EMPIRICAL EXAMINATION OF HERDING BEHAVIOUR IN THE JOHANNESBURG STOCK EXCHANGE: A SECTORAL ANALYSIS

Kofi A. Ababio[1], Prof. John M. Mwamba[2]

This paper uses the daily stock returns from January 2010 to September 2015 to investigate the presence of herding behavior and its dynamics on the South African financial sector. The paper makes use of the median as an alternative proxy to the mean in estimating market average returns. We found evidence in support of herding behaviour in the general financials and the real estate sectors of the Johannesburg Stock Exchange (JSE) during normal market period. Investors in the banking and the insurance sectors were found to show rational investment decisions during all market periods.

Key Words: Herding behaviour, financial sector, Asymmetry, Johannesburg Stock Exchange.

JEL Classifications: G1, D7

1. INTRODUCTION

Herd behavior is a popular phenomenon in financial markets and in stock markets of advanced and emerging markets. Herding of participants in the financial market is defined as the tendency to accumulate on the same side of the market, which is a significant threat for financial market's stability and efficiency (Kremer and Nautz,

[1] Department of economics, University of Johannesburg, P. O. Box 524, Auckland Park 2006. Johannesburg - South Africa.

E-mail: 201493505@student.uj.ac.za

[2] Department of economics, University of Johannesburg, P. O. Box 524, Auckland Park 2006. Johannesburg - South Africa.

E-mail: johnmu@uj.ac.za

2011:1). Herding takes place when investors imitate the market consensus rather than using their own judgments.

Extant literature on the South Africa's financial market that studied for evidence of herding behaviour mainly focused on the market as a whole without emphases on the respective sectors of the industries. We believe that, a sector-based analysis of herding behaviour could reveal the true behavioural patterns among the various investor-types across the respective sectors in an industry. To a large extent, this will help understand in details the behavioural dynamics and bias of investors in specific sectors in a financial market.

The current study attempts to fill this gap by investigating all sectors under the financial industry in the JSE for evidence of herding behaviour. Again, the study considers two conventional approaches: the cross-sectional standard deviation ($CSSD_t$) and the cross-sectional absolute deviation ($CSAD_t$) to analyse herding behaviour. Lastly, an alternative proxy (i.e. median) is employed to estimate the market average return to minimise possible outlier effect. This allows us to compare results and discern whether methods of analysis with different proxies for market return lead to dissimilar conclusions.

Herding behaviour among investors is defined by other researchers from different point of view. Sharma and Bikhchandani (2000) simply defined herding as an investment strategy based on mimicking other investors' actions or the market consensus. According to Banerjee (1992), herding occurs when individuals do what everyone else does, even when their private information suggest they should take a different decision. Devenow and Welch (1996) and Sciubba (2002) refer to patterns of behaviour correlated among individuals. Likewise, Chang et al., (2000) referred to this behaviour as a process by which market participants base their investment decisions on collective actions alone, suppressing their own beliefs.

Herding behaviour is said to be an irrational behaviour by critics of traditional economics (Kahneman and Tversky 1979; 1992). For example, Asch (1952) studied the impact of an individual's social environment on his decision behaviour and observed that within groups, individuals often set-aside their own private signal to rely predominantly on group opinion. This phenomenon as described by Asch (1952) is common among investors' investors in the financial markets.

Behavioural finance has focused on the study of the rationality of investors as well as on the cognitive processes involved in the financial decisions made by investors, specifically, in their capital market investment decisions (Fromlet, 2001). Traditional economic theories are primarily built on the hypotheses of rational

investors and efficient markets. These theories have been contested by some psychologist and experimental economist working in the field of behavioural economics. The field of behavioural economics arose out of criticism of traditional economics.

Behavioural finance theory dictates that, investors are not fully rational but are influenced by psychological factors in their decision-making process (Colin and George (2004). Investors' emotions and beliefs come into play when taking a decision, deviating from rational choices and causing a shift in asset prices in relation to their intrinsic value. Under such market condition, it becomes difficult to determine the underlying value of assets and has a significant effect on security prices. It also leads to sudden crashes and bubbles in financial markets.

According to Ten et al., (2008), herding behaviour may lead to deviation of stock prices from their fair value through the properties of securities primarily associated with earnings and risks. Hwang & Salmon (2004) observed that, herding can lead to mispricing of stocks since decision making is disturbed through the exercise of bias analysis of expected return and systematic risk. Researchers believe that such behaviour is completely contagious.

Empirical studies into this phenomenon in both developed and emerging financial market have primarily focused on the use of two conventional methods: the cross-sectional standard deviation and cross-sectional absolute deviation suggested by Christie and Huang (1995) and Chang et al., (2000) respectively. These methods of analyses generally employed OLS and dummy variable models to study linear and non-linearity between stock dispersion and market return as a means of detecting investor herding behaviour. Likewise, non-parametric kernel regression, quantile regression, rolling regression method and state - space model have been proposed by other authors as alternative models to analyse herding behaviour.

According to Christie and Huang (1995), the investment decision-making process used by investors mainly depends on overall market conditions. They argued that, during normal periods, rational asset pricing models predict that the dispersion in returns will increase with the absolute value of the market portfolio return, since individual investors trade based on their own private information, which is diverse. As the absolute value of the market return increases, so should the dispersion in the individual asset returns.

However, during periods of extreme market movements, they posited that, individuals tend to suppress their own beliefs and investment decisions and follow the collective actions in the market. They observed that, under these conditions,

individual stock returns tend to cluster around the overall market return and herding behaviour becomes more prevalent especially during periods of market stress, described as the occurrence of extreme returns on the market portfolio.

According to Chang et al., (2000), the relationship as suggested by Christie and Huang (1995) may also be non-linear and that asymmetries may exist with herding behaviour during bull and bear markets.

Banerjee (1992), Scharfstein and Stein (1990), Devenow and Welch (1996), Bikhchandani et al., (1992) and Welch (1992) were among the first group of researchers who theoretically studied the herding behaviour. According to the authors, when a significant number of investors consistently chose the same type of behaviour, others begin to disregard their own information and start imitating their predecessors, and therefore extend a sequence of similar decisions.

However, the results of empirical studies into herding behaviour are not consensual. For instance, in the case of institutional investors, it may be due to the choice of time horizon, which is usually quarterly among other factors. According to McAleer and Radalj (2013), long periods make the herding behaviour evidence difficult. Other key factors that have been mentioned includes: the compensation schemes, the desirability of similar assets, the cost of reputation, the quality of the information conveyed to the market and the degree of sophistication of the market (Black 1986; Demirer and Kutan 2006; Patterson and Sharma 2006; Rajan 1994; Scharfstein and Stein 1990; Trueman 1988).

Several studies have analysed the existence of herding behaviour in specific stock markets among mutual fund and pension fund managers: Scharfstein and Stein 1990; Lakonishok et al. (1992); Grinblatt et al., 1995; Wermers 1999; Lobao and Serra 2002; Gleason and Lee 2003; Gallagher and Jarnecic 2004; Clement and Tse 2005; Wylie 2005; Andreu et al, 2009; Huang et al., 2010; Sarpong & Sibanda 2014 and financial analysts: Trueman 1994; Graham (1999); De Bondt et al., 1999; Hong et al., 2000; Welch 2000; Hong et al., 2000; Ashiya and Doi 2001; Lamont 2002; Gleason and Lee 2003; Clement and Tse 2005; Lin et al., 2011; Wen et. al., 2011).

Empirical investigation into herding behaviour among investors in the capital markets have focused largely on the United States and the European and Asian markets over the years with limited studies in other markets. Studies conducted in these markets have rejected the existence hypothesis of herding behaviour (Lakonishok et al., 1992; Grinblatt et al., 1995; Christie and Huang 1995; Chang et al., 2000; Chen et al., 2003 and Gleason et al., 2004). It is also observed that, the characteristics of an emerging market make herding behaviour more likely, in

comparison with a developed market, to be encountered in such a market (Chang et al., 2000; Lao and Singh 2011 and Economou et al., 2011).

Recent empirical evidence into herding behaviour among investors in advanced markets have contradicted the earlier notion that herding behaviour is prevalent in emerging markets (Demirer & Kutan 2006; Tessaromatis & Thomas (2009); Chiang et al., 2010; Tan et al., 2008; Chiang et al., 2010; Khan et al., 2011).

Lakonishok et al., (1992) evaluated changes in the observed proportions of buyers and sellers of certain securities, focusing on institutional investors. The authors found that, money managers did not exhibit herding behaviour in 769 tax-exempt U.S. pension funds analysed from 1985-1989.

Grinblatt et al., (1995) analysed 155 U.S. mutual funds from December 1974 and December 1984. In general, their results showed weak level evidence of herding behaviour among fund managers. The findings was consistent with the results of Lakonishok et al. (1992).

Hwang and Salmon (2001) analysed the US, UK, and South Korean financial markets for evidence of herding behaviour. They evaluated the direction towards which the market may be herding. Their measure of analysis primarily focused on fundamentals of the firms and influence of time series volatility in an attempt to differentiate intentional herding from spurious herding. Contrary to Christie and Huang (1995), they found herding behaviour in normal market conditions rather than market stress.

Demirer and Kutan (2006) used daily firm-level returns, for 375 stocks on the Shanghai and Shenzhen Stock Exchanges from January 1999 to December 2002 to analyse the presence of herding behaviour in the Chinese market employing the methodologies of Chang et al., (2000) and Christie and Huang (1995). They found no evidence in support of herding behaviour and concluded that Chinese investors make investment decisions rationally. Their results were consistent with Chen et al., (2003), who also analysed herding behaviour in the Chinese market.

Chiang et al., (2010) studied for evidence of herding behaviour in 18 countries including: the United States, Australia, France, Germany, Hong Kong, Japan, the United Kingdom, Argentina, Brazil, Chile, Mexico, China, South Korea, Taiwan, Indonesia, Malaysia, Singapore, and Thailand using daily data from May 25, 1988 to April 24, 200. They found evidence in support of herding behaviour in all national markets except the US and Latin America. The result stands in contrast to the earlier literature that, herding in advanced markets (Chang et al. (2000)) and in Chinese markets (Demirer and Kutan (2006)) do not exist.

Bonffm and Kim (2014) analysed 500 largest banks in 43 countries including: the United States, Canada, France, Germany, Italy, the Netherlands, the Russian Federation and the UK for evidence of herding behaviour using eight years' worth of data. They found evidence that herding behaviour was significant only among the largest banks after controlling for endogeneity.

Empirical findings of the Portuguese market have documented evidence of herding behaviour among investors. These studies includes: Lobao and Serra (2002) and Vieira and Pereira (2015). A sample of 32 equity mutual funds and Portuguese stock PSI-20 index were analysed independently over the periods 1998 - 2000 and 2003 - 2011 by Lobao and Serra (2002) and Vieira and Pereira (2015) respectively. Both studies found evidence of herding behaviour.

Largely, most of these studies have been directed towards the advanced markets compared to the emerging markets. Empirical studies on herding behaviour in Africa's context has been less explored. For instance, in South Africa, studies into herding behaviour among investors includes: Gilmour & Smit (2002); Seetharam and Britten (2013) and Sarpong and Sibanda (2014).

Gilmour and Smit (2002) tested for institutional herding in the unit trust industry in South Africa. They found that, herding behaviour was present for unit trusts at a certain level of volatility. They observed that, the greater the volatility, the greater the herding of unit trusts.

Seetharam and Britten (2013) examined herding behaviour among investors using all shares listed on the Johannesburg Stock Exchange (JSE) and All Share Index (ALSI) from 1995 to 2011. They found evidence of herding behaviour during bear market periods only, however, it was absent overall.

Sarpong and Sibanda (2014) investigated herding behaviour among equity mutual fund managers and the performance of mutual funds that trade against the herd in South Africa. Lakonishok et al., (1992) herding measure of trading was employed to analyse herding behaviour of mutual funds from 2006 to 2012. They found evidence of herding behaviour among mutual fund managers. They concluded that, institutional investors in South Africa are prone to the behavioural bias of herding and the phenomenon influences the performance of their funds. Their results was consistent with earlier literature (Gilmour and Smit 2002).

The current study tests for evidence of herding behaviour in the financial industry of the Johannesburg Stock Exchange (JSE) from 2010 - 2015; and examines whether herding behaviour was a key market characteristic. The remainder of the paper is organised as follows. Section 2 presents the methodology used to analyse

herding behaviour. Section 3 describes the data. Section 4 reports empirical evidence of herding behaviour in the models. Section 5 concludes.

2. METHODOLOGY

2.1 Existence of Herding Behaviour on Market as a Whole:

The paper employs the cross-sectional standard deviation (CSSD) and cross-sectional absolute deviation (CSAD) suggested by Christie and Huang (1995) and Chang, Cheng and Khorana (2000) respectively. The two methodologies use the mean as a proxy to estimate average market returns. Using same methodologies, the study also considers the median as an alternative measure in estimating cross sectional average market returns. The median is a robust measure of central tendency in the presence of outliers compared to the mean. In this study, we consider the median as an alternative proxy to the mean.

Employing both proxies for estimating average market returns, the following regression model is run to find out the effect of market stress on individual return dispersion ($CSSD_t$).

$$CSSD_t = \alpha + \beta^L D_t^L + \beta^U D_t^U + \varepsilon_t \quad (1)$$

where D_t^L and D_t^U are dummy variables specifying the periods of market stress from normal periods. β^L and β^U are the respective coefficients of the dummy variables to be estimated.

The dummy variables in equation (1) are used as independent variables to differentiate the periods of market stress from normal periods. Market stress occurs when aggregate returns lie in upper or lower tail of return distribution. So that, $D_t^L = 1$ if, on day t, $R_{m,t}$ lies in lower tail of return distribution and 0 otherwise. Likewise, $D_t^U = 1$ if, on day t, $R_{m,t}$ lies in upper tail of return distribution and 0 otherwise. We use the arbitrary 1% and 5% level thresholds for market stress. Herding was proven if dummy variable coefficients were negative and statistically significant.

$CSSD_t$ has been used as a measure of individual return dispersion. It is formulated as:

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

where $R_{i,t}$ is the return of stock i at time t and $R_{m,t}$ is the cross-sectional average return of N stocks of the sample at time t. In cases of extreme market stress, investors follow the market consensus rather than following their own beliefs to seek certainty and conformity. This is to avoid making incorrect decisions under the conditions of uncertainty during periods of extreme market stress which eventually leads to herding. In the presence of herding, investors' decisions is based solely on market movements. This leads to individual asset returns moving in a similar direction to the overall market returns. The value of $CSSD_t$ therefore increases at a decreasing rate with an increasing market returns. However, in presence of severe herding it may lead to decrease in dispersion.

2.2 Non Linearity of Herding Pattern:

The study also apply the cross-sectional absolute deviation ($CSAD_t$), a variant of the $CSSD_t$ methodology suggested by Chang et al., (2000) to examine the existence of linear and non-linear relationship between stock dispersion and market returns. According to Chang et al., (2000), the stock dispersions will increase at decreasing rates with the increasing returns of the market, in case of moderate to severe herding. They defined $CSAD_t$ as:

$$CSAD_t = \frac{\sum_{i=1}^{N}\left|R_{i,t} - R_{m,t}\right|}{N}, \quad (3)$$

where $R_{i,t}$ is the return of stock i at time t and $R_{m,t}$ is the cross-sectional average return of N stocks of the sample at time t. Similarly, a regression model is run to find the effect of market stress on individual return dispersion using $CSAD_t$ as a measure of stock dispersion.

$$CSAD_t = \alpha + \beta^L D_t^L + \beta^U D_t^U + \varepsilon_t \quad (4)$$

where β^L (D_t^L) and β^U (D_t^U) have same meaning as in equation (1).

Likewise, a negative and statistically significant values of β^L and β^U in equation (4) would indicate the presence of herding behaviour synonymous with equation (1) above.

They consider a general quadratic equation to test this behaviour:

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

where $R_{m,t}$ is the cross-sectional average return of N stocks of the sample at time t. Under the quadratic (non-linear) setting, a negative and significant coefficient of ${R_{m,t}}^2$ (γ_2) indicates herding behaviour.

2.2.1 Presence of Herding in the Extreme Market Phases:

Considering that, the stock behaviour may be asymmetric in the extreme market phases, the generalised relationship as indicated above can be bifurcated into following;

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

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

where $\left| {R_{m,t}}^{UP} \right|$ and $\left| {R_{m,t}}^{DOWN} \right|$ are the absolute values of the average over all sample return when market is up (or down). A negative and significant γ_2^{UP} and γ_2^{DOWN} captures herding behaviour.

3. DATA:

The South African financial industry consist of five sectors namely: banking, general financials, real estate, life insurance and non-life insurance respectively. We limit the sectors into four by merging life insurance and non-life insurance as insurance due to data constraint for the specified study period.

All time-series data are obtained from McGregor Inert Expert Database and span the period from January 4, 2010 to September 30, 2015. The stock return r_t is estimated as the $\log (P_t / P_{t-1})$. For each stock, we have 1435 daily return observations.

4. EMPIRICAL RESULTS

4.1. Descriptive Analysis:

The descriptive statistics related to $CSSD_t$ and $CSAD_t$ employing the conventional mean and an alternative proxy (median) are given by Table 1 below. The general financials sector recorded the highest mean stock dispersion using the conventional mean ($CSSD_t$ - 0.0404 and $CSAD_t$ - 0.0192) and the median ($CSSD_t$ - 0.0411 and $CSAD_t$ - 0.0166) respectively. Similarly, the sector also recorded the highest standard deviation score for both $CSSD_t$ and $CSAD_t$ series in the financial industry. Using the mean, the financial sector's $CSSD_t$ and $CSAD_t$ were estimated as 0.0343 and 0.0115 whiles the median recorded 0.0347 and 0.0082 respectively.

The study analysed a total of seventy-one (71) companies listed on the JSE under the financial industry. The listed companies were drawn from four (4) sectors and included: banking (5), general financials (39), insurance (10) and real estate (17).

Table 1: Descriptive Statistics of Market Dispersion

SECTOR			Mean	S.D.	Max	Min
BANKING	Mean	CSSD	0.0098	0.0049	0.0498	0.0010
		CSAD	0.0067	0.0035	0.0355	0.0008
	Median	CSSD	0.0103	0.0052	0.0560	0.0010
		CSAD	0.0067	0.0031	0.0250	0.0007
GEN. FINANCIALS	Mean	CSSD	0.0404	0.0343	0.3865	0.0063
		CSAD	0.0192	0.0115	0.1303	0.0045
	Median	CSSD	0.0411	0.0347	0.3865	0.0063
		CSAD	0.0166	0.0082	0.0799	0.0034
INSURANCE	Mean	CSSD	0.0135	0.0095	0.1383	0.0028
		CSAD	0.0096	0.0055	0.0787	0.0021
	Median	CSSD	0.0138	0.0099	0.1455	0.0029
		CSAD	0.0091	0.0045	0.0564	0.0020
REAL ESTATE	Mean	CSSD	0.0098	0.0049	0.0498	0.0010
		CSAD	0.0073	0.0035	0.0355	0.0008
	Median	CSSD	0.0103	0.0052	0.0560	0.0010
		CSAD	0.0067	0.0031	0.0250	0.0007

4.2: Regression Results:

We present the empirical results in this study as follows. First, we test for evidence of herding behaviour using the methodologies ($CSSD_t$ and $CSAD_t$) as described above in a linear setting. Here, it is assumed that, the relationship between stock dispersion and market returns is linear. In step two, evidence of herding behaviour is investigated in a nonlinear setting using only the $CSAD_t$ methodology. Likewise, it is assumed that, the relationship between stock dispersion and market returns is non-linear.

4.3: Linearity of Herding Behaviour

Equations (1) and (4) explained above were estimated to test for evidence of herding behaviour among investors in the financial industry of the JSE. A negative and statistically significant coefficients (β^L *or* β^U) of the dummy variables (D_t^L *or* D_t^U) signifies evidence of herding behaviour in a sector. The median was employed as an alternative proxy to the mean for estimating daily market average returns. The market average returns were the primary input statistics in estimating $CSSD_t$ and $CSAD_t$ in equations (1) and (4). Table 2a and Table 2b below show the regression results testing for evidence of herding behaviour in the extreme tails of the return distribution. The extreme tails were tested at a 1% and 5% threshold of the return distribution.

Table 2a: Results of Dummy Regression of Daily $CSSD_t$ and $CSAD_t$

SECTOR	(%)	Mean				Mean			
		Model	Coef.	t-statistic	R^2 (%)	Model	Coef.	t-statistic	R^2 (%)
BANKING	1%	α	0.0097***	75.229	1.93	α	0.0072***	77.637	1.62
		β^L	0.0056**	2.852		β^L	0.0027**	2.609	
		β^U	0.0057***	4.508		β^U	0.0037***	4.117	
	5%	α	0.0094***	71.311	5.56	α	0.0070***	73.742	5.73
		β^L	0.0037***	6.363		β^L	0.0028***	6.668	
		β^U	0.0040***	6.948		β^U	0.0028***	6.866	
	1%	α	0.037***	55.84		α	0.018***	80.02	

GENERAL FINANCIALS	5%	β^L	0.1796***	27.87	47.73	β^L	0.0595***	27.09	46.27
		β^U	0.1503***	23.33		β^U	0.0497***	22.64	
		α	0.0338***	43.37		α	0.0168***	67.12	
		β^L	0.0692***	20.39	33.41	β^L	0.0253***	23.23	39.37
		β^U	0.0626***	18.46		β^U	0.0228***	20.95	
INSURANCE	1%	α	0.0129***	55.714		α	0.0093***	69.07	
		β^L	0.0203***	8.983	15.85	β^L	0.0132***	10.05	17.54
		β^U	0.0313***	13.842		β^U	0.0188***	14.37	
	5%	α	0.0123***	50.29		α	0.0089***	63.11	
		β^L	0.0096***	9.01	14.14	β^L	0.0064***	10.55	17.42
		β^U	0.0137***	12.89		β^U	0.0088***	14.35	
REAL ESTATE	1%	α	0.0097***	75.229		α	0.0072***	77.637	
		β^L	0.0036**	2.852	1.93	β^L	0.0024**	2.607	1.62
		β^U	0.0057***	4.508		β^U	0.0037***	4.117	
	5%	α	0.0094	71.311		α	0.0070***	73.742	
		β^L	0.0037	6.363	5.56	β^L	0.0028***	6.668	5.73
		β^U	0.0040	6.948		β^U	0.0028***	6.866	
	a. Dependent Variable: $CSSD_t$					**b.** Dependent Variable: $CSAD_t$			

T-statistics are reported with ***, **, ***** indicating significance at 10%, 5% and 1%.

Regression results in Table 2a above show no evidence of herding behaviour among investors in all the sectors. None of the coefficients (β^L *or* β^U) of the dummy variables (D_t^L *or* D_t^U) were found to be statistically significant. The results were consistent as both methodologies ($CSSD_t$ and $CSAD_t$) failed to show evidence of herding behaviour during the extreme market periods.

According to Chang et al., (2000), $CSSD_t$ is sensitive to outliers and hence proposed the $CSAD_t$ as remedy to the model weaknesses. In this study, both methodologies resulted in the same conclusion. The results suggest that, investors in the financial industry make investment decisions rationally during periods of extreme market conditions.

Table 2b: Results of Dummy Regression of Daily $CSSD_t$ and $CSAD_t$

SECTOR	(%)	Median				Median			
		Model	Coef.	t-statistic	R^2 (%)	Model	Coef.	t-statistic	R^2 (%)
BANKING	1%	α	0.0102***	73.847	1.33	α	0.0066***	80.793	1.51
		β^L	0.0038**	2.746		β^L	0.0029***	3.531	
		β^U	0.0047***	3.461		β^U	0.0025**	3.107	
	5%	α	0.0100***	69.904	2.49	α	0.0065***	76.586	2.8
		β^L	0.0029***	4.671		β^L	0.0019***	5.124	
		β^U	0.0026***	4.083		β^U	0.0015***	4.140	
GENERAL FINANCIALS	1%	α	0.0409***	44.205	0.14	α	0.0165***	75.936	1.23
		β^L	0.0129	1.381		β^L	0.0083***	3.806	
		β^U	0.0026	0.277		β^U	0.0041	1.860	
	5%	α	0.0410***	43.956	0.04	α	0.0164***	75.263	1.08
		β^L	0.0058	0.434		β^L	0.006***	3.416	
		β^U	0.0006	0.935		β^U	0.0034*	2.036	
INSURANCE	1%	α	0.0137***	52.332	0.92	α	0.0089***	76.218	3.94
		β^L	0.0078**	3.042		β^L	0.0069***	6.082	
		β^U	0.0052*	2.048		β^U	0.0054***	4.731	
	5%	α	0.1340***	49.331	2.02	α	0.0087***	72.189	7.15
		β^L	0.0038**	3.191		β^L	0.0037***	7.114	
		β^U	0.0055***	4.562		β^U	0.0043***	8.076	
REAL ESTATE	1%	α	0.0102***	73.847	1.33	α	0.0066***	80.793	1.51
		β^L	0.0038***	0.0014		β^L	0.0029***	3.531	
		β^U	0.0047***	3.461		β^U	0.0025**	3.107	

	α	0.0100***	69.904		α	0.0065***	76.586	
5%	β^L	0.0029***	4.671	2.49	β^L	0.0019***	5.124	2.8
	β^U	0.0026***	4.083		β^U	0.0015***	4.140	
a. Dependent Variable: $CSSD_t$					**b.** Dependent Variable: $CSAD_t$			

T-statistics are reported with ***, **, ***** indicating significance at 10%, 5% and 1%.

Employing the median as an alternative proxy for estimating market average returns, the results in Table 2b above also show no evidence of herding behaviour in the financial industry. The median was introduced in the study as a robust measure of market average return which is not affected by outliers. This could solve the problem with $CSSD_t$ with respect to outlier effect as posited by Chang et al., (2000).

Generally, the mean is known to be influenced by outliers, using the $CSAD_t$ methodology as an alternative measure of stock dispersion in addressing the effect of outliers in $CSSD_t$ methodology may not yield the expected results. Replacing the conventional proxy (mean) for the median in estimating the market average returns could yield the desired results. However, in this study, using the dummy regression model in equations (1) and (4), both methodologies resulted in the same conclusion employing both the mean and the median.

4.4: Nonlinearity of Herding Behaviour

Equation (5) was estimated to test for non-linear evidence of herding behaviour among investors in the financial industry of the JSE. A negative and statistically significant coefficients (γ_2) of ($R_{m,t}^{\ 2}$) signifies evidence of herding behaviour in the financial industry.

It is evident in Table 3a that, employing the conventional proxy (i.e. mean) for estimating market average return, the results show no evidence of herding behaviour in all the sectors in the financial industry in the entire market. None of the coefficients (γ_2) of ($R_{m,t}^{\ 2}$) were negative and statistically significant in all sectors. The results indicate that, investors in the financial industry make investment decisions rationally and are not susceptible to the behavioural bias of herding.

Table 3a: Total Market Dummy Regression Results Using $CSAD_t$

SECTOR	**Mean**			
	Model	Coef.	t-statistic	R^2 (%)

BANKING	α	0.0064***	35.18	5.47
	γ_1	0.0852**	2.932	
	γ_2	0.8485	0.959	
GENERAL FINANCIALS	α	0.0012***	45.68	74.18
	γ_1	1.0008	21.97	
	γ_2	13.4***	12.-55	
INSURANCE	α	0.0075***	32.375	31.24
	γ_1	0.165**	3.095	
	γ_2	17.21***	7.881	
REAL ESTATE	α	0.0004***	18.624	94.84
	γ_1	0.02***	84.733	
	γ_2	0.6044***	6.698	
	Dependent Variable:			

T-statistics are reported with ***, **, ***** indicating significance at 10%, 5% and 1%.

On the other hand, results in Table 3b show evidence of herding behaviour in the general financials and real estate sectors in the financial industry using the median as proxy for estimating market average return in the entire market. However, the results show no evidence of herding behaviour among investors in the banking and insurance sectors. This implies that, investors in these sectors are not prone to the behavioural bias of herding in the financial industry.

In the general financials sector, we found a negative and statistically significant coefficient of $R_{m,t}^{\ 2}$ as – 87.4454*****. Similarly, in the real estate sector, the statistically significant coefficient of $R_{m,t}^{\ 2}$ was estimated to be – 824*******. Whiles the coefficient in the general financials sector was found to be significant at a 10% level of significance, in the real estate sector, the coefficient was highly significant at a 1% level of significance.

Table 3b: Total Market Dummy Regression Results Using $CSAD_t$

SECTOR	**Median**			
	Model	Coef.	t-statistic	R^2 (%)
BANKING	α	0.0061***	38.538	4.0
	γ_1	0.0556*	2.277	

	γ_2	0.7573	1.058	
GENERAL FINANCIALS	α	0.0164***	75.7	1.45
	γ_1	2.0351***	3.55	
	γ_2	**-87.4454***	**- 1.98**	
INSURANCE	α	0.0077***	44.361	11.43
	γ_1	0.3322***	7.075	
	γ_2	-2.4248	-1.197	
REAL ESTATE	α	0.0114***	28.559	2.50
	γ_1	10.13***	5.375	
	γ_2	**-824.0*** **	**- 4.065**	
	Dependent Variable: $CSAD_t$			

T-statistics are reported with ***, **, ***** indicating significance at 10%, 5% and 1%.

4.4.1: Nonlinearity of Herding Behaviour: Bull and Bear Market Phases

Equations (6) and (7) were estimated to find if there were any evidences of the presence of herding behaviour in bull and bear phases of the market; employing the conventional mean as proxy for estimating market average returns. In Table 4a and Table 4b below, none of the coefficients of $(R_{m,t}{}^{DOWN})^2$ and $(R_{m,t}{}^{UP})^2$ were found to be negative and statistically significant considering the extreme 1% and 5% threshold of the return distribution. The result suggests lack of evidence of the presence of herding behaviour in all sectors in the financial industry.

Table 4a: Dummy Regression Results During Market Stress

SECTOR	Mean (1%)				Mean (99%)			
	Model	Coef.	t-statistic	R^2 (%)	Model	Coef.	t-statistic	R^2 (%)
	Lower Tail				**Upper Tail**			
BANKING	α	0.0109	0.200	0.03	α	0.0187	0.407	0.37
	γ_1^{DOWN}	-0.0573	-0.020		γ_1^{UP}	-0.4285	-0.177	
	γ_2^{DOWN}	0.5693	0.016		γ_2^{UP}	5.7262	0.184	
	α	0.0399	1.549	87.94	α	-0.0255	-0.645	86.64

GENERAL FINANCIALS	γ_1^{DOWN}	0.2144	0.161		γ_1^{UP}	3.2908	1.665	
	γ_2^{DOWN}	17.5846	1.133		γ_2^{UP}	-14.4711	-0.673	
INSURANCE	α	-0.4820	-1.706		α	0.2604	1.620	
	γ_1^{DOWN}	36.4739	1.747	23.3	γ_1^{UP}	-16.7857	-1.538	25.08
	γ_2^{DOWN}	-647.8968	-1.701		γ_2^{UP}	290.5552	1.634	
REAL ESTATE	α	0.0245**	3.656		α	0.0071	0.567	
	γ_1^{DOWN}	1.1833***	7.664	99.85	γ_1^{UP}	1.5430***	5.268	99.54
	γ_2^{DOWN}	2.2173***	4.68		γ_2^{UP}	1.0491	1.188	
Dependent Variable: $CSAD_t$								

Table 4b: Dummy Regression Results During Market Stress

SECTOR	**Mean (5%)**				**Mean (95%)**			
	Model	Coef.	t-statistic	R^2 (%)	Model	Coef.	t-statistic	R^2 (%)
	Lower Tail				**Upper Tail**			
BANKING	α	0.0064	0.822		α	0.0054	0.695	
	γ_1^{DOWN}	0.2351	0.433	0.27	γ_1^{UP}	0.2487	0.479	0.18
	γ_2^{DOWN}	-3.7585	-0.431		γ_2^{UP}	-2.6243	-0.323	
GENERAL FINANCIAL	α	0.0099	1.603		α	-0.0016	-0.300	
	γ_1^{DOWN}	1.4674**	3.062	83.59	γ_1^{UP}	2.0807***	5.494	84.84
	γ_2^{DOWN}	5.2438	0.763		γ_2^{UP}	-1.399	-0.262	
INSURANCE	α	-0.0043	-0.267		α	0.0064	0.446	
	γ_1^{DOWN}	1.3287	0.809	18.3	γ_1^{UP}	0.2349	0.183	28.66
	γ_2^{DOWN}	-11.847	-0.306		γ_2^{UP}	18.1081	0.694	
REAL ESTATE	α	0.0100**	3.128		α	0.0096*	2.521	
	γ_1^{DOWN}	1.531***	13.067	97.47	γ_1^{UP}	1.5289***	11.019	96.85
	γ_2^{DOWN}	1.1645**	2.831		γ_2^{UP}	1.0664*	2.256	
Dependent Variable: $CSAD_t$								

T-statistics are reported with ***, **, ***** indicating significance at 10%, 5% and 1%.

Similarly, employing the median as a proxy in estimating average market return also show no evidence of herding behaviour in all sectors investigated. The extreme 1% and 5% tails of the return distribution in Table 5a and Table 5b yielded no evidence of the presence of herding behaviour.

Table 5a: Dummy Regression Results During Market Stress

SECTOR	Median (1%)				Median (99%)			
	Model	Coef.	t-statistic	R^2 (%)	Model	Coef.	t-statistic	R^2 (%)
	Lower Tail				**Upper Tail**			
BANKING	α	0.0435	1.286		α	0.0307	1.474	
	γ_1^{DOWN}	-1.533	-0.944	12.11	γ_1^{UP}	-1.1833	-1.143	20.75
	γ_2^{DOWN}	16.2751	0.864		γ_2^{UP}	15.618	1.253	
GENERAL FINANCIALS	α	0.0094	0.833		α	0.0152*	3.081	
	γ_1^{DOWN}	4.94	1.346	15.75	γ_1^{UP}	1.8494	0.866	19.54
	γ_2^{DOWN}	-233.7	-1.261		γ_2^{UP}	-88.0395	-0.543	
INSURANCE	α	0.059	1.014		α	-0.0308	-1.482	
	γ_1^{DOWN}	-3.5864	-0.800	14.16	γ_1^{UP}	2.8808	2.033	38.45
	γ_2^{DOWN}	73.1526	0.859		γ_2^{UP}	-42.9036	- 1.853	
REAL ESTATE	α	0.017***	6.075		α	0.0085	0.913	
	γ_1^{DOWN}	-2.1629	-1.674	35.01	γ_1^{UP}	39.57	0.935	15.57
	γ_2^{DOWN}	247.073	2.179		γ_2^{UP}	-3461	-0.960	

Dependent Variable: $CSAD_t$

T-statistics are reported with ***, **, ***** indicating significance at 10%, 5% and 1%.

Table 5b: Dummy Regression Results During Market Stress

SECTOR	Median (5%)				Median (95%)			
	Model	Beta	t-statistic	R^2 (%)	Model	Beta	t-statistic	R^2 (%)
	Lower Tail				**Upper Tail**			

BANKING	α	-0.0016	-0.273		α	0.0028	0.585	
	γ_1^{DOWN}	0.6938	1.786	4.44	γ_1^{UP}	0.2617	0.834	7.78
	γ_2^{DOWN}	-10.4115	-1.781		γ_2^{UP}	-2.2015	-0.466	
GENERAL FINANCIALS	α	-0.0016	-0.273		α	0.0166***	7.709	
	γ_1^{DOWN}	0.6938	1.786	4.44	γ_1^{UP}	1.5635	1.304	18.55
	γ_2^{DOWN}	-10.4115	-1.781		γ_2^{UP}	-74.4759	-0.732	
INSURANCE	α	0.059	0.01		α	-0.0308*	2.42	
	γ_1^{DOWN}	-1.286	-0.915	1.88	γ_1^{UP}	-0.0458	-0.092	3.32
	γ_2^{DOWN}	28.0806	0.817		γ_2^{UP}	4.1812	0.388	
REAL ESTATE	α	0.0274*	2.042		α	0.0085	0.116	
	γ_1^{DOWN}	-1.286	-0.915	1.88	γ_1^{UP}	39.57	0.935	15.57
	γ_2^{DOWN}	28.0806	0.817		γ_2^{UP}	-3461	-0.96	
Dependent Variable: $CSAD_t$								

T-statistics are reported with ***, **, ***** indicating significance at 10%, 5% and 1%.

5. CONCLUSION

This study examines the herding behaviour of investors in four sectors (banking, general financials, insurance and real estate) of the financial industry in the JSE. Estimations were based on daily observations from January 2010 to September 2015. The study finds evidence in support of herding behaviour in the general financials and real estate sectors during normal market period using the median as a proxy for market average return. The results are consistent with the findings of Chang et al., (2000); Lao and Singh (2011) and Economou et al., (2011) who observed that, the characteristics of an emerging market make herding behaviour more likely in comparison with developed markets.

Investors' in the banking and insurance sectors of the financial industry were found to show rational investment decisions in all market conditions. Lack of evidence of

herding behaviour in the two sectors also contradicts the views of Chang et al., (2000); Lao and Singh (2011) as well as Economou et al., (2011). The results for $CSSD_t$ and $CSAD_t$ using the mean and the median were consistent in the case of the two sectors. Both proxies for estimating market average return using the two methodologies yielded same results.

The use of the conventional proxy (i.e. mean) for estimating the market average return during normal market period and market stress showed no evidence of herding behaviour in all sectors considered in this study. The traditional methods of analysing herding behaviour in financial markets (i.e. $CSSD_t$ and $CSAD_t$) failed to find any evidence of herding behaviour among investors both in the linear ($CSSD_t$ and $CSAD_t$) and non-linear ($CSAD_t$) framework. Similarly, employing the median as an alternative and robust measure of estimating average market return, the results in some cases contradicted that of the conventional proxy (mean).

The median is not sensitive to outliers as compared to the mean. The inconsistency in results using the two proxies could be attributed to the sensitivity of the mean to outliers. As a confirmation test, we suggest that, the results of the methodologies considered in this paper could be compared with other alternative technique such as the quantile regression model.

Quantile regression, a semiparametric alternative to Ordinary Least Square Regression (OLS) is robust to the presence of outliers, they will not pose a severe threat to the reliability of results (Koenker and Hallock, 2001:17). Similarly, financial data usually fail to pass the test of normality. Compared to OLS, quantile regression may be a more efficient estimation method when the distribution of errors is non-normal (Barnes and Hughes, 2002: 5).

Whiles the median handles possible outlier effect in the cross-sectional market average return, the quantile regression could offer similar treatment with respect to the stock dispersion (CSSD or CSAD) and the market return time series. To discern and understand the conflicting nature of results with respect to the proxies considered in this study; an attempt to use the median as a market average return proxy and quantile regression model to analyse investors' herding behaviour could help understand the inconsistency in empirical results in the current study with respect to the market average return proxy employed.

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