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Abstract

In August 2011 the financial authorities in France, Spain, Italy and Belgium adopted a covered short sale ban on financial institutions. In this paper, I study the impact of this short-selling ban on stock returns, liquidity and volatility. I analyze various test periods before and after the introduction of the ban to quantify changes over time. The stocks subjected to the ban suffered degradation in market quality, measured by the relative bid-ask spread. The positive effect on stock return was only short-term. There was an especially strong short-term positive effect on stock prices in the Developing and PIGS country subgroup. However, there is no statistically significant positive effect on stock returns in the long-term horizon. The impact on intraday volatility is inconclusive. The short-term jump of excess volatility of the banned stocks is compensated in the long-term horizon.

1. Introduction

Short selling has become a much discussed topic in recent years. We have observed a turbulent stock market development from the year 2007 until now. Short selling influences a downturn in the stock market and expresses popular opinion. If politicians or the stock exchange authority want to stop a market crash, they ban short selling. A sort selling ban has been imposed a few times since 2007. I explore the effect of the short-selling ban during the debt crisis period of 2011. There was a short-selling ban only on financial institutions in my research sample. Which strategy was better? Was the short-selling ban helpful? The examination of this question is based on stock prices, bid-ask spreads, and a volatility analysis. I made several thousands of various empirical observations to justify my conclusions. As we will see, the results change based on different time periods.

Short selling is the selling of shares that the seller does not own. The seller usually borrows the stock from a broker's account and sells it with the anticipation of a downturn. In the future, this trader buys the stock at a lower price on the market. Short selling has not been common only in recent years; short selling has a long history. The first famous short sale was made by the Dutch trader Isaac Le Maire in 1609. He sold more shares of the Dutch East-India company than he

owned. He was blamed for causing a drop in the share price, and short selling was forbidden by the Dutch government. Short sellers were blamed for strong decrease of the Dutch tulip market in the 17th century. In another well-known situation George Soros become famous for "breaking the Bank of England" on September 16, 1992 when he aggressively increased his short position to the amount of ten billions pound sterling. Short sellers were considered culprits in the Wall Street crash on Black Tuesday 1929 as well. Subsequently the short selling regulation was approved. US Congress enacted a law banning traders selling stocks during a down-tick; this rule is called the up-tick rule[1]. Today short-selling is very common. Diether, Lee and Werner (2009) show that short selling accounted for 24% of the New York Stock Exchange trading and 31% of the NASDAQ volume in 2005. In other words, approximately half of all seller-initiated trades are short sales. The popularity of short selling has increased dramatically in recent decades. 95% of developed countries allowed short sales in 2002. This ratio was 31 percent in emerging countries. Before 1990, the respective figures were 64% in developed countries and 10 percent in emerging countries.

On August 11, 2011, European regulators, in response to the continent's debt problems, decided to limit short selling. The existing bans on short selling in Greece and Turkey were supplemented by bans on the short selling of financial stocks in France, Belgium, Italy and Spain. The local financial authorities of France, Belgium, Italy and Spain placed a ban on creating a net short position[2] or increasing the previous one, including intraday trades. The short-selling bans were lifted in the beginning of 2012.

This master's thesis is structured as follows: Chapter 2 consists of a research overview. Chapter 3 describes the sample of all the stocks and data I worked with. Chapter 4 shows the reasons why financial authorities prefer to impose bans on financial institutions. There is also an

[1] A former rule enacted by the US Securities and Exchange Commission that orders that every short sale transaction be realized at price that is higher than the price of previous transaction. This law was announced in the security exchange act of 1934 and was executed in 1938. The up-tick rule avoids short sellers adding to the downward pressure when the markets are very "bearish".

[2] A net short position means any position resulting in a positive economic exposure to falls in the price of the stock

empirical analysis on US stocks in Chapter 4. All other sections are focused solely on the European stock market. Chapters 5 and 6 present the results related to stock returns and bid-ask spread changes respectively. Chapter 7 provides a volatility analysis. Finally, some concluding remarks and policy recommendations are made in the final chapter of the paper.

2. Evolution of short-selling research

Research papers related to short selling often present opposing results. Opponents of short selling argue that short selling disrupts orderly markets by causing high volatility, panic selling, and market crashes. However, supporters of short-selling argue that it increases information efficiency and the liquidity of stock markets, and also improves the risk sharing mechanism in economic systems.

The research related to short selling has evolved over time. Seneca (1967) published a research paper with an unsurprising conclusion: an increase in short interest is a bearish indicator. Academic literature on short selling has had a renaissance since the 1970s.

According to Miller (1977), when short-selling is restricted and traders have heterogeneous beliefs, the private information of optimistic traders is slowly fed into prices through market transactions, but the private information of informed investors, who are pessimistic and do not own stocks, is not revealed in prices. Later, when market information is published through an announcement, because bad news has not been disseminated, there are stronger stock market adjustments for negative news than positive news.

Diamond and Verrechia (1987) developed a theoretical model with rational traders. According to their conclusion, a short-sale ban does not lead to biased prices. Short-sale constraints influence the degree to which private information is revealed in the prices. In other words, these constraints reduce informational efficiency especially with respect to negative news. Option trading serves as an alternative to short selling, and it increases the informational efficiency.

Ofek and Richardson (2003) showed that short selling played an important role during dot.com crisis. In the February 2000 index, NASDAQ reached maximal values. Short interest was substantially higher for dot-com(internet) stocks than for their relevant old economy counterparts at this time. Short interest here is explained as the total position of shares of stock that have been sold short divided by the total amount of shares outstanding. For example, the short interest position was 2.8 percent (for Internet stocks) versus 1.8 percent for the mean and 1.6 percent (for Internet stocks) versus 0.7 percent for the median. To obtain additional evidence, Ofek and Richardson (2003) collected proprietary rebate rates for the universe of stocks on a selected number of dates from a financial institution. They assumed that a low rebate rate represents a weak supply of stocks for lending. The mean and median rebate rate was, respectively, 1.1 percent and 1.5 percent less for dot-com stocks than other stocks, and these results are statistically significant. Note that almost half of dot-com stocks lie in the ten percent tail of all rebate rates. According to the authors of this research paper, a Lockup agreement is the modification of short sale constraints. Some investors are prohibited from selling and short selling in case of a Lockup agreement. This prohibition usually takes effect some period after an IPO. After the expiration of this period, stock performance of Internet stocks is different compared to other stocks. The drop of Internet stocks was approximately 1% stronger compared to the non-Internet firms during the days following the lockup expiration. The negative performance remained for the next 10 days (the whole research period). This fact illustrates the negative pricing effect of sale and short sale constraints. The contribution of this paper to the field of financing is the knowledge that short sale statistics can predict price movement or market crashes.

With the exception of a few papers, most available empirical research papers examine the impact of short-sale restrictions at the individual stock level. Charoenrook and Daouk (2005) examined short-selling issues from an aggregate market point of view. The impact of market-wide restrictions on market returns can differ significantly from the impact of short-sale restrictions on individual stocks due to diversification. They examined the effect of a market-wide short-sale bans on volatility, liquidity, probability of market crashes, and expected market returns. Their data stem from 111 countries. In contrary to other papers which are focused on a critical point-in-time on the stock exchange, the paper by Charoenrook and Daouk (2005) is

focused on the very long-term impact of short sales. The data range from 1969 through 2002. The authors constructed a binary variable that reflects the possibility of traders to take short positions either through the existence of short-selling or derivatives trading (put option). The coefficient and statistical significance of this variable is critical in the empirical analysis. Based on monthly returns from the ARCH model and the variance of daily returns, the aggregate market return is less volatile when short-selling is possible. Their next analysis shows that the feasibility of short-selling does not influence the probability of a market crash. The authors used turnover as proxy for liquidity. When short-selling is possible, the turnover is 15 percentage points higher. As far as returns are concerned, the authors argue that investors should require a lower expected return when liquidity is greater and variance risk is lower, which is when short selling is possible. Additionally, when investors can diversify their risks in a more efficient manner, they require a lower rate of return. This fact is proven empirically in the paper. The theory, however, is not consistent with what happens with prices when a short-selling prohibition is lifted. On one hand, Miller´s overpricing effect during a short-selling ban should cause a decrease in market prices when short selling becomes possible. On the other hand, if short selling causes lower expected returns, stock prices should jump when the short-selling restriction is lifted. The empirical evidence illustrates that market prices increase when short-selling restrictions are lifted. Paper of Charoenrook, Daouk (2005) shows the positive side of short selling in the long-term. Banning bets on decreasing markets may deteriorate volatility and liquidity and increase expected returns.

Reputable paper focused on the financial crisis period (from August 1st until October 31st, 2008) was published by Boehmer, Jones, and Zhang (2009). Their research sample consisted of 465 short restricted stocks traded on the NYSE and NASDAQ. 404 stocks from this sample were short restricted on 18 September, 2008. An additional 61 stocks later became subject to the shorting ban. They also created a matched sample of 465 stocks with no short selling restriction. The authors found a significant abnormal return on the 404 stocks banned on 18 September, 2008. These results were deformed by the TARP announcement. To try to neglect the confounding news about TARP, the authors looked at the subset of firms that were added to the ban list at a later date. This second sample of stock performed differently compared to the first 404 stock sample. Except for the first day outperformance, the short restricted stock performed poorer

compared to the freely traded sample. There are two possible arguments for this. One is an illiquidity discount related to deteriorating market quality. The second one is that the investor can understand the addition to the ban list as a bad signal about the company´s situation. To measure the impact of short selling on market quality, the authors analyzed the effective and quoted spread. The results indicate a dramatic increase of spread on the stocks subject to the shorting ban. The volatility, calculated as the difference between the highest and lowest price quoted for a given stock on a given trading day relative to the stock´s volume-weighted average trade price for the day, increased in the short-term too. This research paper achieved a similar conclusion as Beber and Pagano (2011).

Appel and Fohlin (2010) used a non-traditional difference-in-difference estimator comparing non US stocks with correspondent American Depository Receipts (ADR). These ADRs were not short sale restricted for most of the duration of the non-U.S. bans. Therefore, ADRs are the optimal control group for the short restricted non-U.S. shares. Their research period was from September 2007 until July 2010. The research sample, unfortunately, consisted of only 35 ADR stocks. Liquidity issues were measured by a relative effective spread and Amihud ratio. The short-selling ban improved market liquidity or at least had a neutral impact according to Fohlin, Appel(2010). The authors justify these empirical results through the modified theoretical model by Glosten and Milgrom (1985). They assumed that short sellers are more likely to hold private information relevant to valuation, and other liquidity investors were less likely to sell short. Applying the Bayes´ rule, the difference between the non-ban and ban spread is always positive. In other words, the bid-ask spread during the non-ban period is larger than the spread during the ban period. The authors focused on volatility changes as well. Volatility was empirically measured by the 20-day rolling standard deviation of returns. The results indicate that volatility decreased in equity markets by imposing a short-selling ban. All in all, Appel and Fohlin (2010) found that banning short selling might prove useful in times of crisis.

Beber and Pagano (2011) published a reputable and very extensive research paper. I will describe this paper in detail as it examines similar issues as my master's thesis, just in a different period. It enables me to compare my empirical evidence to the empirical conclusion of Beber and Pagano (2011). Their sample consists of daily data for 16,491 stocks in 30 countries, from

January 2008 to June 2009. This research paper focused on stock return, liquidity and price discovery. The bid-ask spread increased worldwide with the salient moments of the crisis (the collapse of Bear Stearns, collapse of Lehman Brothers, etc.). Short-selling restrictions were implemented in the wake of the bad news about the situation in U.S. banks in September 2008. These short-selling bans contributed to the deterioration in liquidity. Stocks affected by a short-selling restriction experienced a significantly larger median bid-ask spread during the ban period. According to the Wilcoxon test for the difference between the median spread, the difference is statistically different from zero at the 1 percent level for all the countries. For example, the median bid-ask spread for stocks affected by the ban increased by 127 percent. The bid-ask spread of the control group increased by only 49 percent. The analysis by Beber and Pagano (2011) shows that the ban on naked short sales caused an increase of 1.28 percentage points in the bid-ask spread, and covered short sales caused an increase of 1.98 percentage points. The bid-ask spread is negatively correlated to the obligation to disclose short sales. This indicates that this disclosure helps to reduce adverse selection problems. In the subset of financial stocks, short-selling bans are associated with a larger bid-ask spread as well. Very similar results are also obtained using the Amihud illiquidity measure. It is usual that, even in the absence of short-selling ban, market makers provide less liquidity to small-cap and riskier stocks compared to other stocks. The impact of a short-selling ban on small-cap stocks was stronger but not statistically significant. During short-selling constraints, investors could still bet on falling stock prices by trading in the option markets because financial authorities did not impose any direct bans in derivative markets. As expected, the authors found a significantly stronger effect of short-selling bans on liquidity for stocks without listed options. The next part of their paper is related to the analysis of stock returns. Beber and Pagano's (2011) methodology is focused on the countries where the ban did not apply universally, and compares the post-ban median cumulative excess returns for stocks subject to bans with those of exempt stocks, where excess returns are defined as the difference between individual stock returns and the respective country equally-weighted market indices. The median cumulative excess return of U.S. short restricted financial stocks exceeded free traded stocks after the ban inception. But there is no such outperformance in other countries: the median excess return on stocks subject to short-selling restrictions is very close to that for other stocks. We can observe

only a short-term outperformance of banned stocks in countries outside the U.S. The U.S. stock market response to short-selling bans is positive and significant. The authors highlight that the positive effect for the U.S. may be driven by the TARP announcement rather than from the ban itself. Therefore, in countries other than the U.S., short-selling bans are associated either with no significant change or with a decline in stock returns.

All in all, their empirical analysis of Beber, Pagano(2011) suggests that the short-selling ban was damaging to market liquidity, especially for stocks with no listed options, a small market capitalization, and high volatility. Additionally, it slowed down price discovery, and it was at best neutral in its effects on stock prices. They found excess return for the banned stocks in the U.S. Researchers argue this could have been caused by the TARP announcement to support financial institutions. The ban was announced on September 18, 2008, and on September 19, 2008 Treasury Secretary Henry M. Paulson proposed TARP. They found short-term excess return for European banned stocks.

One of a few research papers related to the 2011 debt crisis short-selling ban was published by Alves, Mendes and Silva (2012). They made an empirical analysis but they used a different sample and different methodology than I used. Their sample consisted of 170 financial stocks purely in Western Europe (basically all the listed financial institutions and insurance companies in Western Europe). Stock return and volatility were analyzed by the cumulative abnormal return over the event period. This statistical technique follows the MacKinlay (1997) and Brown and Warner (1985) methodology. The evidence presented suggests a short-term outperformance of banned stocks. Volatility was measured by an f-test, t-test and Beaver´s U. The short-selling ban did not contribute to reducing volatility according to their empirical analysis. Their analysis shows that the number of stocks that exhibit a decrease in volatility is higher for freely traded stocks after the introduction of a short-selling ban. In the next step, the permanent impact of a short-selling restriction was described. The data in this analysis was collected on a weekly basis. Liquidity, measured by bid-ask spread and the Amihud indicator, deteriorated after the initiation of the ban.

Nowadays, not only stock returns, liquidity, volatility or price discovery are connected with short-selling research. Other issues, like the impact of a short-selling ban on information

production, come into discussion. The findings of other important papers are described in the following chapters.

3. Data

I made empirical observations to justify my conclusions. This chapter describes the data used in my master´s thesis. Chapter 4 is related to US stocks. The sample of stocks consists of the 127 biggest financial US titles with a market capitalization of at least 2 bn USD quoted on NYSE. The last row of Table 1 shows the descriptive statistics of this sample. The empirical data stem from Wharton Research Data Service-CRSP.

The next chapters describe stock returns, liquidity and volatility issues in Europe. In the statistical analysis, I worked together with 462 different European stocks from 12 countries: France, Spain, Italy, Germany, the UK, Austria, Poland, Belgium, Holland, Russia, Portugal, and Switzerland. The sample consists of 59 financial institutions with a short sale ban and 61 financial institutions without a short-selling ban. There is descriptive statistics of this sample in Table 2. The rest of the sample stocks are members of stock indices: CAC 40, FTSE MIB, IBEX, FTSE 100, DAX, BEL20, ATX, AEX, MICEX, SLI, PSI20, and WIG20.

Local financial authorities in Spain, Italy, France, and Belgium published the list of stocks with a short sale restriction in 2011. There was no ban in the UK, Germany, Austria, Poland, Holland, Russia, Portugal and Switzerland, so the local financial authorities did not publish any lists of relevant financial institutions. However, it is necessary to collect a sample of financial institutions from countries without a short-selling ban as well in order to compare it to the countries with a short-selling prohibition. Short selling was banned in those countries during the 2009 financial crisis. I assume the list of short restricted financial institutions would be similar if those countries imposed a ban again in 2011. Some of the financial institutions from 2009 are not listed anymore because of bankruptcy or mergers, but the core of this list remains. There was no list of banned financial institutions during the debt crisis or financial crisis in Russia and Poland. I chose all financial institutions contained in the Micex and WIG 20 for the bank sample. The list of financial institutes and relevant stock market indices analyzed can be found in Appendix 1.

I made the statistical analysis with Stata Statistics 10.0 and the graphs and tables with MS Excel. Stock prices (daily closing price, daily price low, and daily price high), shares outstanding, and daily volume data stem from Wharton Research Data Service-Compustat. Bid and ask prices were downloaded from Datastream. Bid and ask prices are measured at the market close. All observations are made on a daily basis. A test for heteroscedasticity was undertaken for each regression and was passed with flying colors. My research periods consist of the period from July 1, 2011 to the end October 30, 2011 and its subperiods. A 1% statistical significance is marked with three stars, a 5% statistical significance is marked with two stars and a 10% statistical significance is marked with one star.

4. Why are short selling bans imposed on financial stocks?

Financial institutions are the first vote if a short-selling ban comes into discussion. A short-selling ban is usually extended into other sectors in the second step. There are several possible explanations for this. The first explanation is that financial institutions have the biggest impact on the whole economy and it is necessary to protect them. Others argue that financial institutions are more sensitive to bearish markets and short selling.

To analyze the impact of short-selling on stock prices, I regress U.S. financial institutions stock returns from July 29, 2011 – August 15, 2011 on a normalized measure of the change in short interest over the period (see Graph 1). The US did not ban short selling, so the short interest position changed freely. In addition to debt crisis, the U.S. rating was downgraded[3] during this period. Battalio, Mehran and Schultz (2011) have already done the analysis for the whole market. I added the regression for financial institutions. I chose all financial institutions traded on the NYSE with a market capitalization higher than 2 billion USD, altogether the 127 biggest US financial institutions. I do not distinguish between weak and strong banks; my empirical analyses in the paper are made for the financial sector in general. Table 3 lists the result for all

[3] Credit rating agency Standard & Poor's on 5 August 2011 downgraded the credit rating of the United States, stripping the world's largest economy of its prized AAA status.

stocks published by Battalio, Mehran and Schultz (2011). The last row of this table contains comparable results for financial institutions.

These results are very similar for the whole market and for the financial institutions. Paradoxically, stocks with a larger increase in short interest had higher returns over this period. This paradox is a little stronger for financial institutions. Regardless, R2 is always very small and coefficients are not statistically significant. The impact of short selling on stock return is not different by financial institutions according to this empirical analysis. From the short selling point of view, there is no strong reason to prefer a short-selling ban on the financial sector to other sectors (utilities, basic materials, etc.). I focus only on financial institutions in the following chapters because my research sample contained no other short sale restricted sectors.

As I proved, there is no strong difference between the financial and other sectors in general. Brunnermeier, and Oehmke (2008) presented a theoretical model about the negative impact of short selling on the fundamental value of financial institutions. This model proves that the impact of short selling on some types of financial institutions may be enormous. Financial institutions with weak balance sheets are especially victim to short selling according to this model.

Brunnermeier and Oehmke (2008) show that short sellers can cause huge troubles to financial institutions. This action of short sellers does not work in other sectors. The reason is that financial institutions are subject to leverage constraints which are given by financial authorities. If the leverage is high, they are forced to reduce it somehow. There are several possibilities how to do it. The model assumes the only possibility is to sell some assets at a fire sale price. Additionally, the model assumes that the market capitalization of the company represents the necessary equity which is given by the financial authority. The model implies that banks with weak balance sheets are vulnerable to short selling.

The theoretical model of Brunnermeier, Oehmke (2008) has three time periods, t=0,1,2. A financial institution has invested in X units of a long-term asset at t=0. The financial institution has debt with face value of D_0. This debt is due to be paid off at t=2. This debt can be paid at t=1 if the financial institution is forced to reduce leverage. The expectation at t=1 is that the

long-term asset will pay off R at t=2. If the financial institution is forced to repay some debt at t=1, it has to sell some long-term assets at t=1. Early liquidation is subject to a discount; the early liquidation decreases the pay off δR, where $\delta < 1$. Therefore, the liquidation decreases the fundamental value of the financial institution. The essence of the model is that short sellers pressure equity, which decreases the leverage ratio below the critical level, and so the financial institution is forced to sell some long-term assets at a fire sale price to satisfy its capital requirements. This unprofitable sale of assets decreases the fundamental value of the financial institutions, and therefore short selling is profitable. A deeper analysis of this model is described below:

The maximal leverage prescribed by the financial authority is γ : $\frac{D}{D+E} \leq \gamma$

There are two types of investors in the model: the long-term investor and short-sellers. The long-term investors offer demand to the short sellers. In other words, long-term investors form a demand curve that short sellers can sell into. The scope of this demand curve is given by the formula: $\tilde{P} = \overline{P} - \lambda S$. Long-term investors determine the intercept $\overline{P}$ and the scope λ . The activity of short sellers, i.e. the amount of shares sold short, is expressed in S. There is some similarity between this curve and the curve of Kyle (1985) related to information asymmetry.

In the beginning, we assume no leverage constraints given by financial authorities. In the second step, I add these constraints into the model.

The fundamental value of the financial institution is calculated by: $P = RX - D_0$. The intercept of this equation with the demand curve determine the price of the stock. This situation is illustrated in Figure 1. There is only one fundamental value and equilibrium. Short sellers cannot change the fundamental value of the financial institution. Equilibrium is highlighted with a black point.

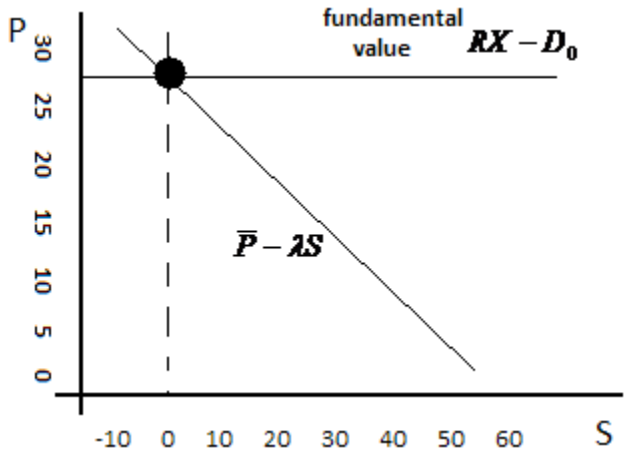


Figure 1

The situation changes if we add leverage constraints into the model. If the leverage of the financial institution breaks a critical value, then it is forced to sell ΔX of long-term assets. As I mentioned above, this sale price is worth δR and is not profitable. The fundamental price of the company with leverage constraints is lowered by $(1-\delta)R\Delta X$. The reduction in equity value $(1-\delta)R\Delta X$ stems from the fact that long-term assets can only be sold at a discount. The price of the financial institutions is $P = XR - D_0 - (1-\delta)R\Delta X$ in this case.

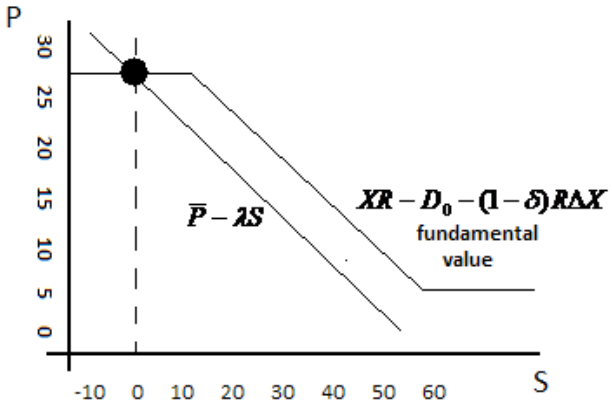


Figure 2

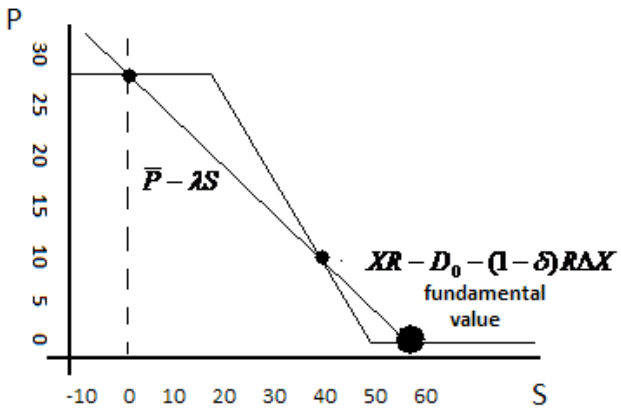


Figure 3

From Figure 3 it is obvious that when short sellers take a large enough position, the fundamental value drops as a result of forced selling of long-term assets at fire sale prices.

Based on the model parameters, the financial institutions can be positioned into three different regions.

- Well-capitalized region (Figure 2). There is no danger of predator short selling in this case. The condition $R \succ \frac{D_0}{\delta X}$ needs to be satisfied. The financial institution does not have to unwind any of its long-term holdings in any case.

- Vulnerability region (Figure 3). The financial institutions especially suffer from short selling in this region if the payoff of the long-term assets occurs in the interval $\frac{D_0}{\gamma X} \leq R \prec \frac{D_0}{\delta X}$. The leverage constraint is initially satisfied and the financial institution does not sell the assets if short selling is forbidden. If short selling is allowed, there are three possible equilibriums (prices) in this state. The middle equilibrium is not stable. If the short sellers know (and have market power), they can influence the price and the equilibrium with P=0 will prevail.

- Constrained region. The leverage constraints are violated even in the absence of short selling in the region. Payoff of the assets has to be low: $R \prec \frac{D_0}{\gamma X}$. There is a unique equilibrium in this state. If short selling is restricted, the financial institutions have to sell part of their long-term assets. If short selling is allowed, it unwinds all long-term assets and P=0.

This paper of Brunnermeier and Oehmke (2008) shows how short selling can destroy the fundamental value of a financial institution. This effect works especially for banks with weak balance sheet. On the other hand, some assumptions of this model are simplified.

Nguyen and Tang (2011) performed an empirical analysis related to financial institutions. They focused on short restricted US financial stocks in the 2009 financial crisis. Together 753 stocks were analysed by linear regressions and a Wilcoxon test. Their research period is a few days around the introduction of the short-selling ban. Their results indicate that the ban has a

positive impact on all financial institutions[4]. However, the subgroup analysis is interesting. Medium/large commercial banks and brokerage firms benefited most from the ban, and small commercial banks and insurance companies benefited the least from this ban. The next subgroup analysis is relevant to the theoretical model by Brunnermeier and Oehmke (2008) described above. Nguyen and Tang (2011) proved that financial firms with a higher leverage and greater likelihood of financial distress experience especially high abnormal returns. Unfortunately, this analysis was made on a very short-term period around the ban. The short selling ban reduced the average frequency of extreme negative returns. The frequency of extreme positive daily returns was higher during the ban period than during the pre-ban period. On the other hand, the authors admit volatility and liquidity problems caused by the ban. The S&P volatility index increases significantly from the pre-ban to ban periods as well.

5. Stock return analysis

On 11 August, 2011, the official justification by the Belgium Financial Authority for a short-selling restriction was as follows: "One of the aims of the measure is to limit the possibility of making a profit by disseminating misleading information." The European Supervisory Authority emphasized the requirements of the Market Abuse Directive ("MAD"), referring to "the prohibition of the dissemination of information which gives, or is likely to give, false or misleading signals as to financial instruments, including the dissemination of rumors and false or misleading news".

Research has an opposite opinion regarding this information. The theory considers information as a true signal which reflects the fair fundamental value of the stock. The ban for short sellers with bad fundamental information slows down price discovery. The theory is quite ambiguous about the long-term effect of a short-selling ban. Shkilko, Van Ness and Van Ness (2011) presented another argument against the financial institutions authorities' justification

[4] This outperformance of financial institutes may be influenced by the TARP announcement. See Beber and Pagano (2011), or Boehmer, Jones and Zhang (2009).

statement. According to their empirical study, short sales may increase downward pressure on prices even in the absence of negative information. In any case, a short-selling prohibition is not as strong as it seems to be. Market participants could use ETFs, put options, CDS, or other derivative instruments to bet on falling stock prices. Based on Boehmer, Jones and Zhang's (2009) empirical research, shorting activity drops by about 65% during a financial crisis short-selling ban. Recall that market-makers are able to short as part of their market-making and hedging activities, and these are probably the short sales that we observe during the ban period.

Haruvy and Noussair (2006) did some non-traditional empirical research. They made an experiment with students, who represented the traders on the stock exchange. The students submitted their orders. The researchers made detailed statistics of price development, bubble creation and so on. The data showed that short selling has the effect of reducing market price. The stocks with loose short-selling constraints exceeded the fair value only occasionally, for small intervals, and by relatively small magnitudes. However, the stocks with short trading possibility achieved the prices below fundamental values.

I made an empirical study to examine the short-selling ban effects. I compared the excess performance of financial institutions in the countries with the ban (Italy, Spain, France and Belgium) to the countries without a ban (Germany, the UK, Austria, Poland, Holland, Russia, Portugal, and Switzerland). Excess return is defined as the difference of financial's daily returns and the relevant daily equally weighted stocks index[5]:

[5] Some of the banned financial institutes are members of the stock index in the country. Such stocks are excluded from the subtrahend in equation (1).

$$r_e = \frac{p_t - p_{t-1}}{p_{t-1}} - \frac{\sum_{i=1}^{z} \frac{p_i - p_{i-1}}{p_{i-1}}}{z} \quad (1)$$

r_e - excess stock return

p_t - financial's closing price on day t

p_{t-1} - financial's closing price on day t-1

p_i - closing price of stock in market index on day t

p_{t-1} - closing price of stock in market index on day t-1

z - number of stocks in the market index

The reason for such a definition of excess return is as follows. In my opinion, it is not possible to compare the performance of financial institutions in different countries directly. The excess return defined above adjusts the overall situation in the economy and I can focus only on financial institutions. All in all, I compared the performance of financial institutions relative to the main stock index in the country.

I focused on various periods to evaluate the change of the short-selling effect over time. The total estimation window comprises of 69 trading sessions. If t_0 refers to the trading session on 12 August, 2011, then the research windows are as follows:

$$[t_{-14};t_{-1}]\,[t_{-10};t_{-1}]\,[t_{-6};t_{-1}]\,[t_1;t_6]\,[t_1;t_{10}]\,[t_1;t_{14}]\,[t_1;t_{30}]\,[t_1;t_{45}]\,[t_1;t_{55}]$$

Graphs 2 – 4 show the daily performance of this excess return. I assume that the initial value is 100 on 11 August, 2011[6] in every country. The next values depend on the excess return performance defined in equation (1). The countries with a short-selling ban are marked with broken lines. As we can see, the financial institutions with a short-selling ban performed better in comparison to financial institutions without a short ban. But this effect is short-term only. There was no misleading event during this period of time[7] and it is hard to believe that fundamentals of short restricted financial institutions are better.

[6] 11 August, 2011 was the last day before the short selling ban

[7] The TARP announcement was an event which influenced stock returns probably more than the short restriction during the 2009 financial crisis. See Beber and Pagano (2009) or Jones, Boehmer, and Zhang (2009).

To quantify my empirical research, I made an OLS regression in Table 4. The dependent variable is the daily excess return of financial institutions in different periods. I used a dummy variable for banned stocks. The short-selling ban is a dummy variable that equals 1 if short sales are forbidden, and is 0 otherwise. Six and ten days after the ban, countries with a short-selling ban achieved a statistically significant outperformance on a daily basis. The strong statistically significant outperformance was 1% per day during the first six days. During ten trading sessions, the outperformance decreased to 0.3% per day. There was an outperformance 6 days before the ban introduction too. Rumors related to the short-selling ban were published a few days earlier. Rumors and correct market expectations caused a little outperformance earlier. The outperformance disappeared in every period after $[t_1;t_{10}]$. In the $[t_1;t_{55}]$ period, the short-ban coefficient is even negative but not statistically significant.

I made a subgroup analysis in the next step. Because of the highest statistical significance in the general analysis, I focused on the $[t_1;t_6]$ test period in the subgroup analyses. All countries are divided into two groups. The PIIGS+Emerging markets group contains Spain, Italy, Poland, Russia and Portugal. France, Belgium, Germany, the UK, Austria, Holland and Switzerland belong to the Developed countries group. The goal of the subgroup analyses is to find the differences between these group. As Table 5 shows, a short-selling ban has a much higher effect in the PIIGS+Emerging markets. An excess daily return of 1.3%, confirmed by a statistical significance at a 1 % level, was achieved in the PIIGS+Emerging markets subgroup. An approximately 0.6% excess return with a statistical significance level of 10% and lower R2 value illustrates a weaker effectivity of the short-selling ban in the Developed countries subgroup.

The second subgroup analysis is related to market capitalization and to the same test period $[t_1;t_6]$. I created SmallCap, MidCap and LargeCap groups. One-third of the banks, with the smallest market capitalization, belong in the SmallCap group, one-third of the banks, with the highest capitalization, in the LargeCap and the last third in the MidCap. The results are introduced in Table 6. There are no significant differences between these groups. Slightly above-average values were achieved in the MidCap group.

A possible interpretation of the stock return analysis is that a short-selling ban is a measurement which "buys" time and helps on a short-term horizon only. The price of this "buy" is calculated in the next chapter related to the bid-ask spread. Beber and Pagano (2009) and Jones, Boehmer, and Zhang (2009) found an outperformance of US short-restricted stocks in the 2009 financial crisis too. They argued this outperformance was caused by the TARP announcement. To adjust for the possible misleading factor (TARP announcement) Beber and Pagano (2009) made the same stock return analysis in Europe. They found a short-term outperformance of banned stocks in Europe, which concurs with my results. Beber and Pagano (2009) unfortunately did not check the statistical significance on different test periods.

6. Bid-ask spread analysis

During a short-selling ban period, an increase in the bid-ask spread is an often mentioned fact in the literature. It is necessary to check the origin of the bid-ask spread to justify this increase. A bid-ask spread consists of three basic components: Adverse selection costs, inventory holding costs and order processing costs. Logically, some of these components have to increase in case of a bid-ask spread increase. I will now briefly examine the connection between each of the components and the short-selling ban.

Order-processing costs are those directly associated with providing the market making service and include items such as the exchange seat, floor space rent, computer costs, informational service costs, labor costs, and the opportunity cost of the market maker's time. Order processing costs are fixed costs per share. Charoenrook and Daouk (2005) proved that a short-selling restriction reduces volume by 15%. Because these costs are largely fixed, at least in the short run, their contribution to the size of the bid-ask spread should fall with trading volume; that is, the higher the trading volume, the lower the bid-ask spread. There are factors that cause market makers costs per share to increase as the scale of trades is decreased. This effect is generally called economies of scale and in our specific case diseconomies of scale. On the other hand, a diseconomy of scale is a long-run concept and short-selling bans are usually in force for only a few months. It is very difficult to quantify this and the final effect would be small if at all.

Market maker bears inventory-holding costs while carrying positions acquired in supplying traders with liquidity. According to Bollen, Smith, Whaley (2002), there are two obvious points to take into consideration: the opportunity cost of funds tied up in carrying the market maker's inventory and the risk that the inventory value will move unfavorably as a result of stock price movements. Regarding the opportunity cost of funds, Demsetz (1968) demonstrates that price per share is a good proxy. He argues that the relative bid-ask spread is equal across stocks, ceteris paribus, or the higher the stock price, the larger the spread. Market makers want to close out or reduce positions before the close of trading every day. If stocks are bought and sold on the same day, the costs are 0. In case inventory is carried overnight, it is ambiguous whether it is a benefit or a cost. If, during the day, most investor orders are buys, the market maker may have a short position in inventory, in which case he will not pay (but earn) interest overnight. With respect to security price movements, market makers use to hold undesired portfolio positions. These portfolio positions do not lie on their efficient frontier. It is necessary to note that the decision to ban short selling did not apply to financial intermediaries acting as market makers or liquidity providers in France, Italy, Spain and Belgium. The market makers could freely change their inventories like before the short-selling ban. Despite no restriction for market makers, there are some reasons to increase inventory holding costs. The inventory holding costs are a function of other variables (fundamental risk, volatility, risk aversion) as well. Short selling has impact on these variables according to various studies.

The assumption of asymmetric information causes adverse selection costs. Market makers are forced to increase the bid–ask spread. This increase represents the premium that dealers demand for trading with traders with insider information. The market maker does not know if the order received stems from somebody with better information (insider) about the company or from a liquidity trader[8]. The market maker's loss caused by insider traders is compensated by profit earned by liquidity traders. There are different opinions on the adverse selection effect. As mentioned in Chapter 2, Appel and Fohlin (2010) argue that a ban on short sales

[8] Liquidity traders are uninformed and submit a random net demand for stock $N(0,\sigma^2)$.Their reasons for trading may be a sudden need for consumption or idiosyncratic shocks to wealth, or needs relating to the life cycle.

disproportionately restricts informed traders from selling, mitigates the adverse selection problem and thereby lowers spreads.

In any case, my empirical research and most other empirical studies have found evidence about a statistically significant increase in the bid-ask spread for short restricted stocks.

I used a Wilcoxon test for the median differences to quantify the change in the bid-ask spread. The test compares the median of 30 trading sessions before the ban to the given test period after the introduction of the ban. The test periods are: $[t_1;t_6]$ $[t_1;t_{10}]$ $[t_1;t_{14}]$ $[t_1;t_{30}]$ $[t_1;t_{45}]$ $[t_1;t_{55}]$ in this case.

I focused on the relative bid-ask spread in this analysis:

$$s = \frac{a_f - b_f}{(a_f + b_f)/2} \quad (2)$$

s - relative bid-ask spread
a_f - market close ask price of financial
b_f - market close bid price of financial

As Table 7 shows, the increase of financial stocks relative bid-ask spread is higher in countries with a short-selling ban compared to freely traded financial stocks. There is no statistically significant bid-ask spread change in Holland and only one test period change in Austria. These countries did not ban short selling, so this result was expected. What is interesting is the highly significant change in Switzerland and Germany. The coefficient, presented in the second row of every test period, is calculated as the median bid-ask spread in the test period divided by the median bid-ask spread in the basic period. The average change of coefficient for every test period is calculated in Table 9. Only statistically significant changes are involved in the average calculation. My empirical results related to the 2011 debt crisis are similar to Beber and Pagano's (2011) results related to the 2008 financial crisis. The increase in the bid-ask spread was, on average, approximately 110% for banned stocks and 25% for freely traded stocks. Beber and Pagano (2011) calculated the average increase at 127% and 49% respectively. The results are similar at the country level as well. The strongest increase in the bid-ask spread occurred in Italy during the financial and debt crises. The increase in Belgium and Spain was 100% in both

crisis periods. The increase in the bid-ask spread for Spain was higher during the debt crisis compared to the financial crisis.

This analysis is commonly used, but it has some disadvantages. First of all, it is difficult to compare the liquidity issues of financial institutions in troubled Spain to those in Germany directly. The huge increase in the bid-ask spread may be caused by the bad macroeconomic situation in Spain. The second important issue is that it is difficult to justify a statistically significant bid-ask spread increase in financial stocks in countries without a short-selling ban (e.g. Germany).

To provide a more accurate analysis, I adjusted the macroeconomic situation. Instead of the relative bid-ask spread defined above, the excess relative bid-ask spread is analyzed. The excess bid-ask spread is defined as the difference between the financial stock relative bid-ask spread and equally weighted relative bid-ask spread[9] of all stocks contained in the main stock market index.

$$s_e = \frac{a_f - b_f}{(a_f + b_f)/2} - \frac{\sum_{i=1}^{z} \frac{a_i - b_i}{(a_i + b_i)/2}}{z} \quad (3)$$

s_e - excess relative bid-ask spread
a_f - market close ask price of financial
b_f - market close bid price of financial
a_i - market close ask price of the stock in the market index
b_i - market close bid price of the stock in the market index
z - number of stocks in the market index

The fraction with the sum in the denominator is the equally weighted average bid-ask spread of the relevant market index.

[9] Some of the banned financial institutions are members of the stock index in the country. Such financial institutions are exluded from the subtrahend in equation (3).

In other words, this analysis shows how the bid-ask spread of short restricted financial institutions changed relative to the whole market in the country. There is the performance of s_e in Graph 5. The Wilcoxon test for the median differences is presented in Table 8. Despite the smaller number of statistically significant results, this analysis has a higher information value. In countries with a short-selling ban, we observe an increase of s_e. There is a high increase in Italy especially. We observe an increase of s_e in Belgium, but this increase is not statistically significant. This may be caused by the small number of banned financial institutions in Belgium (only 4) and an insufficient sample size. There is a statistically significant increase of s_e in Spain and France too. In countries without a ban, the tendency is the opposite. The s_e remained mostly stable (Switzerland, Germany, Holland, and the UK) or it decreased in some countries (Austria and Portugal). In Holland, the UK and Germany, there was no statistically significant change in the excess bid-ask spread. Alves, Mendes and Silva (2012) made an abnormal bid-ask spread empirical analysis related to the 2011 debt crisis. Their results do not significantly differ from my results. They did not find an increase in the abnormal bid-ask spread in Belgium. I found some increase in Belgium, but this increase is not statistically significant.

I estimate the cost caused by short selling restrictions in the next step. Battalio, Schultz (2011) calculated the costs imposed by short sale bans in the US market during the 2009 financial crisis. They calculated these costs for equity and derivative markets separately.

The average dollar trading volume for banned stock during the ban was $66,749,000 in the 2008 financial crisis. There were 404 financial stocks subjected to the short sale ban. The increase of the effective half-spread was 0.0016%. The duration of the short sale ban was 14 days. If we multiply all figures, the total costs were $604,051,750. In other words, the excess liquidity costs of one stock per day were $106,789. This estimate of Battalio, Schultz (2011) does not include the costs associated with mutually beneficial trades that did not occur because of the inflated liquidity costs.

Furthermore, the options market suffered higher costs because of the short sale restriction during the 2008 financial crisis. Battalio and Schultz (2011) estimate the inflated trading costs paid by liquidity demanders in option markets during the short sale ban at more than $110

million in inflated liquidity costs on the first day of the ban. The inflated costs did not vanish once the option market makers were exempt from the short sale ban. Battalio and Schultz (2011) attribute these liquidity costs to the uncertainty of regulatory measurement that prevailed during this period. Overall, authors calculate that liquidity demanding traders paid more than USD 505 million in inflated liquidity costs during the ban. Altogether, the estimated inflated cost of liquidity caused by the short sale ban in the U.S. option and equity markets exceeds USD 1 billion.

My analysis of the excess relative bid-ask spread (s_e) enables us to estimate the liquidity costs caused by the short-selling ban during the 2011 debt crisis. If we assume the s_e did not change in countries without a ban (see Graph 5), then the absolute change of s_e in banned countries represents the short-selling ban costs. These costs are translated into EUR values in Table 10. The methodology for calculating liquidity costs is as follows:

$$LC = \sum_{t=1}^{t+n} (ES_t \times Volume_t) \quad (4)$$

LC - liquidity costs caused by the short-selling ban for one financial institutions over a given time period. The total liquidity costs presented in Table 10 are the sum of all short sale restricted financial stocks in the country.
ES - excess bid-ask spread. Excess spread is calculated for every stock from an absolute change of excess bid-ask spread (Table 8)
Volume- daily stock volume traded
n – achieves the value of 6, 10, 14, 30, 45 or 55 days depending on the test period duration

The value is calculated for statistically significant values only. Statistically non-significant values are marked “n.a.”. As Table 8 and Table 10 indicate, the highest liquidity costs can be found in Italy. In Italy the average daily liquidity cost[10] was 86.442 EUR per share. The costs were 46.433 EUR and 27.634 EUR in Spain and France respectively. There is no statistically significant increase of excess bid-ask spread in Belgium, so it is not possible to quantify those costs.

[10] The daily liquidity costs of the short selling ban are calculated from Table 8. As we can see, the daily costs vary in the different event periods. Therefore, the average value from the whole event period is taken.

Nevertheless, these costs are relatively small for the market capitalization of relevant short sale prohibited financial stocks. If a short-selling ban increases returns slightly (approx. 0.01% - 0.1% per given period), then the liquidity costs are negligible.

7. Volatility analysis

Economic theory and empirical analyses are not absolutely consistent in their prediction of volatility consequences, according to a study by the Financial Service Authority UK. Based on theoretical models, a short-selling ban would lead to lower volatility for restricted shares (when compared to the market). Empirical results for the relative change in volatility of restricted stocks compared to the market after the introduction of the temporary ban are inconclusive.

Chen and Zheng (2005) examined the impact of short selling on the volatility and liquidity of the stock market. Their empirical analysis stems from the Hong Kong Stock Exchange. They used a Granger causality test to provide the empirical analysis. The notion of Granger causality is based on a criterion of an incremental forecasting value. Variable X is said to "Granger-cause" the Y variable if Y can be predicted better from the past of X and Y together than the past of Y alone, with other relevant information being used in the prediction. Impulse response function is the second tool for analyzing volatility. The results from an impulse response function and Granger causality tests indicate that short-selling volumes do not cause market volatility, but market volatility causes short-selling volumes. If the market volatility increases, the short-selling volumes increase too. Authors found no evidence that short selling increase the volatility of stock market. In other words, the empirical results show that when short selling is allowed, aggregate stock returns are less volatile and liquidity is higher. The Chen, Zheng (2005) justify this conclusion by the logical explanation. When the stock price exceeds its fundamental value, some rational investors will surely short sale this stock. It increases the stock supply in the market. It will relieve the strong imbalances of demand and supply for this stock and it will reveal the higher priced signal to other traders. Therefore the price is back to fair value at the end. Consequently, when the price drops, the short sellers will close their short position. The short sellers repurchase the stock. This repurchase increase demand and price of the stock.

Additionally, it will reveal the lower priced signal of this stock to other traders, and then make the price fair. This mechanism makes stock market more liquid and stable.

Schwartz and Norris (2010) examined whether the market capitalization of a company influences its reaction to a short-selling ban. The sample consisted of 60 US financial stocks held by the Vanguard Index mutual fund[11]. The firms were divided into small, medium and large capitalization firms. Small firms had a market value of $1 billion or less. Medium-sized companies had a capitalization of $1 billion-$4 billion and large firms had capitalizations over $4 billion. The firms were divided into restricted and non-restricted portfolios as well. The restricted ones were financial firms whose stock was included in the temporary short-selling ban the SEC ordered from September 19 to October 8, 2008. An analysis of variance was performance to study the impact of the short-selling ban on the volatility of the stock portfolios. Variance represents risk, so an increase in variance is an increase in risk for investors. During the 30 days before the introduction of the ban, small-sized companies had the lowest variance in the restricted and non-restricted sample. The variance of the restricted portfolio was similar to the non-restricted portfolio. On September 19th, when the temporary ban was placed on the market, there was a substantial increase in variance for each size portfolio. The small firms kept the lowest level of volatility in the 14 days after the introduction of the short-selling ban. The variance of the restricted portfolio was twice the variance of the non-restricted portfolio during this period. This difference is primarily caused by large companies. Restricted large companies had a significantly higher volatility than large companies in the non-restricted portfolio. The large restricted firms were objects of media interest very often. The additional media coverage may have caused this increase in volatility for those firms. This ban on financial institutions lasted only 14 days in the US. When the ban was lifted, the small firm portfolio continued to witness a significant increase in variance. Unlike the small firms, both the large-size and mid-size firms saw a decrease in variance. The variance of restricted and non-restricted portfolios returned to the same level in the period after the short-selling ban.

[11] The Vanguard Group is an American investment management company based in Malvern, Pennsylvania that manages approximately $1.7 trillion in assets. It offers mutual funds and other financial products and services to retail and institutional investors in the United States and abroad.

My definition of the volatility measurement is the percentage difference between the daily high and daily low price. To adjust the overall market situation, the excess price range[12] is calculated.

$$v_e = \frac{p_{Fh} - p_{Fl}}{p_{Fl}} - \frac{\sum_{i=1}^{z} \frac{p_{Ih} - p_{Il}}{p_{Il}}}{z} \quad (5)$$

v_e - excess daily price range
p_{Fh} - daily high price of financial stock
p_{Fl} - daily low price of financial stock
p_{Ih} - daily high price of the stock in the market index
p_{Il} - daily low price of the stock in the market index
z - number of stocks in the market index

The performance of v_e is illustrated in Graph 6. The short term increase in volatility of banned stock was more than compensated for in the longer period. The volatility of the banned financial institutions outperformed other financial stocks in the pre-ban period. Shortly after the initiation of the ban, the volatility outperformance of banned financial institutions remained at a high level. This difference between short restricted stocks and free traded stocks disappeared a few days after the introduction of the ban.

I made a regression analysis to quantify this finding. The impact of volume on volatility has been proven several times, so I employed the daily volume of financial stocks as a control variable.

$$v_e = \alpha + \beta \times \ln(volume) + \gamma \times ban \quad (6)$$

v_e - excess daily price range
$\ln(volume)$ - natural logarithm daily volume of financial
ban - dummy variable that equals 1 if short sales are forbidden and 0 otherwise

[12] Some of the banned financial institutions are members of the stock index in the country. Such financial institutions are exluded from subtrahend in equation (5).

The results of this regression analysis are presented in Table 11. As a study by the Financial Service Authority UK indicates, the impact of short selling on volatility is inconclusive. The increase of excess volatility in the 6 days after the initiation of a ban is not observable on a long-term horizon. Excess volatility achieved its lowest level in October 2011. Boehmer, Jones, and Zhang (2009) found a short-term increase of volatility too. The short-selling ban did not contribute to reduced volatility according to Alves, Mendes, and Silva (2012). Based on Alves, Mendes, and Silva's (2012) findings, a short-selling ban deteriorates volatility on the long-term horizon as well. Schwartz and Norris (2010) examined the volatility of restricted stocks for a 14-day period after the initiation of the short-selling ban. They found excess volatility for the banned stock in this period, which concurs with my empirical results.

8. Summary and policy recommendation

I focused my empirical study on the short-selling ban during the debt crisis of 2011. This period provided interesting and not yet fully analyzed research possibilities. The short-selling ban was in force for more than half a year, which is a common policy by financial authorities.

Financial authorities are used to imposing a short-selling ban on financial institutions as an initial step to secure the market. Empirically, I did not find any difference between the financial sector and other sectors in the impact of short interest on stock returns. The existence of capital constraints by financial institutions may theoretically justify this step according to Brunnermeier and Oehmke (2008). The short sellers pressure the equity downwards, which decreases the leverage ratio below the critical level, and then the financial institutions are forced to sell some long-term assets at fire sale prices to satisfy their capital requirements. This unprofitable sale of assets decreases the fundamental value of the financial institutions, and therefore the short selling of these financial stocks is profitable. This effect works especially for banks with weak balance sheets. The empirical evidence presented by Nguyen and Tang (2011) proved that financial firms with higher leverage and a greater likelihood of financial distress experience higher abnormal returns a few days around the introduction of the ban.

A short-selling ban increases returns on the short term horizon by 1% per day during the first six days of the ban and 0.3% per day during the first 10 days. This stock return effect is especially high for short restricted stocks in PIIGS and Emerging markets. An excess stock return of restricted stocks does not meaningfully depend on its market capitalization. The fact that short-term excess performance of short restricted stocks is higher compared to free traded stocks may serve as a trading idea for the investors. Impact of short selling on stock return is not long-term.

On the other hand, the higher liquidity costs do not disappear as fast as the positive return effect. I found empirical evidence about the existence of liquidity costs in almost my whole research period, from the ban initiation on August 12th to the end of October. These costs are relatively small for the market universe. If a short-selling ban helps to increase returns by 0.01%-0.1%, then at least the liquidity costs are negligible. From the long-term perspective, a short-

selling ban does not increase returns by 0.01%-0.1%. A ban induces higher liquidity costs only from a long term perspective.

The impact of short selling on volatility is inconclusive. The increase of excess volatility in the 6 days after the initiation of a ban is not observable on a long-term horizon according to my empirical study. Other research papers have found a negative impact of a short-selling ban on volatility on both short-term and long-term horizons.

According to empirical studies from the 2009 financial crisis and my analysis, it makes no sense to ban short selling for a long period. A short-selling ban may serve as a short term measure against some bad news or situation to protect the market from panic selling. The modification of a short selling policy comes into consideration. The application of a short-selling ban for a shorter period (6 to 10 days) instead a long period is a good point for discussion. It is possible to impose future short-term short-selling restrictions in case of deterioration in the economy or the danger of panic selling.

9. References

1. Alves C., Mendes V., Silva P., 2012, On the Impact of the August 2011 Ban on Covered Short Selling – An Empirical Anlysis, Working paper of Securities and Exchange Commission in Portugal

2. Appel, I., Fohlin, C., 2010: Shooting the Messenger: The Impact of Short Sales in Times of Crisis, Working Paper

3. Battalio, M., Mehran, M., Schultz, P., 2011, Market Declines: Is Banning Short Selling the Solution, Federal Reserve Bank of New York Staff report no. 518

4. Battalio, R., Schultz, P., 2010, Regulatory Uncertainty and Market Liquidity: The 2008 Short Sale Ban's Impact on Equity Option Markets., Journal of Finance Vol 66 Issue 6

5. Beber, A., Pagano, M., 2011, Short-selling bans around the World, Journal of Finance

6. Boehmer, E., Charles, M. Jones, Xiaoyan Z., 2009, Shackling short sellers: The 2008 shorting ban, Working paper, Columbia Business School

7. Bollen, N., Smith, T., Walley, R., 2002, Modeling the bid/askspread: measuring the inventory-holding premium, Journal of Financial Economics 72 (2004) 97–141

8. Brown, S., Warner, J., 1985, Using Daily Stock Returns: The Case of Event Studies, Journal of Financial Economics 14, 3-31

9. Brunnermeier, M., Oehmke, M., 2008, Predatory Short Selling, Working paper, Princeton University and Columbia University

10. Charoenrook, A., Hazem, D., 2005, A Study of Market-Wide Short-Selling Restrictions, Working Paper

11. Chen M., Zheng Z., 2007, The impact of short selling on the volatility and liquidity of stock markets: evidence from Hong Kong market, Advanced Business intelligence and financial engeneering, ISBN: 978-90-78677-13-0

12. Demsetz, H., 1968. The cost of transacting. Quarterly Journal of Economics 82, 33–53

13. Diamond, D. W., Verrecchia, R. E., 1987, Constraints on Short-selling and Asset Price Adjustment to Private Information, Journal of Financial Economics Volume 18 No 2

14. Diether, Karl B., Kuan-Hui Lee, and Ingrid M. Werner, 2009, Short-sale strategies and return predictability, The Review of Financial Studies v 22 n 2/2009

15. Financial Service Authority of UK, 2009, Short Selling, Discussion Paper

16. Haruvy E., Noussair Ch., 2006, The Effect of Short Selling on Bubbles and Crashes in Experimental Spot Asset Markets, The Journal of Finance, 1119-1157

17. Kyle, A. 1985, Continuous auctions and insider trading, Econometric*a*, 53, 1315–35.

18. Rindi B., De Jong Frank, 2009, The Microstructure of Financial Market, Cambridge University Press, ISBN-13 978-0-511-53696-0

19. Seneca, J., 1967, Short Interest: Bearish or Bullish? , Journal of Finance, 22(1), 67-70

20. MacKinlay, A., 1997, Event Studies in Economics and Finance, Journal of Economic Literature 35(1), 13-39

21. Miller, E., 1977, Risk, Uncertainty and Divergence of Options, Journal of Finance 32

22. Nguyen, Van T., Tang, A., 2011, Did the 2008 Short-Sale Ban Prevent Market Crash? , Journal of Applied Finance, Vol. 21 NO.1

23. Ofek E., Richardson M., 2003, DotCom mania: The Rise and Fall of Internet Stock Prices, The Journal of Finance, Vol. LVIII, NO. 3

24. Schwartz, L., Norris, K. , 2009, The Impact of Temporary Short Selling Restrictions on the Volatility of Financial Stock Prices: Does Firm Size Matter?, Journal of the Academy of Business Education, Vol. 10

25. Shkilko, A.,Van Ness, B., Van Ness, R., 2011, Short selling and intraday price pressures, Financial Management

Appendix 1

The financial institutions used in the analysis follow. The local financial authorities published the list of stocks with a short sale restriction in 2011. The list contains these stocks:

France (CAC 40): April Group, Axa, BNP Paribas, CIC, CNP Assurances, Crédit Agricole, Euler Hermès, Natixis, Scor, Société Générale

Italy (FTSE MIB): Azimut Holding, Banca Carige, Banca Finnat, Banca Generali, Banca Ifis, Banca Intermobiliare, Banca Monte Paschi di Siena, Banca Popolare Emilia Romagna, Banca Popolare Etruria e Lazio, Banca Popolare Milano, Banca Popolare Sondrio, Banca Profilo, Banco di Desio e Brianza, Banco di Sardegna Rsp, Banco Popolare, Cattolica Assicurazioni, Credito Artigiano, Credito Emiliano, Credito Valtellinese, Fondiaria – Sai, Generali, Intesa Sanpaolo, Mediobanca, Mediolanum, Milano Assicurazioni, Ubi Banca, Unicredit, Unipol, Vittoria Assicurazion

Spain (IBEX): Banca Cívica S.A., Banco Bilbao Vizcaya Argentaria S.A., Banco de Sabadell S.A., Banco de Valencia S.A.Banco Espanol de Crédito S.A., Banco Pastor S.A., Banco Popular Espanol S.A., Banco Santander S.A., Bankia S.A., Bankinter S.A., Caixabank S.A., Caja de Ahorros del Mediterraneo, Grupo Catlana de Occidente S.A., Mapfre S.A., Bolsas y Mercados Espanoles S.A, Renta 4 Servicios de Inversion S.A.

Belgium (BEL20): Ageas, Dexia, KBC Group, KBC Ancora

The local financial authorities did not publish any list of financial institutions in the UK, Germany, Austria, Holland, Switzerland or Portugal because of the lack of a short-selling ban in 2011. However, short selling was prohibited in these countries during the 2009 financial crisis. I assume the list of banned financial institutions would have been similar if these countries had imposed a ban again in 2011. Some of these financial institutions from 2009 are not listed anymore because of bankruptcy or mergers. Nevertheless, the core of this list remains.

UK (FTSE 100): Barclays PLC, HSBC Holdings PLC, Aviva PLC, Legal&Gen Group PLC, Royal Bank of Scotland Group, Standard Chatered PLC, RSA Insurance Group PLC, Prudential PLC, Lloyds Banking Group PLC, St. James Place, Alliance Trust PLC, Arbuthnot Banking Group PLC, Novae

Group, Old Mutual PLC, Chesnara PLC, Admiral Group PLC, European Islamic Inv Bank, Tawa PLC, Resolution Ltd

Germany (DAX): Generali Deutschland Hldg AG, Commerzbank, Deutsche Bank AG, Munich Re Co, Allianz SE, Hannover Rueckversicherung, MLP AG, Deutsche Boerse AG, Aareal Bank AG, Deutsche Postbank AG

Austria (ATX): Uniqua Versicherungen AG, Vienna Insurance Group, Erste Group Bank AG, Raiffeisen International Bank Holding AG

Holland (AEX): Aegon NV, Bincbank NV, ING Groep NV, KAS Bank NV, Van Lanschot NV, SNS Reaal Groep NV, Delta Lloyd NV

Switzerland (SLI): Baloise Holding, Credit Suisse Group, Swiss Re Ltd., UBS AG, Swiss Life Holding, Zurich Insurance Group AG, Julius Baer Gruppe AG

Portugal (PSI20): Banco Commercial Portugues SA, Banco Espirito Santo SA, Banco BPI SA, Banif SGPS, SA, Banco Popular Espanol

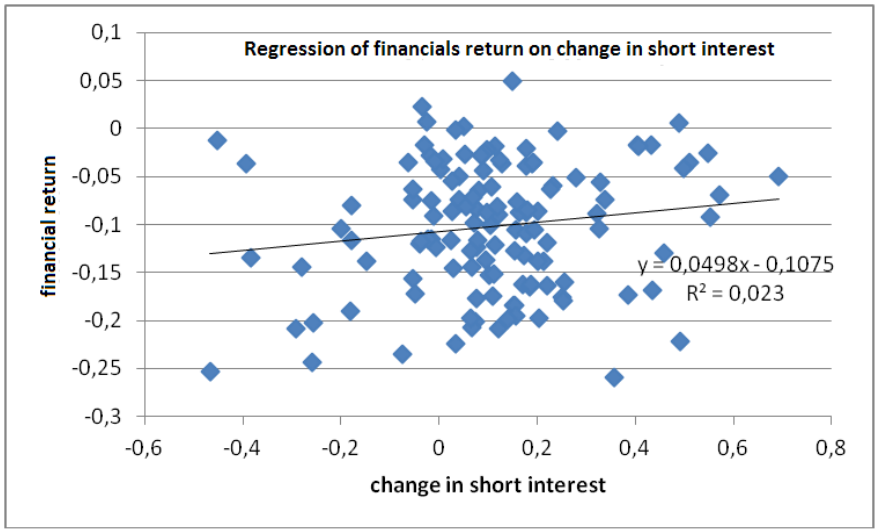
There is a special situation in Russia and Poland. Short selling on financial institutions was not prohibited during the debt crisis or the financial crisis. Membership of the financial title in the MICEX / WIG20 stock index was the key to choosing the title in the analysis.

Russia (MICEX): VTB Bank JSC, Bank Saint Peterburg, Vozrozhdeniye Bank, Sberbank of Russia OJSC

Poland (WIG20): BRE Bank SA, Bank Handlowy W Warzawie SA, Bank Pekao, PZU Group SA, Powszechna Kasa Oszczednosci

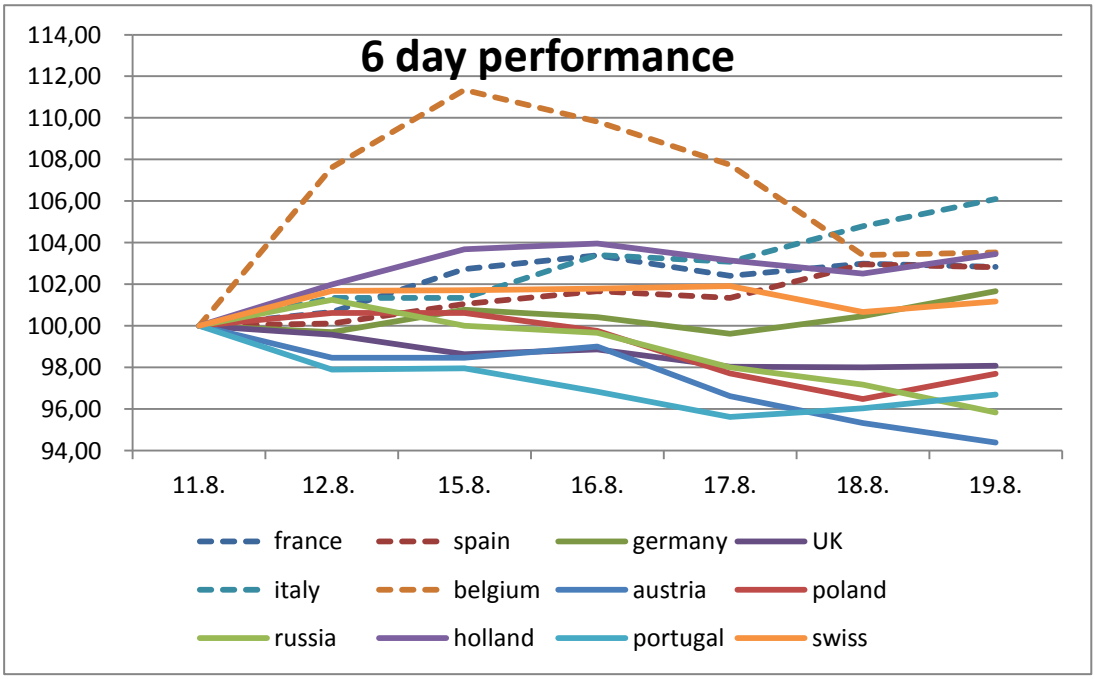
Graph 1

To analyse the impact of short selling on stock prices, I regress U.S. financial stock returns over the period of July 29, 2011 – August 15, 2011 on a normalized measure of the change in short interest over that period.

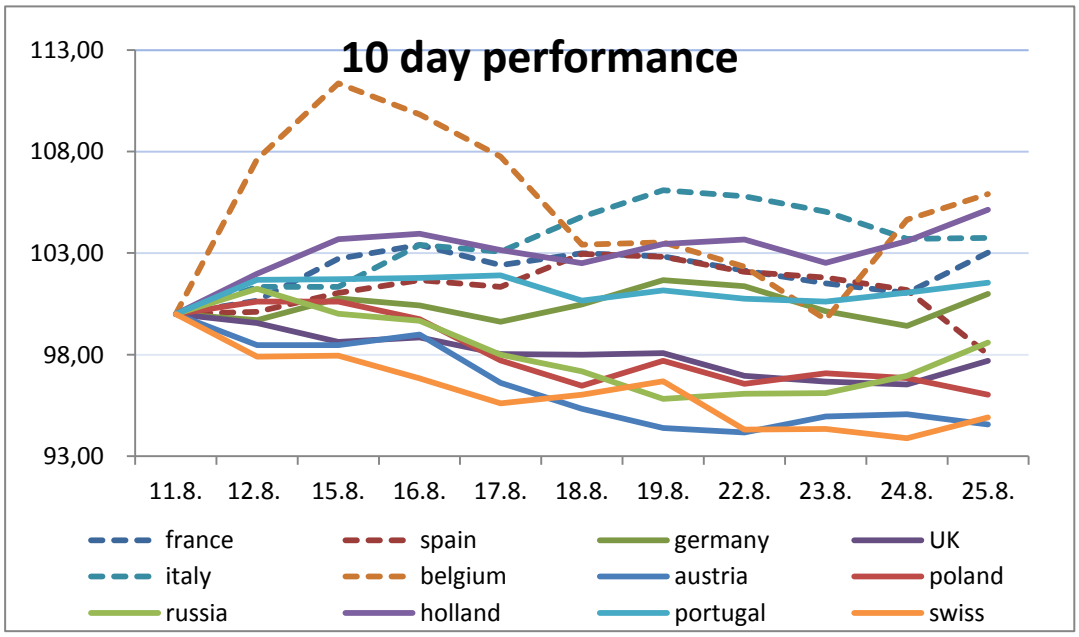


Graph 2

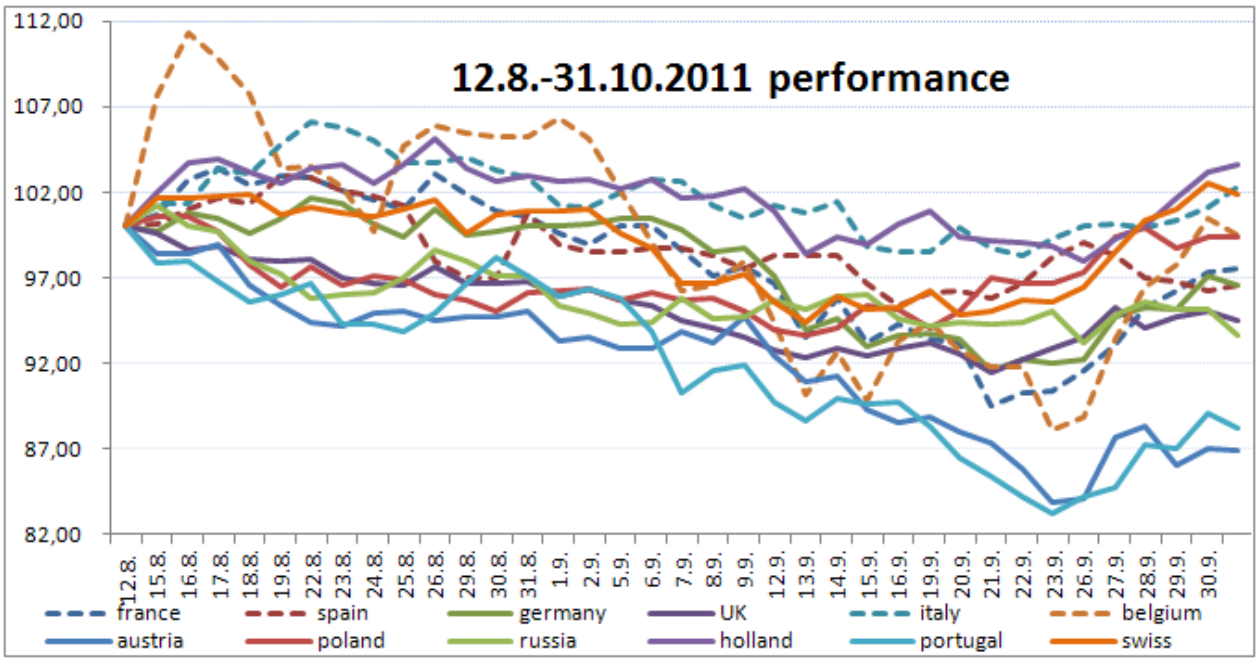
The performance of the financial sector is illustrated in Graphs 2, 3, 4. I assume the initial value is 100 on 11 August, 2011 in every country. The next values depend on the excess return performance. Excess return is defined as the difference in the financial stock' daily returns and relevant daily equally weighted stock returns from the main stock index in the country. The countries with a short-selling ban are market with broken lines.



Graph 3

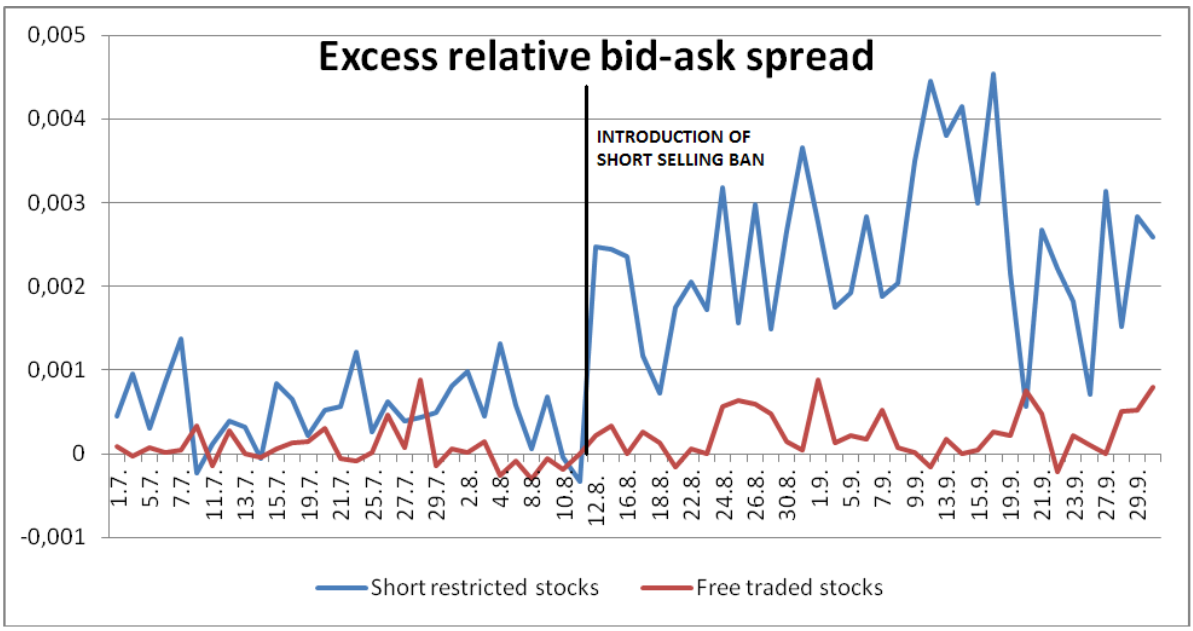


Graph 4



Graph 5

The excess bid-ask spread is defined as the difference between the financial stock relative bid-ask spread and equally weighted relative bid-ask spread of all stocks contained in the main stock market index. In other words, this analysis shows how the bid-ask spread of short restricted financial institutions changed relative to the whole market in the country.



Graph 6

My definition of the volatility measurement is the percentage difference between the daily high and daily low price. To adjust the overall market situation, the excess price range is calculated.

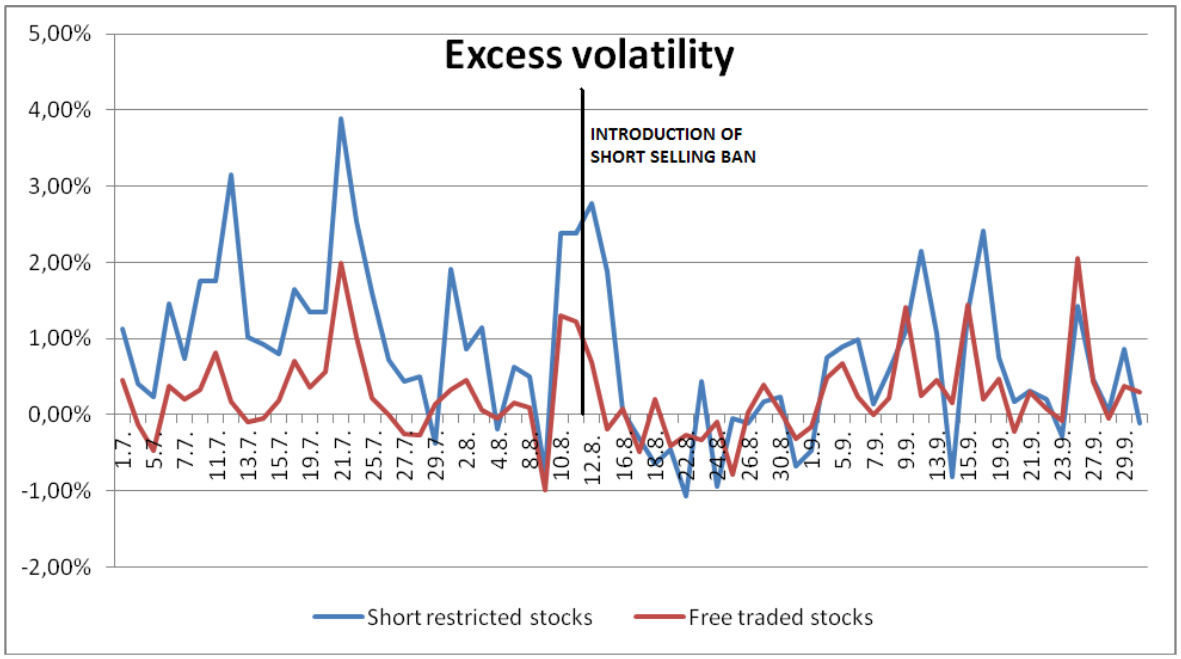


Table 1

Descriptive statistics of the data used by a regression of U.S. stock returns during the period of July 29, 2011 August 15, 2011 on a normalized measure of the change in short interest over that period.

DESCRIPTIVE STATISTICS CHAPTER 4							
		10%	25%	Median	75%	90%	Mean
ALL STOCKS	*Change in Short Interest*	-0,1714	-0,0438	0,0493	0,155	0,3063	0,0605
	Returns	-0,2023	-0,144	-0,087	-0,0377	0,0029	-0,0939
FINANCIALS	*Change in Short Interest*	-0,1532	-0,0038	0,1044	0,2	0,4051	0,1106
	Returns	-0,1978	-0,153	-0,0923	-0,0422	-0,0186	-0,102

Table 2

Descriptive statistics of the data used by return, bid-ask spread and volatility regressions. This descriptive statistics are related to whole research period.

DESCRIPTIVE STATISTICS CHAPTERS 5-7							
		10%	25%	Median	75%	90%	Mean
FINANCIAL	*bid-ask spread*	0,0004	0,0007	0,0025	0,0072	0,0177	0,0063
STOCKS	*volatility*	0,0163	0,0246	0,0364	0,0540	0,0790	0,0433
WITHOUT BAN	*return*	-0,0452	-0,0223	-0,0009	0,0164	0,0398	-0,0024
FINANCIAL	*bid-ask spread*	0,0005	0,0016	0,0063	0,0210	0,0431	0,0158
STOCKS	*volatility*	0,0187	0,0282	0,0422	0,0633	0,0920	0,0504
WITH BAN	*return*	-0,0445	-0,0217	-0,0007	0,0156	0,0384	-0,0022
	bid-ask spread	0,0003	0,0005	0,0010	0,0031	0,0077	0,0040
OTHER SECTORS	*volatility*	0,0156	0,0219	0,0320	0,0469	0,0674	0,0382
	return	-0,0376	-0,0180	-0,0009	0,0159	0,0346	-0,0014

Table 3

To analyse the impact of short selling on stock prices, I regress U.S. financial' stock returns from July 29, 2011 to August 15, 2011 on a normalized measure of the change in short interest over that period. The first, second and third rows are related to the whole market in the US. The last row is related to financial institutions. The dependent variable is the stock return.

REGRESSION RESULTS CHAPTER 4						
	Intercept	t-statistics	Coefficient of short interest change	t-statistics	Stocks	Adj. R2
All stocks	-0,0957	-43,03	0,0298	3,72	1843	0,0069
Stocks>5$	-0,0927	-41,77	0,0277	3,43	1611	0,0066
Stocks: 1000000 shares short	-0,1027	-40,3	0,0624	4,79	1306	0,0166
Financials	*-0,1074*	*-14,84*	*0,0498*	*1,51*	*127*	*0,023*

Table 4

The dependent variable is the equally weighted excess return of financial stocks in different periods. Excess return is defined as the difference in financial stocks' daily returns and relevant daily equally weighted stock returns from the main stock index in the country. I used a dummy variable for banned stocks. The short selling ban is a dummy variable that equals 1 if short sales are forbidden and is 0 otherwise.

STOCK RETURN ANALYSIS					
	$[t_{-14};t_{-1}]$	$[t_{-10};t_{-1}]$	$[t_{-6};t_{-1}]$	$[t_{1};t_{6}]$	$[t_{1};t_{10}]$
Constant	-0,0003	0,0005	-0,0001	-0,0026 *	-0,0013
Short selling ban	0,0003	0,0009	0,004 *	0,01 ***	0,003 **
Number of observation	1680	1200	720	720	1200
R2	0	0,0003	0,005	0,04	0,004

	$[t_{1};t_{14}]$	$[t_{1};t_{30}]$	$[t_{1};t_{45}]$	$[t_{1};t_{55}]$
Constant	-0,0012 *	-0,0023 ***	-0,0012 **	-0,0009 *
Short selling ban	0,0023	0,0012	0,0004	-0,0002
Number of observation	1680	3600	5400	6600
R2	0,001	0,0005	0	0

Table 5

There is subgroup analysis of financial stocks excess return in this table. The Emerging markets + PIGS countries group contains Spain, Italy, Poland, Russia and Portugal. France, Belgium, Germany, the UK, Austria, Holland and Switzerland belong to the Developed countries group.

Subgroups of first 6 days of ban		
	Emerging markets + PIGS	**Developed markets**
Constant	-0,004 **	-0,0006
Short-selling ban	0,013 ***	0,006 *
Number of observations	354	366
R2	0,05	0,01

Table 6

There is other subgroup analysis of financial stocks excess return in this table. All the banks are divided into groups depending on their market capitalization.

Subgroups of first 6 days of ban			
	Lower 33 percentile	**Middle 33 percentile**	**Upper 33 percentile**
Constant	-0,0001	0,001	-0,005
Short-selling ban	0,008 **	0,01 ***	0,007 **
Number of observations	240	240	240
R2	0,02	0,04	0,02

Table 7

There are Wilcoxon test results of bid-ask spread analysis in the table. I compared median of relative bid-ask spread before the ban introduction to the test periods after ban intiation. The coefficient, presented in the second row of every test period, is calculated as median bid-ask spread in test period divided by median bid-ask spread in basic period.

Relative bid-ask spread changes										
	FRANCE	SPAIN	ITALY	BELGIUM	GERMANY	SWISS	AUSTRIA	HOLLAND	PORTUGAL	UK
	30 trading sessions basic period before the ban introduction (1.7.2011 - 11.8.2011)									
BEFORE THE BAN	0,0009	0,0012	0,0090	*0,0016*	0,0043	0,0006	0,0036	0,0017	0,0040	0,0007
	6 trading sessions test period (12.8.2011 - 19.8.2011)									
AFTER THE BAN	0,0010 *	0,0037 ***	0,0126 **	*0,0021*	0,0049 ***	0,0009 **	0,0031	0,0017	0,0041	0,0008
coefficient	1,1486	3,1802	1,4056	1,2782	1,1406	1,3327	0,8683	0,9989	1,0351	1,1315
nb.of observations	360	576	1044	144	360	252	144	252	180	684
	10 trading sessions test period (12.8.2011 - 25.8.2011)									
AFTER THE BAN	0,0013 **	0,0032 ***	0,0164 ***	*0,0029* *	0,0050 ***	0,0009 ***	0,0035	0,0015	0,0043	0,0009
coefficient	1,5439	2,7155	1,8335	1,8040	1,1581	1,3327	0,9877	0,8898	1,0802	1,1402
nb.of observations	400	640	1160	160	400	280	60	280	200	760
	14 trading sessions test period (12.8.2011 - 31.8.2011)									
AFTER THE BAN	0,0014 ***	0,0027 ***	0,0164 ***	0,0030 **	0,0049 ***	0,0008 ***	0,0036	0,0015	0,0042	0,0009 *
coefficient	1,6081	2,3423	1,8335	1,8487	1,1572	1,2987	1,0268	0,8908	1,0531	1,2133
nb.of observations	440	704	1276	176	440	308	176	308	220	836
	30 trading sessions test period (12.8.2011 - 22.9.2011)									
AFTER THE BAN	0,0017 ***	0,0027 ***	0,0280 ***	0,0033 ***	0,0050 ***	0,0007 ***	0,0043	0,0018	0,0049 **	0,0009 **
coefficient	1,9747	2,3387	3,1280	2,0020	1,1661	1,1354	1,2029	1,0995	1,2382	1,1402
nb. of observations	600	960	1740	240	600	420	240	420	300	1140
	45 trading sessions test period (12.8.2011 - 13.10.2011)									
AFTER THE BAN	0,0017 ***	0,0024 ***	0,0281 ***	0,0031 ***	0,0058 ***	0,0007 ***	0,0047	0,0017	0,0052 ***	0,0009 ***
coefficient	1,9726	2,0574	3,1340	1,8871	1,3493	1,1384	1,3202	1,0074	1,3049	1,1925
nb.of observations	750	1200	2175	300	750	525	300	525	375	1425
	55 trading sessions test period (12.8.2011 - 27.10.2011)									
AFTER THE BAN	0,0016 ***	0,0023 ***	0,0274 ***	0,0031 ***	0,0065 ***	0,0008 ***	0,0044 *	0,0018	0,0054 ***	0,0009 ***
coefficient	1,8151	1,9517	3,0584	1,9171	1,5322	1,1706	1,2274	1,0560	1,3627	1,2011
nb.of observations	950	1360	2465	340	950	595	340	595	425	1615

Table 8

There are Wilcoxon test results in the table. I compared **excess** median of relative bid-ask spread before ban introduction to the test periods after ban initiation. The absolute change, presented in the second row of every test period, is calculated as excess median bid-ask spread in test period minus excess median bid-ask spread in basic period.

Excess relative bid-ask spread changes										
	FRANCE	SPAIN	ITALY	BELGIUM	GERMANY	SWISS	AUSTRIA	HOLLAND	PORTUGAL	UK
	30 trading sessions basic period before the ban introduction (1.7.2011 - 11.8.2011)									
BEFORE THE BAN	**0,0002**	**0,0004**	**0,0014**	*-0,0006*	0,0010	**-0,0003**	**0,0004**	0,0008	**-0,0024**	0,0000
	6 trading sessions test period (12.8.2011 - 19.8.2011)									
AFTER THE BAN	0,0004	**0,0024** *	**0,0048** **	*-0,0006*	0,0007	**-0,0002** ***	**-0,0018** *	0,0005	-0,0040	-0,0001
absolute change	0,0001	**0,0020**	**0,0034**	0,0000	-0,0003	**0,0002**	**-0,0022**	-0,0004	-0,0016	-0,0001
nb.of observations	360	**576**	**1044**	144	360	**252**	**144**	252	180	684
	10 trading sessions test period (12.8.2011 - 25.8.2011)									
AFTER THE BAN	0,0004	0,0018	**0,0074** ***	*-0,0003*	0,0010	**-0,0001** ***	-0,0004	0,0005	**-0,0041** **	0,0000
absolute change	0,0002	0,0014	**0,0060**	0,0003	0,0000	**0,0002**	-0,0009	-0,0004	**-0,0017**	0,0000
nb.of observations	400	640	**1160**	160	400	**280**	60	280	**200**	760
	14 trading sessions test period (12.8.2011 - 31.8.2011)									
AFTER THE BAN	0,0007	**0,0016** **	**0,0074** ***	0,0000	0,0009	**-0,0001** ***	**0,0000** *	0,0005	**-0,0040** *	0,0000
absolute change	0,0004	**0,0012**	**0,0060**	0,0005	-0,0001	**0,0002**	**-0,0004**	-0,0004	**-0,0016**	0,0000
nb.of observations	440	**704**	**1276**	176	440	**308**	**176**	308	**220**	836
	30 trading sessions test period (12.8.2011 - 22.9.2011)									
AFTER THE BAN	**0,0008** ***	**0,0014** **	**0,0073** **	0,0006	0,0011	**-0,0001** ***	0,0002	0,0009	**-0,0039** **	0,0000
absolute change	**0,0006**	**0,0010**	**0,0059**	0,0012	0,0000	**0,0002**	-0,0002	0,0000	**-0,0015**	0,0000
nb.of observations	**600**	**960**	**1740**	240	600	**420**	240	420	**300**	1140
	45 trading sessions test period (12.8.2011 - 13.10.2011)									
AFTER THE BAN	**0,0008** **	**0,0011** *	0,0062	0,0006	0,0012	**-0,0002** ***	0,0009	0,0007	-0,0031	0,0000
absolute change	**0,0006**	**0,0007**	0,0048	0,0012	0,0002	**0,0001**	0,0005	-0,0002	-0,0007	0,0000
nb.of observations	**750**	**1200**	2175	300	750	**525**	300	525	375	1425
	55 trading sessions test period (12.8.2011 - 27.10.2011)									
AFTER THE BAN	**0,0008** **	0,0011	*0,0060*	0,0005	0,0019	**-0,0002** ***	*0,0006*	0,0008	-0,0024	0,0000
absolute change	**0,0005**	0,0007	0,0046	0,0011	0,0008	**0,0001**	0,0002	0,0000	0,0000	0,0000
nb.of observations	**950**	1360	2465	340	950	**595**	340	595	425	1615

Table 9

The average increase of the bid-ask spread in countries with a short sale restriction compared to the average increase in the bid-ask spread in countries without any trading restrictions. The coefficient is calculated as the ratio of the relative bid-ask spread after the short-selling ban introduction and relative bid-ask spread before.

Average bid-ask coefficient change from Table 7		
	All countries	
	WITH BAN	WITHOUT BAN
6 days	1,9115	1,2367
10 days	1,9742	1,2454
14 days	1,9082	1,2231
30 days	2,3609	1,1700
45 days	2,2627	1,2463
55 days	2,1856	1,2988

Table 10

There are liquidity costs of short restricted financial institutions in the table. The value is cumulative for the whole period written in the first column

LIQUIDITY COSTS OF BAN				
	FRANCE	SPAIN	ITALY	BELGIUM
6 days	n.a.	€ 9.880.468	€ 12.277.374	n.a.
10 days	n.a.	n.a.	€ 34.208.052	n.a.
14 days	n.a.	€ 10.605.474	€ 44.024.667	n.a.
30 days	€ 11.416.173	€ 21.026.062	€ 97.718.629	n.a.
45 days	€ 17.854.531	€ 25.535.841	n.a.	n.a.
55 days	€ 18.043.401	n.a.	n.a.	n.a.
MCap of banned financials to 12.8.2012	€ 133.026.626.829	€ 131.779.848.409	€ 89.054.176.779	€ 14.840.409.591
Number of banned financials	10	16	29	4

Table 11

There are volatility results in this table. The impact of volume on volatility has been proven several times, so I employed the daily volume of financial stocks as a control variable. The regression model is:

$$v_e = \alpha + \beta \times \ln(volume) + \gamma \times ban$$

Time period	Constant	Logarithm daily volume	Short sale dummy	R2	Observations
1.7.-11.8.2011 $[t_{-30};t_{-1}]$	-0,035 ***	0,0029 ***	0,0078 ***	0,16	3600
25.7.-11.8.2011 $[t_{-14};t_{-1}]$	-0,045 ***	0,0036 ***	0,004 ***	0,15	1680
29.7.-11.8.2011 $[t_{-10};t_{-1}]$	-0,06 ***	0,0045 ***	0,004 **	0,17	1200
4.8.-11.8.2011 $[t_{-6};t_{-1}]$	-0,08 ***	0,0058 ***	0,0047 *	0,2	720
12.8.-19.8.2011 $[t_1;t_6]$	-0,039 ***	0,003 ***	0,006 ***	0,14	720
12.8.-25.8.2011 $[t_1;t_{10}]$	-0,04 ***	0,003 ***	0,004 ***	0,15	1200
12.8.-31.8.2011 $[t_1;t_{14}]$	-0,033 ***	0,0025 ***	0,004 **	0,06	1680
12.8.-22.9.2011 $[t_1;t_{30}]$	-0,03 ***	0,0025 ***	0,0045 ***	0,07	3600
12.8.-13.10.2011 $[t_1;t_{45}]$	-0,03 ***	0,0026 ***	0,0035 ***	0,07	5400
12.8.-27.10.2011 $[t_1;t_{55}]$	-0,03 ***	0,0026 ***	0,0032 ***	0,08	6600

Deutsches Abstract

In August 2011 die Finanzmarktaufsicht in Frankreich, Spanien, Italien und Belgien implementierte das gedeckte Leerverkaufsverbot für Finanztiteln. Ich forsche die Wirkung von diesem Leerverkaufsverbot auf die Aktienrenditen, Liquidität und Volatilität. Ich analysiere verschiedene Perioden bevor und nach Implementierung von Lehrverkaufsverbot. Die Aktien mit Leerverkaufsverbot erlitten die Verschlechterung der Marktqualität. Die Marktqualität ist gemessen mit relativer bid-ask Differenz. Die positive Wirkung auf die Aktienrendite war nur kurzfristig. Besonders starke kurzfristige Wirkung auf Aktienrendite war in Entwicklungsländer und PIGS Länder. Es gab keinen statistisch signifikanten langfristigen Einfluss von Leerverkaufsverbot auf Aktienrendite. Die Wirkung auf die Volatilität ist nicht eindeutig. Der kurzfristige Sprung der Volatilität wurde in dem langfristigen Horizont ausgeglichen.

Curriculum Vitae

- **Education**

2010- 2013 : Master study at University of Vienna

Specialization: Corporate Finance, Financial markets

Language of lectures: German, English

2007-2010 : Bachelor degree at University of Economics in Bratislava

Specialization: Finance, Banking, Investment

Bachelor paper: The methods of stock analysis

Language of lectures: Slovak

2009 : Exchange student at Vienna University of Economics and business

Language of the lectures: German

2003-2009 : A number of language courses focused on Business English
(in Great Britain, Scotland, Malta)

2003-2007 : Grammar school, Velka Okruzna, Zilina, Slovakia

Specialization: Mathematics

2000-2007 : English and German courses at the language schools in Slovakia

- **Practical experience**

2011-2012: Internships and part-time at investment bank Raiffeisen Centrobank

Cooperation in equity research and commodity trading department.

Contact: leder@rcb.at

2007-2010 : Part-timer at investment company mTo, Ltd.

Cooperation in audit, accounting, taxes and portfoliomanagement.

Contact: mto@mto.sk

2009: Internship at company BCI S&T, Ltd. (Daimler Group)

Cooperation in economic analyses and controlling.

Contact: pleskova.jana@bci-st.sk

- **Knowledge**

  German language- excellent knowledge
  English language-excellent knowledge
  Slovak and Czech language- mother tongue
  IT- MS Windows, MS Office(Word, Excel, Access) - advanced

- **Others**

  Performance scholarships for the best students at the university
  Diploma for 4th position at Slovak Young Physicists' Tournament - Bratislava 2005
  Certificate for presentation at Science festival - Bratislava 2005
  University representation in tennis tournament - Milan 2007

- **Hobbies**

  Travelling, Sport (tennis, football), Economy