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HOW DID SHORT SALE BAN AFFECT GERMAN CAPITAL MARKET RISK?

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Abstract

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The problem of short sale is a popular issue of stock trading and efficiency of pricing. Most regulatory authorities around the world adopted in the period 2007–2010 ad hoc bans on short selling. This paper provides an examination of an impact of the short sale regulation on the German capital market during crisis period 2008–2010. The purpose is to identify effects of the short sale regulation on level of systematic risk on German capital market and to investigate the discovery of stock prices of German blue chips at the period from May 2007 to April 2011 and three sub periods which demonstrate different regulatory approach to naked short sale regulation. The results suggest that short sale ban affects the level of systematic risk in the German market and prolongs a price reaction on new information. Further, short sale ban limits activities of investors with bearish view. After adoption of short sale ban the level of systematic risk increases and not only banned stocks are affected by the regulation. Finally, at the analyzed period the problem of negative information corporation in stock prices has arisen. Thereafter, the short sale ban is lifted the level of systematic risk decrease and there are not significant differences for banned and not banned stocks. Further, the price efficiency measured by autocorrelation also decreased after ban is lifted.

Keywords: short sale, ban, Germany, price discovery, capital market

INTRODUCTION

Most stock capital market regulators around the world reacted from 2007 to financial crisis by adopting bans or constraints on short sales. There are two types of short selling according to Hamson (2009).

One of reactions on steep decline in stock prices regulatory authorities around the world has been placing restrictions on short sale at the beginning of the 21st century. Firsts short sale regulations were accepted by SEC and U.K. Financial Services Authority, and other regulators followed quickly such as in France, Switzerland, Canada or Germany. The attempt of regulatory authorities was aimed to slowdown bear market and to prevent transport of crisis from financial crisis to economic crisis since nowadays, the financial system development is considered as a crucial factor of economic growth and development among economists, Kajurova and Rozmahel (2016).

The aim of the paper is to identify effects of short sale ban on the level of systematic risk on German capital market in the period, which respects different regulatory approach. Further, employing cross-autocorrelation, the price discovery is investigated and the prices' reaction on positive or negative information is uncovered.

Several questions arise by analysing market with short sale limitation. First question is following, are activities of investors with negative view limited during short sale ban period? Secondly, does short sale ban affect the pace of price reaction on new information? And the last question, does short sale ban affect the level of systematic and idiosyncratic risk on German market?

On September 19, 2008, the German security regulator BaFin announced the suspicion of naked short selling in 11 German financial services firms. The prohibition of naked short sale of these securities went into effect on September,

20, 2008 and carried through January, 30, 2010. The list of securities that covered banks, insurance companies and other financial provider is in Tab. I. The prohibition applied to all naked short selling. e. g., transaction where, at the time of the transaction, the seller of the share did not own or have a legal claim to a transfer of title of the shares sold. There were exceptions to prohibition such as, so called "name-to-follow" transactions by lead broker, market makers and designed sponsors required for the performance of their contractual obligations, and short sales used to secure existing positions. Other exceptions were adopted alter such as fixed price transactions or transactions agreed by trading participant with a customers for settlement of a transaction in shares concluded at a fixed or definable price.

Literature Review

Beber and Pagano (2013) analysis short sale ban on three variables: liquidity, price discovery and stock overpricing. Diamond and Verrecchia (1987) found that short sale ban impedes informed investor to trade on bad news and thus reduces speed of price discovery. This finding expects that short sale ban constraints equally all investors (informed and uninformed). There might be situation when short sale ban reduces the bid ask spread, but in the most of situation the overall effect increase a bid ask spread. Preventing of short sale limits trading activities of traders with negative information and slows down price discovery and does it asymmetrically more for bear than for bull market. Further, investors' impossibility to reflect negative information in prices makes prices less informative and increases the risk of market participants, Bai *et al.* (2006).

Using 46 equity markets Brie *et al.* (2007) examine how short sale restrictions affect the pace of price discovery. They discover that negative information is embedded faster in countries with any short sale ban and market with short sale ban are less efficient at price discovery level. Moreover, Safi and Sigurdsson (2011) and Boehmer and Wu (2012) point put that ability of short sale increases the information efficiency of prices. Contrary opinion offer Kolasinksi *et al.* (2012) that analyze ban applied on U.S. stocks during financial crisis 2008, finding negative relation between short-selling volume and stock returns. They suggest that during the financial crisis became short activity more informative.

Original researches about impact of short sale constraints engaged fundamental value of stocks provides Miller (1977) suggesting that short sale limitation leads to overpricing of stocks. Bearish investors could not capitalize negative information into stock prices. Diamond and Verrecchia(1987) correct Miller model by expectation of rational investors who might reflect short sale ban in valuation and these systematic overpricing might be cut down.

Further, one of Diamond and Verrecchia (1987) important contributions of short sale constraint analysis is that short sale limitation effects market efficiency by impossibility to reflect all relevant information in asset prices. Ofek and Richardson also (2003) confirm that short sale constraints have negative impact on stock returns and argue that stock prices, as stocks are not able to fully intercorporate all information under short sale constraints.

With respect to all market tests Morck *et al.* (2010) using R^2 as a variable for measure of systematic risk and they found out that develop countries tend to have higher level of idiosyncratic risk. This is explained by capitalization of firm-specific information into stock prices. Considering the market efficiency, more efficient markets tend to have more idiosyncratic risk, since the ratio of firm-specific information to market-level information is likely to be higher for informational efficient markets. This is explained by acting of market participants that could acquire information and quickly reflect them in asset prices. Bris *et al.* (2007) transfer this approach to investigate the potential asymmetry in price adjustment under short sales constraints.

Short sale constraints limit reflecting of negative information in prices. If only the price adjustment

I: *List of banned stocks from DAX index*

German naked ban	September, 19, 2008 – January, 31, 2010
1	Aareal Bank AG
2	Allianz SE
3	ABM Generali Holding
4	Commerzbank AG
5	Deutsche Bank AG
6	Deutsche Borse AG
7	Deutsche Postbank AG
8	Hannover Ruckversicherung
9	Hypo Real Estate Holding AG
10	MPL AG
11	Munchener Ruckversicherung Gesellscgaft AG

to bad news is cut then for negative market return the smaller level of idiosyncratic risk could be expected. This is expected for market where short sale is not practiced or is prohibited.

Using U.S. data from the early 20th Jones and Lamont (2002) find that stock that are expensive for short sale have higher valuations and low subsequent return. This corresponds with expectation that difficult-to-short stocks are overpriced. The speed of price adjustment to market movements could be measure by calculating of cross-autocorrelation as Hou and Moskowitz (2004) suggest. This is alternative method for measuring of market efficiency using a delay in price adjustments. This is backed by Diamond and Verrecchia (1987) which argue that in environment with short sale restriction prices will adjust slowly to negative information. But this result must be taken in wider consideration, as in the market was imposed only partial ban. Thus, banned stocks might feature slower price discovery and their prices might be more sensitive to the short sale, but investors were allowed to carry out on other stocks.

Methodology and Data

The computation is carried out weekly data at the period from 4th May 2007 to 7th April 2011. The period is split in three sub-periods, the period $t = 0$ from 4th May 2007 to 12th September 2008 when short sale is allowed for all securities. The period $t = 1$ is from 19th September and it represents the period when naked short sale was banned for the list of particular securities, the last period begins at February 2010 and short sale is again allowed for all securities. For this period the stock Hypo Real Estate Holding AG is delisted. Data for prices were drawn from Bloomberg terminal.

As Hou and Moskowitz (2004) recommend, the weekly frequency of data was chosen as there is a little variation at the monthly level and too much noise at the daily level of data.

The level of systematic risk

The level of systematic level computation and idiosyncratic risk derivation is based on Morck *et al.* (2010) approach. Their approach is transferred using Bries *et al.* (2007) methodology for application on market with short sale ban. The R^2 is compute from regression in the form:

$$r_{it} = \alpha_i + \beta_i r_{mt} + \varepsilon_{it} \quad (1)$$

The equation 1 regress weekly stock returns r_{it} on the value-weighted market return r_{mt} for every firm i and in time t. In the next step two separate measures are computed for individual security co-movement. The r_{mt}^{+} is stated for market return that is positive or zero and r_{mt}^{-} equals negative market return. It leads to two modified regressions:

$$r_{it} = \alpha_i + \beta_i r_{mt}^{+} + \varepsilon_{it} \quad (2)$$

$$r_{it} = \alpha_i + \beta_i r_{mt}^{-} + \varepsilon_{it} \quad (3)$$

And two different regression coefficients R_{it}^{2+} and R_{it}^{2-}. Then, the average R^2 is calculated.

The asymmetry is measured by computing of difference $R^{2diff}_{it} = R_{it}^{2-} - R_{it}^{2+}$. Following above mentioned methodology if short sales are restricted and negative information could not be incorporate in price we might expect higher R_{it}^{2-} then for situation when short sale are allowed. But even though short sales are restricted, the positive information could be quickly reflected in prices, the limitation exists only for negative information.

A regression of individual stock returns on market returns, conditional on the sign of the market return yields. A higher downside R^2 the slower market news is intercorporate into individual stock prices. But it might be expected that upside R^2 is also affected by short sale restrictions. Thus, R^2 difference drops when short sales are allowed. Bries *et al.* (2007) propose econometrics model that shows formally why it has happened, see Appendix.

The speed of reaction

Cross-autocorrelations between lagged market return and individual stock returns might be considered as a proxy for price efficiency. The correlation coefficients $\rho_{it}^{+} = corr(r_{it} \cdot r_{mt-1}^{+})$ and $\rho_{it}^{-} = corr(r_{it} \cdot r_{mt-1}^{-})$ are computed for all individual securities and cross-autocorrelations across stocks is represented by

$$\rho_t^{+} = \frac{\sum_{i=1}^{n} \rho_{it}^{+}}{n} \quad (4)$$

$$\rho_t^{-} = \frac{\sum_{i=1}^{n} \rho_{it}^{-}}{n} \quad (5)$$

$$\rho_t^{diff} = \rho_t^{-} - \rho_t^{+} \quad (6)$$

Hou and Moskowitz (2004) states that the cross-autocorrelations are equivalents of regression coefficients and the larger the difference, the larger the price delay.

RESULTS

Tabs. II, III and IV demonstrate descriptive statistics for all analyzed period. Tab. II summarizes results for blue chips from DAX, results for group of 10 stocks that are subject of short sale ban at period $t = 1$ and not-banned stocks. The average rate of return of in the future banned stock is below benchmark represents the market and below the group of Non-Banned stock in the period $t = 1$. This group is also only with positive skewness, that means that the most of observation is below average with longer right tail.

In Tab. III the BaFin has reduced naked short selling for stocks of primarily financial institutions. The mean of return is only negative for this group

II: *Descriptive statistics for t = 0*

	Full Sample	Banned Stocks	Not-Banned Stocks	Index DAX
Mean of Return	–0.004	–0.006	–0.003	–0.002
Median of Return	–0.003	–0.006	–0.002	–0.002
Skewness	0.093	0.148	–0.173	–0.230
Number of observations	2,272	710	1,562	71

III: *Descriptive statistics for t = 1*

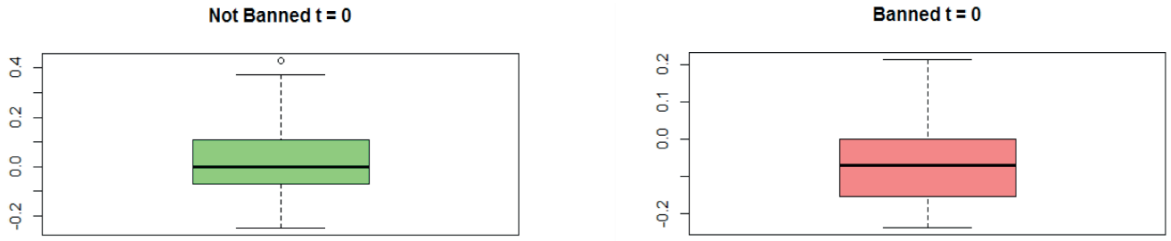
	Full Sample	Banned Stocks	Not-Banned Stocks	Index DAX
Mean of Return	0.001	-0.001	0.002	0.012
Median of Return	0.000	0.000	0.002	0.004
Skewness	0.179	0.398	0.195	0.539
Number of observations	2.272	710	1.562	71

IV: *Descriptive statistics for t = 2*

	Full Sample	Banned Stocks	Not-Banned Stocks	Index DAX
Mean of Return	0.001	0.002	0.001	0,001
Median of Return	0.001	0.001	0.001	0.002
Skewness	0.583	0.860	0.436	0.309
Number of observations	2.138	576	1.562	71

V: *Results of R-Squared for period t = 0*

	R-Squared	Upside R^2	Downside R^2	Difference R^2
		Short Sale Allowed t = 0		
Banned Stocks in t = 1	0.413	0.249	0.192	–0.057
Not Banned Stocks in t = 1	0.294	0.114	0.156	0.042
Full Sample	0.332	0.185	0.138	–0.047



1: *Boxplot period t = 0*

of stocks but all of returns have a positive skewness with longer right tail.

In Tab. IV descriptive statistics for period in which short sale is again allowed are demonstrated. The differences between groups of stocks diminished and skewness is strongly positive.

Level of Idiosyncratic Risk

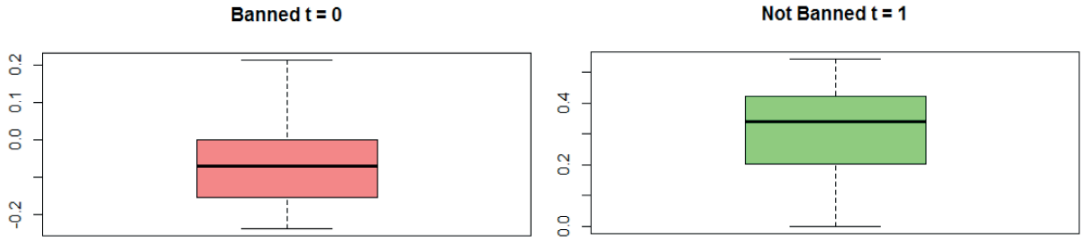
Tab. V demonstrates the average total R^2 33,2%, R^2 is higher for stock that will be banned at $t = 1$ with average R^2 43,3% than for Not-Banned stocks (29,4%). The Fig. 1 demonstrates results in two boxplots.

In Tab. VI are reported results for period $t = 1$ and adoption of naked short sale ban for 10 financial stocks. We could see that the level of systematic risk increase significantly for all groups of analyzed securities. This is consistent with expectation that the level of idiosyncratic risk decreases if short sale is prohibited or limited. Downside R^2 is larger than upside, what is consistent with findings of Hong *et al.* (2000) and Bris *et al.* (2007). The findings support thesis about problem of reflecting negative information in banned stocks and also impact of short sale ban on stocks that are not primary the subject of short sale prohibition.

In Tab. VII are summarized results for the period $t = 2$. The level of systematic risk decrease and results do not differ significantly for any group of stocks.

VI: *Results of R-Squared for period 1*

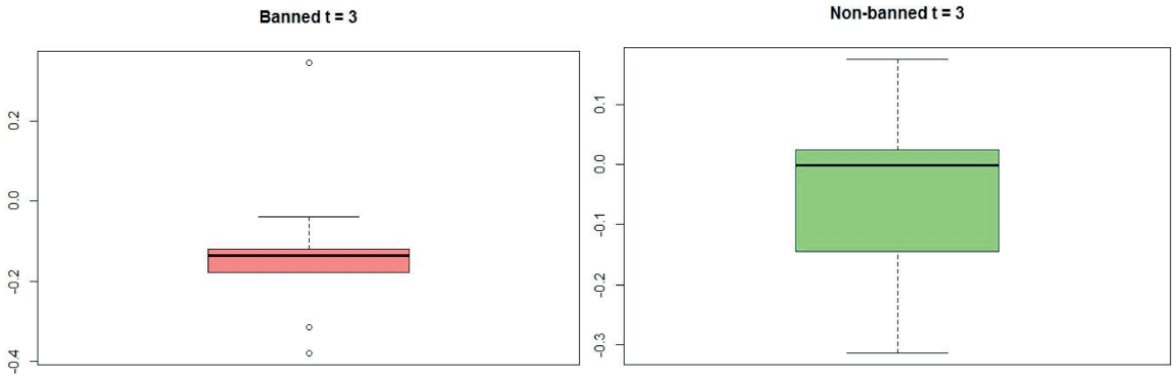
	R-Squared	Upside R2	Downside R2	Difference
		Short Sale Limited t = 1		
Banned Stocks. t = 1	0.448	0.145	0.436	0.290
Not Banned Stocks t = 1	0.504	0.188	0.504	0.316
Full Sample	0.487	0.175	0.483	0.308



2: *Boxplot period t = 1*

VII: *Results of R-Squared for period 2*

	R-Squared	Upside R2	Downside R2	Difference
		Short Sale Allowed t = 2		
Banned Stocks t = 1	0.398	0.176	0.187	0.012
Not Banned Stocks t = 1	0.187	0.178	0.132	–0.046
Full Sample	0.225	0,178	0.149	–0.029



3: *Boxplot period t = 2*

The risk is mostly represented by firm-specifics risks and the system is less risky as a whole.

Effect of Price Discovery

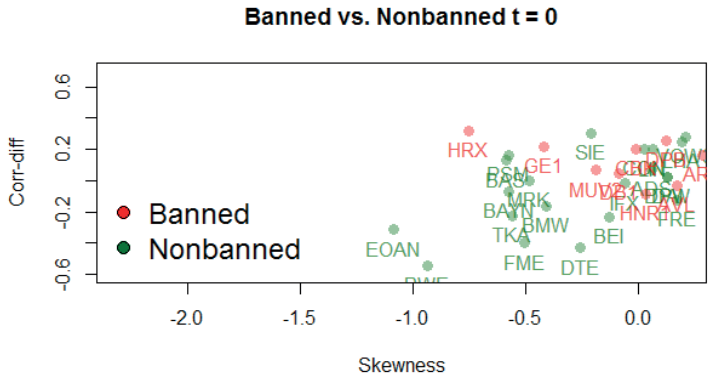
In Tab. VIII the autocorrelation for period $t = 0$ is reported irrespective of the performance of the market and also downside autocorrelation, upside autocorrelation and differences. In the period $t = 0$ the higher cross-autocorrelation is obvious for group of stocks banned in the period $t = 1$. The average autocorrelation is 0.032 and 0.315 for banned stocks. If we distinguish between upside and downside autocorrelation there is again larger delay for financial stocks compare to other analyzed groups. Compare downside and upside autocorrelation we could see that prices quicker react on negative information than positive information.

The relation between difference in auto correlation and skewness is demonstrated in Fig. 4. We could see that in period $t = 0$ the most of stocks have skewness in the interval between –0.5 and 0.5 with maximum of autocorrelation difference 0.4. We could also see that most of stocks create cluster irrespective if they are from financial rector or not.

In Tab. IX are summarized results for autocorrelation on market with banned naked short sale. We could see that reaction on information is longer in banned market. The cross autocorrelation increases from 0.032 to 0.097. The reaction is also prolonging for negative information, the autocorrelation increases from 0.045 to 0.234.

VIII: *Results of Cross-Autocorrelation for period t = 0*

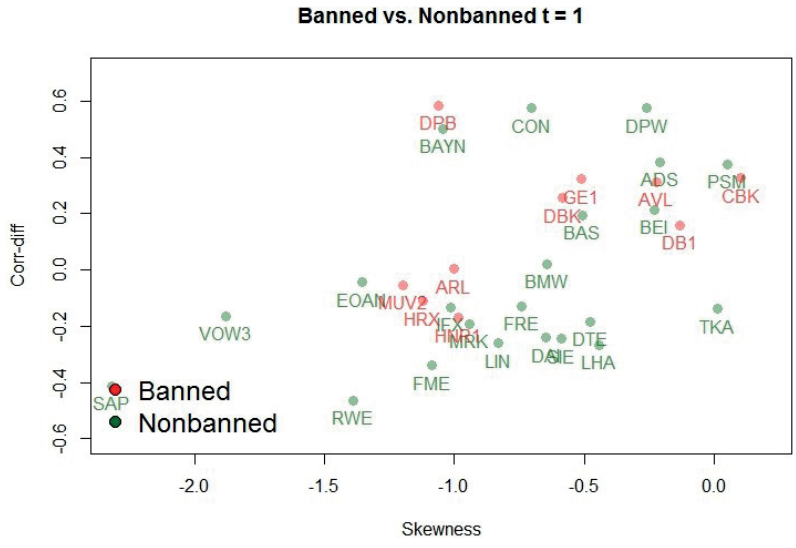
	Cross-Autocorrelation	Upside Cross-Autocorrelation	Downside Cross-Autocorrelation	Difference
		Short Sale Allowed t = 0		
Banned Stocks in t = 1	0.315	0.105	0.045	–0.06
Not Banned Stocks in t = 1	0.101	0.038	0.002	–0.036
Full Sample	0.032	0.077	0.045	–0.032



4: *Relation between auto-correlation difference and skewness in period t = 0*

IX: *Results of Cross-Autocorrelation for period t = 1*

	Cross-Autocorrelation	Upside Cross-Autocorrelation	Downside Cross-Autocorrelation	Difference
		Short Sale Allowed t = 0		
Banned Stocks. t = 1	0.105	0.109	0.234	0.125
Not Banned Stocks. t = 1	0.081	0.105	0.196	0.091
Full Sample	0.097	0.106	0.234	0.128



5: *Relation between auto-correlation difference and skewness in period t = 1*

X: *Results of Cross-Autocorrelation for period t = 2*

	Cross-Autocorrelation	Upside Cross-Autocorrelation	Downside Cross-Autocorrelation	Difference
		Short Sale Allowed t = 2		
Banned Stocks t = 1	–0.027	0.061	0.139	0.078
Not Banned Stocks t = 1	0.023	0.065	0.045	–0.020
Full Sample	0.011	0.036	0.003	0.033

The reaction is longer for banned stocks than for stocks without short sale limitation.

The relation between differences and skewness is summarized in Fig. 5. Comparing to Fig. 4 stocks are more spread along whole interval. A cluster that was established in Fig. 4 and period $t = 0$ disappears in period $t = 1$.

Tab. X demonstrate results for period t = 2 when short sale is again allowed. The price efficiency increases and the results are close for those reached in the period $t = 0$. The previous period banned shock reacts more rapidly to negative information and overall speedup of reactions is obvious.

CONCLUSION

The analysis of short sale and its regulation has been the topic of academics discussion for long period. The prevailing opinion particularly by regulatory authorities is against short sale and leads to adoption of short sale constraints in the times of crisis or sharp market decrease. On the other hand the academic view on short sale is not such negative and a lot of researches advocate it as a method how to reflect negative information in stock prices.

On this paper the impact of naked short sale ban was analyzed in German capital market. The market was investigated in term of efficiency measured by the level of idiosyncratic risk and pace of reaction on information. The analyses was carried out in three periods, the first one represent market without any short sale limitation but respecting two different groups of stocks. At second period short sale is banned for group of financial stocks and the last one is about without any short sale constraints. The findings confirm that short-selling bans are intendent to limit the activity of investors with bearish views and slow price discovery more in overall declining markets. Like Beber and Pagano (2013) our results discover that both upside and downside cross-autocorrelations are positive and significantly larger during ban period. The mean downside cross-autocorrelation exceeds the upside one and the difference between them is significantly larger when short sale is banned. Comparing results for difference in cross-autocorrelation from Tabs. VIII, IX and X the evidence stipulates that not only short sale ban slows price discovery, but it do it significant during market declines. These findings correspond with Miller (1977) suggesting that the restriction of short sale has negative influence on prices from investors not holding them and also with assumptions of Diamond and Verrecchia (1987), Saffi and Sigurdsson (2011) or Boehmer and Wu (2012). These authors refer to lower market quality at the period of short sale restrictions. The total cross-autocorrelation is also smaller when short sale is allowed (for period $t = 0$ and $t = 2$) and price discovery is faster, which correspond with Bris *et al.* (2007) or Chang *et al.* (2007, 2014) that show that the short sale restrictions pushed stock prices upwards.

Tabs. V, VI and VII stipulate that average total R^2 is –0.047 and –0,029 when short sales are allowed and 0.308 what is banned. This is consistent with Bris *et al.* (2007) that the level of idiosyncratic risk being lower when short sale is prohibited and the level of systematic risk increases. The large coefficients of downside R^2 for banned period $t = 1$ indicate that short sale ban impedes the corporation of negative information into prices. However, not only banned stocks are affected by problems with negative information incorporation like shows large coefficients of downside R^2 for both groups of stocks in the period $t = 1$.

Concluding, in term of systematic and idiosyncratic risk the short sale ban increased the level of systematic risk and the change in systematic risk is larger if the market is bear. Afterward the short sale ban was lifted the level of systematic risk increases and idiosyncratic risk is more important.

The imposition of short sale ban influences and slow down the pace of reaction. The reaction is slower for negative information than for positive information. As far as short sale ban disappeared the price efficiency increase again.

Finally, the naked short sale ban affects characteristics of German capital market at analyzed period.

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