

Analysis of the Effect of Short Sales on the Demise of  
Lehman Brothers Holding Inc.

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## Abstract

This research project studied the effects of high-volume short sales on the demise of Lehman Brothers Holdings Inc. The purpose of this research was to determine if the high volumes of short sales acted as a catalyst to the collapse of distressed Lehman Brothers. This study compared the existing research of the effects of short sales with the results of a quantitative analysis of the last three years of the company's operations. The findings suggested a close match between the theoretical patterns of short sale effects and the observed situation of Lehman Brothers. This research drew attention to the ability of short sales to exacerbate the financial distress of a company and opened a discussion on the necessity of additional regulation.

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## Introduction

### *Overview of the Topic*

This research paper is written on ~~the subject of finance, to be more specific,~~ one of the most controversial phenomena of the capital market – short selling. The topic is neither very new nor ~~original,original;~~ it has drawn attention of multiple scholars over a long period of time. However, the subject recently has become very popular ~~and there has been a lot of discussion regarding short selling.~~ In light of ~~Taking into consideration~~ the financial crises of the fall of 2008, this subject has attracted eds considerable attention from leading economists, bright politicians, and business professionalsmen. Now, ~~the~~ financial system of the United States is standing on the edge of being overhauled and possibly reengineered (Lewis & Einhorn, 2009). Because of the importance of this issue to the future structure of the American capital markets, it is worthwhile to contribute to the effort to research and to understand this ambiguous phenomenon that played a significant part in the events of the fall of 2008. This paper and underlying research accordingly considers the advanced trading strategy of short selling. ~~As an aspiring specialist, I decided to contribute to the research as well and use my knowledge and analytical ability to understand this ambiguous phenomenon that played a significant part in the events of the fall of 2008.~~

~~I decided to research the advanced trading strategy of short selling.~~ The Securities Exchange Commission (SEC) defines short selling as, “Short sale is any sale of a security that the seller does not own or any sale that is consummated by the delivery of a security borrowed by or for the account of the seller” (as cited in Woelfel, 1994, p.1050). Avneyon (1988) describes short selling in the following way “in the stock and commodities exchanges, short selling indicates the sale of merchandise which is not owned by the seller but which belongs to a member of the exchange who

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lends it to him, for delivery at a later date. The seller hopes that by the delivery date he will be able to buy the merchandise at a lower price” (p.425).

This financial tool is especially interesting ~~to me~~ because it has two very well established and empirically proven but very contradictory, absolutely opposite characteristics. Short selling has been practiced for almost a hundred years. Saffi and Singurdson (2008) mention that short selling was one of the factors behind the crash of 1929 which led to the establishment ~~imposition~~ of restrictions by the Security Exchange Commission (SEC) in 1934. Multiple scholars like Boehmer and Wu (2008), Saffi and Singurdson (2008) and others insist that short selling increases the informational efficiency of prices. Others like Platt (2002), Goldstein and Guembel (2008), and Shkilko, Van Ness B., and Van Ness R. (2007) say that short selling cannot only manipulate the price but also can be the cause of significant price reversals. Such a split in scholars’ opinions is very interesting. What is even more intriguing is the fact that despite the continuous debate short selling has been practiced for almost a century undoubtedly ~~ea~~ffecting the financial market on a daily basis.

The principal ~~main~~ theoretical explanation for short selling existence is that this financial tool brings clarity and refines efficiency of prices in the capital market (Boehmer & Wu, 2008; Saffi & Sigurdsson, 2008). This theory is founded on the idea that the long-term positions of investors are reluctant to respond to changes in the market and do not incorporate all information available into the price. Short sellers or speculators are very attentive to information that is available to the market and can make short term investments that attempt to make a profit on negative market indicators. Therefore, changes in the market price reflect the most current information available (Goldstein & Guembel, 2008).

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There ~~isare an alternative approach to a number of alternative ideas about~~ short selling. ~~It Most of them~~ takes into consideration examples of trading practices that bring destabilizing effects to the market. Such studies create another point of view approach to on short selling that does not altogether reject the theory of short selling effects on price efficiency but rather add very important details to it (Brunnermeier & Pedersen, 2005; Platt, 2002).

The goal of ~~this my~~ research was to find empirical evidence of negative effects of large-scale short selling. ~~As a first step To start with the research studied I studied~~ the founding theory of this phenomenon and the empirical data that was collected in its support. Then ~~Hooked at the paper overviewed~~ scholarly works that had an opposing point of view and warned about the dangerous side effects and possible problems with short selling. Once the theoretical basis for the research was laid out was, ~~I~~ focus was placed on the practical application of the theory. A specific company was analyzed in order to see the effects of short selling on its business. ~~I analyzed a company that enabled me to see the effects of short selling on its business.~~ The company of ~~my~~ choice was Lehman Brothers Holding Inc.

Lehman Brothers Holding Inc., founded in 1850, was one of the oldest financial institutions in America (Geisst, 1997). During the financial turbulence of fall 2008 Lehman Brothers went bankrupt filing for Chapter 11 bankruptcy protection on 15<sup>th</sup> of September (Mamudi, 2008). The financial institution with more than a hundred years of experience and assets of \$639 billion went bankrupt. ~~In~~ The following research ~~I~~ investigated the possibility that short selling practices contributed to the financial distress of this company.

#### *Statement of the Problem*

In today's business world short selling is considered a legitimate financial tool. Every day billions of dollars are traded in short sales. On one hand, it can be a

successful and lucrative investment tool; on the other hand, there are multiple signs of ~~the possible danger of these its implementation practices~~. After the experiences of ~~the~~ recent financial crises professionals have started discussing the necessity of more regulation.

Short selling is often associated with speculation in financial textbooks and dictionaries. For example Woelfel (1994), in his definition of short selling, mentions ~~eds~~ “Types of short sales encompassed by this definition include the following. The speculative and hedging types of short sales...” (p.1050). Shkilko, et al. (2007), in their study of the price destabilizing effects of short selling, ~~broughting~~ readers’ attention to the evidence of existing speculation by short sellers and techniques that they use to avoid the existing regulations. “Short sellers use aggressive order submission strategies, as proxied by the share of trades identified as seller-initiated, and route away from SuperMontage [see glossary page 11] to avoid restrictions imposed by the bid test” (p.39). However, in practice, short sales have become more deregulated and laws have been softened in the last ten years.

Another side of short selling that requires attention is the volume of investments. ~~We can take notice of the creation of f~~Financial institutions ~~have been created -t~~that accumulate enormous funds and have short operations as a substantial part of their business plan. The new investment strategies such as 130/30 (see glossary page 11) have become very popular and are widely advertised to the general public. ~~This kind of investment strategy suggests that 30% of capital will be invested short, allowing 130% to be invested into long term positions-~~(130/30, 2006). The combination of the accumulation of large funds and the readiness to invest them in short term speculations is a very risky situation. While speculation stays on a low level and does not have large funds at its disposal, it creates investment noise or, in other words, the inevitable price fluctuations in the market. Once there are large funds

~~dedicated to investing~~ short, it may create large swings in the market and affect its liquidity (Brunnermeier & Pederson, 2005; Shkilko, et al., 2007).

Another aspect of short sales that needs to be taken into consideration is that it mostly takes place in negative market development and is often directed toward specific companies (Platt, 2002). Short sales are made against single companies that ~~are~~ either have their equity overpriced or on face financial distress~~the verge of bankruptcy, or have their equity overpriced.~~ To combine this information with the previously mentioned fact that short selling has vastly grown in volume we will see that the market faces an extraordinary situation. This is the situation in which large pools of capital are ~~ready to be~~ invested short against either overpriced or distressed companies. The results of such investments are very easy to predict. Single companies cannot withstand a powerful short run on their stock and the outcomes will be either a huge drop in price of the stock of an overpriced company, or the inevitable bankruptcy of a distressed company. Both of these outcomes turn out to be a high profit situation for short investors.

The recent events of the autumn of 2008 gave ~~us~~ a chance to analyze the outcomes produced by American ~~our~~ investment system. The problem that this research addressed ~~is~~ was the possible negative effect that short selling ~~could~~ have on the distressed situation of Lehman Brother~~se~~ companies.

#### *Purpose of Research and Research Question*

The purpose of this research ~~was~~ is to observe the effects of short selling on prices of a distressed company. Other scholars had already analyzed this relationship. There is significant research that shows that short selling can deflate the price of a stock, reverse the price in daily trading and bring benefit to investors from a bankruptcy of a company (Brunnermeier & Pedersen, 2005; Goldstein & Guembel, 2008; Shkilko et al., 2007). This research paper ~~was~~ is theoretically based on the

findings of previous studies but ~~took~~ took the next step and ~~is intended to show~~ showed the empirical evidence of price effects on a large scale. This ~~study~~ research ~~analyzed~~ analyzes the collapse of one of the biggest and oldest financial institutions in the US. ~~Throughout~~ This research paper studied ~~the research I looked at~~ the last two and a half years of trading in Lehman Brothers (LEH) securities, up to the point when trading stopped and the company filed for bankruptcy. The amount of short sales in Lehman Brothers' stock was compared with volumes of regular trading sales to establish if there was any relationship between changes in both ~~of kinds of trading~~. The focus was the correlation between the volumes of short and regular sales. Investors make their decisions according to the interpretation of price information – to sell, buy or keep stock. ~~This study~~ This study analyzed the information signals incorporated into the price of Lehman Brother's stock and investors' reaction to it.

This study has an explanatory character. Its purpose was to analyze and explain the effects of a large volume of short sales on the stability of a distressed company. The research question was: Did short selling have an effect on the collapse of Lehman Brothers Holdings Inc.

#### *Potential Significance of Research*

The significance of this research is based on the importance of the studied problem. The controversial effects of short selling are well known to professional economist and financiers. They have been discussed and addressed multiple times in academic papers and professional literature. There are two key points of interest that this research ~~is address~~ addresses: first, the regulatory establishments, and second, practicing professionals. The findings of this research may be interesting for both mentioned parties. The significance for the regulatory establishment may be found in an empirical proof of the destabilizing effects of short selling. The conclusions can be taken into consideration and used as an example in the debate over regulation. In the

business of investment and stock trading, information plays an extremely important role in decision making. The significance for practicing professionals can be found in additional information and vivid explanation of short selling effects.

In the United States the federal financial regulatory organ is the Securities Exchange Commission ~~(SEC)~~. The SEC has been watching over short selling for almost a hundred years and at different times had different levels of regulatory strictness. Judging by the decisions made by the SEC after the Great Depression, US officials realized the seriousness of the problem and how costly the negative results can be (Saffi & Sigurdsson, 2008). ~~In my opinion, t~~The empirical evidence of short sales' influence on the collapse of such a gigantic financial conglomerate as Lehman Brothers can be strong evidence in support of the argument that short selling must be regulated.

Public attention has recently been drawn to short selling and its effects. The burst in popularity of short sales in the past several years cannot be overlooked. Anderson (2008a) in her article "A new wave of vilifying short sales" stressed that short sales drew increasing attention and ran at record levels on the New York Stock Exchange making over 4% of all the shares traded in March of 2008. Short selling became a leading investment strategy on the wave of the inflating financial bubble. As many other decisions, it got blamed after the burst of a bubble. As ~~it was~~ mentioned before, information has the most critical value in the business of investing. The ability to understand the information carried by the price of a security, as well as knowing the trading strategies and behavior of market players allows investors to make comprehensive decisions and to attain success. The findings of this study can be a valuable source of information about the effects and strategies of short selling. The understanding of the theoretical basis and analysis of practical experience can provide

deeper insight into the phenomenon of short selling and allow a practicing business [professionalman](#) to see its negative effects and, possibly, to avoid them.

### *Glossary*

The definitions of the terms were obtained from the Encyclopedia of Banking and Finance (Woelfel, 1994) and from [www.investopedia.com](http://www.investopedia.com).

#### *130/30 Strategy*

A strategy that uses financial leverage by shorting poor performing stocks and purchasing shares that are expected to have high returns. A 130-30 ratio implies shorting stocks up to 30% of the portfolio value and then using the funds to take a long position in the stocks the investor feels will outperform the market. Often, investors will mimic an index such as the S&P 500 when choosing stocks for this strategy.

#### *Bear*

Among operators in various markets, a person who believes that a security or commodity prices will decline, and who accordingly sells on that expectation. Bears are also short sellers, they sell what they do not possess in anticipation of a decline in price at which they can buy back (cover) at a profit.

#### *Bear raid*

On the stock market, vigorous short selling by bears, taking tactical advantage of the technical position of an overbought market to force prices down and thus compel those who are long of stock to sell at a loss while bears cover at profit.

#### *Bloomberg*

Bloomberg is a major global provider of 24-hour financial news and information including real-time and historic price data, financials data, trading news and analyst

coverage, as well as general news and sports. In this research paper I used Bloomberg Professional proprietary APU account as a source of data sample.

#### *Front running*

The unethical practice of a broker trading equity based on information from the analyst department before his or her clients have been given the information.

#### *Manipulation*

In the broadest sense, the artificial advancing and depressing of prices by those who have the ability to do so. The course of prices on an organized market could be artificially influenced in greater or lesser degree by numerous devices.

#### *Manipulation strategy*

Goldstein and Guembel (2008) define the trading strategy as manipulative when the presence of a feedback effect from the financial market to the real value of a firm creates an incentive for an uninformed trader to sell the firm's stock. In times when this happens the informativeness of the stock price decreases, and the beneficial allocation role of the financial market weakens. The trader profits from this trading strategy, partly because his trading distorts the firm's investment.

#### *Margin account*

Customers buying stocks on margin or engaging in short sales must have a general account, which also may be used for cash transactions. The strictly cash account permits only cash transactions.

#### *Naked short selling*

The illegal practice of short selling shares that have not been affirmatively determined to exist. Most point to the level of trades that fail to deliver from the seller to the buyer within the mandatory three-day stock settlement period as evidence of naked short selling. Naked short sellers may represent a major portion of these failed

trades. Naked shorting is illegal because it allows manipulators a chance to force stock prices down without regard for normal stock supply/demand patterns.

### *Noise*

Price and volume fluctuations in the market that can confuse one's interpretation of market direction. Used in the context of equities, it is stock market activity caused by program trading, dividend payments or other phenomena that is not reflective of overall market sentiment. Also known as "market noise".

### *Random Walk*

Many economists and financial analysts contend that the price fluctuations of stocks are random, meaning that their movements from one time period to the next are unpredictable. The term used to describe this fact is random walk, meaning that the path of stock prices is random. The random walk model is a model of the behavior of market prices of common stock over time.

### *Speculation*

In its broader sense, is risk taking. ~~That is i.e.~~ taking investing risks with the anticipation of profit, but incurring the chances of loss. Speculation and investment are often confused. In brokerage circles, it is commonly assumed that purchasing a security with the intention of holding it permanently is an investment, whereas purchasing a security with the intention of selling it as soon as a favorable opportunity presents itself is speculation. Technically, the distinction between investment and speculation rests on the degree of safety on the degree of capital sum committed (i.e. relative degree of risk). An investment is a commitment for any length of period of holding, whether for investment income or capital gain anticipation, in which the degree of risk is low; a speculation is a commitment in which the degree of risk is high.

### *SuperMontage*

A fully integrated order entry and execution system for all securities' transactions used by National Association of Securities Dealers Automated Quotations known as NASDAQ.

## Review of Related Literature

A significant part of a research project is an overview of a body of related literature on the studied subject. According to Marshall and Rossman (2006), "A thoughtful and insightful discussion of related literature builds a logical framework for the research and locates it within a tradition of inquiry and a context of related studies" (p. 43). To introduce a reader to the studied subject ~~I am offering~~ an overview of the existing studies ~~is offered. that~~ it provides a definition of short selling, theories of short selling and its effect on stock market price efficiency, alternative effects of short sales on the market, and its regulation and practicing entities. ~~I refer to~~ The scholarly works ~~are referred to~~ for explanation of definitions and concepts related to this study. The business and finance publications are referred to for ~~To~~ cover age of the recent events ~~taking place~~ in financial markets. ~~I refer to business and finance publications.~~ This research covers only the short selling of common stock shares. On one hand, it is the most relevant to the objectives of this study and, on the other hand, common stock trading makes up the majority of short sales.

### *Short Sale Definition and Process Description*

In order to fully describe short selling it is necessary to give its definition. The definition used in this paper is provided by ~~I decided to use the definition provided by~~ the Securities Exchange Commission: "Short sale is any sale of a security that the seller does not own or any sale that is consummated by the delivery of a security borrowed by or for the account of the seller" (as cited in Woelfel, 1994, p.1050). According to the definition in order to sell a stock short it has to be borrowed and the short seller must arrange for his broker to make a delivery for him (Woelfel, 1994). Stocks are borrowed from the "margin account" of regular brokerage customers such as institutions or individuals who acquired the stocks in the primary market. Whenever

an investor wishes to short a particular firm, he or she first needs to locate shares of the firm to borrow. This process is considered to be one of the constraints for short selling because it might imply a low lending supply and tight bidding as well as impose higher searching costs (Saffi & Singurdson, 2008). Different short selling constraints will be addressed in more detail further in this literature review. Once the shares are located, the short seller, depending on the agreement, might need to compensate the lender by paying a borrowing fee (Woelfel, 1994). Fees might vary and depending on how high ~~they are~~<sup>it is</sup>, ~~they~~<sup>it</sup> can create another constraint. Short sellers can borrow stock from a particular firm only when its clients hold the stock in a margin account. Securities in cash accounts are not marginable. The investors from whom the shares are borrowed are not necessarily notified of the transaction and they are generally not compensated for it (Platt, 2002).

The net proceeds of the sale are not immediately available to the short seller. They are used to post the cash for the stock borrowed. Cash in the marginal account must match the value of stocks borrowed at a current market price (Woelfel, 1994). If the price goes up the short seller must put more money into the account to match the margin requirements, if it goes down the investor has a right to serve the market notice mark, and receive the excess cash (Woelfel, 1994). The short seller receives the cash balance of the account after the positions are covered. The difference ~~in~~<sup>in</sup> ~~in~~<sup>in</sup> the price of a share multiplied by the amount of shares shorted is the short seller's profit.

In case the individual from whom the shares were borrowed decides to trade them, the short seller must cover the position. That means the short seller must buy back the stock in the open market regardless of what the price is and replace the borrowed shares at the brokerage company. In the event that too few shares are

available for sale when the short is covering the position, the security price runs up and this situation is called a “short squeeze” (Platt, 2002).

In the description of the process of short selling there are several important aspects. First, a short seller does not own the stock but bears only an obligation to be responsible for it; second, a short seller is expecting the decline of a security price – short sales will not bring profit on a rising price (Goldstein & Guembel, 2008); third, short selling is the primary tool for bear raids and front-running practices [\(see glossary on page 11\)](#) because it provides the ability to play on a descending market (Brunnermeier & Pedersen, 2005); fourth, short selling is recognized and regulated by the Securities Exchange Commission (SEC); and finally there are a number of constraints in the process that allow for indirect control and open opportunities for additional regulation. These aspects play a key role in the understanding of the positive and negative outcomes of the use of this financial tool.

#### *Regulation of Short Selling*

The Securities and Exchange Commission recognizes short selling as a widely used financial tool and intends to regulate it in order to track the short sales and bring transparency to the process. Saffi and Singurdson (2008) express the opinion that the SEC feared that short selling was one of the factors of the crash of 1929 and therefore adopted short sale restrictions under the Securities Exchange Act of 1934. The SEC Rule 10a-1 (b) requires trading institutions to mark every transaction as “short” and “long”. The Rule 10a-1(a) imposes regulations on the short sale based on the price change tendency before the sale: “up-tick” and “zero-plus tick” rules (Security and Exchange Commission [SEC], 1934). In 1974 – 1975 there was an attempt by the SEC to improve the process of short sales by regulating information publishing, but the regulations adopted in October 1974 met harsh criticism from multiple practicing investors including a letter of complaint from the New-York Stock Exchange (NYSE)

and the Amendments to Rules 10a-1 and 10a-2 were suspended and sent to revision. Amendments were adopted in June, 1975 regulating market reporting transactions of short sales (Woelfel, 1994).

In 2004 the SEC proposed changes in regulation to relax short-sale constraints and launched a pilot program to evaluate the effects (Saffi & Singurdson, 2008). It appears that in August of 2004 the SEC established procedures for the Commission to temporarily suspend the operation of the current “uptick” test and any short sale price test of any Stock Exchange or national securities association (SEC, 2004). Under this program multiple exemptions were granted for trading institutions to relax control over short sales. For example in June 2006 the NASDAQ was granted an exemption from Rule 10a-1 which allowed the NASDAQ Exchange regulatory measures to control short sales. This permission was granted until the completion of the pilot program (SEC, 2006). On June 13, 2007 the report was published concluding that “the ban on selling short while a share price was declining had come to seem irrelevant” and the “tick test” was abolished with unanimous 5-to-0 vote (Norris, 2007).

On the other hand the SEC focused its attention on naked short selling (see glossary on page 11). Naked short selling is a very controversial practice. While the naked short sale is not illegal per se, abusive or manipulative naked short selling violates the federal securities law (SEC, 2009). An example of manipulative naked short selling is an intentional failure to borrow and deliver shares sold short in order to drive the stock price down and send the false informational signal to the market. The SEC responded to the abusive naked short selling in 2004 by adopting a short sale regulation, Regulation SHO, that included provisions specifically designed to address naked short selling (SEC, 2004). In the midst of the mortgage crisis of the summer of 2007 the amount of naked short selling rose again. It was addressed by the SEC in early June. The SHO regulation was revised and corrected to impose more

responsibility on traders engaging in ~~the~~ naked short selling (Norris, 2007). However, these measures appeared not to be ~~not~~ sufficient. ~~enough~~. During the following financial crisis of 2008 the SEC received numerous complaints “alleging that Enforcement has failed to take sufficient action regarding the naked short selling” (SEC, 2009, p. 1).

Approximately 5000 naked short selling complaints were received by the SEC between January 1, 2007 and June 1, 2008 (SEC, 2009). Many of these complaints asserted that investors and companies lost billions of dollars because Enforcement ~~had~~s not taken sufficient actions against short selling practices. The SEC responded withby the announcement of emergency measures in July of 2008. It instituted an order to attempt to combat market manipulation by making it harder to short the stocks of 19 financial institutions including the mortgage financial giants Fannie Mae and Freddie Mac as well as ~~the~~ brokerage firms like Lehman Brothers and Morgan Stanley (Anderson, 2008b). Two more emergency orders followed in September and October of 2008 imposing extra disclosure of short sales and short positions by institutional investment managers (SEC 2008a, SEC 2008b).

#### *Short Selling Effects on Stock Market Price Efficiency*

Short selling is a financial tool that has been practiced for almost a hundred years. It has indisputable reasons for existence: first it has been proven by multiple scholars that short selling positively influences price efficiency; second, it is very lucrative and is the best way to react fast to the information that has not yet reached the open market. The question of stock price efficiency has been discussed among economists and financial specialists for a long time and is the cornerstone in successful investment activities. Boehmer and Wu (2008) conducted ~~a~~ quantitative research based on the observation of a large sample of NYSE-listed stocks that empirically ~~proved~~s that short selling increases the price efficiency of stocks. In this

study Bohemer and Wu used a strong mathematical apparatus and a research sample of publicly available daily records of short sales data from January 2005 through December 2007 for a large sample of NYSE-listed common stock to prove their thesis. In the research the authors showed that a greater shorting flow reduces deviations of stock prices from a random walk (see glossary page 11). In other words the amount of short selling directly affects the deviation of stock price swings during the process of trading. Second, the researchers proved that at lower volumes more shorting flow accelerates the incorporation of public information into prices (Boehmer & Wu, 2008). Theoretically this regulating effect helps to keep markets lean and stock prices close to reflecting the intrinsic equity value which is the key idea to successful investment business. The financial market reaches the state close to perfect equilibrium when investors are able to read price information correctly.

Another aspect of the ~~ire study question is was~~ that short selling specifically contributes to the elimination of post-earnings announcement drift for unexpected large negative earnings surprises (Boehmer & Wu, 2008). Short sellers are very attentive to such news as large negative earnings announcements and they front-run ~~(see glossary page 11)~~ to make short-term profits on the consequent reaction of long-term investors or on the distressed companies themselves. In moderate volumes these practices eliminate post-earnings announcement drift, substituting it for sharp price declines and a following recovery.

There is one more approach to measuring the effect of short selling on price efficiency. Saffi and Sigurdson (2008) ~~studied~~ the effect of short sale constraints on the financial market. They relied on the research data that was collected from weekly stock lending transactions across 26 countries for two and a half years. The researchers made a statement that short-sale constraints are associated with lower price efficiency and they negatively effect the distribution of weekly stock returns (Saffi

& Sigurdson, 2008). This approach suggests that both direct regulation and indirect influence on short selling brings negative economic effects to the market. This point of view closely corresponds to the examples of resistance to progressing regulation by the SEC that I have mentioned before. These findings ~~also~~ are also directly connected to the question of ~~this my r~~research. Saffi and Sigurdson (2008) studied two kinds of constraints: the supply of shares that are available for lending and the borrowing fee. They stated that their findings are relevant to market participants and regulators alike and concluded that the negative impact that short sale constraints have on price efficiency measures is economically large but at the same time the authors stated that these constraints do not seem to affect the frequency of stock price crashes. The authors also concluded that higher levels of constraints are associated with lower standard deviations ( $R^2$ ) (Saffi & Sigurdson, 2008). This means that it ~~causes~~ brings stock price changes to fall out of alignment with changes of market indexes, making them less correlated with general market behavior.

Both studies support the idea that short selling is a necessary financial tool that helps to keep markets efficient and ~~that~~ regulation brings only negative effects on economic figures preventing the market from reaching a balance. Hence, investment activities have to overcome additional barriers (Boehemer & Wu, 2008; Saffi & Sigurdson, 2008). Sauer (2006) expresses an opinion that the first most effective tool against ~~the~~ schemes to manipulate the market is not the SEC, which acts slowly, but a short seller. According to his point of view short sellers are the only market participants with an incentive to deflate bubbles and inject pessimistic information into the market (Sauer, 2006).

#### *Alternative Effects of Short Selling*

The motivation for short selling identified by Figlewski (1981) ~~and others~~ arises when investors feel that a company's equity is overpriced. The explanation of the

relation between short selling and price efficiency discussed above relies on ~~fundamentally uses~~ Figlewski's theory. However, Platt (2002) in his research paper "A Fuller Theory of Short Selling" drew attention to an alternative motivation for short selling. He observed the fact that quite a substantial amount of short selling activity takes place when companies face bankruptcy. This observation directly contradicts Figlewski's point of view on short selling motivation. Based on this contradiction Platt (2002) conducted his research and suggested an additional theoretical background for short selling: traders turn to short selling when they anticipate the collapse of a distressed company. The author states that if a trader manages to short the stock of such a company right before it goes bankrupt he will be able to repurchase the stock at an extremely low price or face the situation when "equity does not receive any distribution from the POR [Plan of Reorganization] and the holders are completely wiped out" (p.7). This is the most profitable situation for short sellers to be in. At the same time, shorting the stock of a distressed company puts extra financial pressure on it by devaluing its equity and pushes it to the verge of a fall (Platt, 2002). This addition to the theory of short selling motivation opens the doors to further research and discussion on the subjects of price manipulation, intentionally aggressive, or so-called "predatory" trading and its outcomes.

Shkilko, et al. (2008) conducted research on the question of short selling's influence on price. Not to repeat previous studies on price efficiency, the authors drew their attention specifically to the price-destabilizing effects of aggressive short selling. This study presents evidence of episodic price-destabilizing activities in financial markets. In particular the authors show that the initial stages of large negative intraday price reversals are often accompanied by aggressive abnormal short selling that exacerbates price declines (Shkilko et al., 2008). The findings of this research expand our knowledge of the possible negative effects of short selling and its practitioners.

Thus, it exposes the relatively unexplored class of short sellers, the class that according to the authors' point of view, "instead of enhancing market efficiency, occasionally manipulates prices" (p.4). Second, the study tested predictions of several theoretical models of speculative and predatory trading built by Brunnermeier and Pedersen (2005), Carlin, Lobo, and Visvanathan (2007) and others. Third, it described the mechanism of large price reversals during ~~the~~-daily trades. The authors concluded that "this study reports evidence short sellers' price-destabilizing activities during occasional intraday liquidity crises" (p. 39). The findings stress the fact that aggressive short selling may become the reason for price reversals. This question is studied in more detail in the works of Brunnermeier and Pedersen (2005), and Goldstein and Guembel (2008). Another important conclusion of this research is the identification of the class of short sellers that exacerbates market frictions and creates temporary liquidity shortages.

Relying on the knowledge of short selling's influence on stock prices we can now look deeper at the research surrounding price manipulation. Goldstein and Guembel (2008) investigated the issue of manipulation presence in the theory of allocation role of prices and offered a financial model describing this phenomenon. The authors provide a definition of manipulation strategy (see glossary page 11) and show that the very fact that prices play a role in allocation of information opens up opportunities for manipulation. This study contributes to the large debate on the role of short sales in price efficiency and illustrates the asymmetry between seller-initiated speculation and buyer-initiated speculation making it very obvious by emphasizing its relevance.

The model offered is based on the 1985 constructed model by Kyle (Goldstein & Guembel, 2008, p. 133). That model explains investor's and speculator's behavior, where the speculator acts on the information available on the market situation and

benefits from acting on it. The long-term investor follows the short-term speculator and gets a lower profit. The authors add a “feedback effect” to this model assuming that a price can carry information in itself about the recent tradings, as accepted in multiple modern price efficiency studies including those previously discussed by Saffi and Sigurdsson (2008), and Boehemer and Wu (2008). This addition drastically changes the behavior of a speculator and enables the decisions on trades to be made even when there is profit indicating information. Such behavior still influences the decision of the investor, as explained in the old model. The authors also describe how and why the speculator can generate profit only in sale trades and only in short positions. Finally they link the outcomes of the model to recent episodes in real trade experiences, in particular to currency attacks “where the speculators drove down the price of a currency, which led to subsequent economic collapse of a country’s currency” (Goldstein & Guembel, 2008, p.135).

Goldstein and Guembel (2008) offer a model for the situation in real financial trading when a speculator, having enough financial power, can create a feedback effect with the price allocation of information that can benefit such actions. Once the impression of this feedback is made strong enough, the speculator can persuade the investor to make a decision that will be correct from the standpoint of the feedback yet absolutely inadequate from the standpoint of the company’s financial situation and value of equity. “Specifically, he [the speculator] can establish a short position in the stock and then drive the price down with further sell orders” (Goldstein and Guembel, 2008, p. 150). This, theoretically modeled behavior, has been often practiced in real-world trading, thus it provides a strong basis for any study that might be undertaken with sufficient factual data.

Another example of manipulation presence in the theory of price allocation of information is exhibited in the research by Antonio and Welch (2004). The authors

conducted research on the connection between the availability of inside information and intentional liquidity runs observed in the market. This study provides another example of side effects from investors' manipulative activities based on the ability of price to incorporate information and distribute it across the market. The question of inside information and its usage to manipulate the market price of shares is meticulously discussed in the research by Bernabou and Laroque (1992). The authors give multiple examples of inside information usage and its influence on the market. Their study contributes to the pool of knowledge available on the question of information misuse and its deliberate effect on prices. Subsequently it proves the loss of market efficiency due to false signals from information owners and investors who act on it.

#### *Liquidity Runs and Predatory Trading*

After an overview of the theories of motivation for short selling, information reflection in price, and after the explanation of an idea of price manipulation, I would like to turn my attention to the implementation of this knowledge in practice. The ability to manipulate market information with means of price and to influence the decision making process by other market participants results in an often observed phenomenon of liquidity runs or so called "predatory trading" (Brunnermeier & Pedersen, 2005). Brunnermeier and Pedersen (2005) conducted research on predatory trading techniques. They gave examples from business practices and then modeled the phenomenon of predatory trading. They argued that the technique of intentionally deliquidating the market is often used by strategic traders to take advantage of distressed companies that have to liquidate some of their positions. This idea directly comes from the addition to short selling motivation theory offered by Platt (2002) and discussed previously. And though the companies that Brunnermeier and Pedersen looked at were not going bankrupt, they were still in a position of financial

distress and were forced to liquidate some of their assets. Brunnermeier and Pedersen (2005) explain: “We show that if one trader needs to sell, others also sell, and subsequently buy back the asset. This leads to price overshooting and a reduced liquidation value for the distressed trader. Hence, the market is illiquid when liquidity is most needed” (p.1825).

Brunnermeier and Pedersen (2005) analyzed the process of liquidity runs and stress that: “predatory trading can even induce the distressed trader’s need to liquidate; hence, predatory trading can enhance the risk of financial crisis” (p.1826). There are multiple examples of the implementation of such strategies in the real practice of trading. For example the Askin/Granite hedge fund collapse in 1994 (Brunnermeier & Pedersen, 2005) or the alleged trading against Long Term Capital Management’s positions in the fall of 1998 (Coy, 2001).

In support of Brunnermeier and Pedersen’s (2005) idea that the predatory trader profits from triggering another trader’s crisis and that this crisis can spill over to other traders and across markets; Antonio and Welch (2004) conducted research on the question of liquidity and financial market runs. An important point of this study is that once a crisis spills across to other traders, a consequent liquidity run is based on the fear of the coming market shock and triggers investors to race to liquidate their assets, thus driving a distressed institution from a state of possible liquidity crisis to a bankruptcy state (Antonio & Welch, 2004). The inability of the market to withstand the shock of massive selling accompanied by an imperfect selling execution order creates an atmosphere of huge price falls and panic in the market.

#### *Short Selling Practicing Entities*

In this section the research ~~Finally, I would like to turn my attention to~~  
~~the~~addresses the participants of short ~~selling~~ ~~ale~~ ~~trading~~ and summarizes some of the literature on the question of who practices it. There are multiple studies available that

carry information about large volume short sellers and the amounts of their capital. For example Chen, Hanson, Hong, and Stein (2008) conducted a study on the activities of hedge funds and their profits from mutual-fund distress. In their research, the authors used indirect evidence to show that hedge funds take on short sales in large amounts when mutual funds are in distressed situations. This study revealed market players who practice short selling on a high scale. It also provided examples of the predatory trading mentioned above.

On the other hand, the research paper written by Cheng, Desai, and Krishnamurthy (2008) showed that there is a developing trend for actively managed mutual funds to use short-selling strategies more often. The authors showed that the percentage of the domestic equity mutual funds that use short-selling as their strategy has increased from 26.7% in 1994 to 34% in 2000 (Cheng et al., 2008). The study was based on the observation of 154 mutual funds that had outstanding short positions in domestic US equity and total net assets for the sample fund average of \$419 million per fund. The average size of the short position per stock is smaller than that for long positions, but the average management fee, expense ratio, and portfolio turnover are all larger than those in other funds (Chen et al., 2008).

It is important to stress that Shkilko, et al. (2007), in their research, documented that the stocks with high institutional ownership are more prone to large reversals. In one of their four tests the authors found confirmation to the suggestion that “institutional ownership may be positively related to the probability of large reversals, because institutional owners may be preyed on” (p 5). Institutionalizing and up scaling of the volumes of short trades tends to reveal negative effects of this financial tool.

The data from the examples above show the size of funds available for short trading and the high intensity of trades. Moreover, Chen, et al. (2008) mentioned that “equity beta and standard deviation of returns are higher for the shorted stocks... The

fund managers appear to be exploiting well documented anomalies in stock returns such as the book-to-market effect and the accruals anomaly when they short stocks” (p. 4). This data shows that the risk taken by the managers in short selling is higher than in long positions and that they often use atypical market effects to conduct the trades. Mutual funds that use short selling as their strategic approach manage to generate high returns. As a result of successful practices, mutual fund investors reward it with abnormally high levels of fund flows, providing more and more capital for speculative operations. Story (2008), in his article on the profitability of short sale operations in the declining market, stated~~ed~~ that hedge fund managers who focus on shorting companies sta~~oo~~nd out in the industry during a horrible trading year of 2008. Relying on the data of Chicago based Hedge Fund Research firm he mention~~ed~~ that in the first part of 2008 hedge funds were down more than 4% but short-focused hedge funds were up 9.76% (Story, 2008).

#### *Lehman Brothers Holding Inc.*

Lehman Brothers was founded in 1850 by two cotton brokers in Montgomery, Alabama. The firm moved to New York city after the Civil War and grew into one of Wall Street’s investment giants. At the peak of its success Lehman Brothers operated the assets of up to 639 billion American dollars and its shares reached a high of \$82 per share (Mamudi, 2008). However, Lehman Brothers found itself in a difficult financial situation as the mortgage crises unfolded in the summer of 2007. The fears were based on the fact that the firm was a major player in the market of subprime and prime mortgages, and that as the smallest of the major Wall Street firms; it faced a larger risk that large losses could be fatal (New York Times [NYT], 2009).

Lehman Brothers managed to avoid the fate of Bear Sterns, which was bought by JP Morgan Chase at a bargain price under the threat of bankruptcy in March 2008. However, by summer 2008 the financial situation of the company started to get worse;

a series of write-offs was accompanied by new offerings to seek capital to improve its finances (Marketwatch, 2008). As the situation became tougher for Lehman's financials, the company had to stand up to one more challenge – the increase of short sales of its shares. A slow collapse of Lehman Brothers offered a lucrative opportunity to bet against the company for many institutional investors. Anderson (2008a) in her article "A New Wave of Vilifying Short Sellers" states that shares of Lehman Brothers fell almost 40% the day before the investment bank reported earnings in March. Lehman spokesman said at the time that the company was suspicious that the rumors were promulgated by short sellers who have an economic self-interest (as cited in Anderson, 2008a).

Another example of the attention being paid by short sellers to the demise of Lehman Brothers is the public statement of David Einhorn, one of the most vocal short-sellers on Wall-Street. He made no secret that he was betting against Lehman Brothers when he made a public statement at a large industry gathering in May, 2008. He accused the investment bank of using "accounting ingenuity" to avoid large write-downs and remaining tainted by bad commercial real estate investment. David Einhorn used his own profit to convince people: he had been betting against Lehman's stock since July 2007, when it traded for around \$70 a share, compared to the price around \$40 when he spoke (Story, 2008).

The amount of short sales against the financial institutions rose so high that the question of market manipulation drew the attention of the SEC. In July 2008 the Securities Exchange Commission was forced to interfere in stock market trading. It instituted an order to limit the ability of traders to bet against the shares of 19 financial institutions, including brokerage firms like Lehman Brothers and Morgan Stanley (Norris, 2007). Later in the year the SEC conducted research on practices related to naked short selling that took place in 2008 (SEC, 2009). The amount of complaints

and referrals on this illegal practice of short selling was so high that the SEC had to review the process of its response to the overwhelming number of illegal practices of short sale trading.

However, none of the actions taken by Lehman Brothers' management helped to save the company from collapse. In addition, the measures taken by the SEC to protect the financial institutions from market manipulations also failed to help to shield Lehman Brothers from the liquidity run and fall of investor's confidence. On July 10, 2008, the bank announced a second-quarter loss of \$2.8 billion, which was far higher than analysts had expected. On September 10, 2008, a Lehman Brothers representative made a statement that the company would detach a majority of its remaining commercial real estate holdings into a new public company and confirmed the plans to sell a majority of its investment management division expecting to generate \$3 billion. It was also announced that there was an expected loss of \$3.9 billion in the third quarter after \$5.6 billion in write-downs (NYT, 2009).

In the beginning of September the US Treasury had made a final decision that there was no bailout forthcoming for Lehman Brothers and encouraged other institutions to buy Lehman. By the end of the weekend of September 13-14 the two main prospective buyers, Barclays and Bank of America, refused to purchase Lehman Brothers. On September 14, 2008, the investment bank announced that it would file for liquidation after huge losses in the mortgage market, a hit from a loss of investor confidence, and the inability to find a buyer. Lehman Brothers filed for bankruptcy on September 15, 2008 (NYT, 2009).

In the spring of 2009, after the SEC investigation of the complaints and referrals of the high volumes of naked short selling, the attention turned back to the collapse of the Wall-Street giant. Matsumoto (2009) in his article, "Naked Short Sales Hint Fraud in Bringing Down Lehman", mentions that as many as 32 million shares of Lehman

Brothers were sold and not delivered as of the day of the banks demise, indicating the potential for a massive naked short of the stock. The 32 million failures to deliver is more than a 57-fold increase over the prior year's peak failures. On September 17, two days after Lehman Brothers filed for bankruptcy, the number of failed trades climbed to 49.7 million which is 23% of overall volume in the stock (Matsumoto, 2009). Naked short selling is illegal but very difficult to prove. However, the author expresses an opinion, that in Lehman's case the proof of a massive market manipulation may be available. Story (2008) believes that while Lehman's shares declined as investors lost confidence in the company, short selling played a significant role in the erosion.

#### *Market analysis of Lehman Brothers' operations*

In this subchapter ~~the study focuses on, I would like to present~~ the opinions of professional market analysts on the business operations of Lehman Brothers. ~~I have collected th~~The analytical reports of 10 companies ~~that that~~ carry worldwide recognition and specialize in providing analysis of businesses' performance ~~were collected~~. The reports ~~analyzed, that I analyzed~~ were issued by JP Morgan, Deutsche Bank, Citigroup, Goldman Sacks, Bank of America, BMO Nesbitt Burns, Ladneburg & Thalmann, Bernstein Research, Morgan Stanley, and SHBC Global Research. The reports covered the period from January to mid September of 2008. ~~I believe t~~The study of professional analysts' opinion will help to understand the mood and perception of the company by investors, their vision of the market situation that Lehman Brothers was functioning in, and predictions about the company's future.

The first point that needs to be mentioned is that analysts opened the year of 2008 for Lehman Brothers with a strong "buy" rating. The "buy" or "overweight" rating means that analysts expect a company to outperform the market in the next six to twelve month period. Deutsche Bank in the report on the 29<sup>th</sup> of February lists a "buy" rating and a return potential of 37% (Mayo & Fisher, 2008a), Goldman Sachs reports a

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rating of “buy” as well and a return potential of 42% on the 18<sup>th</sup> of March (Tanona, Ramsden, Hatzius, & Harris, 2008). Throughout the winter and spring of 2008 most of the analysts held the “buy” or “outperform” rating. Several companies were somewhat pessimistic and assigned a “neutral” rating to Lehman Brothers. For example JP Morgan and Bank of America had a “neutral” rating for LEH in the reports on the 1<sup>st</sup> of April and the 16<sup>th</sup> of June respectively (Worthington & Akarsu, 2008a). A “neutral” or “hold” rating means that the stock is expected to perform for the next six to twelve month in line with the average total return of the market. A “neutral” rating recommends neither to buy nor to sell a stock.

The study of the analysts’ opinions showeds that after the analysis of Lehman Brothers’ fundamentals, they had a strong belief in the company’s ability to recover from the complicated situation and get back to successful business. They listed a number of positive actions taken by the company management: the raising of additional capital in first and third quarters, less engagement into marginal profit deals with marginal clients, reduction of hard to sell assets, aggressive deleveraging, solicited Federal support, etc. Another aspect of strong belief in Lehman Brothers can be seen in the report of JP Morgan analysts Kenneth B. Worthington and Funda Akarsu. In the report of the 18<sup>th</sup> of August they said, “Lehman appears a survivor with a great culture and senior management team” (Worthington & Akarsu, 2008b). On July 14<sup>th</sup>, Bernstein Research stated that even with the problems that the company faced “the firm should be able to survive any confidence crises” (Hintz, Werner & Curotto, 2008).

In spite of positive ratings and belief in Lehman’s business, analysts identified a number of problems that the company faced. They tracked every decision made by management and reported on positive and negative effects. Among the identified problems were huge write offs in the first quarter and expected write offs in the third

quarter, exposure to real estate materials, continuing sale of assets, reduction in return on investments, pressure on the share price arriving from market fears and volatility of the market in general. However, after weighing the problems that the company faced and the ability to solve them, there was not a single negative rating encouraging investors to sell Lehman Brothers' shares, and only few analysts assigned a neutral position.

After the announcement of the second quarter results on July 10<sup>th</sup> and a new wave of huge write offs, analysts downgraded their ratings to "neutral" or "hold". The opinions split and belief in Lehman decreased. Analysts included a possibility of a rating agency downgrade and a company "fire sale", although they did not assign a high probability to these actions. Citigroup, in its report on the 11<sup>th</sup> of September downgraded Lehman's rating to "hold" and assigned a 65% probability for the company "to stay the course and execute on the announced plan" (Bhatia, 2008, p 1). However, at the same time Citigroup assigned a 10% probability to a complete loss of confidence. Deutsche Bank also downgraded Lehman to a "hold" position in its report on the 11<sup>th</sup> of September and brought investors' attention to a possible rating downgrade below "A" level. However, the bank stated that in their opinion "liquidity and charges are manageable" (Mayo & Fischer, 2008b, p 1). On the other hand, in the middle of the second week of September HSBC Global Research and Morgan Stanley removed their ratings and coverage of Lehman Brothers' business. Patrick Pinschmidt, the analyst for Morgan Stanley, stated, "While we will maintain research coverage on LEH shares, we are removing our rating and price target due to heightened market uncertainty following the company's announcement of 3Q08 EPS results and strategic initiatives"( Pinschmidt, 2008, p 1). On the morning of the 15<sup>th</sup> of September Lehman Brothers filed for bankruptcy protection.

### *Summary*

A valuable part of the study was to reveal the existing research on the subject of short sales, and to establish the connection between the definition of this financial tool, the ways it is regulated, the effects it has on the market, and entities that practice it. The analysis of the related literature offered a full picture of the phenomenon of short sales and explained its positive and negative effects. The other purpose of the literature review was to introduce a reader to Lehman Brothers Holdings Inc, its business and events that brought the company to the state of bankruptcy.

The first part of the literature review aimed to provide the definition of short selling and describe the process of selling a stock short. During the description of the process I pointed out the constraints to selling a stock short. These constraints are used for indirect regulation of the phenomenon and they are also referred to in the further analyzed research papers. The other important point brought up in that section was the naked short selling. This section offered the definition of naked short selling, a description of the process, underscored the differences from regular short sales, and explained the concerns about naked short selling becoming a fraudulent practice when it reaches high volumes.

The second section offered a traditional view of the phenomenon of short selling. It explained the original theory of short selling motivation and offered examples of its practices in the past. In support of short selling, scholars argued that it improves the efficiency of stock prices. The stock price efficiency is the cornerstone of successful investment business. This section offered a summary of several extensive research papers that indicated the positive effect of short selling on the efficiency of stock price and the negative effect of constraints. Another point of view that was brought up was the market provides financial stimulation in the form of high profits for short sellers to identify the companies that inflate their stock price or engage in fraudulent operations. Thus the short sellers are viewed as natural predators in the

market fulfilling the necessary function of control over the businesses that are not honest with their investors.

The section on the alternative effects of short selling introduced the opposing point of view to the traditional approach. Platt (2002) stated that short sellers are motivated to work not only with “bubbling” companies but also with distressed companies, which are expecting the price of their shares to decline as well. Thus betting against the distressed companies becomes lucrative for short sellers. The research of the price destabilizing effects of short sales provided proof that short sales of high volumes exacerbated price declines and thus worked against price efficiency. The intentional demolishing of price efficiency accompanied by possible profits made me look into the research on price manipulation by means of short selling. This section also addressed the research on the ability of the stock price to allocate market information, ways to manipulate it, and described the model of manipulation. This section aimed to describe the theoretical ability of short selling to bring negative effects to the market and to serve as an effective tool for manipulating the market or using distressed companies to generate income.

The section on liquidity runs and predator trading offered examples of real practices based on the theoretical models of market manipulation. It analyzed several research papers on intentional market deliquidation, identified the role of short selling in these practices, and provided examples of such events. The information in this section is relevant to the financial crises of 2008 and the case of Lehman Brothers in particular, because the illiquidity of the market and the accumulation of illiquid assets on the balance sheets of companies was a crucial issue.

The section on the entities that are involved in short selling identified the organizations that practice it and revealed the volumes of capital that are involved in short selling. The analysis of the research on this subject showed that there are

companies that rely on short selling as a routine business practice and derive large amounts of capital from it.

The sections on Lehman Brothers and the evaluation of its business performance by market analysts introduced a reader to the company that was researched. Analysts offered a description of Lehman Brothers' business, provided a look at its history, described the financial situation, and its position in the market. The section on Lehman Brothers provided a detailed retrospective overview of the company's decline throughout 2008. The research of the market analysts' opinions showed the perception of Lehman Brothers by market participants. ~~I chose to study~~ The analysts' opinions were studied because they described the way the market viewed what was happening to the company. Since the complete demise of Lehman Brothers was a ~~very much~~ very much unexpected and even unbelievable event, the research examined ~~I dedicated time to researching~~ if there were any indications of the fall, or if there were any individuals who foresaw it.

~~In my opinion,~~ This structure of the review of the literature on the subject of short selling describes this phenomenon objectively and explains the events that Lehman Brothers went through. It sets the theoretical foundation for further research and can be used for the analysis of the research findings.

## Methodology

### *Introduction*

This research addresses the ambiguous financial tool of short selling. As the review of related literature and previous studies showed,~~s~~ there was~~is~~ no direct approach to short selling and opinions of leading economists and scholars were~~are~~ divided. The purpose of this study was~~is~~ to analyze the effects of large volumes of short sales on a distressed company.

The objective of this research was~~is~~ to analyze the effect of short selling on Lehman Brothers during its period of distress up to the point when the company filed for bankruptcy.

### *Research Method*

To accomplish the objective of this research ~~I chose to conduct a a~~ quantitative study was conducted. According to the opinion expressed by Creswell (2003) "In quantitative research, the hypotheses and research questions are often based on theories that the researcher seeks to test" (p.119). ~~I chose to use t~~The quantitative research method was used because it enabled the researchers ~~me~~ to analyze the recorded data of trading that occurred and helped to answer the question of whether short selling played a role in the demise of the distressed Lehman Brothers. The quantitative research method was chosen for several reasons. First, this research was~~is~~ designed over an actual situation in the past that produced the factual results which were recorded and ~~now ecouldan~~ be used as a sample database for analysis. Second, quantitative research provides the necessary tools and methods for analyzing the statistical records of a complex phenomenon. In the case of this study the choice of a quantitative analysis ~~will help ed me~~ to examine several variables with nonlinear trends of changes. Finally, the quantitative approach better reflected the s cause and effect thinking and uses deductive logic for analysis (Creswell, 2003).

The goal of this research ~~was is-~~to analyze the demise of Lehman Brothers. Based on this goal ~~I designed this~~the research ~~was designed~~ as a case study. According to Bryman (2008) a study based on a case entails intensive and detailed analysis. Although a case study design often gets associated with qualitative research, Bryman (2008) ~~stated~~ds that the quantitative approach can be used with case study as well. The choice of a quantitative strategy affects the approach of a case study and makes the research bear a deductive character. This idea closely responds to the opinion of Creswell (2003) that quantitative research puts a theoretical foundation to test. Yin (2003) ~~added~~eds to this statement by formulating the objective of a case study: “the important case study objective is to examine some relevant “how” and “why” questions about the relationship of events over time” (p.126). He added an important description of a case study and ~~stated~~s that the ability to trace changes over time is a major strength of case studies (Yin, 2003).

This study ~~focused~~ds on the case of Lehman Brothers. Its rapid decline and the following bankruptcy was a shock for the market and brought stress to the whole financial industry. This case falls under the type of a critical case. Bryman (2008) ~~identified~~ds a critical case as the one when a researcher has a well-developed theory, and a case is chosen on the grounds that it will allow a better understanding of the circumstances in which the hypothesis will and will not hold. The case of Lehman Brothers also ~~had~~ds a longitudinal element due to the fact that in order to cover the desired period of a study sample ~~the research I have~~turned ~~to turn~~to analysis of archival information and made chronological comparison of several variables.

The strategy chosen for analyzing the case study evidence ~~was is-~~the pattern matching. Yin (2003) ~~described~~ds pattern-matching logic as a comparison of an empirically based pattern with a predicted one. He ~~stated~~ds that if the initially predicted values ~~had~~dye been found, and at the same time alternative “patterns” of the predicted

values had ~~not~~ been found, strong causal ~~inferences~~ ~~terferences~~ ~~could~~ ~~an~~ be made.

As mentioned before, this study had ~~s~~ an explanatory character and the observed change patterns of variables were compared to the theoretical layouts to describe the case of Lehman Brothers. In its turn the findings were used to strengthen the argument of short selling effects.

### *Research Design*

The research design ~~was~~ based on the analysis of the historical data. Records of trades in Lehman Brothers (LEH) stock of short and regular positions together with the price of the stock ~~were~~ ~~to~~ ~~be~~ ~~u~~ ~~s~~ed as a data sample. Lehman Brothers was a major participant in the market of subprime and prime mortgages. It fell into a troubled state as the mortgage crises of 2007 emerged (NYT, 2009). In early 2008, as the mortgage crises turned into a credit crisis, the company fell into a distressed state and had to write off large sums of financial assets. Eventually the management of the company had to make a decision to file for bankruptcy. The choice was made to ~~I chose to~~ analyze the fall of Lehman Brothers ~~in my research~~ because it provided an example of fast deterioration and collapse of a profoundly strong financial institution, which was thought to be one of the major market participants in its industry. Lehman Brothers met the necessary requirements for this study. First, it was a publicly traded company, which meant that its stock was traded on the organized exchange and was available to the public. It also meant that the stock of LEH was available for short selling. Second, Lehman Brothers went into a distressed state and ended up filing for bankruptcy. This fact showed a definite end of the existence of the company as the result of a financial distress that the company was going through. Unlike ~~the~~ Bear Sterns that went through a very similar scenario but in the very end was purchased by JP Morgan Chase. In the case of acquisition the question of complete

bankruptcy would have remained open and it would have made it more complicated to get the test results.

The pattern matching analysis technique requires the comparison of empirically based pattern of variable changes with a theoretically predicted one. The theoretical foundations of the effects of short selling and identification of market manipulation were laid out in the literature review. The analysis of factual data provided the empirically based patterns. The research design involves two types of data analysis. First, the data was analyzed vertically or chronologically. Chronological comparison of data was necessary to determine that the company was in the state of a distress. ~~According to the Fuller Theory of short selling a distressed state of the company becomes a motivation factor for active short selling of the company's stock (Platt, 2002).~~ At the second step, the data was analyzed vertically to determine the relations between the observed phenomenon of short selling, the price of the stock and the volumes of trading.

The results of both data analysis ~~were~~ are systemized presented in the form of tables and graphs. Theoretically and empirically derived patterns of variable changes ~~were~~ compared in the conclusion section of this research. Based on these results the conclusions were drawn about the possible influence of intensive short sales on the demise of the company.

#### *Data Collection*

Bloomberg (see glossary page 11) was used as a source of stock trade records. The Bloomberg professional service is the source of real-time and historical financial news and information for central banks, investment institutions, commercial banks, government offices and agencies, and corporations in over 150 countries (Bloomberg, 2009). The data for this study was retrieved from Bloomberg information system on April 15, 2009. The access to Bloomberg information system was provided

by Alaska Pacific University as the subscriber of the proprietary account, Bloomberg Professional.

The Bloomberg information system keeps historical records of short sales as well as regular stock trades. Records of Lehman Brothers transactions are provided with reference to the New York Stock Exchange (NYSE) listings. The NYSE Short Interest File is a monthly file that contains the reported uncovered short positions of NYSE listed securities. The data are reported by Broker Dealers for the current month in accordance to NYSE Rule 421. These records were chosen for the research because the NYSE filings are the first-hand source of information that provides unprocessed factual data.

The data presented by Bloomberg are in two tables: General Price and Short Interest. General Price table contains dates for the data displayed in daily, weekly and monthly periods, closing price of stock trading, and volume of stocks traded. The General Price data can be used for graphing historical closing prices and tracking the performance and price movement patterns of the security over a specified period of time.

Short Interest table contains dates for the displayed data in bi-weekly periods, closing price of stock trading, the volume of short interest, and short interest ratio. Short Interest is the total amount of shares of stock that are sold short and have not yet been repurchased to close out the position. The short interest ratio is the number of days it would take to cover all current short positions based upon the daily average trading volume, assuming all transactions are used to cover outstanding short positions. Data from short interest table can be used to follow market sentiment and observe market liquidity.

The data were collected for the period starting on the 1<sup>st</sup> of January, 2006 and up to the point when the company declared bankruptcy on the 15<sup>th</sup> of September,

2008. The data covered the period of the company distress as well as the period of two years of business prior to it. This time frame provides enough information for thorough chronological comparison of the company's activities during the distressed period to normal business conduct. The records of short sale transactions for LEH are available on bi-weekly bases for 2008 and monthly for 2007 and 2006. The data on trading volumes and price changes are available on a daily, weekly and monthly basis. However, for the purposes of the comparative analysis for three different kinds of tests original data was modified into matching patterns. Data from General Price table was averaged from weekly into biweekly periods, and the biweekly data from the Short Interest table was modified into monthly periods. The results of modifications are exhibited in the modified research data table (Appendix A).

#### *Data Analysis*

The data analysis consists of three steps. Its goal ~~was is~~ to present chronological comparison of the analyzed variables and dependences between them.

First, it ~~was is~~ important to show that the company was in a distressed state. To demonstrate that, the price of the stock, the volume of trading activity and the volume of short sales were compared month-to-month for 2006, 2007, and 2008. The results of the comparison were graphed into the area chart (Figures 1,2 &3). Area chart displays the trend of values over time and helps to compare visually the patterns of changes.

The second stage of the analysis ~~is establish~~ed ing the standard deviation of the stock prices during each year. The standard deviation of a set of sample values is a measure of variation of values about the mean (Triola, 2008). ~~I calculated~~The standard deviation of the price of stock for 2006, 2007 and 2008 was calculated. The results were pulled together in a table for comparison. After the findings were analyzed, the analysis of variance (ANOVA) was used to compare the results of the

experiments. ANOVA is a method of testing the equality of three or more population means by analyzing sample variances (Triola, 2008). The calculation of standard deviation of the stock prices and its analysis shows the price volatility of the stock. The JMP statistical software was used for data processing. My hypothesis for the standard deviation test was that the deviations for each year would differ significantly. The alternative hypothesis was that standard deviations for all three years would be the same.

$$H_0: \sigma^2_{2006} = \sigma^2_{2007} = \sigma^2_{2008}$$

$$H_1: \sigma^2_{2006} \neq \sigma^2_{2007} \neq \sigma^2_{2008}$$

My expectation was that standard deviation of the stock price reached its highest measure in 2008. In 2008 the price became the most unstable as a response to the worsening distress of the company. At the same time, the volatile price of the stock can indicate the panic around the securities of the company and inability of the investors to read the market signals correctly. The findings of the test are presented in and interpreted in the results section.

Third step of the analysis was to find out if there was a correlation between the changes in short sales, price of the stock and volume of trades. Correlation is a numerical measure of the strength and direction of the linear relationship between two variables representing quantitative data (Triola, 2008). My hypothesis in this test was that large volumes of short sales had a direct impact on the price of shares as well as they affected the trading volumes of the stock. The Pearson's correlation was chosen to find out if there was a dependency between these variables. If there was a dependency between these variables, correlation shows how closely they were related. The variables for correlation were tested separately for each year on a yearly basis. Data for 2008 were tested in biweekly periods. Biweekly time periods provide more data entries for analysis and make the findings more robust. After plotting the data on scattergraph it was noticed that correlation

between price and short interest had one outlying point and correlation between short interest and trading volumes had two outlying points. In order to get more substantial results two tests were made for each situation including and excluding the outlying points. Data for 2006 and 2007 ~~were~~ tested in monthly periods. The scattergraph did not identify any outlying points thus only one test was made for each comparison.

The JMP statistical software was used for data processing. This test helps to understand if there ~~was~~ a possible influence of large volume short sales on the company.

#### *Validity and Reliability*

The validity of this research is grounded in extended database and reliability of its sources. The NYSE files the reports on short selling activities according to the requirements of the Securities and Exchange Commission. Bloomberg refers to the NYSE listings for the data on Lehman Brothers. The data used for this research is from the primary source and has not been processed before. On the other hand, the Federal requirements for reporting provide extensive database of records of business transactions, which is available for analysis.

The example of Lehman Brothers chosen for this research also adds to the reliability of the study. The experience that this company has gone through is the vivid example of the way the financial market functions. Within a year the profoundly strong company with assets of \$640 billion faced bankruptcy. The change from stability and success to a bankruptcy in such a short period of time provides a very clear example of market incident that can be studied.

To add more credibility to the statistical analysis of the data, ~~I have expanded the data~~ the time frame ~~was expanded~~ to include two years of business activities during the time of growth and development. The variables from the state of distress acquired from the raw data were compared chronologically to the ones from the period

of stability. The correlation tests include three years as well. This design helped to show sharp differences between the periods of company work. Such comparison allowed accentuating the anomalies in observed changes.

The fact that this research ~~was~~ based on the events that took place in the past and were not a staged experiment protects the study from internal validity threats. There are no experimental procedures, treatments or experiences of the participants that might have brought an error to research process. The research ~~was~~ based on the factual data of the historical incident. The data represent~~ed~~ a full set of available records. This fact allows the use of formulas for calculating the full population variance and standard deviation instead of working with sample formulas. Due to this fact the results have more credibility.

To avoid external validity threats ~~I refrained from generalizing my~~ conclusions ~~were not generalized~~ over other companies engaged in similar business. This research intend~~ed~~ to study the effect of short selling in the particular case of Lehman Brothers and the results are not to be identically projected on other companies.

However, there are several limitations that had an effect on this research. First, the data of short sale transactions collected from Bloomberg is in bi-weekly periods. Two weeks is a much extended period of time for the stock market. Within a week volumes and prices of the trades can dramatically change. It would be preferable to work with data recorded on daily or weekly bases. The second important factor to mention is that there is no direct dependency between the volume of short sales and the volume of regular sales. The trades ~~were~~ taking place in an opened market and for every sale order there ~~was~~ a buyer. It is important to state that it ~~was~~ not the volumes of trades ~~that~~ were analyzed but the patterns of their changes.

*Researcher Statement*

The fall of such a large financial institution as Lehman Brothers is an occurrence of a large scale. It produced an effect over the whole financial market and had reflections on the national level. To analyze the event of this scale the researcher is required to have a world class education and extensive experience in the financial analysis. I need to mention that this research project ~~was~~<sup>is</sup> ~~being~~ carried out on an undergraduate level of education. Thus, the depth of this analysis has its reasonable limitations. It reflects basic knowledge of business finance and my passion for the subject as an aspiring specialist.

In order to identify the possible bias in this research I feel a need to state that in my personal opinion the financial market should be regulated. I think that the idea of free market regulating itself has proved itself wrong one more time during the event of the financial crises of 2008. The modern society cannot afford to expose itself to the market shocks of such scale. The last proof to that is the spill of American financial crises all over the rest of the world. In my opinion the financial business must be understood, standardized, and controlled in order to prevent the similar incidents in the future. I started this research to contribute to the work of understanding the business of finance and intend~~ed~~<sup>ed</sup> to explain the phenomenon of short selling objectively.

## Findings

### *Chronological comparison of the stock price, volumes of short sales and regular trades*

The chronological comparison between the price of the stock, trade volumes, and amount of short sales is provided as a visual interpretation of the data and patterns of changes. Figure 1 shows the changes of the stock price from month to month during the observed period. Figure 2 shows the changes in trading volumes and Figure 3 demonstrates the changes in the amount of shares sold short.

Figure 1. LEH stock price

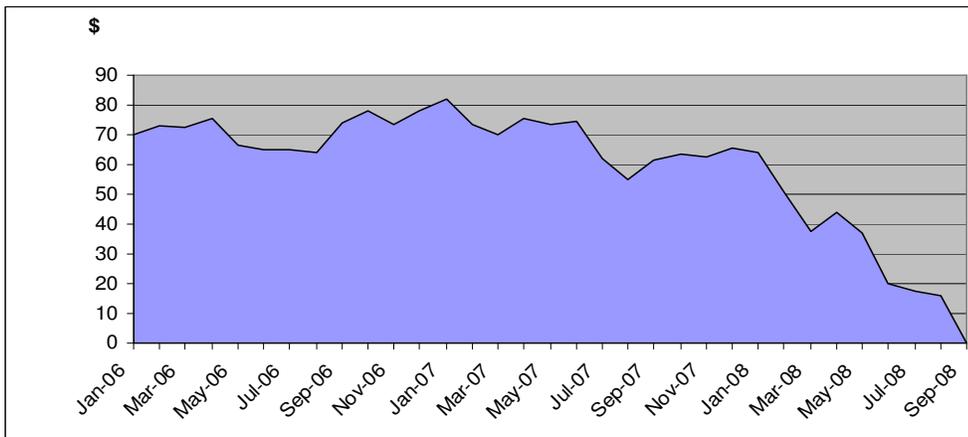


Figure 2. LEH stock trading volumes

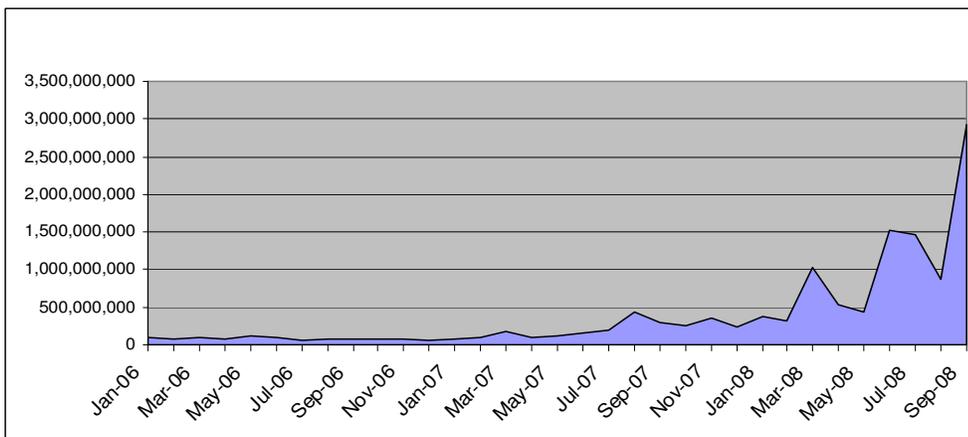
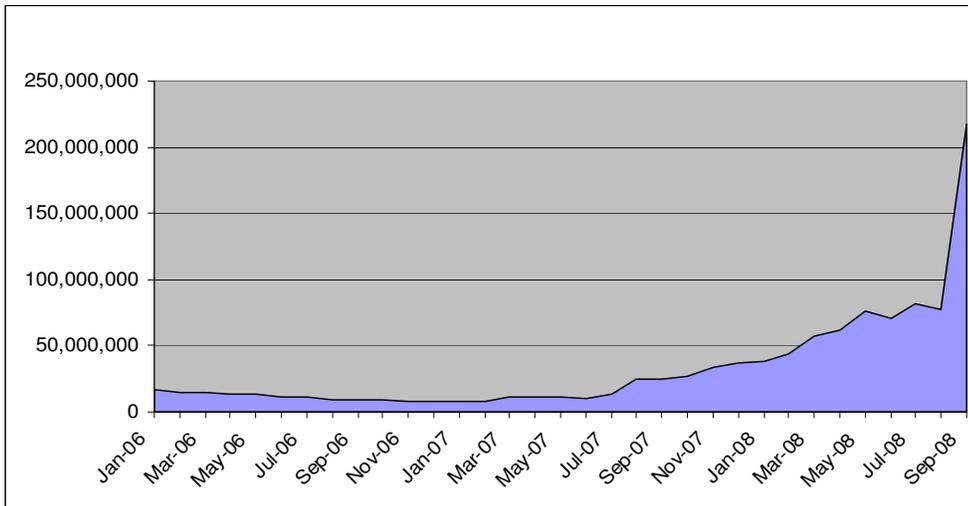


Figure 3. LEH stock short interest



This comparison illustrates the significance of changes in the observed variables in 2008. The rapid fall of the price and increase in both short interest and trading volumes is vividly depicted on the graphs. To be able to make a comparison of variables during the observed time period I have calculated their averages and highest and lowest values. The average price of LEH stock in 2006 was \$ 70.45 (SD = \$5.1440), in 2007 it was \$ 69.23 (SD = \$8.7797), and in 2008 it fell to \$ 36.43 per share (SD = \$16.5505). The highest price in 2006 was \$ 78.65 and the lowest was 59.42. In 2007 the highest and the lowest prices were \$ 85.8 and \$ 51.57 respectively. In 2008 the highest price was registered at \$ 66.00 and by the day before the company filed for bankruptcy it fell down to \$ 3.65 marking the lowest point of the price before the bankruptcy.

The average, highest and lowest values for trading volumes and short sales are displayed in Table 1. The analysis of this data shows the dramatic increase in both absolute and average values in 2008 for both short sales and trading volumes. In 2006 and 2007 I have observed changes in values. While changes increase from 2006 to 2007, 2008 stands out by a wide margin.

Table 1. Average, high and low value for short sales and trading volumes

Year	SS	RS	Value
2006	5,664,786	10,562,300	highest
	4,000,065	4,094,074	average
	3,256,863	1,103,500	lowest
2007	37,126,588	44,602,888	highest
	21,368,258	10,013,878	average
	7,726,113	2,500,600	lowest
2008	217,545,184	473,167,232	highest
	71,521,560	51,983,895	average
	38,406,284	8,438,871	lowest

Bloomberg Professional

*Standard deviation and one-way ANOVA tests*

A one-way analysis of variance was conducted to determine if there were significant price changes between each year of 2006, 2007 and 2008. The data was based on daily periods reflecting price changes for every day of the stock trading for each year. The data for 2008 trading was analyzed only up to the 15<sup>th</sup> of September when the company filed for bankruptcy. The results of the test are exhibited in Appendix B. One-way ANOVA produced the results for each year: in 2006 the average price was \$ 70.45 (SD = \$5.1440), in 2007 \$ 69.23 (SD = \$8.7797) and in 2008 \$ 36.43 (SD = \$16.5505). The analysis of variance showed that there are significant differences between the means for each year  $F(2, 677) = 668.4880, p < 0.0001$  which means that the chance for a mistake in this test is less than 0.01%.

To test the differences between the results for each of the years I used a post hoc t – test. The results for the t-test are exhibited together with the results for the ANOVA test in Appendix B. The t-test gave three pairs of comparisons showing the results for each pair. It found that there are significant differences between the means of years 2006 and 2008; and 2007 and 2008 with significant p values. It also found that there is no significant difference between the means of 2006 and 2007.

The results of these tests support the hypothesis that there were significant differences in the values of means and standard deviation in 2008 compared to 2006 and 2007. My expectations to see higher price volatility in 2008 were met.

$$\sigma^2_{2006} \approx \sigma^2_{2007} \neq \sigma^2_{2008}$$

#### *Correlation tests*

The correlation tests were run to analyze the dependency between the changes of LEH stock price, trade volumes, and short interest. The correlation was analyzed for 2006, 2007 and 2008 separately. The following is a presentation of the results of the tests and the explanation of the findings.

#### *Correlation tests for 2008*

Two correlation tests were run to determine if there was a linear relationship between the changes of stock price and the volumes of shares sold short, and the changes in trading volume and the volumes of shares sold short. The results of the tests are exhibited in Figures 4-7 (Appendix C). The figures show the correlation results, scatterplot matrix, and pairwise correlations. The data for 2008 is analyzed on a biweekly basis and makes the sample of 17 points.

*Correlation between short sales and price of the stock.* In Figure 4 the scatterplot matrix lists all of the variables vertically and horizontally. It fills in the correlations with each combination. In each test there were two variables, thus there are four correlations listed in the graph. Most of these correlations are redundant. The matrix is symmetric along the diagonal. The diagonal list the variable's correlation with itself and has the correlation of 1. This result is not important for the test; it basically shows the necessary condition of correlation – each variable is perfectly correlated with itself – is fulfilled. The other two quadrants show the correlation between the changes in short sales and the price of the stock in 2008. The test shows a significant negative correlation. The test results are  $r = -0.7556$ ,  $p = 0.0005$ . The  $r$  of

-0.7756 shows a high negative correlation between the short sales and the stock price. It means that the increase of short sale volumes was very closely associated with the decline in the price of the stock throughout the year. The p of 0.0005 shows that the correlation result is very significant. In fact the chance that the correlation between short sales and stock price for 2008 was wrong is only 0.05% if the null hypothesis is true.

However, during the analysis of the scatterplot matrix I noticed that one point of data is much different from the others and lies behind the boundaries of the correlation chart. One of the necessary requirements for calculating the correlation says that any outlying points must be removed if they are known to be errors. The effects of any other outliers should be considered by calculating  $r$  with and without the outliers included (Triola, 2008). The point that appeared to be an outlier is the last point in the table. It responds to the day when the Lehman Brothers filed for bankruptcy which resulted in immediate collapse of the share price and a huge increase in short interest. From the market point of view this behavior is not an error. However, to satisfy the statistical requirement I deleted the outlying data point and ran the correlation test one more time. The results are exhibited in Figure 7. The  $r$  value came out to be -0.8490,  $p < 0.0001$ . These results mean that after removing the outlying point the correlation came out to be even stronger and the result of a mistake dropped down below 0.01%.

*Correlation between short sales and trading volume.* The results of the correlation test between the changes in short sales and the volume of regular sales are exhibited in Figure 6. The scatterplot matrix shows a wider spread in data and two outlying points. The test results are  $r = 0.5384$ ,  $p = 0.0258$ . With the significance level of 0.05 I can conclude that there is a correlation between short sales and volumes of regular trades. A 0.05 significance level is a standard level of acceptance for statistical

calculations, which shows that the probability of a mistake is lower than 5% if the null hypothesis is true.

In order to fulfill the requirements for calculating the correlation the outlying data points were removed. These two points also cannot be considered as errors from the market point of view; however, they can have a significant effect on statistical calculations. In the second test the outliers were removed and the correlation test was run one more time. The results are exhibited in Figure 7. The  $r$  value is 0.5368,  $p = 0.0391$ . With the significance level 0.05 both tests show that there is correlation between the observed variables. However, it must be concluded that the correlation between short sales and volumes of regular trades is much weaker than the one between short sales and price of the stock.

Based on the results of these tests the conclusion is that the hypothesis is correct. In 2008 the changes in large volumes of short sales are strongly correlated with the changes in the price of shares, and affect the trading volumes of the stock.

#### *Correlation tests for 2006 and 2007*

Correlation tests for 2006 and 2007 have the same structure as the ones for 2008. The difference between them is that the data for 2006 and 2007 is reported in monthly periods. Therefore the data sample has 12 entries. I made a decision to run correlation tests for 2006 and 2007 in order to be able to compare the results to 2008. Although I am not focusing on the effects of short selling during these years, the results of these tests will extend the studied period and make it possible to compare the results in chronological retrospective.

*Correlation between short sales, stock price, and regular sales in 2007.* The results for these tests are exhibited in Figures 8 and 9 (Appendix D). The analyses of the scatterplot matrix showed that there were no outlying points. Based on this analysis I ran a correlation test of the full data sample. For short sales and price

correlation the results were  $r = -0.6967$ ,  $p = 0.0118$ . For short sales and regular sales correlation the results were  $r = 0.7746$ ,  $p = 0.0031$ . The results are significant enough to make a conclusion that in both cases correlation between the variables is observed. The correlation is not as strong as in the year 2008.

*Correlation between short sales, stock price, and regular sales in 2006.* The results for these tests are exhibited in Figures 10 and 11 (Appendix E). The analyses of the scatterplot matrix showed that there were no outlying points for both tests. Based on this analysis I ran a correlation test of the full data sample. For short sales and price correlation the results were  $r = -0.2542$ ,  $p = 0.4252$ . For short sales and regular sales correlation the results were  $r = 0.5347$ ,  $p = 0.0733$ . The results for these tests suggest that there is no correlation between the change in short sales, stock price, and trading volumes in 2006.

## Discussion

The comparison of the research findings with the literature review is organized by matching the test results with the theoretical statements. This approach was used because it corresponds with the pattern matching analysis technique and helps to interpret the test results.

Figures 1, 2, and 3 show the graphical interpretation of the analyzed data. They track the changes in the stock price, trade volumes, and short interest. One can see that throughout 2006 and 2007 the LEH stock price followed random ups and downs; the average prices for these two years are very close. However, in late January of 2008 the price of LEH stock started to decline sharply and continued a constant fall until the 15<sup>th</sup> of September.

The volume of trading in LEH stock did not have any significant changes in 2006 and the first half of 2007, it remained under 170 million trades a month. The volume increased in the second half of 2007 but still remained under a level of 450 million monthly trades. In early spring of 2008 the amount of trades in LEH stock spiked and had a very unstable pattern of behavior the rest of the year. It showed rapid increases and sharp falls; however, it never returned to the average trade volume in the previous two years. The volume of trading jumped to over 1 billion trades in March and over 1.5 billion trades in June. It achieved its maximum point in September reaching almost 3 billion trades a month.

The pattern of change in short sales is similar to the one in trade volumes. The number of the LEH stocks sold short started to increase in the middle of 2007. The incline of the graph became sharper in 2008 and by the date bankruptcy was filed Lehman Brothers had more than 217.5 million shares sold short. The enormity of this number can be better understood when compared to the average number of stocks sold short in 2006 and 2007, which are 4 million and 21.4 million respectively.

The analysis of publications in the section of literature review dedicated to Lehman Brothers and the data shown above indicate that the company was in a deep crisis in 2008, which began in the middle of 2007. The sharp decline of the stock price and the instability of trades indicate that the company was going through volatile times. According to the research of Platt (2002) a distressed state of a company can attract short sellers. Based on the definition of short selling (Woelfel, 1994) we can see that short selling becomes more lucrative the sharper the decline of the company. At the same time the analysis of the results of the chronological comparison of the amount of short sales indicate its significant increase starting in August of 2007.

The second argument posed is that the analysis of the fundamental financials of Lehman Brothers did not indicate the upcoming bankruptcy. This argument is supported by the study of the financial market analysis. The section of the literature review on the market analysis of Lehman Brothers operations shows that most analysts' opinions on Lehman Brothers were positive. Banks, investment banks, analytical and research companies present professional opinions on businesses and offer analyses for the investment decisions of their clients. Market analysts study business strategy of a specific company, its financial state, debt leverage, corporate culture, and ability to carry out management decisions, etc. Then they summarize this information and express their opinions on the state of the business in monthly or quarterly reports by giving the company a specific rating. The ratings assigned to Lehman Brothers all the way up to the end of the second quarter of 2008 were positive and analysts predicted that the company would overcome its problems and outperform the market in the next six to twelve months. Not a single analyst, out of ten that were studied, assigned enough probability to Lehman's full collapse to change the company rating to "sell". In my opinion this indicates the fact that the fall of Lehman Brothers was not triggered by the deterioration of its core business operations.

The next fact that demands attention is that in 2008 the amount of short sales rose to a very high level. According to the research of Shkilko, et al. (2008) aggressive short selling decreases the efficiency of the stock price ability to display the true market value of a company. It increases the pressure on the price of a stock and as a result can exacerbate its decline. The results of the test of the price standard deviation show that the LEH stock price was the most volatile in 2008. The price standard deviation was more than three times higher when compared to 2006 and two times higher than 2007. To develop this idea attention should be paid to the fact that according to the research of Saffi and Sigurdsson (2008) and Boehemer and Wu (2008) price inefficiency leads to the sending of erroneous signals to the market and mistaken perception by the market participants. To draw a parallel with the market situation around Lehman Brothers; the study of the market analysts' opinions indicates a loss of investors' confidence and a perception of weakness. The turmoil in the market and the indecisiveness of investors is reflected in extraordinarily high trading volumes in Lehman Brother's stock in 2008. At the same time, the investors' perception of weakness completely contradicts the belief of professional analysts in the strong fundamentals of Lehman Brothers in spite of temporary problems. The report by Citigroup states, "We don't view the current price as a reasonable estimate of fundamental value, but perception matters and in this environment of extreme uncertainty and illiquidity, perception has overtaken the fundamentals" (Bhatia, 2008, p 4).

The results of the correlation tests draw attention to the relation between short sales, the price of the stock, and the volume of trading. The tests showed a very strong negative correlation between the price of the stock and the volume of short sales in 2008. This result means that in 2008 the sharp and constant fall of the price was closely accompanied by the persistent increase of short sales. However, in 2006,

when the company was stable and business was successful the correlation test showed no relation between these indicators. The natural cycles of rising and falling stock price did not correspond to the changes in short sales.

Tests also showed a positive correlation between the volumes of short sales and trading activity. The results were not as strong as the correlation between the short sales and the price of stocks, but still fell into the significance level of  $p=0.05$ . This level of significance means that the chance of a mistake is less than 5%. In comparison with the correlation results between short sales and price, the significance level was  $p<0.0001$  meaning that the chance for a mistake is less than 0.01%. The correlation between short sales and trading volumes also disappears in 2006, meaning that the steady level of trading activity in 2006 did not correspond to the changes in short sales.

The last point in this discussion is the fact that the SEC announced an emergency state in July of 2008. As a result the SEC imposed a temporary restriction on short sales for 19 financial institutions, including Lehman Brothers. The fact that the main regulatory institution realized the effects of short sales and made a decision to interfere, underscores the crises in the market. However, the emergency intervention into the market and its restriction did not follow the previously held course of deregulating and liberalizing the process of short selling.

Overall, the results of the literature review in comparison with the research findings, demonstrate consistency through the various types of analysis. Several scenarios of short sales' impact on a company discussed in the literature review can be observed in the case of Lehman Brothers. The distress of the company was followed by a significant increase in short sales and at the same time the findings indicate a strong correlation between the stock price and the amount of short sales. On one hand the study of the financial analysts' opinions reveals the turmoil on the

stock market, on the other, short sales closely correlate with extremely high volumes of trading in Lehman Brothers stocks. The information discussed about short sales regulation and the emergency measures taken by the SEC, corresponds to the findings of the excessive increase in the volumes of short sales. These facts make me conclude that the findings of this research closely correspond to the theoretically modeled situation caused by excessive short sales that was discussed in the literature review.

### *Conclusions*

Short selling serves a certain purpose in the market. It provides the necessary tools and motivation to seek and reveal the businesses that are overpriced and inflated. This function of short sales makes the market more efficient and brings it to equilibrium. However, the same investment practices can be used to derive profits from the distress of a company and there are multiple examples of it. There is a strong theoretical foundation of the negative effects of short sales on the stock price.

This research of the case of Lehman Brothers shows that short sales played a significant role in the demise of the company. The analysis of the theoretical knowledge and its comparison to the research findings indicate that short sales were one of the factors that put enormous pressure on the company and led it to bankruptcy. Short sales contributed to devaluing Lehman Brothers' stock, which in turn led to the loss of investors' confidence. The other factors that contributed to the fall of the company were the deterioration of the main line of business, the prime and subprime mortgage crisis, deliquidation of the market, panic among investors, etc. It was not the intent of this research to measure exactly how extensive the damage inflicted by short sales was. Its goal was to find out if there was an impact at all. As a result this study provides proof of the strong influence of extremely high volumes of short sales on the stability of the company.

The second conclusion of this research is that the case of Lehman Brothers became another example of market volatility and misuse of the available investment tools by entrepreneurs. The fall of the investment bank was shocking to the market and created an unnecessary and avoidable turbulence. I believe it is possible to design and establish protective measures that will help to defend distressed companies from additional pressure in the stock market. The large profits derived from the distress of businesses should not be the justification for destabilizing the market. The case of Lehman Brothers is an example of the collapse of a giant company with assets of \$639 billion and 150 years of business experience. This bankruptcy had an effect on the economy nationwide. It is in the government's interests to create a market with fair rules and practices that support entrepreneurship and exclude speculation.

There is no doubt that the situation around Lehman Brothers will have a strong impact in the time to come. It raises a question that may become a starting point to significant and necessary changes: "What could have been done to prevent it?" This case can be used as a vivid example for designing and modeling the regulation of short sales. In addition to that, the investigation of the demise of Lehman Brothers can start the process of enforcement of the federal securities law against abusive or manipulative naked short selling. As Matsumoto (2009) mentions in his article "in Lehman's case the proof of a massive market manipulation may be available" (p.1).

#### *Recommendations*

From this research, it would seem logical that the process of deregulation and liberalization of short selling did not bring the expected results. Short selling is a very controversial investment tool, thus the approach to its regulation should be balanced. Neither strong liberalization nor complete prohibition of short sales would bring efficiency to the market. Processes that result in both positive and negative effects

should be analyzed. The regulation of short sales should target only the price destabilizing and manipulating effects. The SEC previously used by the “up-tick” test. This test was designed to identify the distressed companies and protect them from additional pressure from short sales. It was the right approach to the problem. The regulation for short sales should protect the companies that are going through a crisis by identifying them and shielding them from excessive short sales.

Another problem with selling stocks short is the fault of delivery or so called “naked” short sales. The case of Lehman Brothers had a record of extremely high volumes of “naked” short sales. The process of selling short does not have strict enough control. The existing procedure allows three days for the delivery of borrowed stock and there are ~~multiple exceptions allowing the several reasons why the~~ delivery ~~can~~ be postponed. It looks like ~~this procedure such regulation~~ allows short sellers not to deliver, if not encourages them to do it. ~~There can be dramatic changes in the market within three days. The investors can make a profit even in such a short time by selling the stock short, not delivering it and buying it back right when the delivery is due.~~ And even if there is an absence of delivery for the sale in proper time, there is no penalty for it. The point when the amount of “naked” short sales becomes fraudulent is also undefined. In my opinion the SEC should separate “naked” and regular short sales. Each procedure must be defined and the rules of the process should be communicated to the Exchanges. The regulation of “naked” short sales should include strict rules of delivery and the penalty for breaking the rules.

#### *Implications for Further Research*

Further research can have two directions. It can pursue a more detailed and thorough study of short sales’ effects on distressed businesses and use Lehman Brothers as an example. On the other hand the same question may be applied to the other companies to make a better founded statement about the effect on the industry.

Such research would be useful for making an argument for the development of regulation.

This research uses a secondary source of information on short selling data, the data was reported on a monthly basis, and the tools for statistical analysis that were used are within the undergraduate level of education. In spite of the limitations this research provides sufficient results to draw conclusions about the patterns of short selling effects on Lehman Brothers. However the case of Lehman Brothers can be studied on a higher level to observe and precisely calculate the impact of short sales. It would be necessary to turn to daily reporting of the amount of short sales to be able to establish its influence on the price of the stock on a daily basis. Such information can be provided only by the NYSE. To be able to establish and analyze the relation between the stock price and short sales, and to add to the robustness of the findings it might be advantageous to use a stronger mathematical and statistical apparatus.

Another option to extend this research would be to include the volume and price levels on options trading and the cost of credit default swaps on Lehman Brothers' debt. This might also show strong correlations to the price action of Lehman Brothers stock over the time period from middle of 2007 until September 15, 2008.

The other way to continue this research is to analyze other examples of the companies that were affected by high levels of short sales during the financial crisis of 2008. The analysis of the effects of short sales on other businesses can be helpful to make conclusions about the industry or market in general. This research can be used as the starting point of such a study. The conclusions about the market in general can be used as an argument by the SEC for lobbying for further regulation of short sales.

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## Appendix A

### Modified Research Data:

Stock price, trade volume, and short interest in monthly periods for 2006-2008

Date	Price	Trade volume	Short Interest
Jan-06	70.22	89,521,000	17,158,110
Feb-06	72.97	77,400,200	14,104,144
Mar-06	72.26	107,698,200	14,064,350
Apr-06	75.57	86,609,400	13,275,178
May-06	66.61	114,420,096	13,235,770
Jun-06	65.15	108,522,800	11,755,686
Jul-06	64.95	65,763,400	10,875,012
Aug-06	63.81	79,489,104	9,450,924
Sep-06	73.86	84,020,496	8,834,817
Oct-06	77.84	71,033,504	8,903,226
Nov-06	73.67	74,273,696	7,448,941
Dec-06	78.12	68,860,704	7,445,060
Jan-07	82.24	88,955,104	7,726,113
Feb-07	73.31	93,820,824	8,031,594
Mar-07	70.07	171,917,600	10,944,905
Apr-07	75.28	100,777,824	11,088,533
May-07	73.38	121,445,712	10,674,619
Jun-07	74.52	150,289,728	10,562,471
Jul-07	62.00	196,234,304	13,587,829
Aug-07	54.83	440,578,656	24,190,540
Sep-07	61.73	289,419,392	24,665,692
Oct-07	63.34	254,354,352	26,713,160
Nov-07	62.63	358,554,112	34,055,324
Dec-07	65.44	247,135,664	37,126,588
Jan-08	64.05	366,648,928	38,470,408
Feb-08	50.99	310,838,880	43,252,332
Mar-08	37.64	1,026,278,464	56,673,704
Apr-08	44.24	532,505,920	61,228,528
May-08	36.81	429,519,168	76,071,760
Jun-08	19.81	1,525,268,224	70,312,680
Jul-08	17.34	1,461,798,656	82,087,768
Aug-08	16.09	876,321,728	76,855,712
Sep-08	0.21	2,931,888,896	217,545,184

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Stock price, trade volume, and short interest in biweekly periods for 2008

<b>Date</b>	<b>Price</b>	<b>Trade volume</b>	<b>Short Interest</b>
1/15/2008	46.945	81144716	38,406,284
1/31/2008	46.945	81144716	38,470,408
2/15/2008	54.77	80,320,168	46,195,568
2/29/2008	50.99	80,800,136	43,252,332
3/14/2008	39.26	211,591,936	46,563,816
3/31/2008	45.28	82123136	56,673,704
4/15/2008	45.28	82123136	59,312,336
4/30/2008	45.28	82123136	61,228,528
5/15/2008	43.59	80526844	73,976,216
5/30/2008	36.81	99,772,728	76,071,760
6/13/2008	43.59	80526844	73,030,752
6/30/2008	43.59	80526844	70,312,680
7/15/2008	43.59	80526844	85,322,264
7/31/2008	43.59	80,526,844	82,087,768
8/15/2008	16.17	158,182,608	70,561,208
8/29/2008	16.09	202,308,560	76,855,712
9/15/2008	0.21	467,808,832	217,545,184

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Appendix B

One-way ANOVA and t-tests results

**Means and Std Deviations**

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
2006	251	70.4460	5.1440	0.3247	69.807	71.085
2007	251	69.2253	8.7797	0.5542	68.134	70.317
2008	178	36.4252	16.5505	1.2405	33.977	38.873

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Year	2	146869.75	73434.9	668.4880	<.0001*
Error	677	74369.94	109.9		
C. Total	679	221239.69			

**Comparisons for each pair using Student's t**

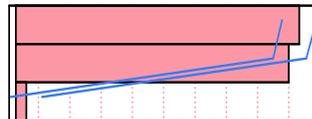
	t	Alpha	
	1.96347	0.05	
Abs(Dif)-LSD			
	2006	2007	2008
2006	-1.837	-0.616	32.004
2007	-0.616	-1.837	30.784
2008	32.004	30.784	-2.181

Positive values show pairs of means that are significantly different.

Level	Mean
2006 A	70.446016
2007 A	69.225299
2008 B	36.425225

Levels not connected by same letter are significantly different.

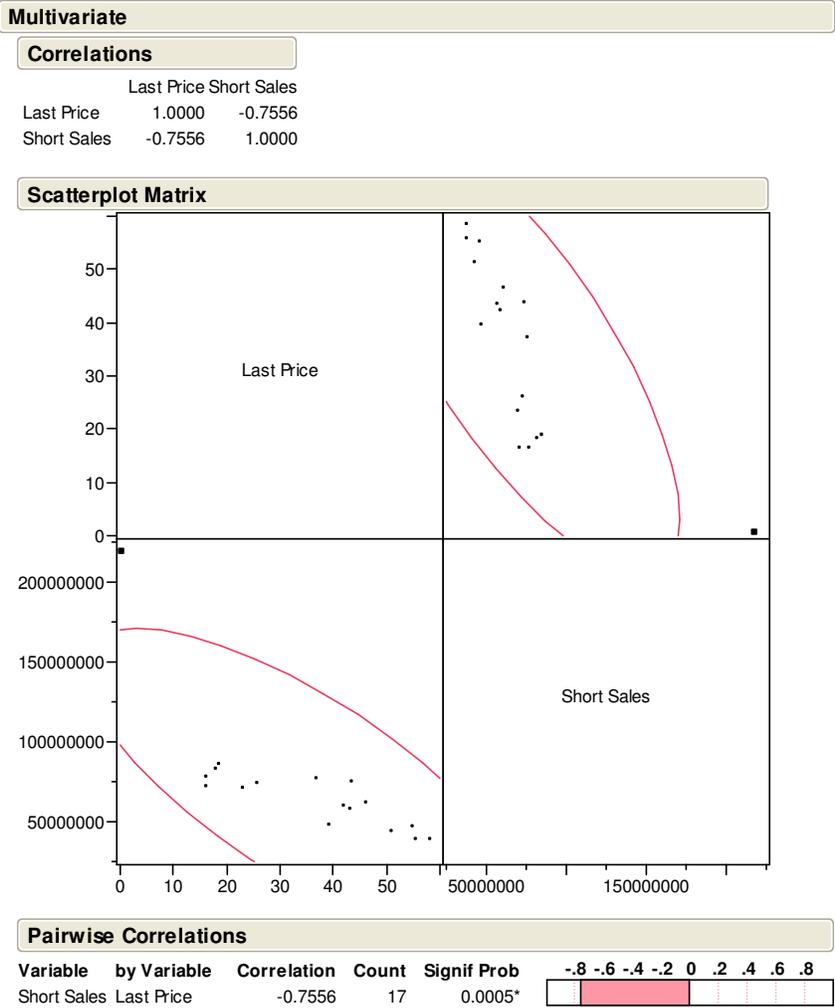
Level - Level	Difference	Lower CL	Upper CL	p-Value
2006 2008	34.02079	32.0042	36.03735	<.0001*
2007 2008	32.80007	30.7835	34.81664	<.0001*
2006 2007	1.22072	-0.6163	3.05771	0.1924



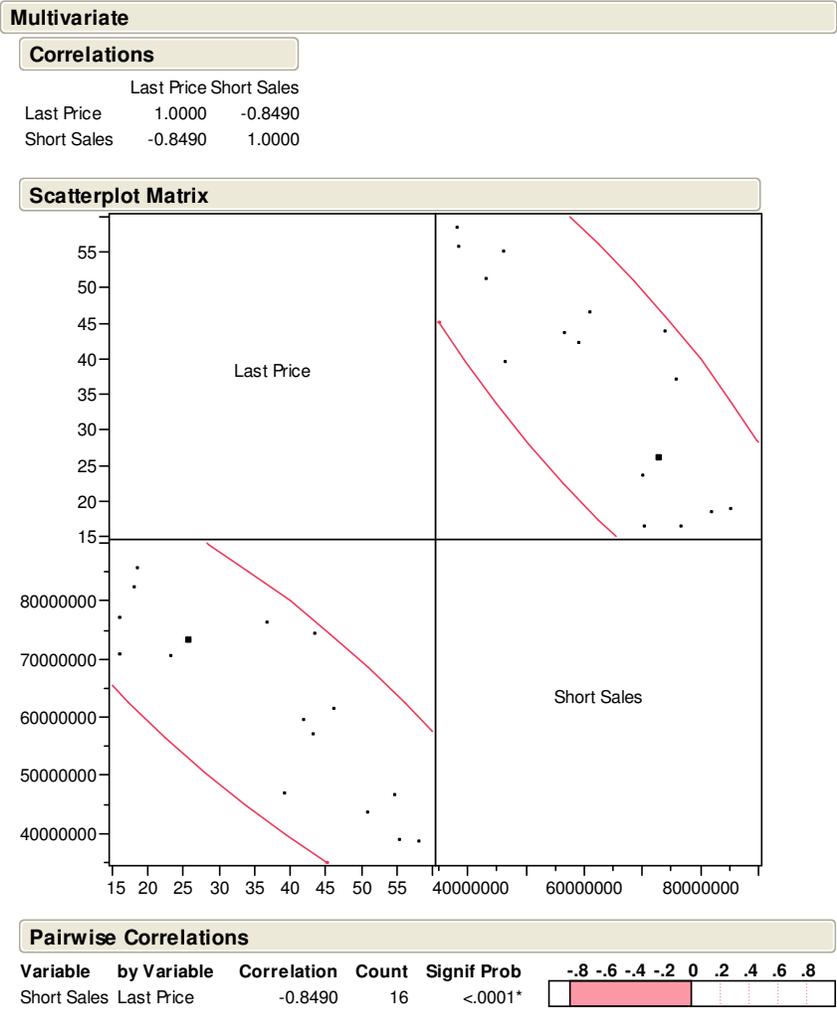
## Appendix C

### Correlation test results for 2008

**Figure 4. Correlations between short sales and stock price 2008, full sample**



**Figure 5. Correlations between short sales and stock price 2008, without outliers**



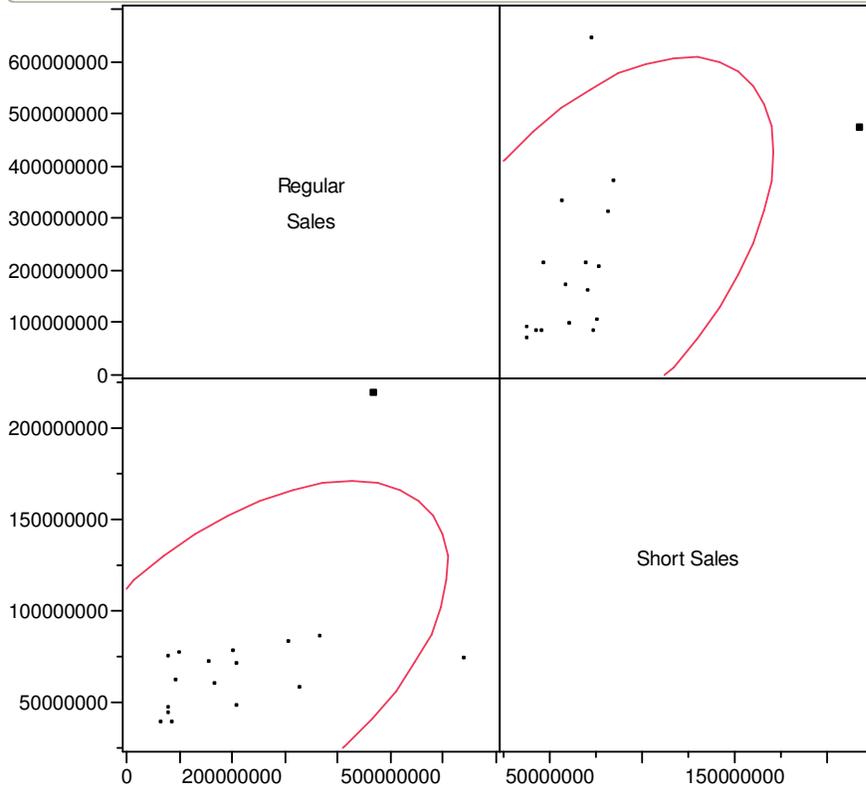
**Figure 6. Correlations between short sales and regular sales 2008, full sample**

**Multivariate**

**Correlations**

	Regular Sales	Short Sales
Regular Sales	1.0000	0.5384
Short Sales	0.5384	1.0000

**Scatterplot Matrix**



**Pairwise Correlations**

Variable	by Variable	Correlation	Count	Signif Prob	
Short Sales	Regular Sales	0.5384	17	0.0258*	

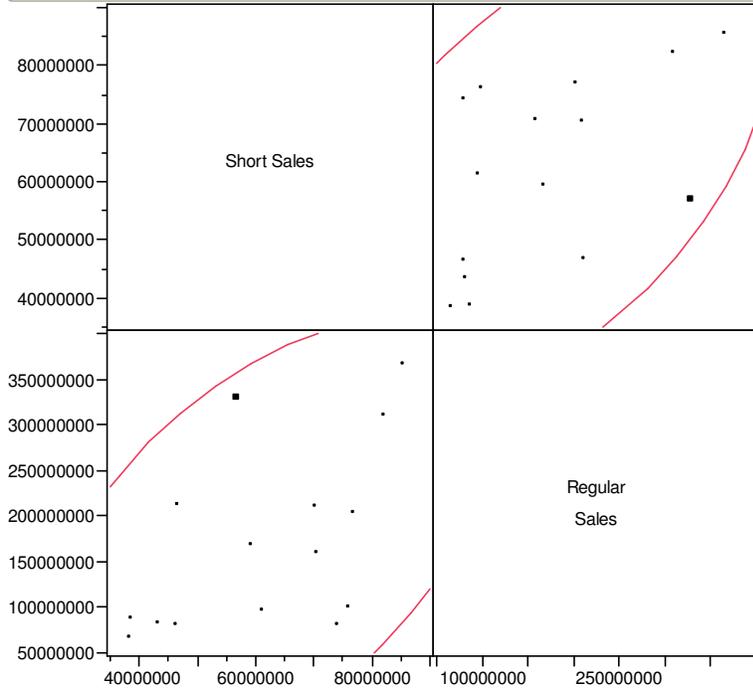
**Figure 7. Correlations between short sales and regular sales 2008, without outliers**

**Multivariate**

**Correlations**

	Short Sales	Regular Sales
Short Sales	1.0000	0.5368
Regular Sales	0.5368	1.0000

**Scatterplot Matrix**



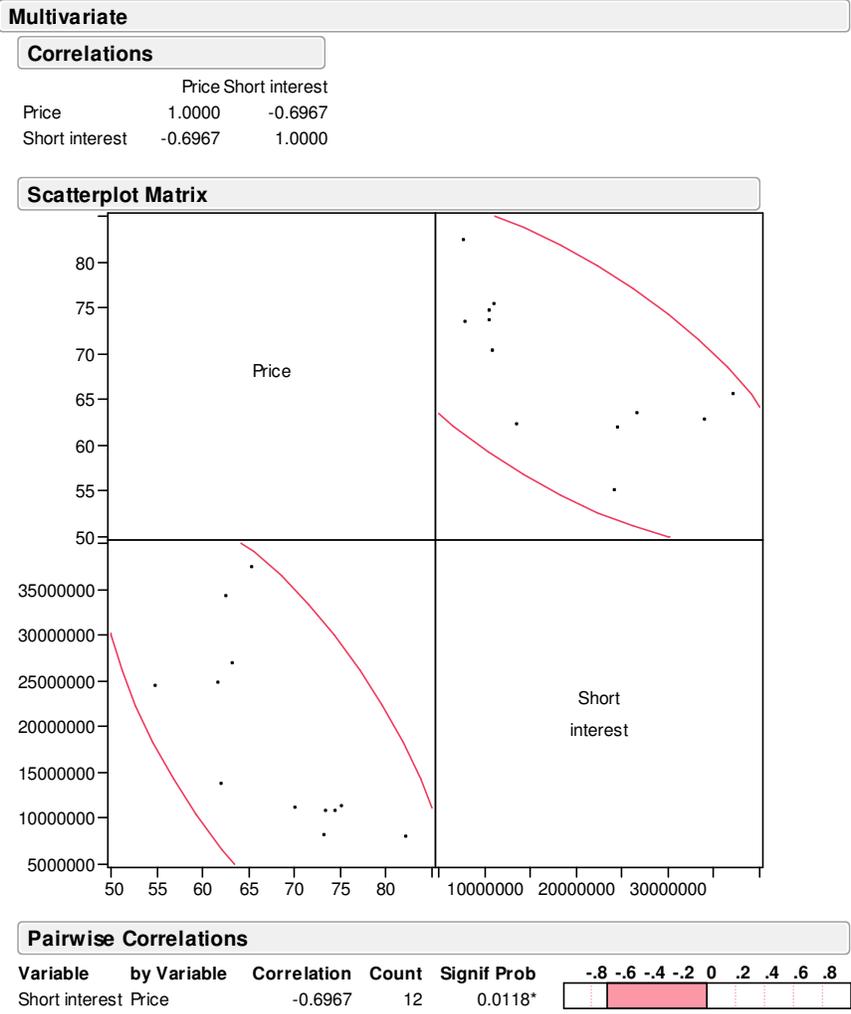
**Pairwise Correlations**

Variable	by Variable	Correlation	Count	Signif Prob	
Regular Sales	Short Sales	0.5368	15	0.0391*	

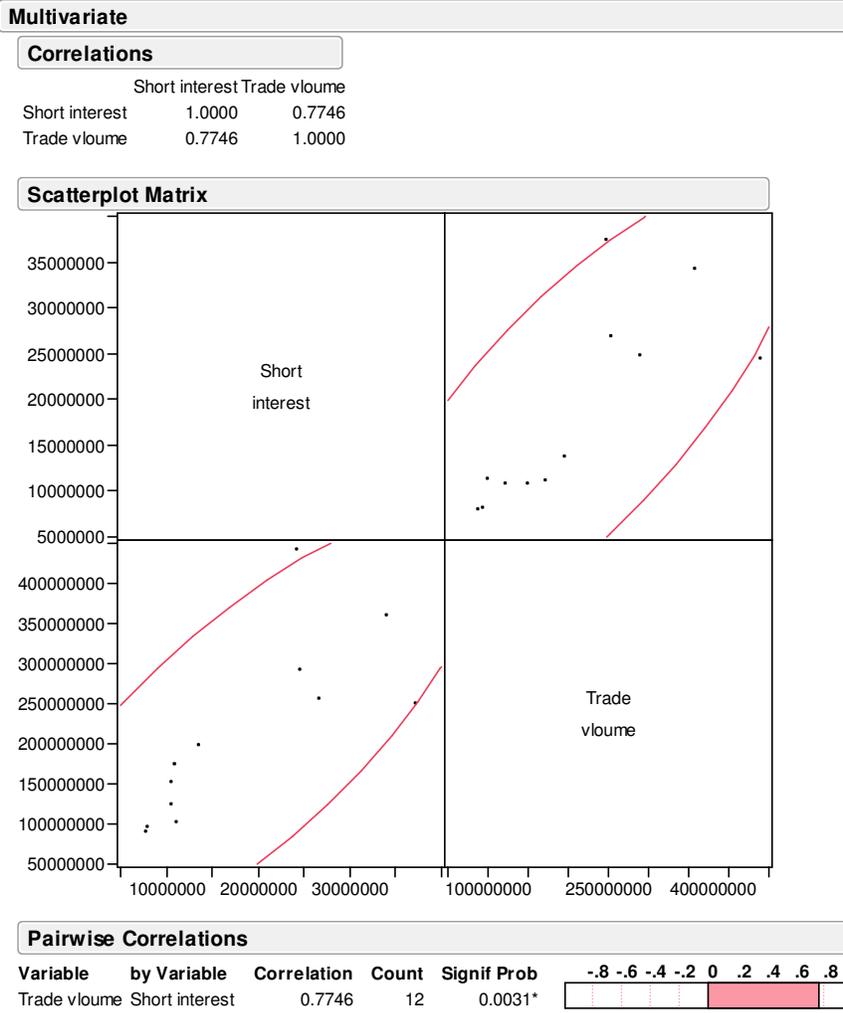
Appendix D

Correlation tests results for 2007

Figure 8. Correlations between short sales and stock price 2007, full sample



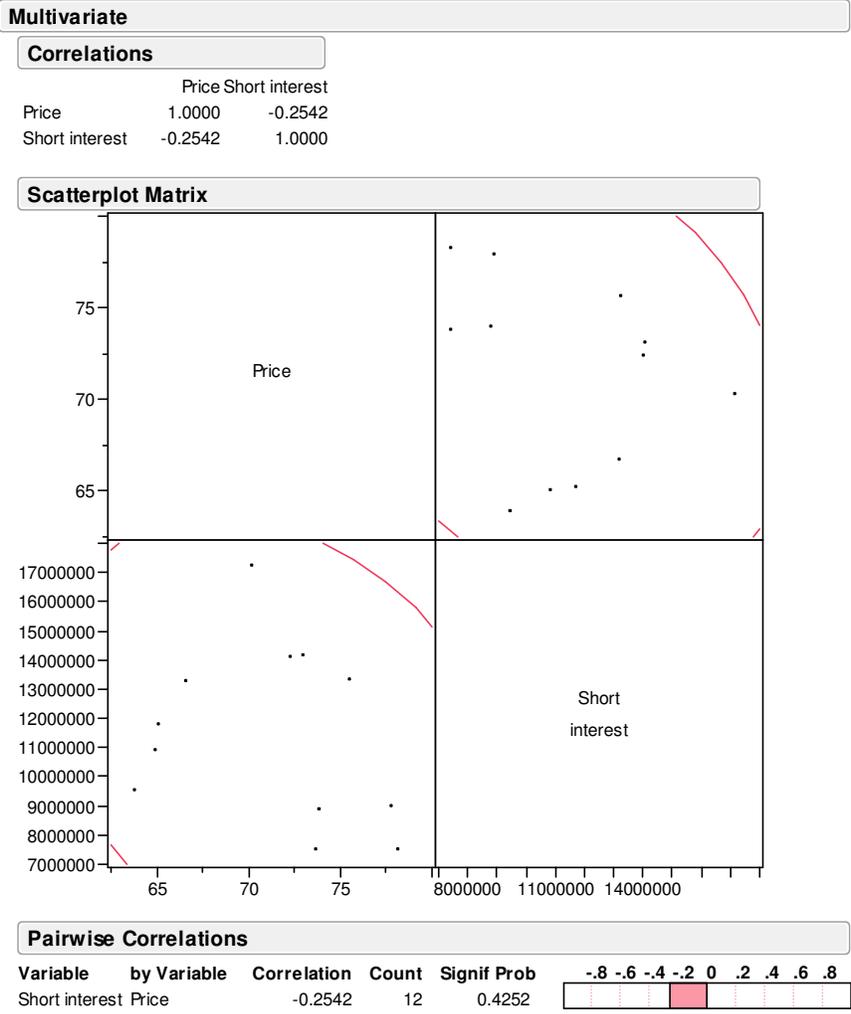
**Figure 9. Correlations between short sales and regular sales 2007, full sample**



## Appendix E

### Correlation tests results for 2006

**Figure 10. Correlations between short sales and stock price 2006, full sample**



**Figure 11. Correlations between short sales and regular sales 2006, full sample**

