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2017

Sectorial Herding: Evidence from the JSE

A research project submitted in partial fulfilment of the requirements for the degree of Master of Management in Finance and Investment at Wits Business School, University of the Witwatersrand

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Written for BUSA 7163

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Approved by:

Date 14 March 2017

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Prelude

Declaration



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Abstract

This study investigates the existence of herd behaviour within the Johannesburg Stock Exchange (JSE) and three sectorial indices using monthly closing prices for all shares listed on the JSE for the period 31 January 2003 to 31 May 2016. No evidence of herding was found on either the JSE or in any of its sectors during the sample period. Furthermore, no evidence of herding was found during bull and bear markets within the sample period.

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Key words and concepts

Bull and bear markets, Efficient Market Hypothesis, herd instinct, JSE.

Acronyms and Abbreviations

ADF	Augmented Dickey-Fuller
BP	Breusch Pagan
CAPM	Capital Asset Pricing Model
CCE	Central and Eastern European Countries
CSAD	Cross Sectional Absolute Deviation
CSSD	Cross Sectional Standard Deviation
CFTC	Commodity Futures Trading Commission
DW	Durban Watson
EMH	Efficient Market Hypothesis
EU	European Union
ETFs	Exchange Traded Funds
JB	Jarque-Bera
JSE	Johannesburg Stock Exchange
KPSS	Kwiatkowski-Phillips-Schmidt-Shin
MK	Mann Kendall
PFAs	Pension Fund Administrators
QFII	Qualified Foreign Institutional Investors

SA	South Africa
SARB	South African Reserve Bank
SAST	South African Standard Time
SEBS	School of Economic and Business Sciences
SIC	Schwarz Information Criterion
U.K.	United Kingdom
U.S.	United States of America
REIT	Real Estate Investment Trusts
TRACE	Trade Reporting and Compliance Engine
WBS	Wits Business School
WT	White test

Chapter 1 – Introduction

1.1 Introduction

The purpose of the study is to establish whether there is herding on the JSE and whether this herding is prevalent in bull or bear markets. In the literature and the media, herding is sometimes referred to as social learning, social interaction, peer pressure, neighbourhood effect, herd behaviour or behavioural herding.. In financial markets, herding is the propensity for market participants to trade in a similar way to that of their peers, regardless of whether such trades are rational or irrational, that in some cases they would have otherwise not taken (Devenow and Welch, 1996). By its very nature, herding has the tendency to increase volatility within markets, increasing the risk of stock market bubbles and crashes. Investors/traders that exhibit herding behaviour generally make systematically flawed trades by copying the actions of other traders over a given period. This often results in asset price bubbles and depressions (Seetharam and Britten, 2013), exposing investors/traders to significant market risk. Hence, it is paramount for investors and traders to establish if they are dealing with a market that exhibits herd behaviour and under what market conditions they can expect to find it. Herding is very common in global financial markets and this study hopes to establish if there is evidence of it within the JSE.

Evidence of herding in Africa is sparse, however, in South Africa, Gilmour and Smit (2002), found evidence of herding in both bear and bull market conditions whereas Seetharam and Britten (2013) found herding in South Africa's stock market to be only present in the bear market. Two years later, Niyitegeka and Tewari (2015) found evidence that herding behaviour was only present in the bull market.. This study hopes to update these studies and obtain another snapshot of how herding behaviour has evolved within the JSE and three of its main sectors. Herding is a widespread phenomenon throughout global markets. Evidence of it has been spotted in the financial markets of both developed economies and emerging markets. Galariotis, Rong and Spyrou (2015), found evidence of both intentional and spurious herding practised by investors in the United States of America (U.S.) during different crises periods. Moreover, the same study found evidence of spurious herding in both the United Kingdom (U.K.) and the European Union's (E.U.) bond markets. Kremer and Nautz (2013) found evidence of unintentional institutional herding in Germany's stock market and Holmes, Kallinterakis and Ferreira (2013) found evidence of intentional herding in the Portuguese stock market. Similarly, Rahman, Chowshurry and Sadique (2015), found

evidence of intentional herding in the Saudi stock market and Gavriilidisa, Kallinterakis, and Ferreira (2013) found evidence of intentional institutional herding in most sectors of the Spanish market.

1.2 Background to the study

There are two types of herding - intentional and spurious herding. Intentional herding is the practice of basing one's investment or stock picking strategy on what other traders are doing within a market, for instance, buying into the JSE simply because other prominent traders have bought into the JSE and not necessarily because the JSE has good fundamentals. Like a Ponzi-scheme, such behaviour is extremely profitable for first movers but may cause significant losses to late movers. Evidence of intentional herding is most prevalent when stocks, indices or markets are either elevated or depressed beyond certain psychological thresholds. Spurious herding, on the other hand, is when several market players independently arrive at the same trading decisions (possibly because they have access to the same information and are processing it with the same risk models) and trade financial assets in unison. Such trading patterns then cause extreme swings in asset prices which add new information to the market, causing more trades that exacerbate price swings (for example when asset prices breach price floors and ceilings). Both types of herding have similar results and financial assets are often mispriced.

Bikhchandani and Sharma (2000) assert that one is more likely to observe herding when looking at the trading of an asset or an asset class where the traders involved can see each other's trades and they are restricted by similar problems such as liquidity and poor regulation. In such a scenario, those that are herding are merely anchoring themselves to the investment analysis and decisions of competitors. One may reasonably expect to find herding in all economic and business sectors (Cakan, 2015; Demirera, Kutana and Chen, 2010). Angela-Maria, Maria and Miruna (2015) investigated the herd behaviour of investors across five Central and Eastern European Countries (CCE) - Bulgaria, Czech Republic, Hungary, Poland and Romania – and in five industry-groups including banks, construction, oil and gas, other financials, pharmaceuticals and hotels. Herding was present in a few industrial sectors, mainly under low market volatility. Herding was detected on the Bulgarian Stock Exchange under low market volatility in the oil and gas sector – as well as in high volatility conditions within the banking and pharmaceutical sectors. This reaffirms past evidence that herding takes place in all business sectors.

A great deal of finance literature has identified, measured and established that herding does in fact exist. However, there is still debate on the causes as to why it exists. Some researchers for instance, Lakanishok, Shleifer and Vishny (1992), believe that market players exhibit herding behaviour out of fear, thus taking incorrect investment decisions on their own. Banerjee (1992) and Bikhchandani, Hirshleifer and Welch (1992), believe herding behaviour can be explained by informational cascades. They reasoned that market players pay attention to the trading decisions of the people preceding them as they may have additional information. Whilst there may be rational reasons for herding, it does not preclude it from being dangerous to financial markets. In the short-run, if the deviations that are caused by herding are not corrected by market forces or the regulatory authorities, herding may lead to greater financial instability; and exacerbate crises and inefficiency, hence exposing investors and or traders to huge losses.

This study seeks to establish if there was any herding behaviour within the JSE and three of its main sectors during the period starting from 31 May 2003 until 31 May 2016. This research period encompasses both bull and bear markets, making it possible to investigate the relationship between the market condition and the herding tendencies.

1.3 Problem Statement

Herding is a market distorting behaviour that is prevalent throughout both advanced and developing economies. The negative impact of herding on the market includes asset bubbles, erosion of investor confidence, asset mispricing, and distortion of market fundamentals. Thus, herd behaviour undermines financial markets and poses existential risk to the modern economy. It is important that both market players and regulators determine if their markets exhibit herding behaviour to ensure that the right responses are taken. Unfortunately, for traders, investors and regulators on the JSE, the most recent study on establishing and characterising herding on the South African stock market is just over two years old now, and in the fast-paced world of stock markets, is becoming ever more outdated. This study seeks to address that problem. Primarily, it seeks to provide market participants with an up to date market characterisation of herding on the JSE and some of its biggest sectors.

1.4 Research objectives

The following research objectives are central to this thesis:

- To investigate the existence of herding in various economic sectors on the JSE; and

- To investigate the impact of market conditions (bull and bear) on herding in various economic sectors within the JSE.

1.5 Significance of the study

Per the JSE, just under ZAR 700 billion worth (about US$ 53 billion) of equities are traded on the JSE every month.[1] This represents about 15% of the annual South African Gross Domestic Product and is thus a significant amount of money in the economy indeed. Should there be herding that causes a mispricing of just 1% which is about ZAR7 billion of investors' and savers' money would be lost in the impending correction. Thus, it is extremely important and valuable that market participants fully understand herding within any market and how it affects them.

Several studies have attempted to shed more light on the existence and characteristics of herd behaviour on the JSE. This study builds upon these studies by updating the results obtained in some studies and by adding additional dimensions to the body of knowledge that characterises herd behaviour on the JSE. Gilmour and Smit (2002), Sarpong and Sibanda (2014) and Seetharam and Britten (2013)'s studies are excellent resources in learning more about particular elements of herding in South Africa (see section 2.5.1 for more details on these studies). This study adds to this body of knowledge by using higher frequency data and a more general approach to investigating herd behaviour (i.e. analysing herd behaviour amongst all market participants as opposed to only mutual fund managers or institutional investors as in the aforementioned studies). Special mention is made of Niyitegeka and Tewari (2015)'s study on herd behaviour at the JSE. This study will directly compliment that study by using a different research methodology to confirm the results in that study and to expand on their investigation by looking for the existence of herding in particular sectors within the JSE. Niyitegeka and Tewari (2015) discovered that herd effects are short-lived. These results are complimented by those of this study that find no evidence of herding when one looks at monthly price data. Thus, only high frequency traders on the JSE need worry about the effects of herd behaviour.

[1] The quoted and the latest market statistics are available on https://www.jse.co.za/services/market-data/market-statistics

1.6 Benefits of the Study

Understanding herd behaviour within any market is extremely important. When investors trade in markets that exhibit herd behaviour, their risk of significant market losses is greater than in markets that do not exhibit herd behaviour. This is because, in the short-run, when traders herd, they often force prices to deviate from fundamental values, causing instability and inefficiency in the market in the long run. (Kremer et al., 2013).

This study will help policymakers to identify which sectors on the JSE are prone to herd behaviour. Thus, policymakers will be able to formulate appropriate policies that will help to prevent herd behaviour on the JSE. Jitka and Haoran (2015) found that herd behaviour in China decreased after a series of stock-market regulations were introduced in 2006 by the China Securities Regulatory Commission. This indicates that herd behaviour can be curbed with the introduction of appropriate policies. Since herding behaviour can affect the stability and volatility of stock markets and in turn returns to investors, this study will benefit domestic and foreign institutional investors as well as individual investors in understanding the consequences associated with herding as well as to formulate appropriate investment strategies.

Additionally, Sarpong and Sibanda (2014) provided empirical evidence that herd funds tend to underperform contrarian funds on the JSE. This study will also help risk managers to tailor their risk models to accommodate the existence (or non-existence) of the presence of herding. Risk managers will thus be able to limit the impact of their use of similar risk models and thus prevent making risk management decisions that are adverse.

1.7 A Synopsis of the Research Method

This quantitative study will be conducted using monthly sectorial indices returns, JSE all share returns and individual stock data. The methodologies that will be used to detect herding will be those developed by Christie and Huang (1995) and Chang, Cheng, and Khorana (2000). These models focus on herding that occurs throughout an entire market or sector i.e. when people herd into or out of an index, tracking an entire market. Both methodologies are based on cross-sectional dispersion to detect herding toward the market index. The following hypotheses are going to be investigated:

- $H_{0,a}$: Market-wide herding behaviour does not exist within the JSE.
- $H_{0,b}$: Sector-wide herding behaviour exists within the industrials, financials and resources sectors.

- $H_{0,c}$: Market-wide herding behaviour does not exist within the JSE during bull and/or bear markets
- $H_{0,b}$: Sector-wide herding behaviour exists within the industrials, financials and resources sectors during bull and/or bear markets

Additional detail on research methodologies is given in Section 3.1.

1.8 Organisation of the thesis

The thesis is divided into five chapters. Chapter 1 provides the background of the study, research problem and research objectives. Chapter 2 presents the extant literature and reviews theories underlying herding in the financial market, herding methodologies, market participants and herding behaviour, and herding in financial markets. The chapter concludes by discussing the consequences of herding and it summarises the key findings of the literature review. Chapter 3 presents the research design and methodologies. The chapter describes the chosen approach to the research topic in terms of basic considerations of methodology and epistemology. The methodologies developed by Christie and Huang (1995) and Chang et al. (2000), were chosen to detect herding in the South African market. The sampling strategy, data collection instruments, and data analysis, will also be discussed in this chapter. Chapter 4 presents the results and Chapter 5 discusses the findings and concludes the thesis.

1.9 Chapter Summary

In this chapter, the thesis was introduced. A brief discussion of the background and the objectives of the study are presented. This is followed by a discussion of the benefits of the study. Here, it is established that the study will be of significant economic value to market participants and stakeholders. Chapter 1 also informs us that the research methodology employed by the study was first introduced by Christie and Huang (1995) and concludes by showing how the thesis will be organised. Chapter 2 builds upon this introduction by expanding on the background of the thesis. A comprehensive literature review including, but not limited to the theories behind what herding is and how it is measured, is presented. Most notably, chapter 2 also presents the results of other similar studies, clearly showing where this study fits in the overall body of knowledge on this topic.

Chapter 2 – Literature Review

2.1 Introduction

This chapter reviews the literature on herd behaviour. The chapter is organised as follows: Section 2.2 presents the literature on the theories of herding, Section 2.3 discusses the methods of measuring herding.

2.2 Theories of Herding

To explain why herding exists, Demirera et al. (2010), theorised that herding can be subdivided into the following categories; psychology-related herding, information-driven herding and principal-agent relationship herding.

2.2.1 Psychology-related herding

Psychology related herding is when traders, or any individual, is psychologically pressured into making decisions that do not necessarily maximise their utility but conform with the actions of their peers. For example, a lot of people love certain cars, not because they are fuel efficient, fast or just better for them, but because they are popular or driven by their role models. Similarly, people wear certain clothes because they have seen them in the media. People adjust their behaviour to the behaviour of other people in their social environment or to models provided by the mass media (Cynamon and Fazzari, 2008). Such psychological herd behaviour has been shown to increase in stressful environments or in environments in which some participants may not have enough (or as much as their peers) information to make decisions (Fenzl, Brudermann, Malik and Pelzmann, 2013). Financial markets are riddled with optimistic, non-sophisticated traders who follow other traders' behaviour. These traders are joined by pessimistic traders who easily change their attitudes and become optimistic, resulting in a contagion of sentiment (Lux, 2015). In so doing, market participants feel a false sense of security that is dangerous and which may cause financial market instability (Devenow and Welch, 1996).

2.2.2 Information-driven herding theory

Access to information is not free and in some cases, can be prohibitively expensive. Thus, in any financial market, there are two types of traders; sophisticated traders with access to the best information on market fundamentals and 'simple' traders without this access. Simple traders often observe and mimic the actions of sophisticated traders to compensate for their

information disadvantage and as such these traders act, based on what they observe in the market. This results in information-related herding. Per the information-related herding theory, the actions of more informed traders are considered by the market to reveal useful information which may not be accessible to an individual investor (Banerjee, 1992). Bikhchandani et al. (1992) and Shiller (2002) note that other individuals ignore their own information and follow the decisions of other investors that are considered superior mavens. In this regard, information is the driving force in herding.

2.2.3 Principal-agent relationship

Herding behaviour is currently unpredictable and thus, the price distortions that they cause may last longer than anyone expects. Investment managers and any market participant that is remunerated for the returns achieved during a pre-defined period, have the incentive to "ride herds" (i.e. buy into assets that they know are overpriced but believe will go up due to signs of herding), just so they can lock in their end-of-year bonuses. Furthermore, the unpredictability of herding behaviour discourages managers from trading against a "herd" (i.e. short-sell an overpriced asset) as they may incur deep losses before the prices rationalise. Such behaviour is extremely dangerous for investors and it significantly reduces the risk adjusted returns of investors (Scharfstein and Stein, 1990).

2.3 Measuring herding in Financial Markets

There are two main types of methodologies which are currently used to measure just how much herding is within a certain market. The first method analyses how trading volumes change and compares it to how they should have changed had trading been conducted in a market with no herding (Lakonishok et al., 1992; Wermers, 1995). To practically do this, Lakonishok et al. (1992) developed a metric that measures the propensity of traders to trade particular financial assets at the same time, parallel to what they should have had they all been making independent decisions. Later, Wermers (1999) improved this methodology and proposed a new way of measuring herding, famously known as the portfolio-change measure of correlated trading. Wermers' (1999) methodology simply analysed how investors changed their portfolio weights to measure herding. In particular, the methodology tracks to what degree portfolio managers change their portfolio weights similarly. However, Wermers' (1999) methodology has been widely criticised for yielding only results based on spurious herding.

The other set of methodologies focuses on herding into or out of entire markets or sectors. They attempt to capture how all participants collectively behave and are particularly useful to passive investors that just buy indices. These measures are primarily based on the cross-sectional dispersion of asset returns and are often calculated by determining just how disperse asset returns are from the market or sector index that these assets are a part of.

The first of these is the methodology proposed by Christie et al. (1995). The methodology assumes that herding is a function of the market condition and thus to detect herding one needs to observe how the dispersion of asset returns changes as markets move from normal conditions to extreme conditions. Christie et al. (1995) used cross sectional standard deviation (CSSD) of individual stock returns to measure just how clustered asset returns were to around the market aggregate. Christie et al. (1995) claimed that during periods of large price movements, individual investors may herd by basing their trading decisions on the behaviour of the market. If indeed, individual investors do herd, individual stock returns will cluster closely to the return of the market (cross-sectional dispersion of returns is predicted to be low in the presence of herding behaviour by investors). Chang et al. (2000) proposed a new model which differs slightly from the methodology of Christie et al. (1995) although both methodologies are similar in vein. The methodology of Chang et al. (2000) has the capacity to detect herding behaviour in less extreme market movements. In place of CSSD, Chang et al. (2000) use the average cross-sectional absolute deviation. Their methodology has been used to test herding behaviour in developed markets such as the U.S. and Hong Kong and there was no evidence of herding detected in such markets (Chang et al., 2000). That said, Chang et al. (2000) found evidence of herding in the emerging markets (South Korea and Taiwan). Furthermore, the same model has been used to detect herding behaviour in several African stock markets (Tunisia and Egypt). Using the methodology in question, herding was not detected in Egypt (El-Shiaty and Badawi, 2014) whilst in Tunisia there was weak evidence of herding (Mrad, Wyeme and Olfa., 2013).

2.4 Market Participants and Herding

2.4.1 Institutional (foreign and domestic) investors and herding

Financial literature has several examples of herding displayed by institutional investors. In fact, Kremer and Nautz (2013) found that institutional investors exhibit herding behaviour daily. Choi and Skiba (2015) found evidence that institutional investors normally herd in developed and emerging markets. In South Africa's case, institutional investors also tend to

herd (Gilmour and Smit, 2002; Sarpong and Sibanda, 2014). Chen (2013) investigated whether foreign institutional investors in Taiwan herd towards stocks in the same industry; identified the causes of industry herding; analysed whether herding behaviour impacts future industrial returns and traced the changing pattern of industrial herding, especially during the 2007-2008 financial crisis. The authors found that on average, foreign institutional investors herd in the Taiwan securities market and that they follow each other into and out of the same industries.

As already mentioned, herding may be either intentional or unintentional. Choi and Skiba (2015) found evidence in emerging and developed markets that institutional herding is more likely to be based on fundamental information and that it is a mechanism through which fundamental information is incorporated into security prices. This suggests that institutional herding is likely to be unintentional in developed and emerging markets. Holmes et al. (2013) found evidence that institutional herding in the Portuguese stock market was intentional. Similarly, Gavriilidis et al. (2013) found evidence of intentional institutional herding in the Spanish market for most sectors during periods when the market or a specific sector under investigation, had underperformed. Lin, Tsai, Lung (2013) also found evidence that institutional herding in Germany is mainly unintentional and partly driven using similar risk models.

The literature on institutional herding does not just establish the existence of intentional institutional herding but investigates how and why it varies across asset classes. Claudio (2013) examined herding across asset classes and industries and established that there is a relationship between the risk premium of an asset, the incentive structure of a fund and the level of institutional herding. For this study, the author used a unique and detailed monthly portfolio from pension funds in Chile between 1996 and 2005. The author found that pension funds' herd behaviour is driven by three primary factors; the level of risk of the assets that fund is investing in, the more the risk the more the herding, the level of competition between the funds, the more competitive the more the herding and finally, the compensation structure of the fund administrators.

Institutional investors are some of the most important market participants as they are responsible for a disproportion amount of all order flows. Having institutional investors succumb to herding is likely to have a significant impact on any market. Several studies have attempted to measure the effects of herding by institutional investors. Garg, Mitra and Kumar

(2016) examined the presence of herding behaviour among foreign institutional investors and the impact of herding by foreign institutional investors on stock returns. They found it to have a destabilising effect on the Indian stock market. Correspondingly, Lin et al. (2013) also found that institutional herding in Germany has the tendency to destabilise stock prices in the short-term. Interestingly Yuksel (2015), when examining the price impact of short and long-term institutional herding, found that over short horizons, herding by short-term institutions promotes price discovery. In contrast, herding by long-term institutions drives stock prices away from fundamentals over the same period. Yuksel (2015) argues that the destabilising effect of institutional herding persistence documented in the recent literature is entirely driven by persistent herding by long-term institutions. Institutional herding is also believed to have a positive impact on stock prices. Jin, Yan, Xi and Liu (2016) found that in China, herding behaviour by qualified foreign institutional investors acts as the mediating role between stock price synchronicity and stock price crash risk. Furthermore, Jin et al (2016) empirically analysed the effects of stock price synchronicity and the effect of herding behaviour of qualified foreign institutional investors (QFII) on a stock price crash risk, especially the mediating effect of herding behaviour of QFII on the relation of stock price synchronicity and stock price crash risk. The author's findings concluded that either herding behaviour of QFII or stock price synchronicity can increase stock price crash risk. Furthermore, the authors found that herding behaviour of QFII improves the effect of stock price synchronicity on stock price crash risk. The authors argue that herding behaviour of QFII acts as the mediating role between stock price synchronicity and stock price crash risk

The overall inference is that institutional herding is present in both emerging and developed markets. The phenomenon may be either intentional or unintentional, and exhibited daily. Its intensity is dependent on stock characteristics (past returns and volatility), and is largely driven by reputational concerns. Pension funds herd more in assets that have more risk and for which pension funds have less market information. All in all, institutional herding has a negative impact on stock markets.

2.4.2 Retail Investors and herding

Several studies (Agarwal, Chiu, Liu, Rhee 2011; Choi, 2016; Hsieh, 2013) have undertaken to investigate herding behaviour amongst individual investors (foreign and domestic) and institutional investors. These studies have revealed that herding is present amongst individual and institutional investors.

Choi (2016), investigated herding behaviour amongst online and offline individual investors, by analysing a dataset of online and offline individual investor trading activities. The dataset for this study was obtained from a Korean brokerage firm. The authors found evidence that local offline investors exhibit stronger herding than investors across the country (Korea). The author argues that herd behaviour is primarily driven by offline investor in-person interactions with brokers at local brokerage firm branches. On the other hand, herding was found to be substantially weak when trades were conducted online; per the author this outcome can be explained by the fact that online investors rarely interact with local brokers, thus they are unlikely to herd.

Agarwal et al. (2011), examined the herding behaviour of domestic and foreign investors on the Indonesian stock market and found evidence of herding between both groups of traders. They additionally found that, foreign investors are more likely to herd than domestic investors. The authors found evidence that there is weak evidence of herding by domestic investors and no herding by foreign investors. The overall evidence seems to suggest a strong brokerage firm effect on herding but a weak marketwide effect. Furthermore, the authors also found evidence that the stronger brokerage effect on herding is likely driven by acting on common information.

Caldwell and Dolvin (2012), examined herding in student managed investment funds. These funds are fast becoming popular however, there is still a lack of research into the efficacy of these funds. Caldwell and Dolvin (2012), found evidence of herding by the investment managers of these funds which often caused these funds to underperform. They also analysed what made some funds managers more likely to herd than others and discovered that when fund administrators had general and targeted behavioural training, they were less likely to herd.

Balcilar, Demirer and Ulussever (2016), examined whether speculation in the global oil market contributes to herd behaviour in the stock markets of net exporting nations. Using firm level data from the Gulf Arab stock markets, the authors showed that investors display herd behaviour during periods of high volatility while anti-herding is prevalent during calm markets. Furthermore, anti-herding in the stock market is also found to be positively related to speculative activities in the global oil market as investors use signals from the oil market in their trades by trading away from the market consensus. Balcilar et al. (2016) argue that

traders take the speculative signals from the oil market as a sign of positive expectations and try to generate superior profits by going against the crowd in their local market.

Interestingly, religious occasions may induce herding behaviour as was proven in the study that was undertaken by Gavriilidis, Kallinterakis and Tsalavoutas (2015). Gavriilidis et al. (2015) investigated the relationship between herding and Ramadan. This study was motivated by emotional/behavioural expressions which have been observed to facilitate herding, particularly during Ramadan. What is unique about this study is, that unlike other studies, it examines Ramadan from a market efficiency viewpoint (i.e. as a seasonal anomaly). The authors' work takes a behavioural perspective, thereby addressing a literature gap in the wider debate over the role of religion in investor behaviour. The authors document the presence of significant herding during Ramadan in many sample markets (the sample comprises the following countries; Bangladesh, Egypt, Indonesia, Malaysia, Morocco, Pakistan and Turkey). Herding was found to be prevalent during Ramadan.

2.4.3 Analysts and herding

Financial Markets Analysts are people that advise traders on how to trade. They often make recommendations such as what stocks to buy, sell, hold or avoid. Their ability to make the right calls on financial assets directly impacts their reputation which directly affects how much money they can make from selling their advice. Thus, they tend to herd to protect their reputations (Syros, 2013). Where herding by analysts is observed, it is generally in the form of analysts forecasting close to the consensus estimates which in itself is generally equal to the forecast by the best forecaster at that moment in time (Campenhout and Verhestraeten, 2010). Herding by analysts is particularly dangerous as it encourages traders to herd in certain directions that may yield in significant losses (Chen, 2016). Furthermore, analyst herding has a negative implication for listed companies. Kim and Pantzalis (2003) found evidence that herding among analysts diminishes market capitalisation of the firms which they cover, indicating that the market does indeed punish herding behaviour among security analysts.

Although, analyst herding is very destructive, it is nonetheless prevalent. Chen (2016) found evidence of it in the Taiwan stock market. The empirical results from that study showed that smaller, less experienced and less equipped traders were more readily affected by analyst herding. Campenhout et al. (2010) identified herding behaviour in U.K.'s financial market and measured the impact of herding behaviour on the accuracy of analyst earnings

forecasts. Kim and Pantzalis (2003), examined herding behaviour among security analysts during an eight-year period ending in 1998 and found evidence that herding is more pronounced among analysts concentrating on diversified companies which implies that herding behaviour increases with task difficulty.

2.5 African Markets and Herding

There are several studies (Gilmour and Smit, 2002; Sarpong and Sibanda, 2014; Seetharam and Britten, 2013; Niyitegeka and Tewari, 2015; Shiaty and Badawi, 2014; Guney, Kallinterakis and Komba, 2016) that investigated the existence of herd behaviour on the African continent.

Gilmour and Smit (2002) examined institutional herding in the South African unit trust industry for the period of 1991 to 1999, using quarterly equity holdings of unit trust funds and found that institutional investor herd when the stock market is volatile. Furthermore, Sarpong and Sibanda (2014) examined herd behaviour among institutional investors as well as the performance of these investors. Sarpong and Sibanda (2014) found evidence of herding behaviour amongst institutional investors. Furthermore, the authors also found that institutional investors that traded against the herd provided superior returns.

Additionally, Seetharam and Britten (2013) investigated herding behaviour during market cycles in South Africa for the period from 1995 to 2011, using a monthly price for all shares listed on the JSE as well as the all share index. The authors found that herding behaviour was absent in the overall market but was significantly present in the bear market and that herding appears to increase before the markets contract.

On the other hand, Niyitegeka and Tewari (2015) examined whether investor herding on the JSE is instantaneous or occurs with lapses in time. The authors also examined the asymmetric effects of herding behaviour on increasing versus decreasing market returns. The authors found that herd behaviour on the JSE is a short-lived phenomenon and that herding behaviour is only present in the bull market. Their results indicate that herding is not instantaneous during increasing market returns and has a low speed of adjustment to the long-run equilibrium, but during the bear market, the study could not detect the presence of herd behaviour among investors.

Mrad et al., (2013) examined the presence of herding behaviour on the Tunisian Stock Exchange (TSE). The authors found no evidence of herding behaviour pre- and post- the

Tunisian revolution using Christie and Huang's (1995) methodology. Furthermore, using the methodology of Chang et al. (2000), it was found that investors did not exhibit herding pre-the Tunisian revolution but there was weak evidence of post- the Tunisian revolution.

That said, Shiaty and Badawi (2014) examined herding behaviour in the Egyptian stock market using the model designed by Christie et al. (1995) and Chang et al. (2000). Daily stock returns were used for this study. Herding was not found on the Egyptian stock market.

Guney et al. (2016) examined herding in eight African frontier stock exchanges namely; Bourse Régionale des Valeurs Mobilières (which is a cross border exchange established in 1998 by the eight member-states of the West African Economic and Monetary Union - Benin, Burkina Faso, Guinea Bissau, Ivory Coast, Mali, Niger, Senegal and Togo); Botswana; Ghana; Kenya; Namibia; Nigeria; Tanzania; and Zambia for the January 2002 – July 2015 period. Evidence shows that herding is present across all eight markets and the authors attribute this to the low transparency levels prevalent in frontier stock exchanges that reduce the quality of their informational environment. This leads investors there to deem herding a feasible option, allowing them to infer information from their peers' trades. Interestingly enough, according to the authors, the magnitude of herding grows larger when herding is estimated based on equal- (compared to value-) weighted tests, which suggests that smaller capitalisation stocks amplify its size; this is not surprising, given the greater informational uncertainty surrounding smaller stocks, leading investors to herd more when trading them. Further evidence shows that herding appears significant, irrespective of the market's directional movement in most cases. On the other hand, herding is also found to exhibit asymmetric behaviour with respect to market volatility, as it appears significant (or stronger, compared to high volatility days) mainly during days of low volatility; however, this pattern grows weak when partitioning the sample period to account for the 2007-2009 global financial crisis. While "domestically" motivated herding is significant across all eight markets, the same cannot be argued for herding induced by the U.S. and South African market returns, the presence of which is confirmed on only a small number of occasions; similarly, the return dynamics of regional economic initiative's member-markets are found to motivate herding in each other very rarely. According to the authors, these results are very interesting, as they indicate that investor behaviour in African frontier markets is not significantly affected by non-domestic factors and is in line with extant research, denoting the overall low levels of integration of frontier markets within the global financial system.

Overall, herd behaviour was found to be present in the bear market (Seetharam and Britten, 2013) and during the bull-run (Niyitegeka and Tewari, 2015) in the South African economy. Similarly, herding was found to have taken place when the South African economy contracted (Seetharam and Britten, 2013). Gilmour and Smit (2002) and Sarpong and Sibanda (2014) found evidence of herding by intuitional investors in the South African markets. Likewise, Guney, Kallinterakis and Komba (2016) examined herding in eight African frontier stock exchanges and found evidence that herding was present across all eight markets. In contrast, herding was not found on the Egyptian stock market (Shiaty and Badawi, 2014), whereas in Tunisia, weak evidence of herd behaviour was found by Mrad et al. (2013). Interestingly, Sarpong and Sibanda (2014) found evidence that market participants that trade against the herd generally generate superior returns and impact the market positively.

2.6 Real Estate Investment Trusts (REIT) and Herding

Various studies (Baballos, Balcilar and Gupta 2015; Zhou and Anderson, 2013) have been undertaken to investigate investor herding in the U.S. REIT sector. Baballos (2015) found that empirical evidence with regards to investor herd behaviour in the REIT sector is mixed as the two methodologies which he deploys in his study provided a contradictory outcome. On the other hand, Jian Zhou (2011) found evidence that REIT investors tend to herd under turbulent market conditions. An overview on both these studies is provided below.

Baballos et al. (2015) investigated herding behaviour in the U.S.-listed Real Estate Investment Trusts (REITs), using a dynamic model that captures herding under different market regimes. The author found substantial evidence of herding behaviour under the crash regime for almost all REIT sectors. In contrast, it was found that the static herding model that was also used rejects the existence of herding in REIT's markets. Most interestingly, the authors observed a shift from negative herding behaviour during a low and high volatility regime for almost all REIT sectors.

Zhou and Anderson's (2013) study also investigated herding behaviour in the U.S. equity REIT market. The quantile regression method was applied to this study. Evidence was found that herding is more likely to be present when stock markets are volatile. This implies that herding is likely to be present in the bear market phases. Lastly, Zhou and Anderson (2013) found that REIT investors usually herd when market conditions are extremely volatile.

2.7 Stock Market Restrictions and Herding

The empirical evidence thus far that has been gathered on stock market restriction and investor herding is mixed as in China, regulatory reforms curbed herding behaviour (Hilliard and Zhang, 2015), whereas in other markets (i.e. United States, the United Kingdom, Germany, France, South Korea and Australia), short-selling restriction exhibits either no influence on herding formation or induces adverse herding (Martin, Bohl, Arne, Kleina, Pierre and Siklos , 2014). Interestingly in South Arabia, where there are restrictions on direct portfolio investment, short-selling is prohibited and derivatives markets are not present when herding was found to be present (Rahman et al., 2015). The section below highlights the empirical data which has been gathered thus far on stock market restrictions and investor herding.

Herding behaviour amongst market participants can be curbed by introducing appropriate regulatory reforms. Hilliard and Zhang (2015) examined the presence of herding behaviour in the Chinese markets (Shanghai and Shenzhen stock exchange) for a five-year period ending in 2012. The data excluded financial companies, Exchange Traded Funds (ETFs) and companies without ordinary common stocks. Evidence of herd behaviour was found during 2002 and 2005. Herding was also found to decrease following a string of regulatory reforms by Chinese regulators in 2006. This clearly indicates that regulatory reforms can curb herd investing.

The findings of Martin et al. (2014) contradict the evidence of Hilliard and Zhang, (2015) as we would expect short-selling restrictions to have an influence on herd behaviour. This was not the case in the study by Martin et al. (2014). Martin et al. (2014) argue that literature on short-selling restrictions thus far has mainly focused on a ban's impact on market efficiency, liquidity and overpricing. The authors also point out that there is a lack of literature on the effect of short-sale constraints on herd behaviour. Thus, this has prompted the authors to investigate six stock markets (in the United States, the United Kingdom, Germany, France, South Korea and Australia), that faced bans during the recent global financial crisis. The author found evidence that short-selling does not induce herd behaviour.

Garg et al. (2013) tested herd behaviour in the Indian stock market. The empirical evidence found no evidence of herding. This was due to the regulatory reforms that were introduced by the regulators according to the authors.

Another study which examined a stock market with a variety of restrictions, provides evidence which contradicts both studies (Jitka et al., 2015; and Martin et al., 2014), analysed thus far. Rahman et al. (2015) examined herding in the Saudi stock market. The authors found evidence of investor herding, irrespective of market conditions. The evidence gathered by the authors does not support the notion of "spurious" herding.

2.8 Herding in non-equity investments

Herd behaviour has also been examined in the bonds, foreign exchange and derivatives markets. Empirical evidence of the existence of herding is mixed.

Galariotis et al. (2016) examined and provided evidence of herding behaviour in European government bond prices. Overall, the authors found that there was no evidence of investor herding either before or after the EU crisis. Further tests undertaken by the authors indicate that during the EU crisis period, macroeconomic information induced bond market investors to herd. These findings contradict the popular belief that irrational investor herding intensified the recent EU crisis. The authors' evidence supports the notion of 'spurious' herding. The authors also found that during the recent financial crisis there was a herding spillover effect however, with the direction going from the European countries with no financial difficulties (Northern European markets) to the financially troubled European markets (Southern European markets).

Gleason, Lee and Mathur (2003) examined herding behaviour in thirteen commodity futures contracts traded on three European exchanges. The methodology that was used for this study was the Christie et al. (1995) herding model. The authors found evidence that herding was not present in futures markets. According to Kimberly et al. (2003), these results show no evidence of herding.

Boyd, Buyuksahin, Haigh, and Harris (2016) examined herding among large speculative traders in futures markets by employing a unique dataset from the U.S. Commodity Futures Trading Commission (CFTC) on the individual positions of these traders in thirty-two futures markets covering the period 2002 - 2006. The authors found weak evidence of herding. Boyd et al. (2016) argue that this type of herding will not affect the stability of financial markets.

Similarly, Boyd, Bahattin, Haigh and Harris (2015) examined the prevalence, sources and effects of herding among large speculative traders in thirty U.S. futures markets over the

period 2004–2009. The authors found significant herding levels within the large trader category of managed money traders (hedge funds) who are known to have similar performance evaluation measures. These results, according to the authors, support the notion that greater public information takes away the incentive to herd. The number of traders and floor-based markets are positively associated with herding, while trading volume and electronic trading are negatively related to herding. Notably, Boyd et al. (2016) found little evidence that herding by managed money traders serves to destabilise prices in futures markets.

Sherman (2011) provided the first extensive analysis of herding in currency markets, focusing on the trading of mutual funds in 28 currencies. Sherman (2011) found evidence that herding is more pronounced in less frequently traded currencies, consistent with existing research which shows that herding is more pronounced in smaller stocks. Sherman (2011) also found evidence that mutual funds follow contrarian trading strategies after controlling for feedback trading.

Overall, in the futures market, herding was found to be weak or none existent and could not destabilise market prices. Furthermore, in the foreign exchange market, herding was found to be more pronounced in less frequently traded currencies, consistent with existing research showing that herding is more pronounced in smaller stocks. Additionally, in the bond markets, herding in corporate bonds was found to be generally stronger among illiquid bonds and buy herding and sell herding are driven by different factors (negative news about bond ratings and corporate earnings). Herding in the European government bond prices was found to be spurious.

2.9 Impact of Market Conditions on Herding

Market conditions (bull or bear markets) can induce herding behaviour amongst market participants. The literature reviewed in this section supports the notion that herding is more likely to occur and becomes stronger in declining markets than in rising markets. The conclusion is that herding takes place during both bear and bull market conditions.

As herding is already present in the bull and bear markets in South Africa. Hammami and Boujelbene (2015) found evidence that herding is prominent in both booms and bust stock in the Tunisian stock market. Furthermore, the author also found evidence that investor herding contributes to an increase in the probability of stock market booms.

Patni, Jain and Gupta (2014) found evidence that the magnitude of herd behaviour was relatively higher in the bull market in Indian equity markets. Luo and Schinckus (2015) found evidence of herding in both A (foreign) and B (domestic) shares in the Chinese equity market. A-shares investors were found to herd in the bearish market while B-shares investors were found to herd when the markets were bullish. Tessaromatis and Thomas (2009) found strong evidence of herding, both up and down in the Greek markets during 1998-2004. Hwang and Salmon (2004) also found evidence of herding towards the market portfolio in both bull and bear markets in the U.S. and the South Korean stock exchange. Similarly, Zhou, Randy and Anderson, (2013) found evidence that U.S. equity REIT market investors tend to herd under turbulent market conditions.

2.10 Economic Stress and Herding: Global Financial Crises (2007 – 2009)

The preceding literature noted that herding is correlated with unfavourable economic conditions. Recently, the global economy was beset by an economic contraction of global proportions. Indeed, the global economic crisis (of 2007-2009) originated in the U.S. in the subprime mortgage market, and it rapidly spread across virtually all economies, both advanced and emerging. Amongst others, it affected equity markets (Bartram and Bodnar, 2009): stock market performance was down approximately 40% on their end of 2006 levels. Bartram and Bodnar (2009) observed that deterioration started in most markets in early to mid-2008, and between the crisis periods of mid-September to the end of October 2008 - almost all indices had declined by 30–40%.

Laih and Liau (2013) argue that herding during the crisis was more pronounced in developing countries, where individual investors are the dominant market players and daily price limits are observed. There was significant evidence of herding in the stock markets of Taiwan and China. Chiang and Zheng (2010) found evidence that usually a crisis triggers herding activity in the crisis country and this produces a contagion effect, which spreads the crisis to neighbouring countries. Ouarda, Bouri and Bernard (2013) found evidence in European markets that herding behaviour was influenced by the crisis as well, especially in the financial and technology sectors.

Africa was not spared from the crisis, and South Africa was also hit by the global financial economic crisis. Heymans and Câmara (2013) state that South Africa's sound regulatory system played a pivotal role in limiting the effects of the sub-prime mortgage crisis on the local financial system as South African banks were well-capitalised and had

limited exposure to risky foreign assets such as sub-prime asset backed securities and credit default swaps. That said, South African banks did experience a drop in earnings and some stress.

The financial crisis took a while to reach the shores of South Africa as the JSE All Share Index reached its peak on May 2008, thanks to mining and commodity stocks. That said, during the period of June-July 2008, there was a sudden drop in international capital flows which in turn resulted in a collapse of share prices and the local currency exchange rate. The JSE had devalued and in the same period the rand had also depreciated against the U.S. dollar. Furthermore, mining, manufacturing production and exports were hit particularly hard. The South African economy also experienced a slowdown in GDP growth. This suggests that South Africa's equity markets faced pressure because of the onset and spread of the global economic crisis.

2.11 Consequences of Herding

Herd behaviour has the potential of creating asset price distortions, and this in turn can destabilise financial markets by creating an asset price bubble and sudden crashes.

Litimi, BenSaïdab and Bouraoui (2016) found evidence that herding was present in the U.S. stock market, and that it had actively contributed to different financial crises and bubbles starting from Black Monday of 1987 until the last global financial crisis. In the same vein, Singh's (2013) research on the U.S. stock market found evidence that institutional investor herding behaviour created temporary price pressures and contributed to asset bubbles.

In Germany, Kremer et al. (2013) found that institutional herding has the tendency to destabilise stock prices in the short-term. This was also the case in India as Garg et al. (2016) found evidence that herding has a destabilising effect in the Indian stock market. These observations portray herding as a nefarious practice with the capacity to distort the equities market.

Against the grain, Yuksel (2015) found evidence that herding by short-term institutional investors promotes price discovery. In contrast, herding by long-term institutions drives stock prices away from fundamentals over the same periods. Jin, Yan, Xi and Liu's (2016) findings in China contradicts other empirical evidence which has been presented as it is found that herding behaviour of qualified foreign institutional investors acts as the

mediating role between stock price synchronicity and stock price crash risk. The overall inference is that herding has a negative impact on the market**.**

2.12 Conclusion of the Literature Review

This chapter reviewed the literature on herding. The literature on herd behaviour is vast, however, there are a couple of key findings from the literature that were highlighted in this chapter. Firstly, institutional herding is present in both emerging and developed markets. The phenomenon may be either intentional or unintentional and is largely driven by reputational concerns. Secondly, herding is present amongst individual and institutional investors. Analysts tend to herd to protect their reputation. This has thus led to previous studies observing the existence of herding in South Africa, regardless of market conditions. Thirdly, market conditions (bull or bear markets), can induce herding behaviour amongst market participants. For instance, REIT investors tend to herd more under turbulent market conditions. Finally, herd behaviour has the potential of creating create asset price distortions, and this in turn can destabilise financial markets by creating asset price bubbles and sudden crashes.

Based on the literature review, we are still interested in investigating the existence of herding in various economic sectors in South Africa and the impact of market conditions (bull and bear phase) on herding. We would like to see if it is still indeed the case that herding in the South African economy takes place regardless of market conditions and if it is still existent.

The next chapter will discuss the research design and the methodology that will be undertaken for this study. This study will add to the current body of literature by investigating if market-wide herding exists within the JSE and within some of the sectors in the JSE. Christie et al.'s (1995) cross-sectional dispersion methodology (as described in section 2.2) accompanied by higher frequency data (as compared to previous studies conducted on the JSE), is used to ascertain the hypotheses of this study.

Chapter 3 – Research Methodology

3.1 lntroduction

The aim of this study is to investigate herding on the JSE and in three of its biggest sectors namely the Financials, Industrials and Resources sectors. The purpose of this section is to articulate the methods and data used to achieve the aim of the study. The chapter is organised as follows: Section 3.2 presents data used in the study and the data sources. Section 3.3 discusses the research design. Section 3.4 highlights the limitations of the selected methodology and the chapter summary concludes this chapter.

3.2 Data and Data sources

The data used in this study is monthly closing prices for all shares listed on the JSE for the period 31 January 2003 to 31 May 2016. The chosen sample period is sufficient to examine herding behaviour under different market conditions (i.e., bull and bear markets). The data for this study is sourced from *I-NET Bridge*.

Reclassification of the data into different sectors was conducted to enable the investigation of sectorial herding. All the listed shares were reclassified into three major sectors (industrials, financials and resources) using the Industry Classification Benchmark (ICB) approach. The resources sector is comprised of companies that belong to the ICB Industries Oil and Gas (0001) and Basic materials (1000). The financial sector is comprised of companies that belong to ICB Industry Financials (8000). Lastly, the industrial sector was made up all the remaining companies.

The researcher used monthly data as it provided an adequate sample size, which in turn was satisfactory for the statistical tests to be conducted. Logarithmic stock returns were computed for each stock. Dispersion tests were conducted to detect herding.

3.3 Research design

To determine the existence of market-wide (sector-wide) herding in a financial market, one needs to establish if there is a negative relationship between the dispersion of the stock returns to the aggregate market (sector) return and extreme movements in the market (sector) return. The first step is to measure the dispersion.

Christie et al's (1995), dispersion is measured in this research by using the Cross Sectional Standard Deviation (CSSD) which is computed as follows:

$$CSSD_t = \sqrt{\frac{\sum_{i=1}^{N}\left(r_{i,t} - r_{m,t}\right)^2}{N-1}} \quad (1)$$

Where: $r_{i,t,}$ is the observed stock return of stock i at time t;

$r_{m,t}$ is the observed return of the market index at time t;

N is the number of stocks listed in the market or sector during the period t.

The CSSD is calculated for the overall market and for financial, industrial and resources sectors.

To calculate the CSSD for the overall market (sector) in equation (1), $r_{i,t}$, is derived as the logarithmic returns of the daily stock returns of all listed shares within the market (specific sector) at time *t*, $r_{m,t}$ is derived as the logarithmic returns of the daily all share market (sector) index during the same period and N is the number of firms listed in the market i.e. the JSE (sector i.e. industrials, resources, or financials).

Once the researcher has the requisite measure of dispersion, the next step is to quantify and categorise market (sector) movements for comparison with the CSSD. Christie et al. (1995) suggested the use of two dummy variables, $D_t^U \; and \; D_t^L$. These take the value of one whenever the market return on day *t* lies in the extreme upper tail and lower tail respectively.

The derived CSSD of returns from equation (1) are then regressed against a constant and the two dummy variables to identify the extreme market conditions. The regression equation is as follows:

$$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t \quad (2)$$

There are three levels of "extreme markets conditions" that are investigated. At the first and most sensitive level, the market (sector) is determined to be under extreme market conditions when the market (sector) index returns lie more than one standard deviation (σ) from the mean. The second and third levels are determined when the market (sector) index returns are more than two and three σ away from the mean. The JSE all-share index and the sectorial indices were used to calculate extreme market conditions respectively for the overall market and for the financials, resources and industrial sectors.

If herding exists, $CSSDt$ will be smaller during periods of market stress and statistically significant negative values for β_1 and β_2 would be observed. The α co-efficient that is estimated from the regression will denote the average dispersion of the sample, excluding the regions corresponding to the two dummy variables.

Since this investigation is searching for herding within the overall market and in three other sectors at three different levels of market extremes, 36 $CSSDt$ regressions are conducted.[2]

The other measure of dispersion was developed by Chang, Cheng and Khorana (2000). This model extends the work of Christie and Huang (1995) by proposing a nonlinear test regression test for herding.

Like all measures of dispersion that square differences, the CSSD of returns can be heavily influenced by the presence of outliers. Thus, the presence of herding tends to be downplayed when there are outliers in the data. As in Chang et al. (2000), the Cross-Sectional Absolute Deviation (CSAD) is used and deemed a better measure of dispersion. The CSAD is modelled as follows:

$$CSAD_t = \frac{1}{N}\sum_{i=1}^{N}\left|r_{i,t} - r_{m,t}\right| \tag{3}$$

Where: $r_{i,t,}$ is the observed stock return of stock i at time t;

$r_{m,t}$ is the observed return of the market index at time t and

N is the number of stocks listed in the market or sector during period t.

The CSAD is calculated for the overall market and for the three sectors. The $r_{i,t}, r_{m,t}$ and N are used to calculate the CSAD for the overall market in equation (3) and are the same as those used in equation (1). The corresponding regression equation is as follows:

$$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t \tag{4}$$

Chang et al. (2000) proposed a new regression model to establish the relationship between CSAD and market (sector returns). This avoided the use of dummy variables altogether and used the absolute values and squared values of $r_{m,t}$ to establish how the CSAD varies with

[2] That is 4 (the market plus 3 sectors) x 3 (levels of extreme market conditions) x 3 (different market conditions namely all market conditions, bullish markets and bearish markets).

changes to market (sector) returns. Thus, there is no need to determine levels of extreme market conditions and only 12 regressions need to be conducted. Chang et al.'s (2000) formulation was as follows:

$$CSAD_t = \alpha + \gamma_1 |r_{m,t}| + \gamma_2 r_{m,t}^2 + \varepsilon_t \quad (5)$$

Note that this model is nonlinear in the independent variable $r_{m,t}$. To make it valid, Chang et al. (2000) made the Capital Asset Pricing Model (CAPM) assumptions. **A statistically significant negative coefficient γ_2 infers the existence of herding.** The existence of herding usually increases with a correlation amongst individual stock returns. On the other side, the dispersion amongst the individual stocks in question can either increase at a decreasing rate or diminish in instance where herding is severe. In instances where stock market participants herd over a period of huge stock price movements, researchers would expect a less than proportional increase (or decrease) in the CSAD measure. When herding is not present, the relationship is linear and increasing, which means that stock dispersions increase proportionately with the increasing returns of the market. Also, the connection between CSAD and market returns may not be symmetric.

The relationship between CSAD and market returns might not be symmetric in bull and bear markets. The generalised relationship may be separated into two separate equations. A positive or zero market return is labelled as a bull phase and, in contrast, a negative market return is classified as a bear phase.

$$CSAD_t^{UP} = \alpha + \gamma_1^{UP} |r_{m,t}^{UP}| + \gamma_2^{UP} \left(r_{m,t}^{UP}\right)^2 + \varepsilon_t \quad (6)$$

$$CSAD_t^{Down} = \alpha + \gamma_1^{Down} |r_{m,t}^{Down}| + \gamma_2^{Down} \left(r_{m,t}^{Down}\right)^2 + \varepsilon_t \quad (7)$$

Here, $|r_{m,t}^{UP}|$ and $|r_{m,t}^{Down}|$ are the absolute values of the average overall sample return when the market is up (or down). As in the earlier case, a negative and significant $\gamma_2^{UP} and\ \gamma_2^{Down}$ captures herding in the market (or sector).

3.4 Limitations of herding measurement models

One of the biggest limitations with dispersion based herding measurement models is that such models do not consider the effect of variations in fundamental variables. Thus, the models

fail to distinguish between spurious and intentional herding (Bikchandani and Sharma, 2001). Other limitations include the fact that there are no rules which clearly state which variables from the stock market returns should be considered extreme. Furthermore, a decline in cross-sectional standard deviation of stock returns does not imply in all cases that herding is present as this can arise due to a decline in market returns uncertainties. Hwang (2000) proved in his empirical study that there is a positive link between the cross-sectional volatility of market return and time series volatility and finally, Christie et al's (1995) model fails to detect herding in calm periods

3.5 Chapter Summary

In this chapter, the research methodology and the data used for the study is introduced and described. Monthly data from *I-Net bridge* and a dispersion based measure of herding are used to determine if herding exists within the JSE. The results of this study are presented in the next chapter.

Chapter 4 – Research Findings

4.1 Introduction

This chapter presents the results. The chapter is organised as follows: Section 4.2 provides the descriptive statistics of the data and the herding measures. Section 4.3 presents the herding regression results and section 4.4, the chapter summary, concludes the chapter.

4.2 Descriptive statistics

Key summary statistics of the data that were used are presented in Table 1 below. Since a dispersion based model is used to identify herd behaviour, it is important that one gets a good grasp of the spread and the first four moments of each series of the data used. One of the major criticisms of dispersion based models is that they do not pick up any herding that occurs during periods of 'calm' trading activity, hence it is important that one understands just how often trading conditions are calm.

Should most of all trading occur during periods of non-extreme returns, then it is possible that no evidence of herding will be spotted by the methodology employed when there could be herding within the market. i.e., there will be an elevated risk of committing a type 2 error. To avoid committing a type 2 error, the data needs to be non-normal and particularly platykurtic. A platykurtic distribution implies that a significant amount of trading occurred when returns were at their extremes and thus, should there be no evidence of herding, then one can reasonably fail to reject the null hypothesis of no herding.

The descriptive statistics in Table 1 show that the excess kurtosis of all variables was positive and thus all variables had platykurtic distributions. Furthermore, all returns variables were negatively skewed, indicating there were more incidences of bearish markets than there were of bullish ones. Of interest is how average and median returns data are negatively correlated with the measures of dispersion. This seems to provide rudimentary evidence of the negative effects of herding and requires further investigation.

Table 1 Descriptive statistics for all variables

	Min.	Max.	Mean	Med	Std. Dev.	Skew	Kurt.
Allshare Returns	-13.24	13.99	1.45	1.59	4.61	-0.09	0.52
Market CSSD	5.59	23.47	10.36	9.65	3.57	1.35	1.83
Market CSAD	4.34	35.47	12.90	11.07	6.17	1.43	1.99
Financials Returns	-12.95	12.54	1.50	4.71	1.50	-0.24	0.55
Financials CSSD	3.52	14.66	6.47	6.21	1.95	1.59	3.53
Financials CSAD	2.79	10.38	4.76	4.54	1.33	1.41	2.94
Industrials Returns	-12.64	11.76	1.91	1.86	4.27	-0.44	0.75
Industrials CSSD	4.48	18.27	7.82	7.28	2.20	1.50	3.52
Industrials CSAD	3.49	10.94	5.77	5.45	1.39	0.94	0.79
Resources Returns	-21.12	18.97	0.95	0.64	7.19	-0.04	0.29
Resources CSSD	5.54	34.47	11.05	10.15	4.36	2.21	7.80
Resources CSAD	3.94	25.82	8.10	7.55	3.05	2.64	11.86

Figure 1 below is a chart showing the returns data of each of the sector indices and of the JSE all-share index on the same time axis, thus resulting in superimposed plots. Figure 1 shows that Resources returns is the most volatile and the JSE all share is the least volatile. All four indices seem to track each other's performances. Returns peak and plummet at around the same time as do volatility clusters. That may seem to indicate herding across sectors.

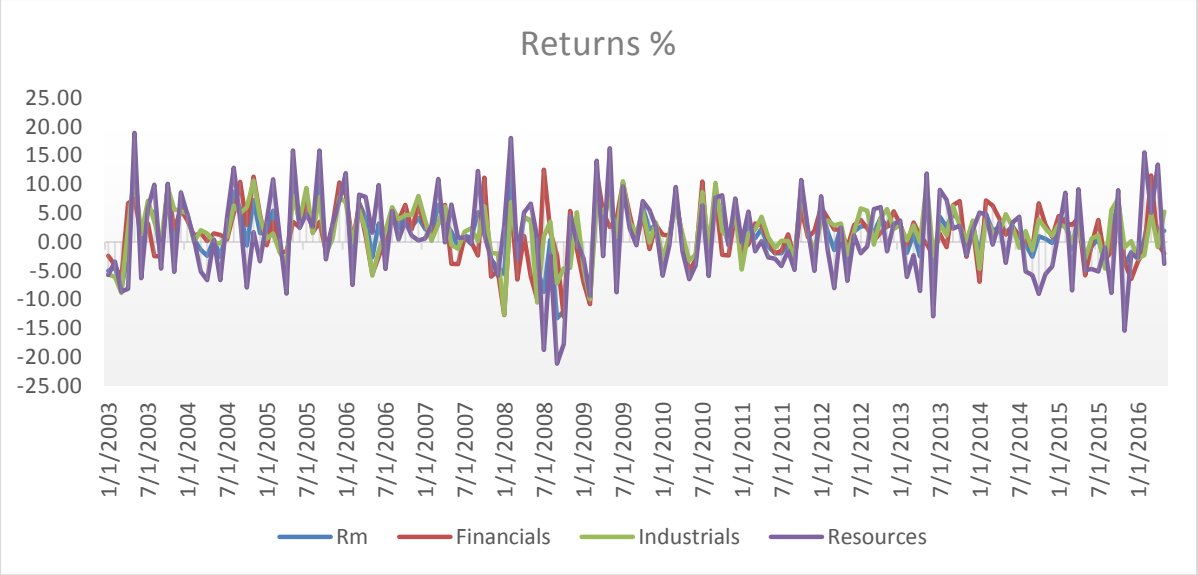

Figure 1 The relationship between the industry and market returns overtime

Figures 2 and 3 show the measures of dispersion against time using CSSD and CSAD respectively. Figure 2 shows that financials had a visibly lower dispersion of returns compared to all the other indices. As expected from the summary statistics, the resources index displays the greatest levels of dispersion. One may, thus, expect a greater risk of a type 2 error in the estimates of the financials and a lower one for the estimates of the resources.

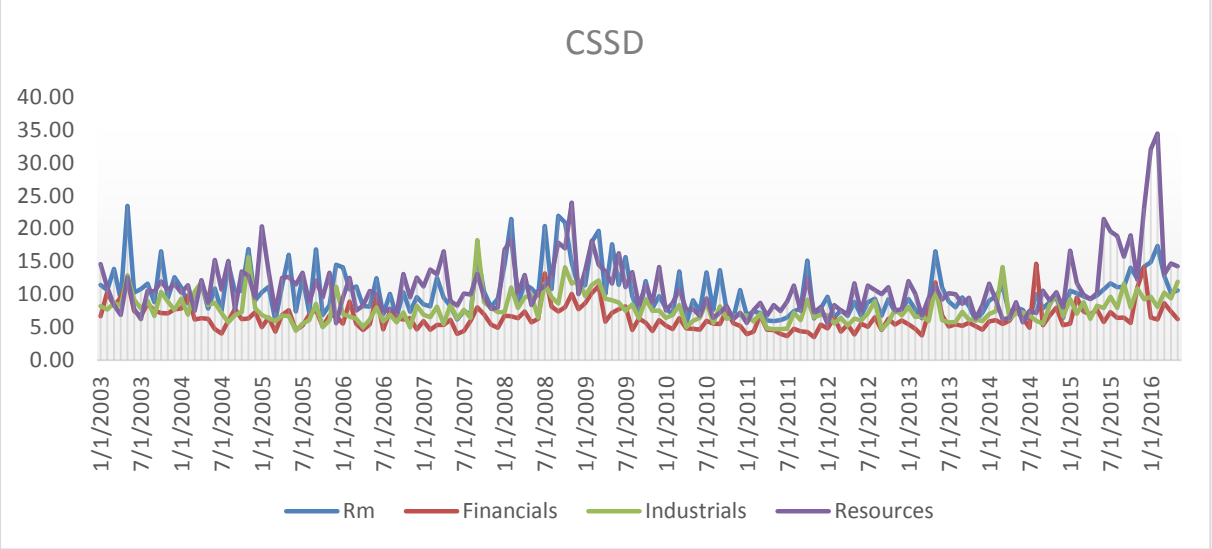

Figure 2 CSSD against time

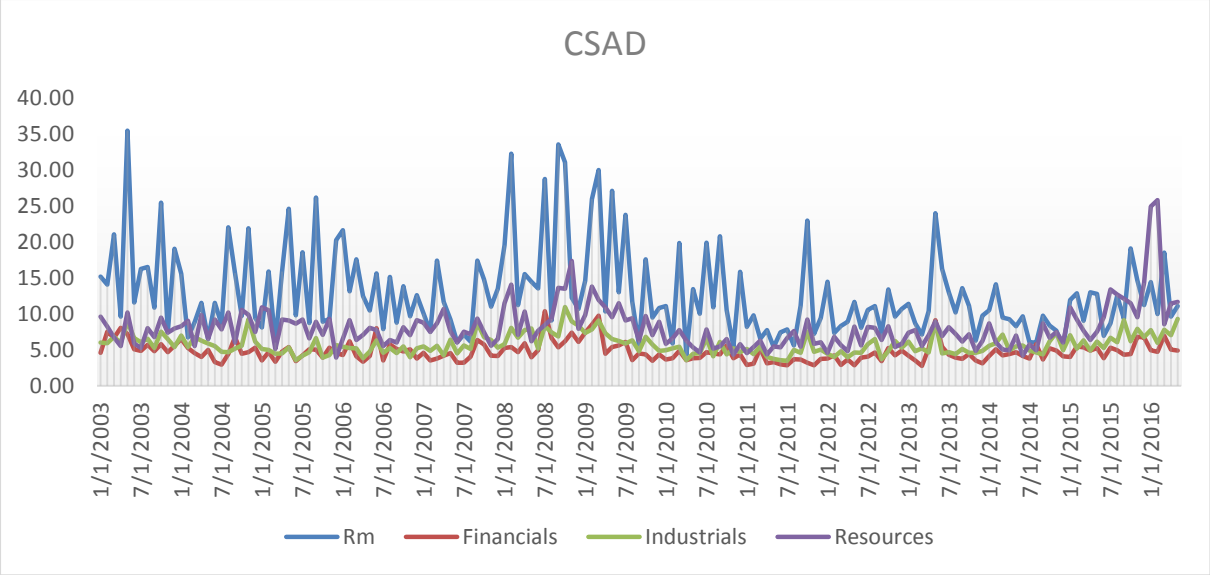

Figure 3 CSAD against time

Correlation matrices (in Figure 4) of the market confirm that there is a positive correlation between the deviation of market returns from the mean of 1.45% and the values of both CSSD and CSAD. This is true for all sectors however; only the correlogram for the overall market is included in this report. Note that, whilst there is visibly a stronger positive correlation between CSAD and the deviation of market returns from the mean, this phenomenon is clear as both measures provide the first pieces of evidence against the existence of herding within the JSE.

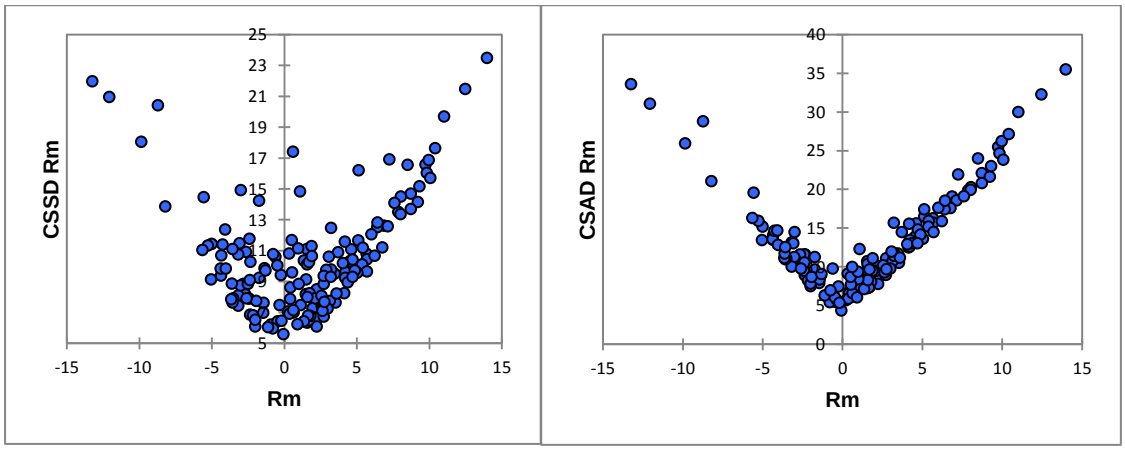

Figure 4 The Q-plots depicting the relationship between CSSD /CSAD and the market

4.3 Herding on the JSE over the research period

A total of 60 regressions where conducted, 15 for the JSE All Share and 15 for each of the three indices. The 15 regressions conducted on each index are organised as follows; three regressions using the CSSD measure of dispersion coupled with dummy variables that are triggered at three different levels of dispersion (measured at each of the first three standard deviations) as described in the methodology section and similar three regressions however, using the CSAD as measure of dispersion. The seventh regression, couples the CSAD measure of dispersion with the absolute value of the returns and the squared returns. The last eight regressions simply run the regressions with either up-market data or down-market data to investigate if herding exists in specific market conditions. For one to conclude that herding exists in any of these markets, at least one of the parameters within these regressions needs to be significant. Table 2 presents regression results for the JSE All Share Index. By using all dispersion based measures of herding under different market conditions, there is not enough evidence of herding into and out of this index. (Note that all the estimated parameters are positive and significant).

Table 2 Regression results from the JSE All share index

	Parameters		Goodness of Fit	
Regressions on the entire market	β_1 *or* γ_1 (p-value %)	β_2 *or* γ_2 (p-value %)	R^2	Adj. R^2
$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	3.07 (0)	6.27 (0)	0.42	0.41
$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	9.2 (0)	11.7 (0)	0.07	0.06
$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	11.7 (0)	-	0.07	0.06
$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	6.64 (0)	12.6 (0)	0.58	0.57
$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	16.0 (0)	20.5 (0)	0.40	0.39
$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	20.8 (0)	-	0.08	0.06
$CSAD_t = \alpha + \gamma_1 \lvert r_{m,t} \rvert + \gamma_2 r_{m,t}^2 + \varepsilon_t$	1.58 (0)	0.04 (0)	0.95	0.94
$CSSD_t^{Up} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	6.09 (0)	0	0.54	0.53
$CSSD_t^{Up} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	11.3 (0)	0	0.29	0.29
$CSSD_t^{Up} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	-	-	-	-
$CSAD_t^{UP} = \alpha + \gamma_1^{UP} \lvert r_{m,t}^{UP} \rvert + \gamma_2^{UP} \left(r_{m,t}^{UP}\right)^2 + \varepsilon_t$	1.36 (0)	0.05 (0)	0.96	0.96
$CSSD_t^{Down} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	6.27 (0)	3.07 (0)	0.42	0.41
$CSSD_t^{Down} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	11.7 (0)	9.18 (0)	0.38	0.38
$CSSD_t^{Down} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	0	11.7 (0)	0.06	0.06
$CSAD_t^{Down} = \alpha + \gamma_1^{Down} \lvert r_{m,t}^{Down} \rvert + \gamma_2^{Down} \left(r_{m,t}^{Down}\right)^2 + \varepsilon_t$	1.6 (0)	0.04 (0)	0.95	0.95

The results in all the above regressions are startling, and go against the conventional wisdom that developing markets have higher incidences of herd behaviour. Significantly positive parameters indicate that when the magnitude of the returns within the index increase, the cross-sectional dispersion also increases. This is in line with the prediction of standard asset pricing models and reflects what is termed as anti-herding behaviour. Repeating the exact same regressions for each of the three indices yields similar results.

Table 3 Regressions within the Financials Sector

	Parameters		Goodness of Fit	
	β_1 *or* γ_1 (p-value %)	β_2 *or* γ_2 (p-value %)	R^2	Adj. R^2
$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	0.85 (4)	1.05 (2)	0.05	0.04
$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	2.95 (0)	1.5 (12)	0.08	0.06
$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	0	0.97(50)	0.008	-0.005
$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	0.99 (0)	0.83 (0)	0.10	0.09
$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	2.86 (0)	1.59 (1)	0.17	0.16
$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	0	1 (31)	0.019	0.007
$CSAD_t = \alpha + \gamma_1 \lvert r_{m,t} \rvert + \gamma_2 r_{m,t}^2 + \varepsilon_t$	0.01 (93)	0.02 (6)	0.20	0.19
$CSSD_t^{Up} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	0.85 (4)	0	0.04	0.03
$CSSD_t^{Up} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	3 (0)	0	0.12	0.11
$CSSD_t^{Up} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	-	-	-	-
$CSAD_t^{UP} = \alpha + \gamma_1^{UP} \lvert r_{m,t}^{UP} \rvert + \gamma_2^{UP} \left(r_{m,t}^{UP}\right)^2 + \varepsilon_t$	-0.06 (63)	0.02 (2)	0.31	0.29
$CSSD_t^{Down} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	0.85 (4)	1.06 (2)	0.05	0.04
$CSSD_t^{Down} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	2.9 (0)	1.5 (12)	0.08	0.07
$CSSD_t^{Down} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	0	0.95 (50)	0.003	-0.003
$CSAD_t^{Down} = \alpha + \gamma_1^{Down} \lvert r_{m,t}^{Down} \rvert + \gamma_2^{Down} \left(r_{m,t}^{Down}\right)^2 + \varepsilon_t$	0.008 (94)	0.02 (6)	0.2	0.19

All the estimated parameters from the regressions on the financial sector index show that they are either positive and significant or simply insignificant. Thus, none of the estimated parameters provide evidence for herd behaviour within this index. Results from both the Resources index and the Industrials index also fail to find evidence of herd behaviour within the respective indices. All the parameters from all 30 regressions across the two sectors are either positive and significant or insignificant. They all imply that a positive relationship exists between the returns of each of the indices and their dispersion.

Table 4 Regressions of both Resources and Industrials Sectors

	Parameters		Goodness of Fit	
	β_1 *or* γ_1 (p-value %)	β_2 *or* γ_2 (p-value %)	R^2	Adj. R^2
$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	1.6 (0)	0.65 (20)	0.07	0.06
$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	4.3 (0)	0.8 (40)	0.07	0.06
$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	0 (0)	-0.5 (83)	0.001	-0.01
$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	1 (44)	0.7 (0)	0.08	0.07
$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	2.3 (0)	0.8 (20)	0.6	0.5
$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	0	0.03 (98)	0.003	-0.009
$CSAD_t = \alpha + \gamma_1 \lvert r_{m,t} \rvert + \gamma_2 r_{m,t}^2 + \varepsilon_t$	0.14 (20)	0.03 (73)	0.12	0.11
$CSSD_t^{Up} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	1.5 (0)	0	0.07	0.06
$CSSD_t^{Up} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	4.2 (0)	0	0.09	0.08
$CSSD_t^{Up} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	-	-	-	-
$CSAD_t^{UP} = \alpha + \gamma_1^{UP} \lvert r_{m,t}^{UP} \rvert + \gamma_2^{UP} \left(r_{m,t}^{UP}\right)^2 + \varepsilon_t$	0.04 (76)	0.02 (24)	0.16	0.15
$CSSD_t^{Down} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	1.6 (0)	0.65 (20)	0.07	0.06
$CSSD_t^{Down} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	4.32 (0)	0.8 (40)	0.07	0.06
$CSSD_t^{Down} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	-0.49 (82)	0	0	-0.0006
$CSAD_t^{Down} = \alpha + \gamma_1^{Down} \lvert r_{m,t}^{Down} \rvert + \gamma_2^{Down} \left(r_{m,t}^{Down}\right)^2 + \varepsilon_t$	0.14 (20)	0.003 (79)	0.12	0.11
Regressions within the Resources Sector				
$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	2.8 (0)	1.5 (12)	0.06	0.04
$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	1.7 (0)	2.1 (6)	0.09	0.08
$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	0	6.9 (12)	0.02	0.01
$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	2.3 (0)	1.4 (4)	0.09	0.08
$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	5.1 (0)	3.5 (2)	0.13	0.12
$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	0	5.6 (7)	0.02	0.01
$CSAD_t = \alpha + \gamma_1 \lvert r_{m,t} \rvert + \gamma_2 r_{m,t}^2 + \varepsilon_t$	-0.08 (59)	0.02 (3)	0.14	0.12
$CSSD_t^{Up} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	3.02 (0)	0	0.11	0.10
$CSSD_t^{Up} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	6.33 (0)	0	0.14	0.15
$CSSD_t^{Up} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	-	-	-	-
$CSAD_t^{UP} = \alpha + \gamma_1^{UP} \lvert r_{m,t}^{UP} \rvert + \gamma_2^{UP} \left(r_{m,t}^{UP}\right)^2 + \varepsilon_t$	-0.17 (37)	0.03 (2)	0.22	0.20
$CSSD_t^{Down} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 1 σ)	2.8 (0)	1.5 (12)	0.61	0.49
$CSSD_t^{Down} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 2 σ)	6.3 (0)	3.9 (6.9)	0.09	0.08
$CSSD_t^{Down} = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t$ (at 3 σ)	0	6.9 (12)	0.02	0.01
$CSAD_t^{Down} = \alpha + \gamma_1^{Down} \lvert r_{m,t}^{Down} \rvert + \gamma_2^{Down} \left(r_{m,t}^{Down}\right)^2 + \varepsilon_t$	0.02 (3)	-0.1 (59)	0.14	0.12

None of the 120 estimated coefficients provide enough evidence to reject the null hypothesis that there is no herding in the JSE. Of note are the Goodness of Fit statistics which are higher (for 1 and 2 standard deviations), than those reported in other studies.

These results make a compelling case for concluding that there is no herding in the JSE and within any of its sectors. It must however be highlighted that these results do not preclude the existence of herding in calm markets and during short periods (i.e., intramonth herding). Higher frequency data and an error correction based model would be required to confirm these facts and are thus recommended as future areas of study.

4.4 Chapter Summary

In this chapter, the results of the study were presented. Firstly, a brief description of the data showed that the JSE all share and its three main indices' data were distributed well enough for the researcher to use a dispersion based measure of herding. Secondly, evidence from 60 regressions using three different measures of herding at three different levels of sensitivity, could not reject a null hypothesis of no herding within the JSE or any of its sectors under any of the three previously described market conditions. Most the 60 regressions had relatively high goodness of fit statistics and highly significant coefficients. This led to the conclusion of there being no evidence of herding within the JSE or its sectors. The next chapter concludes this study and provides guidance for future areas of study.

Chapter 5 – Discussion and conclusion

5.1 Introduction

Herd behaviour is the tendency of individuals to make investment and trading decisions based upon what other investors and traders have decided. Herding often results in asset bubbles and crashes, greatly magnifying and clustering the volatility within the market where participants actively practice it. The result is often unstable markets and low confidence in the markets. Herding often works like a Ponzi scheme. It is a losing strategy that pays well to early movers that exit in time. Thus, it is imperative that market participants know when they are in a market that exhibits herd behaviour and that they actively try to avoid succumbing to its lure.

5.2 Discussion

This study investigates and establishes that there is no evidence of herding on the Johannesburg Stock Exchange and within any of its sectors. Monthly data spanning from January 2013 to May 2016 sourced from I-Net Bridge is combined with a dispersion based approach to measuring herding first proposed by Christie et al., (1995) and further developed by Chang et al., (2000) to make this case. Sixty regressions were conducted. Each regression looked for evidence of herd behaviour in a particular market under particular market conditions, however, none of the regressions provided enough evidence for one to conclude that there could be herding.

This result seems to contradict earlier findings by Gilmour and Smit, (2002); Sarpong and Sibanda, (2014); Seetharam and Britten, (2013) and Niyitegeka and Tewari, (2015), who all found some evidence of herding on the South African equity markets. Gilmour and Smit, (2002) found evidence of herding amongst unit trusts only during periods of elevated volatility and Sarpong and Sibanda (2014), found evidence of herding amongst mutual fund managers fund managers' compensation schemes often incentives herding as discussed in section 2.2, hence this result was expected. Furthermore, Seetharam and Britten, (2013) and Niyitegeka and Tewari, (2015) found contradictory results on herding. Seetharam and Britten, (2013) found evidence of herding only in bear markets and two years later, Niyitegeka and Tewari, (2015) found evidence of herding in bull markets. Exactly two years later, however, this study established that there was no evidence of herding within the JSE. These last three findings seem to suggest that herding is dynamic and changes, depending on when we look.

This makes sense. Financial markets are full of arbitrageurs, that, once patterns such as "herding exists in bear markets" are made public, trade them away almost immediately. This probably explains why Niyitegeka and Tewari, (2015) also found evidence of herding being short-lived on the JSE. The study's results might be skewed due to the fact that its data is subjected to survivorship bias, which could not be avoided as result of resource constraints. Furthermore, the study's results seem to suggest that in latter years the JSE has improved as it is more transparent, which has improved the quality of information sourced from the Stock Exchange. Interestingly, the conclusion that can be drawn from the study is that JSE investors are sophisticated, meaning that they do not have to herd in order to generate returns. Another assumption that can be made is that the financial models that are used by investors seem to vary as unintentional herding was not found, which at times can arise when investors use the same information and financial models. Investors on the JSE also seem to be well educated and their investment decisions are based on fundamental analysis.

5.3 Conclusion

This study did not find any evidence of herd behaviour in the JSE and within three of its sectors, hence the conclusion that there is no herding in JSE and within its sectors. However, by design of the research methodology, there is a relatively high risk of making a type 2 error. Whilst all due efforts were not spared in ensuring this risk is minimised, more can still be done. To begin with, further work on the topic, with the use of high frequency data and or different measures of herding, are recommended in order to compliment this study.

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