

**EFFECTS OF SHORT SELLING DISCLOSURE  
REGULATION ON THE UK MARKET: ASSET PRICING,  
INFORMATIONAL EFFICIENCY, & HERINDG**

**Sibel Kütükcü**

**Master Thesis July 2016**

**Student number: 4221796**

**Supervisor: Dr. J. Qiu**

**Degree: Master of Science (Msc) Financial Economics**

**Department: Nijmegen School of Management**

**Radboud University Nijmegen**

**Radboud University**



**ABSTRACT.** The objective of this paper is to analyse the effects of the European Short Selling Disclosure Regulation on informational efficiency, asset pricing, and herding. The analyses are based on the UK financial market during the time-frame of 2012 – 2015 and considers FTSE100 companies. The paper advances the knowledge on the effect of public short selling disclosures. Short selling is considered in the context of asset pricing theory, the Fama and French three-factor model (1993), and from a behavioural finance theory, herding. The results indicate that the public disclosure of short selling does not capture a risk factor in the asset pricing model, does have a minor effect on stock price returns, and does influence subsequent short selling trades. The conclusion is that public disclosures of short positions is informative to the market.

*Keywords:* Short selling, public disclosure, informational efficiency, Fama-French three-factor model, herding, market sentiment

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## **ACKNOWLEDGMENT**

The writing process of my thesis taught me a lot about conducting research and critical academic writing.

I want to express my sincere thanks to my supervisor, Dr. Qiu, for his support throughout the research process. He provided great advice and taught me a lot about conducting research and finance from a critical academic viewpoint.

Thanks to my parents and sibling for their unconditional support.

Finally, thanks to anyone who supported me in any way throughout this process.

July, 2016

## I. INTRODUCTION

Short Selling Disclosure Regulation (SSDR) came into force within the European Union (EU) on the first of November 2012. This meant that all Member States had to disclose short positions taken on their financial markets through their assigned national authority. By implementing the Union-wide SSDR, European authorities aimed to create regulatory consistency regarding short selling among member states, to ensure well-functioning internal markets, and enhance transparency on short selling positions (European Parliament and Council (2012). Regulation (EU) No. 236/2012). The implementation of the SSDR was a result of the European crisis of 2008. The authorities perceived short selling to be a risky practice and one of the reasons for the stock market decline during the crisis.

In order to monitor and control short selling within the EU, the European Securities and Markets Authority (ESMA) was assigned as the central authority responsible for the SSDR. ESMA has the power to take measures when the stability on the European financial markets are threatened. To ensure greater coordination and consistency between Member States' financial market regulation, all Member States had to assign a national authority cooperating with ESMA on short selling regulation. For example, the Financial Conduct Authority, the Federal Financial Supervisory Authority, and the Authority for the Financial Markets are responsible for the regulation and monitoring of short selling on the financial market of the United Kingdom, Germany, and the Netherlands respectively. Due to their ability to directly monitor domestic market conditions, national authorities play an important role in the supervision of the SSDR.

The SSDR is based on a two-tier information disclosure system. The first threshold requires a private notification to the country's national authority when a net short position is reached equalling 0.2% of the issued share capital of the stock shorted, and each 0.1% above that. The second threshold requires a public notification, which is disclosed by the national authority, in the case a short position equals 0.5% of the issued share capital of the specific stock, and each 0.1% above that.

European authorities emphasize the important role of short selling activities for the functioning of financial markets in the context of liquidity and efficient price formation (European Parliament and Council (2012). Regulation (EU) No. 236/2012). In addition, they state that disclosing short sales publicly provides useful information to market participants. With these statements, authorities emphasize the information provision effects of short selling. Together with the implementation of the SSDR is announced that ESMA closely monitors the developments on international and European financial markets and may implement regulatory adjustments when required, e.g. adjustments on the disclosure threshold for short selling can take place.

The interest for short selling is not limited to the political realm. The academic community has also shown an interest in this topic. Beber and Pagano (2013) analysed the effects of short selling bans in various countries resulting from the 2008 financial crisis. They found that these bans had a detrimental

effect on market liquidity and slowed the price discovery mechanism on financial markets. Boehmer, Jones, and Zhang (2009) conducted an analysis on the short selling ban in the United States (US) and conclude that there was a reduction in market quality as market making became more difficult. Marsh and Payne (2012) analysed the United Kingdom (UK) ban on short selling and found that bid-ask spreads widened and trading volume reduced. They conclude that short selling bans cause markets to be less efficient.

Even though there is considerable attention to short selling from both a political as well as an academic perspective, there is not much knowledge about short selling after the financial crisis of 2008. Most of the current studies on short selling are based on the effects of short selling bans. There are a limited number of researches that focus on the effects of public short selling disclosure regulation, e.g. in the context of information provision effects and investor trading. This gap in the literature is acknowledged by recent papers on this topic. Kampshoff, von Nitzsch, and Braun (2012) remark that there are still remaining questions regarding the overall effects of public disclosures and the optimal thresholds for disclosures. Bohl, Klein, and Siklos (2013) conclude that the academic literature is neglecting and silent about the effects of short selling on trading behaviour. With their paper they aimed to start closing the gap in the literature concerning short selling.

The fact that the SSSR is open for regulatory adjustments and the subsequent gap in the literature regarding short selling, makes it a suitable topic for research purposes and policy recommendations.

The aim of this paper is to analyse the informational efficiency of the European SSSR. Informational efficiency meaning whether the public disclosure of short selling positions does provide additional information to the market and influences stock price returns. Here is assumed that markets are semi-strong form efficient. The analyses are based upon short selling on the United Kingdom (UK) financial market during the period from 2012 – 2015. This market is chosen due to its central and significant role within the EU. All FTSE100 corporations with a short selling position during the considered time-frame are included in the analyses. The main research question of the paper is: *Are public disclosures of short selling informative to the market?* The question is answered by an empirical analyses in which short selling disclosures are placed within the context of both asset pricing theory, the Fama-French three-factor model and behavioural finance theory, herding. An additional insight is provided by considering the relation between stock returns and market sentiment.

This paper contributes to advance the knowledge on short selling and further close the gap in the literature. Therefore, the paper is of relevance for academicians, policy-makers, and practitioners.

The results show that public disclosure of short selling does not capture a risk factor in the asset pricing model, does have a minor effect on stock price returns, and does influence subsequent short selling trades. The conclusion is that public disclosures of short positions is informative to the market.

The paper continues in Chapter II with an elaboration on the current state of literature and the construction of the research question and hypotheses. In Chapter III the methodological aspects of the research are discussed together with the introduction of the dataset, relevant variables and models. Chapter IV presents the empirical results and the implications of these results on the research. Chapter V concludes the paper. Chapter VI provides a discussion and recommendations for further research.

## **II. LITERATURE REVIEW & HYPOTHESES**

This chapter covers current literature on short selling and related topics. Consequently, the central research question and hypotheses of the study are constructed. There are four sections in this chapter. Firstly, the focus is on the definition of short selling. Secondly, short selling is discussed within the context of the efficient market hypothesis and asset pricing models. Thirdly, herding literature is related to short selling with an introduction to a herd model. Fourthly, the relation between market sentiment and asset returns is discussed. The chapter concludes with the research question and hypotheses of the study.

### ***Short Selling***

Short selling is the practice of selling a security that is not owned by the seller, but is borrowed from another party. A short position is created when the short seller borrows the stock, from e.g. a bank or a stock-broker, and sells it on the market. Ideally, the short seller closes the position when the securities' price has declined to such an extent that the short seller makes a profit on it. The position is closed when the short seller buys the security at the current, low, price and returns the security to the bank or stock-broker from whom it was borrowed.

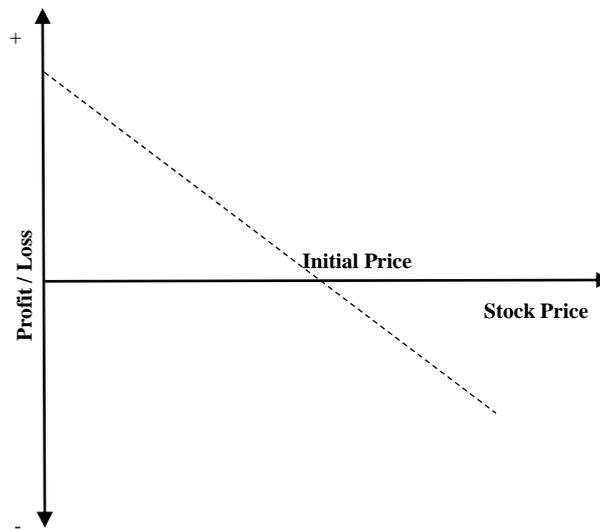
The profitability of short selling depends on the earnings from these transactions and the costs and fees involved with borrowing the stock. In addition, since the seller does not own the stock any dividends or rights that are declared during the borrowed period should be proceeded to the lender.

Alongside the risk of high costs, there are other considerable risks involved with settling a short position which are also the concerns about short selling of regulators. The profit and loss profile of a short position is asymmetric. On the one hand, stock prices decline as far as zero on the downside. This leads earnings to be equal to the initial stock price at maximum, without considering any costs or fees. On the other hand, stock prices can increase, in theory, unlimited and thus lead to unlimitedly losses. Figure 1 illustrates this asymmetric profit and loss.

Another risk of short selling is the so called short squeeze. This occurs when the stock price unexpectedly increases, which can cause significant losses for the short seller as seen in figure 1. In this case, the short seller might choose to close the position due to expectations of further price increases and to limit losses (Lamont, 2004). An additional risk of short selling is when the stock is called away by the lender, e.g. when the lender of the stock wants to sell the stock (Lamont, 2004; Dechow, Hutton,

Meulbroek, and Sloan, 2001). The borrower is obligated to deliver the position by either closing the position by buying the security at the current market price or the borrower needs to find new stocks to borrow.

**Figure 1 –Profit and Loss Profile of Short Selling**



Due to the high costs and risks involved with short selling, short sellers are regarded to be sophisticated investors. In an early study, Diamond and Verrechia (1987) state that short sellers will not trade unless they expect prices to decrease enough to compensate for the costs and risks. Therefore, short sellers should be well-informed investors in order to account for this compensation. Dechow, Hutton, Meulbroek, and Sloan (2001) state that short sellers are investor who target and make profit on temporarily overpriced stocks by targeting securities with low fundamental-to-price ratios and revert their positions when these ratios converge to normal levels. They emphasise that short sellers have an important role in keeping prices in line with fundamentals. In line with this, Drake, Myers, Myers, and Stuart (2015) indicate that these sophisticated investors trade on information based on fundamental signals and information not yet been fully incorporate in the stock price. Therefore, short positions provide information about future earnings and improves the information efficiency of stock prices. The results of Drake et al. (2015) support this view and they conclude that regulators should take this informative role of short selling in account when implementing regulatory measures.

***Informational Efficiency and Asset Pricing Model***

Fama (1970) introduced the efficient market hypothesis (EMH hereafter). This theory discusses whether security prices at any point in time reflect the information available in the market. The EMH is divided into three forms of market efficiency. First, weak-form efficiency assumes security prices to reflect past stock price patterns only. Second, semi-strong form efficiency considers prices to reflect all information that is publicly available. Third, strong-form efficiency assumes security prices to reflect both all publicly available information as well as individuals’ private information. The EMH has been subject

to many financial research papers, various studies test the theory's assumptions. Jensen (1978) tested the assumptions in markets such as the United States, United Kingdom, and Germany, in which the results are consistent with the theory. Fama (1970) stated that many of the researches support the weak-form efficiency and that the strong-form efficiency should be seen as a benchmark to which deviations from market efficiency can be compared to. The semi-strong form efficiency is often considered to be the accepted form in finance literature (Jensen, 1978). When markets are assumed to be semi-strong form efficient, investors should not be able to earn excess returns from actions based on public information (Copeland, Weston, and Shastri, 2005). Only investors with private information should be able to earn excess returns.

Current empirical studies indicate that short selling itself is informative to the market and market participants. French, Lynch, and Yan (2012) analyse whether short sellers of Real Estate Investment Trusts (REITs) are informed traders. They find a positive relation between short selling activity and price volatility. In the paper is argued that this is an indication that short sellers are informed since volatility is primarily driven by the arrival of new information. Lynch, Nikolic, Yan, and Yu (2014) research whether aggregate short selling provides information about future market returns and is able to predict future returns. They conclude that short sellers have superior market-wide information, in contrast to firm-specific information. In addition, daily aggregate shorting forecasts market returns over subsequent trading days. Drake, Myers, Myers, and Stuart (2015) also investigate whether short sellers are able to bring information forward by impounding information about future earnings into the current price. They assume that short sellers are informed and sophisticated investors, therefore the amount shorted reflects their information about future earnings that still has to be incorporated in current prices. Drake et al. (2015) conclude that indeed short sellers provide information about future earnings and improve the informativeness of stock prices.

Although, there are indications that short selling itself is informative, there are mixed results about the information that short sellers hold. Earlier in this chapter is mentioned that short sellers are regarded as sophisticated investors who are well-informed about the costs and risks involved of settling a short position. Empirical results have different opinions on the sophistication of short sellers. On the one hand there are researches showing that short sellers have private information and therefore play an important role in the market to provide informative signals. Leung, Rui, and Wang (2009) examined short selling in relation to insider trading in Hong Kong and found that short sellers seems to have private information. Khan and Lu (2011) and Chakrabarty and Shkilko (2013) found significant positive abnormal short selling prior to a large insider sale is publicly reported on the NYSE and NASDAQ respectively. On the other hand there are researches concluding against the private information possession of short sellers. Blau and Wade (2012) state that although they find abnormal short selling before analyst recommendations, they indicate that this is due to speculative trading by short sellers.

Engelberg, Reed, and Ringgenberg (2012) argue that short sellers do not have private information but that they process public information in a certain way.

For this study is assumed that markets are semi-strong form efficient, meaning that the action of short selling is incorporated in the stock price immediately. The current analysis is based on the informational efficiency of the public disclosure of short selling by the authority, after the action of short selling is incorporated in the stock price assuming semi-strong form efficient markets. This means that the analyses focus on whether the public disclosure of short selling positions does provide additional information to the market and influences stock price returns. To analyse this, an asset pricing model is considered, i.e. the Fama and French three-factor model. For a long time, the Capital Asset Pricing Model (CAPM hereafter) by Sharpe (1964), Litner (1965), and Black (1972) has been one of the main asset pricing models within finance till Fama and French (1992; 1993) introduced their three-factor model. Fama and French (1992; 1993), state that the CAPM is limited in its empirical support in explaining returns. The CAPM is based on only one variable, market returns, to describe the returns on a portfolio of stock. Fama and French extended the CAPM by including factors on market capitalisation and book-to-market ratio. They identified these factors as SMB, i.e. small minus big market capitalisation, and HML, i.e. high minus low book-to-market ratio.

### ***Testing Herding Using Short Selling Disclosures***

Herding is the tendency of individuals to mimic the actions of others (Chang, Cheng, and Khorana, 2000). Herding behaviour occurs when an individual is aware of and influenced by others' actions. Bikhchandani and Sharma (2001) state that herding occurs when an individual would not have made an investment without knowing other investors' decisions, but does not make that investment when others decide not to do so, and vice versa.

For this study short selling disclosures are used as a test of herding to see whether more short selling follows previous short selling. There is expected that the public disclosure of short selling positions might cause investor herding. In the current literature there are various models and theories confirming the relation between herd behaviour and the presence of public information.

Banerjee (1992) designed one of the early models of herding. In this sequential decision model, the first individual makes a decision randomly, subsequently each individual makes their own decision and is able to observe choices made by previous decision-makers, but not others' signals. There is a probability that each individual receives a signal about the true value of the asset. Nevertheless, signals received by decision-makers need not be true. The model shows that the equilibrium is reached at a point of extensive herding, i.e. subsequent decision-makers tend to abandon their private information and base their decisions on decisions made by previous individuals. According to the model, herding could be rational because it is possible that previous decision-makers have superior information. Nevertheless, in the paper is suggested that the equilibrium causes the market's public information pool to be less

informative as individuals are less responsive to their private information by following the herd. As a result of this, less new information is provided to the market. In addition, herding causes volatility and frequent unpredictable changes as individuals abandon their own signal and follow others' without knowing if the other is right. Therefore, it might be desirable that decision-makers should not be allowed to observe previous decisions. By relying on their private information, individuals contribute to the public information pool.

Lux (1995) analyses information acquisition and herding on speculative markets. The model is based on noise traders, also called naïve traders, who deviate from rationality and have expectations not based on fundamentals but on behaviour or expectations of others. Due to the fact that these types of investors do not have access to information about fundamental values, they rely on publicly available information such as the action of others. In the paper is stated that rational behaviour for naïve traders is to follow the herd in the believe that others are better informed than their selves.

Avery and Zemsky (1998) state that with increasing uncertainty, whether this is uncertainty about the value of the asset, occurrence of an event or uncertainty about others' valuations, herding will occur. In addition, with sequential actions, earliest decision-makers have a disproportional effect on subsequent decision-makers. A slight preponderance of public information seems to be sufficient to induce following agents to herd. Cipriani and Guarino (2008) agree with the view that uncertainty causes herding on the market. They state that herding effects market stability and informational efficiency. Even though the occurrence of herding behaviour due to uncertainty, Avery and Zemsky (1998) argue that herding does not cause long-term mispricing of securities because at any point in time there is the possibility that new information arrives and adjustment in prices occur.

Bikhchandani and Sharma (2001) note that as public information becomes more informative than individuals' private information, individuals prefer to follow others and a herd begins. They state that these herds do not have a long-term characteristic as herds can be dislodged with the release of new public information. In addition, herd behaviour due to uncertainty is also mentioned even in the case of rational investors. Furthermore, there is stated that herds have a higher likelihood to occur in periods of market stress since individuals are more likely to suppress their own beliefs and favour market consensus.

Bohl, Klein, and Siklos (2013) conducted an analysis on institutional investors' herd behaviour after the implementation of short selling bans resulting from the 2008 financial crisis. In their study they state that the restriction of short selling causes adverse herding, i.e. dispersion of returns and divergence of opinion, resulting from market uncertainty and reduced trust in the market consensus. Corresponding with other papers they found that banning short selling causes deterioration in market liquidity, decreased trading volume, and increased bid-ask spreads (Boehmer, Jones, and Zhang, 2011; Beber and Pagano, 2012; Marsh and Payne, 2012).

### ***Herding Model***

In this section a short selling herding model is introduced considering the SDDR. The model is based on previous models of herding and investor reaction.

In the previous section, the herding model of Banerjee (1992) was introduced. In this sequential decision-making model, the first person makes a random choice which is observed by the subsequent decision-makers. These subsequent investors only know the action undertaken by previous decision-makers, not knowing whether the signal is right or wrong. The equilibrium of this model is always a point of extensive herding. Even though in the paper is stated that in this model it might be rational to follow the herd since there is the possibility that others are better informed than their selves, the market's pool of information becomes less informative and individuals less responsive to their private information.

Daniel, Hirshleifer, and Subrahmanyam (1998) (DHS hereafter), introduced a model on market under- and overreaction based on investor overconfidence and biased self-attribution. The DHS model distinguishes between informed and uninformed investors, the difference between them is that informed investors receive a signal about the value of the security while uninformed investors do not. During a specific time period, informed individuals receive a common noisy private signal. This is followed by a noisy public signal and subsequently by a conclusive public signal.

For the development of the hypothesis for this study a herding model within the context of short selling and the SDDR is considered. Based on the previous models and literature this model is formed. Rather than incorporating the assumption of the DHS model, the time-line of events is incorporated.

Previous literature states that short sellers are sophisticated investors (Diamond and Verrechia, 1987; Drake et al., 2015). In this model is assumed that indeed short sellers are sophisticated and well-informed investors. Nevertheless, the market does not only exist of short sellers but of many other market participants. It is assumed that there are both sophisticated investors, who are not only short sellers but also other informed investors, and non-sophisticated investors, also called naïve traders in previous literature (Lux, 1995). Each investors is expected to have some prior, private information about the value of a security. This signal could either be right or wrong. When an investor decides to act based on this private information and decides to short sell a specific stock at  $t = 0$ , considering that markets are semi-strong form efficient (Jensen, 1978), this effect will be immediately incorporate in the stock price. The act of this investor to short sell a stock is a public signal to the market, which could either be understood by other market participants or not. In addition, there is the possibility that other investors might or might not agree with this action. In the context of the SDDR, short positions taken at  $t = 0$  should be disclosed to the local authority by the next trading day at 15.00 (European Parliament and Council (2012). Regulation (EU) No. 236/2012). The public disclosure of this short position by the authority takes place at  $t = 1$  and all market participants are able to fully observe this public signal. After this

publication two possibilities might occur. The first option is that no herding occurs and the market does not observe a surge in short selling by other investors. This might mean that other investors do not agree with the action of the previous investors. The second option is that herd behaviour is observed. This herd behaviour can result due to the believe of other investors that previous decision-makers are better informed than their selves. Important to note here is that this study does not intend to analyse the private information of individual investors, but rather focuses on the actions of investors following the public disclosures of short selling positions by the authority.

### ***Market Sentiment***

Additionally to the main models of asset pricing and herding, the relation between short selling positions and market sentiment is shed a light on. Financial theories suggest the existence of rational investors optimising their portfolios which leads to a market equilibrium in which prices are equal to rationally discounted values of expected cash flow (Baker and Wurgler, 2006). Recently, there is increasing evidence that rather than rational expectations, market sentiment has an influence on stock prices and thus on market equilibrium. Market sentiment is the belief of investors about future cash flows and investment risks which are not justified by the facts at hand (Baker and Wurgler, 2007).

For this study is expected that market sentiment might play a role in explaining the relation between short selling and stock returns. Market sentiment represents an overall opinion present in the market at a specific moment. This opinion can either be a positive or negative outlook on financial markets. As discussed earlier, short selling is conducted when investors expect a specific stock price to decline in value in the near future. Therefore, short selling is expected to be present just before declining stock prices. In this study the coherent relation between market sentiment, short selling, and returns is analysed. In the literature there is support for this proposition. Baker and Wurgler (2006, 2007) state that there is an influence of market sentiment on stock prices and market returns. Especially stocks with low capitalisation, high volatility, and non-dividend paying companies seem to be sensitive to sentiment. In addition, Brown and Cliff (2004) emphasise that high sentiment is related to an increase in short interest and specialist short selling. They state that returns predict future sentiment, but sentiment does not predict future returns. For this research, it is expected that both short selling and market sentiment are related to stock price returns. Furthermore, as suggested by Drake et al. (2015), short interest is negatively related to future abnormal returns. This suggest the ability of short sellers to anticipate stock price declines.

Brown and Cliff (2004) empirically examine market sentiment and refer to early noise trader theories by Black (1986) and DeLong et al. (1990). These theories state that if some investors trade on noisy signals that is unrelated to fundamentals, e.g. market sentiment, security prices deviate from intrinsic values. In their paper, Brown and Cliff (2004) distinguish between two types of trader, i.e. fundamentalists and speculators. They characterise fundamentalist as a group of investors with unbiased

expectations of an asset's value, while the speculators are characterised by having biases in valuing assets. In this context, they define speculator's bias, which is either excessive optimism or pessimism, as sentiment. The market price is the result of the weighted average of the two groups. To analyse the relation between returns and market sentiment, Brown and Cliff (2004) use both direct sentiment measures, such as market participant surveys, as well as indirect measures, e.g. closed-end funds, IPOs, and liquidity. They conclude that returns are a prediction for future sentiment, but sentiment does not predict future returns. In addition, they conclude that months with high sentiment are followed by an increase in short interest and high specialist short selling.

Baker and Wurgler (2006, 2007) quantified different ways to measure market sentiment. One measure is the closed-end funds discount, which is the average difference between the net asset values of closed-end stock fund shares and their market prices. Another measure is the NYSE share turnover, which is the ratio of reported share volume to average shares listed from the NYSE Fact Book. Share turnover, or liquidity, is an indication of overvaluation. They state that Baker and Stein (2004) suggest that in markets with short-sales constraints, irrational investors participate and add liquidity only when they are optimistic, causing overvaluation. Other measures are the first-day returns on IPOs, equity share in new issues, and dividend premium. They conclude that measures positively associated with sentiment are share turnover, IPO returns, new equity issues. Measures negatively associated are closed-end fund discounts and the dividend premium. They emphasise the relation between sentiment and stock prices and state that when sentiment is high, subsequent market returns are low. In addition, they found that in particular stocks with low market capitalisation, high volatility, and non-dividend paying stocks are sensitive to sentiment.

Stambaugh, Yu, and Yuan (2011) also state that sentiment-driven investors, who they also call noise traders, cause the prices to depart from fundamental values. They used the Baker and Wurgler (2006) sentiment measures for the time period 1965 – 2007 and with these measures they were able to capture events such as the Electronics Bubbles of the 1970s and the Internet Bubbles of the 1990s. Besides these measure they included additional macroeconomic factors such as the term premium of Treasury bonds, real interest rate, and the inflation rate. These additional factors did not provide further explanation.

### ***Research Question and Hypotheses***

The aim of this research is to analyse the informational efficiency of the European SSSDR. The informational efficiency of public disclosures are analysed by considering literature on the Fama-French asset pricing model, herding, and market sentiment. Based on the previously discussed literature the research question and hypotheses are introduced.

Implementing the SSSDR, European authorities acknowledged the important role of short selling within financial markets and that disclosing shorting publicly provides useful information to market participants. The view of academicians on public disclosures is mixed. On the one hand, public

disclosures are said to improve financial market transparency and to increase the information provision on financial markets (Morris and Hyun, 2002). On the other hand, public disclosures might be too effective and might cause individuals to rely on public information and disregard their private information (Diamond, 1985). In order to analyse the information provision of public disclosures within the context of the European SDR, the main research question of this paper is: ***Are public disclosures of short selling informative to the market?***

The first hypothesis to be analysed is: ***Public disclosure of short selling positions influences stock price returns.*** There is evidence in the literature that short selling activity influences stock prices and returns. Bohl et al. (2013) argue that short selling is an instrument for investors to express negative opinions on future stock values. This is supported with subsequent findings in the literature that states that short sales are followed by negative abnormal returns (Aitken et al. 1998; Senchak and Starks, 1993). Therefore, for the first hypothesis is expected that the public disclosure of short selling activity is informative to investors and provides new information to the market which is subsequently followed by an influence on stock price returns. As is considered in the literature, short sellers are regarded as sophisticated investors. These investors' actions are seen to reflect information about future earnings that has yet to be impounded into current period prices (Drake et al., 2015). French, Lynch, and Yan (2012) have findings in line with these expectations. They state that short selling activity and price volatility are positively related to each other. By assuming that volatility is primarily driven by the arrival of new information, they emphasises that short sellers are informed and influence stock prices and returns.

The second hypothesis to be analysed is based on market sentiment: ***Market sentiment influences stock price returns.*** Here is expected that market sentiment influences stock price returns. Current literature supports the opposite of this proposition. Baker and Wurgler (2006, 2007) state that there is an influence of market sentiment on stock prices and market returns. Brown and Cliff (2004) emphasise that high sentiment is related to an increase in short interest and specialist short selling. They state that returns predict future sentiment, but sentiment does not predict future returns. For this research, the opposite direction of market sentiment and returns are considered within the context of short selling. As short selling is expected to influence returns, and short selling is conducted when prices are expected to decline, periods with high sentiment have a current positive influence on stock prices but is followed by high short selling and negative stock price returns. This is subsequently followed by a decrease in market liquidity and thus a decrease in market sentiment.

The third hypothesis to be analysed is: ***Herding is observed with public disclosure of short selling positions.*** As stated earlier in the literature overview, Banerjee's model of herding (1992) indicated that with public disclosures individuals seem to herd and the equilibrium is reached at a point of extensive herding. Therefore public disclosure of information is too effective and causes investors to put more weight on public signals and discard private signals (Morris and Shin, 2002; Lux, 1995). It is possible

that herding is not the most optimal decision, but it could be a rational decision. Individuals might consider others to be better informed and base their action on more information (Bikhchandani and Sharma, 2001; Avery and Zemsky, 1998). This is especially perceived in situations with uncertainty (Cipriani and Guarino, 2008). Christie and Huang (1995) emphasise that especially in periods of extreme market movements individuals are more in favour of the market consensus. Drake et al. (2015) state that herding occurs more often, and has a stronger effect when the firm's information provision is weak or when future earnings growth expectations are high. For hypothesis three is expected that the publication of short sale activity causes investors to herd.

### **III. METHODOLOGY**

In this chapter a detailed description is provided on the methodological aspect of the research. In order to answer the main research question three hypotheses are formulated. The first section focuses on the data collection and management. The subsequent section focus on the hypotheses, relevant variables and models, data and empirical approach.

#### ***Data collection and management***

The SSDR is implemented on the 1<sup>st</sup> of November 2012. The time-frame considered for this study incorporates the implementation date of the regulation, 1<sup>st</sup> of November 2012 till 31<sup>st</sup> of June 2015. The UK financial market is considered for the analyses due to the significant and central role of this market within the EU. The authority responsible for short selling regulation in the UK is the Financial Conduct Authority (FCA). As is required by the short selling regulation, the FCA publishes short selling position reports daily. These reports consist of all short positions from the implementation of the regulation till current short positions. Reports provide information on the position holder, name of the share issues, the International Securities Identification Number (ISIN), net short positions in percentage, and the position date. Net short positions in percentage meaning the net short position in percentage of the total outstanding capital of the concerned stock.

Reports on short selling are obtained from the FCA. All FTSE100 corporations with a short position during the time-frame of this study are incorporated in the final dataset. In order to be included in the final dataset a corporation should have at least two short position during the considered time-frame of this study. During the collection of the data, companies where excluded from the dataset due to the deficiency in data availability for this company regarding the relevant variables for the analysed models. The final dataset consists of 41 companies from the FTSE100. Table 1 in Appendix I enlists the corporations included in the final dataset. For companies within the final dataset daily stock prices are obtained from Datastream. From these stock prices, daily stock price returns are computed.

The factors for the Fama-French three-factor model are obtained from Xfi Centre for Finance and Investment, University of Exeter (see Gregory, Tharayan, and Christidis, 2013). The factors obtained from this database include daily factors of the Fama-French three-factor model for the UK market. The

factors, SMB and HML are constructed considering the FTSE All Share Index. The risk-free rate is the monthly return on three month Treasury Bills. These factors are regarded as suitable factors within the dataset of this study since the companies included in the FTSE100 are a component of the FTSE All Share Index.

As a proxy for market sentiment, data on daily order book trading is obtained from the database of the London Stock Exchange, Secondary Markets Statistics. This variable is considered as a suitable proxy for market sentiment due to the information it provides on market liquidity. There is support within the literature to consider market liquidity as a proxy for market sentiment (Brown and Cliff, 2004; Baker and Stein, 2004; Baker and Wurgler, 2006, 2007). Baker and Stein (2004) argue that when market sentiment is high, market liquidity increases subsequently. Therefore, market liquidity is regarded to be a suitable proxy of market sentiment.

Various models are adopted in order to analyse the hypotheses. First, the original Fama-French (1993) three-factor model is analysed. Second, augmented versions of the Fama-French (1993) model are considered. Finally, a herding model is analysed.

### ***Empirical Models***

The first model that is considered in the empirical analysis is the Fama-French three-factor model (1993). This model is constituted as:

$$R_{i,t} = R_{ft} + \beta_{1i} (R_{m,t} - R_{ft}) + \beta_{2i}SMB_t + \beta_{3i}HML_t + \varepsilon_{i,t} (1) ,$$

where  $R_{i,t}$  is the return on an asset  $i$ , the term in parentheses is the CAPM market risk premium with  $R_m$  is the return of a market index and  $R_f$  the risk free rate of return.  $SMB$  and  $HML$  are the size and value factors respectively.

For both the original model of Fama-French (1993), based on a US dataset as well as the UK dataset of this study obtained from Xfi Centre for Finance and Investment, University of Exeter (see Gregory, Tharayan, and Christidis, 2013), the factors are constructed with the same methodology. The factors for the current research are constructed with portfolios obtained from the FTSE All Share Index.

The methodology of Gregory, Tharayan, and Christidis (2013) is as follows. The sample of the FTSE All Share Index is sorted based on market capitalisation and book-to-market ratio (BTM). Then, market capitalisation is sorted based on S-small and B-big taking in account the median market capitalisation. Then, BTM is sorted into H-High, M-Medium, and L-low. Having obtained these values, six portfolios are created: SH, SM, SL, BH, BM, and BL. Here, SH is the small size, high BTM portfolio, SL is the small size, low BTM portfolio and so forth. These six portfolios are used to construct the values for SMB and HML:

$$SMB = \frac{(SL + SM + SH)}{3} - \frac{(BL + BM + BH)}{3} \quad (2)$$

$$HML = \frac{(SH + BH)}{2} - \frac{(SL + BL)}{2} \quad (3)$$

The second model that is considered in the empirical analysis is an augmented version of the Fama-French model and includes a variable on the public disclosure of short selling positions:

$$R_{i,t} = R_{ft} + \beta_{1i}(R_{m,t} - R_{ft}) + \beta_{2i}SMB_t + \beta_{3i}HML_t + \beta_{4i}SS_t + \varepsilon_{i,t} \quad (4),$$

where SS is the daily public disclosure of short position for a specific company  $i$  at time  $t$ .

The third model of this study considers a herding model for disclosures of short positions to be of an effect on subsequent short positions:

$$SS_{i,t} = SS_{i,t-1} + \varepsilon_{i,t} \quad (5)$$

The last model considers an augmented Fama-French model including a proxy variable, market liquidity, for market sentiment:

$$R_{i,t} = R_{ft} + \beta_{1i}(R_{m,t} - R_{ft}) + \beta_{2i}SMB_t + \beta_{3i}HML_t + \beta_{4i}MS_t + \varepsilon_{i,t} \quad (6),$$

where MS is the market sentiment for which the proxy daily order book trading is considered.

#### IV. RESULTS & IMPLICATIONS

In this chapter the results from the statistical analyses are discussed. An overview is provided on summary statistics. Subsequently, the results and implications for the research question and hypotheses are discussed including the conducted statistical analyses. Where necessary, information in the appendix supports the given arguments and explanations. Statistical analyses are conducted with the statistical program STATA and additionally with Excel.

##### *Summary Statistics*

Table 2 in Appendix II displays the summary statistics for the independent variables included in the statistical analyses. Table 3 in Appendix II shows the correlation table for these variables. There can be observed that for all independent variables, there is moderate to weak correlation among the variables. Correlation between SMB and HML is -0.2927. The correlations between the market risk premium, RM-RF, and SMB and HML are -0.4828 and 0.1602 respectively. Compared to the original dataset of Fama and French (1993), in which the correlation between SMB and HML is only -0.08, the correlation of SMB and HML is larger in the current study. The correlation of RM-RF with SMB and HML in this is close to the original dataset of Fama and French (1993), i.e. 0.32 and -0.38 respectively. Although the difference among the correlation coefficients of the original Fama-French dataset and the current study,

the variables still capture variation in asset return along different dimensions since there is moderate to weak correlation among the variables. During the regression analyses this result is taken in account. Market sentiment and market excess return indicate a correlation of -0.0990 while the correlation between RM-RF and short positions is 0.0111.

### ***Results and Implications***

Table 1 provides the statistics for the first model. The first model is a time-series regression of the Fama-French three-factor model considering RM-RF, SMB, and HML as the independent variables. The overall explanatory power of the model is moderate taking in account the fact that the explanatory power of the Fama and French model (1993) is expected to be around 70%. The lower explanatory power of the model can be due to the construction of the dataset. The factors constructed for the original model of Fama and French (1993) originate from the NYSE, NASDAQ, and Amex. The subsequent dependent variable is the return from 25 portfolios originating from the NYSE, NASDAQ, and Amex formed based on size and book-to-market equity. For the current empirical model, the three-factors, as indicated earlier, originate from the FTSE All Share index. The dependent variable of this study is the return on a portfolio constructed on a subset of this benchmark, i.e. a subset of the FTSE100 Index. Companies included in the portfolio of the dependent variable are not formed based on size and book-to-market equity, but rather on their short positions during the time-frame considered for this study. Therefore, the observed R2 is considered to be a suitable explanatory power for this model. In addition, literature on econometrics argues that there is no specific method to determine how high R2 should be, and that it can vary depending on the dataset (Studenmund, 2014). What of more importance is to identify the effect on the independent variable on the dependent variable of the model.

***Table 1: Fama-French 3-Factor Model***

<b>rmrf</b>	1.091 **(82.29)
<b>smb</b>	0.212 **(10.32)
<b>hml</b>	-0.062 **(-3.28)
<b>cons</b>	0.00016 (-1.87)
<b>R<sup>2</sup></b>	0.221
<b>N</b>	27593

*\*p<0.05; \*\*p<0.01*

The estimated regression for the first model, the three-factor Fama-French model is:

$$R_{i,t} = 1.091 (R_{m,t} - R_{ft}) + 0.212SMB_t - 0.062HML_t \quad (7)$$

(82.29)                      (10.32)                      (-3.28)

All three independent variables are significant at the 1%-level and the explanatory power of the model is around 22%. The excess return of the market, RM-RF, and the size variable, SMB, show a positive coefficient to its relation with the asset return, while the book-to-equity variable, HML, indicates a negative coefficient to its relation with the asset returns. The sign of the coefficient for the SMB factor indicates that small capitalisation stocks outperformed large capitalisation stocks during the time-frame analysed, while the sign of the coefficient for the HML coefficient shows that growth stocks outperformed value stocks during the time-frame analysed. The market excess return indicates that an increase in market returns result in an increase in asset returns. As is expected from the Fama-French methodology (2004), the intercept of the model is close to zero, significant at the 10%-level.

In order to control for any multicollinearity among the independent variables of this model, a Variance Inflation Factor (VIF)-test is conducted. A VIF-test can be interpreted as a measure that estimates how much the variance of the estimated regression coefficient is inflated by the presence of correlation among the independent variables in the regression model. A VIF value of 1 indicates that there is no correlation among the independent variables. VIF values more than 5 should be further investigated, while values more than 10 indicate strong multicollinearity among the independent variables of the model. Table 4 in Appendix II displays the VIF values for the first regression model. As can be seen, no multicollinearity is detected as the observed values are well below the critical value of the VIF-test.

The second model includes the Fama-French three-factors and a variable on short selling positions. The short selling variable is not significant and does not improve the explanatory power of the model in comparison with the first model ( $R^2 = 0.22$ ). The coefficients of the three-factors are significant at the 1%-level and the signs are almost similar to the previous model. The results are displayed in table 5 in Appendix II. The third model considers the Fama-French three-factors, the short selling variable, and the market sentiment variable. The results in table 6 in Appendix II show that the factors, RM-RF, SMB, HML, and the market sentiment variable are significant at the 1%-level (t-values of 81.96, 10.45, -3.27, and 2.35 respectively). The short selling variable is not significant. The explanatory power of the model did not change ( $R^2 = 0.22$ ).

The results of the second and third model indicate that the short selling variable is not able to capture a risk factor in the asset pricing model. Therefore, it does not seem to provide additional explanation to the estimated regression model and the pricing of shares. The short selling variable does not seem to have a relation to stock returns. The addition of the market sentiment variable seems not to provide additional explanatory power to the model, in comparison with the previous model. Nevertheless, the coefficient is significant, but rather small. This shows that the variable does have an effect on returns and is able to capture a risk factor.

To analyse the market sentiment variable more closely, additional empirical analyses are conducted to study the relation between market sentiment and stock returns. First, a time-series regression is

conducted. Table 2 shows the statistics for this model. The model considers RM-RF, SMB, HML, and market sentiment as the independent variables. The estimated regression model is:

$$R_{i,t} = 1.095 (R_{m,t} - R_{ft}) + 0.215SMB_t - 0.062HML_t + 1.19e^{-0.9}market\_sentiment \quad (8)$$

(81.99)                      (10.46)              (-3.29)              (2.39)

**Table 2: Augmented Fama-French 3-Factor Model**

<b>rmrf</b>	1.095 **(81.99)
<b>smb</b>	0.215 **(10.46)
<b>hml</b>	-0.062 **(-3.29)
<b>market_sentiment</b>	1.19e-0.9 *(2.39)
<b>cons</b>	-0.00686 (-1.88)
<b>R<sup>2</sup></b>	0.221
<b>N</b>	27593
<i>*p&lt;0.05; **p&lt;0.01</i>	

The overall explanatory power of the model is moderate ( $R^2 = 0.221$ ) and similar to the value observed in earlier models. Nevertheless, the value is regarded as sufficiently high, as explained earlier, taking in account the data construction. All the independent variables are significant at the 1%-level and the explanatory power is around 22%. The excess return of the market, RM-RF, the size variable, SMB, and market sentiment variable show a positive coefficient to the relation with the portfolio return, while the value factor, HML, indicates a negative coefficient. The signs of the coefficient for RM-RF, SMB, and HML are similar to the signs observed from earlier models. It indicates that small capitalisation stocks outperformed large capitalisation stocks and growth stocks outperformed value stocks during the time-frame analysed. The coefficient of the market sentiment variable is as expected. There is a positive, but rather small relation between asset returns, the dependent variable, and the market sentiment variable. This indicates that as market sentiment increases, there is a positive influence on asset returns. The intercept is again close to zero, as expected, and is significant at the 10%-level.

The relation between asset returns and market sentiment is analysed more closely in order to analyse if there is any causality or correlation between the two variables. Current academic literature on market sentiment and asset is not conclusive about the relation of these variables. To test causality between these two variables, a Granger causality test is conducted. Granger causality in which one time-series variable predictably change before another variable (Studenmund, 2014). The Granger causality test is conducted with the use of the OLS methodology. First, market sentiment is regressed on lagged values

of the variables itself and on lagged values of asset returns. The results show that statistically, market sentiment is able to Granger-cause asset returns. Second, asset returns are regressed on lagged values of the variable itself and on lagged values of market sentiment. The results show that statistically, returns are able to Granger-cause market sentiment. From these two causality tests, it is not possible to make a conclusive conclusion of a causal relation between asset returns and market sentiment. In addition, the regression analysis showed that a positive coefficient for the market sentiment, but a rather small coefficient value. A VIF-test is also conducted for the second model in order to detect multicollinearity among the independent variables. Table 7 in Appendix II shows the result of this test. As can be seen, no multicollinearity is detected.

The following time-series regressions consider a lagged short selling variable. As is stated in the theoretical section, public short positions are announced with a lag of one day. Therefore, here is expected that a variable lagged with one day is able to indicate a relation between asset returns and short positions. The subsequent models provide more information on the efficiency of the market rather than asset pricing, due to the inclusion of the lagged variable. The first estimated regression model includes the Fama-French three-factor model and a one-day lag short position variable:

$$R_{i,t} = 1.0915 (R_{m,t} - R_{ft}) + 0.212SMB_t - 0.063HML_t + 0.0013short\_position\_lag1_{t-1}$$

(82.39)                      (10.31)              (-3.32)              (3.15)

**Table 3: Augmented Fama-French 3-Factor Model**

<b>rmrf</b>	1.091
	** (82.39)
<b>smb</b>	0.212
	** (10.31)
<b>hml</b>	-0.063
	** (-3.32)
<b>short_position_lag1</b>	0.00134
	** (3.15)
<b>cons</b>	-0.00011
	(1.32)
<b>R<sup>2</sup></b>	0.221
<b>N</b>	27635

\* $p < 0.05$ ; \*\* $p < 0.01$

All the independent variables, including the one-day lag short position, of the model are significant at the 1%-level. Table 3 shows the results. The signs of the three-factors show similar values to the previously estimated models. The R2 (0.22) is similar to the previously estimated models. The coefficient of the lagged short selling variable is small and positive. This indicates that the lagged variable does influence stock returns, but positively. The public disclosure of short positions has a small positive influence on stock price returns. This could indicate that the initial reaction of the market to the

short selling activity is already incorporated in the stock price and that the public announcement of the authority has a minor effect on stock returns.

The second model includes the Fama-French three-factor models, a lagged short selling variable, and the market sentiment variable:

$$R_{i,t} = 1.095 (R_{m,t} - R_{ft}) + 0.215SMB_t - 0.063HML_t + 4.99e^{-10}market\_sentiment$$

(82.01)                      (10.43)                      (-3.33)                      (2.28)

$$+ .00131short\_position\_lag1_{t-1} \quad (10)$$

(3.08)

**Table 4: Augmented Fama-French 3-Factor Model**

<b>rmrf</b>	1.095
	** (82.01)
<b>smb</b>	0.215
	** (10.43)
<b>hml</b>	-0.063
	** (-3.33)
<b>market_sentiment</b>	1.14e-09
	* (2.28)
<b>short_position_lag1</b>	0.00131
	** (3.08)
<b>cons</b>	-0.00069
	(-1.91)
<b>R<sup>2</sup></b>	0.221
<b>N</b>	27593

\* $p < 0.05$ ; \*\* $p < 0.01$

The independent variables of the model are significant at the 1%-level. The sign and the coefficient of the variables show similar values to the previously estimated models. The R2 (0.22) is equal to the previously estimated regression models. The VIF-test (Table 8 in Appendix II) shows that there is no sign of multicollinearity among the independent variables of the estimated regression model. This estimated model also indicates a positive, but rather small, effect of the lagged short selling variable on stock returns. For this result the same can be stated as with the previous model, the initial reaction of the market to short selling activity is already incorporated in the stock price and the public announcement has a minor effect on stock returns.

Considering these results, the implications of the results on the hypotheses can be discussed. The first hypothesis: *public disclosure of short selling positions does influence stock price returns*. From the statistical results can be concluded that the hypothesis is partly supported. The short selling variable in the context of the asset pricing model does not show a significant results. With these analysis, short

selling does not capture a risk factor in the asset pricing model. There is a significant relation between returns and a lagged variable of short positions. This relation seems to be positive and rather small. This indicates that the initial reaction of the market to short selling activity might already be incorporated in the stock price and that the public announcement of the authority has a minor impact on stock price returns.

The second hypothesis of the study is: *market sentiment influences stock price returns*. The statistical analysis shows that this hypothesis is supported. Even though the coefficient is significant, the coefficient has a rather small value. A possible causal relation between the two variables is controlled for, hence no conclusive conclusion can be stated. There is a two-way causality between market sentiment and asset returns. This two-way causality of market sentiment and asset returns does have support in the academic literature (Schmeling, 2009).

The final model of the empirical analyses is the estimation on herding. Table 5 shows the results. For this model the methodology of dynamic models is used. An Autoregressive (AR) model is conducted in which the dependent variable is estimated on lagged independent variables of itself. The first model that is estimated is an AR(1) model in which the independent variable is a lag-one of the dependent variable. By estimating this model, there can be detected whether previous short positions influence current short positions. This could be an indication of any herd behaviour. The AR(1) that is estimated:

$$SS_{i,t} = 0.19SS_{i,t-1} + 0.0283 \quad (11)$$

(32.40)

**Table 5: Herding Model**

<b>short_position_lag1</b>	0,191
	** (32,40)
<b>cons</b>	0,028
	** (23,69)
<b>R<sup>2</sup></b>	0,0366
<b>N</b>	27633
<i>*p&lt;0.05; **p&lt;0.01</i>	

The independent variable is significant at the 1%-level and indicates a positive coefficient in its relation to the dependent variable. This means that current short positions can cause future short positions to increase. The explanatory power of the model is weak ( $R^2 = 0.0366$ ), indicating that the model is not able to fully explain the changes in value of the variables. The low  $R^2$  indicates that the highly variable data still has a significant trend, meaning that the independent variable does provide information about the dependent variable even though data points fall further from the regression line. This high variability might occur due to the fact that the percentage short positions do not have a specific trend their selves, it is the sequence of the short positions that is of importance. With this model is tried to analyse a relation

between current and future short positions, to find any herding behaviour. From the AR(1) model can be seen that the coefficient is positive and significant, indicating that the independent variable, lagged value of short positions, is able to provide information about the dependent variable, the current short position. Nevertheless, the low explanatory power of the model should be taken in account when making conclusive statements. AR models with multiple lags seem not provide more explanation to the relation between lagged values of short positions and are therefore not discussed. A VIF-test is conducted for multicollinearity, table 9 in Appendix II indicates no sign of multicollinearity.

The implication for the third hypothesis: *herding is observed with public disclosures of short selling positions*. From the statistical results can be concluded that the third hypothesis is supported. The model shows that short positions do follow previous short positions. This means that current disclosed position are followed by additional short positions. There can be concluded that there is herd behaviour on public disclosure of short positions.

The research aimed to answer the question: *Are public disclosures of short selling informative to the market?*. From the empirical analyses and the implications of the hypotheses the following can be said to answer the research question. In the context of asset pricing models, the Fama-French three-factor model, the short selling variable does not capture a risk factor within the model. Therefore, regarding asset pricing short selling does not have an influence. Considering market efficiency and the effect on asset returns, a lagged short selling variable does influence stock price returns. Nevertheless, this effect is positive and rather small. This might indicate that the initial reaction to the action of short selling is already incorporated in the stock price, indicating the semi-strong form efficiency of the stock market. This small positive effect of the public announcement of short positions by the authority does influence stock returns but it is not an influential effect. The addition of a market sentiment variable does not increase the explanatory power of the models. Considering the herding model, the public announcement of short positions does influence subsequent short positions. All in all, answering the research question the public disclosure of short selling is informative to the market. From this research can be concluded that this goes for the minor influence of this on stock returns and subsequent trades based on these public announcements by the authority.

## V. CONCLUSION

The objective of this research was to analyse informational efficiency of the European Short Selling Disclosure Regulation. The analyses are based on the UK financial market during the time-frame of 2012 – 2015 and considers FTSE100 companies. The paper contributes to advance the knowledge on short selling and further close the gap in the literature. Therefore, the paper is of relevance for academicians, policy-makers, and practitioners. Short selling is considered from the Fama-French asset pricing model (1993) and behavioural finance theory of herding. The results indicate that the public disclosure of short selling does not capture a risk factor in the asset pricing model, does have a minor

effect on stock price returns, and does influence subsequent short selling trades. The conclusion is that public disclosures of short positions is informative to the market.

## **VI. DISCUSSION & RECOMMENDATIONS FOR FURTHER RESEARCH**

The final chapter discusses recommendations for further research on the public disclosure of short selling. Research on short selling and disclosure of public information is highly encouraged. It is of importance to understand the effects of both for academic purposes as well as policy-making purposes. Based on the conclusions of this research, recommendation are provided for further research in this area.

First, this research considered companies that are a subset of the FTSE100 Index based on short selling positions. Future research could consider including a broader index, such as the FTSE All Share Index. This makes it able to construct a broader portfolio of companies for which the Fama-French size and value factors can be constructed. Now, the size and value factors were from a dataset including the FTSE All Share index, for which the FTSE100 is a subset. Considering a larger portfolio constructing from this index could increase the explanatory power of the model. Second, the current research only took in account the UK market due to its important role within the EU. Nevertheless, short selling disclosure regulation is implemented for all EU countries. This makes it possible to conduct a cross-sectional analysis in order to compare the effect of public disclosure on the varying markets. This provides a broader view and knowledge on this area. Third, now the relation of market sentiment and short selling is analysed by considering their relation to asset returns. Future research could consider the relation between market sentiment and short selling. Fourthly, for this research order book trading is used as a proxy variable for market sentiment. Other variables, such as closed-end funds discount rate as Baker and Wurgler (2007, 2007) state can be considered in order to increase the explanatory power of the model. Finally, the magnitude of short selling percentages can be taken in account. In the current research this effect is not searched for. It could be possible that the percentage shorted does have an influence on subsequent short selling activity and public disclosure.

## REFERENCES

- Aitken, M., Frino, A., McCorry, M., & Swan, P. (1998). Short Sales are Almost Instantaneously Bad News: Evidence from the Australian Stock Exchange. *Journal of Finance*, 53, 2205 - 2223.
- Avery, C., & Zemsky, P. (1998). Multidimensional Uncertainty and Herd Behaviour in Financial Markets. *The American Economic Review*, 88(4), 88(4), 724 - 748.
- Baker, M., & Stein, J. (2004). Market Liquidity as a Sentiment Indicator. *Journal of Financial Markets*, 7, 271 - 299.
- Baker, M., & Wurgler, J. (2006). Investor Sentiment and the Cross-Section of Stock Returns. *The Journal of Finance*, Vol. LXI, No. 4.
- Baker, M., & Wurgler, J. (2007). Investor Sentiment in the Stock Market. *NBER Working Paper Series*, Working Paper 13189.
- Banarjee, A. (1992). A Simple Model of Herd Behaviour. *The Quarterly Journal of Economics*, 107(3), 797 - 817.
- Beber, A. &. (2013). Short-Selling Bans Around the World: Evidence from the 2007-09 Crisis. *The Journal of Finance*, Vol. LXVIII, No. 1.
- Bikhchandani, S., & Sharma, S. (2001). Herd Behaviour in Financial Markets. *IMF Staff Papers*, 47(3), 279 - 310.
- Black, F. (1972). Capital Markets Equilibrium with Restricted Borrowing. *Journal of Business*, pp. 444 - 455.
- Black, F. (1986). Noise. *Journal of Finance*, 41, 529 - 543.
- Blau, B., & Wade, C. (2012). Informed or Speculative: Short Selling Analyst Recommendation. *Journal of Banking and Finance*, 36, 14 - 25.
- Boehmer, E., Jones, C.M., & Zhang, X. (2009). Which Shorts are Informed? *Journal of Finance*, 63, 491 - 527.
- Boehmer, E., Jones, C.M., & Zhang, X. (2011). Shackling Short Sellers: The 2008 Shorting Ban. *Working Paper*.
- Bohl, M., Klein, A., & Siklos, P. (2013). *Short-Selling Bans and Institutional Investors' Herding Behaviour: Evidence from the Global Financial Crisis*. Waterloo: CIGI Papers.
- Brown, G., & Cliff, M. (2004). Investor Sentiment and the Near-Term Stock Market. *Journal of Empirical Finance*, 11, 1 - 27.
- Chakrabarty, B., & Shkilki, A. (2013). Information Leakages in Financial Markets: Evidence from Shorting Around Insider Sales. *Journal of Banking and Finance*, 37(5), 1560 - 1572.
- Chang, E., Cheng, J.W., & Khorana, A. (2000). An Examination of Herd Behaviour in Equity Markets: An International Perspective. *Journal of Banking and Finance*, 24, 1651 - 1679.
- Christie, W., & Huang, R. (1995). Following the Pied Piper: Do Individual Returns Herd around the Market. *Financial Analyst Journal*.
- Cipriani, M., & Guarino, A. (2009). Herd Behaviour in Financial Markets: An Experiment with Financial Market Professionals. *Journal of the European Economic Association*, 7(1), 206 - 233.

- Copeland, T., Weston, J., & Shastri, K. (2005). *Financial Theory and Corporate Policy*. Pearson Education Inc.
- Daniel, K., Hirshleifer, D., & Subrahmanyam, A. (1998). Investor Psychology and Security Market Under- and Overreaction. *The Journal of Finance*, Vol. LIII, No. 6.
- Dechow, P., Hutton, A., Meulbroek, L., & Sloan, R. (2001). Short-Sellers, Fundamental Analysis, and Stock Returns. *Journal of Financial Economics*, 61, 77 - 106.
- DeLong, J., Shleifer, A., Summer, L., & Waldmann, R. (1990). Noise Trader Risk in Financial Markets. *Journal of Political Economy*, 98, 703 - 738.
- Diamond, D. (1985). Optimal Release of Information by Firms. *The Journal of Finance*, 40(4), 1071 - 1094.
- Diamond, D., & Verrecchia, R. (1987). Constraints on Short-Selling and Asset Price Adjustment to Private Information. *Journal of Financial Economics*, 18(2), 277 - 311.
- Drake, M., Myers, J., Myers, L., & Stuart, M. (2015). Short Sellers and the Informativeness of Stock Prices with Respect to Future Earnings. *Rev Account Stud*, 20.
- Engelberg, J., Reed, A., & Ringgenberg, M. (2012). How are Shorts Informed? Short Sellers, News, and Information Processing. *Journal of Financial Economics*, 105, 260 -278.
- European Parliament and Council. (2012). Regulation (EU) No. 236/2012 of the European Parliament and of the Council of 14 March 2012 on Short Selling and Certain Aspects of Credit Default Swaps. *Official Journal of the European Union*.
- Fama, E. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, 25(2), 383 - 417.
- Fama, E., & French, K. (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance*, 47(2), pp. 427 - 465.
- Fama, E., & French, K. (1993). Common Risk Factors in the Returns on Stocks and Bonds. *Journal of Financial Economics*, 33, pp. 3 - 56.
- French, D., Lynch, A., & Yan, X. (2012). Are Short Sellers Informed? Evidence from REITs. *The Financial Review*, 47, 145 - 170.
- Gregory, A., Tharyan, R., & Christidis, A. (2013). Constructing and Testing Alternative Versions of the Fama-French and Carhart Models in the UK. *Journal of Business Finance & Accounting*, 40(1), pp. 172 - 214.
- Jensen, M. (1978). Some Anomalous Evidence Regarding Market Efficiency. *Journal of Financial Economics*, 6(2/3), 95 - 101.
- Kampshoff, P., von Nitzsch, R., & Braun, D. (2012). Herding Behaviour of Investors After the Disclosure of Individual Short Positions: Evidence from the Japanese Stock Market. *Journal of International Business and Economics*, 12(2).
- Khan, M., & Lu, H. (2011). *Do Short Sellers Front-Run Insider Sales?* MIT Sloan Research Paper No. 4706 - 08.
- Lamont, O. (2004). *Go Down Fighting: Short Sellers vs. Firms*. National Bureau of Economic Research, Working Paper No. 10659.

- Leung, T., Rui, O., & Wang, S. (2009). Short Interest, Insider Trading, and Stock Returns. *Working Paper at Social Science Research Network*.
- Litner, J. (1965). The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. *The Review of Economics and Statistics*, pp. 13 - 37.
- Lux, T. (1995). Herd Behaviour, Bubbles and Crashes. *The Economic Journal*, 105(431), 881 - 896.
- Lynch, A., Nikolic, B., Yan, X., & Yu, H. (2014). Aggregate Short Selling, Commonality, and Stock Market Returns. *Journal of Financial Markets*, 17, 199 - 229.
- Marsh, I., & Payne, R. (2012). Banning Short Sales and Market Quality: The UK's Experience. *Journal of Banking & Finance*, Vol. 36, Issue 7, 1975 - 1986.
- Morris, S., & Hyun, S. (2002). Social Value of Public Information. *The American Economic Review*, 92(5), 1521 - 1534.
- Morris, S., & Shun, H. (2002). Social Value of Public Information. *American Economic Review*, pp. 1521 - 1534.
- Schmeling, M. (2009). Investor Sentiment and Stock Returns: Some International Evidence. *Journal of Empirical Finance*, Vol. 16, Issue 3, pp. 394 - 408.
- Senshack, A., & Starks, L. (1993). Short-sale restrictions and market reactions to short-interest announcements. *Journal of Financial and Quantitative Analysis*, 28, 177-194.
- Sharpe, W. (1964). Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk. *The Journal of Finance*, 19(3), pp. 425 - 442.
- Stambaugh, R., Yu, J., & Yuan, Y. (n.d.). The Short of it: Investor Sentiment and Anomalies.
- Studenmund, A. (2001). *Using Econometrics, A Practical Guide* (International 6th ed.). Pearson Education.

## APPENDIX I: COMPANY DATASET

**Table 1: Company List**

	Company Name
1	Admiral Group
2	Anglo American
3	Antofagasta
4	ARM Holdings
5	Ashtead
6	Aviva
7	Barratt Developments
8	Berkeley Group Developments
9	Bunzl
10	Burberry Group
11	Capita
12	Carnival
13	Centrica
14	DCC
15	Direct Line Insurance Group
16	Dixons
17	Easyjet
18	Fresnillo
19	Glencore
20	Hargreaves Lansdown
21	Inmarsat
22	International Consolidated Airlines Group
23	Intertek Group
24	INTU Properties
25	ITV
26	London Stock Exchange Group
27	Marks & Spencer Group
28	Pearson
29	Persimmon
30	Provident Financial
31	Prudential
32	Randgold Resources
33	Relx
34	RSA Insurance Group
35	SAGE Group
36	Sainsbury (J)
37	SSE
38	Taylor Wimpey
39	Tesco
40	Unilever
41	WPP

## APPENDIX II: STATISTICAL RESULTS

*Table 2*  
*Summary Statistics*

	<i>rmrf</i>	<i>smb</i>	<i>hml</i>	<i>market_sentiment</i>	<i>short_position</i>
<b>Mean</b>	0.00039	0.00035	-0.00004	707247	0.03497
<b>Standard Error</b>	0.00004	0.00003	0.00003	1030	0.00120
<b>Median</b>	0.00076	0.00044	-0.00007	689523	0.00
<b>Mode</b>	-0.00174	0.00115	-0.00056	824656	0.00
<b>Standard Deviation</b>	0.00728	0.00485	0.00466	171234	0.20
<b>Sample Variance</b>	0.00005	0.00002	0.00002	29321152450	0.04
<b>Kurtosis</b>	1.45	0.49	0.80	1.89	79.82
<b>Skewness</b>	-0.18	-0.15	0.06	0.38	7.90
<b>Range</b>	0.06	0.03	0.03	1533284	3.33
<b>Minimum</b>	-0.03	-0.02	-0.02	110276	0.00
<b>Maximum</b>	0.03	0.02	0.02	1643560	3.33
<b>Sum</b>	10.75	9.62	-1.24	19544051749	966
<b>Count</b>	27634	27634	27634	27634	27634
<b>Confidence Level(95.0%)</b>	0.00009	0.00006	0.00005	2019	0.00235

*Table 3: Correlation*

	<i>rmrf</i>	<i>smb</i>	<i>hml</i>	<i>market_sentiment</i>	<i>short_position</i>
<b>rmrf</b>	1				
<b>smb</b>	-0.4824	1			
<b>hml</b>	0.1602	-0.2927	1		
<b>market_sentiment</b>	-0.0990	-0.0132	0.0044	1	
<b>short_position</b>	0.0111	-0.0007	-0.0060	0.0348	1

*Table 4: Multicollinearity - VIF Test*

	<b>VIF</b>	<b>1/VIF</b>
<b>smb</b>	1.39	0.7198
<b>rmrf</b>	1.3	0.767
<b>hml</b>	1.09	0.9138
<b>mean VIF</b>	1.26	

**Table 5: Augmented Fama-French 3-Factor Model**

<b>rmrf</b>	1.091
	** (82.33)
<b>smb</b>	0.212
	** (10.33)
<b>hml</b>	-0.062
	** (-3.27)
<b>short_position</b>	0.000504
	(1.19)
<b>cons</b>	0.000143
	(1.70)
<b>R<sup>2</sup></b>	0.221
<b>N</b>	27634

\* $p < 0.05$ ; \*\* $p < 0.01$

**Table 6: Augmented Fama-French 3-Factor Model**

<b>rmrf</b>	1.095
	** (81.96)
<b>smb</b>	0.215
	** (10.45)
<b>hml</b>	-0.062
	** (-3.28)
<b>short_position</b>	0.000504
	(1.19)
<b>market_sentiment</b>	1.17e-0.9
	*(2.35)
<b>cons</b>	-0.00069
	(-1.89)
<b>R<sup>2</sup></b>	0.221
<b>N</b>	27593

\* $p < 0.05$ ; \*\* $p < 0.01$

**Table 7: Multicollinearity - VIF Test**

	<b>VIF</b>	<b>1/VIF</b>
<b>smb</b>	1.4	0.71665
<b>rmrf</b>	1.32	0.755841
<b>hml</b>	1.09	0.913886
<b>market_sentiment</b>	1.01	0.985281
<b>short_position</b>	1	0.99849
<b>mean VIF</b>	1.17	

**Table 8: Multicollinearity - VIF Test**

	<b>VIF</b>	<b>1/VIF</b>
<b>smb</b>	1.4	0.71665
<b>rmrf</b>	1.32	0.75584
<b>hml</b>	1.09	0.91389
<b>market_sentiment</b>	1.01	0.98528
<b>mean VIF</b>	1.21	

**Table 9: Multicollinearity - VIF Test**

	<b>VIF</b>	<b>1/VIF</b>
<b>smb</b>	1.4	0.716598
<b>rmrf</b>	1.32	0.755831
<b>hml</b>	1.09	0.913757
<b>market_sentiment</b>	1.02	0.984182
<b>short_position_lag1</b>	1	0.998593
<b>mean VIF</b>	1.17	

**Table 10: Multicollinearity - VIF Test**

	<b>VIF</b>	<b>1/VIF</b>
<b>Short_position_lag1</b>	1.0	1.0
<b>Mean VIF</b>	1.0	