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HERDING IN THE NORDIC STOCK MARKETS
Evidence from Finland, Sweden and Denmark

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TABLE OF CONTENTS

	page
TABLE OF FIGURES AND TABLES	3
ABBREVIATIONS	4
ABSTRACT	5
1. INTRODUCTION	7
1.1. Purpose of the study	9
1.2. Previous main studies	10
1.3. Intended contribution	10
1.4. Limitations and assumptions	11
2. WHAT IS HERDING?	12
2.1. Herding	12
2.2. The rationality of herding	14
2.3. First assessments on herding	16
2.4. Dividing herding	17
3. THEORETICAL BACKGROUND ON HERDING ON THE STOCK MARKET	21
3.1. Efficient Market Hypothesis	21
3.2. Capital Asset Pricing Model	22
3.3. Three-factor model	24
3.4. Five-factor model	25
3.5. Herding opposing efficient markets	26
4. ASSESSMENT OF HERDING MODELS	28
4.1. Linear regression model	28
4.2. Beta coefficient model	29
4.3. Nonlinear regression model	31
5. LITERATURE REVIEW, PRIOR INTERNATIONAL AND NORDIC MARKET STUDIES	33

5.1. International results	33
5.2. Nordic countries	37
5.3. Hypotheses development	40
6. METHODOLOGY	42
7. DATA AND DESCRIPTIVE STATISTICS	45
7.1. Data	45
7.2. Descriptive statistics	46
8. EMPIRICAL RESULTS	51
8.1. Herding across the entire sample period for separate markets	51
8.2. Herding across separate yearly subsamples	53
8.3. Herding in up- and down-markets	55
8.4. Herding around US and European markets	58
8.5. Herding results	60
9. CONCLUDING REMARKS	61
9.1. Conclusion	66
9.2. Consideration for future research	66
LIST OF REFERENCES	67

TABLE OF FIGURES AND TABLES

Figure 1. Division of herding (Bikhchandi and Sharma 2001; Spyros 2014).	17
Figure 2. Historical index developments for OMXH25, OMXS30 and OMXC20	48
Figure 3. Relationship between CSAD and stock returns for the time period	49
Figure 4. Relationship between CSAD and stock returns	50
Table 1. Descriptive statistics	47
Table 2. Regression estimates of herding behaviour, 2007-2018	52
Table 3. Regression estimates of herding behaviour, divided into yearly subperiods between the years, 2007-2018	54
Table 4. Estimates of herding behaviour in rising and declining markets, 2007-2018	56
Table 5. The influence of the US and German markets on cross-country herding, 2007-2018	58

ABBREVIATIONS

CAPM	Capital Asset Pricing Model
HML	High Minus Low
SMB	Small Minus Big
CSAD	Cross Sectional Absolute Deviation
EMH	Efficient Market Hypothesis
P/E	Price-To-Earnings
CMA	Conservative Minus Aggressive
RMW	Robust Minus Weak
BV	Book Value
MV	Market Value

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ABSTRACT

This study assesses herding behaviour and how it occurs on the separate Nordic stock markets of Finland, Sweden and Denmark during the time period of 2007-2018. Herding can be characterised as investors abandoning their own initial vision and then following a common market consensus. This behaviour can be categorised as either rational or irrational.

The study utilises the CSAD methodology established by Chiang and Zheng (2010) to detect market-wide herding during the chosen sample period of 2007-2018. The method comprises calculating the non-linear relationship between dispersions of individual asset or stock returns compared to the full market portfolio return.

When observing the entire sample period, none of the selected markets, Finland, Sweden, Denmark, display herding behaviour. When exposed to subsample testing, where the entire sample period is divided into one-year periods, results demonstrate that Sweden experienced herding behaviour in 2013. Additionally, the study finds evidence that herding is most likely to occur there on down-market days. Finland nor Denmark display significant herding on either the entire sample period or during subsample periods. Moreover, Finland or Denmark did not display significant herding occurring on either up- or down-market days. This study also recognises the importance of the US and European markets on smaller markets. It is found that Denmark in particular is prone to herding around the German and US markets. Furthermore, stock return dispersions from the US and Germany affect all of the three selected markets. Empirical results suggest that Sweden displays the most significant evidence of herding for the entire sample period according to all of the different regression estimates which were tested.

These results are partially inconsistent with previous studies. The greatest contribution this study makes is the observation of why results are inconsistent particularly in Finland. It is suggested that the difference in time periods renders different results. This in extension would suggest that at least the Finnish stock market has developed over the course of time and does not suffer as extensively from market anomalies.

KEY WORDS: Herding, stock market, behavioural finance, Nordic markets

1. INTRODUCTION

“Collective fear stimulates herd instinct and tends to produce ferocity toward those who are not regarded as members of the herd.” (Russell 1901)

Should humans still be seen as merely animals, who want to be a part of a larger pack and not stand out individually as Russell suggests. Can an argument be made, where people base their judgements on the decisions made by others rather than thinking for themselves? Consider the situation of choosing where to eat or which movie to watch. Many gourmards and cinephiles alike have a basic instinct of first surveying reviews online – which restaurant has received the most starts on TripAdvisor, and which movie has been awarded the best score on Rotten Tomatoes. How many would take the risk of choosing a restaurant or a movie with a rotten score? Most likely the choice would be made to eat or watch something what other people have suggested and enjoyed.

Although these are extreme examples, the same fundamental idea can plausibly be applied to investor behaviour on the stock market. Investors tend to buy stocks, which have received buy or add ratings from stock analysts. Moreover, large-cap companies who enjoy considerable prestige attract inexperienced amateur investors to make their first stock market purchases on their shares. This decision to buy and follow the example of others is exactly what investor herding is about: Investors blindly following decisions made by others before them and not coming to their own conclusions by assessing individual stock characteristics. This behaviour can and ultimately does change the structure of stock markets and drive the prices of stocks away from their fundamental values. But a single investor making a buy or sell decision is not enough to result in an act of herding. Herding occurs when a mass of investors simultaneously, or almost simultaneously, make a sell or buy decision in acceptance of a broad and general market consensus.

This study aims to firstly explain what herding is in context of the stock market. The reasons behind herding behaviour are also examined. Furthermore, models assessing

herding are inspected: Are these models adequate and have they accumulated consistent results? It can shortly be said that herding behaviour has been studied by a plethora of researchers internationally. So far, the Nordic market has however received rather little attention. This paper aims to compile all noteworthy studies and compare them with empirical results and research conducted by this study. The research will be thorough and meticulous, where the three Nordic markets of Finland, Sweden and Denmark are inspected. The presence of herding is inspected during the entire sample period of 11 years (1/1/2007-31/12/2017) and during separate years during the entire time period.

During the selected time period the financial market experienced major turmoil in form of the Financial crisis in 2008 and the Euro Crisis of 2012. The market also experienced a record breaking incline. This will make the inspection of this particular period extremely fascinating as the market was far from being dull and steady. Additionally, specific examination of herding in regard to up- and down-market days is made. An abundance of studies has found that investors herd differently in dissimilar market conditions.

This herding instinct has been found accountable for even deepening crises in addition to mangling stock prices (Christie and Huang 1995; Spyros 2014). The logic behind this assumption is easy to grasp. When everyone is panicking and selling in a market crash situation, wouldn't one's own first instinct be to also do this and sell all shares? When the parameter of risk in the risk/reward equation is realised how many can hold their ground, stand firm and hold on to their stock capital? Naturally, it is easy to beforehand laugh and despise the fools who panic, when the stock market hits a slump, and say that I would never fall for such nonsense. But when an investor has his or her own money at stake would it be so easy to withhold from following this herd of panicking investors?

This herding behaviour can also be turned the other way around. When, for example, Apple releases their latest smartphone and tech journalists and analysts alike suggest that this telephone will beat all prior sales records. Would it then be logical and recommendable to buy Apple shares, despite nothing fundamentally changing in the company? Would it be an act of intellect or an act of investor herding?

The reasons behind selecting this particular topic are very simple. Investor behaviour is always a current issue. Understanding how investors act or react may give another enlightened investor insight on how to exploit this behaviour. Furthermore, human behaviour as a field of study is particularly interesting. Why do we do the things we do? This question of humanity is rather broad and will not be answered, at least fully, in this paper. But the topic is interesting to study even in a narrower sense: Why do investors do the things they do?

This concept is commonly contemplated vis-à-vis investors. What makes a certain stock continue to decline even though there are no fundamental and apparent reasons to this occurrence? Similarly, why do vast amounts of investors trust a certain electric car company to deliver on their promises despite there not being any proof of this ever happening. Another example could be the huge expansion of the bitcoin market of recent years where apparently many, or should we say, a herd of, investors simultaneously thought that it was a great investment opportunity. The evidence is quite clearly as to whether or not this herd of investors had the correct assessment. But these examples just simply come to show how investor behaviour is an extremely interesting and intriguing topic and should be studied further. This is also what motivated this paper to study the herding behaviour of investors on the Nordic stock markets, where research has not been as extensive as on other international markets.

1.1. Purpose of the study

This study aims to explain what herding is in the context of the stock market – what the actual concept means and how different researchers have studied it. Also, this study will explain how it is assessed and detected through different models and what the actual impact of herding is, according to these specific models. Previous main studies and the framework established by them in addition to their main findings will also be discussed. In continuation, the study will also present an overview of previous studies conducted on the Nordic stock markets.

These previous results will, together with results from this paper, be used to assemble an extensive compilation of how herding occurs on the three selected markets. Furthermore, the purpose is to explain if herding is persistent through the entire sample period or conversely during specific years or in fluctuating market conditions. Also, it is demonstrated if Nordic markets herd around international markets. It will also be assessed if herding is similar between Finland, Sweden and Denmark or if there is a difference between the markets. Additionally, the purpose is to see if results for herding are consistent with previous studies.

1.2. Previous main studies

Previous main studies discussed in this paper include a large variety of studies. Studies by especially by Christie, W., Huang, R. (1995), Chang, E., Cheng, J. and Khorana, A. (2000), Hwang, S., Salmon, M. (2004) and Chiang and Zheng (2010) will be discussed intensively in order to establish a framework to assess herding in this study. Also, other noteworthy main studies by Lakonishok, J., Shleifer, A., and Vishny R. (1992) and more recently by Spyros, S. (2014).

Furthermore, research on specifically Nordic markets will be covered. Main studies include interpreting the findings of Saastamoinen (2008) and Mobarek, A., Mollah, S., and Keasey, K. (2014). Additional insight will be provided by international research on developed markets. Also, some masters' theses' results will shortly be discussed to provide minor evidence for Nordic markets, as most international research so far have not included studying Nordic stock markets. These theses will provide some slight comparison of results, where there is a lack of data for these specific markets.

1.3. Intended contribution

The main contribution of this study is to demonstrate how herding occurs on the Finnish, Swedish and Danish stock markets. Contribution also lies with demonstrating how

herding has or hasn't changed in separate years during the sample period. The study will also inspect if there is asymmetry between up- and down- market days between the three markets. Another contribution of this study to the existing literature, is to provide results with the latest data for the Finnish, Swedish and Danish stock markets. Additionally, insight of Nordic markets herding around the US and German market will be provided. The chosen time period of 2007–2018 provides interesting insight into recent turbulent time periods and can examine herding during the Financial and Euro crisis but also the relatively stable upheaval and inclining time period following both crises. There are only a few studies which have studied the time period around the financial crisis and to the best of my knowledge no study has as updated data as this paper.

1.4. Limitations and assumptions

Limitation of this study lies in the data and the chosen time period. The study only inspects the indices of the most traded stocks of the three selected markets in Finland, Sweden and Denmark (OMXH25, OMXS30 and OMXC20 respectively). Herding behaviour might differ if the entire market for all markets would have been chosen. Another limitation is the seclusion of Norway entirely. Furthermore, the chosen time period has not been researched extensively and comparing results with other studies is not possible for the entire sample period. The assumptions of this study are that the data gathered is accurate and does not display false information. Another assumption to the study is that the method chosen to detect herding is correct and truly displays the existence or nonexistence of herding.

2. WHAT IS HERDING?

2.1. Herding

Human herding is not a novel idea conjured up by economists or an act which only occurs in the stock market and acted by investors. Conversely, it is in addition to zoology, a comparatively well studied and extensively debated subject in psychology, neurology and sociology (Spyros 2014: 175). The actual and initial act of herding refers to animals, assembling to form a group in order to follow each other. This same phenomenon can be seen in humans as well, for example voters falling behind a political candidate, or masses of teens following trend setting fashion stars. It is often mentioned that people indeed want to be led and shown the way. This type of behaviour can also be examined and seen on the stock market. Avery and Zemsky (1998) suggest that this type of behaviour is embodied when investors abandon their initial assessment and strategy and follow trading trends made by previous traders. This in turn causes investors to wander aimlessly and follow market trends without purpose. Shiller (2015) paints an even more sinister and dismal picture of investors, where they are regarded as sheep who follow a herd without any understanding of their own.

Bikchandani and Sharman (2001) define herding as the correlation between individual investors' causal investment decisions. What this actually means is, that herding would be defined as investors making an investment decision based on earlier investment decision made by other investors. This concept of herding on the financial markets can be challenging to explain. The description changes and shifts with each research and researcher. Some researchers have an extremely detailed description of herding, where a pinpointed act of investors is only seen as herding itself and everything else is disregarded. Others oppositely have a broad and general approach towards herding. The difference in the two definitions can arguably and quite naturally be caused by the type of research conducted. The first mentioned researchers having a detailed description have inspected herding on an individual level – what causes an *individual* to follow a specific market consensus. Secondly, the other group assesses herding as a market-wide

phenomenon, where the research question is most commonly addressed to answer the question of do a certain *group* of investors commit to the act of herding. This latter research question is also discussed in this paper, where the objective is to see and find, if market-wide herding occurs on the three Nordic markets of Finland, Sweden and Denmark.

The topic and act of herding has been keenly researched after the Financial crisis of 2008. Especially the impacts and effects of herding towards financial markets have been of special interest. Investors, be it institutional or nonprofessional, displaying symptoms of herding can cause market inefficiency and even lead to pricing bubbles (Spyros 2014: 178). Herding might cause an inflation of some certain stocks, industries or markets where the market price of the asset is shifted and twisted from its fundamental value to such an extent that it forms a pricing bubble. Naturally researchers have been trying to find material reasons as to why herding occurs as the behaviour might cause enormous market disturbances (Bikhchandani and Sharkma 2001).

Empirical analysis and methodology can coarsely be broken into two categories: 1) models which suggest that herding is actually rational and voluntary and 2) models which asses herding as non-rational and involuntary behaviour (Spyros 2014:176). This creates a problem for researchers trying to make and compile an all-encompassing and detailed definition for herding. Moreover, the act of herding might have changed during the passage of time. Investors might display certain types of herding behaviours differently or not display previously detected herding symptoms at all. This paper itself suggests that herding behaviour might have changed in Nordic markets during the 21st century. Additionally, the comparison of results between studies becomes challenging because of this problem with time. Some models have not been updated to utilise current datasets, which makes the comparison of results difficult (Spyros 2014: 176).

Yet another difference between studies is the target group of herding analysis. Some studies research herding within a certain small group of investors, for example hedge fund managers or stock analysts. Meanwhile, other studies have investigated herding as a market-wide phenomenon which disregard groups and sees investors as a whole (Spyros

2014: 179). Combining all of the afore mentioned differences and coming up with a theory of everything for herding has not been accomplished by any prior study. Furthermore, the empirical evidence of herding even occurring on financial markets is inconclusive (Cipriani and Guarino 2014; Spyros 2014).

From such a short introduction, it is already plain to see that herding is by no means an ease concept to grasp even though the initial thought would be the opposite. Herding can not only be defined as irrational, foolish investors shouting “sell, sell, sell”, but rather as a behaviour and act of investors, which occurs on all different levels of the financial markets, between small groups and as a market-wide phenomenon. It can of course happen during turbulent and stressful market situations but also during times of market boom. This lastly mentioned positive affair could even suggest that herding might have some rationale behind it.

2.2. The rationality of herding

Hence, after some discussion and assessment of the irrational aspect of herding, some light should be shed on the rational side of herding. This argues the question of can there be a rational explanation as to why some investors herd and follow a market consensus. Researchers have suggested that under some circumstances herding could be a rational and even voluntary act (Spyros 2014: 177). Consider a situation where a stock analyst comes to the conclusion that all of his fellow colleagues have made an incorrect assessment of a stock, and then this individual stock analyst deviates from the common consensus. Following this decision, the individual analysts later finds out that he was the only one that made the wrong prediction and all the other analysts were right all along. In a worst-case scenario this individual stock analyst might even face a problem of employment following this wrongful decision. Could one then argue that had he or she just followed the common consensus, or the herd, of other analysts the outcome would not have been negative. The act would have been less risky and might have been even rational. Another example could be applied to a poor performing hedge fund manager. Could he or she turn the course of performance by just imitating other successful and

triumphant hedge fund managers. In these two examples the act of herding and following of others to gain better outcomes does actually sound logical and rational. This would argue that herding can actually in many cases be a justified, conscious and rational behaviour.

Thus, herding can be divided into two different and separate categories, where the first category is intentional and true herding. The other category is unintentional and spurious herding which some would suggest fill the definition of blind and irrational herding. The firstly named, intentional and true herding is the type of herding where an investor abruptly abandons his or her initial vision and decides to copy the actions and behaviour of other investors consciously and intentionally. This is the type of herding which most individuals initially think herding to be, where an individual for no apparent reason decides to follow a group of others. This decision could be influenced by a multitude of separate or connected reasons. These could include the belief of others having more information or knowledge, a reputational issue or simply not trusting one's own assessment. This behaviour can however lead to a deduction of market inefficiency, where investors simply follow actions of other investors. (Bikhchandani and Sharma 2001; Hirshleifer and Teoh 2003)

The secondly mentioned unintentional and spurious herding, is a phenomenon where a group of individuals separately come to the same conclusion and act in the same manner unbeknownst of the actions of the others. The objective is the opposite of intentional herding where the aim is to not follow others, but to act in a way which can produce profit and exploit the gap of knowledge in other investors. This type of behaviour can even have some egoistic characteristics to it, where an investor thinks that he or she has come to a novel conclusion and decides to act upon it in order to gain something. When many investors come to this same conclusion and then simultaneously act upon it, unintentional herding is achieved. This is a great example of efficient markets, where an infusion of recent news and decision-making leads individual investors to make a parallel move. This phenomenon makes the financial markets even more efficient (Bikhchandani and Sharma 2001). An example of this type of behaviour could be displayed by a sudden rise of interest rates by a non-specific central bank. This could indicate a development of a

booming market or raise the desire to invest in interest-based products. This might cause many investors to change investment plans and switch up their portfolios. They did not however do this because other investors did it but simple because of the possibility of benefitting from new information. These findings might suggest that intentional and unintentional herding have a difference in the timing of the said phenomenon, where in intentional herding an investor comes to the decision later and only *after* others have already made it and vice-versa in unintentional herding an investor believes that he or she has made the investment decision *before* anyone else.

2.3. First assessments on herding

The assessment and examination of herding was first started by Lakonishok et al. in 1992, when they inspected the occurrence of herding between pension fund managers. Their study found little to no evidence of herding. They however suggested that unintentional herding was greater in large-cap companies than in smaller companies. Their thought being that information on larger companies was more readily and extensively available when compared to smaller companies. This in turn would lead investors to come to a unilateral decision even individually as they all have the same information readily available (Bikhchandani and Sharma 2001). This argument is logical and makes sense. Larger companies are followed by many investors and stakeholders. The information flow is constant, and many investors can easily come to a similar conclusion and make a decision upon it, which would ultimately result in unintentional herding. Oppositely, Lakonishok et al. (1992) also suggested that smaller companies had a bigger risk of experiencing intentional herding which is consistent with the logic of Bikhchandani and Sharma (2001). News flow from smaller companies is not as constant as from larger companies. Smaller companies are not as intensively followed by stock analysts and even the opinions and statements of a single investor might have huge consequences on the stock performance of that particular company. This two-way division of herding has further been expanded and developed by later studies to include more intricate descriptions and definitions of certain types of unintentional or intentional herding.

2.4. Dividing herding

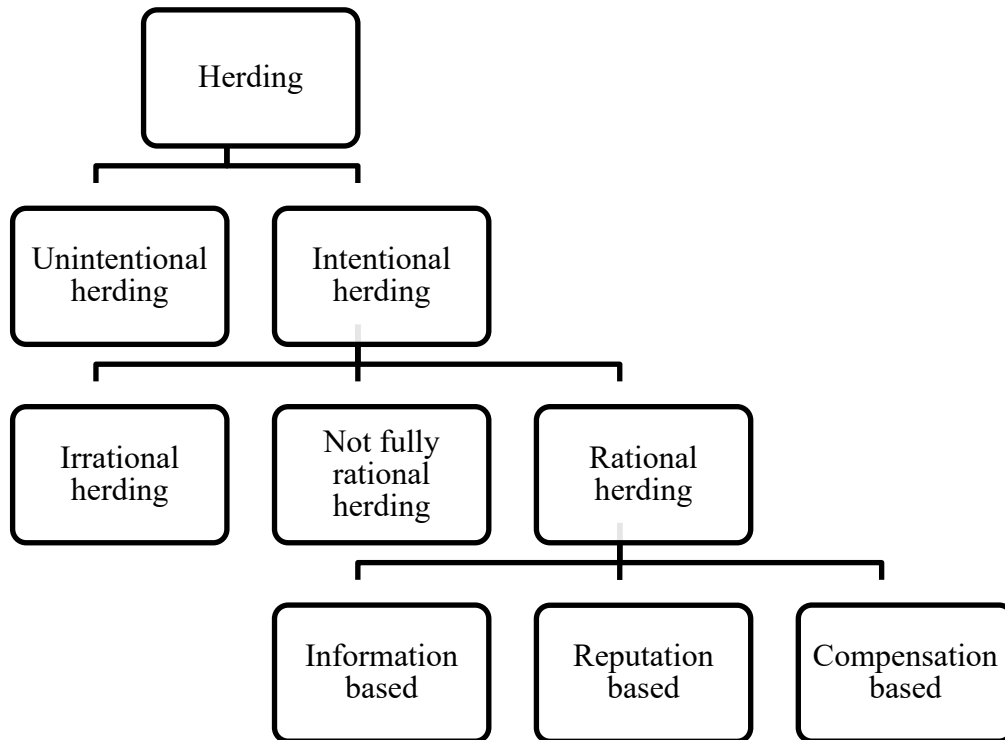


Figure 1. Division of herding (Bikhchandi and Sharma 2001; Spyros 2014).

Figure 1 displays how herding can be divided. Bikhchandani and Sharma (2001) break intentional and true herding up into irrational, not fully rational and rational herding. The first, rational herding, can be even further divided into subcategories which include herding based on information, reputation and compensation. This compensational aspect can be seen to mean herding which is deeply connected to employment. The division could be viewed as an arbitrary grouping of herding, but essentially it exists to ease the separation of definitions of different forms of herding. This separation in turn makes different and specific forms of herding easier to study.

Going through the various subcategories of intentional herding displayed in Figure 1, we first assess irrational herding. Irrational herding is grounded in the psychology of an investor, where he or she makes an unconscious and involuntary decisions (Shiller 2015:

165). These types of investors are prone to making abrupt, surprising and poor investment decisions, which are mainly based on missing information. Spyros (2014) states that irrational investors make decisions because of ulterior pressure from either social circles and stigmas. Baddeley (2004) further suggests that even experienced and professional investors may falter to irrational herding when given a scarcity of information. Irrational investors commonly make investment decisions based on a market consensus or even trends propagated by the media.

For example, in October of 2017, the tele network company, Nokia's, stock price dropped from €5.10 to €4.21 (Yahoo Finance 2018). This decline could partially be blamed on headlines propagated by the media to spike the interest of readers. Kauppalehti for example, stated with a front-page headline that over a billion euros had vanished from Nokia's funds (Hurmerinta 2017). The share price was already experiencing a decline before the headlines on that day, and these new stories certainly did not have a stabilising effect on investors. An irrational investor could see this new development as a signal of the company's future struggles and decide to sell of their shares.

This behaviour serves as a prime example of herding where investors had initial thought that Nokia would be a profitable investment but after media attention and market consensus, many decided to abandon all hope in the company even though none of the fundamental values of the company had changed. Nokia's stock price had recovered from this drop by May of 2018 (Yahoo Finance 2018). After the drop, many stock analyst houses, such as Inderes (2017) reacted by saying the dip in share price was an over-reaction by the market. They responded by giving Nokia a strong buy recommendation (Inderes 2017).

Another subcategory of intentional herding is not fully rational herding. This type of herding can partially be seen as a momentum investment strategy, where investors trade shares according to historical performance (Bikchandani and Sharma 2001: 282). Not fully rational herding already as a term sets in between irrational and rational herding. Investors *rationally* attempt to mime earlier historical profits gained by others but *irrationally* conduct this behaviour because there is no present-day proof which would

suggest, that what has happened in the past, will also be true in the present or the future. Observably, the investor attempts to profit, and exploit actions made by earlier investors. This behaviour can however morph and develop into rational herding if the investor does achieve profits and gains from exploiting earlier patterns (Bikhchandani and Sharma 2001: 282). Here the investor has successfully followed earlier and historical market consensus deliberately, even though there was no guarantee that this strategy would yield the desired results

Figure 1 demonstrates how the third category of intentional herding, rational herding, can be divided even further into three subcategories: information-, reputation- and compensation-based herding. Informational herding is displayed when an investor has a firm belief that other investors have better insight and knowledge of the market (Bikhchandani and Sharma 2001). Information based herders then follow the investment decisions made by other investors deliberately and intentionally. The deprivation of knowledge and incapability to devour new information causes an investor to believe that he or she must follow the example of other investors. This action could be argued to be rational, if an investor truly lacks the ability to make decisions for oneself and thus is dependent on the decisions of other investors.

The last two categories of intentional herding are deeply interconnected. Reputational and compensational herding are both connected to employment. The reputation of an investor may be damaged if he or she makes erroneous investment decisions. This type of herding can for example be seen in stock analysts, where deviating from a common consensus of a company's performance may ultimately cause the stock analyst to suffer from distrust from investors hoping to receive accurate predictions. Compensational herding on the other hand occurs when an employee's salary is connected to his or her performance. Taking risks and making decisions which differ from a market consensus may ultimately lead to a termination of employment. Conversely following market consensus and copying what other investors do will serve as insurance for the employee. Naturally he or she will not perform better than others but at least the performance won't be inferior. Furthermore, an employee's bonuses may be connected to actually beating the market. Wouldn't it then again be *rational* to follow the example of successful investors? Alas

employment based rational herding can be seen as an insurance for success and minimising risk (Trueman 1994; Graham 1999; Spyros 2014). In both of these types of herding, investors herd in order to protect their reputation and remuneration (Spyros 2014).

3. THEORETICAL BACKGROUND ON HERDING ON THE STOCK MARKET

This chapter will establish how herding opposes the efficient market hypothesis (henceforth, EMH) and asset pricing models, which argue that investors are always rational and only act when new information is given to them. Kendall and Bradford Hill already discussed the random walk and unpredictability of stock prices in 1953, where they argued that market participants were not always rational and share prices wobbled like a local zythophile returning from the pub. Motivated by Kendall and Hill (1953), later studies conducted in the 1960's and 70's extensively researched their views and deductions about an efficient market and asset pricing (Fama 1970; Shleifer 2000).

3.1. Efficient Market Hypothesis

As a field of financial research, behavioural finance and specifically herding, has presented critique to the believers of traditional EMH. These believers suggest that investor behaviour is always rational. It has been suggested that asset pricing analysis is always correct if it fully reflects all available information on the market (Fama 1970: 383). This deduction of correct pricing is grounded in the argument of investor rationality, where rational actions should always lead to efficiency (Fama 1970). Investor herding presents a problem for EMH and opposes the hypothesis directly. Herding specifically states that investors are not rational even though they are represented with all available information. Conversely investors displaying symptoms of herding abandon fundamental asset values and act in discordance with them.

Shleifer (2000 :1) separates market efficiency in to three levels: weak, semi-strong and strong. A market with weak efficiency will have asset pricing, which only reflects historical data and information. A semi-strong efficient market suggests that asset pricing includes and contains all and entire public information in them. The third and final level

of efficiency is a strong market. This type of market will contain all and even private insider information in an asset's price (Shleifer 2000: 2).

The EMH firmly states that investors are indeed rational. Additionally, if random irrational phenomena do occur, they are cancelled out by opposite adverse and irrational phenomena (Shleifer 2000: 1). Furthermore, EMH has a response in the instance that an opposite counteraction does not occur. EMH states that finally arbitrageurs will eliminate any and all mispricing by exploiting incorrectly priced assets. These actions should then ultimately restore market efficiency even though some inefficiency may occur. Widely used and referenced financial theories and empirical studies have at least some foundations in EMH (Shleifer 2000: 1), and only after the 1980's research has shown that results aren't always consistent with the EMH (Shleifer 2000: 8).

Many anomalies have actually been found to consistently appear on the financial markets. Keim (1983) represented the well-known January effect, which showed that in January, daily abnormal returns are significantly higher than in other months (Reinganum 1983). Another example of empirical results which are inconsistent with EMH are the findings of De Bondt et al. (2008). They examined and represented many examples of the mispricing of assets of high and low price-to-earnings (henceforth, P/E) ratio companies. Even Fama and French (2015) demonstrated with their updated 5-factor model that not all assets can be priced correctly. These few studies already come to show that asset pricing does not follow the EMH and in continuation, that investors do not always act rationally. It also comes to show that one should never disregard the humane component in any theory or aspect of life.

3.2. Capital Asset Pricing Model

The Capital Asset Pricing Model (henceforth, CAPM) explains the linear relationship between an asset's expected returns and systematic risk. The model is based on the logic that an investor should be compensated by a choice of risk and return (Fama and French 1992), i.e. an investor can choose to either expect greater returns by adding risk or vice-

versa expect lower returns with lowering risk. The relationship can then be used to price different assets accordingly. In turn, this would make it easier for an investor to choose an asset which resembles his or her expected return and risk aversion level. The CAPM equation is represented below:

$$(1) \quad E(r)_a = r_f + \beta_a(r_m - r_f)$$

Where:

$E(r)_a =$ expected returns of the asset

$r_f =$ risk-free rate, normally derived from yields of government bonds

$\beta_a =$ beta of the security

$(r_m - r_f) =$ market premium

Although the logic and idea behind the CAPM in an investor choosing a risk/reward level is still applied today, the model has received warranted criticism. The market premium component explains the deviations of stock returns poorly and the model does not price assets correctly (Mergner 2009; Fama and French 2015). Hence alterations and expansions to the model have been suggested in order to account for these deficits. These alterations come in the form of different factors, which attempt to explain the effects that changes in an asset's macroeconomic, fundamental and momentum values have (Mergner 2009).

The next models represented will emphasise on the fundamental and momentum factors. The momentum factor examines how the historical returns of an asset impacts future asset pricing (Mergner 2009). In addition, the fundamental factors measure quantifiable data from a company, which include size, value or investment. By adding factors to a single factor model it naturally changes the name of the initial model. If you say add two factors it is obviously then called the three-factor model due to its two additional factors in comparison to the CAPM. Fundament and momentum factors are arguably more renowned and revered in the financial community in comparison to the macroeconomic factor. The macroeconomic factor should not be entirely disregarded, but for the purposes

of this paper and length restraints, the next section will explore the other two factors and the three-factor model.

3.3. Three-factor model

The framework of the CAPM has later been utilised by many researchers including Fama and French (1992, 1993, 2015) and Jegadeesh and Titman (1993) to comprise new factors, which try to price assets better than the standard CAPM. The standard CAPM inaccurately measures the returns of value and small-cap companies (Fama and French, 1992). The market premium factor from CAPM cannot solely explain asset returns or price them correctly. Hence, Fama and French (1992) added two factors which sought to address the size and the value of a company and how these factors and aspects affect the expected returns of a company. The size factor is named Small Minus Big (henceforth, SMB) and it describes how the size of a company affects its returns. Looking at past returns, small-cap companies have had higher returns than large-cap companies. The factor is equated by calculating the difference between the stock returns of small and large companies. (Fama and French, 1993)

The other factor, value, seeks to explain how the value of a company affects the expected returns of said company. The value factor is named High Minus Low (henceforth, HML), where the difference of a low and high book-to-market value (henceforth, BV/MV) companies is calculated. This factor was included because higher BV/MV companies, also called value companies, have had significantly higher returns than low BV/MV companies, also commonly referred to as growth companies (Fama and French, 1993). The HML factor is calculated in the same manner as the SMB factor where the difference of returns between high and low BV/MV companies is calculated. The three-factor model has been one of the most utilised asset pricing models in the financial markets (Mergner 2009: 127). The equation for the three-factor model is represented here (Fama and French 2015):

$$(2) \quad E(r)_a = r_f + \beta_a(r_m - r_f) + \beta_b(SMB) + \beta_c(HML) + e_i$$

Where in addition to equation (1):

$\beta_b =$	sensitivity of asset to SMB
(SMB) =	Small Minus Big factor
$\beta_c =$	sensitivity of asset to HML
(HML) =	High Minus Low factor
$e_i =$	zero-mean residual

3.4. Five-factor model

Fama and French (2015) also amalgamated the five-factor asset pricing model because of criticism directed towards the three-factor model (Titman et al., 2004; Novy-Marx, 2013). The model inaccurately priced aggressively investing and lower profitable small-cap companies (Fama and French, 2015). Fama and French claimed that by adding factors to the existing five-factor model they could come up with the best model despite it not being perfect. Alas, they added two additional factors: investment and profitability. The profitability factor is named Robust Minus Weak (henceforth, RMW), and it measures the difference between companies which have high (robust) and low (weak) operating profits. The investment factor is named Conservative Minus Aggressive (henceforth, CMA) and it measures the difference of conservatively (low) and aggressively (high) investing companies. The equation for the five-factor model is represented below (Fama and French 2015):

$$(3) \quad E(r)_a = r_f + \beta_a(r_m - r_f) + \beta_b(SMB) + \beta_c(HML) + \beta_d(RMW) + \beta_e(CMA) + e_i$$

Where in addition to equations (1) and (2):

$\beta_d =$	sensitivity of asset to RMW
(RMW) =	Robust Minus Weak factor
$\beta_e =$	sensitivity of asset to CMA
(CMA) =	Conservative Minus Aggressive

3.5. Herding opposing efficient markets

Traditional asset pricing models, as the ones mentioned afore, completely disregard a human component in them. The objective is to only measure what an assets price should be, which is commonly in stark contrast to what it actually is. The difference can be caused by a variety of reasons, and one of them is human behaviour. The models listed before always establish investors as being rational and only acting rationally upon novel information (Hirshleifer and Teoh 2009). These models also expect a linear pattern of expected returns (Fama 1970; Fama and French 1992, 1993, 2015), which just simply cannot be upheld. Nothing in nature is linear so why should the prices of assets move this way when they are ultimately determined by the way investors behave.

Behavioural finance can be seen as a countermovement towards the linearity of asset pricing models which assume that the EMH is correct and investors are always rational (Hodnett and Hsieh, 2012). It can quickly be noticed that investors do not make trading decisions based on estimates from asset pricing models and seeing if there is an exploitable arbitrage opportunity. Many investors actually act irrationally and make decisions based on feelings or even hunches. Just by listening to anyone who has ever invested in anything, one can almost instantly hear the phrase “I just had a hunch about it”. Hence, there are other factors than just mathematical or measurable factors to take into account in addition to just the ones conjured up by Fama and French (1970, 1992, 1993, 2015). Everything and anything an investor experiences affects his or her investment decisions: education, employment, media coverage, mood and even the weather can have an immense effect on how an investor comes to making a decision. The research in behavioural finance is particularly interested in this aspect of investor irrationality and many investor behaviours have been discovered. Herding is just one of the countless areas of behavioural finance.

Barberis and Thaler (2003) suggest that behavioural finance derives from two areas: psychology and the limits to arbitrage. The latter, limits to arbitrage, partially cause irrational investor behaviour. They argue that the costs of transactions limit the opportunities of exploiting and utilising arbitrage opportunities. Additionally, risk and

self-doubt of arbitrageurs may cause them to not utilise all arbitrage possibilities. These limits to arbitrage can cause permanent mispricing of assets and ultimately inefficient markets. The argument opposes the EMH and the afore listed asset pricing models, which suggest that arbitrage should finally eliminate all ill-pricing of assets and inefficiency of markets (Fama 1970).

Investor psychology, the second area of behavioural finance, aims to understand the reasons behind why investor do what they do. This area of behavioural finance also tries measurable assess different behaviours in order to firstly understand why they occur and secondly when they occur. This information could be utilised in all market conditions. De Bondt et al. (2007) for example suggest that financial crises may ultimately even be caused by investor behaviour and that investor psychology should be listed as one of the reasons for the deepening crises situations. Moreover, even superstar and influential investors state that they have made investment decisions based on decisions and recommendations of other investors (Devenow and Welch 1996). This fact alone clearly demonstrates that investors, no matter how experienced they are, don't always act rationally and follow the example of others.

Herding behaviour and the following of other investors has been suggested to explain many market anomalies and the incorrect pricing of assets. The next chapter will assess some of these herding models, which try to detect herding on stock markets. This detection of herding deeply opposes the EMH and asset pricing models discussed in this chapter, which state that such a behaviour shouldn't exist at all.

4. ASSESSMENT OF HERDING MODELS

The following chapter assesses some herding models. These models were constructed after Lakonishok et al. (1992). The models challenge the previously discussed asset pricing models and stem from the observation that investors aren't actually rational, at least all the time. Although most of these models have detected herding occurring in some instances, they can't specifically measure what kind of an impact this has had to the efficiency of markets or the pricing of assets. The only statement these models can make is that herding does transpire. The results which these studies compiled are discussed in chapter 5.

It is also important to mention that the following models listed in this chapter are not the only models which measure herding. These models have, however, been utilised the most by various researchers. The results and evidence gathered by these models will also be discussed in a later chapter. Additionally, the model discussed in subchapter 4.3. will be employed in the empirical research of this paper. This is the reason as to why these models have been included and other models secluded.

4.1. Linear regression model

Christie and Huang (1995) employed a linear regression model to study investor herding. The model utilised the standard deviation of stock returns when markets were experiencing turbulent times. They wanted to show that investors don't act according to traditional asset pricing theories but instead act oppositely and especially in market stress situations. The reasoning was that the irrational behaviour of investors should drive share prices away from their fundamentals values when investors and markets were under stress. The deviation of returns of stocks should diminish as investors abandoned individual stock characteristics and followed the market performance (Christie and Huang 1995). This behaviour should be predominantly evident in market stress situations, when investors ensue to panic (Christie and Huang 1995). This would indeed determine that

investors are prone to herding, when they followed a market consensus and disregarded how an individual stock performed (Henker et al. 2006).

This study was a small revelation, as it unconventionally studied herding by the standard deviation of returns. Many researchers and models today base their framework on the Christie and Huang (1995) model. Albeit, their methodology has been modified to some extent the similarity between methods is still evident. The criticism towards Christie and Huang's (1995) model was directed especially towards the linearity of the model and its ability to only detect herding in certain market conditions.

4.2. Beta coefficient model

Hwang and Salmon (2004) approached herding from a somewhat different perspective. Their definition of herding was an investor making trading decisions from market news or other indicators, for example macro-economic announcements. This approach sees a group of investors coming to a similar conclusion by consuming new information. Hwang and Salmon (2004) assessed the standard deviation of the beta-component and how the fluctuations of it determined whether or not herding was happening. They were motivated to inspect if results from prior studies had been robust or not when they were exposed to a different model (Cipriani and Guarino 2014).

Hwang and Salmon (2004) suggest that their method of assessing the beta-coefficient can dissect and differentiate intentional and unintentional herding. Their approach is certainly different than methods employed by other researchers. Here herding is seen as investors coincidentally coming to the same trading decision. When investors comply to this type of behaviour the individual betas should resemble the fluctuations of a general market beta consensus, i.e. when the standard deviation of separate beta-coefficients diminishes the market is experiencing herding. This is explained by many investors making the same decisions simultaneously and thus reducing the fluctuation of separate betas from the market norm. Their study focused on the matter of detecting comovements of betas in stock markets (Hwang and Salmon 2004). Investor herding means that market

participants aren't keen on correct asset pricing, according to pricing models, but rather in share prices reflecting market returns (Hwang and Salmon 2004). This assumption dictates that the values of beta-coefficients change as time passes.

The method at first inspects herding to a balanced state of the CAPM (Hwang and Salmon 2004):

$$(4) \quad E_t(r_{it}) = \beta_{imt}E_t(r_{mt})$$

Where:

- r_{it} = the stock i's abnormal returns
- β_{imt} = systematic risk
- E_t = expected value at time t
- r_{mt} = market premium

When herding does not occur, the share price of stock i, should only be equated from using the β_{imt} and E_t values. If, however, the share price of stock i is incorrect according to equation (4), herding is occurring. Correct pricing and mispricing are further equated by using the following equation (Hwang and Salmon 2004):

$$(5) \quad \frac{E_t^b(r_{it})}{E_t(r_{mt})} = \beta_{imt}^b = \beta_{imt} - h_{mt}(\beta_{imt} - 1)$$

Where in addition to equation (4):

- $E_t^b(r_{it})_i$ = stock i's deviation from expected abnormal value at time t
- β_{imt}^b = systematic risk at time t
- h_{mt} = latent/hidden variable to determine herding

When no herding is detected on the market, the values in equation (5) should equate to $h_{mt}=0$ and $\beta_{imt}^b = \beta_{imt}$. When herding is perfect $h_{mt}=1$ and $\beta_{imt}^b = 1$. Then naturally, if only some herding is occurring for the stock i, then $0 < h_{mt} < 1$. (Hwang and Salmon 2004)

4.3. Nonlinear regression model

Chiang and Zheng (2010) also research herding on stock markets. They expanded the framework established by Chang et al. (2000) and Christie and Huang (1995). Chang et al. (2000) had to some extent addressed the issue of linearity from Christie and Huang's (1995) paper but according to Chiang and Zheng (2010) not all issues were completely resolved especially concerning asymmetric investor behaviour. Chiang and Zheng (2010), similarly to Chang et al. (2000), studied the absolute standard deviation of returns of stocks from a market portfolio. They also added a nonlinear component to Christie and Huang's (1995) model. Herding should actually grow or diminish at an exponential rate in specific and different market conditions (Chang et al. 2000). Chiang and Zheng (2010) suggested that herding is most intensive when the absolute deviations of returns between an asset and a market portfolio decreases or increases at a slowing speed. The logic behind the equation is simple, if the returns of an individual asset start to follow the returns of a market portfolio, market-wide herding is happening as investors disregard individual asset characteristics and in turn follow the market performance. Their methodology can also assess herding in all market conditions and not only in stressful and turbulent situations. Moreover, compared to the study of Chang et al. (2000) they added an additional component to the equation in order to address asymmetric investor behaviour.

Chiang and Zheng (2010) utilise the following equation to equate the Cross-Sectional Absolute Deviation (henceforth, CSAD) of returns at time t :

$$(6) \quad CSAD_t = \frac{1}{N} \sum_{i=1}^N |R_{it} - R_{mt}|$$

Where:

N = the number of companies in a portfolio

R_{it} the return of the stock at time t

R_{mt} = the return of the market portfolio at time t

The CSAD measure from this equation is then further utilised to detect herding by inserting the CSAD measure into the following equation (Chiang and Zheng 2010):

$$(7) \quad CSAD_t = \alpha + \gamma_1 R_{mt} + \gamma_2 |R_{mt}| + \gamma_3 R_{mt}^2 + \varepsilon_t$$

Where:

$\gamma_1 R_{mt}$ = the asymmetry component

$\gamma_2 |R_{mt}|$ = the absolute term

$\gamma_3 R_{mt}^2$ = the nonlinear component

α = constant term

ε_t = error term at time t

$\gamma_3 R_{mt}^2$ is the non-linear component of interest, which Christie and Huang's (1995) method lacked. A negative and significant value of γ_3 would be consistent with market-wide herding. (Chang et al. 2000; Chiang and Zheng 2010). Additionally, the $\gamma_1 R_{mt}$ component was added by Chiang and Zheng (2010) to account for asymmetry in investor behaviour.

This lastly mentioned model is also utilised in the empirical research part of this paper as it is wide used. Because of the popularity it should be easier to assess and compare results from prior studies compared to selecting a model which hasn't seen as much popularity by prior studies. The next chapter of this paper will discuss important international studies and also ones conducted in the Nordic stock markets.

5. LITERATURE REVIEW, PRIOR INTERNATIONAL AND NORDIC MARKET STUDIES

As previously mentioned, this chapter will compile the empirical results of international studies and also of ones which have been conducted in Nordic stock markets. The Nordic markets have so far seem somewhat neglected by the research community and only a handful of studies have absolutely concentrated on Nordic stock markets. Most studies have only happened to include the Nordic markets as one portion of the study and a larger dataset, where the main emphasis was on the European market as a whole. Because of the scarcity of results from Nordic markets, some masters' theses' results will be introduced as minor evidence for herding behaviour in Nordic stock markets. This chapter will not have an extensive overview of the methodology of each study, but rather emphasise the results and evidence from each paper.

5.1. International results

Christie and Huang (1995) studied herding on US stock markets in 1925 to 1988. Their results were, in short, inconclusive. Their results were not consistent with their claims of detecting herding on stock markets in turbulent and volatile conditions. Christie and Huang (1995) hypothesised that deviations of returns between individual assets and the market should diminish, and definitely not grow, as investors disregarded singular asset characteristics and herded around the market performance. Their empirical results suggested the opposite, where deviations of returns actually increased in turbulent market conditions. They also observed that deviations of returns expanded substantially more in bear-markets than in bull-markets, which would suggest according to their methodology that herding diminished in reclining markets. Additionally, the evidence pointed to receding market pricing of assets being consistent with traditional asset pricing models (Christie and Huang, 1995). In conclusions, Christie and Huang (1995) found no evidence of significant herding occurring in the US stock market between 1925-1988. The results

suggested that herding was more likely to occur during bull markets rather than in bear markets, but these findings were not significant.

Chang et al. (2000), as discussed in the previous chapter, employed a nonlinear model to detect herding. They studied herding from 1963 to 1997 on various international markets to see if there was a difference in herding between developed and emerging markets. The markets selected were the US, Hong Kong, Japan, South Korea and Taiwan. Similarly, to Christie and Huang (1995), the sample period for the study was relatively long and would've provided a sufficient overview of the selected markets at that time. Chang et al. (2000) did not find significant evidence for herding in the stock markets of the US, Hong Kong or Japan. These results were consistent with the findings of Christie and Huang (1995). Chang et al. (2000), did however find significant evidence of herding for the two emerging markets, South Korea and Taiwan. Their findings were consistent for the two over the entire sample period and also for differently sized portfolios. Another observation they made, was that macroeconomic announcements and news had a more significant effect on herding than novel small scale and detailed market information (Chang et al. 2000). These findings would indicate that herding is more likely to occur on emerging markets rather than developed markets. These observations would also be consistent with evidence from Christie and Huang 's (1995) study. A suggested reason as to why emerging markets experience more herding than developed one's could be the scarcity of information for investors. Detailed news reports on individual companies in emerging markets are not as constant as with companies in developed markets and macroeconomic announcements could sway investor decisions and sentiment radically.

Hwang and Salmon (2004) examined herding on the US and South Korean markets between 1993 and 2002. They utilised the beta-coefficient model discussed in chapter 4.2. of this paper. Their results were opposite to previous main studies. Their model detected herding in significant amount in all market conditions and for the entire sample period. Significant herding was consistent in bull- and bear-markets and surprisingly even diminished in declining markets. These results contradict previous findings (Christie and Huang 1995; Chang et al. 2000), which together only found significant herding to occur in emerging markets and more probably in bull markets. Hwang and Salmon (2004),

suggested that the asymmetry of herding between bull- and bear-markets was due to investors actually trusting the fundamental values of individual stocks and opposite to traditional view, not panicking and following market consensus. In addition to detecting herding in inclining and declining market conditions, Hwang and Salmon (2004) also found significant evidence of herding in stable markets. They argued that large institutional investors distributed capital between market segments according to market performance, which explained herding even in stable market conditions. These findings were inconsistent with the evidence provided by previous studies (Christie and Huang 1995; Chang et al. 2000). The argument could be made that this was due to the difference of the model and methodology used to detect market-wide herding.

Hwang and Salmon (2009, 2012) also specifically researched herding in turbulent market conditions to reinforce the findings of their previous study, which saw that herding diminished in bear-markets. They researched herding during the 1987 market crash, the 1998 Russian crisis and the Financial crisis of 2008. Their results were consistent with their previous results, where levels of market-wide herding significantly decreased in turbulent markets. The results between the different studies from the same researchers seem to be robust and show that investors don't only herd in declining markets. Oppositely, Hwang and Salmon (2004, 2009, 2012) demonstrated that investor herding is more likely to occur in bull-markets and when the outlook of the market is overwhelmingly positive. If an educated guess is to be made for the reasoning behind this, one might suggest that it is the urge to mimic the success of other investors. In a positive market surge, investors are looking to find the single most profitable asset. Then if new and potentially positive information is introduced to the market investors might rush, or herd, to act on it. This behaviour would be consistent with the already discussed definition of herding, where investors disregard the individual characteristics of assets and instead follow a common market consensus. Here in this case the belief would be that, because the market is surging this particular asset must also perform well.

Chiang and Zheng (2010) examined herding behaviour in global stock markets by utilising their slightly modified nonlinear model discussed in chapter 4.4. They used data from 18 countries for a sample period ranging from 1988 to 2009. They found significant

evidence of herding occurring in all advanced and Asian markets for the exception of the US and Hong Kong. Additionally, they did not find significant evidence of herding occurring at all in Latin American markets. The difference of results for Latin American markets was explained to be caused by global information processing. Chiang and Zheng (2010) suggested that investors particularly in Asia valued information from Wall Street media more than other information. This processing of similar information in Asia by individual investors would lead to investors simultaneously reaching a similar conclusion and trading strategy and thus creating herding behaviour. Herding was also consistent and present in rising and declining markets. However, some evidence of herding asymmetry was found in up-and down-markets for Asian markets. Another observation was the contagion patterns in herding during market crisis situations, where if herding behaviour occurred in the country where the crisis initially began, the behaviour also spread to neighbouring countries. The results of the study were partially consistent with the findings of previous studies (Christie and Huang 1995; Chang et al. 2000; Hwang and Salmon 2004, 2009, 2012). They opposed Hwang and Salmon (2004, 2009, 2012) by not finding evidence of herding behaviour in the US, but results were consistent with other sample countries. Oppositely to Chang et al. (2000), Chiang and Zheng (2010) found evidence of herding to occur in Japan. The results are inconsistent and in stark contrast to Christie and Huang (1995, who did not find any significant herding occurring in any markets for their sample period. (Chiang and Zheng 2010)

International studies can be concluded with some consistency and also partial inconsistency. Christie and Huang (1995) examined the US market in 1925-1988 and found no evidence of herding and only some slight indication of insignificant herding occurring in bull markets. Chang et al. (2000) used a partially overlapping sample period of 1963-1997 and assessed herding in the markets of the US, Hong Kong, Japan, South Korea and Taiwan. They found that herding only occurred in emerging markets. Hwang and Salmon (2004) used an entirely different method of detecting herding, the beta-coefficient model. The chosen sample period of 1993-2002 was only partially overlapping with Chang et al. (2000). They investigated the stock markets of the US and South Korea and found herding to occur on both and in various market conditions. These results are strongly inconsistent and oppose the results from other prior studies. Additionally, Hwang

and Salmon (2009, 2012) researched markets in crises situations and found that herding diminished in such times. Finally, Chiang and Zheng (2010) used a slightly altered model of Chang et al. (2000) and found herding to occur on most markets. The exceptions were the US, Hong Kong and Latin American markets. Their sample period of 1988-2009 overlaps at least partially with most studies.

In sum, emerging markets seem to experience herding most likely whereas developed markets are not as prone to it. Additionally, results from the same markets may change when exposed to different time periods and different methods of detecting herding.

The differences in results between all the studies could be at least partially explained by a dissimilar model and a somewhat different sample period. This same issue in differing data and sample periods seems to challenge comparing all the results under inspection in this paper. By not utilising the same model to detect herding, and scientific community clearly not abiding by just one method, it makes the comparison between results at least moderately challenging. Even though some conclusions can be drawn, a full and cohesive picture of investor herding cannot be painted on global markets. The next subchapter will compile the results of studies from Nordic countries.

5.2. Nordic countries

It would be fair to assume and quickly conclude that the stock markets of Nordic countries should resemble each other to at least some degree. The countries are not separated by long distances and share many aspects culturally. Holidays and trading days occur at roughly the same time, and all experience the same market crises and surges similarly due to their proximity. According to previous studies, the similarity between herding behaviour among these markets is very dissimilar. As discussed in the previous subchapter, it is important to note that the studies discussed have for the most part selected different datasets and sample periods to detect herding. Additionally, some studies have employed different models to assess herding. Another observation to be made, is that only a few studies have included the Danish market and even fewer have discussed herding in

Norway. This information scarcity especially from Norway affected the decision to not include Norway in this paper for empirical research at all.

Mobarek et al. (2014) studied herding behaviour on a large variety of stock markets in Europe. The chosen time period for the study was 2001 to 2012. This paper was one of the few studies to include the Norwegian market. Their paper employed the method introduced by Chang et al. (2000). They found consistent evidence of low levels of herding occurring in Finland during the entire sample period and in varying market conditions. Moreover, all Nordic markets were prone to experiencing low levels of herding in market stress situations when they are summed together. Another observation they made was that the level of herding in Nordic countries was more pronounced during the Euro crisis than in the Financial crisis. A reason to why this happened was because of the bailout payments made to Greece, especially by Finland. Their results were consistent with finding herding occurring in European, and especially Nordic markets, in days of low volatility and bear-market conditions. Mobarek et al. (2014) did not split the sample period up into smaller subsamples, where individual years could have been inspected this separation would have made the assessment of herding more detailed in the sense of examining it for individual years. Mobarek et al. (2014)

The results from Mobarek et al. (2014) are inconsistent with results from Hwang and Salmon (2004, 2009, 2012) who observed that herding was more likely to occur in bull-market conditions. The difference and inconsistency in results could however be explained by the difference in the selected markets and the method chosen to conduct the study. Mobarek et al. (2014) utilised the same stock indices from Finland, Sweden and Denmark as this paper will. The results from this paper will be discussed in chapter 8. (Mobarek et al. 2014)

Some minor evidence and comparison of results can be derived from discussion papers and masters' theses, which have investigated the Nordic markets. Saastamoinen (2008) researched herding on Finnish large-cap stocks. His sample period was between 2002-2007. Saastamoinen (2008) found herding in Finland to be more likely to occur in a bear-market situation. Ohlson (2010) researched herding on the Swedish stock market. His

sample period was from 1998 to 2009. Evidence from the paper pointed to Swedish investors herding on up-market days and with large-cap companies. These findings of herding on up-market days are consistent with evidence from Hwang and Salmon (2004). Lindhe (2012) was one of the few who studied herding on all four Nordic stock markets. Her research found herding to be consistent in Finland in the early 2000's, but herding was not detected for any other country for the entire sample period of 2001-2012 (Lindhe 2012). She also found that Nordic markets herd around international markets and here her results were consistent with Chiang and Zheng (2010), who suggested that investors in advanced markets might herd around bigger international markets due to the pronounced value of some information. Lindhe (2012) utilised the same methodology as this paper later will, but her dataset is different. Rissanen (2015) employed the beta-coefficient- and the nonlinear method to examine herding in Finland. His sample period was from 1999 to 2014. His results display that, whilst using the beta-coefficient method, significant herding could not be detected in Finland for the entire sample period. When utilising the nonlinear method, he found consistent evidence of herding occurring in Finland for the entire sample period and especially in bull-market conditions and large-cap companies.

To sum up the results from the Nordic markets, one can argue that Finland does experience herding to at least some degree. Other markets have seen inconsistent results, and this most likely demonstrates that other Nordic markets do not experience herding. The inconsistency in results cannot entirely be explained by the use of different models as, for example, Mobarek et al. (2014) and Lindhe (2012) used practically the same method to assess herding but with varying results. Most studies have, however, utilised already dated data and did not separate the individual years of the sample period into smaller subsamples. This separation would have made it easier to pinpoint if a certain year mangled the results to display significant herding occurring for the entire sample period. And even though some studies utilised similar methods to detect herding they did use different datasets. Some investigated the stock indices of the most traded stocks in a country, where as others tried to include all stocks in the selected countries.

Another observation from examining these studies is that, there really is a scarcity of studies to examine, which have researched herding in the Nordic stock markets. This lack

of studies can be explained simply by the disinterest from international researchers in Nordic markets. Nordic markets can be seen as unimportant and small when comparing them to other international markets and thus do not receive as much attention as other markets. This lack of studies, however, motivates this study to research the Nordic stock markets as they definitely have not been extensively studied and novel findings entirely exhausted.

5.3. Hypotheses development

Hypotheses based on previous studies and literature are formed. Firstly, efficient market hypothesis suggests that stock returns and their dispersions should be normally distributed. Market anomalies suggest that this is not the case and stock return dispersions are driven away from their expected values precisely because of market anomalies. Herding being one of the anomalies and the anomaly under inspection in this study, it is only natural to inspect whether or not stock return dispersions are normally distributed or not. Any prevalence of the contrary would suggest that the three markets are not efficient and something, be it a market event or an anomaly, drives this. Thus, the null hypothesis is as follows:

H0: Stock return dispersions are normally distributed among separate Finnish, Swedish and Danish markets during the sample period of 2007-2018.

The first hypothesis examines the anomaly of interest in this study: Herding. The hypothesis inspects, if herding does indeed occur during the chosen sample period of 2007-2018. The objective of the hypothesis is to address herding as a market-wide phenomenon for each separate country for the entire inspected sample period, or even more simply to see if herding does occur on these three markets. Hence, the first hypothesis is the following:

H1: Herding occurs in the Finnish, Swedish and Danish stock markets for the entire sample period of 2007-2018.

The second hypothesis inspects herding during separate years of the sample period. The objective is to see if international and even global events affected the levels of herding in Finland, Sweden and Denmark. Hwang and Salmon (2004, 2009, 2012) and others (Christie and Huang 1995; Bikchandani and Sharma 2001) have provided evidence that herding dynamics change during market crisis situations. This is why this study also aims to reveal whether there is a difference in herding behaviour between separate years. The hypothesis to inspect this phenomenon and occurrence is the following:

H2: Herding occurs differently in different subperiods in the Finnish, Swedish and Danish stock markets for the chosen sample period of 2007-2018.

Additionally, herding behaviour has been seen to sometimes be asymmetrical especially in developing markets (Mobarek et al. 2014). Asymmetry here means the difference of herding in different market conditions, i.e. up- and down-market days. Evidence from previous papers motivates this study to also include an examination of asymmetry in herding in the three selected markets. Thus, the third hypothesis is formed to be the following:

H3: Herding behaviour occurs differently in rising and declining market conditions across different markets during the sample period of 2007-2018.

Lastly, the influence of bigger markets on smaller markets is also acknowledged similarly to prior studies (Chiang and Zheng 2010; Mobarek et al. 2014). Thus, the influence of the US and German markets on the three Nordic markets are tested. Hence, the fourth hypothesis is the following:

H4: Finland, Sweden and Denmark separately herd around the US and the German markets during the sample period of 2007-2018.

The next chapter explains the chosen methodology for the study in order to reject or accept the afore listed hypotheses.

6. METHODOLOGY

This study assesses herding from a market-wide approach. This form of herding behaviour is present when investors abandon and ignore the individual characteristics of assets and follow the market consensus (Henker et al. 2006). The study will not try to detect herding on individual stocks or selected industries. The method will include examining three separate markets, Finland, Sweden and Denmark, and their individual stock markets. The proxy for the market will be each separate country's stock index of most traded stocks.

The nonlinear regression model equations (6) and (7) are chosen to conduct this study. This empirical approach follows the method and study of Chiang and Zheng (2010). The approach implies a non-linear relationship between dispersions of individual asset or stock returns compared to the full market portfolio return. Moreover, this particular method is chosen because the framework for assessing herding has been established by it. Furthermore, this methodology has been successfully used by prior studies to discover the presence of herding. Another advantage of this model and methodology is that it is relatively simple and easy to utilise and carry out the testing for the study. The equations, which are already mentioned before in this study are again listed below for convenience:

$$(6) \quad CSAD_t = \frac{1}{N} \sum_{i=1}^N |R_{it} - R_{mt}|$$

$$(7) \quad CSAD_t = \alpha + \gamma_1 R_{mt} + \gamma_2 |R_{mt}| + \gamma_3 R_{mt}^2 + \varepsilon_t$$

The coefficient of particular interest is still the non-linear component γ_3 . A negative and statistically significant coefficient demonstrates the occurrence of market wide herding. These equations are used for the assessment of H1 and H2, where the study examines the occurrence of herding as a market wide phenomenon for the entire sample period and also for subsample periods. For the second hypothesis yearly data is inserted to each equation to examine herding in yearly subperiods.

$$(8) \quad CSAD_t = \alpha + \gamma_1(1 - D)R_{mt} + \gamma_2(D)R_{mt} + \gamma_3(1 - D)R_{mt}^2 + \gamma_4(D)R_{mt}^2 + \varepsilon_t$$

For the purpose of examining herding in different market conditions equation 8 is introduced to the study. Many prior studies have found asymmetry in herding during up- and down-market days (Tan et al., 2008; Chiang and Zheng, 2010). Prior literature motivates this study as well to demonstrate if rising or declining Finnish, Swedish and Danish markets experience asymmetrical herding. This equation is used to test H3.

The dummy variable (D) in the equation is equal to one, if index returns are negative and the variable is zero, if index returns are not negative. A negative and statistically significant γ_3 constitutes as herding occurring on up-market days. Similarly, a negative and statistically significant γ_4 would be consistent with herding occurring in down-market days.

$$(9) \quad CSAD_t = \alpha + \gamma_1 R_{mt} + \gamma_2 |R_{mt}| + \gamma_3 R_{mt}^2 + \gamma_4 CSAD_{us,t} + \gamma_5 R_{us,mt}^2 + \varepsilon_t$$

$$(10) \quad CSAD_t = \alpha + \gamma_1 R_{mt} + \gamma_2 |R_{mt}| + \gamma_3 R_{mt}^2 + \gamma_4 CSAD_{ger,t} + \gamma_5 R_{ger,mt}^2 + \varepsilon_t$$

The fourth hypothesis is tested with the afore listed regression model equations (9) and (10). Acknowledging the findings and suggestions of Chiang and Zheng (2010), where the US market influences smaller markets, this study also inspects the impact of the US and additionally the German market in regard to herding in the three Nordic markets. The German market is introduced similarly to the study of Mobarek et al. (2014), who recognised its influence on other European markets. In addition to equation (7) the CSAD measure is equated for both the US and the German market. Also, the market returns of both of these markets are needed and equated.

This method relays three coefficients of interest. First, a negative and statistically significant γ_3 is consistent with market-wide herding on one of the three examined markets occurring, when the influence of another market (the US or Germany) is introduced to the regression. Secondly, a positive and statistically significant value of γ_4

displays that stock return dispersions from either the US or Germany affecting the market under inspection. Thirdly and most importantly, a negative and statistically significant coefficient γ_5 is consistent with the examined country herding around either the US or the German market.

7. DATA AND DESCRIPTIVE STATISTICS

7.1. Data

Data for this study is predominantly gathered from Nasdaq OMX Nordic. The data set consists of the most liquid shares of the main indices of Finland (OMXH25), Sweden (OMXS30) and Denmark (OMXC20). For testing the fourth hypothesis, and the effect of the US and German markets on the three Nordic markets, additional data is gathered from Thomson Reuters Datastream. The S&P500 index is used to test the influence of the US market. The influence of the German market is tested by utilising data from the DAX30 index. Daily prices for all indices and stocks from the indices are used. The time period chosen is from the 1.1.2007 to 31.12.2017. All data and prices are in local currencies as the study concentrates on assessing herding on separate markets and does not include an examination of herding between markets. For S&P500 and DAX30 indices the daily index prices are converted into the local currencies of Finland (EUR), Sweden (SEK) and Denmark (DKK). Initially the study was meant to include the Norwegian market as well, but comparable data could not be gathered from the same source as the other markets, and that is why the Norwegian market is left out. Additionally, the Norwegian market is left out of this study because there is clearly a lack of studies and research to compare empirical results to.

Another notion to be remarked is that the chosen indices have had structural changes to them during the chosen time period. Some stocks have been removed and others introduced to the indices. To account for this fluctuation of assets, the stock returns for assets which were no longer constituents of the index as of 31.12.2017 but had been for at least some of the sample period, a neutral value is given to them (i.e. those days, for those particular stocks, are given the same lognormal return as the average of the market portfolio). This decision is made because, yet again comparable data for the removed stocks could not be assumed from the same data source. Daily stock returns are equated by using daily changes in closing prices by the following formula:

$$(11) \quad R_t = 100 * (\log(P_t) - \log(P_{t-1}))$$

R_t = Change in stocks daily closing price from day t-1 to day t

(P_t) = Stocks price at time t

The required market portfolio for the CSAD measure for each index is equally weighted, meaning that each stock within the portfolio has an equal weight. Each stock index has at least 2750 observations. Even though the time period is the same for each stock index the number of observations vary from 2751 to 2766. This difference in observations or trading days is due to various reasons, one of which is for example national holidays which occur at different times for the selected markets and affect trading days.

7.2. Descriptive statistics

Table 1 displays the descriptive statistics of the CSAD measure and the market returns for each of the three selected markets. Denmark shows a higher median and standard deviation for the CSAD measure than Finland and Sweden. Chiang and Zheng (2010) suggest that a higher standard deviation in similar markets may be caused by the market experiencing unexpected news or shocks more frequently. Finland seems to display the lowest measure of CSAD suggesting that it experienced the least amount of unexpected shocks or news. The differences of the CSAD measure are relatively large as Finland has a range of 0-1,784 and Sweden has a range of 0-3,212. There is also a difference in stock returns for each market. Finland minimum value for stock returns is -3,868 and for Denmark the corresponding value is -5,091. This would mean that there is difference between the selected markets. It will be interesting to see how variously herding behaviour occurs in these different markets.

Additionally, the skewness and kurtosis measures for CSAD are positive for all markets. Also, kurtosis is above three which indicates that all three markets have stock returns which are not normally distributed. The null hypothesis stated that stock return dispersions are normally distributed among separate Finnish, Swedish and Danish

markets. Evidence from Table 1 suggests the contrary. Thus, the null hypothesis is rejected for all markets, as the stock return dispersions for Finland, Sweden and Denmark do not follow a normal distribution.

Table 1

Descriptive statistics.

	Finland		Sweden	
	CSAD	R_m	CSAD	R_m
Mean	0,094	0,005	0,106	0,005
Median	0,069	0,016	0,068	0,021
Maximum	1,784	4,033	3,212	4,284
Minimum	0,000	-3,868	0,000	-3,822
Std.deviation	0,101	0,651	0,173	0,623
Skewness	4,989	-0,066	8,323	-0,005
Kurtosis	60,077	3,842	106,507	4,908
N	2766	2766	2765	2765
	Denmark			
	CSAD	R_m		
Mean	0,177	0,013		
Median	0,128	0,036		
Maximum	2,415	4,124		
Minimum	0,000	-5,091		
Std.deviation	0,189	0,591		
Skewness	3,654	-0,251		
Kurtosis	24,347	6,099		
N	2751	2751		

This table lists descriptive statistics of daily, equally weighted cross-sectional absolute deviations (CSAD) and daily market returns (R_m) for Finland, Sweden and Denmark. The time period is 1/1/2007-31/12/2017

Figure 2. represents the historical stock market development for the chosen time period of 2007-2018. The selected time period includes huge market shocks in form of the Financial Crisis and the Euro Crisis. These two occurrences can be seen as drops in all of the three markets in 2008 and 2011. The proximity and similarity of the markets can be

seen in the index developments of the three stock indices. From a swift assessment and analysis, it can be seen that all the three markets experienced similar although not perfectly parallel comovements and fluctuations. Denmark experienced the greatest surge for the entire time period and Finland experienced the steepest decline during the Financial Crisis. Moreover, the Euro Crisis of 2012 affected Finland more severely, which could have been caused by Finland being the only country to have euros as the local currency. The findings of Figure 2 suggest that Denmark recovered from the Financial Crisis faster and was less affected by the Euro Crisis than the other two markets. Denmark's immunity to international financial shocks and the ability to recover from them quickly will be interesting to compare to herding behaviour in the next chapter of the study. Can Denmark prove to be immune to such a market anomaly as well? Comparatively, if this argument is made, Finland, who experienced the greatest decline, should be more susceptible to herding than the other two markets.



Figure 2. Historical index developments for OMXH25, OMXS30 and OMXC20

Figures 3 and 4 show the relationship of CSAD and stock market return for the three stock indices. Figure 3 displays the relationship for the entire time period and Figure 4 displays the linearity or nonlinearity of the relationship. A nonlinear relationship between the individual dispersions and the stock returns would indicate market-wide herding. Figure 3 demonstrates that the Finnish and Danish stock indices seem to have proportionate and linear fluctuations in CSAD and the index return. This can be seen as simultaneous movements in both measures across the time period. Interestingly for Sweden, a stark rise in the CSAD measure seems to anticipate large index fluctuations. Evidence from this can be seen especially in the years 2008 and 2001 where the CSAD measure rises before fluctuations in stock returns. Denmark has the most proportionate movements between the two measures suggesting that the Danish stock market experiences the lowest levels of herding.

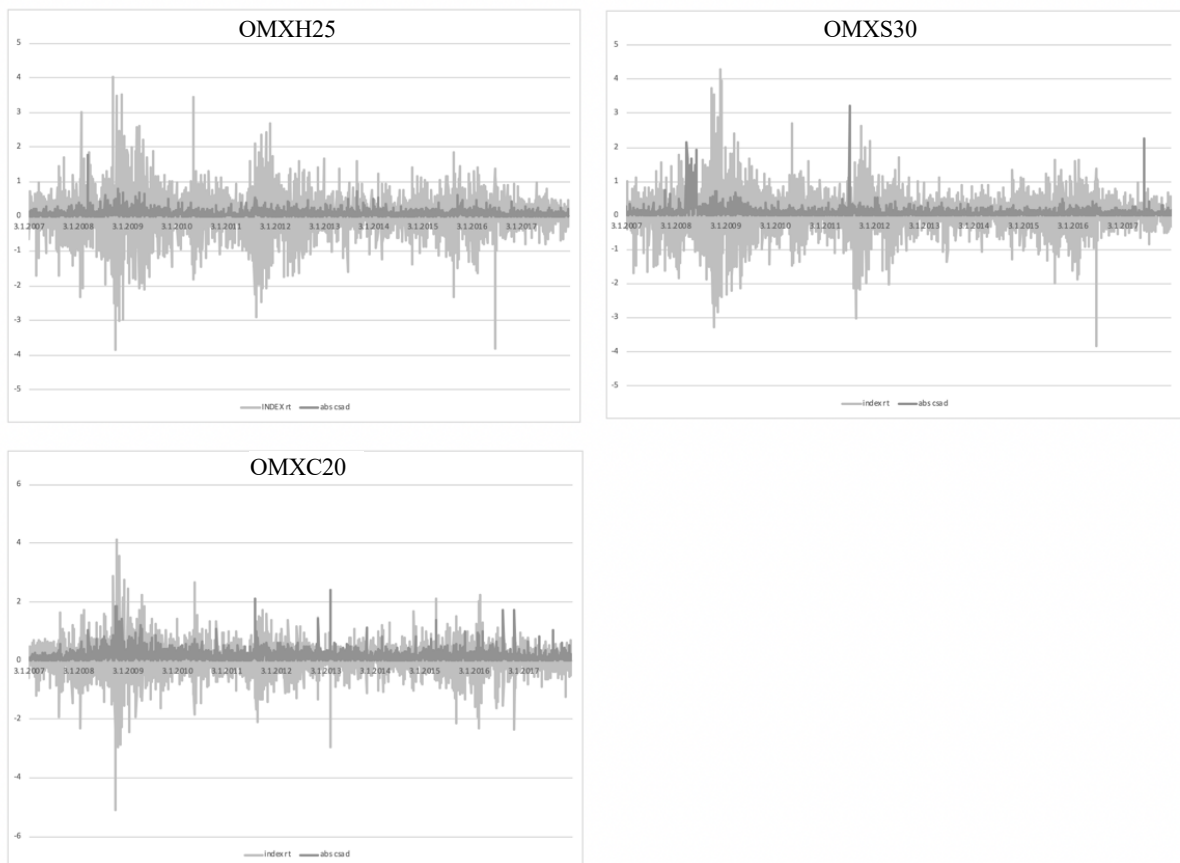


Figure 3. Relationship between CSAD and stock returns for the time period

Figure 4 demonstrates that the relationship between the cross-sectional absolute deviation and the different stock index returns. Denmark clearly demonstrates a linear relationship, again suggesting that herding does not occur on the market. Sweden and Finland however do not seem to have a linear relationship between cross-sectional absolute deviations and the stock index returns. Sweden especially shows a larger dispersion suggesting that it is the most susceptible market to experience herding.

In regard to the descriptive data alone, it is evident that the three markets chosen for this study react differently to market movements and have varying stock returns and stock returns dispersions. This will make interpreting and examining the empirical results of the next chapter more interesting and intriguing. The varying results of this chapter and the difference of descriptive data should translate into differences between herding in the Finnish, Swedish and Danish markets.

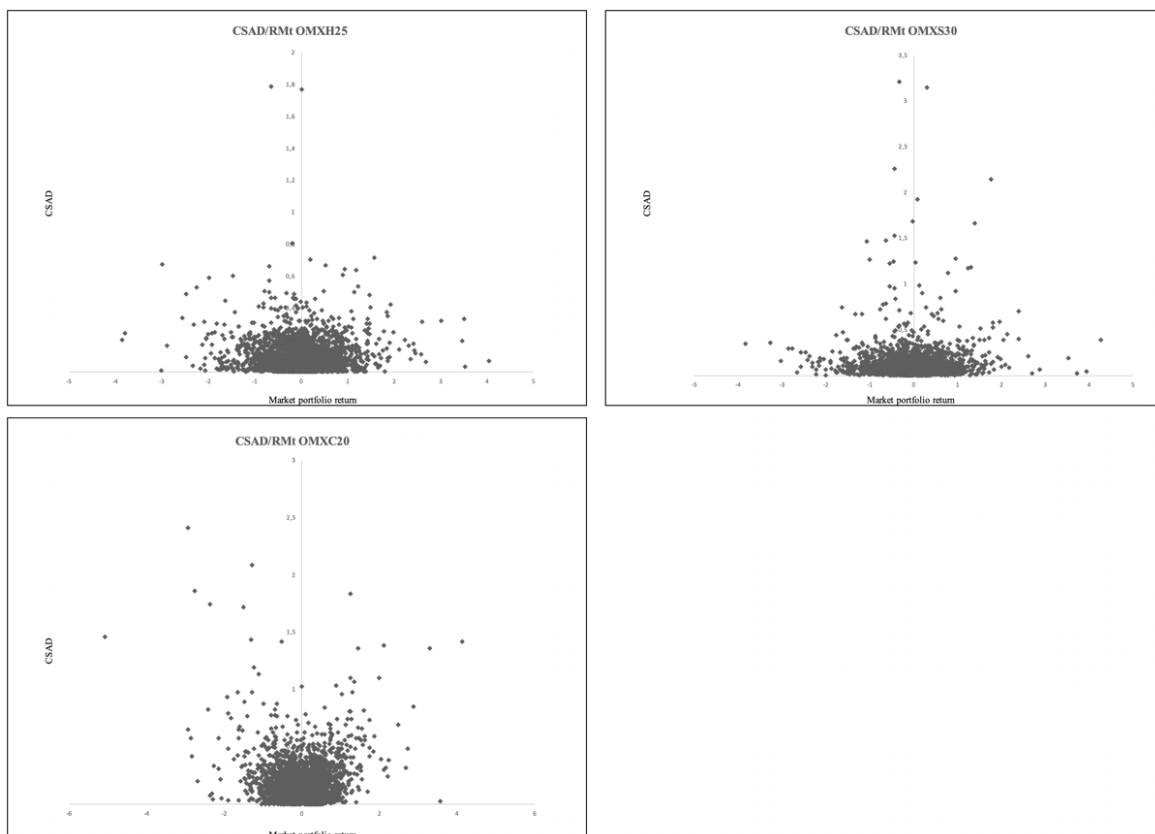


Figure 4. Relationship between CSAD and stock returns

8. EMPIRICAL RESULTS

This section presents the results of the estimated regressions. These results will then be used to inspect hypotheses H1-H4 and further utilised to either accept or reject them as per market separately within each subchapter. The results of each regression estimates will be split into separate subchapters in order to inspect the results for each hypothesis more deliberately and meticulously. The first subchapter will inspect herding across the entire sample period of 2007-2018. The second chapter will assess herding for separate years during the sample period and the third chapter will examine herding during various market conditions in up- and down-market days. Lastly, the fourth chapter will assess if the selected markets herd around the US or German market.

8.1. Herding across the entire sample period for separate markets

Table 2 displays the results for herding during entire sample period for the separate markets of Finland, Sweden and Denmark. Equations (6) and (7) and utilised to obtain the regression results. As mentioned afore, the coefficient γ_3 is the variable of interest, where a negative and statistically significant value indicates the presence of market-wide herding.

According to the results of Table 2 none of the selected markets display market-wide herding. This would suggest that investors in all markets don't ignore the individual characteristics of stocks and additionally do not blindly follow the market performance. Sweden is the only market to even display a negative value, but it is still insignificant. Previous studies have also reached mixed results, and thus the results here are not surprising. The results are consistent with some prior studies but also inconsistent with others.

Consistent results and evidence derive from at least Saastamoinen (2008), Chiang et al. (2000) and Henker et al. (2006), who found no market-wide herding in advanced and

developed markets. Conversely however, many studies have indeed found market-wide herding in Nordic and developed markets (Chiang and Zheng 2010; Hwang and Salmon 2004; Lindhe 2012). Some of the inconsistencies could be explained with the difference in data and the sample period. None of studies mentioned in this paragraph utilised data from the three indices chosen for this particular study. However, what is interesting and surprising is that the results are only partially consistent with results from Mobarek et al. (2014).

Table 2

Regression estimates of herding behaviour 2007-2018

	γ_0	γ_1	γ_2	γ_3
Market				
Finland	0,077 *** (23,163)	-0,003 (-1,032)	0,035 *** (4,042)	0,003 (0,695)
Sweden	0,076 *** (13,700)	0,004 (0,797)	0,077 *** (5,088)	-0,009 (-1,333)
Denmark	0,106 *** (19,827)	0,005 (0,909)	0,145 *** (10,107)	0,033 *** (5,479)
	<u>Adj. R²</u>			
Finland	0,034			
Sweden	0,023			
Denmark	0,228			

This table reports the estimated coefficients for the model Eq. (6) and (7). The sample period is 1/1/2007 – 31/12/2017.

A negative and statistically significant γ_3 represents herding

The T-statistics are reported in parentheses.

* Statistical significant at the 10% level.

** Statistical significant at the 5% level.

*** Statistical significant at the 1% level.

Of all the studies mentioned in chapter 5, the study of Mobarek et al. (2014) was the only one that obtained data from the same indices as this study. Their results displayed significant market-wide herding in the Finnish market (statistically significant at the 10%

level). Remarkably their study did not find market-wide herding occurring on Swedish or Danish markets. An explanation to the partially inconsistent results might lie in the selected sample period for both studies. Mobarek et al. (2014) had a sample period of 2001-2012 and this study inspected the time period of 2007-2018. This could suggestively indicate that all Nordic markets have developed and become more efficient as time has passed. Investors don't abandon their initial vision but still assess individual stocks and don't follow the performance of the market.

The results displayed in Table 2 reject the first hypothesis, which stated that herding occurs in the Finnish, Swedish and Danish stock markets for the entire sample period. None of the markets displayed significant herding during the time span of 2007-2018. What will be intriguing to inspect are the results for the separate subsamples, where each year of the entire sample period is assessed separately.

8.2. Herding across separate yearly subsamples

Table 3 displays the results for the regression estimates of herding for separate years of the entire sample period. Equations (6) and (7) and utilised to obtain the regression results. As for Table 2 the coefficient γ_3 is the variable of interest, where a negative and statistically significant value still indicates the presence of market-wide herding. This method allows the study to obtain results for individual years and to see if herding is more pronounced in periods of large market fluctuations, for example the Financial Crisis of 2008 or the Euro Crisis of 2012. Furthermore, Christie and Huang (1995) suggested that herding would be more intensive during turbulent conditions or periods of market stress.

From results obtained from Table 3, it can be seen that there is only one negative and statistically significant finding. According to the regression results, Sweden displayed market-wide herding in 2013. All other years for all of the selected markets do not display significant herding for separate years. What is noteworthy, is that the results indicate that during the Financial crisis in 2007 and 2008, Finland and Sweden display negative coefficients although they are insignificant. Additionally, Finland individually displays

Table 3

Regression estimates of herding behaviour, divided into yearly subperiods between the years 2007-2018

Market	Finland	Sweden	Denmark
	γ_3	γ_3	γ_3
2007	-0,007 (-0,318)	-0,007 (-0,215)	0,023 (0,773)
2008	-0,003 (-0,203)	-0,030 (-1,124)	0,030 ** (2,064)
2009	0,030 (1,564)	0,032 (1,481)	0,027 (0,778)
2010	-0,002 (-0,161)	-0,021 (-1,423)	-0,036 (-1,151)
2011	0,010 (0,800)	0,008 (0,200)	0,033 (0,600)
2012	-0,038 (-1,498)	0,000 (-0,015)	0,451 *** (5,040)
2013	0,132 *** (3,131)	-0,086 * (-1,685)	0,247 *** (9,013)
2014	0,032 (0,742)	-0,044 (-1,101)	0,030 (0,477)
2015	0,014 (0,619)	0,003 (0,129)	0,192 *** (5,078)
2016	0,000 (0,040)	0,017 * (1,926)	0,121 *** (3,424)
2017	-0,003 (-0,036)	0,022 (0,010)	0,224 * (1,911)

This table reports the estimated coefficients for the model Eq. (6) and (7).

The sample period is split yearly periods of 1/1/200x – 31/12/200x

A negative and statistically significant γ_3 represents herding

The T-statistics are reported in parentheses.

* Statistical significant at the 10% level.

** Statistical significant at the 5% level.

*** Statistical significant at the 1% level.

an insignificant variable for 2012 during the Euro crisis. It must be stressed that these findings are insignificant, but they could provide at least some minor proof of investors tending more towards herding in turbulent bear-market conditions than in stable or bull-market conditions.

Further minor evidence of consistent results come from the prior studies of Ohlson (2010) and Lindhe (2012), whom also obtained results for separate years. Neither found market-wide herding occurring during the overlapping time periods with this study. In this sense the results here are not a surprise but rather expected. In addition, the results here are also consistent with the previous results of this study, where Finland and Denmark displayed no market-wide herding and where Sweden was the only market to display some tendency towards herding during the entire sample period.

With regression estimates and results obtained from Table 3 we accept the second hypotheses for Sweden but reject it for Finland and Denmark. The hypothesis stated that herding occurs differently in different subperiods in the Finnish, Swedish and Danish stock markets. Herding only occurred significantly differently in Sweden for the year 2013. For the other markets market-wide herding was not seen in separate years. Thus, the markets of Finland and Denmark perform consistently and indifferently in regard to herding during separate years during the time period of 2007-2018.

Many prior studies have inspected the asymmetry of herding in up- and down-market days (Saastamoinen, 2008; Mobarek et al., 2014). The next chapter will assess herding during these different market conditions. So far only Sweden has displayed market-wide herding occurring during the sample period of 2007-2018 and thus it should be curious to see if the results change.

8.3. Herding in up- and down-markets

Table 4 displays the results for the regression estimates of herding during rising and declining markets during 2007-2018 for the selected markets. The equation (8) is applied

to this method. The coefficients of interest in regard to herding are γ_3 and γ_4 . A negative and significant coefficient γ_3 is consistent with herding occurring during up-market days and a negative and significant coefficient γ_4 is consistent with herding occurring during down-market days.

Table 4
Estimates of herding behaviour in rising and declining markets, 2007-2018

Panel A – Regression estimates						
Market	γ_0	γ_1	γ_2	γ_3	γ_4	Adj. R^2
Finland	0,077 *** (23,166)	0,035 *** (3,420)	-0,036 *** (-3,381)	0,001 (0,228)	0,005 (0,893)	0,034
Sweden	0,076 *** (13,544)	0,074 *** (4,325)	-0,086 *** (-4,539)	-0,004 (-0,482)	-0,018 * (-1,827)	0,023
Denmark	0,105 *** (19,641)	0,161 *** (9,100)	-0,133 *** (-8,105)	0,025 *** (2,878)	0,038 *** (5,268)	0,229
Panel B – Test equality of herding coefficients between up and down markets, $\gamma_3 = \gamma_4$						
Market	γ_3	γ_4	Difference	Chi-square	p-value	
Finland	0,001	0,005	-0,004	0,9999	0,3173	
Sweden	-0,004	-0,018	0,014	0,9997	0,3174	
Denmark	0,025	0,038	-0,013	0,9996	0,3174	

This table reports the estimated coefficients for the model Eq. (8).

The sample period is 1/1/2007 – 31/12/2017.

A negative and statistically significant γ_3 represents herding in up-markets

A negative and statistically significant γ_4 represents herding in down-markets

The T-statistics are reported in parentheses.

* Statistical significant at the 10% level.

** Statistical significant at the 5% level.

*** Statistical significant at the 1% level.

The results obtained from Table 4 demonstrate the same consistent results as previous findings of this study. The results are similar for all the selected markets, where Denmark and Finland do not display market-wide herding. Table 4 results display that again only Sweden displays market-wide herding. From the results of regression estimates, Sweden displays market-wide herding occurring more probably on down-market days. Panel B represents the results from a conducted Wald test to examine the equality of herding coefficients and to see whether there is significant asymmetry in herding in the tested markets. The hypothesis tested is $\gamma_3 = \gamma_4$. Asymmetry would be consistent with a negative

and statistically significant value in the difference between γ_3 and γ_4 . The results displayed in Panel B show that there is no significant asymmetry in herding in either of the three markets. The results are consistent with Chiang and Zheng (2010), who also found no herding asymmetry in advanced markets. Notably all selected countries display similar results from the Wald test. Further examination should be conducted in the future to verify whether or not the results are robust for the equality of herding coefficients.

The result consistencies in comparison to previous studies are mixed. Saastamoinen (2008) found evidence of herding occurring during up-market days in Finland. Mobarek et al. (2014) found evidence for herding behaviour during down-market days for Finland and Sweden. Alas, the study does have consistent results for Sweden but inconsistent results for Finland when comparing to previous studies. The difference in results could be explained by both the difference in sample period and difference of used data for Saastamoinen (2008). Interestingly Chiang and Zheng (2010) found no asymmetry of herd behaviour for developed markets. This would suggest that Sweden is not seen as a developed or advanced market in regard to herd behaviour asymmetry, but the other two selected markets are. Mobarek et al. (2014) provide that another explanation to this phenomenon might be the panic reaction of Swedish investors. This behavioural characteristic of investors could suggest that Swedish investors stress and panic during declining markets and abandon separate stock assessments and tend to follow the market performance. This herding behaviour could be caused by the unintentional panicky reaction or due to a variety of rational reasons, for example reputational loss which was explained in lengthy detail in chapter 2 of this study.

In regard to the third hypothesis “Herding behaviour occurs differently in rising and declining market conditions across different markets” it can be said that the third hypothesis is rejected for Finland and Denmark who displayed no asymmetry in declining or rising market conditions. Both countries displayed insignificant herding in up- and down-market days. Conversely Sweden displayed herding behaviour in down-market days and thus the third hypothesis is accepted for Sweden.

8.4. Herding around US and European markets

Table 5

The influence of the US and German markets on cross-country herding, 2007-2018

Panel A – Influence of the US						
Market	γ_3		γ_4		γ_5	Adj. R^2
Finland	-0,003 (-0,766)		0,266 ** (2,246)		0,012 *** (6,129)	0,058
Sweden	-0,011 * (-1,695)		0,671 *** (2,737)		0,008 ** (2,180)	0,029
Denmark	0,032 *** (5,345)		1,858 *** (11,340)		-0,013 *** (-3,979)	0,265
Panel B – Influence of Germany						
Market	γ_3		γ_4		γ_5	Adj. R^2
Finland	-0,004 (-1,040)		1,795 *** (9,618)		0,006 ** (2,335)	0,076
Sweden	-0,004 (-0,484)		1,267 *** (3,332)		-0,006 (-1,380)	0,027
Denmark	0,041 *** (6,624)		2,822 *** (13,347)		-0,023 *** (-6,793)	0,281

This table reports the estimated coefficients for the model Eq. (9) and (10).

The sample period is 1/1/2007 – 31/12/2017.

A negative and statistically significant γ_3 represents market-wide herding

A positive and statistically significant γ_4 represents that stock return dispersions from the US and Germany influence Nordic markets

A negative and statistically significant γ_5 represents that Nordic countries herd around the US or German market

The T-statistics are reported in parentheses.

* Statistical significant at the 10% level.

** Statistical significant at the 5% level.

*** Statistical significant at the 1% level.

Motivated by prior studies (Chiang and Zheng 2010; Mobarek et al. 2014, etc.), it is also examined here whether or not the selected Nordic markets herd around larger markets. The influence of US and German markets on the three Nordic markets are introduced to the regression separately and according to equations (9) and (10) respectfully. Table 5 displays the results for the regression estimates of herding around the US and German markets for Finland, Sweden and Denmark.

A negative and statistically significant coefficient γ_3 displays market wide herding occurring for the examined markets. Only Sweden displays significant herding, when the influence of the US market is added to the regression. The results are consistent with evidence gathered in this study, where Sweden has been the only market to show signs of herding. Finland or Denmark still continue to not show market-wide herding happening when taking into account the influence of bigger markets.

Results displayed in Table 5 demonstrate that stock return dispersions from the US and Germany have a highly significant effect on all Nordic markets. The coefficient γ_4 is positive and statistically significant for all markets at least at a 5% significance level. Hence, all of three countries, Finland, Sweden and Denmark show evidence of market conditions from the US and Germany affecting their own local stock markets.

Interestingly only Denmark shows statistically significant evidence of herding around US and German markets. Table 5 displays that the coefficient γ_5 is negative and statistically significant for Denmark only. This study does find evidence of herding around US or German markets for Finland or Sweden. These results are partly consistent with the findings of Chiang and Zheng (2010), who recognised the importance of especially the US market internationally. Inconsistency with results arise from the findings from Finnish and Swedish markets, which do not seem to herd around bigger markets.

The fourth hypothesis assessed the impact of the US and German markets on Finland, Sweden and Denmark in regard to herding behaviour. The only market to show evidence of herding around an international market was Denmark and thus the fourth hypothesis is accepted for Denmark. The fourth hypothesis is rejected for Finland and Sweden as they

did not display evidence of significant herding around the markets of the US and Germany.

8.5. Herding results

The results here are mostly consistent for the entire study where Sweden has displayed characteristics of herding during the entire sample period. Sweden has also displayed herding during separate subsample periods and herding behaviour in down-market days. Sweden, however, did not display evidence of herding around international markets. This suggests that the first three hypotheses concerning herding are accepted for Sweden and the fourth hypothesis is rejected.

The results are partially consistent with Finland and Denmark, which have displayed no domestic herding occurring during the entire sample period. Neither of the markets have displayed herding in up- or down-market days or in separate years. Hence, all four of the hypotheses for this study are rejected for Finland. Denmark has displayed herding around the German and US market. Thus, the first three hypotheses are rejected for Denmark as it does not experience domestic herding, but the fourth hypothesis is accepted because Denmark does herd around international markets.

The next section will draw a conclusion for the entire paper and subjects discussed. Finally, the results will shortly be summed into seeing what contribution this paper provides.

9. CONCLUDING REMARKS

This paper's starting remark by Russell (1901) illustrates how the herd instinct and herding behaviour is a ferocious, primordial and in every aspect an animalistic act. This negative association of herding in regard to human behaviour is logical – why would anyone want to resemble an animal? It is arguable that especially an investor would not enjoy being compared to a blind sheep following a herd of other sheep. The objective of investing and partaking in the stock market is to many, at least to some degree, a game where you lose, or you win. How can then herding be a positive or dare say logical act?

The notion and occurrence of herding has been studied by countless different fields of science and research. In addition to the remarked economists in this study, a plethora of neurologists, psychologists and philosophers have studied the human behaviour of herding (Spyros 2014). The Finnish language has an extremely apt proverb in context of this study, which can loosely be translated into English to mean “*stupidity condenses in a group*”. Can this sentiment then be applied to the financial market? Does an individual investor often abandon his or her own ideas and decide to follow the group or market consensus, which in this regard would render and alter him into a stupid investor?

Conversely, the opposite may bare a truer image of a herding investor. An investor displaying herding behaviour may actually rather wittingly and rationally follow the common market consensus. An investor might see a definitive reputational hazard in acting against a common sentiment. He or she could also face an employment problem if the risk of repelling market consensus is realised. The division of herding established by Bikhchandi and Sharma (2001) and Spyros (2014) commendably explain this aspect of herding. Herding should not only be seen as a negative and bestial affair but rather also as a rational act of human intellect.

The study of herding was begun by Lakonishok et al. in 1992, when they assessed herding around fund manager behaviour. They found herding to exist intensely within small-cap companies, which could be explained by the lack of information from smaller companies.

Later the empirical framework for studying herding on stock markets was contrived by Christie and Huang (1995). Their method assessed herding by examining the standard deviation of returns. Their study consisted of assessing stock markets at high stress levels and when market fluctuations were elevated. The two researches could not find concrete and significant evidence of herding from the US stock market between the years 1925-1988. They concluded that investors followed the efficient market theory where asset pricing was correct.

Christie and Huang's (1995) empirical model was later expanded and arguably bettered by Chang et al. (2000), who saw the linearity of Christie and Huang's (1995) model to be, to at least some extent, flawed. Chang et al. (2000) added a nonlinear component to the model as they saw and suggested that levels of herding are not constant. Instead they stated that the levels of herding change exponentially in different market conditions. They reported evidence of emerging markets displaying significant intentional herding.

The model of Chang et al. (2000) has later been used by countless studies for a variety of reasons. It is easy to utilise, it can detect herding on varying market fluctuations and situation and not only in stable markets like the method employed by Christie and Huang (1995). Chiang and Zheng (2010) only slightly modified this method to include a variable for investor behaviour asymmetry. This method of Chiang and Zheng (2010) gives the researcher a better and great tool to assess herding in stock markets and it is also utilised in this study.

Another approach to investigate and examine herding was introduced by Hwang and Salmon (2004). They approached herding from an entirely different perspective. Hwang and Salmon (2004) examined the fluctuations in beta-coefficients between different market periods. Additionally, Hwang and Salmon (2004) defined herding in a novel way compared to other previous researchers. They argued that herding is the phenomenon or act of an investor following market indicators, for example macro-economic announcements, news coverage or earnings announcements to converge from his or her initial sentiment and follow a new market sentiment. Hwang and Salmon's (2004) study displayed the same evidence as Chang et al. (2000) where they found herding behaviour

in emerging markets. Moreover, Hwang and Salmon (2004) demonstrated that herding occurred during bull-markets and a significant but diminishing amount of herding occurred in bear-markets.

Evidently, proof of herding from core studies about herding is mixed. Most results are tied by the methodology chosen for the study and that makes most studies incomparable between each other. Some comparison can however be derived from analysing studies which utilised the same methodology. Not all obstacles are removed, because therein however lies a problem with the used data. Most studies utilise different data from different markets and this makes comparing and gathering consistent results hard and challenging.

The method employed in this study, the Chiang and Huang (2010) nonlinear method, has luckily been used as the main model to assess herding in the Nordic countries (Finland, Sweden, Denmark, Norway). Most of these studies are however masters' theses and only provide minor proof. Even so in having the same methodology, the results are still inconclusive and make a decisive verdict impossible to reach. This of course could be simply explained by the difference in datasets as apparently no study has had exactly the same data than another study. Additionally, studies have seemed to disregard the Danish and Norwegian markets as only a handful of studies could be found for this paper. Even this study failed to find comparable data of the Norwegian market in order to utilise it for the Nordic section of the study. Now only Finland, Sweden and Denmark were included in this study.

The previous studies discussed in this paper concerning the Finnish stock market consist of Saastamoinen (2008) and Mobarek et al. (2014). Further minor proof is given by a pair of masters' theses by Lindhe (2012) and Rissanen (2015). These previous studies, with exception of Rissanen (2015), suggest that some herding can be found on the Finnish stock market. Rissanen (2015) was however the only one to employ the beta coefficient model.

This paper did not use the beta-coefficient model but the same model as most other studies for the Finnish stock market. What results from regression estimates suggest is that during the sample period of 2007-2018 from the OMXH25 index is that Finland does not experience herding. No herding could be found during the entire time period. Nor could it be found during individual years. Furthermore, herding behaviour was not present for Finland during up- or down-market days separately and the results for herding were symmetric for both. The difference in data cannot be used as a sole explanation to this discrepancy. Mobarek et al. (2014) also used the OMXH25 index to assess herding in Finnish stock markets. What was different was the time period for their sample. Mobarek et al. (2014) used the sample period of 2001-2012, which is relatively earlier than the sample period of this study.

From inspecting the assembly of studies conducted in Finland it would seem that studies with sample periods from the early 2000's found evidence of herding in Finnish stock markets no matter which data or method was employed. Furthermore, later studies, which included data primarily from the 2010's and had separated it into individual years did not find evidence of herding after the year 2007. Mobarek et al. (2014) used the same dataset as this study and hence it truly is a shame and a pity that Mobarek et al. (2014) did not provide a separation of subsamples indicating herding during individual years. These results could have been compared with this study to see, if their results for detecting herding on the Finnish stock market derived from the early 2000's and whether or not there was lack of herding in the latter part of their sample period.

What this observation of herding occurring during the early 2000's could suggest, is that the Finnish stock market has developed during the 21st century and acts more accordingly to the efficient market theory, where anomalies and investor behaviours don't play as large a role as in previous years. This observation would be consistent with the findings of previous studies, although it must be remarked that comparison to earlier studies only provide minor evidence as some of them are indeed master's theses.

Studies conducted on other Nordic markets also have varying results. Again, it is noteworthy to mention that only a few studies have been carried out in the Danish and

Norwegian markets, and Norway was entirely secluded from this paper for the lack of data. Additionally, most studies conducted in Sweden have been master's theses and the results from them only provide minor evidence and do not bear significant weight in reaching a conclusion of herding occurring on the Nordic markets. But it is still interesting to see how the results of this study compare to other studies.

Mobarek et al. (2014) did not find herding occurring in Swedish or Danish markets for their sample period even though they utilised the same indices as this study. The result for regression estimates from this study are consistent with no herding occurring in Denmark for the entire sample period or for individual years and up- and down-markets. The lack of asymmetry between market conditions is consistent with the findings of Chiang and Zheng (2010) who suggest that advanced markets should not experience asymmetric herding. Denmark, additionally to herding, seemed to be immune to market shocks and recovered from crises more rapidly than the other two markets. Additional consistency and evidence with prior studies is derived from Denmark herding around international markets (Mobarek et al., 2014).

Where the results are not consistent are with Sweden. This study found that Sweden experienced herding during the sample period and specifically in 2013. Also, Sweden was more likely to experience herding in down-market days, which actually is consistent with the results of Mobarek et al. (2014) and other studies which suggest asymmetry between herding between declining and ascending markets (Tan et al., 2008; Ohlson, 2010). However, the asymmetry of herding between different market conditions was not significant, even though down-market days were more likely to experience herding. The partial difference in results could again be explained by the different sample periods as Mobarek et al. (2014) did not include the year 2013, where this study found that Sweden experienced significant herding. Further minor contradiction to the results come from the masters' theses of Ohlson (2010) and Lindhe (2012) who did not find herding occurring on Swedish markets.

9.1. Conclusion

To summarise herding behaviour is not consistent between Nordic markets and there is a difference between the three selected markets. Sweden was the only market to experience herding behaviour. This was especially displayed in 2013 and on down-market days. However, Denmark was the only market to display herding behaviour around international markets. Finland was the only market to not display herding under any of the tested regressions. The study's results are mostly consistent with studies conducted during a similar time period but inconsistent with studies during an earlier time period.

This study has contributed to the scientific community by providing further research on investor herding behaviour on the Nordic markets of Finland, Sweden and Denmark. It has provided novel findings especially in Sweden and gathered an important observation of detecting a possibly shift in herding behaviour as time has passed especially for the Finnish stock market.

With these findings, may the research for herding continue along with assessment of human behaviour and decision making.

9.2. Consideration for future research

Suggestions for future studies include utilising a longer sample period starting from the early 2000's and seeing the yearly results for herding. This could provide essential evidence in proving how herding behaviour has changed in the Nordic markets. Also, more extensive research should be conducted in Danish and Norwegian markets to create an encompassing view of the entire Nordic stock market in regard to herding.

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