 3-month holding period

	Benchmark	**Bull LETFs**	**Bear LETFs**	
Date	CAC40	LVC (2)	BX4 (-2)	SHC (-1)
03/31/2014	0,1647	0,3289	-0,3197	-0,1680
06/30/2014	-0,0035	0,1794	-0,1997	-0,1017
09/30/2014	-0,0396	-0,0987	-0,0089	0,0046
12/31/2014	-0,0821	-0,1809	-0,0204	0,0102
03/31/2015	0,9635	2,7652	-0,7704	-0,5145
06/30/2015	-0,1982	-0,2647	0,1295	0,0821
09/30/2015	-0,3071	-0,5592	0,5526	0,2986
12/31/2015	0,2464	0,4187	-0,4183	-0,2234
03/31/2016	-0,1161	-0,2603	0,0000	0,0317
06/30/2016	-0,0762	-0,0180	-0,2575	-0,1114
09/30/2016	0,1734	0,3537	-0,3494	-0,1860
12/31/2016	0,4208	1,0283	-0,5494	-0,3257
03/31/2017	0,2117	0,4656	-0,3628	-0,2002
06/30/2017	0,0276	0,2482	-0,2752	-0,1432
09/30/2017	0,1073	0,2212	-0,2379	-0,1260
12/31/2017	-0,0280	-0,0454	-0,0161	-0,0053
03/31/2018	-0,0886	-0,1795	0,0829	0,0489
06/30/2018	0,1399	0,5526	-0,4046	-0,2282
09/30/2018	0,1747	0,3689	-0,3212	-0,1762
12/31/2018	-0,4554	-0,7061	1,9143	0,7298
03/31/2019	0,6948	1,8549	-0,6851	-0,4344
06/30/2019	0,1025	0,4561	-0,3718	-0,2042
09/30/2019	0,0813	0,1518	-0,2362	-0,1178
12/31/2019	0,3008	0,6788	-0,4634	-0,2594
03/31/2020	-0,7197	-0,9370	5,2709	1,7730
06/30/2020	0,8946	2,5103	-0,8181	-0,5509
09/30/2020	-0,0966	-0,1783	0,0125	0,0212
12/31/2020	0,7538	1,9473	-0,7344	-0,4731
03/31/2021	0,3888	0,9132	-0,5229	-0,3069
06/30/2021	0,2930	0,8835	-0,5072	-0,2967
09/30/2021	-0,0205	-0,0459	-0,0516	-0,0269
12/31/2021	0,4507	1,0657	-0,5766	-0,3443
03/31/2022	-0,2749	-0,5158	0,3846	0,2286
06/30/2022	-0,3835	-0,5630	0,8443	0,3832
09/30/2022	-0,1090	-0,2245	0,0836	0,0645
12/31/2022	0,5584	1,3460	-0,6298	-0,3722
Mean	0,1153	0,3878	-0,0232	-0,0617
Median	0,0919	0,2347	-0,2663	-0,1346

Table 25: Returns for LETFS tracking DAX over 3-month holding period

	Benchmark	**Bull LETFs**	**Bear LETFs**	
Date	DAX	3DEL (3)	3DES (-3)	DSD (-2)
03-31-2014	0.067995488	0.062910402	-0.330148238	-0.195858568
06-30-2014	0.099006944	0.083358196	-0.401062633	-0.207790696
09-30-2014	-0.162036985	-0.518874246	0.297572106	0.309209825
12-31-2014	0.19316493	0.472357726	-0.55476793	-0.394300967
03-31-2015	1.255171746	6.35950563	-0.950034295	-0.825731752
06-30-2015	-0.308274912	-0.75054204	0.940380115	0.765832164
09-30-2015	-0.442631009	-0.848954451	2.908014491	1.460968143
12-31-2015	0.628991511	2.598599915	-0.834583887	-0.678911532
03-31-2016	-0.118049258	-0.252191936	0.301498098	0.049543376
06-30-2016	-0.04596633	-0.187829684	-0.102349214	-0.104060728
09-30-2016	0.336328578	1.43377767	-0.613407653	-0.494903414
12-31-2016	0.366134794	1.168637776	-0.687501515	-0.499792591
03-31-2017	0.270150947	0.958990216	-0.558571002	-0.414484002
06-30-2017	0.022349818	0.13287215	-0.065630971	-0.095476812
09-30-2017	0.118270802	0.342801338	-0.351030299	-0.240137375
12-31-2017	0.004654981	-0.016404116	-0.091465268	-0.06028385
03-31-2018	-0.219864096	-0.590825426	0.638238811	0.483505558
06-30-2018	0.10506543	0.304381727	-0.345302139	-0.249641858
09-30-2018	0.00280092	-0.026013791	-0.107822639	-0.076336152
12-31-2018	-0.46375846	-0.85397588	4.48291723	2.112517562
03-31-2019	0.408466616	1.151461379	-0.748851936	-0.541053881
06-30-2019	0.268969652	1.293486496	-0.492281929	-0.425774757
09-30-2019	-0.029473485	-0.199601167	-0.124058722	-0.033284171
12-31-2019	0.362163324	0.984504386	-0.712530116	-0.50160594
03-31-2020	-0.696454239	-0.984466616	10.17953853	4.553489932
06-30-2020	1.767611796	15.60414872	-0.975707846	-0.912193159
09-30-2020	0.173436123	0.403094538	-0.545818477	-0.383699452
12-31-2020	0.348476483	1.022816543	-0.71834012	-0.53349262
03-31-2021	0.429094541	1.140396643	-0.772547949	-0.54787824
06-30-2021	0.11704251	0.352247975	-0.361948719	-0.246537691
09-30-2021	-0.085098869	-0.2916838	0.103921125	0.111784589
12-31-2021	0.206548369	0.478304613	-0.572742148	-0.389682988
03-31-2022	-0.344610917	-0.784966953	0.915638957	0.6933542
06-30-2022	-0.386820664	-0.783716783	2.437433012	1.279636877
09-30-2022	-0.200912121	-0.542425106	0.512259065	0.332827917
12-31-2022	0.691282473	3.531079819	-0.812955621	-0.677185725
Mean	0.131645206	0.895757274	0.302387508	0.067293645
Median	0.102036187	0.218626939	-0.348166219	-0.223964036

Table 26: Returns for LETFS tracking EURO STOXX50 over 3-month holding period

	Benchmark	**Bull LETFs**		**Bear LETFs**		
Date	STOXX50E	3EUL (3)	LVE (2)	3EUS (-3)	BXX (-2)	BSX (-1)
03-31-2014	0.118328381	0.383916114	0.289537314	-0.46259164	-0.309954289	-0.160702481
06-30-2014	0.053646047	0.232616674	0.251518816	-0.482388553	-0.287912112	-0.150857763
09-30-2014	-0.039633753	-0.234505609	-0.088399902	-0.165620862	-0.026627131	-0.004546308
12-31-2014	-0.07199674	-0.280994539	-0.144216138	-0.148172121	-0.088017604	-0.019420524
03-31-2015	1.237398378	3.792195479	2.625272264	-0.922772764	-0.767503927	-0.510870494
06-30-2015	-0.278056079	-0.638605486	-0.435334898	0.371082338	0.382735488	0.200158449
09-30-2015	-0.381417958	-0.787049043	-0.645915918	1.685322856	0.920875675	0.447453011
12-31-2015	0.317348784	1.039015754	0.612660282	-0.6908827	-0.491146003	-0.271847244
03-31-2016	-0.187217639	-0.392453888	-0.373221405	0.551549997	0.176194337	0.120789951
06-30-2016	-0.114635044	-0.196164196	-0.148196019	-0.26477187	-0.209380685	-0.080733816
09-30-2016	0.175890451	0.752103107	0.373340811	-0.450122978	-0.365498141	-0.19470238
12-31-2016	0.450246871	1.748948617	1.116487446	-0.74819285	-0.56941402	-0.340982948
03-31-2017	0.243910269	1.025372031	0.601164795	-0.562630854	-0.419632167	-0.238641244
06-30-2017	-0.035296736	0.164989339	0.037973097	-0.147021264	-0.148421989	-0.074059633
09-30-2017	0.123364498	0.435705225	0.271611607	-0.375642809	-0.26472148	-0.142934737
12-31-2017	-0.105193785	-0.265562424	-0.191714744	0.263815175	0.16532443	0.082337938
03-31-2018	-0.158675674	-0.410254856	-0.261703021	0.215974325	0.20691658	0.103521079
06-30-2018	0.059448054	0.498752607	0.309318045	-0.425401353	-0.323749002	-0.171041261
09-30-2018	0.032401008	0.128926786	0.067731102	-0.191330741	-0.136538067	-0.068350221
12-31-2018	-0.414492977	-0.795848493	-0.646780342	3.211283715	1.478466783	0.589075007
03-31-2019	0.655906157	2.269608235	1.515310179	-0.824848786	-0.641419857	-0.397639482
06-30-2019	0.108497116	0.946237493	0.427065353	-0.410181773	-0.36798098	-0.201918198
09-30-2019	0.084749727	0.185911112	0.172972559	-0.390644442	-0.23444404	-0.122921948
12-31-2019	0.288573984	0.765872351	0.647171538	-0.667546852	-0.446415859	-0.254119829
03-31-2020	-0.702444585	-0.985763276	-0.931712816	11.34987247	4.884404319	1.670777241
06-30-2020	1.119649448	8.157225031	3.487842365	-0.948835158	-0.859686354	-0.606021578
09-30-2020	-0.042472306	-0.165688281	-0.088312708	-0.184037443	-0.103803782	-0.035439497
12-31-2020	0.563355665	2.277164011	1.254655548	-0.822521114	-0.646945341	-0.389140375
03-31-2021	0.461683373	1.426305279	1.148429212	-0.791672835	-0.579165908	-0.348394369
06-30-2021	0.125465931	0.61563207	0.388407317	-0.469212517	-0.335528814	-0.18648285
09-30-2021	-0.029873312	-0.120520657	-0.044552095	-0.120935667	-0.049989986	-0.013864608
12-31-2021	0.296644554	0.889043917	0.639777334	-0.679414528	-0.487377893	-0.265072674
03-31-2022	-0.341282774	-0.771430481	-0.59627534	0.833682416	0.679861405	0.340312768
06-30-2022	-0.395825077	-0.743473301	-0.590026149	1.63342754	0.926204373	0.413371872
09-30-2022	-0.142597048	-0.389652925	-0.28041686	0.248945014	0.171940621	0.104424391
12-31-2022	0.659973874	3.454147545	1.671635035	-0.809635827	-0.671506994	-0.411947817
Mean	0.103760308	0.666992259	0.345641768	0.200220154	0.004448377	-0.044178683
Median	0.056547051	0.209263893	0.212245687	-0.383143626	-0.24958276	-0.132928342

Table 27: Returns for LETFS tracking FTSE100 over 3-month holding period

	Benchmark	**Bull LETFs**		**Bear LETFs**		
Date	FTSE100	3UKL (3)	2UKL (2)	3UKS (-3)	2UKS (-2)	SUK1 (-1)
03-31-2014	-0.069299529	-0.155338588	-0.099316563	0.030359783	0.038933312	0.023959005
06-30-2014	0.056054992	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000
09-30-2014	-0.101818469	-0.238381319	-0.163129021	0.182590585	0.134844898	0.068082875
12-31-2014	0.005237843	-0.031884629	0.001612454	-0.21790252	-0.122083394	-0.05157966
03-31-2015	0.14486147	0.536398986	0.354268339	-0.478104823	-0.333922161	-0.176412511
06-30-2015	-0.159010495	-0.386971267	-0.269023736	0.354496802	0.253726836	0.127914037
09-30-2015	-0.292189946	-0.678437275	-0.503981373	0.788011966	0.569751876	0.287502509
12-31-2015	0.11666422	0.346078101	0.245381885	-0.430286467	-0.289710252	-0.147236108
03-31-2016	0.054562708	0.11891287	0.127657056	-0.444708399	-0.285520045	-0.134664335
06-30-2016	0.254370734	0.943707048	0.609754654	-0.64541545	-0.476047823	-0.263259709
09-30-2016	0.210311309	0.823337836	0.507450527	-0.533839458	-0.386099626	-0.211981472
12-31-2016	0.094419269	0.336701455	0.222856179	-0.356586641	-0.241123358	-0.12560447
03-31-2017	0.083303046	0.376457046	0.239091628	-0.338037177	-0.231526022	-0.122829133
06-30-2017	0.016596204	0.132002576	0.091009028	-0.218332945	-0.138616754	-0.069820527
09-30-2017	-0.002345743	0.05651132	0.040908349	-0.155699293	-0.093690028	-0.046124861
12-31-2017	0.140724204	0.539626394	0.334823714	-0.404073162	-0.282907396	-0.151893699
03-31-2018	-0.275280024	-0.600907175	-0.451449519	1.104020176	0.679230642	0.304852137
06-30-2018	0.392323883	1.888894705	1.050789933	-0.708582716	-0.55052942	-0.325076424
09-30-2018	-0.019803906	-0.00973935	0.000693754	-0.111530312	-0.058724239	-0.024773973
12-31-2018	-0.350864047	-0.72888435	-0.572769201	1.915416615	1.103733158	0.467082847
03-31-2019	0.365150212	1.690386061	0.95797943	-0.686161805	-0.527264319	-0.306913807
06-30-2019	0.060500277	0.302881057	0.198719205	-0.308065694	-0.205192725	-0.104693321
09-30-2019	-0.04679296	-0.084959494	-0.045550841	-0.079599625	-0.031194588	-0.007762157
12-31-2019	0.10270837	0.354715354	0.240625147	-0.380912049	-0.255954333	-0.13029002
03-31-2020	-0.690475045	-0.982104962	-0.915669565	8.977595354	4.559434681	1.573258041
06-30-2020	0.636912152	2.46980608	1.471987775	-0.86623257	-0.714764187	-0.445692914
09-30-2020	-0.176525046	-0.458746965	-0.313767063	0.259355748	0.218307781	0.121456088
12-31-2020	0.457884422	1.924048254	1.101449639	-0.759287119	-0.596296319	-0.355134919
03-31-2021	0.089108411	0.33972364	0.232490242	-0.40103298	-0.270270629	-0.139323925
06-30-2021	0.190481584	0.728402988	0.451352866	-0.507486393	-0.364250242	-0.199681446
09-30-2021	-0.021571555	0.016559538	0.018585527	-0.161550927	-0.093376633	-0.044250828
12-31-2021	0.219541743	0.794039836	0.49123241	-0.533802253	-0.38564017	-0.212322919
03-31-2022	0.005623968	-0.001456333	0.034145916	-0.315189537	-0.186723238	-0.081603849
06-30-2022	-0.181722363	-0.467515426	-0.323831523	0.380486299	0.290700348	0.155594383
09-30-2022	-0.14476054	-0.359229357	-0.24230345	0.290974367	0.222861031	0.121961355
12-31-2022	0.353413016	1.366733128	0.802593916	-0.617445086	-0.458109027	-0.25150467
Mean	0.041778268	0.311467651	0.169333363	0.103526923	0.01405679	-0.024410233
Median	0.054562708	0.132002576	0.127657056	-0.315189537	-0.205192725	-0.093148585

Table 28: Returns for LETFS tracking FTSE Developped EU over 3-month holding period

	Benchmark	**Bull**	**Bear**
Date	FTSE_Developped_EU	UPV (2)	EPV (-2)
03-31-2014	0.152870991	0.326377695	-0.345010857
06-30-2014	0.033675996	0.206119853	-0.225043426
09-30-2014	-0.297597097	-0.509000021	0.830887829
12-31-2014	-0.122846041	-0.272622055	0.165238501
03-31-2015	0.164498676	0.381652916	-0.392577764
06-30-2015	-0.030861498	-0.021940094	-0.101197968
09-30-2015	-0.33276346	-0.549930685	0.815688064
12-31-2015	0.103322076	0.123305185	-0.208140967
03-31-2016	-0.001917188	-0.104396664	-0.091552371
06-30-2016	-0.113875395	-0.195593171	-0.174152626
09-30-2016	0.185428873	0.412672787	-0.36525149
12-31-2016	-0.038818606	-0.098860399	0.03100854
03-31-2017	0.275637822	0.77960623	-0.464310491
06-30-2017	0.322727834	0.906049693	-0.516604212
09-30-2017	0.241926419	0.576781639	-0.392319528
12-31-2017	0.098061441	0.159238092	-0.168820509
03-31-2018	-0.093028456	-0.191470421	0.077842983
06-30-2018	-0.103763894	-0.068044363	-0.001247077
09-30-2018	0.065596059	0.052742901	-0.120621746
12-31-2018	-0.439893757	-0.742762958	1.842176321
03-31-2019	0.472991402	1.230223603	-0.589309551
06-30-2019	0.065425226	0.178135964	-0.21460489
09-30-2019	-0.100682853	-0.209482613	0.166041538
12-31-2019	0.490111688	1.213040239	-0.579000373
03-31-2020	-0.692849051	-0.938416744	3.979136448
06-30-2020	1.001486221	3.535499575	-0.854227977
09-30-2020	0.182484137	0.305117968	-0.34949803
12-31-2020	0.788165426	1.850659945	-0.708008301
03-31-2021	0.152822587	0.29234304	-0.30463256
06-30-2021	0.245917935	0.574307844	-0.429925033
09-30-2021	-0.09084599	-0.207502125	0.135580753
12-31-2021	0.225715668	0.372969836	-0.343213524
03-31-2022	-0.291244286	-0.583429412	0.724166894
06-30-2022	-0.505674706	-0.738424982	1.883557289
09-30-2022	-0.36050995	-0.68760046	1.443324056
12-31-2022	0.95325495	2.373469114	-0.787803431
Mean	0.0723597	0.270301026	0.093543736
Median	0.065510642	0.141271638	-0.191146797

Table 29: Returns for LETFS tracking FTSE MIB over 3-month holding period

	Benchmark	**Bull LETFs**		**Bear LETFs**		
Date	FTSE_MIB	3ITL (3)	LEVMIB (2)	3ITS(-3)	XBRMIB (-2)	BERMIB (-1)
03-31-2014	0.724342273	3.456811728	1.854018105	-0.844652972	-0.697744713	-0.442000368
06-30-2014	-0.110521553	-0.348808273	-0.145073578	-0.235606868	-0.053108823	-0.010387595
09-30-2014	-0.118833776	-0.45053565	-0.334873365	-0.072061448	0.061520804	0.052458142
12-31-2014	-0.289282972	-0.717062014	-0.556333794	0.651474823	0.498799467	0.271212783
03-31-2015	1.147111976	5.104683101	3.344874981	-0.946968413	-0.817481623	-0.563911353
06-30-2015	-0.145174086	-0.425608344	-0.218300569	-0.195160647	-0.025689088	0.006986873
09-30-2015	-0.257904723	-0.661855204	-0.60904256	0.336898069	0.230419776	0.169778607
12-31-2015	0.053151209	0.014142993	0.026665205	-0.37234549	-0.227786853	-0.107345805
03-31-2016	-0.417068971	-0.825808578	-0.706595251	1.944890255	0.925516187	0.476520715
06-30-2016	-0.310707219	-0.704401161	-0.51711101	0.00245101	0.025368719	0.079047941
09-30-2016	0.026078772	0.073643796	-0.277749002	-0.286263456	-0.226437912	-0.105541698
12-31-2016	0.951456708	5.116585658	2.566084429	-0.909418711	-0.777314121	-0.520811956
03-31-2017	0.203266489	0.645080205	0.423452411	-0.527453655	-0.382451893	-0.211047974
06-30-2017	0.069176245	0.501685469	0.260853631	-0.432920429	-0.347110269	-0.182487116
09-30-2017	0.360999508	1.530660476	0.57178426	-0.660086162	-0.511962833	-0.301286141
12-31-2017	-0.157675325	-0.412732246	-0.324424008	0.487256104	0.296207297	0.142687983
03-31-2018	0.107734418	0.198526039	0.205345334	-0.448831944	-0.282703787	-0.146791213
06-30-2018	-0.148079565	-0.292257303	-0.18956882	0.010656107	0.010652369	0.014018478
09-30-2018	-0.12702603	-0.346972747	-0.390343544	0.179446134	0.119277634	0.068231356
12-31-2018	-0.375154204	-0.771626792	-0.64761448	2.220828076	1.179240251	0.500323443
03-31-2019	0.818206302	3.829294516	2.294510788	-0.887207044	-0.731876578	-0.481292013
06-30-2019	-0.052012452	0.257322006	0.067773073	-0.124801261	-0.174882254	-0.093336661
09-30-2019	0.170599343	0.452553118	0.055235801	-0.555522472	-0.384330632	-0.207512921
12-31-2019	0.320627228	0.828716666	0.655599011	-0.690877321	-0.479674252	-0.274290887
03-31-2020	-0.738157072	-0.993506503	-0.951780092	10.60596764	4.862149645	1.743081175
06-30-2020	0.880829949	5.118779443	2.409353836	-0.922879179	-0.817878548	-0.552090498
09-30-2020	-0.063724873	-0.255907947	-0.233529421	-0.136016154	-0.059907768	-0.015758063
12-31-2020	0.850785825	4.231795405	2.160493827	-0.893713387	-0.760970082	-0.497954039
03-31-2021	0.488370036	1.475955917	1.195480469	-0.809006265	-0.606271873	-0.366495443
06-30-2021	0.064988915	0.31474618	0.211429084	-0.359470822	-0.256533736	-0.138349096
09-30-2021	0.064420273	0.151037847	0.062973201	-0.372165567	-0.227523804	-0.124229068
12-31-2021	0.299060863	1.019426076	0.53776717	-0.704718731	-0.517746914	-0.300569003
03-31-2022	-0.337147073	-0.77592988	-0.595402689	0.761859598	0.594479921	0.317436082
06-30-2022	-0.487200969	-0.843441001	-0.701897096	2.943866187	1.514551945	0.613227677
09-30-2022	-0.125794274	-0.383042668	-0.448462497	0.035585556	0.029960477	0.043393389
12-31-2022	0.632664152	3.35944149	1.378297774	-0.80635783	-0.670614653	-0.414417344
Mean	0.110344593	0.790871995	0.34538585	0.194074259	0.008615041	-0.043319489
Median	0.03961499	0.112340821	0.040950503	-0.322867139	-0.226980858	-0.106443751

Appendix C3:Returns for 1-year holding period

Table 30: Returns for LETFS tracking CAC40 over 1-year holding period

Table 31: Replace

	Benchmark	**Bull LETFs**	**Bear LETFs**	
Date	CAC40	LVC (2)	BX4 (-2)	SHC (-1)
12-31-2014	0.0108	0.0478	-0.1576	-0.0718
12-31-2015	0.0999	0.1900	-0.3311	-0.1630
12-31-2016	0.0751	0.1778	-0.3119	-0.1545
12-31-2017	0.0881	0.2356	-0.2511	-0.1319
12-31-2018	-0.1055	-0.1695	0.0805	0.0463
12-31-2019	0.2748	0.6871	-0.4670	-0.2648
12-31-2020	-0.0811	-0.2144	-0.1965	-0.0591
12-31-2021	0.2798	0.6738	-0.4622	-0.2634
12-31-2022	-0.1030	-0.1957	-0.0085	0.0213
Mean	0.0599	0.1592	-0.2339	-0.1157
Median	0.0751	0.1778	-0.2511	-0.1319

Table 32: Returns for LETFS tracking DAX over 1-year holding period

	Benchmark	**Bull LETFs**	**Bear LETFs**	
Date	DAX	3DEL (3)	3DES (-3)	DSD (-2)
12-31-2014	0.0431	-0.0493	-0.3153	-0.1608
12-31-2015	0.1002	0.0324	-0.5098	-0.3104
12-31-2016	0.1165	0.3873	-0.3764	-0.3068
12-31-2017	0.1137	0.3633	-0.3253	-0.2386
12-31-2018	-0.1797	-0.4879	0.5274	0.3523
12-31-2019	0.2522	0.7219	-0.5905	-0.4135
12-31-2020	0.0249	-0.2053	-0.5113	-0.3311
12-31-2021	0.1572	0.3345	-0.4964	-0.3150
12-31-2022	-0.1309	-0.4259	0.1178	0.1111
Mean	0.0553	0.0746	-0.2755	-0.1792
Median	0.1002	0.0324	-0.3764	-0.3068

Table 33: Returns for LETFS tracking EURO STOXX50 over 1-year holding period

	Benchmark	**Bull LETFs**		**Bear LETFs**		
Date	STOXX50E	3EUL (3)	LVE (2)	3EUS (-3)	BXX (-2)	BSX (-1)
12-31-2014	0.0200	0.0006	0.0752	-0.3527	-0.1997	-0.0932
12-31-2015	0.0876	-0.0176	0.0713	-0.4769	-0.2747	-0.1271
12-31-2016	0.0397	0.2276	0.0894	-0.3295	-0.2723	-0.1303
12-31-2017	0.0570	0.2915	0.1632	-0.2832	-0.2108	-0.1095
12-31-2018	-0.1491	-0.3460	-0.2336	0.2580	0.1641	0.0856
12-31-2019	0.2687	0.9234	0.6299	-0.6233	-0.4486	-0.2535
12-31-2020	-0.0535	-0.3231	-0.1797	-0.3889	-0.2265	-0.0777
12-31-2021	0.2081	0.6315	0.4926	-0.5903	-0.4027	-0.2185
12-31-2022	-0.1242	-0.3544	-0.2347	-0.0009	0.0308	0.0437
Mean	0.0394	0.1148	0.0971	-0.3097	-0.2045	-0.0978
Median	0.0397	0.0006	0.0752	-0.3527	-0.2265	-0.1095

Table 34: Returns for LETFS tracking FTSE100 over 1-year holding period

	Benchmark	**Bull LETFs**		**Bear LETFs**		
Date	FTSE100	3UKL (3)	2UKL (2)	3UKS (-3)	2UKS (-2)	SUK1 (-1)
12-31-2014	-0.0226	94.9089	97.1515	88.3397	93.6467	96.8008
12-31-2015	-0.0467	-0.1505	-0.0787	-0.1355	-0.0582	-0.0159
12-31-2016	0.1722	0.6026	0.4030	-0.5348	-0.3780	-0.2012
12-31-2017	0.0710	0.3069	0.1985	-0.3122	-0.2100	-0.1098
12-31-2018	-0.1203	-0.2931	-0.1965	0.1818	0.1447	0.0781
12-31-2019	0.1200	0.4786	0.3120	-0.4220	-0.2907	-0.1517
12-31-2020	-0.1504	-0.5028	-0.3148	-0.1142	0.0092	0.0451
12-31-2021	0.1237	0.4665	0.3037	-0.4318	-0.2987	-0.1583
12-31-2022	-0.0071	-0.0387	-0.0020	-0.1852	-0.0954	-0.0329
Mean	0.0155	0.1087	0.0782	-0.2443	-0.1471	-0.0683
Median	-0.0071	0.1341	0.0983	-0.2487	-0.1527	-0.0713

Table 35: Returns for LETFS tracking FTSE Developped EU over 1-year holding period

	Benchmark	**Bull**	**Bear**
Date	FTSE_Developped_EU	UPV (2)	EPV (-2)
12-31-2014	-0.0711	-0.1216	0.0078
12-31-2015	-0.0306	-0.0644	-0.0858
12-31-2016	-0.0062	-0.0375	-0.1494
12-31-2017	0.2269	0.5548	-0.3901
12-31-2018	-0.1765	-0.3556	0.3340
12-31-2019	0.2071	0.4798	-0.3764
12-31-2020	0.0415	-0.0506	-0.3573
12-31-2021	0.1373	0.2898	-0.3036
12-31-2022	-0.1853	-0.3763	0.1795
Mean	0.0159	0.0354	-0.1268
Median	-0.0062	-0.0506	-0.1494

Table 36: Returns for LETFS tracking FTSE MIB over 1-year holding period

	Benchmark	**Bull LETFs**		**Bear LETFs**		
Date	FTSE_MIB	3ITL (3)	LEVMIB (2)	3ITS(-3)	XBRMIB (-2)	BERMIB (-1)
12-31-2014	0.0043	-0.1500	-0.0533	-0.3793	-0.2021	-0.0863
12-31-2015	0.1196	0.1298	0.1310	-0.5914	-0.3888	-0.1958
12-31-2016	-0.0723	-0.2640	-0.2535	-0.2787	-0.2049	-0.0723
12-31-2017	0.1169	0.4409	0.2042	-0.4186	-0.3088	-0.1652
12-31-2018	-0.1612	-0.4249	-0.3371	0.2321	0.1739	0.0951
12-31-2019	0.2823	1.0253	0.5863	-0.6629	-0.4887	-0.2819
12-31-2020	-0.0673	-0.4323	-0.2512	-0.4211	-0.2573	-0.0918
12-31-2021	0.2254	0.6916	0.4653	-0.6209	-0.4382	-0.2450
12-31-2022	-0.1451	-0.4088	-0.3384	0.0023	0.0309	0.0415
Mean	0.0336	0.0675	0.0170	-0.3487	-0.2315	-0.1113
Median	0.0043	-0.1500	-0.0533	-0.4186	-0.2573	-0.0918

Appendix D: Volatility

Appendix D: Volatility for LETFs for 6-month holding period

Table 37: Volatility for LETFS tracking CAC40 for 6-month holding period

	Benchmark	**Bull LETFs**	**Bear LETFs**	
Date	CAC40	LVC (2)	BX4 (-2)	SHC (-1)
06-30-2014	0.0878	0.1770	0.1764	0.0882
12-31-2014	0.1335	0.2686	0.2683	0.1345
06-30-2015	0.1385	0.2700	0.2692	0.1354
12-31-2015	0.1771	0.3557	0.3562	0.1778
06-30-2016	0.1833	0.3733	0.3732	0.1865
12-31-2016	0.0948	0.1896	0.1892	0.0949
06-30-2017	0.0812	0.1624	0.1621	0.0813
12-31-2017	0.0656	0.1312	0.1319	0.0658
06-30-2018	0.0925	0.1855	0.1860	0.0929
12-31-2018	0.1017	0.2035	0.2043	0.1019
06-30-2019	0.0918	0.1797	0.1793	0.0899
12-31-2019	0.0963	0.1937	0.1958	0.0970
06-30-2020	0.2875	0.5800	0.5816	0.2899
12-31-2020	0.1508	0.3002	0.3043	0.1507
06-30-2021	0.0852	0.1711	0.1757	0.0855
12-31-2021	0.1099	0.2209	0.2237	0.1106
06-30-2022	0.1854	0.3731	0.3720	0.1862
12-31-2022	0.1239	0.2492	0.2562	0.1246
Mean	0.1270	0.2547	0.2558	0.1274
Median	0.1058	0.2122	0.2140	0.1062

Table 38: Volatility for LETFS tracking DAX for 6-month holding period

	Benchmark	**Bull LETFs**	**Bear LETFs**	
Date	DAX	3DEL (3)	3DES (-3)	DSD (-2)
06-30-2014	0.1015	0.3089	0.3243	0.2046
12-31-2014	0.1318	0.3841	0.4160	0.2659
06-30-2015	0.1521	0.4416	0.4690	0.3020
12-31-2015	0.1793	0.5049	0.5885	0.3620
06-30-2016	0.1779	0.4857	0.6098	0.3581
12-31-2016	0.1004	0.2971	0.3198	0.2008
06-30-2017	0.0765	0.2429	0.2389	0.1540
12-31-2017	0.0724	0.2109	0.2390	0.1459
06-30-2018	0.1121	0.3337	0.3461	0.2260
12-31-2018	0.1078	0.3233	0.3305	0.2169
06-30-2019	0.1016	0.3023	0.3117	0.2014
12-31-2019	0.0970	0.2760	0.3178	0.1957
06-30-2020	0.2943	0.8590	0.9246	0.5951
12-31-2020	0.1524	0.4506	0.4668	0.3037
06-30-2021	0.0981	0.2897	0.3015	0.1999
12-31-2021	0.1050	0.3018	0.3381	0.2164
06-30-2022	0.1870	0.5682	0.5662	0.3750
12-31-2022	0.1385	0.4054	0.4377	0.2792
Mean	0.1325	0.3881	0.4192	0.2668
Median	0.1099	0.3285	0.3421	0.2214

Table 39: Volatility for LETFS tracking FTSE Developped EU for 6-month holding period

	Underlying benchmark	**Bull**	**Bear**
Date	FTSE_Developped_EU	UPV (2)	EPV (-2)
06-30-2014	0.0772	0.1799	0.1800
12-31-2014	0.0921	0.2036	0.2037
06-30-2015	0.1126	0.2484	0.2482
12-31-2015	0.1255	0.2572	0.2573
06-30-2016	0.1842	0.3788	0.3791
12-31-2016	0.0877	0.1853	0.1853
06-30-2017	0.0748	0.1497	0.1496
12-31-2017	0.0517	0.1053	0.1050
06-30-2018	0.0904	0.2139	0.2135
12-31-2018	0.1023	0.2121	0.2184
06-30-2019	0.0823	0.1778	0.1772
12-31-2019	0.0817	0.1638	0.1636
06-30-2020	0.2584	0.6312	0.6321
12-31-2020	0.1310	0.2677	0.2677
06-30-2021	0.0931	0.2016	0.2018
12-31-2021	0.0977	0.1869	0.1869
06-30-2022	0.2003	0.3715	0.3713
12-31-2022	0.1681	0.3634	0.3630
Mean	0.1173	0.2499	0.2502
Median	0.0954	0.2079	0.2086

Table 40: Volatility for LETFS tracking FTSE MIB for 6-month holding period

	Benchmark	**Bull LETFs**		**Bear LETFs**		
Date	FTSE_MIB	3ITL (3)	LEVMIB (2)	3ITS(-3)	XBRMIB (-2)	BERMIB (-1)
06-30-2014	0.1349	0.4063	0.2709	0.4216	0.2708	0.1353
12-31-2014	0.1726	0.5299	0.3645	0.5643	0.3641	0.1818
06-30-2015	0.1603	0.4786	0.3234	0.4992	0.3244	0.1619
12-31-2015	0.1934	0.5539	0.3888	0.6287	0.3917	0.1962
06-30-2016	0.2663	0.7519	0.5334	0.8778	0.5338	0.2670
12-31-2016	0.1460	0.4264	0.3163	0.4591	0.2930	0.1461
06-30-2017	0.1137	0.3605	0.2311	0.3532	0.2323	0.1159
12-31-2017	0.0776	0.2329	0.1571	0.2517	0.1592	0.0784
06-30-2018	0.1269	0.3807	0.2545	0.3872	0.2566	0.1280
12-31-2018	0.1328	0.3930	0.2747	0.4004	0.2669	0.1321
06-30-2019	0.1005	0.2895	0.1940	0.2994	0.1923	0.0963
12-31-2019	0.1091	0.3176	0.2250	0.3469	0.2194	0.1092
06-30-2020	0.3121	0.9330	0.6379	0.9857	0.6351	0.3186
12-31-2020	0.1539	0.4579	0.3085	0.4680	0.3079	0.1530
06-30-2021	0.1008	0.2994	0.2028	0.3132	0.2025	0.1016
12-31-2021	0.1186	0.3371	0.2418	0.3757	0.2347	0.1181
06-30-2022	0.1980	0.6001	0.3981	0.5996	0.4039	0.1995
12-31-2022	0.1474	0.4270	0.3016	0.4645	0.2951	0.1483
Mean	0.1536	0.4542	0.3125	0.4831	0.3102	0.1549
Median	0.1404	0.4164	0.2882	0.4404	0.2819	0.1407

Appendix E: Beta

Appendix E: Beta for ELETFs over 6-month holding period

Table 41: Beta for LETFS tracking CAC40 over 6-month holding period

	Bull LETFs	**Bear LETFs**	
Date	LVC (2)	BX4 (-2)	SHC (-1)
06/30/2014	2.6121	-1.9216	-1.0512
12/31/2014	2.3632	-1.8351	-1.0012
06/30/2015	2.5269	-1.6702	-0.9600
12/31/2015	-0.9165	1.5267	0.7663
06/30/2016	1.9595	-1.1072	-0.6626
12/31/2016	1.6223	-1.1537	-0.6378
06/30/2017	3.7668	-3.3229	-1.7308
12/31/2017	-0.5647	1.3643	0.6451
06/30/2018	2.3225	-2.5326	-1.2576
12/31/2018	2.3078	-1.8492	-0.9809
06/30/2019	2.8987	-1.5861	-0.9390
12/31/2019	2.0221	-1.1628	-0.7395
06/30/2020	2.0365	-1.3218	-0.8026
12/31/2020	3.6294	-0.6507	-0.5955
06/30/2021	2.8802	-1.4684	-0.8675
12/31/2021	1.8504	-1.6921	-0.8989
06/30/2022	1.8132	-1.7120	-0.8775
Mean	2.0665	-1.2997	-0.7407
Median	2.3078	-1.5861	-0.8775

Table 42: Beta for LETFS tracking DAX over 6-month holding period

	Bull LETFs	**Bear LETFs**	
Date	3DEL(3)	3DES (-3)	DSD (-2)
06/30/2014	2.9163	-1.9914	-1.4001
12/31/2014	2.2205	-2.6028	-1.7035
06/30/2015	2.2350	-2.4169	-1.4547
12/31/2015	-1.2027	-8.2149	-2.3550
06/30/2016	3.1556	-2.2518	-1.3933
12/31/2016	3.3879	-2.0844	-1.4915
06/30/2017	3.9459	-1.9632	-1.7182
12/31/2017	3.3028	-2.1889	-1.7190
06/30/2018	2.2060	-4.4090	-2.5568
12/31/2018	2.9442	-2.8505	-1.8909
06/30/2019	3.9348	-1.5444	-1.3945
12/31/2019	3.3523	-0.4219	-0.3343
06/30/2020	3.3700	-0.9856	-0.8418
12/31/2020	2.6160	-0.0960	1.1756
06/30/2021	3.0083	-2.1011	-1.4940
12/31/2021	2.3703	-3.3746	-2.1500
06/30/2022	2.6044	-3.0445	-2.0598
Mean	2.7275	-2.5025	-1.4578
Median	2.9442	-2.1889	-1.4940

Table 43: Beta for LETFS tracking FTSE Developped EU over 6-month holding period

	Bull	**Bear**
Date	UPV (2)	EPV (-2)
06/30/2014	2.1978	-2.2962
12/31/2014	2.1514	-2.4565
06/30/2015	2.3371	-2.3062
12/31/2015	2.3426	-5.4839
06/30/2016	1.8960	-0.5233
12/31/2016	2.9526	-1.8851
06/30/2017	3.6507	-2.4759
12/31/2017	1.9529	-1.5486
06/30/2018	2.5609	-2.9203
12/31/2018	2.3022	-2.0572
06/30/2019	2.6452	-1.7759
12/31/2019	2.2339	-0.7181
06/30/2020	2.1233	-1.0066
12/31/2020	1.6752	-1.1129
06/30/2021	2.5205	-1.8995
12/31/2021	1.7384	-2.1069
06/30/2022	1.5677	-2.1572
Mean	2.2852	-2.0430
Median	2.2339	-2.0572

Table 44: Beta for LETFS tracking FTSE MIB over 6-month holding period

	Bull LETFs		**Bear LETFs**		
Date	3ITL (3)	LEVMIB (2)	3ITS (-3)	XBRMIB (-2)	BERMIB (-1)
06/30/2014	3.032	2.271	-2.352	-1.757	-0.956
12/31/2014	2.735	2.251	-2.378	-1.727	-0.951
06/30/2015	2.735	2.482	-2.230	-1.511	-0.878
12/31/2015	1.956	1.271	-2.728	-1.504	-0.830
06/30/2016	2.821	1.646	-2.193	-1.443	-0.825
12/31/2016	2.914	0.931	-1.738	-1.262	-0.716
06/30/2017	6.710	8.658	-7.387	-5.518	-2.762
12/31/2017	3.108	0.439	-0.327	-0.606	-0.391
06/30/2018	2.661	2.438	-4.175	-2.591	-1.263
12/31/2018	3.284	2.396	-2.887	-1.953	-1.026
06/30/2019	6.651	5.132	-1.771	-1.818	-1.116
12/31/2019	2.911	1.816	-1.442	-1.069	-0.704
06/30/2020	3.020	1.947	-1.491	-1.165	-0.735
12/31/2020	2.806	-1.114	-1.458	-1.761	-0.833
06/30/2021	3.026	3.646	-1.678	-1.174	-0.691
12/31/2021	2.494	1.688	-2.968	-1.980	-0.998
06/30/2022	2.603	1.484	-2.797	-1.932	-0.964
Mean	3.263	2.317	-2.471	-1.810	-0.979
Median	2.911	1.947	-2.230	-1.727	-0.878

Appendix F: Alpha

Appendix F: Alpha for ELETFs over 6-month holding period

Table 45: Alpha for LETFS tracking CAC40 over 6-month holding period

	Bull LETFs	**Bear LETFs**	
06/30/2014	0.0373	-0.1048	-0.0560
12/31/2014	0.0162	-0.0848	-0.0426
06/30/2015	-0.0065	-0.0987	-0.0433
12/31/2015	-0.1951	0.0610	0.0365
06/30/2016	0.0223	-0.1180	-0.0520
12/31/2016	0.0700	-0.1182	-0.0604
06/30/2017	-0.0243	-0.0229	-0.0124
12/31/2017	0.0511	-0.1056	-0.0547
06/30/2018	0.0480	-0.1012	-0.0525
12/31/2018	0.0424	-0.0180	-0.0164
06/30/2019	-0.0824	-0.0390	-0.0043
12/31/2019	-0.0076	-0.0807	-0.0264
06/30/2020	-0.0056	-0.1079	-0.0367
12/31/2020	-0.2370	-0.1824	-0.0507
06/30/2021	-0.0849	-0.0624	-0.0214
12/31/2021	0.0150	-0.0496	-0.0244
06/30/2022	0.0198	-0.0917	-0.0471
Mean	-0.0189	-0.0779	-0.0332
Median	0.0150	-0.0917	-0.0426

Table 46: Alpha for LETFS tracking DAX over 6-month holding period

	Bull LETFs	**Bear LETFs**	
Date	3DEL(3)	3DES (-3)	DSD (-2)
06/30/2014	-0.0606	-0.1593	-0.0791
12/31/2014	-0.0793	-0.1614	-0.0773
06/30/2015	-0.0845	-0.1724	-0.0981
12/31/2015	-0.2662	-0.5476	-0.1804
06/30/2016	0.0334	-0.0356	-0.0671
12/31/2016	0.0005	-0.0737	-0.0576
06/30/2017	-0.0306	-0.0819	-0.0456
12/31/2017	-0.0122	-0.0736	-0.0442
06/30/2018	-0.0635	-0.1908	-0.0911
12/31/2018	0.0342	0.0495	0.0169
06/30/2019	-0.1603	-0.1494	-0.0458
12/31/2019	-0.1165	-0.2259	-0.1181
06/30/2020	-0.1160	-0.2681	-0.1560
12/31/2020	-0.0649	-0.3494	-0.4099
06/30/2021	-0.0729	-0.1102	-0.0461
12/31/2021	-0.0583	-0.0872	-0.0350
06/30/2022	0.0156	-0.0895	-0.0687
Mean	-0.0648	-0.1604	-0.0943
Median	-0.0635	-0.1494	-0.0687

Table 47: Alpha for LETFS tracking FTSE Developped EU over 6-month holding period

	Bull	**Bear**
Date	UPV (2)	EPV (-2)
06/30/2014	0.0455	-0.0968
12/31/2014	0.0289	-0.0884
06/30/2015	0.0227	-0.0916
12/31/2015	0.0111	-0.2844
06/30/2016	-0.0032	-0.0817
12/31/2016	-0.0396	-0.0342
06/30/2017	-0.1153	0.0227
12/31/2017	0.0077	-0.0435
06/30/2018	0.0436	-0.1252
12/31/2018	0.0042	0.0001
06/30/2019	-0.0586	-0.0059
12/31/2019	-0.0229	-0.0911
06/30/2020	-0.0386	-0.1303
12/31/2020	0.0596	-0.1154
06/30/2021	-0.0312	-0.0279
12/31/2021	-0.0093	-0.0252
06/30/2022	-0.0386	-0.0924
Mean	-0.0079	-0.0771
Median	-0.0032	-0.0884

Table 48: Alpha for LETFS tracking FTSE MIB over 6-month holding period

	Bull LETFs		**Bear LETFs**		
Date	3ITL (3)	LEVMIB (2)	3ITS (-3)	XBRMIB (-2)	BERMIB (-1)
06/30/2014	-0.0058	0.0086	-0.1811	-0.0999	-0.0528
12/31/2014	-0.0543	-0.0009	-0.1661	-0.0811	-0.0415
06/30/2015	-0.0570	-0.0418	-0.1860	-0.1134	-0.0509
12/31/2015	-0.1108	-0.1285	-0.2315	-0.1194	-0.0521
06/30/2016	0.0728	-0.0480	-0.0876	-0.0885	-0.0382
12/31/2016	0.0620	0.0799	-0.1774	-0.1278	-0.0630
06/30/2017	-0.1059	-0.2710	0.0728	0.0601	0.0259
12/31/2017	0.0110	0.0041	-0.1607	-0.1012	-0.0510
06/30/2018	0.0052	0.0351	-0.2219	-0.1333	-0.0655
12/31/2018	0.0906	0.0237	-0.0137	-0.0265	-0.0224
06/30/2019	-0.5296	-0.4727	-0.1425	-0.0010	0.0267
12/31/2019	-0.0594	-0.0647	-0.2070	-0.1124	-0.0404
06/30/2020	-0.0404	-0.0414	-0.2148	-0.1289	-0.0452
12/31/2020	0.0138	0.4081	-0.2485	-0.0687	-0.0513
06/30/2021	-0.0319	-0.1794	-0.1964	-0.1167	-0.0515
12/31/2021	0.0165	-0.0125	-0.0969	-0.0558	-0.0303
06/30/2022	0.0658	-0.0524	-0.1140	-0.0886	-0.0519
Mean	-0.0387	-0.0443	-0.1514	-0.0825	-0.0386
Median	-0.0058	-0.0414	-0.1774	-0.0999	-0.0509

Appendix G: Sharpe ratio

Appendix G: Sharpe ratio for ELETFs over 6-month holding period

Table 49: Sharpe ratio for LETFS tracking CAC40 over 6-month holding period

	Bull LETFs	**Bear LETFs**	
06/30/2014	0.0542	-0.6860	-0.6612
12/31/2014	0.3484	-0.6701	-0.6353
06/30/2015	0.2852	-0.7987	-0.6800
12/31/2015	-8.6401	-1.4708	-0.3355
06/30/2016	0.3325	-1.0004	-0.8016
12/31/2016	2.1234	-3.0017	-2.8471
06/30/2017	1.3260	-2.0117	-2.0117
12/31/2017	7.3782	-6.0435	-6.6565
06/30/2018	-0.4223	0.1836	0.1644
12/31/2018	0.2733	-0.2282	-0.2615
06/30/2019	1.3779	-2.1465	-1.9156
12/31/2019	-0.2983	-0.1048	0.0809
06/30/2020	-0.1191	-0.2665	-0.1029
12/31/2020	3.4143	-17.0066	-9.7226
06/30/2021	1.9657	-3.3582	-3.0124
12/31/2021	-0.1925	0.0724	0.0799
06/30/2022	-0.2402	0.0318	0.0378
Mean	0.5274	-2.2651	-1.7224
Median	0.2852	-0.7987	-0.6612

Table 50: Sharpe ratio for LETFS tracking DAX over 6-month holding period

	Bull LETFs	**Bear LETFs**	
Date	3DEL(3)	3DES (-3)	DSD (-2)
06/30/2014	-0.3693	-2.1984	-1.6061
12/31/2014	0.1299	-1.1717	-0.9876
06/30/2015	-0.0221	-0.9395	-0.9042
12/31/2015	-10.3219	0.1568	-0.2562
06/30/2016	0.4054	-0.4351	-0.6307
12/31/2016	1.4523	-1.8703	-1.9044
06/30/2017	1.8965	-4.4133	-3.6166
12/31/2017	-0.2259	-0.4410	-0.3008
06/30/2018	-1.8943	0.8203	0.9408
12/31/2018	0.1230	0.0102	-0.0282
06/30/2019	0.9931	-2.7552	-1.9654
12/31/2019	-0.4244	-5.4019	-3.5401
06/30/2020	-0.0739	-2.0999	-1.4848
12/31/2020	13.6728	-460.3139	-24.3494
06/30/2021	0.6673	-1.6229	-1.3537
12/31/2021	-0.7460	0.4042	0.4613
06/30/2022	-0.3201	0.2152	0.1981
Mean	0.2907	-28.3563	-2.4311
Median	-0.0221	-1.1717	-0.9876

Table 51: Sharpe ratio for LETFS tracking FTSE Developped EU over 6-month holding period

	Bull	**Bear**
Date	UPV (2)	EPV (-2)
06/30/2014	-0.2296	0.0696
12/31/2014	-0.3263	0.1145
06/30/2015	-0.1889	-0.2025
12/31/2015	-2.8253	0.1474
06/30/2016	-0.1762	-2.6494
12/31/2016	0.9813	-1.4681
06/30/2017	1.8380	-2.4162
12/31/2017	0.1503	-0.4169
06/30/2018	-1.4564	0.9807
12/31/2018	0.0298	-0.0191
06/30/2019	1.6977	-2.3590
12/31/2019	-0.3115	-0.6260
06/30/2020	0.0787	-0.6713
12/31/2020	2.5880	-3.4313
06/30/2021	0.9718	-1.4567
12/31/2021	-0.6043	0.4873
06/30/2022	-0.5654	0.2666
Mean	0.0972	-0.8030
Median	-0.1762	-0.4169

Table 52: Sharpe ratio for LETFS tracking FTSE MIB over 6-month holding period

	Bull LETFs		**Bear LETFs**		
Date	3ITL (3)	LEVMIB (2)	3ITS (-3)	XBRMIB (-2)	BERMIB (-1)
06/30/2014	-0.0670	-0.0336	-0.3919	-0.2744	-0.2638
12/31/2014	0.0047	0.0988	-0.4371	-0.3263	-0.3091
06/30/2015	0.1611	0.1847	-0.7719	-0.7225	-0.6209
12/31/2015	-1.9079	-2.3105	0.6271	0.6893	0.8634
06/30/2016	0.0187	-0.1761	-0.0690	-0.1447	-0.0920
12/31/2016	1.4759	2.2067	-2.3412	-2.3272	-2.1653
06/30/2017	2.8231	0.9881	-3.4250	-3.2861	-3.4045
12/31/2017	0.3818	0.5572	-14.1748	-4.9896	-3.9491
06/30/2018	-0.8472	-0.7162	0.3169	0.3363	0.3363
12/31/2018	0.1510	0.0685	-0.0444	-0.0853	-0.1238
06/30/2019	1.7591	1.4078	-6.3169	-4.1561	-3.6120
12/31/2019	-0.2734	-0.3470	-0.5176	-0.3319	-0.1020
06/30/2020	-0.1137	-0.1468	-0.5465	-0.4063	-0.2008
12/31/2020	7.8041	13.7435	-16.4242	-9.1425	-10.0135
06/30/2021	3.1176	1.8568	-7.2753	-6.6985	-5.8832
12/31/2021	-0.3113	-0.3765	0.1865	0.2050	0.1899
06/30/2022	-0.2031	-0.4506	0.1466	0.1271	0.0995
Mean	0.8220	0.9738	-3.0270	-1.8549	-1.7206
Median	0.0187	0.0685	-0.5176	-0.3319	-0.2638

Appendix H: Treynor ratio

Appendix H: Treynor ratio for ELETFs over 6-month holding period

Table 53: Treynor ratio for LETFS tracking CAC40 over 6-month holding period

	Bull LETFs	**Bear LETFs**	
06/30/2014	0.0035	0.0414	0.0388
12/31/2014	0.0411	0.0812	0.0781
06/30/2015	0.0339	0.0959	0.0821
12/31/2015	0.1048	-0.0248	-0.0066
06/30/2016	0.0470	0.1430	0.1152
12/31/2016	0.1309	0.1939	0.1881
06/30/2017	0.0245	0.0378	0.0382
12/31/2017	-0.0967	-0.0641	-0.0664
06/30/2018	-0.0331	-0.0142	-0.0126
12/31/2018	0.0547	0.0462	0.0533
06/30/2019	0.1063	0.1590	0.1395
12/31/2019	-0.0541	0.0190	-0.0147
06/30/2020	-0.0260	0.0585	0.0226
12/31/2020	0.0924	0.4167	0.2365
06/30/2021	0.1014	0.1734	0.1556
12/31/2021	-0.0362	-0.0142	-0.0159
06/30/2022	-0.0471	-0.0060	-0.0069
Mean	0.0263	0.0790	0.0603
Median	0.0339	0.0462	0.0388

Table 54: Treynor ratio for LETFS tracking DAX over 6-month holding period

	Bull LETFs	**Bear LETFs**	
Date	3DEL(3)	3DES (-3)	DSD (-2)
06/30/2014	-0.0152	0.0822	0.0588
12/31/2014	0.0118	0.1098	0.0933
06/30/2015	-0.0025	0.1068	0.1031
12/31/2015	0.1216	-0.0021	0.0033
06/30/2016	0.0667	0.0719	0.1045
12/31/2016	0.1139	0.1496	0.1530
06/30/2017	0.0362	0.0863	0.0709
12/31/2017	-0.0126	0.0249	0.0170
06/30/2018	-0.1260	-0.0539	-0.0616
12/31/2018	0.0268	-0.0022	0.0062
06/30/2019	0.0807	0.2162	0.1538
12/31/2019	-0.0415	0.5288	0.3466
06/30/2020	-0.0104	0.2972	0.2103
12/31/2020	0.1294	1.4675	-0.2519
06/30/2021	0.0535	0.1302	0.1086
12/31/2021	-0.1140	-0.0637	-0.0732
06/30/2022	-0.0663	-0.0434	-0.0397
Mean	0.0148	0.1827	0.0590
Median	0.0118	0.0863	0.0709

Table 55: Treynor ratio for LETFS tracking FTSE Developped EU over 6-month holding period

	Bull	**Bear**
Date	UPV (2)	EPV (-2)
06/30/2014	-0.0290	-0.0085
12/31/2014	-0.0363	-0.0131
06/30/2015	-0.0145	0.0158
12/31/2015	-0.0518	-0.0030
06/30/2016	-0.0098	0.1547
12/31/2016	0.0683	0.0998
06/30/2017	0.0674	0.0896
12/31/2017	0.0135	0.0378
06/30/2018	-0.0749	-0.0496
12/31/2018	0.0053	0.0035
06/30/2019	0.0843	0.1103
12/31/2019	-0.0455	0.0915
06/30/2020	0.0196	0.1675
12/31/2020	0.1921	0.2625
06/30/2021	0.0541	0.0811
12/31/2021	-0.1074	-0.0900
06/30/2022	-0.1231	-0.0557
Mean	0.0007	0.0526
Median	-0.0098	0.0378

Table 56: Treynor ratio for LETFS tracking FTSE MIB over 6-month holding period

	Bull LETFs		**Bear LETFs**		
Date	3ITL (3)	LEVMIB (2)	3ITS (-3)	XBRMIB (-2)	BERMIB (-1)
06/30/2014	-0.0116	-0.0058	0.0665	0.0464	0.0441
12/31/2014	0.0010	0.0203	0.0910	0.0681	0.0651
06/30/2015	0.0273	0.0313	0.1318	0.1236	0.1066
12/31/2015	-0.2083	-0.2542	-0.0669	-0.0729	-0.0901
06/30/2016	0.0053	-0.0496	0.0195	0.0410	0.0261
12/31/2016	0.1329	0.1957	0.2151	0.2149	0.2026
06/30/2017	0.0238	0.0083	0.0294	0.0283	0.0297
12/31/2017	0.0134	0.0186	0.5440	0.1842	0.1494
06/30/2018	-0.0811	-0.0686	-0.0301	-0.0319	-0.0317
12/31/2018	0.0323	0.0146	0.0096	0.0184	0.0269
06/30/2019	0.0661	0.0531	0.2235	0.1472	0.1245
12/31/2019	-0.0567	-0.0719	0.1073	0.0688	0.0211
06/30/2020	-0.0271	-0.0350	0.1306	0.0971	0.0481
12/31/2020	0.1354	-0.2657	0.3115	0.1716	0.1991
06/30/2021	0.0955	0.0569	0.2232	0.2056	0.1807
12/31/2021	-0.0682	-0.0820	-0.0418	-0.0461	-0.0434
06/30/2022	-0.0498	-0.1115	-0.0351	-0.0303	-0.0233
Mean	0.0018	-0.0321	0.1135	0.0726	0.0609
Median	0.0053	-0.0058	0.0910	0.0681	0.0441

Appendix I: Tracking error

Appendix I1: Tracking errorr 1 and 2 over 6-month holding period

Table 57: Tracking error 1 for ELETFs tracking the CAC40 over 6-month holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**	
Date	Mean_return	Volatility	LVC(2)	BX4(-2)	SHC(-1)
06-30-2014	0.0264	0.7821	7.7768	-9.6013	-4.8049
12-31-2014	-0.0246	1.1891	-4.5514	-3.3831	-0.8956
06-30-2015	0.0987	1.2340	6.2219	-5.2466	-3.2397
12-31-2015	-0.0057	1.5781	-7.3557	-6.1212	-1.5710
06-30-2016	-0.0640	1.6325	10.3259	-25.0731	-11.0530
12-31-2016	0.1094	0.8449	0.6212	1.7337	0.1628
06-30-2017	0.0434	0.7237	2.6167	-4.4260	-2.3756
12-31-2017	0.0305	0.5848	-4.9777	2.0001	1.0199
06-30-2018	0.0050	0.8244	5.1987	-9.4462	-4.6444
12-31-2018	-0.0967	0.9062	6.2341	-8.1689	-4.1015
06-30-2019	0.1295	0.8174	11.5641	-0.4436	-1.8433
12-31-2019	0.0634	0.8576	-3.1346	0.1435	0.0193
06-30-2020	-0.1184	2.5611	-2.4622	-22.5824	-7.2866
12-31-2020	0.1058	1.3437	1.7799	-4.6896	-2.7282
06-30-2021	0.1291	0.7586	4.9629	3.3457	0.2719
12-31-2021	0.0792	0.9794	0.0129	-2.0070	-1.4316
06-30-2022	-0.1349	1.6516	-0.3436	-5.9350	-1.9656
12-31-2022	0.0745	1.1039	-2.2460	-1.2919	-0.2255
Median			1.2006	-4.5578	-1.9044
Volatility			5.4414	7.6514	2.9998

Table 58: Tracking error 2 for ELETFs tracking the CAC40 over 6-month holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**	
Date	Mean_return	Volatility	LVC(2)	BX4(-2)	SHC(-1)
06-30-2014	0.0264	0.7821	8.5271	-7.6502	-4.1266
12-31-2014	-0.0246	1.1891	-2.9006	1.9792	0.8799
06-30-2015	0.0987	1.2340	7.0096	-4.8138	-2.9461
12-31-2015	-0.0057	1.5781	-4.3593	3.3968	1.6295
06-30-2016	-0.0640	1.6325	12.0852	-16.6588	-8.4626
12-31-2016	0.1094	0.8449	-0.1985	-1.2297	-0.7930
06-30-2017	0.0434	0.7237	2.9792	-3.6694	-2.0956
12-31-2017	0.0305	0.5848	-4.7202	2.5620	1.2248
06-30-2018	0.0050	0.8244	6.0529	-6.9421	-3.7999
12-31-2018	-0.0967	0.9062	5.2944	-10.4185	-4.9093
06-30-2019	0.1295	0.8174	9.7846	-5.7443	-3.6235
12-31-2019	0.0634	0.8576	-2.7823	0.3988	0.1664
06-30-2020	-0.1184	2.5611	0.3122	-2.4251	-1.3079
12-31-2020	0.1058	1.3437	3.1092	-3.0037	-1.9777
06-30-2021	0.1291	0.7586	3.0095	-2.2767	-1.6300
12-31-2021	0.0792	0.9794	0.6775	-1.1768	-1.0636
06-30-2022	-0.1349	1.6516	-0.4016	-1.3811	-0.8696
12-31-2022	0.0745	1.1039	-1.3893	-0.0955	0.2852
Median			1.8284	-2.3509	-1.4689
Volatility			4.9564	4.9416	2.5108

Table 59: Tracking error 1 for ELETFs tracking the DAX over 6-month holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**	
Date	Mean_return	Volatility	3DEL(3)	3DES(-3)	DSD(-2)
06-30-2014	0.0274	0.9042	-3.6909	-12.7851	-5.6667
12-31-2014	0.0047	1.1738	-14.0254	-7.6163	-1.8160
06-30-2015	0.0975	1.3548	-17.0051	-9.6308	-2.7455
12-31-2015	-0.0015	1.5970	-11.9474	-11.7792	-6.6817
06-30-2016	-0.0694	1.5851	14.1281	-19.4506	-17.8962
12-31-2016	0.1363	0.8943	2.4533	13.2889	6.4457
06-30-2017	0.0586	0.6816	-1.9152	3.0926	0.7870
12-31-2017	0.0394	0.6446	-5.0176	0.8007	0.3731
06-30-2018	-0.0338	0.9988	-2.6087	-10.4506	-5.0657
12-31-2018	-0.1169	0.9601	5.1978	2.2935	-0.1378
06-30-2019	0.1336	0.9053	1.3394	9.0469	4.6566
12-31-2019	0.0560	0.8638	-13.8591	-2.9517	0.8097
06-30-2020	-0.0240	2.6214	-16.3172	-41.0567	-23.8598
12-31-2020	0.0929	1.3576	-1.5152	-8.3506	-5.7362
06-30-2021	0.1031	0.8739	-6.7714	0.0579	1.4201
12-31-2021	0.0217	0.9352	-5.6169	-11.3874	-5.1528
06-30-2022	-0.1571	1.6661	0.9945	4.1032	2.9793
12-31-2022	0.0732	1.2339	-5.3850	-2.2218	-2.1092
Median			-4.3543	-5.2840	-1.9626
Volatility			8.0833	12.1691	7.4608

Table 60: Tracking error 2 for ELETFs tracking the DAX over 6-month holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**	
Date	Mean_return	Volatility	3DEL(3)	3DES(-3)	DSD(-2)
06-30-2014	0.0274	0.9042	-0.5553	-7.7387	-3.0155
12-31-2014	0.0047	1.1738	-8.8276	1.9712	3.1437
06-30-2015	0.0975	1.3548	-12.3448	-7.4781	-1.1167
12-31-2015	-0.0015	1.5970	-3.1327	7.0370	2.9906
06-30-2016	-0.0694	1.5851	18.5175	-1.9905	-9.6398
12-31-2016	0.1363	0.8943	-3.3836	1.3641	0.4335
06-30-2017	0.0586	0.6816	-1.4312	3.0681	0.8516
12-31-2017	0.0394	0.6446	-3.8975	2.2726	1.1744
06-30-2018	-0.0338	0.9988	-0.0852	-3.6627	-1.7755
12-31-2018	-0.1169	0.9601	1.6553	-2.8134	-2.9249
06-30-2019	0.1336	0.9053	-3.5015	-1.3246	-0.5402
12-31-2019	0.0560	0.8638	-12.0785	-1.5730	1.6694
06-30-2020	-0.0240	2.6214	1.6911	5.7804	0.7656
12-31-2020	0.0929	1.3576	4.1575	-4.2256	-3.0898
06-30-2021	0.1031	0.8739	-8.1415	-4.6128	-0.8026
12-31-2021	0.0217	0.9352	-2.1754	-5.3444	-2.0254
06-30-2022	-0.1571	1.6661	-2.8107	11.4175	5.0893
12-31-2022	0.0732	1.2339	-0.6398	2.0668	0.4790
Median			-2.4931	-1.4488	-0.0534
Volatility			6.8445	5.1395	3.2205

Table 61: Tracking error 1 for ELETFs tracking the EURO STOXX50 over 6-month holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3EUL(3)	LVE(2)	3EUS(-3)	BXX(-2)	BSX(-1)
06-30-2014	0.0371	0.8679	4.6414	6.2500	-16.7631	-9.3491	-4.7049
12-31-2014	-0.0151	1.2518	-7.9611	-2.1048	-14.3514	-6.7743	-2.4793
06-30-2015	0.0811	1.2522	-10.8099	2.3478	-15.9764	-7.0452	-3.6681
12-31-2015	-0.0185	1.5999	-8.9937	-6.8195	-13.3705	-6.5494	-1.6748
06-30-2016	-0.0948	1.7214	18.5766	8.2670	-29.0245	-24.1136	-10.3996
12-31-2016	0.1115	0.8985	5.8406	1.3965	5.1150	1.3885	-0.1297
06-30-2017	0.0388	0.7067	7.0354	2.6127	-6.4408	-5.7828	-3.1036
12-31-2017	0.0158	0.5757	-4.8415	-3.6927	1.1073	0.5615	0.3171
06-30-2018	-0.0218	0.8817	4.6758	4.5053	-17.0023	-10.3425	-4.8811
12-31-2018	-0.0980	0.8757	6.1414	3.1433	-2.5168	-4.2743	-2.2335
06-30-2019	0.1271	0.8241	13.1462	7.7657	3.3877	0.2874	-1.2678
12-31-2019	0.0633	0.8150	-10.4225	-3.2546	-2.7100	0.6319	0.1189
06-30-2020	-0.0860	2.5785	-5.9790	-3.8636	-42.4318	-24.6584	-8.5878
12-31-2020	0.0854	1.3203	1.1566	0.9742	-9.7675	-6.1266	-3.0072
06-30-2021	0.1078	0.8389	2.1727	5.6810	-2.2677	-0.9163	-1.4365
12-31-2021	0.0498	1.0356	-2.8111	1.2724	-11.8386	-6.0050	-2.5320
06-30-2022	-0.1611	1.7336	8.9430	3.8472	-13.4556	-7.2276	-2.8636
12-31-2022	0.0795	1.1858	-2.7375	-2.4257	0.5794	-0.6594	0.0742
Median			1.6647	1.8722	-10.8030	-6.0658	-2.5057
Volatility			8.3858	4.3422	11.9094	7.4515	2.8642

Table 62: Tracking error 2 for ELETFs tracking the EURO STOXX50 over 6-month holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3EUL(3)	LVE(2)	3EUS(-3)	BXX(-2)	BSX(-1)
06-30-2014	0.0371	0.8679	7.2183	7.0773	-12.9686	-7.3248	-3.9890
12-31-2014	-0.0151	1.2518	-2.8930	-0.3306	-2.6054	-0.9033	-0.5415
06-30-2015	0.0811	1.2522	-5.7169	3.8971	-11.5808	-4.3650	-2.6091
12-31-2015	-0.0185	1.5999	-1.0132	-3.9577	5.9730	3.2014	1.5513
06-30-2016	-0.0948	1.7214	21.3934	9.5711	-11.2020	-15.9969	-8.0064
12-31-2016	0.1115	0.8985	3.8679	0.6617	-0.8706	-1.4955	-1.0468
06-30-2017	0.0388	0.7067	8.4503	3.0652	-4.3729	-4.6807	-2.7139
12-31-2017	0.0158	0.5757	-3.6266	-3.2957	3.1863	1.6349	0.6857
06-30-2018	-0.0218	0.8817	6.9024	5.2789	-11.7026	-7.7370	-4.0312
12-31-2018	-0.0980	0.8757	3.9432	2.4458	-5.1606	-5.7809	-2.7924
06-30-2019	0.1271	0.8241	8.4305	6.1756	-6.1057	-4.4977	-2.8706
12-31-2019	0.0633	0.8150	-9.6112	-3.0446	-3.0462	0.6055	0.1606
06-30-2020	-0.0860	2.5785	3.9749	0.5136	2.7176	-2.5126	-1.6263
12-31-2020	0.0854	1.3203	6.5286	2.6208	-4.8838	-3.1791	-1.8534
06-30-2021	0.1078	0.8389	0.0380	4.9121	-8.0089	-3.7121	-2.3375
12-31-2021	0.0498	1.0356	1.1900	2.5479	-6.3914	-3.0425	-1.4667
06-30-2022	-0.1611	1.7336	3.5349	2.3251	-8.0721	-6.2935	-3.1030
12-31-2022	0.0795	1.1858	0.5302	-1.4816	1.9674	0.4318	0.5776
Median			3.7014	2.4969	-5.0222	-3.4456	-2.0954
Volatility			6.8331	3.7223	5.5930	4.3399	2.2013

Table 63: Tracking error 1 for ELETFs tracking the FTSE Developped EU over 6-month holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**
Date	Mean_return	Volatility	UPV(2)	EPV(-2)
06-30-2014	0.0300	0.6875	7.9240	-10.5969
12-31-2014	-0.0911	0.8207	-2.7468	1.8062
06-30-2015	0.0249	1.0033	-3.4219	-2.3836
12-31-2015	-0.0366	1.1181	-3.4497	-2.6945
06-30-2016	-0.0462	1.6414	19.5735	-34.3739
12-31-2016	0.0347	0.7816	-0.0361	-3.8894
06-30-2017	0.1002	0.6668	5.9133	0.5753
12-31-2017	0.0642	0.4609	1.2456	-0.8734
06-30-2018	-0.0356	0.8049	1.7190	-6.5000
12-31-2018	-0.1096	0.9110	0.5846	-2.7762
06-30-2019	0.0990	0.7331	5.2618	-1.2399
12-31-2019	0.0504	0.7278	0.8566	-2.7920
06-30-2020	-0.0914	2.3024	-4.4480	-28.8242
12-31-2020	0.1618	1.1669	1.0975	4.9439
06-30-2021	0.0793	0.8298	-1.4034	1.4694
12-31-2021	0.0259	0.8702	0.3508	-5.1749
06-30-2022	-0.1908	1.7848	0.3957	4.2358
12-31-2022	0.0570	1.4976	-6.4145	-6.6689
Median			0.4902	-2.7353
Volatility			5.8425	10.3549

Table 64: Tracking error 2 for ELETFs tracking the FTSE Developped EU over 6-month holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**
Date	Mean_return	Volatility	UPV(2)	EPV(-2)
06-30-2014	0.0300	0.6875	8.4850	-9.1571
12-31-2014	-0.0911	0.8207	-3.2031	1.0492
06-30-2015	0.0249	1.0033	-2.5886	-0.6633
12-31-2015	-0.0366	1.1181	-2.3837	1.5117
06-30-2016	-0.0462	1.6414	20.0227	-29.3151
12-31-2016	0.0347	0.7816	0.7083	-1.9264
06-30-2017	0.1002	0.6668	4.5868	-3.2867
12-31-2017	0.0642	0.4609	1.0474	-1.5585
06-30-2018	-0.0356	0.8049	2.1419	-4.8117
12-31-2018	-0.1096	0.9110	-0.6710	-6.1263
06-30-2019	0.0990	0.7331	4.5199	-3.7468
12-31-2019	0.0504	0.7278	1.2879	-1.9087
06-30-2020	-0.0914	2.3024	-1.3138	-11.3808
12-31-2020	0.1618	1.1669	-0.3518	-0.8738
06-30-2021	0.0793	0.8298	-1.8258	-0.4161
12-31-2021	0.0259	0.8702	1.3457	-2.4094
06-30-2022	-0.1908	1.7848	-1.4042	4.9325
12-31-2022	0.0570	1.4976	-3.6472	-0.3835
Median			0.1783	-1.9175
Volatility			5.5720	7.3852

Table 65: Tracking error 1 for ELETFs tracking the FTSE MIB over 6-month holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3ITL(3)	LEVMIB(2)	3ITS(-3)	XBRMIB(-2)	BERMIB(-1)
06-30-2014	0.0979	1.2016	-2.6579	2.6876	-5.9101	-3.5459	-2.2859
12-31-2014	-0.0692	1.5377	-9.6836	-8.0623	-15.3864	-5.2788	-1.2692
06-30-2015	0.1425	1.4280	-13.4873	1.9155	-1.1543	0.0600	-1.1583
12-31-2015	-0.0217	1.7231	-11.4585	-12.5834	-15.3398	-8.8067	-2.6502
06-30-2016	-0.1911	2.3727	21.9701	10.2032	-37.0094	-28.0437	-11.0847
12-31-2016	0.1416	1.3007	-1.2220	-14.6211	11.2440	4.8631	1.2439
06-30-2017	0.0586	1.0129	-2.4065	-2.4264	-2.6568	-3.0782	-1.6379
12-31-2017	0.0497	0.6909	-9.9452	-12.4857	5.6964	3.2040	1.5063
06-30-2018	-0.0019	1.1304	0.0262	2.3297	-18.1843	-10.7738	-5.0413
12-31-2018	-0.1245	1.1833	6.8504	-2.0695	-4.5892	-4.3054	-2.2461
06-30-2019	0.1220	0.8954	12.9561	8.2681	1.3349	-1.2198	-2.1953
12-31-2019	0.0847	0.9723	-9.9068	-10.6353	-1.3941	0.3043	-0.3479
06-30-2020	-0.1122	2.7806	-6.8716	-4.9696	-47.4853	-27.2628	-9.1802
12-31-2020	0.1158	1.3715	-0.3880	-2.8984	-2.4052	-2.9832	-2.1632
06-30-2021	0.1004	0.8984	-3.5426	2.5415	-2.6568	-1.1564	-1.3695
12-31-2021	0.0715	1.0569	-0.8226	-2.7068	-11.2193	-6.6238	-3.6512
06-30-2022	-0.1812	1.7640	4.3357	-0.0670	-1.4990	-0.1153	-0.1395
12-31-2022	0.0918	1.3136	-3.1500	-13.6537	-0.6548	-1.8627	-0.9577
Median			-2.5322	-2.5666	-2.6568	-3.0307	-1.9006
Volatility			8.9349	7.4497	14.4666	8.9646	3.2031

Table 66: Tracking error 2 for ELETFs tracking the FTSE MIB over 6-month holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3ITL(3)	LEVMIB(2)	3ITS(-3)	XBRMIB(-2)	BERMIB(-1)
06-30-2014	0.0979	1.2016	0.1100	3.4379	-6.1319	-3.2406	-2.0339
12-31-2014	-0.0692	1.5377	-6.2625	-6.6677	-0.2978	1.7372	0.8615
06-30-2015	0.1425	1.4280	-11.5193	2.2040	-7.6021	-2.5741	-1.8001
12-31-2015	-0.0217	1.7231	-2.4126	-9.3029	7.1931	2.5750	1.1137
06-30-2016	-0.1911	2.3727	12.8402	7.7856	-19.4942	-22.7917	-10.5299
12-31-2016	0.1416	1.3007	-3.0803	-15.4903	0.9945	0.0666	-0.2164
06-30-2017	0.0586	1.0129	0.5851	-1.5040	0.4297	-1.2883	-0.9582
12-31-2017	0.0497	0.6909	-9.3406	-12.3183	5.7436	3.3170	1.5750
06-30-2018	-0.0019	1.1304	4.5809	3.8866	-8.7403	-5.9901	-3.4379
12-31-2018	-0.1245	1.1833	3.3730	-3.1419	-6.9174	-5.9699	-2.9543
06-30-2019	0.1220	0.8954	9.6051	7.0879	-6.7818	-5.2270	-3.5058
12-31-2019	0.0847	0.9723	-9.3873	-10.5668	-3.5621	-0.5657	-0.5588
06-30-2020	-0.1122	2.7806	2.0687	-0.6107	4.0492	-2.1790	-1.3977
12-31-2020	0.1158	1.3715	3.4004	-1.8885	-3.1998	-2.7926	-1.8837
06-30-2021	0.1004	0.8984	-4.4463	2.1626	-6.7000	-3.0402	-1.9448
12-31-2021	0.0715	1.0569	2.7789	-1.6063	-7.7405	-4.5805	-2.8658
06-30-2022	-0.1812	1.7640	-1.2127	-1.6238	3.7277	0.7722	-0.3911
12-31-2022	0.0918	1.3136	1.2344	-12.3989	0.8497	-0.5646	-0.3298
Median			0.3476	-1.6150	-3.3809	-2.3766	-1.5989
Volatility			6.3984	6.9227	6.5409	5.6858	2.6603

Appendix I2: Tracking errorr 1 and 2 over 1-year holding period

Table 67: Tracking error 1 for ELETFs tracking the CAC40 over 1-year holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**	
Date	Mean_return	Volatility	LVC(2)	BX4(-2)	SHC(-1)
12-31-2014	0.0030	1.0102	4.7893	-15.7615	-7.1862
12-31-2015	0.0455	1.4225	0.7283	-14.8392	-7.1648
12-31-2016	0.0237	1.2945	11.0470	-24.4506	-12.0852
12-31-2017	0.0369	0.6620	2.8922	-4.4487	-2.8609
12-31-2018	-0.0417	0.8664	8.8847	-17.7837	-8.2876
12-31-2019	0.0953	0.8368	13.7949	8.2088	0.9805
12-31-2020	-0.0079	2.0288	-6.3663	-34.7199	-13.4484
12-31-2021	0.1022	0.8779	11.3713	9.7902	1.6708
12-31-2022	-0.0290	1.4018	-1.8158	-18.6038	-6.7487
Median			4.7893	-15.7615	-7.1648
Volatility			6.7821	14.6131	5.2243

Table 68: Tracking error 2 for ELETFs tracking the CAC40 over 1-year holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**	
Date	Mean_return	Volatility	LVC(2)	BX4(-2)	SHC(-1)
12-31-2014	0.0030	1.0102	7.3641	-8.2647	-4.6211
12-31-2015	0.0455	1.4225	5.7827	-5.2769	-3.4212
12-31-2016	0.0237	1.2945	15.6377	-13.3024	-8.0438
12-31-2017	0.0369	0.6620	3.1549	-4.5450	-2.8239
12-31-2018	-0.0417	0.8664	8.6337	-16.6455	-8.0777
12-31-2019	0.0953	0.8368	9.1521	-5.0522	-3.5445
12-31-2020	-0.0079	2.0288	2.0806	-4.9251	-3.1713
12-31-2021	0.1022	0.8779	6.7974	-3.7112	-2.9125
12-31-2022	-0.0290	1.4018	1.4375	-4.4126	-2.2495
Median			6.7974	-5.0522	-3.4212
Volatility			4.3663	4.5808	2.2168

Table 69: Tracking error 1 for ELETFs tracking the DAX over 1-year holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**	
Date	Mean_return	Volatility	3DEL(3)	3DES(-3)	DSD(-2)
12-31-2014	0.0159	1.0478	-12.8892	-23.5738	-10.7767
12-31-2015	0.0471	1.4867	-29.0216	-18.7181	-9.5314
12-31-2016	0.0347	1.2837	18.3651	-17.2760	-17.0998
12-31-2017	0.0490	0.6659	-1.2128	5.0055	1.1684
12-31-2018	-0.0755	0.9769	5.9865	-2.0378	-1.2856
12-31-2019	0.0943	0.8847	-4.2401	17.3836	9.6068
12-31-2020	0.0354	2.0691	-32.7840	-38.8782	-24.9395
12-31-2021	0.0616	0.9049	-12.8320	-3.3570	-0.6449
12-31-2022	-0.0406	1.4648	-5.3654	-25.4396	-13.7023
Median			-5.3654	-17.2760	-9.5314
Volatility			16.0501	17.4513	10.6243

Table 70: Tracking error 2 for ELETFs tracking the DAX over 1-year holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**	
Date	Mean_return	Volatility	3DEL(3)	3DES(-3)	DSD(-2)
12-31-2014	0.0159	1.0478	-4.3647	-9.7039	-3.3494
12-31-2015	0.0471	1.4867	-11.7470	-3.7490	-0.0824
12-31-2016	0.0347	1.2837	32.3350	-0.9146	-7.6154
12-31-2017	0.0490	0.6659	-1.4179	1.8909	-0.2109
12-31-2018	-0.0755	0.9769	0.4522	-5.9111	-4.0538
12-31-2019	0.0943	0.8847	-14.0325	-4.0268	-1.2225
12-31-2020	0.0354	2.0691	-0.1430	2.8322	0.3388
12-31-2021	0.0616	0.9049	-10.9711	-7.0436	-2.0193
12-31-2022	-0.0406	1.4648	0.3548	5.2046	0.6833
Median			-1.4179	-3.7490	-1.2225
Volatility			13.7483	4.9690	2.6856

Table 71: Tracking error 1 for ELETFs tracking the EURO STOXX50 over 1-year holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3EUL(3)	LVE(2)	3EUS(-3)	BXX(-2)	BSX(-1)
12-31-2014	0.0104	1.0808	-3.3290	5.2653	-31.8858	-17.7102	-8.1953
12-31-2015	0.0297	1.4457	-16.2999	-2.5673	-33.1472	-17.7702	-7.8642
12-31-2016	0.0100	1.3663	23.6036	9.5007	-33.7909	-27.7904	-13.3160
12-31-2017	0.0271	0.6485	9.6892	3.3480	-8.8579	-8.1071	-4.4631
12-31-2018	-0.0604	0.8775	9.6970	6.1746	-18.5018	-13.1226	-6.2033
12-31-2019	0.0946	0.8174	15.8022	11.9682	14.2110	6.1653	0.1639
12-31-2020	0.0017	2.0260	-18.1544	-8.5325	-53.0467	-32.0855	-12.4890
12-31-2021	0.0781	0.9435	0.9630	7.8010	3.1607	1.1857	-1.1257
12-31-2022	-0.0389	1.4826	-0.7954	-0.3709	-34.7375	-20.0184	-7.1792
Median			0.9630	5.2653	-31.8858	-17.7102	-7.1792
Volatility			13.9321	6.4513	21.2608	12.5151	4.5350

Table 72: Tracking error 2 for ELETFs tracking the EURO STOXX50 over 1-year holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3EUL(3)	LVE(2)	3EUS(-3)	BXX(-2)	BSX(-1)
12/31/2014	0,0104	1,0808	5,2928	8,1854	-16,5038	-9,5958	-5,3798
12/31/2015	0,0297	1,4457	0,3125	2,9880	-10,5026	-4,8745	-3,0921
12/31/2016	0,0100	1,3663	37,6441	14,3646	-8,6140	-14,2565	-8,5633
12/31/2017	0,0271	0,6485	12,1178	4,1076	-5,9785	-6,4941	-3,8679
12/31/2018	-0,0604	0,8775	6,9382	5,3678	-18,5065	-13,6852	-6,5675
12/31/2019	0,0946	0,8174	4,1705	8,0358	-8,1456	-5,2803	-3,7214
12/31/2020	0,0017	2,0260	5,9596	0,6506	-1,2677	-3,4592	-2,3502
12/31/2021	0,0781	0,9435	-1,1654	6,7844	-8,6569	-4,3858	-2,8329
12/31/2022	-0,0389	1,4826	5,9541	2,5087	-3,2598	-5,0213	-2,5706
Median			5,9541	5,3678	-8,6140	-5,2803	-3,7214
Volatility			11,5503	4,0812	5,6101	4,0816	2,1036

Table 73: Tracking error 1 for ELETFs tracking the FTSE Developped EU over 1-year holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**
Date	Mean_return	Volatility	UPV(2)	EPV(-2)
12-31-2014	-0.0316	0.7618	3.0343	-14.4163
12-31-2015	-0.0099	1.0655	5.1033	-20.1275
12-31-2016	-0.0054	1.2807	6.6409	-25.3398
12-31-2017	0.0822	0.5725	12.1719	4.2998
12-31-2018	-0.0707	0.8585	-0.5430	-1.6200
12-31-2019	0.0748	0.7292	9.6841	0.6559
12-31-2020	0.0325	1.8200	-12.6304	-28.1586
12-31-2021	0.0529	0.8503	12.7380	-14.1274
12-31-2022	-0.0664	1.6478	-1.7425	-17.9424
Median			5.1033	-14.4163
Volatility			8.0194	11.5965

Table 74: Tracking error 2 for ELETFs tracking the FTSE Developped EU over 1-year holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**
Date	Mean_return	Volatility	UPV(2)	EPV(-2)
12/31/2014	-0,0316	0,7618	3,7516	-11,1230
12/31/2015	-0,0099	1,0655	7,2480	-12,0841
12/31/2016	-0,0054	1,2807	10,3442	-12,7303
12/31/2017	0,0822	0,5725	8,7258	-4,8569
12/31/2018	-0,0707	0,8585	-2,3613	-5,7388
12/31/2019	0,0748	0,7292	7,9632	-5,2163
12/31/2020	0,0325	1,8200	-3,2986	-7,6279
12/31/2021	0,0529	0,8503	14,2155	-11,3459
12/31/2022	-0,0664	1,6478	-0,4266	-2,3502
Median			7,2480	-7,6279
Volatility			6,0736	3,7861

Table 75: Tracking error 1 for ELETFs tracking the FTSE MIB over 1-year holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3ITL(3)	LEVMIB(2)	3ITS(-3)	XBRMIB(-2)	BERMIB(-1)
12-31-2014	0.0106	1.3900	-18.9569	-7.9676	-33.9747	-17.5741	-7.3154
12-31-2015	0.0594	1.5865	-25.5959	-12.6117	-20.5713	-13.1699	-6.7218
12-31-2016	-0.0234	1.9083	2.6400	-5.9900	-56.9145	-39.8470	-16.9107
12-31-2017	0.0541	0.8747	-2.1827	-10.4239	4.4113	-0.0373	-1.0960
12-31-2018	-0.0632	1.1509	5.9585	-1.4107	-25.2396	-14.9087	-6.6447
12-31-2019	0.1032	0.9325	17.6890	2.0705	18.5561	7.6973	0.0948
12-31-2020	0.0031	2.1787	-25.6693	-13.4072	-59.6741	-37.4352	-15.0368
12-31-2021	0.0857	0.9810	4.6121	3.5039	2.4524	-0.7910	-2.9898
12-31-2022	-0.0436	1.5563	-2.8212	-8.4721	-37.8312	-22.2797	-8.5329
Median			-2.1827	-7.9676	-25.2396	-14.9087	-6.7218
Volatility			15.1842	6.1705	27.3228	16.2918	5.7687

Table 76: Tracking error 2 for ELETFs tracking the FTSE MIB over 1-year holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3ITL(3)	LEVMIB(2)	3ITS(-3)	XBRMIB(-2)	BERMIB(-1)
12-31-2014	0.0106	1.3900	-5.1519	-3.2136	-10.1199	-4.6466	-2.7451
12-31-2015	0.0594	1.5865	-5.2344	-6.2655	-6.4269	-3.6204	-2.6647
12-31-2016	-0.0234	1.9083	19.2037	0.7256	-5.9185	-13.2627	-8.0386
12-31-2017	0.0541	0.8747	-1.0111	-10.2426	0.3858	-1.6415	-1.4757
12-31-2018	-0.0632	1.1509	4.2642	-1.6800	-15.5542	-11.2354	-5.8181
12-31-2019	0.1032	0.9325	4.9647	-2.3376	-7.7880	-5.7455	-4.4416
12-31-2020	0.0031	2.1787	3.5273	-2.2011	-0.9427	-4.2835	-3.0569
12-31-2021	0.0857	0.9810	2.6255	2.4879	-10.2021	-6.7375	-4.8009
12-31-2022	-0.0436	1.5563	4.0144	-5.4593	-3.5537	-5.9253	-3.5169
Median			3.5273	-2.3376	-6.4269	-5.7455	-3.5169
Volatility			7.2440	3.8058	4.9684	3.6936	1.9771

Appendix I3: Tracking errorr 1 and 2 over 3-month holding period

Table 77: Tracking error 1 for ELETFs tracking the CAC40 over 3-month holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**	
Date	Mean_return	Volatility	LVC(2)	BX4(-2)	SHC(-1)
03/31/2014	0,0392	0,9080	2,9201	-4,7328	-2,2690
06/30/2014	0,0270	0,6273	3,6855	-4,8916	-2,3843
09/30/2014	-0,0151	0,9390	-1,5152	-1,2731	-0,4101
12/31/2014	-0,0417	1,4477	-3,0233	-2,3549	-0,6671
03/31/2015	0,2664	1,1602	3,6829	4,8355	1,2814
06/30/2015	-0,0397	1,2902	4,1399	-8,4483	-3,7788
09/30/2015	-0,1010	1,8239	2,9460	-9,8366	-3,9811
12/31/2015	0,0840	1,2808	-3,4890	-0,0406	0,1867
03/31/2016	-0,0895	1,6595	5,2303	-12,4897	-5,4608
06/30/2016	-0,0260	1,6115	18,1830	-25,8072	-12,2260
09/30/2016	0,0781	0,9554	-2,2676	-0,0565	0,0509
12/31/2016	0,1417	0,7280	1,1487	0,1208	-0,2887
03/31/2017	0,0820	0,5924	1,5241	-2,1511	-1,1810
06/30/2017	0,0029	0,8384	4,4801	-6,5114	-3,1799
09/30/2017	0,0638	0,6417	0,6829	-2,1273	-1,0907
12/31/2017	-0,0038	0,5233	-0,5065	-1,0522	-0,4576
03/31/2018	-0,0398	0,9172	0,6425	-3,4565	-1,5327
06/30/2018	0,0499	0,7255	5,5783	-6,1100	-3,2457
09/30/2018	0,0536	0,6805	1,0585	-2,1227	-1,1748
12/31/2018	-0,2276	1,0722	3,2942	0,9946	-0,1483
03/31/2019	0,1990	0,8384	3,7812	1,1135	-0,1774
06/30/2019	0,0663	0,7894	2,8059	-3,9288	-2,0282
09/30/2019	0,0202	0,9351	1,9778	-4,8969	-2,2748
12/31/2019	0,0836	0,8451	-0,2415	-0,3419	-0,1991
03/31/2020	-0,4358	2,9066	3,6138	4,7316	2,2865
06/30/2020	0,2029	2,0374	11,4144	-9,2295	-5,4065
09/30/2020	-0,0271	1,2498	2,6019	-7,0827	-3,1716
12/31/2020	0,2330	1,4417	-0,2785	3,0906	0,8487
03/31/2021	0,1444	0,8094	-0,9746	1,6945	0,5339
06/30/2021	0,1231	0,7096	1,4015	-0,4676	-0,5504
09/30/2021	0,0066	0,9350	-3,3308	0,8473	0,4033
12/31/2021	0,1456	1,0270	2,2171	-1,6651	-1,1810
03/31/2022	-0,0938	1,9013	-5,0797	-3,0294	-0,4709
06/30/2022	-0,1718	1,3662	2,3710	-4,5311	-2,0849
09/30/2022	-0,0354	1,1186	2,5316	-6,6637	-2,7700
12/31/2022	0,1878	1,1714	-5,6089	7,3690	3,6971
Median			2,0974	-2,1392	-1,1327
Volatility			4,3220	5,8023	2,6724

Table 78: Tracking error 2 for ELETFs tracking the CAC40 over 3-month holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**	
Date	Mean_return	Volatility	LVC(2)	BX4(-2)	SHC(-1)
03/31/2014	0,0392	0,9080	3,4412	-3,3349	-1,7880
06/30/2014	0,0270	0,6273	3,9337	-4,1563	-2,1380
09/30/2014	-0,0151	0,9390	-0,9928	0,3179	0,1202
12/31/2014	-0,0417	1,4477	-1,8088	1,3664	0,5773
03/31/2015	0,2664	1,1602	1,5890	-1,1427	-0,7445
06/30/2015	-0,0397	1,2902	4,7260	-6,0931	-3,0405
09/30/2015	-0,1010	1,8239	3,4284	-6,4925	-3,0225
12/31/2015	0,0840	1,2808	-2,7000	1,6709	0,8139
03/31/2016	-0,0895	1,6595	6,4161	-7,8172	-3,9816
06/30/2016	-0,0260	1,6115	18,6953	-23,2480	-11,4553
09/30/2016	0,0781	0,9554	-1,8701	0,8398	0,3748
12/31/2016	0,1417	0,7280	0,7173	-1,2419	-0,7385
03/31/2017	0,0820	0,5924	1,5833	-2,0468	-1,1402
06/30/2017	0,0029	0,8384	4,9080	-5,2173	-2,7484
09/30/2017	0,0638	0,6417	0,9289	-1,4589	-0,8618
12/31/2017	-0,0038	0,5233	-0,3387	-0,5392	-0,2872
03/31/2018	-0,0398	0,9172	1,0665	-2,0539	-1,0745
06/30/2018	0,0499	0,7255	5,8325	-5,4466	-3,0160
09/30/2018	0,0536	0,6805	1,2492	-1,6696	-1,0139
12/31/2018	-0,2276	1,0722	1,6429	-4,1513	-1,8548
03/31/2019	0,1990	0,8384	2,6286	-2,2192	-1,3011
06/30/2019	0,0663	0,7894	3,1020	-3,1950	-1,7705
09/30/2019	0,0202	0,9351	2,5494	-3,2818	-1,7264
12/31/2019	0,0836	0,8451	-0,2933	-0,7082	-0,3053
03/31/2020	-0,4358	2,9066	-0,3520	-0,2012	-0,1314
06/30/2020	0,2029	2,0374	13,2708	-7,0877	-4,4193
09/30/2020	-0,0271	1,2498	3,2912	-4,6691	-2,3920
12/31/2020	0,2330	1,4417	-1,0144	0,0885	-0,0984
03/31/2021	0,1444	0,8094	-1,3409	0,4406	0,1268
06/30/2021	0,1231	0,7096	1,1497	-1,3430	-0,8335
09/30/2021	0,0066	0,9350	-2,8013	2,3429	0,9112
12/31/2021	0,1456	1,0270	2,2648	-2,0387	-1,2674
03/31/2022	-0,0938	1,9013	-3,4237	3,3801	1,5682
06/30/2022	-0,1718	1,3662	2,1943	-4,1226	-2,0330
09/30/2022	-0,0354	1,1186	3,0764	-4,6733	-2,1335
12/31/2022	0,1878	1,1714	-6,8027	3,6871	2,4720
Median			1,5862	-2,0428	-1,1074
Volatility			4,4748	4,5540	2,2868

Table 79: Tracking error 1 for ELETFs tracking the DAX over 3-month holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**	
Date	Mean_return	Volatility	3DEL(3)	3DES(-3)	DSD(-2)
03/31/2014	0,0062	1,0447	1,4192	-9,4143	-5,2252
06/30/2014	0,0593	0,7413	-5,6722	-4,3338	-0,5276
09/30/2014	-0,0655	0,9581	-12,0329	2,0466	3,8459
12/31/2014	0,0657	1,3916	-2,0274	-6,1320	-3,6591
03/31/2015	0,3232	1,2101	-1,3970	13,3830	8,6800
06/30/2015	-0,0987	1,4611	-1,0047	-10,2986	-3,6064
09/30/2015	-0,1935	1,7728	7,1542	-4,2115	-4,6255
12/31/2015	0,1780	1,3564	-7,0202	8,5258	5,1104
03/31/2016	-0,1070	1,6003	14,7042	-14,9020	-13,2583
06/30/2016	-0,0172	1,5691	12,8283	-20,5597	-14,6407
09/30/2016	0,1299	1,0095	0,5134	3,2410	0,5623
12/31/2016	0,1431	0,7570	-8,7909	4,9102	4,1936
03/31/2017	0,1098	0,6549	-0,5579	0,3751	0,0513
06/30/2017	0,0041	0,7096	1,4867	-0,0014	-1,3566
09/30/2017	0,0639	0,6563	3,0804	-5,6787	-3,5905
12/31/2017	0,0133	0,6363	-2,4887	-0,2934	-0,1584
03/31/2018	-0,0987	1,0575	-0,9559	-5,9305	-2,3472
06/30/2018	0,0320	0,9367	1,6790	-4,8582	-3,4685
09/30/2018	0,0070	0,7758	-2,6044	-0,8644	-0,6672
12/31/2018	-0,2366	1,1058	3,1609	11,6775	5,2616
03/31/2019	0,1434	0,9470	-6,3656	-1,7317	0,6254
06/30/2019	0,1374	0,8579	0,3458	7,1285	2,1945
09/30/2019	-0,0121	0,9100	-1,4309	-7,2403	-3,4981
12/31/2019	0,1082	0,8652	-2,3443	-5,7429	-1,9553
03/31/2020	-0,4066	2,8693	13,0384	5,1196	1,6884
06/30/2020	0,3647	2,2131	25,6097	15,7311	5,2702
09/30/2020	0,0585	1,3550	-0,3478	-8,7232	-5,2747
12/31/2020	0,1243	1,3770	-2,6246	-5,2667	-2,7667
03/31/2021	0,1467	0,9081	-7,2449	-2,7408	0,7999
06/30/2021	0,0653	0,8435	-2,6065	-0,1828	0,1294
09/30/2021	-0,0329	0,8456	-5,2234	-0,5345	0,6599
12/31/2021	0,0678	1,0251	-1,4183	-7,4673	-3,8235
03/31/2022	-0,1330	1,9471	-7,7518	-6,5052	-2,0269
06/30/2022	-0,1751	1,3379	1,1141	3,2443	0,9301
09/30/2022	-0,0727	1,3351	0,1361	-6,9963	-4,4798
12/31/2022	0,2237	1,1696	-2,9524	14,6145	7,9441
Median			-1,2008	-2,2362	-0,5974
Volatility			7,2174	8,0304	4,8434

Table 80: Tracking error 2 for ELETFs tracking the DAX over 3-month holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**	
Date	Mean_return	Volatility	3DEL(3)	3DES(-3)	DSD(-2)
03/31/2014	0,0062	1,0447	3,5499	-5,2975	-3,1390
06/30/2014	0,0593	0,7413	-4,7803	-2,8478	0,2421
09/30/2014	-0,0655	0,9581	-10,4707	5,4464	5,5337
12/31/2014	0,0657	1,3916	1,2774	-1,1283	-0,9970
03/31/2015	0,3232	1,2101	-12,2925	-4,8301	-0,7453
06/30/2015	-0,0987	1,4611	-0,6991	-6,4462	-1,9604
09/30/2015	-0,1935	1,7728	4,4589	-3,5973	-4,9343
12/31/2015	0,1780	1,3564	-8,6083	2,6126	2,3076
03/31/2016	-0,1070	1,6003	17,3441	-6,0039	-9,0496
06/30/2016	-0,0172	1,5691	15,7999	-12,5060	-10,7350
09/30/2016	0,1299	1,0095	0,9360	2,8545	0,4615
12/31/2016	0,1431	0,7570	-10,4243	1,4621	2,4766
03/31/2017	0,1098	0,6549	-0,7535	-0,3396	-0,2819
06/30/2017	0,0041	0,7096	2,3825	1,7910	-0,4580
09/30/2017	0,0639	0,6563	3,8970	-4,1968	-2,8348
12/31/2017	0,0133	0,6363	-1,7647	1,1086	0,5484
03/31/2018	-0,0987	1,0575	-0,4078	-3,6981	-1,3235
06/30/2018	0,0320	0,9367	3,2804	-1,9891	-1,9980
09/30/2018	0,0070	0,7758	-1,5229	1,1788	0,3683
12/31/2018	-0,2366	1,1058	-0,7440	4,0962	1,4140
03/31/2019	0,1434	0,9470	-6,8735	-3,5678	-0,2363
06/30/2019	0,1374	0,8579	0,3016	6,2809	1,8256
09/30/2019	-0,0121	0,9100	0,0927	-4,0708	-1,9142
12/31/2019	0,1082	0,8652	-2,3633	-6,4084	-2,2426
03/31/2020	-0,4066	2,8693	1,4571	4,2140	-1,7021
06/30/2020	0,3647	2,2131	22,3718	-2,1711	-3,2497
09/30/2020	0,0585	1,3550	2,7210	-3,8409	-2,7077
12/31/2020	0,1243	1,3770	0,0797	-2,5179	-1,1760
03/31/2021	0,1467	0,9081	-7,9831	-4,9312	-0,2474
06/30/2021	0,0653	0,8435	-1,5131	1,4660	1,0002
09/30/2021	-0,0329	0,8456	-4,0028	1,9753	1,9149
12/31/2021	0,0678	1,0251	0,3596	-4,8682	-2,4411
03/31/2022	-0,1330	1,9471	-4,3503	6,6952	4,1129
06/30/2022	-0,1751	1,3379	0,0281	3,5768	0,8601
09/30/2022	-0,0727	1,3351	1,9046	-1,3712	-1,8200
12/31/2022	0,2237	1,1696	-7,7287	5,1833	3,1824
Median			-0,1898	-1,6801	-0,6017
Volatility			7,2059	4,3716	3,1474

Table 81: Tracking error 1 for ELETFs tracking the EURO STOXX50 over 3-month holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3EUL(3)	LVE(2)	3EUS(-3)	BXX(-2)	BSX(-1)
03/31/2014	0,0367	0,9908	2,5924	2,6505	-8,5103	-4,9448	-2,3287
06/30/2014	0,0522	0,7239	0,0899	2,2508	-9,9018	-4,6201	-2,2466
09/30/2014	-0,0110	0,9637	-4,0888	-0,7048	-6,7995	-2,2549	-0,9051
12/31/2014	-0,0351	1,5446	-3,1154	-0,6181	-8,7308	-5,4776	-2,0894
03/31/2015	0,2774	1,0943	-5,7527	2,1800	6,4251	5,2451	1,5318
06/30/2015	-0,0822	1,3640	1,9592	2,9688	-16,2150	-7,8442	-3,4746
09/30/2015	-0,1462	1,8383	6,8105	3,0589	-10,8676	-8,1928	-3,2737
12/31/2015	0,1015	1,2980	-8,6652	-6,0844	2,7260	3,2339	1,7625
03/31/2016	-0,1303	1,6623	14,1125	6,1944	-14,2189	-13,0767	-5,7168
06/30/2016	-0,0489	1,7789	15,5723	9,9927	-28,2862	-19,6276	-9,0442
09/30/2016	0,0773	1,0300	0,3632	-1,5376	0,8002	-0,9582	-0,3738
12/31/2016	0,1461	0,7540	-0,0316	1,4192	-0,3671	0,2021	-0,3019
03/31/2017	0,0988	0,6122	1,8770	0,8760	-1,2581	-1,1050	-0,7828
06/30/2017	-0,0253	0,7906	7,3125	3,2167	-7,3184	-6,2176	-3,0455
09/30/2017	0,0700	0,6130	2,2171	1,3608	-3,8633	-2,5692	-1,3674
12/31/2017	-0,0392	0,5361	0,1590	-0,1252	-1,5570	-1,1576	-0,5306
03/31/2018	-0,0625	0,9673	-0,1703	0,8267	-7,1869	-3,3174	-1,5725
06/30/2018	0,0196	0,7914	7,6019	4,9410	-9,8922	-7,2879	-3,5669
09/30/2018	0,0108	0,7042	-1,7096	-1,5399	-0,3830	-0,4118	-0,1585
12/31/2018	-0,2034	1,0121	3,6390	1,3728	6,8323	1,1913	0,1356
03/31/2019	0,1894	0,8461	-2,2132	1,4803	1,3751	1,8383	0,3252
06/30/2019	0,0730	0,7924	7,1953	2,0190	-1,4466	-3,5588	-1,8432
09/30/2019	0,0230	0,8453	-0,6965	0,7015	-6,5963	-3,0931	-1,5420
12/31/2019	0,0820	0,8490	-1,8639	1,8614	-6,9265	-2,3159	-1,3542
03/31/2020	-0,4262	2,8992	11,4994	2,4240	10,5060	4,4445	2,1855
06/30/2020	0,2638	2,0870	23,1416	11,6724	-1,6249	-4,9200	-3,8356
09/30/2020	-0,0112	1,2820	2,2907	2,1940	-11,6760	-7,1816	-3,1375
12/31/2020	0,1869	1,3742	0,2874	-0,3020	-0,8340	-0,0769	-0,1734
03/31/2021	0,1511	0,8515	-4,3925	1,6024	-3,2417	0,0088	-0,4216
06/30/2021	0,0678	0,8297	2,1898	1,5151	-4,0926	-2,6795	-1,5115
09/30/2021	-0,0065	0,9233	-6,8845	-3,6162	0,5538	1,2094	0,8932
12/31/2021	0,1030	1,1508	0,1993	1,8031	-7,7170	-4,0269	-1,7318
03/31/2022	-0,1349	1,9484	-6,6857	-4,1749	-7,8030	-2,2674	-0,4594
06/30/2022	-0,1885	1,4945	9,3790	5,4925	-10,8228	-7,6660	-3,7026
09/30/2022	-0,0548	1,2164	4,2379	2,6687	-10,1349	-6,5202	-2,7691
12/31/2022	0,2159	1,2244	-3,1946	-4,4650	14,5232	8,0193	3,7263
Median			0,3253	1,5587	-5,3445	-2,6243	-1,4394
Volatility			6,7146	3,4853	7,8684	5,1172	2,3148

Table 82: Tracking error 2 for ELETFs tracking the EURO STOXX50 over 3-month holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3EUL(3)	LVE(2)	3EUS(-3)	BXX(-2)	BSX(-1)
03/31/2014	0,0367	0,9908	4,4018	3,2429	-5,3922	-3,3355	-1,7765
06/30/2014	0,0522	0,7239	0,9897	2,5462	-8,2965	-3,7987	-1,9668
09/30/2014	-0,0110	0,9637	-2,4365	-0,1463	-3,3477	-0,5299	-0,3319
12/31/2014	-0,0351	1,5446	0,7287	0,7001	-0,4546	-1,3243	-0,7086
03/31/2015	0,2774	1,0943	-11,5498	0,2277	-5,0446	-0,5593	-0,4197
06/30/2015	-0,0822	1,3640	2,6201	3,2543	-12,4341	-6,1611	-2,9833
09/30/2015	-0,1462	1,8383	6,1295	2,9856	-5,7740	-6,2287	-2,8121
12/31/2015	0,1015	1,2980	-7,1570	-5,6576	3,1443	3,6414	1,9676
03/31/2016	-0,1303	1,6623	16,1109	6,9903	-5,7759	-9,1812	-4,5362
06/30/2016	-0,0489	1,7789	19,2767	11,3285	-18,0979	-14,6814	-7,4573
09/30/2016	0,0773	1,0300	1,9839	-1,0251	2,9756	0,2215	0,0500
12/31/2016	0,1461	0,7540	-1,4765	0,9291	-3,4663	-1,3375	-0,8108
03/31/2017	0,0988	0,6122	1,6952	0,8080	-1,8666	-1,3908	-0,8716
06/30/2017	-0,0253	0,7906	8,3271	3,5628	-5,0314	-5,0930	-2,6774
09/30/2017	0,0700	0,6130	2,8639	1,5713	-2,7687	-2,0041	-1,1733
12/31/2017	-0,0392	0,5361	0,4678	-0,0181	-0,7923	-0,7872	-0,4111
03/31/2018	-0,0625	0,9673	0,8020	1,1693	-4,6318	-2,0848	-1,1775
06/30/2018	0,0196	0,7914	8,7274	5,3140	-7,7695	-6,2116	-3,2037
09/30/2018	0,0108	0,7042	-0,8756	-1,2669	1,0819	0,3393	0,0979
12/31/2018	-0,2034	1,0121	0,7495	0,4125	1,4500	-1,5589	-0,7972
03/31/2019	0,1894	0,8461	-5,1576	0,5018	-4,2793	-1,0179	-0,6354
06/30/2019	0,0730	0,7924	8,0693	2,2978	-0,1653	-2,8786	-1,6034
09/30/2019	0,0230	0,8453	0,6658	1,1482	-4,2088	-1,8662	-1,1226
12/31/2019	0,0820	0,8490	-1,4733	1,9728	-6,7714	-2,1909	-1,2960
03/31/2020	-0,4262	2,8992	0,5604	-0,9265	9,8124	1,5373	0,4502
06/30/2020	0,2638	2,0870	26,8034	12,5390	-5,2418	-6,0287	-3,9374
09/30/2020	-0,0112	1,2820	4,6697	3,0118	-6,3059	-4,5222	-2,2632
12/31/2020	0,1869	1,3742	0,9318	-0,1720	-2,2396	-0,5896	-0,2758
03/31/2021	0,1511	0,8515	-5,5269	1,2058	-6,0329	-1,3549	-0,8640
06/30/2021	0,0678	0,8297	3,2120	1,8422	-2,5604	-1,8694	-1,2269
09/30/2021	-0,0065	0,9233	-5,3832	-3,1216	3,2583	2,5931	1,3642
12/31/2021	0,1030	1,1508	2,1554	2,4113	-5,3842	-2,7318	-1,2564
03/31/2022	-0,1349	1,9484	-3,2264	-2,8376	5,2650	3,8379	1,4158
06/30/2022	-0,1885	1,4945	7,4607	4,9276	-11,1499	-8,1835	-3,9861
09/30/2022	-0,0548	1,2164	5,7813	3,2287	-5,5390	-4,3327	-2,0793
12/31/2022	0,2159	1,2244	-7,6656	-5,9745	5,4359	3,4477	2,1977
Median			0,9608	1,1876	-4,2441	-1,8678	-1,1479
Volatility			7,4127	3,6860	5,3249	3,7432	1,8898

Table 83: Tracking error 1 for ELETFs tracking the FTSE100 over 3-month holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3UKL(3)	2UKL(2)	3UKS(-3)	2UKS(-2)	SUK1(-1)
03/31/2014	-0,0336	0,6783	2,5669	1,8852	-5,9491	-3,5069	-1,6395
06/30/2014	0,0504	0,4696	0,0000	0,0000	0,0000	0,0000	0,0000
09/30/2014	-0,0410	0,5334	-1,3401	-0,8604	-0,9593	-0,2811	-0,0868
12/31/2014	-0,0082	1,0426	-0,2160	0,4342	-6,5503	-3,5966	-1,5122
03/31/2015	0,0532	0,9282	1,8781	1,5727	-5,5491	-3,3562	-1,5845
06/30/2015	-0,0362	0,8219	4,6117	3,2157	-8,2457	-4,9352	-2,3205
09/30/2015	-0,0970	1,4764	-1,5196	-0,6271	-7,5408	-3,5182	-1,2041
12/31/2015	0,0508	1,0052	-12,8649	-8,0792	7,4566	5,5219	2,9557
03/31/2016	-0,0072	1,4122	6,0889	5,2092	-16,9164	-10,2216	-4,6314
06/30/2016	0,1061	1,2221	10,4874	7,5809	-15,2457	-9,8625	-4,8244
09/30/2016	0,0932	0,7050	-4,9106	-3,2703	3,7427	2,5922	1,2559
12/31/2016	0,0575	0,7046	-1,1829	-0,6467	-1,7306	-0,8603	-0,3973
03/31/2017	0,0400	0,4620	-1,2055	-0,8417	-0,2786	-0,0243	-0,0496
06/30/2017	-0,0004	0,6120	5,4605	3,7429	-8,2846	-5,2032	-2,5639
09/30/2017	0,0145	0,5807	2,8862	2,0090	-5,6453	-3,4309	-1,6744
12/31/2017	0,0676	0,4731	-1,4259	-1,0582	0,6793	0,5677	0,2376
03/31/2018	-0,1328	0,7838	4,1117	2,4804	-4,1921	-2,5844	-1,3314
06/30/2018	0,1304	0,7642	5,7002	3,2211	-1,8555	-1,6729	-1,1375
09/30/2018	-0,0266	0,6548	3,3496	2,4133	-6,5071	-3,8976	-1,8232
12/31/2018	-0,1673	0,9326	3,1657	1,5187	-0,3373	-0,2378	-0,2797
03/31/2019	0,1280	0,7824	3,5007	1,9103	-0,5815	-0,7001	-0,5672
06/30/2019	0,0493	0,5817	0,8028	0,6121	-2,7602	-1,5562	-0,7151
09/30/2019	-0,0104	0,7798	0,8166	0,8492	-5,0642	-2,7971	-1,1986
12/31/2019	0,0312	0,8920	-0,9493	-0,3514	-2,4625	-1,2351	-0,4849
03/31/2020	-0,4085	2,6419	15,2775	6,3569	-0,9744	1,0843	0,4203
06/30/2020	0,1500	1,8172	3,8064	3,6057	-6,8475	-5,1357	-2,8226
09/30/2020	-0,0657	1,2364	4,2333	3,3229	-12,5259	-7,2465	-3,2463
12/31/2020	0,1575	1,1653	-5,1039	-3,5126	5,9149	3,6240	1,5690
03/31/2021	0,0653	0,9110	-4,1679	-2,4707	-0,2733	0,2608	0,2363
06/30/2021	0,0988	0,7515	2,9050	1,9232	-4,4721	-2,8696	-1,4982
09/30/2021	0,0006	0,7360	1,4337	1,1429	-5,3316	-3,1024	-1,4659
12/31/2021	0,0675	0,7851	2,5429	1,7126	-4,1788	-2,6733	-1,3954
03/31/2022	0,0361	1,2606	-5,3640	-2,7088	-3,7036	-1,4841	-0,3298
06/30/2022	-0,0708	1,1673	1,6320	1,4862	-7,8139	-4,2182	-1,7213
09/30/2022	-0,0572	0,9059	2,0619	1,6932	-5,9991	-3,2364	-1,2787
12/31/2022	0,1261	0,7633	-3,4808	-2,4716	6,1593	4,1407	2,1851
Median			1,8781	1,5187	-4,1921	-2,6733	-1,2041
Volatility			4,8959	3,0016	5,3283	3,3935	1,6279

Table 84: Tracking error 2 for ELETFs tracking the FTSE100 over 3-month holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3UKL(3)	2UKL(2)	3UKS(-3)	2UKS(-2)	SUK1(-1)
03/31/2014	-0,0336	0,6783	3,2286	2,1122	-4,4173	-2,7565	-1,3948
06/30/2014	0,0504	0,4696	0,0000	0,0000	0,0000	0,0000	0,0000
09/30/2014	-0,0410	0,5334	-0,8900	-0,7073	0,0443	0,2129	0,0752
12/31/2014	-0,0082	1,0426	1,7374	1,0888	-2,6889	-1,6481	-0,8586
03/31/2015	0,0532	0,9282	3,2214	2,0059	-3,4382	-2,2494	-1,1988
06/30/2015	-0,0362	0,8219	4,8771	3,3216	-7,0601	-4,3985	-2,1602
09/30/2015	-0,0970	1,4764	-0,1120	-0,0786	-1,9544	-0,9382	-0,4190
12/31/2015	0,0508	1,0052	-11,8458	-7,7735	8,2872	6,0342	3,1595
03/31/2016	-0,0072	1,4122	9,6952	6,4381	-9,3787	-6,4253	-3,3641
06/30/2016	0,1061	1,2221	13,0854	8,4334	-10,8019	-7,5581	-4,0311
09/30/2016	0,0932	0,7050	-5,1268	-3,3559	2,8675	2,1875	1,1325
12/31/2016	0,0575	0,7046	-0,4358	-0,4050	-0,5179	-0,2291	-0,1788
03/31/2017	0,0400	0,4620	-1,0730	-0,8007	-0,1254	0,0613	-0,0180
06/30/2017	-0,0004	0,6120	6,1182	3,9640	-6,9220	-4,5243	-2,3387
09/30/2017	0,0145	0,5807	3,5261	2,2235	-4,3410	-2,7792	-1,4575
12/31/2017	0,0676	0,4731	-1,4829	-1,0810	0,4376	0,4568	0,2040
03/31/2018	-0,1328	0,7838	3,0766	2,1443	-5,8532	-3,4564	-1,6349
06/30/2018	0,1304	0,7642	4,9993	2,9727	-3,6943	-2,5636	-1,4238
09/30/2018	-0,0266	0,6548	4,1143	2,6718	-4,8775	-3,0886	-1,5558
12/31/2018	-0,1673	0,9326	1,3229	0,9161	-3,3903	-1,8351	-0,8333
03/31/2019	0,1280	0,7824	2,8659	1,6840	-2,2996	-1,5285	-0,8322
06/30/2019	0,0493	0,5817	1,3073	0,7765	-1,8936	-1,1104	-0,5624
09/30/2019	-0,0104	0,7798	1,9105	1,2174	-2,8011	-1,6671	-0,8231
12/31/2019	0,0312	0,8920	0,1051	-0,0119	-0,8065	-0,3681	-0,1830
03/31/2020	-0,4085	2,6419	2,1750	2,1022	-12,7113	-6,9242	-2,8342
06/30/2020	0,1500	1,8172	8,8525	5,0937	-3,8278	-3,0744	-1,9412
09/30/2020	-0,0657	1,2364	5,4501	3,7773	-8,3999	-5,3142	-2,6479
12/31/2020	0,1575	1,1653	-6,1648	-3,9146	2,3762	1,9450	1,0431
03/31/2021	0,0653	0,9110	-2,8576	-2,0490	1,7461	1,3245	0,6085
06/30/2021	0,0988	0,7515	3,5940	2,1400	-3,5535	-2,3730	-1,3200
09/30/2021	0,0006	0,7360	2,4769	1,4922	-3,2400	-2,0530	-1,1154
12/31/2021	0,0675	0,7851	3,3384	1,9599	-3,2024	-2,1366	-1,1999
03/31/2022	0,0361	1,2606	-2,2117	-1,6707	1,7793	1,3530	0,6447
06/30/2022	-0,0708	1,1673	2,8573	1,9321	-4,0947	-2,4545	-1,1671
09/30/2022	-0,0572	0,9059	2,9238	1,9982	-3,6800	-2,1220	-0,9230
12/31/2022	0,1261	0,7633	-4,8883	-2,9451	3,2506	2,6894	1,7029
Median			2,4769	1,6840	-3,2400	-2,0530	-0,9230
Volatility			4,5851	2,9713	4,1446	2,7727	1,4191

Table 85: Tracking error 1 for ELETFs tracking the FTSE Developped EU over 3-month holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**
Date	Mean_return	Volatility	UPV(2)	EPV(-2)
03/31/2014	0,0349	0,8231	3,3283	-6,0498
06/30/2014	0,0368	0,5200	2,4310	-3,8091
09/30/2014	-0,1348	0,6329	-4,6921	4,7237
12/31/2014	-0,0619	0,9983	-1,4217	-2,3305
03/31/2015	0,0504	1,0148	2,5503	-5,8506
06/30/2015	0,0169	1,0050	-5,5678	2,3827
09/30/2015	-0,1264	1,3177	3,5714	-5,5839
12/31/2015	0,0404	0,8832	-7,9608	5,2430
03/31/2016	-0,0374	1,3916	1,9410	-7,0317
06/30/2016	-0,0399	1,8568	19,4380	-29,4049
09/30/2016	0,0825	0,8917	-2,5858	0,8655
12/31/2016	-0,0138	0,6571	1,5649	-3,3673
03/31/2017	0,1030	0,6126	2,2708	-1,2194
06/30/2017	0,0973	0,7134	3,8792	-2,9977
09/30/2017	0,0950	0,4892	3,7709	-3,4214
12/31/2017	0,0334	0,4336	0,8804	-1,6347
03/31/2018	-0,0339	0,8514	-0,3690	-2,9140
06/30/2018	-0,0373	0,7680	4,6354	-6,4129
09/30/2018	0,0045	0,7302	-2,3159	0,4467
12/31/2018	-0,2143	1,0485	0,1114	0,9468
03/31/2019	0,1542	0,7646	3,0542	-0,7966
06/30/2019	0,0472	0,6889	0,3147	-1,9917
09/30/2019	-0,0507	0,7344	0,8506	-2,6429
12/31/2019	0,1365	0,7558	4,8456	-2,3263
03/31/2020	-0,4163	2,6685	4,1495	-4,9552
06/30/2020	0,2375	1,7821	13,4090	-5,6850
09/30/2020	0,0805	1,1600	2,1322	-5,4409
12/31/2020	0,2313	1,1820	0,8416	2,6058
03/31/2021	0,0591	0,8510	-0,6928	-1,3684
06/30/2021	0,1084	0,8118	-4,7205	3,6272
09/30/2021	-0,0264	0,8494	-5,6446	3,2259
12/31/2021	0,0761	0,8932	0,9452	-2,6749
03/31/2022	-0,1161	2,1021	-5,1560	0,0837
06/30/2022	-0,2695	1,4176	0,7206	1,1061
09/30/2022	-0,1702	1,4994	3,0926	-3,3066
12/31/2022	0,2841	1,5363	-8,3885	11,7845
Median			0,9128	-2,3284
Volatility			5,2688	6,1223

Table 86: Tracking error 2 for ELETFs tracking the FTSE Developped EU over 3-month holding period

	Benchmark		**Bull LETFs**	**Bear LETFs**
Date	Mean_return	Volatility	UPV(2)	EPV(-2)
03/31/2014	0,0349	0,8231	3,7561	-4,8869
06/30/2014	0,0368	0,5200	2,5950	-3,3409
09/30/2014	-0,1348	0,6329	-4,7951	4,5116
12/31/2014	-0,0619	0,9983	-0,9364	-0,6718
03/31/2015	0,0504	1,0148	3,0705	-4,4900
06/30/2015	0,0169	1,0050	-5,0276	3,8485
09/30/2015	-0,1264	1,3177	3,2604	-5,7226
12/31/2015	0,0404	0,8832	-7,6908	5,8012
03/31/2016	-0,0374	1,3916	3,1310	-3,1755
06/30/2016	-0,0399	1,8568	19,5759	-27,4430
09/30/2016	0,0825	0,8917	-2,3383	1,3287
12/31/2016	-0,0138	0,6571	1,7752	-2,6779
03/31/2017	0,1030	0,6126	2,1020	-1,7986
06/30/2017	0,0973	0,7134	3,7805	-3,4005
09/30/2017	0,0950	0,4892	3,7632	-3,4887
12/31/2017	0,0334	0,4336	0,9805	-1,3520
03/31/2018	-0,0339	0,8514	0,0276	-1,6286
06/30/2018	-0,0373	0,7680	4,8518	-5,6580
09/30/2018	0,0045	0,7302	-2,0002	1,3072
12/31/2018	-0,2143	1,0485	-1,4847	-4,0968
03/31/2019	0,1542	0,7646	2,5810	-2,2975
06/30/2019	0,0472	0,6889	0,6011	-1,2082
09/30/2019	-0,0507	0,7344	1,0709	-1,8744
12/31/2019	0,1365	0,7558	4,5060	-3,4447
03/31/2020	-0,4163	2,6685	-0,4840	-14,6969
06/30/2020	0,2375	1,7821	13,6821	-7,4996
09/30/2020	0,0805	1,1600	2,9231	-3,3456
12/31/2020	0,2313	1,1820	-0,0824	-0,6309
03/31/2021	0,0591	0,8510	-0,3377	-0,5027
06/30/2021	0,1084	0,8118	-4,9309	2,7883
09/30/2021	-0,0264	0,8494	-5,2113	4,5071
12/31/2021	0,0761	0,8932	1,3654	-1,6155
03/31/2022	-0,1161	2,1021	-3,3412	7,7165
06/30/2022	-0,2695	1,4176	-0,4345	-1,5237
09/30/2022	-0,1702	1,4994	2,1621	-4,9376
12/31/2022	0,2841	1,5363	-11,1521	3,5200
Median			1,0257	-1,8365
Volatility			5,3599	5,9993

Table 87: Tracking error 1 for ELETFs tracking the FTSE MIB over 3-month holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3ITL(3)	LEVMIB(2)	3ITS(-3)	XBRMIB(-2)	BERMIB(-1)
03/31/2014	0,2160	1,1092	5,2731	3,2938	2,8044	0,8295	-0,2299
06/30/2014	-0,0011	1,2834	-7,6782	-2,1823	-8,9868	-3,0154	-1,0909
09/30/2014	-0,0289	1,2834	-6,4280	-4,7083	-9,3280	-3,4800	-1,2054
12/31/2014	-0,1269	1,8549	-9,9089	-6,9472	-3,7962	-0,7929	0,4634
03/31/2015	0,3183	1,4029	-9,8544	-0,3183	15,0292	10,0563	3,6102
06/30/2015	-0,0042	1,4392	-2,6272	0,9060	-15,5992	-7,5259	-3,2645
09/30/2015	-0,0686	2,0743	2,6824	-3,3088	-18,8974	-12,2968	-4,8105
12/31/2015	0,0171	1,2744	-13,1754	-8,3580	2,5354	2,7601	1,7101
03/31/2016	-0,2420	2,3295	10,8465	4,4267	-15,2441	-13,0309	-5,1817
06/30/2016	-0,1311	2,4214	27,1506	18,9709	-53,3540	-34,9819	-15,8849
09/30/2016	0,0285	1,3931	-1,7403	-10,1676	-4,5528	-3,8620	-1,5724
12/31/2016	0,2564	1,1945	4,0045	1,9135	8,1192	4,2005	0,9535
03/31/2017	0,1022	0,9472	-3,0032	-1,6085	-0,8338	-0,5153	-0,3356
06/30/2017	0,0129	1,0725	7,5107	3,8402	-10,0332	-7,9846	-3,8496
09/30/2017	0,1552	0,6694	-1,6571	-6,5537	4,1400	2,1049	0,6885
12/31/2017	-0,0576	0,7018	-1,3170	-1,9111	-0,7101	-0,7273	-0,3234
03/31/2018	0,0458	1,0831	-3,0262	-0,3252	-6,1794	-2,8660	-1,3385
06/30/2018	-0,0496	1,1808	2,2276	1,8853	-10,2412	-6,7391	-3,1536
09/30/2018	-0,0685	1,0713	-8,5075	-10,5715	2,6144	1,7918	1,1311
12/31/2018	-0,1892	1,2848	3,7135	0,1030	-0,6192	-1,5562	-0,8540
03/31/2019	0,2420	0,8906	-0,2535	2,3946	6,4476	4,2890	1,0305
06/30/2019	0,0015	0,8803	6,6152	2,1353	-4,0013	-5,1745	-2,6610
09/30/2019	0,0544	1,0897	-0,2889	-5,3611	-8,2774	-4,7055	-2,2915
12/31/2019	0,1025	0,9049	-3,9996	-0,0926	-5,1473	-1,5431	-0,9397
03/31/2020	-0,4408	3,3241	13,0529	3,3044	-0,0920	-0,8423	0,4724
06/30/2020	0,2197	2,0066	12,7708	6,2129	-2,7956	-5,0023	-3,3561
09/30/2020	-0,0161	1,3534	1,2099	-0,8772	-11,9223	-7,0881	-3,1741
12/31/2020	0,2581	1,4035	0,9033	-0,2236	7,4332	3,4788	0,9540
03/31/2021	0,1684	0,9698	-7,1558	-0,0048	-1,2961	0,9440	0,0802
06/30/2021	0,0433	0,8238	-1,6988	-0,9410	-1,7595	-1,2900	-0,7277
09/30/2021	0,0355	1,0322	-3,6552	-3,2844	-3,7510	-1,4271	-0,8504
12/31/2021	0,1039	1,0910	-0,7017	-1,9151	-6,3743	-3,3932	-1,9128
03/31/2022	-0,1188	2,0051	-8,7474	-5,2778	-7,2407	-2,5965	-0,3485
06/30/2022	-0,2363	1,4892	4,0100	1,2959	-0,1847	-1,4789	-1,0024
09/30/2022	-0,0368	1,4623	0,6098	-5,8337	-11,1052	-7,2481	-2,9268
12/31/2022	0,2224	1,1759	-5,8762	-9,3977	16,7090	9,3395	4,2686
Median			-1,0093	-0,6012	-3,7736	-1,5497	-0,8968
Volatility			7,8307	5,4693	11,5261	7,4269	3,2526

Table 88: Tracking error 2 for ELETFs tracking the FTSE MIB over 3-month holding period

	Benchmark		**Bull LETFs**		**Bear LETFs**		
Date	Mean_return	Volatility	3ITL(3)	LEVMIB(2)	3ITS(-3)	XBRMIB(-2)	BERMIB(-1)
03/31/2014	0,2160	1,1092	3,1368	2,5343	-2,6569	-1,8428	-1,0962
06/30/2014	-0,0011	1,2834	-4,7333	-1,1813	-2,8032	0,0868	-0,0581
09/30/2014	-0,0289	1,2834	-3,8665	-3,8225	-3,3919	-0,5487	-0,2451
12/31/2014	-0,1269	1,8549	-5,6410	-5,3924	8,3454	5,1000	2,3490
03/31/2015	0,3183	1,4029	-18,9488	-3,3853	-2,5367	1,0963	0,5770
06/30/2015	-0,0042	1,4392	0,5030	1,9940	-8,2585	-3,8981	-2,0761
09/30/2015	-0,0686	2,0743	6,2590	-1,9110	-5,2387	-5,8814	-2,8338
12/31/2015	0,0171	1,2744	-10,2396	-7,4122	6,9065	5,0924	2,5342
03/31/2016	-0,2420	2,3295	10,1613	4,5136	-3,2267	-8,1839	-3,9657
06/30/2016	-0,1311	2,4214	24,9547	18,4940	-46,8044	-32,6954	-15,4524
09/30/2016	0,0285	1,3931	1,9495	-8,9357	2,2950	-0,3458	-0,3755
12/31/2016	0,2564	1,1945	-1,5763	0,0390	-2,9175	-1,3754	-0,9189
03/31/2017	0,1022	0,9472	-1,7918	-1,2328	0,5777	0,2731	-0,0448
06/30/2017	0,0129	1,0725	9,6254	4,5475	-5,8972	-5,8938	-3,1471
09/30/2017	0,1552	0,6694	-3,0157	-7,0141	1,2359	0,6616	0,2112
12/31/2017	-0,0576	0,7018	-0,8935	-1,7602	0,4848	-0,1582	-0,1433
03/31/2018	0,0458	1,0831	-0,8819	0,3759	-2,5611	-0,9878	-0,6910
06/30/2018	-0,0496	1,1808	4,2173	2,5808	-5,3127	-4,3335	-2,3743
09/30/2018	-0,0685	1,0713	-6,8261	-10,0058	6,0296	3,5061	1,7033
12/31/2018	-0,1892	1,2848	2,0241	-0,4128	-1,7802	-2,3616	-1,1925
03/31/2019	0,2420	0,8906	-6,1220	0,4746	-3,8488	-0,9873	-0,7703
06/30/2019	0,0015	0,8803	8,0670	2,6214	-1,1107	-3,7205	-2,1745
09/30/2019	0,0544	1,0897	1,8541	-4,6683	-4,9238	-2,9404	-1,6748
12/31/2019	0,1025	0,9049	-3,7915	-0,0462	-5,4785	-1,6537	-0,9571
03/31/2020	-0,4408	3,3241	0,9925	-0,2278	5,6606	-1,2354	-0,6879
06/30/2020	0,2197	2,0066	17,3235	7,4135	-3,8577	-4,8499	-3,0493
09/30/2020	-0,0161	1,3534	3,8260	0,0278	-5,8587	-4,0930	-2,1926
12/31/2020	0,2581	1,4035	-2,2226	-1,3585	-1,0337	-0,6589	-0,3824
03/31/2021	0,1684	0,9698	-8,4575	-0,4653	-4,6564	-0,6898	-0,4468
06/30/2021	0,0433	0,8238	-0,5994	-0,5864	-0,0172	-0,3788	-0,4108
09/30/2021	0,0355	1,0322	-1,6959	-2,6472	-0,5290	0,2506	-0,2699
12/31/2021	0,1039	1,0910	0,7178	-1,4896	-5,1465	-2,6560	-1,6242
03/31/2022	-0,1188	2,0051	-4,4205	-3,6515	6,8930	4,1498	1,7702
06/30/2022	-0,2363	1,4892	1,3553	0,4728	-2,4110	-2,9156	-1,5812
09/30/2022	-0,0368	1,4623	3,6940	-4,7469	-3,3750	-3,4601	-1,6977
12/31/2022	0,2224	1,1759	-10,9594	-11,1062	6,6394	4,2530	2,5608
Median			-0,7407	-0,8838	-2,6090	-1,1116	-0,7306
Volatility			7,8570	5,2523	8,7078	6,0856	2,9149