

DO INVESTORS HERD IN FRONTIER MARKETS? EVIDENCE FROM THE DAR ES SALAAM STOCK EXCHANGE

Gabriel V. Komba (PhD)
School of Business
Mzumbe - Morogoro, Tanzania
Email: gkomba@mzumbe.ac.tz

ABSTRACT

The purpose of this study is to investigate the presence of herding effects at the Dar-es-Salaam Stock Exchange. It employs a dataset of daily closing prices and market capitalizations of companies composing the industrial and allied sector, and those covering banks, finance, and investment sector. The study used cross-sectional dispersion of stock return tests to examine the presence of herding for the two sectors. The findings provide evidence of herding in the banks, finance, and investment sector throughout the full-sample period, with the herding being driven mainly by large-capitalization stocks. Furthermore, the results indicate clear presence of herding asymmetries conditional on the performance of the market and on the market's volatility. On the case of the industrial and allied sector, herding is found to be stronger on days with low volatility only. The economic implication of this evidence is that the observed correlated trading patterns for the banks, finance, and investment sector may undermine financial stability.

Keywords: *Herding behaviour; Asymmetric behaviour ;
Dar-es-Salaam Stock Exchange*

1.0 INTRODUCTION

The literature is rich with theories that explain what makes the market prices move and what drives the actions of investors on investment decision-making process in the capital markets. The main competing schools of thought are split along two theoretical lines. The first line supports the efficient market hypothesis (EMH). Other scholars believe in the influence of behavioural or psychological biases on investors' trading decisions. According to the EMH, investors maximize utility, and they are homogeneous. In this way, the current market conditions or valuations reflect a sensible response because market prices for shares incorporate all the available information about that stock. That is, future stock prices not only reflect the fundamental values but also are unpredictable based on historical prices. Later, however, empirical evidence showed that the theory failed to provide sufficient explanation regarding several market anomalies, e.g. the October 1987 stock market crash (De Bondt and Thaler, 1985, 1987, 1989; Pesaran and Timmermann, 1995; Daniel et al., 1998). This evidence of contradiction resulted into many scholars questioning the validity of the EMH on explaining the functioning of capital markets.

Advocates of behavioural finance, however, do not ignore that fact that in some circumstances, markets are informationally inefficient (Ricciardi and Simon, 2000; Shefrin, 2002). They have, thus, come up with alternative explanation of how investors process information and make investment decisions. These scholars oppose the notion that human beings are fully rational

economic agents as much as the EMH propounds (Tversky and Kahneman, 1974; De Bondt and Thaler, 1994; Ritter, 2003). As such when making investment decisions, investors are prone to cognitive, motivational and emotional factors. As a result of them, evidence shows that in the presence of risks and uncertainty, investors tend to exhibit repeated patterns of systematic errors during processing information signals and ultimately, in the way they take decisions (Shefrin, 2002; Ritter, 2003). Because of these biases, asset prices, at least temporarily, deviate from their fundamental values to cause the anomalies (although not all misvaluations are caused by psychological biases).

Herd investing is one of the investor trading behaviour that has attracted the interest of many scholars in the stock market's literature. Herding is a situation where masses of people behave in a similar fashion like the majority of people around them (Hirshleifer and Teoh, 2003). This could be due to interaction between them - the influence of words or conversation, learning from quantities (individual actions), and learning from observation of outcomes such as market prices, or sometimes for no sensible reason (Devenow and Welch, 1996; Hirshleifer and Teoh, 2003; Barber et al., 2009; Shive, 2010). In stock trading, the term herding refers to the investment strategy where investors make investment-decisions by imitating the actions of others or the market consensus over some period of time (Bikhchandani and Sharma, 2000; Hirshleifer and Teoh, 2003; Demirer and Kutan, 2006; Economou et al., 2011). This paper uses firm level data according to sector classification by the Dar-es-Salaam stock exchange (DSE) to extend herding tests. The aim is to provide

further insight, from the frontier market context, of the forces that drive herd investing behaviour.

2.0 MOTIVATION FOR SELECTING THE DAR-ES-SALAAM STOCK EXCHANGE

The DSE is an unchartered market and is still at infancy stage in terms of market development when compared with other stock exchanges in the region, such as the Nairobi stock exchange (NSE)¹. The market exhibits several characteristics of frontier markets such as; a narrowness of market, ineffective regulatory frameworks², lack of sophisticated analysts, inexperienced market participants, low transparency, low overall trading activity, information asymmetries, and under-developed IT infrastructure (Antonioni et al., 1997; Appiah-Kusi and Menyah, 2003; Walter and Weber, 2006; Economou et al., 2015; El Hami and Hefnaoui, 2019). These qualities produce an investment climate that may facilitate more pronounced herding behaviour compared to that of both emerging and developed markets (Economou, 2016; 2020; Indārs et al., 2019).

¹ The NSE is among the top five markets according to the MSCI Emerging Frontier Markets Africa Index as June 30, 2020. Other countries in this category are South Africa, Morocco, Egypt and Nigeria.

² Several studies have linked the level of herding with financial systems development in general and stock markets, in particular (Walter and Weber, 2006; De Groot et al., 2012; Balcilar et al., 2015; Economou et al., 2015; Guney et al., 2017). It is argued that since the financial systems in frontier markets are at their infancy stage, the expectation is that their regulatory frameworks will be ineffective and hence face difficulties in implementation of their rules. Although empirical evidence is mixed, vast amounts of studies report that stock exchanges in frontier markets (e.g. DSE) are expected to exhibit herding more than the long-standing emerging markets like the NSE (Guney et al., 2017; Economou, 2020).

The specific motivation that has led to conduct this study is the country's economic, social, political and cultural background. The establishment of the DSE is an outcome of the Economic Recovery Programme (ERP) which started during the mid-1980s, and more specifically, the financial sector reforms that the country implemented since 1991 (Nord et al., 2009). This was after the long period of following the African Socialism (*Ujamaa*) politics that culminated in the Arusha Declaration in 1967. The socialist model of economic development put all sectors of the economy under strict control of the State; cultivated social equality ideology among the citizens; and promoted collective production activities. It regarded all forms of individual investment as exploitation and hence was discouraged (Van Arkadie, 1973; Temu and Due, 2000). In addition, the country adopted a national policy of creating socialist villages – called “*Vijiji vya Ujamaa*” (or Ujamaa Villages). The government persuaded people to form the villages, elect leaders from among themselves, and make decisions in a cooperative manner (Nyerere, 1973). This social-political background inculcated a high degree of social interactions among the Tanzanians and may have significant effects on individual's decision-making behaviour (Bikhchandani et al., 1992; Banerjee, 1992).

Another motivation is that by the end of 2015, the market was estimated to have around 200,000 investors. Although since its inception, the market has been largely dominated by relatively few institutional investors, many of the market participants are local retail investors. Individual investors are said to be more prone to psychological biases than professional investors (Shiller et al., 1984; Barber and Odean, 2008). The latter are more skilled

in investment matters. They are also well-equipped in terms of resources needed to acquire accurate information, analysing, and interpret the same to make decision based on specialized knowledge (Kim and Wei, 2002). On the other hand, individual investors are faced with information-asymmetry due to limited access to information. As such they are more likely to mimic the actions of others, including the more informed professional investors.

Moreover, the literature indicates that market factors may trigger herd formation (Balcilar et al., 2014; Demirer and Kutan, 2006; Demirer et al., 2010). The DSE is characterised by short trading history, a small number of listed companies, thin trading, and low market capitalization. Despite these characteristics, the DSE has grown impressively since its establishment. In 2014, for example, the market was declared the best performer in the African continent in terms of growth of its market capitalization (Elinaza, 2014). To the best knowledge of the researcher, herd investing at the DSE has only been investigated by Komba (2016) and Guney et al., (2017). Both studies used the main stock index, the Dar es Salaam Stock Exchange Tanzania Share Index (local) which was composed of 11 companies. It is more appealing, therefore, to examine the presence of herd formation in the market under different sector index portfolios.

3.0 THEORETICAL EXPLANATION FOR INVESTOR HERDS

The literature is rich with theoretical explanations concerning the drivers of herd formations, although they are not conclusive. From a psychological perspective, herding behaviour is a mutual mimetic contagion that happens when investors trade by observing the actions of their peers and the payoffs of those actions (Lux, 1995; Bikhchandani and Sharma, 2000; Hirshleifer and Teoh, 2003). For individual investors, who in most cases are considered non-sophisticated, this tendency is mainly attributed to information asymmetry. They may choose to disregard their prior information when other members of the group are acting differently, only to conform to the social norms (Banerjee, 1992; Baker and Nofsinger, 2002; Bikhchandani and Sharma, 2000). Social interaction and observational learning may also be responsible for herd formation (Banerjee, 1992; Bikhchandani et al., 1992, 1998). For professional investors, on the other hand, the existence of herding is attributed to both intentional and spurious motives (Bikhchandani and Sharma, 2000; Gavrilidis et al., 2013).

Another strand of the literature posits that herd formation is information driven (Bikhchandani et al., 1992; Banerjee, 1992). That is, herding occurs when an individual ignores his or her own judgement and makes a decision based the actions of others believing that they more informed or they possess better information-processing skills. Consistent with informational cascade theory, individuals engage in herd investing by ignoring their private information signals and think that they make optimal decisions by inferring on the actions, words, or outcomes of

preceding individuals (Bikhchandani et al., 1992; Banerjee, 1992).

From a principal-agent theoretical perspective, herd formation in the case of professional investors may be driven by the incentive provided by the compensation scheme or in order to maintain reputation capital (Scharfstein and Stein, 1990; Bikhchandani et al., 1992; Devenow and Welch, 1996). This kind of herding is considered to be intentional.

Herding can be also be triggered by spurious or non-intentional factors. Possession of common characteristics (relative homogeneity) by investors, for example, can form the impression of herd investing (spurious herding) in the market (Grinblatt and Keloharju, 2000; Gavriilidis et al., 2013). Communalities in trading can as well be a result of investors employing a similar investing style. With momentum trading, for example, investors use same indicators to make decision (Grinblatt et al., 1995).

4.0 PREVIOUS STUDIES ON HERDING BEHAVIOUR

The consensus from the literature is that both; professional and retail investors are susceptible to herd investing (Shiller et al., 1984; Banerjee, 1992; Bikhchandani et al., 1998; Bikhchandani and Sharma, 2000; Hirshleifer and Teoh, 2003; Goodfellow et al., 2009; Gavriilidis et al., 2013). However, the later are more prone to herd formation because they lack the necessary skills and resources to enable them to take decisions based on properly analysed information (Lakonishok et al., 1992; Kim and Wei, 2002). As a result, individuals may engage in herd activities spuriously; that is, they act on the same information set as the rest

in the market (Shleifer and Summers, 1990; Nofsinger and Sias, 1999). Similarly, they might also herd intentionally, for example, by overreacting to recent news (Goodfellow et al., 2009).

Evidence provided by prior studies regarding institutional or professional herding offer mixed conclusions as well. Shiller and Pound (1989), for example, found that institutional investors relied on the advice from other professionals during periods of volatile conditions, to make trading decisions. Other studies that show institutions exhibit herd behaviour include: Nofsinger and Sias (1999); Dennis and Strickland (2002); and Sias (2004). Lakonishok et al. (1992), on the contrary, found only weak evidence of herd formation among large stocks, and more but not dramatic herding in smaller stocks. This finding is consistent with Wermers (1999), who further indicate that institutional investors are more likely to herd when buying than selling stocks. The empirical results by Goodfellow et al. (2009), on the other hand, suggests that institution's trading is not influenced by the state of the market.

Other studies link the level of financial markets development and herding behaviour. For example, Walter and Weber (2006) documents that German managers engage in herding and positive feedback trading more than the level reported in the UK and US markets-based studies because it is not as developed as them. On the contrary, Chiang and Zheng (2010) report the existence of herd investing in advanced markets, except that of the US.

Another strand of the literature associates the tendency to herd with information asymmetry. Chang et al. (2000) examined herding behaviour in international markets. Their findings revealed herding was stronger for South Korea and Taiwan during bull than bear markets. No evidence was reported for the US and Hong Kong market participants. Other studies that find herding toward the consensus is stronger during upward and downward market conditions include: Tan et al. (2008) who studied the Chinese stock market; Hwang and Salmon (2004) who used data from US and South Korean stock markets, and Chiang and Zheng (2010) who examined herding behaviour from 18 markets. Demirer and Kutan (2006) also investigated the Chinese markets but reveals no evidence of herd formation. Christie and Huang (1995) concluded that US equity investors do not herd during periods of market stress (see also Gleason et al., 2004).

Social interaction or peer influence is also associated with herd formation in stock markets. Shiller and Pound (1989) strongly suggest that investors develop interest in and receive essential information that ultimately leads to making investment decision through direct interpersonal communication. Hong et al. (2005) found that through the word-of-mouth communication to transmit information and ideas; the stock-portfolios held by managers coming from the same geographical location, were different from those coming from other cities (see also Ivković and Weisbenner, 2007). For professional investors however, Grinblatt and Keloharju (2001) documents that the influence of social interaction is less prominent.

Although a growing strand of the literature acknowledges that frontier markets are expected to display herding behaviour, there is limited empirical evidence on the same, particularly on the literature dealing with African frontier markets (see also Economou, 2016; Ferrouhi, 2020). El Hami and Hefnaoui (2019) examined the Moroccan stock market, indicating clear presence of herding activity. They specifically find strong evidence of herding irrespective of market conditions, that is during both periods of positive and negative market returns. These results are consistent with those of Ferrouhi (2020) who also document a positive impact of liquidity and volatility on herding. Economou (2016) also examined the prevalence of herding behaviour in two African frontier markets, Nigeria and Morocco, for the period from 2004 to 2014. The empirical results were mixed. The findings based on the benchmark Chang et al., (2000) model revealed non-existence of herding. However, examination of asymmetric market states on herding indicated existence of the effect of down-market volatility days for Nigeria and no evidence for Morocco. However, the results for structural breaks revealed presence of significant herding in Morocco between December 2005 and December 2014 with days of high market volatility and trading volume exhibiting more herding. Guney et al., (2017) on the other hand, studied eight African stock markets (BRVM, Botswana, Ghana, Kenya, Namibia, Nigeria, Tanzania and Zambia) between January 2002 and July 2015. The findings showed that there was significant evidence of herding for all markets, with smaller stocks found to enhance its magnitude.

The hindsight presented in previous studies on the existence of herd investing is inconclusive. This paper contributes to a better understanding of this phenomenon by providing additional

evidence from different sector portfolios³ of the nascent, unchartered stock market, the DSE, by extending the studies of Komba (2016) and Guney et al., (2017).

5.0 METHODOLOGY AND DATA

5.1 Methodology

This paper builds on the popular cross-sectional dispersion of stock returns tests used for detecting herd behaviour introduced by Christie and Huang (1995) and Chang et al. (2000). Like other nascent frontier markets, the DSE has relatively few stocks, and suffers from thin and short trading history. The features lend the application of the cross-sectional absolute deviation (CSAD) test, introduced by Chang et al. (2000) more appropriate. The CSAD is a non-linear model. The main idea behind this methodology is that it captures the herding during periods of large market swings and at other times of return distribution continuum (Economou et al., 2011; Chiang and Zheng, 2010). The CSAD is estimated as a quadratic regression model:

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

where $R_{i,t}$ = the return on stock i on day t which is calculated as $R_{i,t} = 100 \times (\ln(P_{i,t}) - \ln(P_{i,t-1}))$; $R_{m,t}$ = average market portfolio return on day t ; $i = 1, \dots, N$ and $t = 1, \dots, T$. The non-linear relation between $R_{i,t}$ and $R_{m,t}$, is estimated as:

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

³ See also Vo and Phan (2019) for more details on why it is important to examine herding by focusing the analysis on industry levels.

where $|R_{m,t}|$ = the absolute value of a cross-sectional average realized return of all available securities on day t when the market is either up or down. Under the standard asset pricing models, a positive value of the coefficient γ_1 (*i.e.* $\gamma_1 > 0$ and $\gamma_2 = 0$) indicates the absence of herding effects (Economou et al., 2011). It has been noted earlier that herding behaviour exists when the CSAD increases at a decreasing rate relative to $R_{m,t}$ during periods of market stress, and that $R_{i,t}$ do not deviate too far from $R_{m,t}$. The introduction of $R_{m,t}^2$ in the equation above captures this non-linearity aspect in the model (Economou et al., 2011). The model indicates there is herd formation when the estimate of the coefficient γ_2 is negative and statistically significant (*i.e.* $\gamma_2 < 0$). We, therefore, hypothesize that:

H₁: Stock returns at the DSE exhibit presence of herding effects (*i.e.* $\gamma_2 < 0$)

A good number of studies from the developed markets show that investors tend to herd more during periods of negative returns (Christie and Huang, 1995; Chang et al., 2000; Demirer et al., 2010; Economou et al., 2011; Philippas et al., 2013). For professional investors, this could be interpreted as a means of protecting their reputation because their performance is assessed with reference to that of their peers (Choi and Sias, 2009; Gavriilidis et al., 2013). Gleason et al. (2004) and Tan et al. (2008) on the other hand, contends that investors tend to move with the crowd during periods of market stress to seek the comfort of the group. Thus, we hypothesize that:

H₂: Stock returns at the DSE exhibit presence of herding effects during days with negative market returns (*i.e.* $\gamma_3 < 0$ and $\gamma_4 < 0$, with $\gamma_4 < \gamma_3$).

We employ a dummy variable approach used by Chiang and Zheng (2010), Chiang et al. (2010) and Economou et al. (2011), to test this asymmetric behaviour of market return by estimating the following model:

$$\text{CSAD}_t = \alpha + \gamma_1 D^{up} |R_{m,t}| + \gamma_2 (1 - D^{up}) |R_{m,t}| + \gamma_3 D^{up} R_{m,t}^2 + \gamma_4 (1 - D^{up}) R_{m,t}^2 + \varepsilon_t \quad (3)$$

where D^{up} is a dummy variable. We set $D^{up}=1$ for days with positive market returns, and $D^{up}=0$ otherwise.

Another commonly studied asymmetry in herding behaviour is the volatility of the market returns. Although the findings in prior studies are inconclusive, Gleason et al. (2004) and Tan et al. (2008) have argued that herding effects are expected to be more pronounced during periods of abnormal volatility. They further assert that this is when investors seek the comfort of the consensus opinion. Thus, we hypothesize that:

H_3 : Stock returns at the DSE exhibit presence of herding effects during days with high market volatility (*i.e.* $\gamma_3 < 0$ and $\gamma_4 < 0$, with $\gamma_3 < \gamma_4$)

As above, we employ the following regression equation to examine the asymmetric behaviour of returns' dispersion with respect to market volatility:

$$\begin{aligned} \text{CSAD}_t = & \alpha + \gamma_1 D^{H\sigma} |R_{m,t}| \\ & + \gamma_2 (1 - D^{H\sigma}) |R_{m,t}| + \gamma_3 D^{H\sigma} R_{m,t}^2 \\ & + \gamma_4 (1 - D^{H\sigma}) R_{m,t}^2 + \varepsilon_t \end{aligned} \quad \begin{pmatrix} (\\ 4 \\) \end{pmatrix}$$

where $D^{H\sigma}$ is a dummy variable. We set $D^{H\sigma} = 1$ for days with high market volatility, and $D^{H\sigma} = 0$ otherwise.

We measure market volatility using $R_{m,t}^2$. As in Economou et al. (2011) and Tan et al. (2008) trading volatility is high, if on a particular day, it is high than the previous 30-day moving average. Likewise, volatility is low if it is less than the 30-day moving average.

5.2 Data Description

We analyze the daily closing prices and free float market capitalizations of sector returns in local currency, the Tanzanian shilling (TZS). The data set contains all eight companies composing the Industrial and Allied (I&A) sector, and three companies covering banks, finance, and investment companies (BF&I) index (see, Table 1). Trading at the bourse is active in these two sectors. In order to capture the short-term of herding behaviour, this study uses daily data as many prior studies have done (Christie and Huang, 1995; Chang et al., 2000; Caporale et al., 2008; Economou et al., 2011).

Table 1: Companies Involved in the Study

Company Name	Stock Symbol	Date Listed	Data Starting Date
Industrial & Allied Index			
Tanzania Breweries Ltd	TBL	09/09/1998	03/01/2000
TOL Gases LTD	TOL	15/04/1998	04/01/2000
TATEPA Ltd	TATEPA	17/12/1999	05/01/2000
Tanzania Cigarette Co Ltd	TCC	16/11/2000	16/11/2000
Tanga Cement Co Ltd	SIMBA	26/09/2002	26/09/2002
Swissport Tanzania Ltd	SWISSPORT	26/06/2003	26/06/2003
Tanzania Portland Cement Co Ltd	TWIGA	29/09/2006	29/09/2006
Precision Air Services Ltd	PAL	21/12/2011	21/12/2011
Banks, Finance, and Investment Index			
Dar es Salaam Community Bank	DCB	16/09/2008	16/09/2008
National Microfinance Bank Plc	NMB	06/11/2008	06/11/2008
CRDB Bank PLC	CRDB	17/06/2009	17/06/2009

Although the market started operations in 1998, our overall sample period covers January 2000 to July 2019. However, the starting time between individual firms varies depending on when it was listed in the market. The beginning period was chosen because it was the time when exchange started being more active with four listed companies. All data were collected from one earliest brokerage firm of the DSE. As the case with other frontier markets, the DSE is characterized by infrequent trading. In recognition of this, we carefully inspected the collected data for

any non-trading days and interpolated the days with zero trading using EViews 7. The data was then cleaned to remove outliers to ensure that it complied with the ordinary least square assumptions.

5.0 EMPIRICAL RESULTS

5.1 Descriptive Statistics

Table 2 reports the descriptive statistics for the CSAD measure and the average market return ($R_{m,t}$), calculated using both equal weights (Panel A) and market value weights (Panel B) for each of the two examined sectors. A close examination of the table reveals that the summary statistics are slightly inconsistent with those reported in prior studies (e.g. Tan et al., 2008; Economou et al., 2011). The average daily portfolio returns are extremely small, in both sectors. Moreover, in both cases, the median is zero, while the standard deviations are very low. This situation is typical for many African frontier markets. It reflects non- or thin trading nature of the markets.

Table 2: Descriptive Statistics

	Industrial & Allied Index		Banks, Finance, & Investments Index	
	CSAD	Rm	CSAD	Rm
Panel A: Equally Weighted Market Returns				
Mean	0.0041	0.0005	0.0061	0.0004
Median	0.0000	0.0000	0.0000	0.0000
Maximum	0.2584	0.1764	1.1603	1.1513
Minimum	0.0000	-0.1510	0.0000	-1.1603
Std. Dev	0.0107	0.0074	0.0398	0.0399
Panel B: Value Weighted Market Returns				
Mean	0.0047	0.0008	0.0064	0.0007
Median	0.0000	0.0000	0.0000	0.0000
Maximum	0.2941	0.2140	1.1603	2.2502
Minimum	0.0000	-0.1057	0.0000	-1.8826
Std. Dev	0.0111	0.0097	0.0398	0.0709
Observations	4052		1744	
Number of Firms	8		3	
Notes:	This table presents descriptive statistics of the daily cross-sectional absolute deviation (CSAD) computed as $CSAD_t = \frac{1}{N} \sum_{i=1}^N R_{i,t} - R_{m,t} $ where $R_{i,t}$ denotes the return on stock i on day t; $R_{m,t}$ is the weighted average return on market portfolio on day t; $i = 1, \dots, N$ stocks; and $t = 1, \dots, T$. Panel A reports the descriptive statistics of equally weighted market returns, while the panel B reports the descriptive statistics of value weighted market returns, while capitalization weights. The data covers the period from January 2000 to the mid of July 2019. The starting dates for the companies, however, vary depending on their listing dates.			

The CSAD statistics, which indicate how close the individual returns, are, to the market portfolio, are also not consistent with those reported in other studies. The values reported in Table 2 are

very small suggesting that there is a minimal deviation between the two variables at the DSE.

5.1 Regression Results Using Sector Index Returns

The results in Table 3 correspond to the estimates of equation (1) for each sector. We present the findings for the equal-weighted portfolio return in Panel A. The corresponding results for the value-weighted portfolio are in Panel B. In both panels, the estimates of the coefficient γ_1 reveal that there is a positive relationship between the CSAD and the $R_{m,t}$. This is consistent with the prediction of the asset pricing models (Christie and Huang, 1995; Chang et al., 2000).

Table 3: The Benchmark Model Estimates of Herding Behaviour

	Constant	γ_1	γ_2	R ² Adj.
Panel A: Equally Weighted Market Returns				
I & A Index	0.0005(0.001)***	1.4375(0.0401)***	0.5644(0.4837)	0.9333
BF & I Index	0.0008(0.0001)***	1.0549(0.0374)***	-0.0481(0.0323)	0.9923
Panel B: Value Weighted Market Returns				
I & A Index	0.0015(0.0001)***	0.9277(0.0463)***	1.2770(0.7874)	0.7344
BF & I Index	0.0009(0.0003)***	0.9183(0.0684)***	-0.1743(0.0311)***	0.9849
Notes: This table presents the results of the benchmark model; $CSAD_{i,t} = \alpha + \gamma_1 R_{m,t} + \gamma_2 R_{m,t}^2 + \varepsilon_{i,t}$, where $CSAD_{i,t}$ = cross sectional absolute deviation of $R_{i,t}$ from $R_{m,t}$ on day t for each sector. Figures in parentheses are the Newey-West heteroskedasticity and autocorrelation consistent standard errors. ***, ** and * stands for the 1%, 5% and 10% levels of significance respectively.				

A further examination of Table 3 reveals that the estimates of the coefficient γ_2 in both panels for the two sectors are consistent in terms of the sign. However, only the BF&I index show that the CSAD is increasing at a decreasing rate during extreme market conditions. Nevertheless, and in agreement with H_1 the evidence of presence of herd formation appear to be stronger and significant with the large capitalization stocks only. The results for the benchmark model are not consistent with those of Ferrouhi (2020) for the Moroccan Stock Exchange and Guney et al., (2017) for African stock markets. These findings suggest that investors in Tanzania are more likely to be influenced by others' actions and by market variations when dealing with stocks that compose the BF&I index.

Table 4 reports the herding regression results under asymmetric market conditions using both the equal-weighted and value-weighted portfolio returns. As with the benchmark model, the estimates of the coefficient γ_4 for the BF&I index are significantly negative in falling markets in both panels. We also apply the Wald tests to establish whether the herding coefficients are equal or not in both market conditions. The evidence suggests that herding is stronger in BF&I Index during falling markets with the equal-weighted portfolio. This is interesting to note because the results from the benchmark model have changed to being strongly significant when the asymmetry is taken into account. This finding is in support of H_2 (see also; Economou et al., 2011). However, it contradicts the results of previous studies such as those of Tan et al. (2008) in Shanghai, Economou et al. (2011) for the Greece market and Guney et al., (2017) for the DSE.

Table 4: Estimates of Herding Behaviour during Rising and Falling Returns

	Constant	γ_1	γ_2	γ_3	γ_4	R ² adj.
Panel A: Equally weighted market returns						
I & A Index	0.0005(0.0001)***	1.4178(0.0412)***	1.4718(0.0649)***	0.7254(0.6445)	0.2210(0.6681)	0.9334
BF & I Index	0.0007(0.0001)***	0.9749(0.0469)***	1.1789(0.0353)***	0.0212(0.0406)	-0.1548(0.0304)***	0.9926
Panel B: Wald tests for equality of herding coefficients						
	I & A Index	BF & I Index				
Chi-square ($\gamma_1 - \gamma_2$); Ho: $\gamma_1 = \gamma_2$	(0.56)	(14.16)***				
Chi-square ($\gamma_3 - \gamma_4$); Ho: $\gamma_3 = \gamma_4$	(0.30)	(14.04)***				
Panel C: Value weighted market returns						
	Constant	γ_1	γ_2	γ_3	γ_4	R ² adj.
I & A Index	0.0015(0.0001)***	0.8829(0.0536)***	0.9774(0.0977)***	1.4355(0.8745)	1.5425(3.0736)	0.7361
BF & I Index	0.0014(0.0002)***	0.7712(0.0513)***	0.8504(0.0479)***	-0.1157(0.0228)***	-0.1247(0.0254)***	0.9868
Panel D: Wald tests for equality of herding coefficients						
	I & A Index	BF & I Index				
Chi-square ($\gamma_1 - \gamma_2$); Ho: $\gamma_1 = \gamma_2$	(0.78)	(1.51)				
Chi-square ($\gamma_3 - \gamma_4$); Ho: $\gamma_3 = \gamma_4$	(0.00)	(0.08)				
Notes:	This table presents results of the model: $CSAD_{i,t} = \alpha + \gamma_1 D^{up} R_{m,t} + \gamma_2 (1 - D^{up}) R_{m,t} + \gamma_3 D^{up} R_{m,t}^2 + \gamma_4 (1 - D^{up}) R_{m,t}^2 + \varepsilon_t$, for each of the two sectors. $CSAD_{i,t}$ is the cross-sectional absolute deviation of $R_{i,t}$ from $R_{m,t}$ on day t. D^{up} is the dummy variable that is equal to 1 on days with positive market returns and the value 0 otherwise. We report the estimated coefficients of the equal and value weighted market portfolio return in Panel A and Panel C respectively. Figures in parentheses are the Newey-West heteroskedasticity and auto correlation coefficient standard errors. ***, ** and * stands for the 1%, 5% and 10% statistical significance levels respectively. The Wald tests for the null hypothesis $\gamma_1 = \gamma_2$ and $\gamma_3 = \gamma_4$ of the estimated models are presented in Panels B and D respectively.					

The value-weighted results in Table 4, on the other hand, seem to be consistent with those reported in the benchmark model in Table 3. The evidence shows that the coefficient γ_3 and γ_4 for the BF&I index are negative and statistically significant at conventional levels, in both rising and falling market conditions. The Wald test, however, fails to reject the null hypothesis of the equality of the herding coefficient in both market conditions. This finding, therefore, contradicts the described asymmetry. The evidence implies that herding at the DSE occurs under both, rising and falling market conditions (see also, El Hami and Hefnaoui, 2019 for the Moroccan market). Chiang and Zheng (2010) also observed that although the effect of herding asymmetry in Asian markets was stronger during rising markets, in others (except the US and Latin America) herding was present in both up and down markets. The result, however, does not corroborate those of Guney et al., (2017) for African stock markets and Ferrouhi (2020) for the Moroccan Stock Exchange.

We next examine the potential asymmetric effects of herding behaviour with respect to market volatility. The evidence in Table 5 shows that, for the BF&I index; the values of the coefficients γ_3 and γ_4 in both Panels are negative and statistically significant at conventional levels. These findings provide evidence of existence of herding behaviour in this sector, hence confirming the results of Guney et al., (2017). In contrast to H_3 , however, the statistics show that the estimates of $\gamma_3 > \gamma_4$, indicating that at the DSE, the effects of herding are more pronounced during days with low market volatility. The results are supported by the Wald tests for the large capitalizations only and are in line with those reported by Economou et al. (2011), for the case of Italy and Economou (2016) for Nigeria.

Table 5: Estimates of Herding Behaviour during High and Low Volatility

	Constant	γ_1	γ_2	γ_3	γ_4	R ² adj.
Panel A: Equally weighted market returns						
I & A Index	0.0004(0.0001)***	1.4291(0.0380)***	1.7019(0.0610)***	0.6721(0.4920)	2.1182(6.5124)	0.9414
BF & I Index	0.0004(0.0001)***	1.2548(0.0649)***	1.4246(0.0576)***	-7.5557(3.1334)**	-14.2035(4235)***	0.8124
Panel B: Wald tests for equality of herding coefficients						
	I & A Index	BF & I Index				
Chi-square ($\gamma_1 - \gamma_2$); H ₀ : $\gamma_1 = \gamma_2$	(18.19)***	(4.38)**				
Chi-square ($\gamma_3 - \gamma_4$); H ₀ : $\gamma_3 = \gamma_4$	(0.05)	(1.56)				
Panel C: Value weighted market returns						
	Constant	γ_1	γ_2	γ_3	γ_4	R ² adj.
I & A Index	0.0010(0.0001)***	0.8861(0.0417)***	2.2502(0.1600)***	1.6439(0.6562)***	-60.0071(7.4493)***	0.7567
BF & I Index	0.0007(0.0001)***	0.9505(0.0436)***	1.7085(0.1280)***	-3.4749(3637)***	-50.9675(12.3688)***	0.7229
Panel D: Wald tests for equality of herding coefficients						
	I & A Index	BF & I Index				
Chi-square ($\gamma_1 - \gamma_2$); H ₀ : $\gamma_1 = \gamma_2$	(72.86)***	(32.6)***				
Chi-square ($\gamma_3 - \gamma_4$); H ₀ : $\gamma_3 = \gamma_4$	(68.47)***	(14.62)***				
Notes:	This table presents results of the model: $CSAD_{i,t} = \alpha + \gamma_1 D^{H\sigma} R_{m,t} + \gamma_2 (1 - D^{H\sigma}) R_{m,t} + \gamma_3 D^{H\sigma} R_{m,t}^2 + \gamma_4 (1 - D^{H\sigma}) R_{m,t}^2 + \varepsilon_t$, for each of the two sectors $CSAD_{i,t}$ = the cross-sectional absolute deviation of $R_{i,t}$ from $R_{m,t}$ on day t. $D^{H\sigma}$ = dummy variable that takes the value 1 on days with higher than 30-day moving average, and the value 0 otherwise. We report the estimated coefficients of the equal and value weighted market portfolio return in Panel A and Panel C respectively. Figures in parentheses are the Newey-West heteroskedasticity and autocorrelation coefficient standard errors. ***, ** and * stands for the 1%, 5% and 10% statistical significance levels respectively. The Wald tests for the null hypothesis $\gamma_1 = \gamma_2$ and $\gamma_3 = \gamma_4$ of the estimated models are presented in Panels B and D respectively.					

On the other hand, the results for I&A index offer mixed conclusions based on the way market returns are calculated. In Panel A, the evidence provides no evidence of asymmetric effects of volatility on return's dispersion at the DSE (thus contradicting the findings by Guney et al., 2017). As with the BF&I index, the evidence goes against H_3 with the value-weighted calculated returns presented in Panel B. There is strongly significant evidence in support of herding effects on days with low volatility for the case of the I&A index (similar findings were reported by Economou (2016) for Nigeria). The interpretation of the results is that, in times of low variations of the market returns at the DSE, investors are likely to copy actions of other investors, which is not correct. The results are not in line with the theory and contradicts what was reported by Guney et al., (2017) and Ferrouhi (2020) for the Moroccan Stock Exchange.

7.0 SUMMARY OF THE FINDINGS AND CONCLUSIONS

This study examines the existence of herding behaviour at the DSE in the two sectors whose stocks are actively traded. The DSE falls under the frontier stock markets' category. One feature of this kind of markets is that, in the recent years, their stocks offer better promising returns than the more mature emerging markets (Kratz, 1999; Elinaza, 2014). However, it is interesting to find that studies on the functioning of frontier stock markets are rare, thus denying investors the opportunity to have a clear understanding of these markets.

The findings from this study could save as an eye-opener. Notably, the estimations based on aggregate daily market data,

provide no evidence of existence of herding behaviour in the I&A sector, under both cases, that is, the equal- and value-weighted calculated returns. This sector represents companies whose shares are actively traded in this market. The absence of evidence of herding behaviour, therefore, suggests that investors trading decisions are not influenced by group consensus. We further examined possible behavioural changes by using different market conditions. The statistical results for the I&A Index seems to be consistent. We find no asymmetries, except under the value-weighted returns during high and low market volatility.

The BF&I portfolio results in the benchmark model, on the other hand, indicates the presence of herding behaviour in this sector. The evidence is strongly robust with the large-capitalization stocks. The tests for potential asymmetries in the herd behaviour related to the market returns and volatility also shows the existence of herding in the BF&I sector. These results provide evidence of the tendency by investors to mimic the actions of others when investing in this sector. One possible reason for this observation could be that many investors are more familiar with companies in this sector. An alternative explanation could be that the observed evidence is a result of spurious herding. That is, most of the investors in the market are not sophisticated in terms of stock investing skills. Due to this common factor, their trades may exhibit correlation, which in turn can create an impression of herding, although the later may not be intentional. In general, however, the findings imply that the respective companies' market prices do not reflect their true fair values. This is because, when investors herd, they do not trade on information, a practice that compromises the market's informational efficiency. It is important to note that, if these mispricing become widespread, it can lead investors to make flawed investment decisions. For

policy makers, the same can result to erroneous reactions. Consequently, failure to correct the deviations by the market forces or the regulatory authorities to develop initiatives that will ensure the stability of the market, monitor the implementation of all relevant legislation, and protection of the rights of participants, the observed inefficiency can cause huge losses to investors.

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