Herding Behavior in the Nairobi Securities Exchange*

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In this study, we use 2010-15 daily data stock market from the Nairobi Securities Exchange (NSE) to investigate herding behavior among NSE market participants. We examine the impact of rising and falling markets, as well as exogenous factors such as political and regulatory instability, on herding behavior. Our findings are twofold. First, herding behavior differs by sector, moreover, each sector responds differently to rising and falling markets. Thus, failing to consider each sector separately may mask herding behavior. Second, herding behavior is most pronounced from 2013 through 2014, which was a time of both political and regulatory instability for Kenya.

INTRODUCTION

Herding behavior in financial markets is typically defined as a tendency for investors to follow the actions of others (see e.g. Choi and Sias 2009; Rıza Demirer and Kutan 2006; Bikhchandani and Sharma 2000). Herding, i.e., reliance on collective information rather than private information, may lead asset prices to deviate from their fundamental value. Thus, creating potential arbitrage opportunities and in extreme cases expectations bubbles. Furthermore, associated behavioral effects of herding may affect not only the idiosyncratic riskiness of an individual stock but also the systemic risk at the sector and market levels.

Several studies have attempted to detect herding behavior.[1] Lakonishok et al. (1992) found that money managers did not exhibit significant herding behavior. Grinblatt et al. (1994), on the other hand, found a low level of herding behavior among fund managers. Cakan and Balagyozyan (2014), and others[2] have investigated the tendency to herd among investors in emerging markets. We extend this research by focusing on the Nairobi Securities Exchange (NSE), one of the largest and oldest stock exchanges in Africa.

In this study, we use daily returns of the stock prices within the period between 2010 and 2015 to investigate the presence of herding behavior for a sample of stocks in various sectors of the NSE. As the largest securities exchange in East and Central Africa and fifth largest market in Africa with an average annual market capitalization of $20 billion,[3] the NSE has a significant impact on both the Kenyan and African economies. Thus, understanding potential herding behavior among NSE investors is one important key to understanding African financial markets. Moreover, the NSE has several attributes that make it especial interesting with respect to herding.

Over the last few years, the proportion of shares exchanged on the NSE held by local investors has increased, yet foreign institutional investors remain a strong presence in the NSE. The foreign participation to equity turnover ratio on average ranged from 38% in 2010 to 56% in 2015 and the ratio in April 2017 was 72%.[4] Given the perception that institutional investors are more sophisticated than individual investors, it is reasonable to conjecture that individual investors may follow the action of these sophisticated investors. However, Nofsinger and Sias (1999) and Shu-Fan Hsieh (2013) found that the degree of herding on institutional investors is higher than that of individual investors. Thus, the NSE is an excellent market in which to study the effects of institutional investors on herding.

Despite the importance of the NSE, there has been very little research investigating herding behavior in this market. Aduda et al. (2012) use questionnaire survey data from a sample of 50 investors, along with other secondary data sources, to study the individual investor behavior. They find that while some investors exhibited rational behavior, other investors did exhibit herding behavior. However, Choi and Sias (2009) and Cakan and Balagyozan (2014) argue that investors usually base their trade decisions on sector-specific information. Aduda et al. did not classify the firms by industry/sector. We continue the work of Aduda et al. (2012) by classifying the firms by industry/sector using a metric of herding behavior proposed by Chang et al. (2000), and we improve upon Cakan and Balagyozan by using market capitalization weighted sectoral aggregates. Finally, we test for structural breaks in our herding model to determine if there are sub-periods of more or less herding behavior.

METHODOLOGY

Following Chang et al. (2000), we conjecture that overall market conditions will influence the behavior of individual investors. During periods of extreme price volatility, Chang et al. argue that individual investors may abandon their beliefs and base investment decisions on the collective actions in the market, i.e., those investors will exhibit herding behavior. Hence, fluctuations in market return may be used to detect herding behavior. Accordingly, Chang et al. propose the following,

$$CSAD_t = \alpha + \gamma_1 \mid R_{m,t} \mid + \gamma_2 R_{m,t}^2 + \varepsilon_t \, . \tag{1}$$

$CSAD_t$, is the cross-sectional standard deviation of market returns quantifying the average proximity of individual returns to the realized average, i.e.

$$CSAD_t = \sqrt{\frac{1}{N-1} \sum_{i=1}^{N} \left(R_{i,t} - R_{m,t} \right)^2} \, , \tag{2}$$

where N is the number of firms in the sector, $R_{i,t}$ is the return of stock i at time t and $R_{m,t}$ is the market capitalization weighted average of all stock returns in the sector. We group the stocks in our sample into four sectors: agriculture, financials, industrials, services. Utilizing a market capitalization weighted average is an improvement upon papers by Christie and Huang (1995) and Cakan and Balagyozyan (2014) who used the simple average of all stock returns in the sector.

Chang *et al.* (2000) argue that in the absence of heading the relationship between $CSAD_t$ and $R_{m,t}$ is linear,[5] but that relationship will become non-linear in the if investors exhibit herding behavior. As market volatility increases, investors may tend to suppress individual evaluations of fundamentals and herd around market consensus, which would yield a tendency for stock returns to converge, leading to a reduction in return dispersion, i.e. $CSAD_t$. Consequently, in the presence of severe (moderate) herding, we expect that return dispersion will decrease (or increase at a decreasing rate) with an increase in the market return (i.e. $\gamma_2 < 0$). On the other hand when the return dispersion will decrease (or increase at increasing rate) with decrease in market return (i.e. γ_2 >0), we conclude herding is not present. Thus, it is sufficient to test within equation (1) whether the coefficient, γ_2 is significantly negative to detect herding, i.e., if $\gamma_2 < 0$, then we conclude that herding is present.

Cakan and Balagyozyan (2014) point out that a non-linear relationship found in (1) may be due to omitted controls for market fundamental; thus, they add a risk-free interest rate and the simple average of earnings per share over the sector. We follow similar a methodology with the exception that we use a market capitalization weight average of earnings per share,

$$CSAD_t = \alpha + \gamma_1 | R_{m,t} | + \gamma_2 R_{m,t}^2 + \theta_1 RF_t + \theta_2 EPS_t + \varepsilon_t \,. \tag{3}$$

Further, we follow Cakan and Balagyozyan (2014) who also exam the possibility that γ_2 is capturing the relationship between idiosyncratic risk and market return (see Goyal and Santa-Clara 2003). In order to insure this is not an issue with our study, we control for the impact of volatility by adding a conditional variance term to the mean equation,[6] i.e., we estimate the following GARCH(1,1) in-mean model,

$$CSAD_t = \alpha + \gamma_1 | R_{m,t} | + \gamma_2 R_{m,t}^2 + \theta_1 RF_t + \theta_2 EPS_t + \theta_3 \log\left(\sigma_t\right) + \varepsilon_t \tag{4}$$

where the variance equation is $\sigma_t^2 = \omega_0 + \omega_1 \varepsilon_{t-1}^2 + \omega_2 \sigma_{t-1}^2$.

Next, we test for differing levels of herding in rising and falling markets

$$\begin{aligned} CSAD_t = {} & \alpha + \gamma_1 | R_{m,t} | + \gamma_2 R_{m,t}^2 + \theta_1 RF_t + \theta_2 EPS_t \\ & + \delta + \delta\left(\gamma_3 | R_{m,t} | + \gamma_4 R_{m,t}^2 + \theta_3 RF_t + \theta_4 EPS_t\right) + \varepsilon_t \end{aligned} \tag{5}$$

where

$$\delta = \begin{cases} 1 & \text{if } R_{m,t} < 0 \\ 0 & \text{otherwise} \end{cases}$$

Finally, we attempt to determine if there are sub-periods within our sample that exhibit more or less herding by allowing the coefficients of (3) to change over time. We allow both the timing and number of breaks to be unknown by employing the Bai and Perron (1998) double maximum test, i.e., l vs. no structural breaks. The double maximum test results in a test statistic that has a non-standard distribution for which Bai and Perron (2003) provide critical values.

DATA

We obtained daily stock prices, and earnings per share, and total stocks outstanding for a sample of 28 firms categorized into four sectors of the NSE for the period of July 23, 2010, through July 23, 2015, from the Bloomberg database. Note that, due to missing data, we could not consider all traded securities in the NSE. Share of securities in each sector in our sample out of total traded securities for that sector in the NSE during 2010-2015 period were 63%, 55%, 50%, and 45% for Services, financial, agriculture, and industrial sectors respectively. Again, due to missing data, 2010-15 time period provided us with the largest and most complete set of observations related to companies on NSE regarding the variables of our model as compared to prior periods. According to the Business Daily publications at www.businessdailyafrica.com on March 8, 2007, February 26, 2009, and March 30, 2009, trading volume at the NSE sunk significantly to a low level of 2.6 billion Schillings(about $25 million) forcing down the market capitalization to lowest levels since early 2000 underlining a general collapse in investor confidence and heightened risk aversion aggravated by local and external shocks such as the great recession of 2007-08, post-election violence of 2007, and endemic political corruption of 2004. These events along with low volume and liquidity in the NSE during 2000-10 (The NSE 20-share index dropped from a high of 6000 to 2600 points) generated significant noise in trading that made it very difficult to detect herding behaviour. Finally, we used Kenya's 3-month Treasury bill rate as a proxy for the risk-free interest rate.

RESULTS

Table 1 summarizes a one-tailed test for the presence of herding behavior for all models. Equations (1), (3) and (4) indicate herding at least 90% confidence level in the agriculture, financial, and service sectors. Moreover, equation (5) indicates herding in agriculture, and financial sectors during rising markets and in the service sector during falling markets. No evidence of herding in the industrial sector was found in any equation.

Table 2 and Table 3 report OLS parameter estimates of equations (1) and (3) respectively for each sector. Our results are consistent with the findings of Hwang and Salmon (2017) who suggest that stock returns and herding are affected by both market and firm fundamentals, i.e., we find that the risk-free interest rate and sector earnings per share are significant for some of the sectors. Hence, we include market fundamentals in all further estimations. Table 4 reports GARCH(1,1) parameter estimates of equation (4) estimated for each sector (see Goyal and Santa-Clara 2003). While the conditional variance term, θ_3, is significant at the 90% confidence level for all sectors, our conclusions with respect to herding are unchanged.

In Table 5 we test for the presence of herding in rising and falling markets respectively. Christie and Huang (1995) and Chang, Cheng, and Khorana (2000) argue that herding behavior may be more pronounced in periods of market stress. Interestingly, we find that highly significant evidence of herding in agriculture, and financial sectors during rising markets, but no significant herding is indicated in the services sector during rising markets. During falling markets, though, the services sector exhibits highly significant evidence of herding with no significant herding indicated in either agriculture or financial sectors. This result suggests that in our sample, herding is asymmetrical in the agriculture, financial and service sectors. Furthermore, no evidence of herding was indicated in the industrial sector.

Table 6 presents multiple structural break testing of equation(3). We found significant herding in the agriculture sector: 2012M07 – 2014M06, the financial sector: 2013M02 – 2015M07, and the service sector 2013M07 – 2014M04. No herding was found in the industrial sector, which is consistent with Cakan and Balagyozyan (2016).

Herding was particularly high from 2013 through 2014. During this period, Kenya experienced a contested presidential election in 2013, a continued post insecurity-induced effect of major terrorist attack in 2012, and several financial regulatory changes in 2014. These events may have contributed to increased herding behavior. Service sector is the largest contributing sector to Kenya's GDP and in 2015, contributed 49% of GDP. Tourism makes a significant segment of the service sector and is very sensitive to negative political and terrorism events. The negative events of 2012-14 may have contributed to higher volatility and downturn in the NSE during this period and may have subjected the service sector to increased significant herding in falling markets. Furthermore, share of industrial sector contribution to Keny's GDP is lowest and in 2015 was 19%. Since foreign investment is stronger in financial, service, and agriculture (comprised mainly from cash crops such as tea and coffee as well as cut flowers) sectors and is more than in industrial sector, our findings may indicate that domestic investors herd less than foreign investors.

CONCLUSION

This study uses 2010-15 daily stock market data from the Nairobi Securities Exchange (NSE) in Kenya to investigate potential herding behavior in this market. We extend the existing literature by (i) focusing on daily NSE data; and (ii) allowing herding behavior to change over time. We have found consistent results across models that herding tends to be present and significant in agriculture, and financial sectors during rising markets and present and significant in the service sector during falling markets and present but insignificant in the service sector in the rising markets. In addition, we did not detect any herding in the industrial sector and herding in this sector was found to be not asymmetric with respect to market ups and downs. Moreover, political and regulatory turmoil during 2012-2014 may have contributed to increased herding behavior. Finally, a major challenge faced by investors in the NSE is lack or paucity of reliable micro-information about listed companies. To the extent that herding is indicative of relative market inefficiencies, the market can be improved by enhancing the quality of information disclosure and establishment of local derivatives market. As of January 26, 2018, no trading in derivatives at the NSE were allowed until all regulatory approvals are met.

TABLE 1
ONE-TAIL TEST FOR PRESENCE OF HERDING BEHAVIOR

$$H_0 : \gamma_2 = 0 \quad H_a : \gamma_2 < 0$$

	Agriculture		Financials		Industrials	Services	
Equation (1): $CSAD_t = \alpha + \gamma_1 \mid R_{m,t} \mid + \gamma_2 R_{m,t}^2 + \varepsilon_t$							
γ_2	-0.0622	†††	-0.0465	†	0.0243	-0.0684	††
Std. Error	0.0226		0.0366		0.0107	0.0405	
DF	1245		1245		1245	1245	
p-Value	0.0030		0.1021		0.9883	0.0457	
Equation (3): $CSAD_t = \alpha + \gamma_1 \mid R_{m,t} \mid + \gamma_2 R_{m,t}^2 + \theta_1 RF_t + \theta_2 EPS_t + \varepsilon_t$							
γ_2	-0.0625	†††	-0.0499	†	0.0257	-0.0646	†
Std. Error	0.0231		0.0359		0.0108	0.0404	
DF	1242		1242		1242	1242	
p-Value	0.0035		0.0824		0.9913	0.0550	
Equation (4): $CSAD_t = \alpha + \gamma_1 \mid R_{m,t} \mid + \gamma_2 R_{m,t}^2 + \theta_1 RF_t + \theta_2 EPS_t + \theta_3 \log(\sigma_t) + \varepsilon_t$							
γ_2	-0.0603	†††	-0.0418	†††	0.0248	-0.0354	†
Std. Error	0.0143		0.0147		0.0219	0.0216	
p-Value	0.0000		0.0022		0.8713	0.0506	
Equation (5): $CSAD_t = \alpha + \gamma_1 \mid R_{m,t} \mid + \gamma_2 R_{m,t}^2 + \theta_1 RF_t + \theta_2 EPS_t + \delta + \delta\left(\gamma_3 \mid R_{m,t} \mid + \gamma_4 R_{m,t}^2 + \theta_3 RF_t + \theta_4 EPS_t\right) + \varepsilon_t$							
γ_2 (Rising Market)	-0.0812	†††	-0.0825	†††	0.0335	-0.0236	
Std. Error	0.0243		0.0273		0.0121	0.0472	
p-Value	0.0004		0.0013		0.9971	0.3086	
γ_2 (Falling Market)*	-0.0063		0.0175		0.0041	-0.0829	††
Std. Error	0.0398		0.0623		0.0279	0.0432	
p-Value	0.4371		0.6106		0.5584	0.0276	
DF	1234		1234		1234	1234	

†, ††, ††† indicate 90%, 95%, and 99% confidence levels, respectively, for a one-tailed test for herding.

** γ_2 (Falling Market) is equal to $\gamma_2 + \gamma_4$*

TABLE 2
OLS PARAMETER ESTIMATES OF EQUATION (1)

	Agriculture	*Financials*	*Industrials*	*Services*
α	1.098	1.5425	2.1394	1.8567
	(0.0896)**	(0.0448)**	(0.0515)**	(0.0758)**
γ_1	1.1211	0.6359	0.4802	0.7923
	(0.1036)**	(0.0984)**	(0.0619)**	(0.1291)**
γ_2	-0.0622	-0.0465	0.0243	-0.0684
	(0.0226)**	(0.0366)	(0.0107)*	(0.0405)
n	1248	1248	1248	1248
R^2	0.2982	0.1331	0.1854	0.1023

TABLE 3
OLS PARAMETER ESTIMATES OF EQUATION (3)

	Agriculture	*Financials*	*Industrials*	*Services*
α	1.4781	1.2182	1.6373	1.6481
	(0.1674)**	(0.1010)**	(0.2798)**	(0.2353)**
γ_1	1.1226	0.6254	0.4704	0.7712
	(0.1052)**	(0.0981)**	(0.0606)**	(0.1300)**
γ_2	-0.0625	-0.0499	0.0257	-0.0646
	(0.0231)**	(0.0359)	(0.0108)*	(0.0404)
θ_1	-0.0289	0.039	0.017	0.024
	(0.0124)*	(0.0069)**	(0.0113)	(0.0115)*
θ_2	-0.0439	-0.0074	0.0987	0.0017
	(0.0186)*	(0.0264)	(0.0554)	(0.0478)
n	1247	1247	1247	1247
R^2	0.3040	0.1696	0.1892	0.1064

TABLE 4
GARCH PARAMETER ESTIMATES OF EQUATION (4)

	Agriculture	*Financials*	*Industrials*	*Services*
Mean Equation				
α	0.4083	2.1036	1.5172	0.868
	(0.3078)	(0.4242)**	(0.2232)**	(0.3328)**
γ_1	1.1252	0.57	0.4903	0.6806
	(0.0793)**	(0.0620)**	(0.0833)**	(0.0928)**
γ_2	-0.0603	-0.0418	0.0248	-0.0354
	(0.0143)**	(0.0147)**	(0.0219)	(0.0216)
θ_1	-0.0058	0.0332	0.0145	0.0284
	(0.0089)	(0.0057)**	(0.0082)	(0.0081)**
θ_2	-0.0227	0.0047	0.1022	0.0400
	(0.0163)	(0.0237)	(0.0404)*	(0.0403)
θ_3	0.8873	1.5635	1.4709	1.0343
	(0.3592)*	(0.7277)*	(0.6769)*	(0.4769)*
Variance Equation				
ω_0	0.1571	0.1056	0.3536	1.4126
	(0.0318)	(0.0262)	(0.1045)	(0.1858)
ω_1	0.0551	0.022	0.0526	0.1502
	(0.0117)	(0.0089)	(0.0231)	(0.0441)
ω_2	0.8803	0.7956	0.6125	0.0817
	(0.0153)	(0.0438)	(0.1034)	(0.0889)
n	1247	1247	1247	1247
R^2	0.3226	0.1888	0.2061	0.1183

TABLE 5
OLS PARAMETER ESTIMATES OF EQUATION (5)

	Agriculture	*Financials*	*Industrials*	*Services*
α	1.5010	1.3802	1.4693	1.6010
	(0.2052)**	(0.1328)**	(0.3254)**	(0.3095)**
γ_1	1.1701	0.7050	0.4177	0.7175
	(0.1293)**	(0.1058)**	(0.0814)**	(0.1690)**
γ_2	-0.0812	-0.0825	0.0335	-0.0236
	(0.0243)**	(0.0273)**	(0.0121)**	(0.0472)
θ_1	-0.0309	0.0315	0.0279	0.0235
	(0.0160)	(0.0087)**	(0.0124)*	(0.0154)
θ_2	-0.0461	-0.0659	0.1379	0.0163
	(0.0243)	(0.0336)	(0.0663)*	(0.0609)
δ	0.0083	-0.3320	0.3602	0.1001
	(0.2995)	(0.1516)*	(0.4362)	(0.4281)
$\delta \cdot \gamma_1$	-0.2214	-0.2451	0.1541	0.0463
	(0.2129)	(0.1874)	(0.1419)	(0.2215)
$\delta \cdot \gamma_2$	0.0750	0.1000	-0.0295	-0.0592
	(0.0466)	(0.0677)	(0.0292)	(0.0558)
$\delta \cdot \theta_1$	0.0042	0.0176	-0.0256	0.0034
	(0.0219)	(0.0098)	(0.0182)	(0.0210)
$\delta \cdot \theta_2$	0.0057	0.1206	-0.0818	-0.0317
	(0.0357)	(0.0389)**	(0.0823)	(0.0890)
n	1244	1244	1244	1244
R^2	0.3058	0.1815	0.1931	0.1096

TABLE 6
MULTIPLE STRUCTURAL BREAK ANALYSIS OF EQUATION (3)

	Agriculture	*Financials*	*Industrials*	*Services*
No. of Breaks	3	2	1	2
Max Scaled F-stat	25.2259	37.5743	22.0451	37.4843
*Critical value**	18.4200	18.4200	18.4200	18.4200
No. of Breaks	*Scaled F-statistics*			
1	24.9028	25.7675	**22.0451**	27.4433
2	21.8399	**37.5743**	16.8610	**37.4843**
3	**25.2259**	28.1946	18.6300	26.0738
4	24.6777	22.9272	14.4459	28.6304
5	20.0587	35.3693	15.6723	26.7565
Estimated break dates:				
	2011-05-02	2011-06-02	2014-07-30	2013-07-19
	2012-07-05	2013-02-06		2014-04-24
	2014-06-12			
γ_2 *with breaks (robust standard errors in parenthesizes):***				
Regime 1	-0.1574	-0.0592	0.0319	-0.0461
	(0.1347)	(0.0753)	(0.0115)	(0.0379)
Regime 2	-0.0440	0.1015	0.0771	-0.1446†††
	(0.0238)	(0.0470)	(0.1134)	(0.0337)
Regime 3	-0.0860††	-0.1157†††		0.0198
	(0.0575)	(0.0233)		(0.0442)
Regime 4	-0.0404†			
	(0.0517)			

** Bai-Perron (Econometric Journal, 2003) critical values.*
*** †, ††, ††† indicate 90%, 95%, and 99% confidence levels, respectively, for a one-tailed test for herding.*

ENDNOTES

1. For example Wylie (2005), Andreu, Ortiz, and Sarto (2009), Huang et al. (2010) search for hearding among mutual fund and pension fund managers, and Hong, Kubik and Solomon (2000), Welch (2000), Gleason and Lee (2003), Clement and Tse (2005), Lin, Chen and Chen (2011) search amoung among financial analysts.
2. See e.g. Tan et al. (2008), Demirer, Kutan, and Chen (2010), Aduda, Odera, and Onwonga (2012), Ngoc (2014), Cakan and Balagyozyan (2014)
3. See NSE 2016 Annual Report, https://www.nse.co.ke/inverstor-relations/financial-reports-and-results/category/46-nse-annual-reports.html?download=9896%3Anse-2016-annual-report
4. Percentages of foreign participation to equity turnover were taken from various issues of the NSE Monthly Statistical Bulletin.
5. This is a standard result of the capital asset pricing model.
6. While the conditional variance term is significant at the 90% confidence level for all sectors, our conclusions with respect to herding are unchanged. Therefore, we conclude that   is capturing herding and not the relationship between idiosyncratic risk and market return.

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