Analysis of Short Sale Determinants along Particular NASDAQ Sectors

Dagmar Linnertová
Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipova 41a
Brno, 60200
Czech Republic
e-mail: dagmar.linnertova@mail.muni.cz

Abstract
The aim of this paper is to test hypotheses of the short-sale trading and to analyze short sale determinants along particular sectors of NASDAQ index. The analysis is carried out for firm-specific variables and market characteristics of blue chips traded on NASDAQ in the period 2000 – 2014. The panel regression is applied to investigate whether determinants are long term stable of vary within particular sectors. The analysis also uncovers the stability of these determinants in short and long run. The results are compared and findings about attractiveness of particular stocks for short sale are suggested.

Keywords blue chips, short sales, NASDAQ, determinants, panel regression
JEL codes: G10, G14,

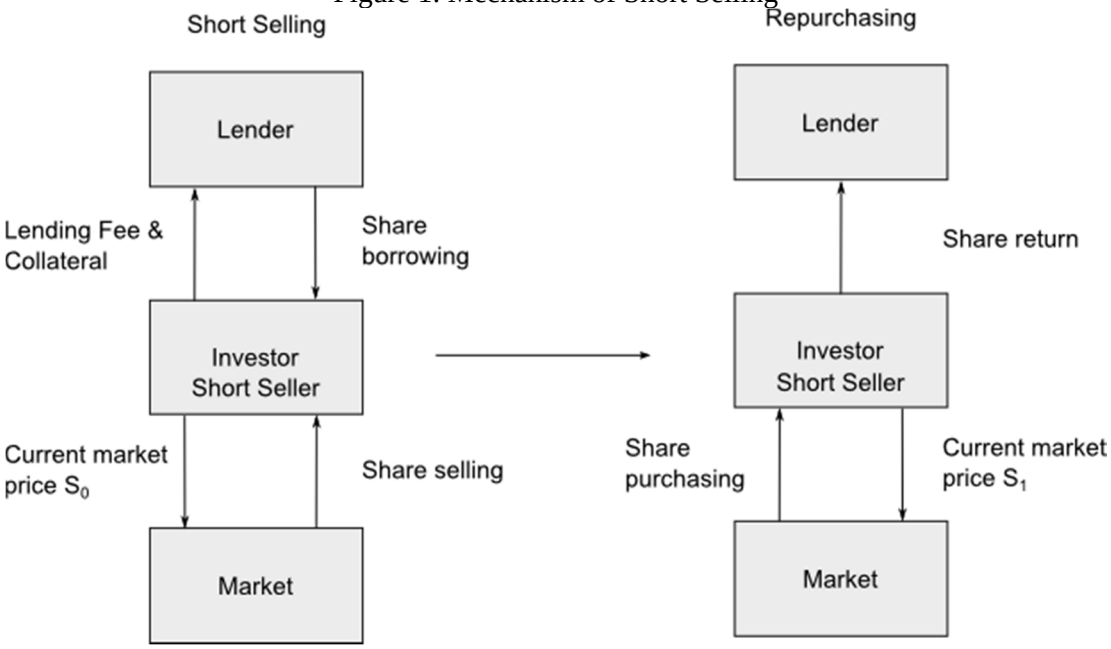
1. Introduction

Short selling becomes important market mechanism in the field of theoretical and practical finance. In the last 20 years there is significant increase of short selling activity in the market, in the NYSE and the NASDAQ in the period from 1988 to 2002, the annual growth rate of short interest was more than 20 percent per year. And in recent years there is also number of studies on short selling activity and its motivation and impact of short sale restriction and relaxation on markets.
The motivation of this paper is to test of main hypotheses of the short-sale trading within U.S. market sectors in the period 2000 – 2014 and to introduce the comprehensive analysis of determinants of the short interest ratio in the NASDAQ. The aim of the study is to provide an empirical assessment of the short sale determinants on NASDAQ and within sectors. The research is targeted into following three areas: Which factors affect the short interest level? What is a contribution of particular factors to short interest level? Are there any differences between determinants for the market as a whole and these for industries? The motivation for this research is the lack of research that is focused on the sectors not the market as a whole and whether the determinants vary within sectors or are stable.

2. Mechanism of Short Selling and Recent Literature Review

The short sale is a market mechanism that allows to capitalize overpricing of securities or to participate in a decreasing market. According to financial theory the short sale is a sale of a stock that a particular market subject does not own in the time of a transaction, but has borrowed it from a lender that may be represented by a large institutional investor, brokerage house or a broker-dealer. A short seller opens his position by selling of borrowed securities and closes his position by purchasing securities back and returning them to a lender. Short selling mechanism is described in the Figure 1.

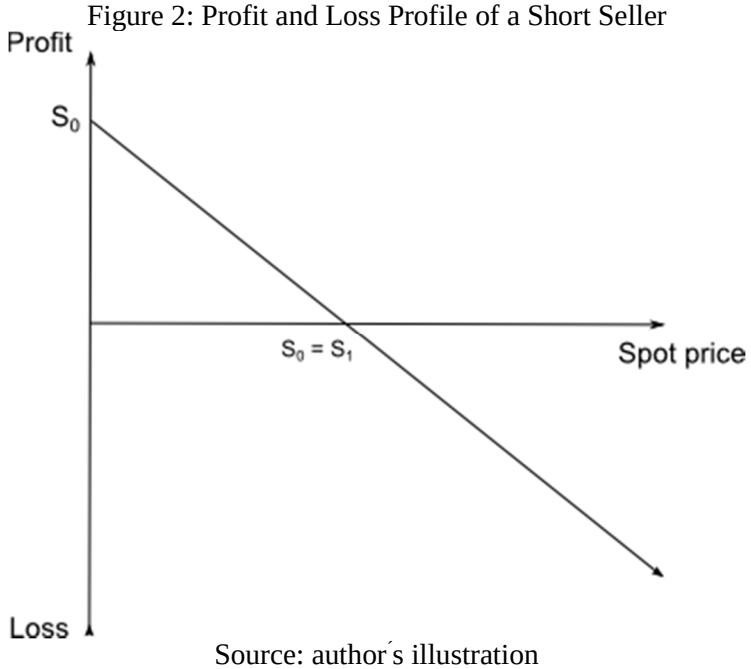
Figure 1: Mechanism of Short Selling



Source: author´s illustration

A short sale is more risky operation than to be in long position. The maximum gain of a short seller is the sale price (S_0) of the stock at the time t = 0 if the stock price falls at zero at the time t = 1. The loss is unlimited if the stock price rises (Figure 2).

Figure 2: Profit and Loss Profile of a Short Seller



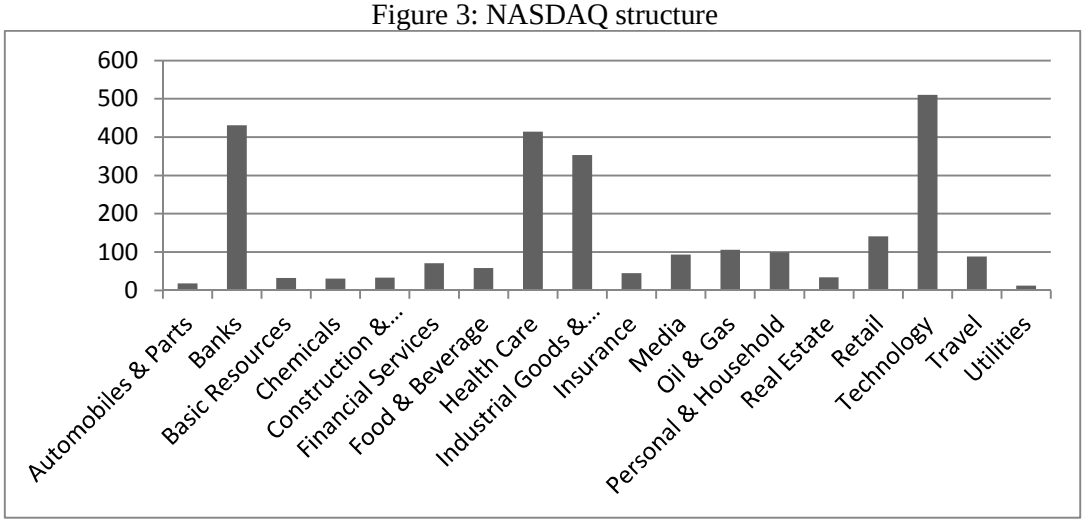
Source: author´s illustration

In U.S. the short sale was making more difficult because of the adoption of so called uptick rule that went into effect in 1938 and was removed in 2007. In 2009, the reintroduction of the uptick rule was widely debated, and proposals for a form of its reintroduction by the SEC. A modified form of the rule was adopted in 2010.

Despite all attempts for short selling limitations it level has increased significantly over the last two decades. Short interest grew by 15% on the NZSE/ Amex and 16% on the NASDAQ annually from 1988 to 2011 (Kot, 2014). The short interest ratio has also increased sharply. The median SIR on the NYSE was 0.84% in January 1988 and 4,61% in December 2011. Stock prices are more accurate when short sellers are more active and market quality decrease when short selling is banned (Boehmer and Wu, 2013; Jones and Zhang, 2013).

The aim of this paper is to examine short sale determinants in NASDAQ along market sectors and compare the results with those for the market as a whole. The structure of NASDAQ is demonstrated in the Figure 3.

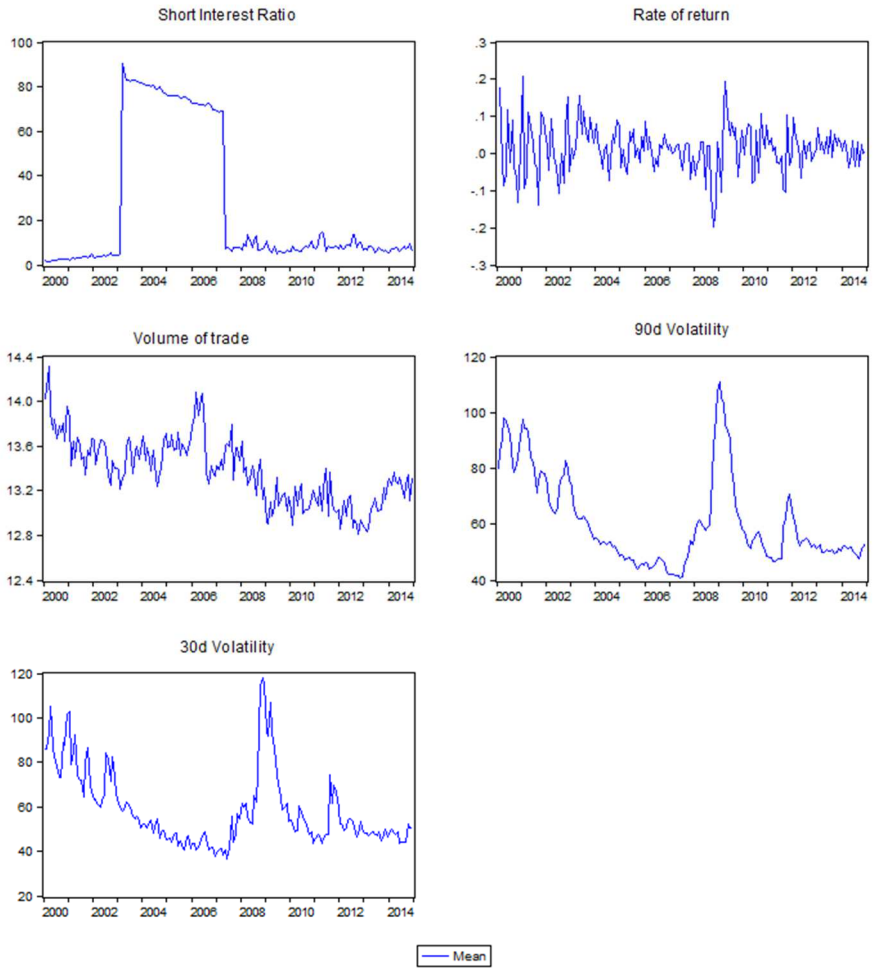
Figure 3: NASDAQ structure



Source: author's chart

In the Figure 4 are demonstrated results of main determinants performance for the NASDAQ stocks (2.607 stocks were analyzed). Short interest ratio has reached its peak in 2002 with SIR more than 80 days. As sharply as SIR increased in the period 2002 – 2006 as rapidly it decreased in the mid of 2007. This period was leading to rising uncertainty in the market as a whole and it can be observed in variables of rate of return and volatility respectively. Although SIR significantly decreased its current level is still over its period prior to financial crisis.

Figure 4: Variables Performance



Source: author's charts in EViews

The motivations of investors for short selling are summarized in four hypotheses – Trend Hypothesis, Overpricing Hypothesis, Arbitrage Hypothesis and Taxation Hypothesis with minority importance. There exists number of studies on short selling in recent years. An examination of overpricing hypothesis as a reason for short sale can be found in following studies: Dechow, et al. (2001), Desai et al. (2002). Boehme et al. (2005) and Asquith et al. (2005) investigate relation between short sale restriction and stock prices. Trend Hypothesis as a motivation for short sale is investigated e.g. by Jagadeesh and Titman (1993), with Arbitrage Hypothesis deal Brent et al. (1990) or Arnold et al. (2005).

Trend Hypothesis (1) (also known as Following the Trend Hypothesis) according that short sellers close their positions if the stock prices have been increasing in the past short term. Jagadeesh and Titman (1993) demonstrate that the stocks with high (low) rate of returns at the horizon from 3 to 12 months are repeating this high (low) rate of return at the horizon of next 3 to 12 months. Overpricing hypothesis (2) that expects that investors have inside information and if they expect that the stock is overprice the short selling is a way how to capitalize it. Diamond and Verreichia (1987) point out that short sale is an expensive transaction and short sellers trade only if they expect that the price will significantly decrease as a compensation for this costs and risks. Dechow et al. (2001) emphasize the relation between low level of fundamentals factors and a level of short selling.The aim of these studies is to analyze the information contents of short selling and suggest trading strategies based on information intercorporate in short selling Arbitrage Hypothesis (3) argues that short sellers participate in overpricing between a stock and convertible security. High correlation between an instrument and instrument that is going short is demanded. And (4) Taxation Hypothesis that has only

limited impact on short interest nowadays because of elimination of opportunity to defer capital gain tax if investor shorting securities. (Arnold et al., 2005). As the main authors that deals with short selling determinants may be referred Brent et al. (1990), Dechow et al. (2001), Angel et al. (2003), Desai et al.(2002) or Kot (2007). Brent et al. (1990) analyze short selling motivation based on three above mentioned hypotheses. They find that short interest follows a seasonal pattern that is weakly consistent with tax hypothesis. Further stocks with high betas and the existence of convertible securities or options tend to have higher level of short interest. This supports arbitrage motivation of short sale. The list of analyzed determinants is summarized in the Table 1.

Table 1: Brent et al. Analyzed Short Selling Determinants

Analyzed determinant	Expected impact on short sale interest	Motivation/ Hypothesis
Average market value of shares during year proxy for firm size	Unknown	Transactions costs
Average coefficient of variation of analyst forecast of the next annual earnings during year	Unknown	Speculation
Systematic risk (beta)	Positive	Arbitrage and hedging hypothesis
Prior year's average monthly return	Unknown	Speculation
Dummy for convertible security existence	Positive	Arbitrage and hedging hypothesis
Dummy for option existence	Positive if arbitrage reasons or negative if substitute to short sale	Arbitrage or Speculation

Source: author's summary based on Brent et al. (1990)

Dechow et al. (2001) document that short sellers open positions in stock of firms with low ratios of fundamentals (like earnings or book value) to market value and close their positions at the ratios mean-revert. They also point out the importance of transactions costs in decision making process of short sellers. Angel et al. (2003) examine the frequency of short selling in stocks listed in NASDAQ and analyzed stock characteristics. They get that short sale is more common among stocks with high returns than stocks with weaker performance and further actively traded stocks are more shorted. Short selling also depends directly and positively on stock price volatility. Desai et al. (2002) examines the relationship between the level of short interest and stock return on the NASDAQ. They find out that heavily shorted stocks experience significant negative abnormal returns with the respect to the market, size, book-to-market and momentum factors. The higher level of short interest is a stronger bearish signal. Kot (2007) finds that short-selling activity is positively related to arbitrage opportunities and hedging demand, and negatively related to previous short-term returns. Linnertova and Deev (2014) analyzed short selling activity with ETFs because ETFs short interest is 10 times higher than short interest with common stocks. Recent analysis of short sale is focused on repeated analysis of short sale constraints. This topic became important during the financial crisis when particular governments reaccepted short sale limitations that have been relaxing during last 20 years. For example Mohamand et al. (2015) investigate the ban on the short-selling of specified financial-sector stocks in September 2008 introduced by The UK's Financial Services Authority. Grullon et al. (2015) investigate impact of Regulation SHO that relaxes short-selling constraints on a random sample of U.S. stocks to test whether capital market frictions have an effect on stock prices and corporate decisions. Hasan (2015) investigates whether such selling activity before the 2008 short ban reflected financial companies' risk exposure in the subprime crisis. Duong et al. (2015) examine the impact of a market-wide mandatory disclosure policy on short selling on the Tokyo Stock Exchange.

Based on previous literature analysis the determinants of short sale are separated into two categories – market specific and fundamentals-to-price, their definitions and expected impact on short sale level is stated in Table 2. Data was gathered from Bloomberg and full sample consists of 171.506 monthly observations.

Table 2: Examined Variables

Variable	Abbreviation	Definition	Expected effect	Motivation
Short interest ratio	SIR	Average number of days for closing all open short sale positions	-	-
Volume of trade (logarithm)	LOGVOLUME	The total quantity of shares bought and sold during a particular period.	Positive/ Negative	Transactions costs/ Overpricing hypothesis
Volatility	VOL	A measure of the risk of price moves for security calculated from the standard deviation	Positive	Overpricing hypothesis
Beta coefficient	BETA	The systematic risk	Positive	Arbitrage and Hedging Hypothesis
Price-to-Book-Value	PBV	A ratio used to compare a stock's market value to its book value. Low value might indicate undervaluation of a stock.	Positive	Overpricing hypothesis
Price-to-Earnings	PE	A valuation ratio of a company's current share price compared to its per-share earnings.	Positive	Overpricing hypothesis
Price-to-Sales	PS	A valuation ratio that compares a company's stock price to its revenues.	Positive	Overpricing hypothesis
Price-to-Free-Cash-Flow	PFCF	A valuation metric that compares a company's market price to its level of annual free cash flow.	Positive	Overpricing hypothesis
Rate of Return	RATE	The gain or loss on an investment over a specified period, on the monthly basis.	Positive	Trend hypothesis

Source: Author's summary

1.1 Model and Data

In the paper the cross-sectional panel regression is applied. Consider the multiple linear regression model for individual $i = 1,\ldots, N$ that is observed at several time period $t = 1, \ldots, T$.

$$y_{it} = \alpha_i + x'_{it}\beta + z'_i\gamma + c_i + u_{it} \quad (1)$$

where yit is the dependent variable, x'_{it} is a K- dimensional row vector of time-varying explanatory variables and $z'_i\gamma$ is a M-dimensional row vector of time-invariant explanatory variables excluding the constant, α is the intercept, β is a K-dimensional column vector of parameters, γ is a M-dimensional columns of vector of parameters, c_i is a individual-specific effect and u_{it} is an idiosyncratic error term. We assume the balanced panel that each individual i is observed in all time periods t. There are two basic models for the analysis of panel data, the fixed effect model and the random effect model. For the fixed effects model, the individual-specific effect is a random variable that is allowed to be

correlated with the explanatory variables, in the random effects model is random variable uncorrelated with explanatory variables.

In a fixed effects model is included an individual-specific intercept in the model (1). In this case, the model is written as:

$$y_{it} = \alpha_i + x'_{it}\beta + u_{it}, \quad u_{it} \sim IDD(0, \sigma_u^2) \tag{2}$$

where α_i (i = 1, . . ., N) are fixed unknown constants that are estimated along with β, and where u_{it} is typically assumed to be i.i.d. over individuals and time. To decide between fixed or random effect the Hausman test was run where null hypothesis is that the preferred model is random vs. alternative the fixed effects. The Hausman test statistic is computed as:

$$\xi_H = \left(\hat{\beta}_{FE} - \hat{\beta}_{RE}\right)'\left[\widehat{V}\{\hat{\beta}_{FE}\} - \widehat{V}\{\hat{\beta}_{RE}\}\right]^{-1}\left(\hat{\beta}_{FE} - \hat{\beta}_{RE}\right) \tag{3}$$

where the $\widehat{Vs}$ denote estimates of the true covariance matrices. Under the null hypothesis, which implicitlz says that plim$\left(\hat{\beta}_{FE} - \hat{\beta}_{RE}\right)$=0, the statistic ξ_H has an asymptotic Chi-squared distribution with K degrees of freedom, where K is the number of elements in β. Based on Hausman test result the fixed effect model was chosen for further analysis. As a dependent variable in fixed effect model is chosen short interest ratio and the explanatory variables are represented by a market specific and fundamentals to price variables. Muticolinearity was checked by correlation matrix.

3. Results and discussion

In the Table 3 are demonstrated main results for panel regression of the whole data set. The coefficient of determination is very weak, statistically significant results for the market category are represented by beta coefficient; rate of return and 30days volatility but their impact on the SIR is low. All variables from firm-specific category are significant. The average SIR for the period 2000 – 2014 is 22,4 days. The strongest effect was measured by beta coefficient but its effect is against the expectation. The volatility of stocks lowers the exploitation of stocks for short sale. Thus, this can implicate that investors are unwilling to open short position if they are not sure about the further performance of securities. This finding corresponds with Jagadeesh and Titman. Further, all firm-specific variables are statistically significant. The results for full dataset are different if we compare them with results for individual sectors and mostly against the theoretical background.

Table 3: Results for NASDAQ

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	22,4	1,5645	143,40	0,0000
Beta	-0,002***	0,0003	-8,20	0,0000
Rate of return	0,001*	0,0000	1,70	0,0884
Volume	0,001	0,0000	0,58	0,5614
30d Volatility	-0,004*	0,0024	-1,73	0,0837
90d Volatility	-0,003	0,0024	-1,33	0,1827
P/E ratio	0,0008***	0,0002	3,43	0,006
P/BV ratio	0,0009***	0,0002	-3,89	0,0001
P/S ratio	-0,0009***	0,0002	-4,05	0,001
P/FCF ratio	-0,001**	0,000	-1,90	0,0586
Coefficient of determination: 0,042 Number of observations: 171.506 *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively				

Source: author's calculation

Table 4 a,b,c in Appendix demonstrates results of panel regression for particular subsectors. The results of this analysis are mixed. The coefficient of determination varies from 0,027 to 0,481. This method was able to quite sufficiently explain the short sale determinants in the sectors of construction & materials, oil & gas and utilities. These sectors represent these with the lowest average level of short sale (approximately 7 days). The average of short interest is from 4,6 to 28,4 days.

Results of panel regression for market variable are following beta coefficient is mostly positive and significant. The investors are looking for close relation between the market and a stock. The performance of stocks has also positive impact on SIR. Although the absolute importance these variable for short sale is low. The volume of trade positively influences SIR it means that investors take transaction costs into consideration because the actively traded stocks are cheaper for short sale. At the same moment the short squeeze risk is limited because these stocks can be easily returned back on demand. The findings for impact of 30days volatility are mixed the volatility plays for both probability of overpricing and risk. The outcomes also indicate the decreasing importance of volatility. The 90days volatility is important only in rare sectors and its power is low.

The consequences for firm-specific variable are mixed. The variable of P/E indicates that short seller short stocks with high P/E ratio it means stocks in which the effect of overpricing can be probable. The other variable such as P/BV, P/S and P/BV do not indicate any significant importance. Based on the panel regression the results for the NASDAQ market are very weak but situation change when the market is separated into sub sectors. The short sellers are looking for over-valuated securities with higher beta coefficient. The investors also deal with liquidity and more tradeable securities are demanded. The volatility is important only on 30days basis and has positive relation to the level of Sir as a whole.

4. Conclusion

Short selling plays an important role in financial markets. Short selling activity increased significantly in last decades. The results of panel regression suggest that some sectors are more attractive for short selling than another. The results suggest that short sale determinants vary within sectors. The motivation of short sellers based on overpricing hypothesis was confirmed by several determinants. The short sellers also take liquidity of a security into the consideration. Further research should be oriented to two fields. The structure of the sector may be analyzed in more details and the examined period should be split up into sub periods what will be correspond with different economic and legislative environmental on the U.S. market.

References

ASQUITH, P., PATHAK, P.A., RITTER, J.R. (2005). Short interest, institutional ownership, and stock returns. *Journal of Financial Economics*, vol. 2, no.78, pp. 243–276.

ANGEL, J.J., CHRISTOPHE, S.E., FERRI, M.G. (2003). A close look at short selling on the Nasdaq Market. *The Financial Analysis Journal*, vol. 59, pp. 66 – 74.

ARNOLD, T., BUTLER A.W., CRACK, T.F., ZHANG, T. (2005). The information content of short interest: A natural experiment. *The Journal of Business*, vol. 78, no. 4, pp. 1307–1336.

BOEHMER, E., WU, J. (2013). Short selling and the price discovery process. *Review of Financial Studies*, vol. 26, pp. 287–322.

BRENT, A., MORSE, D., STICE, E.K. (1990). Short interest: Explanations and tests. *Journal of Financial and Quantitative Analysis*, vol. 25, pp. 273–289.

DEEV, O., LINNERTOVÁ D. (2014). The determinants of ETFs short selling activity. *Procedia Social and Behavioral Sciences*, vol. 109, pp. 669–673.

DECHOW, P., HUTTON, A. P., MEULBROEK, L., SLOAN, R.G. (2001). Short–sellers, fundamental analysis, and stock return. *The Journal of Financial Economics*, vol. 61, pp. 77–106.

DESAI, H., RAMESH, K., THIAGARAJAN, S.R., BALACHANDRAN, B.V. (2002). An investigation of the informational role of short interest in the Nasdaq market. *Journal of Finance*, vol. 57, pp. 2263–2287.

DIAMOND, D.W., VERRECCHIA, R.E. (1987). Constraints on short-selling and asset price adjustment to private information. *Journal of Finance*, vol. 18, pp. 277–312.

DUONG, T., HUSZÁRB, Z.R., YAMADAC, T. (2015). The costs and benefits of short sale disclosure. *Journal of Banking*, vol. 53, pp. 124–139.

GRULLON, G., MICHENAUD, S., WESTON, J.P. (2015). The Real Effects of Short–Selling Constraints. *Review of Financial Studies*, vol. 28, no. 6, pp. 1737–1767.

HASAN, I., MASSOUDC, N., SAUNDERSD, A., SONGE, K. (2015). Which financial stocks did short sellers target in the subprime crisis? *Journal of Banking*, vol. 54, pp. 87–103.
JAGADEESH, N., TITMAN, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance*, vol. 43, pp. 65–91.
KOT, H.W. (2007). What determines the Level of Short–Selling Activity? *Financial Management*, vol. 36, pp. 123–141.
KOT, H.W. (2014). *The Determinants of Increased Short–selling activity*. Available: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2543750.
MOHAMAD, A., JAAFAR, A., GODDARD, J. (2015). Short–selling ban and cross–sectoral contagion: Evidence from the UK. *Journal of Asset Management*, vol. 16, no. 7, pp. 484–501.

Appendix

Table 4 a

Variable	Automobiles & Parts	Banks	Basic Resources	Chemicals	Construction & Materials	Financial Services
Constant	7,8	15,5	18,5	22,1	7,5	20,4
Beta	0,227	0,008 ***	0,009 ***	-0,004 **	0,001 ***	0,003 **
Rate of return	-3,062 ***	0,001 ***	0,005	0,008	0,002 **	0,002 **
Volume	-0,056	0,001 ***	0,000	0,005 **	0,003 ***	0,005 *
30d Volatility	-0,002	0,041 ***	0,098 ***	-0,029	0,086 ***	0,018
90d Volatility	-0,016	-0,003	0,071 ***	-0,070 ***	0,058	-0,001
P/E ratio	-0,003	-0,001	-0,001	0,002	-0,003 ***	0,003 ***
P/BV ratio	-0,298 ***	0,001 ***	-0,008 ***	0,002	0,011 ***	0,002 **
P/S ratio	0,444 ***	0,001 **	-0,003	0,001	0,015	0,004 ***
P/FCF ratio	0,002	0,003 ***	-0,006 **	0,001	-0,001	-0,002 *
Coefficient of determination	0,027	0,059	0,178	0,289	0,401	0,368
Number of Observations	1.742	33.794	2.568	2.047	3.620	7.597
*, ** and *** indicate significance at the 10%, 5% and 1% level, respectively						

Table 4 b

Variable	Food & Beverage	Health Care	Industrial Goods and Services	Insurance	Media	Oil & Gas
Constant	24,5	23,1	20,2	19,4	24,6	7,5
Beta	-0,010 ***	-0.003 ***	-0.005 ***	0.004 *	0.016 ***	0.014 ***
Rate of return	-0,001	0.001	0.002 ***	0.001	0.001	0.005
Volume	-0,001 ***	0.003 **	0.001 ***	0.001	0.001	0.002 ***
30d Volatility	-0,028 *	-0.039 ***	0.010 *	0.034 **	0.071 ***	0.142 ***
90d Volatility	-0,016	-0.004	0.002	0.044 ***	-0.002	0.076 ***
P/E ratio	0,003 **	0.000 ***	0.001 **	0.005 ***	-0.002	0.006 **
P/BV ratio	-0,003 **	0.003 ***	-0.001 **	-0.001	-0.023 ***	0.017 ***
P/S ratio	-0,001	-0.002 ***	0.0025 ***	0.004 **	0.002	0,003
P/FCF ratio	0,000	0.000	0.000	0.005 ***	-0.010 ***	0.000
Coefficient of determination	0,195	0,174	0,097	0,322	0,352	0,408
Number of Observations	5.304	16.150	29.864	3.711	1.501	1.753

*, ** and *** indicate significance at the 10%, 5% and 1% level, respectively						

Table 4 c

Variable	Personal & Household	Real Estate	Retail	Technology	Travel	Utilities
Constant	8,2	19,3	17,3	4,6	28,4	6,3
Beta	0,016 ***	0,014	0,001 ***	-0,000	0,006 ***	0,020
Rate of return	0,003 *	-0,003	0,001 ***	-0,005	-0,001 **	0,001
Volume	0,001 ***	0,003	0,003 ***	-0,002	0,003 ***	0,005
30d Volatility	0,069 ***	-0,052	0,048 ***	0,000	-0,159 ***	0,160
90d Volatility	0,046	-0,096	-0,001	-0,002	-0,099 ***	0,068
P/E ratio	0,002	0,001	0,001 ***	-0,004	-0,000	0,005
P/BV ratio	0,017 ***	0,009	-0,001 ***	-0,002	-0,001	0,021
P/S ratio	0,016 ***	-0,0085	0,001 ***	-0,004**	-0,003	-0,002
P/FCF ratio	-0,003 **	0,003	0,001 ***	0,001	0,002	0,002
Coefficient of determination	0,178	0,257	0,169	0,369	0,194	0,481
Number of Observations	2.339	2.024	12.863	11.735	7.928	872
*, ** and *** indicate significance at the 10%, 5% and 1% level, respectively						

Source: author's calculation