TRADING RULES ON A SMALL STOCK MARKET

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Abstract: *In this article, the results of an extensive study of the weak form efficiency of the Iceland stock market are presented. This study almost covers the market's entire history, with the research starting at the beginning of 1993 and ending in July 2017. Four trading rules based on 70-day moving averages were constructed and compared with the passive investment strategy of buying the market index. All of these trading rules provided significantly better returns than the passive strategy, even when considering trading costs. This result indicates that the Icelandic stock market did not show weak form efficiency, and past returns predicted future returns during the period examined.*

Keywords: Icelandic stock market, trading rules, weak form efficiency.

JEL classification: G12, G14, G17.

1. Introduction

An efficient stock market is one in which all information is incorporated into stock prices. For the market to be that efficient, all information must be free and available, and no trading costs must exist (Malkiel & Fama, 1970). A weaker and more sensible definition of market efficiency is when the price of a security represents information to the point that the marginal benefit of gathering and analysing new information is the same as the cost of obtaining it (Jensen, 1968). Therefore, stock price movements are random and uncertain and follow a random path, which has been named the random walk (Fama, 1995).

Stock markets are normally classified into three groups on the basis of their efficiency: weak form efficient, semi-strong efficient and strong form efficient. A weak form of efficiency means that stock prices reflect all information regarding their movements and trading volume. Therefore, past stock prices' movements do not predict their future direction (Eom, Choi, Oh, & Jung, 2008). The semi-strong form of stock market efficiency means that all public information is already reflected in stock prices. Therefore, studying company annual reports, the markets in which companies operate, financial ratios and similar information is of no benefit (Givoly & Lakonishok, 1979). Finally, the strong form of stock market efficiency means that all information, even information only known to insiders, is already reflected in stock prices. Therefore, no one – not even company insiders – can generate abnormal profits when trading stocks (Seyhun, 1986). Most stock markets are assumed to be both weak form and semi-strong efficient. The larger the market and the higher the number of investors trading in the market, the more efficient that market should be (Rizvi, Dewandaru, Bacha, & Masih, 2014).

When performing technical analyses on a stock, the analyst looks for predictable patterns in stock price movements, which can be used to generate profits and better returns. Therefore, technical analyses – if profitable – contradicts the assumption that stock markets possess the weak form of market efficiency (Roberts, 1959). Trading rules are based on simple rules applied to beat the stock market, i.e., generate better returns than the market average. These trading rules are often based on simple moving averages, momentum, Bollinger bands, relative strength indexes or other similar technical indicators. Therefore, investing in stocks and applying simple trading rules in those investments should not yield abnormal

returns, which are returns higher than the market average in an efficient stock market that is at least weak form efficient.

In this article, the weak form efficiency of the Icelandic stock market is studied. This study examines whether any information was contained in the previous development of stock prices. Four simple trading rules are applied, and their performance is compared with a buy and hold strategy. These trading rules were based on the development of the Icelandic stock index and its moving average. Trading rules that generate abnormal returns indicate that the Icelandic stock market is not weak form efficient.

2. The Icelandic stock market

Trading Icelandic stocks stared in 1985 when a private enterprise, Hlutabréfamarkaðurinn hf., began to buy and sell stocks, an effort that proved to be successful. In 1986, the Icelandic Stock Exchange was founded. In the beginning, the exchange was housed and linked to the Icelandic central bank and only bonds were traded. Not until 1990 were stocks registered and traded on the exchange (Guðjónsdóttir, 2000).
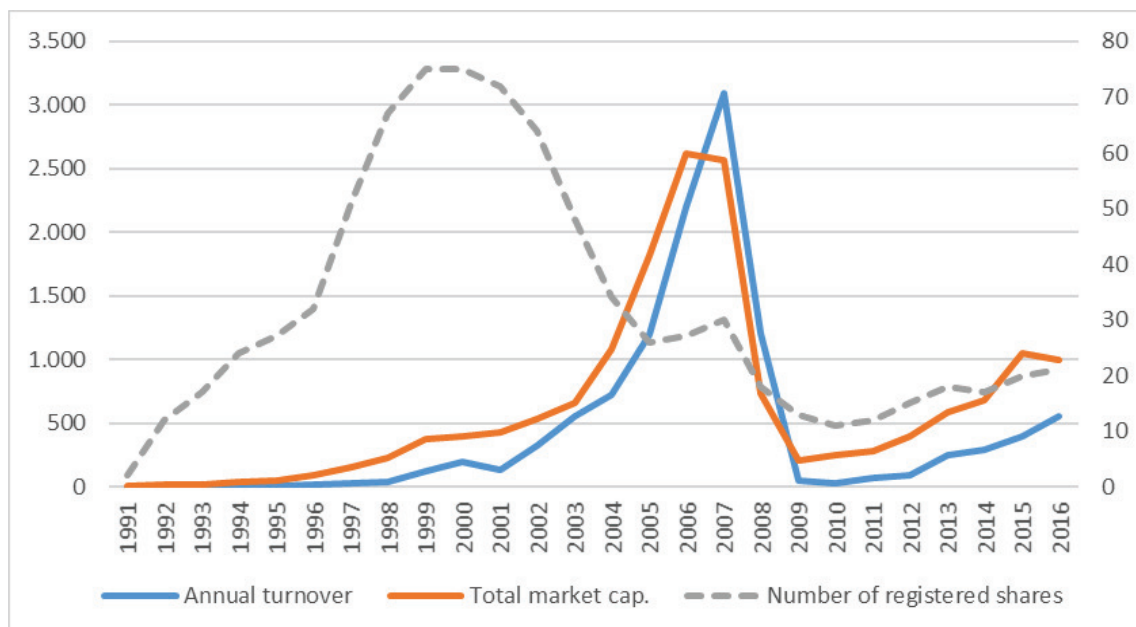

Figure 1: Number of registered companies on the Icelandic Stock Exchange (right-hand axis), total market capitalization and annual turnover in billion ISK (left-hand axis)
Source: Iceland – NASDAQ

Figure 1 charts the number of registered shares on the exchange and indicates its total market capitalization and annual turnover from 1991 to 2016. In figure 2, the development of the main stock index (ICEX) is charted. These two pictures show an interesting story. The market started in 1991 but was extremely small that year, when only two shares were traded. The stock exchange was a success and the number of registered shares increased gradually, until it reached a peak in 1999–2000 of 75 shares being bought and sold on the exchange (Magnússon, 2010). The trading volume was very small in the beginning and increased gradually every year during that period. The market generated good returns in the beginning and the average annual return from 1993 to 2000 was approximately 20%. Therefore, the 1991–2000 period can be described as successful for this small market.

In 2000, the market peaked briefly at the beginning of the year but declined sharply thereafter and again in 2001. Annual turnover on the exchange temporally peaked at 197 billion ISK in 2000, or approximately 1.6 billion euros. In 2001, the market experienced a

brief decline. Trading volume declined, but that downturn was short-lived. The number of registered shares also started to decline that year, which proved to be longer term in nature. The number of registered shares on the exchange declined from 75 in 2000 to 26 in 2005. The reasons for this decline were numerous. During that period, an excessive credit boom occurred in Iceland and credit was cheap and plentiful (Gunnlaugsson, 2017) (Gunnlaugsson & Saevaldsson, 2016). Therefore, shares in many companies were bought by leading investors and/or investing companies, thus these shares were delisted. In addition, a number of mergers occurred, which reduced the number of traded stocks. Finally, the number of listed stocks was probably too high and some of the smaller companies had little interest. Thus, their owners saw no point to listing their shares on the exchange (Jónsson, 2009).
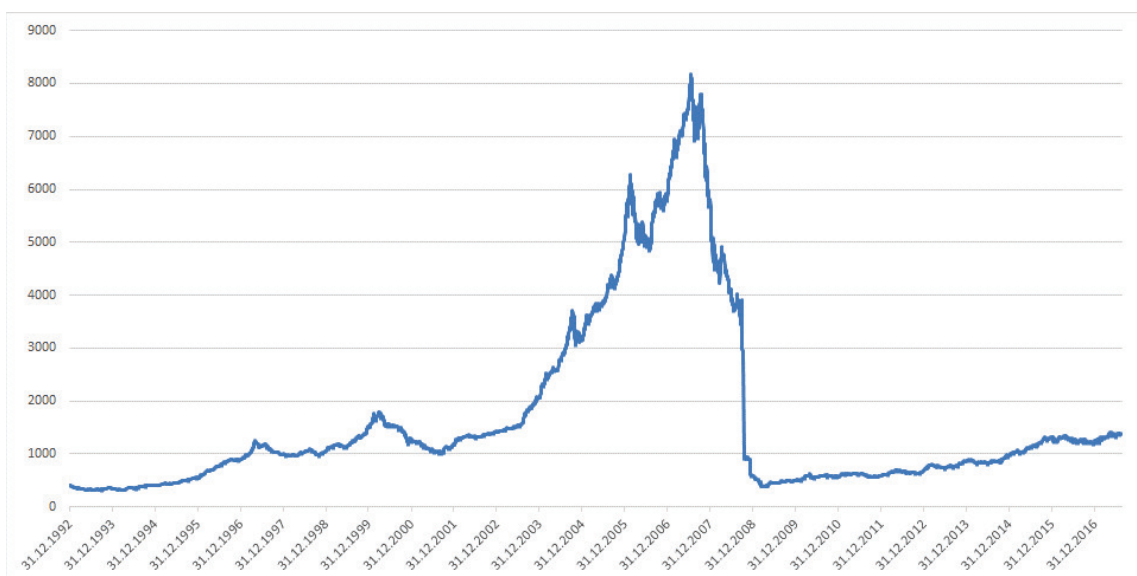

Figure 2:. Development of the Icelandic stock index (ICEX) for 1993–2017
Source: Iceland – NASDAQ

In 2003, the great Icelandic financial bubble started. Two of the three largest banks were privatized in 2002 and 2003, thus initiating financial liberation and the credit boom that followed. The Icelandic stock market experienced a rapid boom from 2003 to 2007. Although the number of traded stocks declined, annual turnover increased more than 450% from 2003 to 2007. The market generated very good returns and increased more than 50% for three years in a row, i.e., during 2003–2005. During that period, the market was characterized by the dominance of trading of financial stocks. The vast majority of trading (more than 80%) was in bank stocks and other financial institutions. As a result, the market became very monotonous and did not represent the Icelandic economy (Graham, Peltomäki, & Sturludóttir, 2015).

The crash of 2008 completely changed the Icelandic market. The three largest banks were restructured in October that year and their shares became worthless. Their shares had dominated the market in both trading volume and market capitalization. Because of this crash, trading volume declined more than 99% between 2007 and 2010, when it was only 25 billion ISK, or approximately 240 million USD. The market declined sharply, and the ICEX was down by 94.4% in 2008.

Since this crash, the market has been in a slow but steady recovery. Trading volume has increased and the number of traded stocks has increased. Returns have been reasonable, but the market is just a shadow of what it was before the crash of 2008.

A chart of the development of the stock market shows that long, consecutive periods have existed during which the index generated positive returns and shorter periods when returns

have been negative. This history indicates that trading rules based on simple technical indicators might have been profitable and might have generated significantly better returns than the market index.

3. Previous research

Technical analysis is built on finding trends in stock price movements. Most trading rules, or technical trading strategies, are based on technical analysis and are normally simple and easy to apply. These trading rules are often implemented on simple moving averages, Bollinger bands, momentum, relative strength index or other similar technical indicators. Therefore, investing in stocks and applying simple trading rules to those investments should not yield abnormal returns. Most research that studied trading rules based on technical analysis found that they did not yield better returns on the US stock market (Fama & Blume, 1966) (Jensen & Benington, 1970). Recent studies have had different findings. One study on the US Dow Jones stock index found that simple trading rules provided better returns than the market average (Brock, Lakonishok, & LeBaron, 1992). In an extensive study of Asian stock markets, the main findings were that trading rules resulted in excess returns in some markets (Bessembinder & Chan, 1995). A study on the UK stock market found that trading rules generated better returns but not when taking into account trading costs (Hudson, Dempsey, & Keasey, 1996). An extensive study of the Malaysian stock market found that a few trading rules provided excess risk-adjusted returns (Ling & Abdul-Rahim, 2017).

No articles have been published that studied the weak form efficiency of the Icelandic stock market. Similarly, no papers have been written that studied the performance of trading rules on this small market. The research published on the Icelandic stock market has indicated its inefficiency. An extensive study of this market during 1993–2003 found that it did not display the semi-strong form of market efficiency. Value stocks, i.e., stocks which are inexpensive based on the market capitalization/equity (M/B) ratio, provided higher than average returns. The same applied to stocks which were cheap, i.e., had low market capitalization/earnings (P/E) ratios. A portfolio of those stocks provided abnormal risk-adjusted returns (Jónsson & Gunnlaugsson, 2004). A study of the calendar effects on the Icelandic stock market during 1993–2003 found no relationships between months of the year and returns or between days of the week and returns. Returns were on average abnormally high before holidays and, in particular, on the last trading day of the year (Gunnlaugsson, 2003). A study on the performance of the Capital Asset Pricing Model (CAPM) on the Icelandic stock market during 1999–2004 found that this important model works well on this small market and the beta coefficient, which measures systematic risk, explained returns better than it did for most other stock markets (Gunnlaugsson, 2007).

4. Methodology

Data were obtained from the Icelandic stock exchange. The data contained the daily value of the ICEX from the beginning of 1993 until 31 July 2017. This index is a conventional stock index now composed of 8 stocks.The weights of the stocks in the index are based on their market values. Data on the risk-free rate were received from the Icelandic central bank.

Four trading rules were constructed and tested. They were based on a 70-day moving average which was calculated as follows:

$$MA_t = \frac{1}{70} \sum_{i=1}^{70} P_{t-1}$$

where P_t is the daily value of the stock index and MA_t is its 70-day moving average. Thus, equation 1 calculates the average value of the stock index for the previous 70 days. The

trading strategies were tested from the beginning of 1993 until the end of July 2017. Every month, i.e., in the first trading day of each month, a trading decision was made depending on whether the value of the stock index on the last trading day was higher or lower than its 70-day moving average. The trading rules were as follows.

- Trading rule 1. (TR 1): Buy the stock index when its current value is higher than the 70-day moving average. If it is lower, then invest in risk-free assets.
- Trading rule 2. (TR 2): Buy the stock index using leverage (double) when its current value is higher than the 70-day moving average. If it is lower, then invest in risk-free assets. The borrowing cost was set at the risk-free rate plus 2%.
- Trading rule 3. (TR 3). Buy the stock index when its current value is higher than the 70-day moving average. If it is lower, then short sell the index and invest the proceeds at the risk-free rate.
- Trading rule 4. (TR 4). Buy risk-free assets when the current value of the index is higher than the 70-day moving average. If it is lower, then short sell the index and invest the proceeds at the risk-free rate.

As an example, let us assume that it is the first trading day of July 2016. On the last trading day of June, the stock index closed at 1776.66. At that time, the 70-day moving average was 1847.57. Thus, the previous value of the index was lower than the moving average. Therefore, the stock index is not bought when all four trading rules are applied. By applying trading rules 1 and 2, the funds available are invested in risk-free assets for one month. However, under trading rules 3 and 4, the stock index is shorted for one month and the proceeds are invested in risk-free assets. Then, this process is repeated on the first trading day in August.

The return from those four trading rules was compared with the market index, which is a passive investment strategy. Those four strategies are similar but at the same time different. They all have in common that decisions are made on the first trading day of the month and are based on the same principle, i.e., whether or not yesterday's stock index value was lower or higher than the 70-day moving average. The first trading rule simply buys the index if it is on an uptrend, i.e., when it is higher than the moving average. If not, the money is invested in risk-free assets, which are short-term Icelandic T-bills. The second trading strategy is based on borrowing and, thus, has an equity ratio (equity/assets) of 50% at the beginning of every month when the index value is higher than the moving average. The third rule applies short selling when the market is lower than the moving average and buying the index when the market is higher. Short selling occurs by borrowing a security that is then sold and returned. When it is returned, it is bought back at the market price. If the value of the security declines, the short seller has earned a profit. However, if the price increases, the short seller has a loss. In this study, the money obtained from short selling and the original equity was invested in the risk-free rate. Finally, the last trading rules are based on short selling the index when it is lower than the moving average and buying risk-free assets if it is higher than the moving average.

If the Icelandic stock market was weak form efficient, those strategies would not yield abnormal returns, which are returns higher than what is expected for a certain amount of risk. In addition, those returns should not be significantly higher than returns from simply holding the market, i.e., buying the market index during the entire period.

5. Results

In table 1, the main results of the study are shown, and greater detail is provided in Appendix 1. As the table and the appendix indicate, all four trading rules provided significantly better returns than the market average. Trading rule 3, which was based on shorting the market when it was in a downtrend (lower than the 70-day moving average) and buying the market

when it was in an uptrend provided the best annual return of 36% on average. The second-best performance was from trading rule 2, which called for buying the index with leverage when the market was in an uptrend and investing in a risk-free asset when the market showed a downtrend. Trading rules 1 and 4 provided similar returns around and a little higher than 20% per year, which is a very good long-term return. The difference between the market index and the trading rules was surprising and large – the lowest difference was 17.9% per year between trading rule 4 and the market index and the highest was 33.9% between trading rule 3 and the market.

When the risk is examined and measured using the standard deviation, the findings indicate that trading rule 1 was the least risky and the only one that was less risky than the market index. This finding is expected because this rule is the one for which the stock market index and risk-free assets were the only possible options, and both have very low standard deviations in their returns. The riskiest strategy was trading rule 4, which has the highest standard deviation, indicating the high risk associated with shorting the Icelandic stock market. Table 1 also shows the Sharpe ratio, and its formula is as follows:

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

where R_p is the average return, R_f is the average risk-free rate and σ_p is the standard deviation of the annual returns. This ratio measures the excess return in relation to the total risk. The higher the Sharpe ratio, the better this measure is of risk-adjusted return. The market index is the worst performer, according to the Sharpe ratio, which is negative and indicates that the average return for the Icelandic stock market was lower than the risk-free rate during this period. Trading rule 1 has the highest Sharpe ratio and, thus, is that best performer with respect to risk-adjusted returns.

Table 1: Average return, standard deviation of returns and Sharpe ratio of the ICEX and four trading rules, from January 1993 to July 2017.

	Market index	TR (1)	TR (2)	TR (3)	TR (4)
Geometric mean	2.1%	22.5%	34.8%	36.0%	20.0%
Standard deviation	33.8%	19.4%	44.5%	73.9%	85.9%
Sharpe ratio	-0.17	0.75	0.60	0.38	0.14

Source: Iceland – NASDAQ

One of the main problems and abnormalities when examining returns and trading rules on the Icelandic stock market is the spectacular decline in 2008 of the market. That year, the market declined by 94.4% and was almost completely decimated – all returns since the market's inception were wiped out. Therefore, 2008 is an outlier and dominates the performance of all trading rules relative to the market average. Therefore, the performance of the four trading rules was compared with the market from 1993 to 2017, with 2008 excluded in that study. In table 2, the results of the four trading rules and the market are compared, excluding 2008. The findings are interesting. Trading rules 1, 2 and 3 all provided significantly better mean returns than the market average. Only trading rule 4 had a worse return. That trading rule was based on shorting the market when in a downtrend, indicating that only shorting the market was not enough to beat its returns if the only other investment option was a risk-free asset. The best performer was trading rule 2, which called for leveraging the market index with borrowings when in an uptrend and higher than the moving average.

A comparison of the strategies' risks showed that two strategies were less risky than the market average – trading rules 1 and 4. These rules were based on investing in risk-free

assets for a considerable length of time, thus yielding lower risk. When the Sharpe ratio was studied, trading rule 3 was the best performer even though it did not have the highest return. The reason was its relatively low risk as measured by its standard deviation and relatively good return.

Table 2: Average return, standard deviation of returns and Sharpe ratio of the ICEX and four trading rules, from January 1993 to July 2017, excluding 2008. .

	Market index	TR (1)	TR (2)	TR (3)	TR (4)
Geometric mean	15.7%	23.2%	37.1%	29.0%	12.3%
Standard deviation	25.8%	19.6%	44.8%	23.8%	16.1%
Sharpe ratio	0.30	0.78	0.65	0.89	0.27

Source: Iceland – NASDAQ

6. Discussion

It is obvious that following these trading rules would have been very profitable relative to the market average. How profitable is demonstrated by the fact that 100 dollars invested in the market index would have resulted in only 168 dollars in July 2017. However, if 100 dollars was invested in the most profitable trading strategy, i.e., trading rule 3, that investment would have increased to approximately 219,000 dollars! However, would it have been possible to execute these trading rules? How often did one have to trade? In addition, were the trading rules profitable when trading costs were included? The answer to the first question is no for trading rules 3 and 4. Short shelling the stock index was normally not available on the Icelandic stock market. The market is small, there are few players in the market, and short selling was never widely available. During certain periods, especially from 2003 to 2007, the market was very active and its leading banks and players made short selling available to institutional clients. However, those years are an exception, making the application of trading rules based on short selling, as in trading rules 3 and 4, impossible or impractical during the entire period covered by this study. In contrast, applying trading rules 1 and 2 was possible during almost the entire period. The only exception was the great market turmoil in the latter half of 2008 and the first months of 2009. During that period, the banking system was more or less non-functional, and borrowing to leverage stock positions was not possible, thus excluding trading rule 2. However, investing according to trading rule 1 was possible during the entire period.

How often did you have to trade when applying the four trading rules? All of the trading rules were based on the same principle: buying or selling at the beginning of the month depending on whether the previous value of the stock index was higher or lower than the 70-day moving average. Doing so requires 58 trades during the entire period, which is on average 2.3 trades per year. The average cost per trade would have been between 0.5% and 1.0%. Thus, at most, the performance of the trading rules would reduce the annual return by 2.3% per year. Considering the vastly superior performance of the trading rules, it is safe to assume that they provided much better returns even when accounting for trading costs.

7. Conclusion

This study shows that the behaviour of the Icelandic stock market has been interesting. There have been long periods of positive returns, during which month after month of returns have been positive, and shorter periods of negative returns. Therefore, trading rules based on following the market trend have been extremely profitable and have beaten the market by a wide margin, even considering trading costs. What are the reasons for this phenomenon? One likely explanation is that few players exist in this small market. Those players are mostly pension funds, a small number of other institutional investors and a number of speculators. Their behaviour has been similar, and they have bought and sold stocks on similar

occasions, which has resulted in long periods of positive returns and shorter periods when the market has declined sharply.

As previously stated, studies in other countries indicated that smaller stock markets are less efficient than larger ones. By all measures, the Icelandic stock market is a small market, and one would expect it to be inefficient. This paper proves the market's lack of efficiency. Therefore, it is fair to assume that the Icelandic stock market has not been weak form efficient.

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Bio-note

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Appendix
Performance of the market index and the four trading rules 1993–2017

	Market index	TR (1)	TR (2)	TR (3)	TR (4)
1993	-12,0%	9,0%	7,9%	31,8%	30,1%
1994	24,9%	24,8%	45,8%	23,6%	3,4%
1995	34,1%	34,1%	65,8%	34,1%	5,1%
1996	59,3%	59,3%	131,9%	59,3%	5,1%
1997	14,7%	41,0%	75,5%	69,7%	28,7%
1998	9,8%	13,9%	18,1%	16,3%	9,5%
1999	47,4%	42,6%	82,0%	36,7%	3,5%
2000	-19,3%	10,4%	8,4%	44,9%	44,9%
2001	-11,2%	19,9%	28,3%	57,3%	45,9%
2002	14,3%	14,6%	18,4%	12,3%	6,0%
2003	56,4%	56,4%	122,4%	56,4%	5,0%
2004	58,9%	61,0%	125,0%	62,5%	6,6%
2005	64,7%	50,7%	100,2%	36,4%	-1,2%
2006	15,8%	35,7%	55,6%	9,6%	6,8%
2007	-1,4%	5,1%	-6,9%	79,2%	52,5%
2008	-94,4%	9,3%	3,6%	381,9%	436,0%
2009	-18,0%	15,0%	13,1%	27,5%	31,8%
2010	14,6%	7,6%	2,2%	0,2%	0,6%
2011	-2,6%	-5,3%	-16,1%	-10,1%	0,1%
2012	16,5%	25,8%	46,1%	34,1%	13,1%
2013	18,9%	16,8%	24,3%	13,4%	3,8%
2014	4,1%	13,6%	18,5%	22,2%	15,1%
2015	43,4%	34,7%	64,9%	25,7%	-0,6%
2016	-9,0%	-3,4%	-13,9%	0,4%	11,4%
2017*	4,8%	4,5%	4,0%	3,7%	2,9%
	Market index	TR (1)	TR (2)	TR (3)	TR (4)
Geometric mean	2,1%	22,5%	34,8%	36,0%	20,0%
Standard deviation	33,8%	19,4%	44,5%	73,9%	85,9%
Sharpe ratio	-0,17	0,75	0,60	0,38	0,14
*to 31. July					