Analysis of Factors Influencing the ETFs Short Sale Level in the US Market

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Abstract
Short sale is a market practise that allows making money if price of instruments go down. There are four hypotheses that explain the motives for short-selling activity and also transaction costs are taking into account. The aim of this paper is to investigate factors that influence the short sale level with ETFs measured with short interest ratio (SIR) in the period 2000 – 2012 in the U.S. market and if main determinants of the short interest change during the time, respectively in a particular sub periods representing pre-, during and post- financial crisis.

Keywords: short sale, short interest ratio, ETFs, determinants, U.S. market, LSDV
JEL codes: G10, G14

1. Introduction

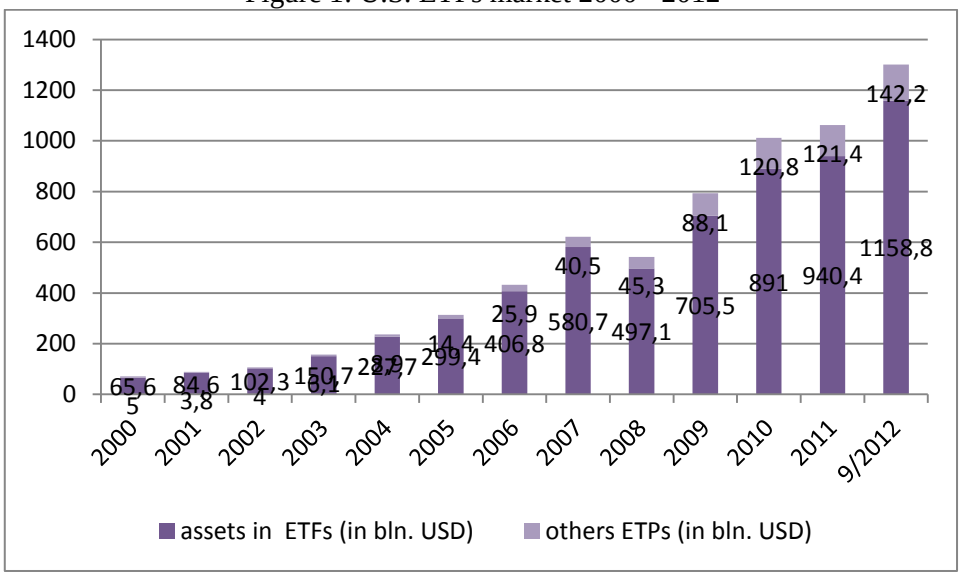
The aim of this paper is investigation of factors that influence the level of short sale measured by short interest ratio (SIR). These factors are chosen to correspond with four hypotheses that explain the motivation of investors for short sale. The impact of transaction costs into SIR is also examined, because they could influence the short sellers' interest about going short. The purpose of this study is to find some characteristics or determinants that influence the level of short sale measured by short interest ratio and investigated how these determinants correspond with mentioned hypotheses or expectation about transaction costs.

An ETF is a specific investment product that was introduced in 1993 when ETFs called SPIDER was issued. ETF is open-end mutual fund that is, compare to these funds, continuously traded on the stock exchange. It also uses the specific creation process base on in-kind mechanism. This product can represent specific market index, sector or the basket of securities. Because of the trading mechanism ETFs are similar to stocks they could be also used for specific trading operations such as buying on margin or short sale.

The short sale is the selling of securities that the subject does not own and only have borrowed it. The short seller is opening its position with selling securities and closing it with repurchasing and returning them to the lender. Going short is more risky operation than going long because the short seller is facing the unlimited loss if the price of securities is, regardless of expectation, increasing. The maximum level of the profit is limited with the current securities price. The short sellers face the same risk as any other investors. But also extra risks must be taken into account – because the borrowed securities must be returned on demand the short seller face so called re-call risk and also short squeeze risk is important. Due to the specific creation process of ETFs, this kind of risk is very low for ETFs.

In the U.S. the ETPs market reached 1,3 trillion USD at the end of 2012 and it is still rising. U.S. ETPs market represents about 70 percent of the world market with more than 3.200 ETPs products. About 89 percentage of this market is represented by ETFs with the growing rate of 30 percentages per year on average (with the exception of 2008). Development of ETPs, resp. ETFs market in the U.S. is reflected in the Figure 1.

Figure 1: U.S. ETPs market 2000 - 2012



Sources: author, data Bloomberg

Short selling of ETFs has become a common means of speculation or hedging in response to pessimistic expectation, at the short interest is more than 10 times than of individual stock, on average (Madura and Ngo. 2008).

The short seller's motivation should be summarized in four hypotheses about short selling (Kot, 2008):

Trend Hypothesis suggests that some investors are trend-traders and selling or short selling securities if their short term past prices are decreasing. According to this hypothesis short sellers close their positions if the stock prices are increasing in the short run period.

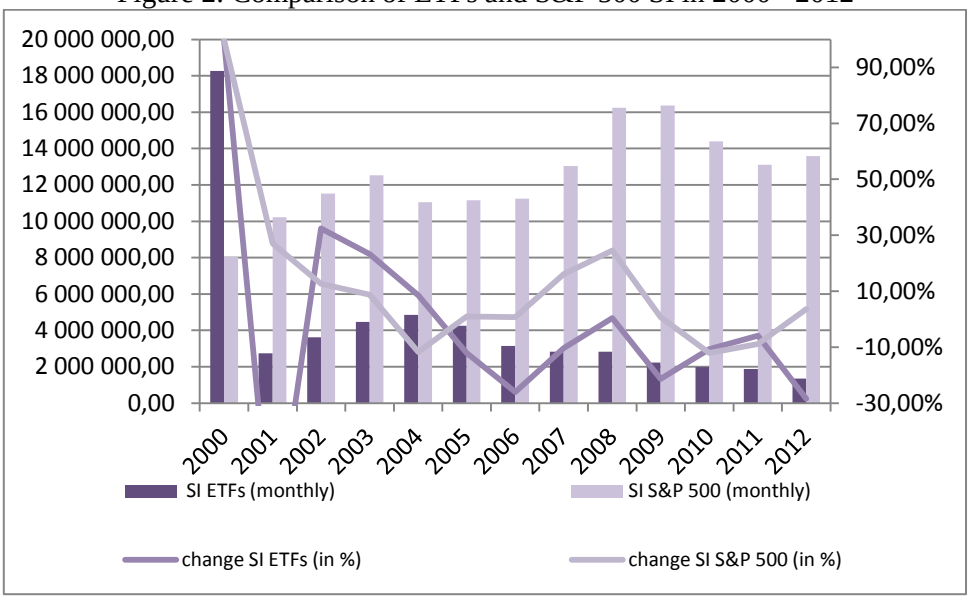
Overpricing hypothesis (also known as Miller's hypothesis) sets that short sellers trade in the situation when there is a poor future perspective of a security. Short sale is a method how to push security prices back to their fundamental values. The securities in a market with restricted short sale or short sale constraints have a tendency to be overpriced because there is an absence of mechanism that returns security prices to their fundamental values. The short sellers trade only if the expected decrease in security prices is enough to compensate all costs and risks of short selling (Diamond and Verrechia, 1987). Thus, the overpricing hypothesis also emphasizes the importance of transaction costs.

Arbitrage and hedging hypothesis stands for investor arbitrage profit because of differential between the security and convertible securities into the same security (Dechow et al., 2001).

The tax hypothesis is based on tax benefits when investor short sales the security while holding a long position in the same security, but does not deliver the security to cover the short position. This action is called short-sale against the box. Adoptions of several tax regulations this opportunity was eliminated (e.g. Taxpayer Relief Act in 1997).

The level of short sell is measured by two variables short interest and short interest ratio. Short interest (SI) reflects the number of securities sold short but not yet returned or closed out. Short interest ratio (SIR) is derived by dividing the short interest by the average daily volume for a stock. SIR reflects the number of days that are necessary for closing out all open short position. In 2000 the short interest of ETFs reached double compare to stocks in S&P 500 index in the U.S. At the same time the average monthly level of ETFs SI was 18,3 million shares (S&P 500 stocks reached 8 million shares on average). Hence, the short sale of ETFs has started decreasing in -11 percentages per year on average. (Figure 2)

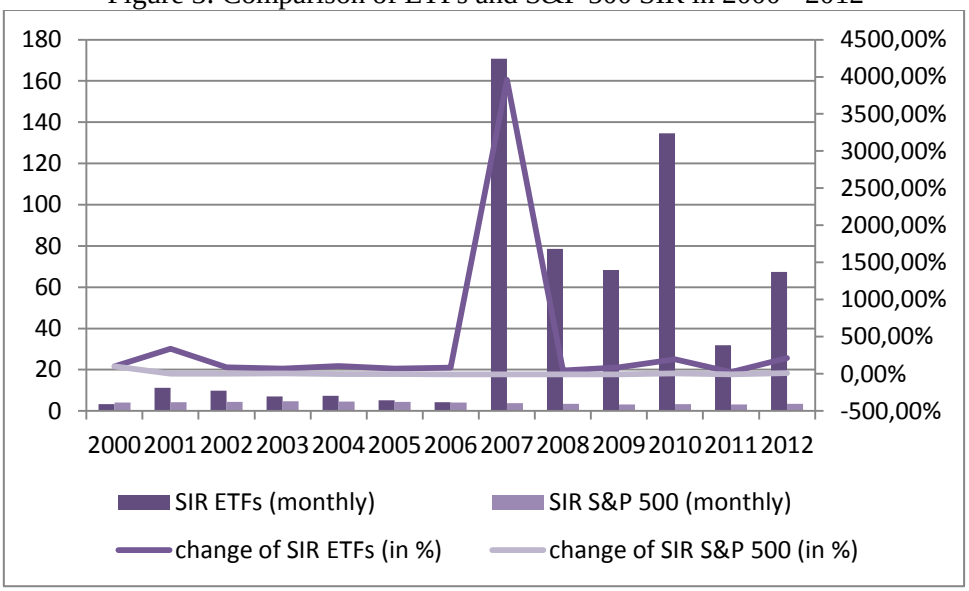
Figure 2: Comparison of ETFs and S&P 500 SI in 2000 - 2012



Sources: author, data Bloomberg

The level of SIR is realized in the Figure 3. Till 2007 the level of the ETFs SIR was reaching 6,9 days on average (at the same time the SIR of S&P 500 stocks were achieving 4,3 days on average). Since 2007 the level of SIR for ETFs is volatile because of the extreme volume of short sale with particular ETFs.

Figure 3: Comparison of ETFs and S&P 500 SIR in 2000 - 2012



Sources: author, data Bloomberg

Brent et al. (1990) investigate the short interest ratio determinants correspond with three above mentioned hypothesis (trend, arbitrage and tax hypothesis). They show that individual stocks with high betas and tradable option have higher level of short interest that is consistent with arbitrage strategy.

Dechow et al. (2001) have amended the hypothesis with problems of transaction costs. They focus the analysis on stock fundamentals and their impact onto short interest ratio. They suggest that stocks with low fundamentals-to-price are more attractive for short sellers. Angel et al. (2001) suggest that short sellers target the most volatile and most active traded stocks. They investigated the short sale on Nasdaq and founded out that short selling is more common for stocks with high returns than stocks with weaker performance (support overpricing hypothesis), that actively traded stocks experience

more short sales than stocks with limited trading (support the importance of trading cost) and that short selling varies with shares price volatility. Kot (2008) analysis the factors to explain all four above mentioned hypothesis with stocks traded in NYSE and Nasdaq in the period 1988 - 2002. This paper represents the most complete view of determinants influencing the short interest level. He refers that short-selling activity is positively related to arbitrage opportunities and hedging demand, also founded out that previous short term return acts as negative factor. McKenzie and Henry (2006) analyze short selling determinants in intraday basin on Hong Kong stock market.

Because ETFs do not represent one stock but the portfolio of stocks they must be investigate in a different way. For example price-to-fundamental characteristics could not be applied. But also some specific factors could be taken into consideration, e.g. replication strategy or expense ratio.

Only study focused on short sale with ETFs not stocks is Madura and Ngo (2008) analyze the ETFs short sale determinants in AMEX in 2001 to 2004. They founded out that short interest is large for sector ETFs and small for international ETFs, short interest is larger for ETFs that have a higher trading volume and for ETFs with low market capitalization and low expense ratio. Short interest is also low for ETFs represent a particular index or have tradable derivative.

Following previous studies the author sets the group of determinants that could affect the level of short interest ratio. These determinants, their expected impact into the SIR level and motivation why these variables were chosen are summarized in the Table 1.

Table 1: Variable characteristics and expected impact on level of SIR

Variable	Expected impact into SIR	Motivation
12M lagged ETFs rate of return	Positive	Overpricing hypothesis
9M lagged ETFs rate of return	Positive	Overpricing hypothesis
6M lagged ETFs rate of return	Positive	Overpricing hypothesis
3M lagged ETFs rate of return	Positive	Overpricing hypothesis
Shares outstanding	Positive Negative	Transaction costs Overpricing hypothesis
Volume of trade	Positive Negative	Transaction costs Overpricing hypothesis
90days volatility	Positive	Overpricing hypothesis
Market capitalization	Positive	Transaction costs
Beta	Positive	Arbitrage and hedging hypothesis
Replication strategy of ETFs: - Full replication - Synthetic replication	 - Positive - Negative	Arbitrage and hedging hypothesis
Focus of ETFs base on market capitalization: - SmallCap - MiddleCap - LargeCap - MultiCap	 - Positive - Negative	Overpricing hypothesis
Expense ratio of ETFs	Negative	Transaction costs
Option available	Negative	Transaction costs
Type of ETFs: - Sector ETFs - Geographical ETFs - Emerging Markets	 - Positive - Positive - Positive	Overpricing hypothesis
Trend: - 2000 – 2006		

- 2007 – 2009 - 2010 - 2012		

Source: author's

Rate of return is calculated from monthly observation with using this formula:

$$r_i = \frac{P_i - P_{i-1}}{P_{i-1}} \quad (1)$$

Then, the rate of the return is lagged about 3, 6, 9 or 12 months to express previous performance of ETFs. These variables were chosen to conform or reject overpricing hypothesis. Number of shares outstanding represents total number of ETFs shares outstanding on monthly observations. This variable was chosen to confirm the role of transaction costs (if the impact is positive) or the overpricing hypothesis (if it is negative). Volume of trade represents the total number of shares traded in a particular month. The impact on SIR should be same as impact of the variable shares outstanding. 90days volatility is measured as a standard deviation ETFs rate of returns base on close prices. This variable is also chosen in the accordance with overpricing hypothesis. Volatile securities have a tendency to be wrongly priced. Market capitalization is measured as ETFs prices multiplied by the number of shares outstanding base on monthly observations. With the increasing market capitalization is expected decreasing of transaction costs. Beta coefficient measure the relation of ETFs to represented index and it is chosen to confirm hypothesis of arbitrage and hedging. Replication strategy describe the manner how ETFs mimic an underlying index. The full replication strategy perfectly correspond with the underlying index, using synthetic replication strategy could lead to discrepancies. The perfect tracking of underlying is essential for using ETFs for hedging or arbitrage. Focusing of ETFs on market capitalization distinguish between SmallCap investing in common stocks of companies with market capitalization at most 1,5 billion USD, MidCap represents investing in common stock of companies with turnover from 1,5 to 8 billion USD and LargeCap investing in commons stock of companies with market capitalization over 8 billion USD. MultiCap represents ETFs investing in mixture of capitalizations. It is expected overpricing in the sector of SmallCap ETFs and thus positive impact on SIR (and negative impact of LargeCap ETFs where the probability of overpricing is lower). Expense ratio is aggregate variable measure the expensiveness of ETFs represents operational costs of ETFs. This variable is chosen because of investigation of transaction costs impact on SIR. This is set in percentage and calculated as operational costs to average asset value of ETFs. If option with the same underlying as the underlying of ETFs exists, thus this option is consider being the cheaper substitute of the ETFs short sale. Impact of this kind of option on SIR is expected negative. Type of ETFs characterizes the prevailing investment strategy of ETFs. In the case of sector ETFs, geographical ETFs and Emerging Markets ETFs the overpricing could be expected because these ETFs could not be as diversified as e.g. index ETFs. Trend controls how the impact of variables varies over the time in different economic periods.

2. Model and data

The initial sample reflects all ETFs listed on NYSE Arca, Nasdaq and BATS during the period January 2000 to December 2012. There were a total of 1.324 ETFs. Total dataset is based on 206.388 monthly observations and it is gained from Bloomberg.

The analyzed periods reflect a different economical and financial condition. The period 2000 – 2006 is a term of economic growth that came out with the bankrupt of Lehman Brothers. The first years of 2000s were weak because of uncertainty following September 2001 crisis and fraud cases of corporation but the economy of U.S. improve during 2003 and was generally stable till the end of this sub period. The interval 2007 – 2008 represents financial market uncertainty, real estate bubble and the epoch of sub-prime crisis that passed into to world financial crisis. The last period 2009 – 2012 represent first years of slight world economy recovery.

Descriptive statistics of variable is introduced in the Table 2. The SIR monthly average is 3,05 days and only in pre-crisis period has exceed this level significantly and reached 6,5 days. The average level of 90days volatility is 27 percentages but this result is skewed because of financial crisis period

when the volatility highly increase to 35,4 percentage. The market capitalization of ETFs is over 1.000 million USD in the average and decreased under this level only during the period of financial crisis. The mean of trading volume is 29,1 million ETFs shares per months on average. Only during the period of the financial crisis reached more than 41,2 million shares on average. Thus, it correspond with higher level of volatility in that period.

Table 1: Descriptive Statistics for U.S. market 2000 – 2012, monthly observation

Period/Variable	**2000 – 2012**	**2000 – 2006**	**2007 – 2009**	**2010 - 2012**
SIR				
Mean	3,05	6,5	2,347	2,578
Median	1,02	3,43	0,810	0,930
Standard deviation	41,01e+01	1,14e+01	8,62e+00	1,017e+01
Shares outstanding (*in mln.*)				
Mean	20,8	25,41	20,17	19,748
Median	2,85	4,45	2,75	2,40
Standard deviation	7,15e+01	8,11e+01	6,72e+02	7,073e+01
Volatility (*in %*)				
Mean	27,00	19,22	35,398	23,019
Median	21,66	16,49	27,258	20,327
Standard deviation	2,04e+01	9,96e+00	2,62e+01	1,54e+01
Market capitalization (*in mln.*)				
Mean	1.054,3	1.320,27	979,87	1.009,27
Median	105,13	150,63	105,69	83,20
Standard deviation	4,5e+03	4,65e+03	4,15e+03	4,65e+03
Beta				
Mean	0,91	1,07	0,908	0,876
Median	1,02	1,02	1,023	1,024
Standard deviation	7,01e-01	5,1e-01	6,85e-01	7,51e-01
Volume (*in mln.*)				
Mean	29,06	28,59	41,6	20,66
Median	0,7496	1,242	0,8537	0,5335
Standard deviation	2,23e+02	1,78e+02	3,12e+02	1,56e+02

Source: author's calculations in R, data Bloomberg

For the investigation of determinants is applied LSDV model. The basic regression equation is following:

$$sir = \beta_1 lag.rate12 + \beta_2 sh.out + \beta_3\, volatility + \beta_4 mk.cap + \beta_5 beta + \beta_6 volume + +\beta_7 lag.rate3 + \beta_8 lag.rate6 + \beta_9 lag.rate9 + \beta_{10} repli.der + \beta_{11} repli.full + \beta_{12} focus.Lcap + \beta_{13} focus.Scap + \beta_{14} focus.Midcap + \beta_{15} focus.Multicap + \beta_{16} Expanse.ratio + \beta_{17} Option + \beta_{18} Sector + \beta_{19} Geo + \beta_{20} Emerging + \lambda_1 D1_t + \lambda_2 D2_t + \lambda_3 D3_t + \cdots \lambda_{13} D13_t + \upsilon_{it} \quad (2)$$

Where *D*1, for example, denotes a dummy variable that takes the value 1 for the first year of analysis and zero elsewhere, and so on.

Residuals can be tested for homoscedasticity using the Breusch–Pagan test. Multicollinearity is detected by calculation of GVIF factors, if variables have a GVIF around or greater than 5 one of them is removed from the regression model.

Results of LSDV model are reported in Table 3. The coefficient of determination is significant for analyses period and particular sub-periods. The highest level this coefficient is reached in the sub-period 2000 – 2006 when the model determinate 33,8, resp. 33,5 changes in the level of SIR. In the period of the financial crisis the determination coefficient has declined to 12,2, resp. 12,06 percentage.

After the crisis it has reached the level of 16,0, resp. 15,9 percentage. Results also demonstrate the individual effect of particular years (except 2000) on the level of SIR. The highest level of SIR was in 2002, when, if other factors held zero, it reaches 9,7 days, contrary in 2001 it was only 1,1 day. There also exists significance difference between individual effects of years in particular sub periods. This effect is strongest in the period 2000 – 2006, but in the further periods it is decreasing.

Table 2: Results of LSDV model

Period	**2000 - 2012**	**2000 - 2006**	**2007 - 2009**	**2010 - 2012**
Number of observations:	206.388	111.132	47.628	42.628
Variables:				
lag.rate,12	-1,051e-01 (4,003e-01)	1,2924e+00 (2,2508e+00)	8,472e-02 (8,415e-01)	-2,567e-01 (3,759e-01)
sh.out	-4,355e-03*** (6,696e-04)	-3,5056e-03 (2,3672e-03)	-3,091e-03** (1,378e-03)	-3,022e-03*** (7,461e-04)
volatility	-1,171e-02*** (2,178e-03)	-1,5438e-01*** (2,2708e-02)	-1,243e-02*** (3,131e-03)	-1,184e-02*** (3,284e-03)
mk.cap	9,912e-06 (1,069e-05)	-1,1332e-04*** (3,6648e-05)	1,601e-05 (2,271e-05)	1,618e-05 (1,182e-05)
beta	2,002e-01*** (5,604e-02)	3,0378e+00*** (4,6272e-01)	3,190e-01** (1,294e-01)	1,100e-01** (5,199e-02)
volume	-1,271e-10 (1,604e-10)	-2,0812e-09 * (9,3725e-10)	-2,375e-11 (2,397e-10)	1,988e-10 (2,459e-10)
lag.rate3	-7,325e-01* (4,327e-01)	2,3687e-01 (2,5115e+00)	-3,948e-01 (7,831e-01)	-2,324e-01 (4,987e-01)
lag.rate6	-4,276e-01 (4,129e-01)	1,7593e+00 (2,3766e+00)	-8,045e-01 (6,787e-01)	-3,048e-01 (4,150e-01)
lag.rate9	2,628e-01 (4,142e-01)	-2,3382e+00 (2,3377e+00)	1,746e+00** (7,666e-01)	-2,046e-01 (4,282e-01)
repli.der	1,820e-01 (1,556e-01)	-	7,182e-02 (3,138e-01)	-
repli.full	3,884e-01*** (8,255e-02)	-3,6552e-01 (3,2078e-01)	7,222e-01*** (1,670e-01)	4,304e-01*** (8,580e-02)
focus.Lcap	4,015e-01*** (1,021e-01)	1,3507e+00 ** (4,1549e-0)	-3,752e-01* (1,980e-01)	-1,015e-01 (1,124e-01)
focus.Scap	-3,529e-02 1,209e-01)	-1,6493e+00 ** (5,5840e-01)	-1,120e-01 (2,416e-01)	3,399e-01*** (1,256e-01)
focus.Midcap	1,766e-01 (1,461e-01)	1,3423e+00 * 6,0903e-01)	-7,113e-01** (2,796e-01)	6,638e-02 (1,582e-01)
focus.Multicap	6,380e-01 *** (1,521e-01)	5,0903e-01 (5,1414e-01)	3,293e-01 (3,007e-01)	4,226e-01** (1,760e-01)
expense.ratio	-7,176e-01 *** (1,739e-01)	-5,2008e+00*** (1,2034e+00)	-2,357e-01 (3,352e-01)	-4,369e-01** (1,709e-01)
option	-1,004e-01 (7,029e-02)	-4,7673e-01 (3,1633e-01)	-5,686e-01*** (1,378e-01)	2,362e-01*** (7,322e-02)
sector	1,260e+00*** (8,624e-02)	1,1206e+00 ** (4,1554e-01)	1,393e+00*** (1,706e-01)	1,331e+00*** (9,012e-02)
geo	-5,903e-02 (1,002e-01)	-2,7233e-01 (4,8030e-01)	7,283e-02 (2,057e-01)	4,058e-01*** (1,056e-01)
emerging	2,287e-01 (2,233e-01)	-1,7192e-01 (1,7542e+00)	8,648e-03 (4,904e-01)	3,962e-01* (2,078e-01)
factor(year)2000	-	-	-	-

factor(year)2001	1,183e+01*** (3,667e-01)	1,6347e+01 *** (9,1908e-01)	-	-
factor(year)2002	9,665e+00*** (2,782e-01)	1,3929e+01 *** (8,4820e-01)	-	-
factor(year)2003	6,556e+00 *** (2,442e-01)	9,3689e+00*** (7,6589e-01)	-	-
factor(year)2004	7,516e+00*** (2,298e-01)	9,7110e+00 *** (7,2615e-01)	-	-
factor(year)2005	5,078e+00*** (2,112e-01)	6,5825e+00 *** (7,0772e-01)	-	-
factor(year)2006	4,440e+00*** (1,943e-01	6,0380e+00 *** (7,0988e-01)	-	-
factor(year)2007	4,084e+00 *** (1,798e-01)	-	3,896e+00*** (2,934e-01)	-
factor(year)2008	1,852e+00 *** (1,626e-01)	-	1,677e+00*** (2,749e-01)	-
factor(year)2009	1,600e+00 *** (1,491e-01)	-	1,424e+00*** (2,636e-01)	-
factor(year)2010	1,570e+00 *** (1,375e-01)	-	-	1,196e+00*** (1,216e-01)
factor(year)2011	1,592e+00 *** (1,333e-01)	-	-	1,336e+00*** (1,179e-01)
factor(year)2012	1,731e+00 *** (1,326e-01)	-	-	-
	R^2 = 0,1963 Adj. R^2 = 0,1958 p-value < 2,2e-16	R^2 = 0,3378 Adj. R^2 = 0,3355 p-value < 2,2e-16	R^2 = 0,1222 Adj. R^2 = 0,1207 p-value < 2,2e-16	R^2 = 0,1598 Adj. R^2 = 0,1588 p-value <2,2e-16
Standard errors are reported in parentheses *,**,*** indicates significance at the 90%, 95% and 99% level, respectively				

Source: author's calculations in R, data Bloomberg

The most important factors with negative affect on the SIR level are following: shares outstanding (*sh.out*), volatility (*volatility*) and expense ratio (*expense.ratio*). The positive affect was investigated about beta coefficient (*beta*), replication strategy based on full replication (*repli.full*) and focusing of ETFs on a sector stocks (*sector*). On the other hand the previous performance of ETFs almost does not influence short sellers's decisions. Also the results for significance of ETFs characteristics are mixture (was founded significance of e.g. market capitalization, or existence of an option but only for a particular period not for the periods as a whole).¨

The most negatively powerful factor is expense ratio that is statistically significant to 3 out of 4 periods. The increase of this variable per unit (1 p.p.) leads to decrease of SIR about 0,72 day on average if other factors held constant. In the pre-crisis period it contribute to decrease of the SIR level about 0,52 day but this affect disappeared during the financial crisis. It has recovered after the crisis with negative affect on SIR in the value 0,43 day per unit (ceteris paribus). This finding confirms the expectation about the negative influence of transaction costs on SIR.

The volatility is negative and statistically significant in all analysis periods. The strongest this factor influences the SIR level in pre-crisis period when increase of volatility about 1 p.p. leads to decreasing the SIR level about 0,15 day (ceteris paribus). In the next periods its affect was lower about a 0,12 day on average. This is against expectation of positive affect of volatility on SIR because of higher probability of overpricing. But the result assumes that the volatility reflects more likely uncertainty and thus investors do not going short.

Shares outstanding reduces the SIR level about a 0,0044 day per unit on average. This factor is statistically significant to 3 out of 4 periods. It corresponds with expectation about transaction costs of ETFs rather than overpricing.

The beta coefficient is statistically significant for all 4 periods. It leads to increase of SIR about a 0,20 day per unit on average. This variable is most powerful in the pre-crisis period where it increases the level SIR about 3,0 days per unit. In the next periods is the effect of this variable weaker. This finding is consistent with arbitrage and hedging hypothesis.

Further, positively affecting variables of SIR are dummies characterized the ETFs. Repli.full variable determines the replication strategy of ETFs and indicates that for ETFs applying full replication strategy is the level of SIR higher about a 0,39 day on average. The impact of this variable is forcing in the crisis period. It is according to arbitrage and hedging hypothesis where precarious tracking of underlying is crucial.

The variable sector determines ETFs based on particular sectors not broad base index. These ETFs reach the SIR level higher about a 1,3 day on average. The most significant is the impact of his factor in the crisis period. In this period increases the SIR level about a 1,4 day. This finding agrees with overpricing hypothesis.

3. Conclusion

The aim of this paper was the investigation of factors that influence the level of SIR in the U.S. market in the period 2000 – 2012. This period was, because of a different economic condition, divided into tree subsections that correspond with pre -, during and post-crisis sub periods. The factors were chosen in conformity with 4 hypotheses and also the importance of transaction costs was taken into account. These determinants were investigated using LSDV model. According to results the factors influencing the SIR level are long term stable and only the power of their impact on the SIR level is changing during the analyzed period, resp. sub periods. As factors with negative impact were founded out expense ratio that corresponds with expectation about the transaction costs, volatility that is against overpricing hypothesis and shares outstanding. Using the model statistical significance of individual years was confirmed. The negative affect of volatility could be explained by uncertainty that investors concerned more. The negative affect of share outstanding supports the overpricing hypothesis but at the same moment it is against expectation about the action of transaction costs. Positive impact of variables beta, replication strategy - full and sector ETFs correspond with expectation about arbitrage and hedging hypothesis, resp. overpricing hypothesis.

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