Empirical Study on Herding Behavior in Sri Lankan Stock Market: Evidence from Quantile Regression Approach

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Abstract: The study of herd behavior has become an interesting area among academic and practitioners during the last two decades as it consequences market bubbles and subsequent crashes which impair market stability. Though this irrational behavior is more pronounced in emerging and frontier stock markets, empirical studies are limited in this context. We, therefore, investigate the herd behavior for a sample of non-financial firms listed on the Sri Lankan stock market covering the time period 2007-2016.This study also extends the previous study in the Sri Lankan context by using the quantile regression approach to obtain better results than the traditional ordinary least squared regression method. The quantile regression results show that herding is found to occur only in the return dispersions at the lower tail of the distribution and mostly in periods when the market rises. However, there is no evidence of herding when using the ordinary least squared method in the analysis.
Key words: Market-wide herding; Colombo stock exchange; Non-financial firms; Quantile regression

1 Introduction

Over the last few decades with the emergence of behavioral finance theories, investors' behavior in capital market has been an interesting and most researched field in finance. Many studies were focusing mainly on investors' behavioral patterns/styles affecting the stock prices. Standard finance, also known as traditional finance, is based on various theories and principles, for example the arbitrage principles of Miller and Modigliani; the portfolio principles of Markowitz; the capital asset pricing theory of Sharpe, Lintner and Black; and the option-pricing theory of Black, Scholes and Merton. According to these approaches, markets and market participants are assumed to be efficient and behave rationally in the financial markets. However, behavioral finance suggests that the investment decision-making process is influenced by various behavioral biases that encourage investors to deviate from rationality and make irrational investment decisions. One of these behavioral biases is herding. Herding in equity markets is the behavior of the investors to imitate the investment decisions of others rather than their own beliefs and information. This irrational behavior affects the stock prices, then changes of which deviate from risk–return relationship predicted by the rational asset pricing models. Further, herding behavior among investors has been a popular behavioral explanation for the excess volatility and short-term trends observed in financial markets. Therefore, this phenomenon has recently received more attention among academics and practitioners. It has been empirically investigated in developed financial markets in different contexts such as institutional investors' herding behavior (Sias, 2004), individual investors' herding behavior (Fernandez et al., 2011), analyst recommendations and herding behavior (Dasgupta et al., 2011; Dasgupta et al., 2011) and herding on aggregate market activity (Andronikidi and Kallinterakis, 2010; Chiang and Zheng, 2010; Economou et al., 2011; Galariotis et al., 2015; Galariotis et al., 2016). However, the studies on herding behavior are limited in the context of emerging and frontier equity markets (Spyrou, 2013; Kumar and Goyal, 2015).

The recent empirical studies on herding relating to aggregate market activity (that is, also called as market-wide herding) in emerging and frontier stock markets is very limited to those on, for example, Chinese equity markets (Chiang et al., 2010; Yao et al., 2014; Sharma et al., 2015), Taiwanese stock market (Demirer et al., 2010), five Gulf Arab stock markets (Balcilar et al., 2013), Chinese and Indian equity markets (Lao and Singh, 2011), and Saudi stock exchange (Rahmana et al., 2015). To the authors' knowledge, there is only one published study examining this herding behavior in the Sri Lankan stock market (Sewwandi, 2016). However, inconsistent with the findings of other emerging and frontier markets, it does not find herding behavior in the Sri Lankan context. Nevertheless, many previous studies show that this tendency is an inherent psychology of investors but it becomes stronger when they have to make decisions in an uncertain market conditions. As shown in Figure 1, the Sri Lankan stock market exhibits wide fluctuations over the last decade. Since this uncertainty in market conditions could cause herding behavior, this study focuses on supporting this hypothesis in the Sri Lankan context. Meanwhile, this irrational behavior could hinder market stability by creating market bubbles and

subsequent crashes, it is vital to detect whether it exists in order to implement necessary regulatory reforms to improve the market stability. It is also found that the herding behavior is sector-specific (Sharma et al., 2015). Since the testing for herding behavior by sector is novel, there is a need to do more research to contribute it. Accordingly, the objective of this study is to examine whether there exists herding behavior in the non-financial firms listed on the Sri Lankan stock market.

The remainder of the paper is organized as follows. The next section discusses about the data used in the study. The third section describes research methodology. The fourth section presents the empirical results and their discussion. The final section concludes the paper.

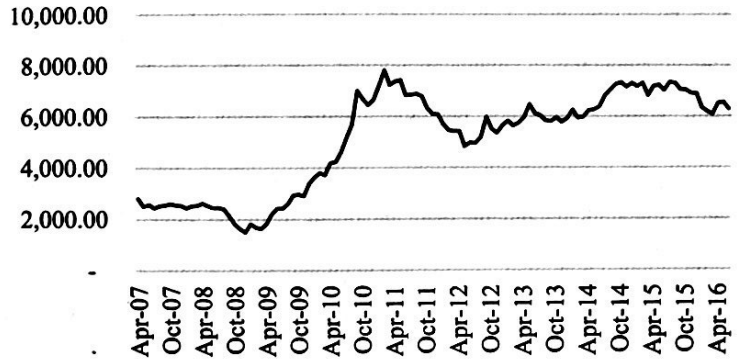

Figure 1 Movement of ASPI of CSE

2 Data

This study focuses on examining the herding behavior in the Sri Lankan stock market which is the Colombo Stock Exchange (CSE). It currently has a membership of 15 institutions, all of which are licensed to operate as stock brokers. As of 31st March 2016, 295 companies are listed on the CSE, representing twenty business sectors with a market capitalization of 2,586 billion rupees, which corresponds to approximately 1/4 of the Gross Domestic Product of the country. The financial firms include 63 banking, finance and insurance companies and 11 investment trusts. The rest of the companies represent business sectors such as beverage, food and tobacco, construction, chemicals and pharmaceuticals, footwear and textiles, manufacturing, services, trading, plantation, telecommunication, store and supplies, hotels and travel, land and property, health care, etc. For the purpose of this study, these companies are broadly classified as "Non-financial firms". There are currently two indices used in the CSE, namely, All Share Price Index (ASPI) and S&P Sri Lanka 20 Index (S&P SL20). The ASPI represents the performance of the all listed companies whereas S&P SL20follows the performance of 20 leading publicly traded companies listed in the CSE.

The daily data is used in this study because the herd behavior is a short-term phenomenon (Chang et al., 2000). Daily stock prices fall non-financial firms and daily ASPI data are collected from the Data Library published by the CSE. The sample period selected for the study is from 1st April, 2007 to 31st March, 2016 which covers periods of higher market volatility, market crashes and global financial crisis to facilitate the investigation of the hypothesis that market uncertainty leads to herd behavior. The ASPI is used as a proxy for calculating the market returns over the sample period. The final data set includes 207 firms yielding 2,155 daily observations. The daily stock return and market return are calculated as given in Equation (1) and (2) respectively.

$$R_{it} = [ln(P_{it}) - ln(P_{it-1})] \, x \, 100 \quad (1)$$

Where, $R_{it}$is the return for stock i for the day t, and $P_{it}$and $P_{it-1}$are the closing prices of stock i for day t and t-1respectively.

$$R_{mt} = [ln(ASPI_t) - ln(ASPI_{t-1})] \, x \, 100 \quad (2)$$

Where, $R_{mt}$is the market return for the day t , and $ASPI_t$and $ASPI_{t-1}$are the ASPI at the end of day t and t-1respectively.

3 Methodology

The models given in Equation (3) is adopted to examine the existence of herding in CSE(Chang et al., 2000). Since investors are more likely to suppress their own beliefs and use market consensus during large price changes, equity return dispersions are sensitive to aggregate market returns squared. Thus, the herding behavior exists if least squares estimates shows a [illegible]

squared term. Accordingly, the Equation (3) is run for each trading day over the sample period to detect the herding behavior in the market.

$$CSAD_t = \propto + \gamma_1|R_{mt}| + \gamma_2 R_{mt}^2 + \varepsilon_t \quad (3)$$

Where, $CSAD_t$is cross-sectional absolute deviation of stock return at day t which is calculated as given in Equation (4).

$$CSAD_t = (1/N)\sum_{i=1}^{N}|R_{it} - R_{mt}| \quad (4)$$

As investors are more prone to exhibiting herding behavior during extreme market conditions, the model given in the Equation (3) is run using the quantile regression approach. This analysis provides a more complete picture of the conditional distribution between return dispersions and independent variables in Equation (3). For the comparison with the previous empirical studies, Ordinary Least Squared (OLS) regression is also used in this study. A negative and significant $\gamma_2$coefficient would indicate the presence of herding. Further, the Equation (3) is run for both up-market (where R_{mt}>0) and down-market (where R_{mt}<0) movements of daily market return.

4 Empirical Results and Discussion

4.1 Descriptive analysis

As reported in Table 1, the mean value of average daily market return is 0.016% with a very small median of 0.002%. However, the market return deviates from the minimum of -2.218% to maximum of 2.719% during the sample period. This shows a higher volatility of the Sri Lankan stock market during the period of study. The standard deviations of$CSAD_t$and $R_{mt}$are more close is up-market period than those of down-market period.

Table 1 Descriptive Statistics of Main Data Series

Statistic	Total Sample Period		Up-Market Period		Down-Market Period	
	R_{mt} (%)	$CSAD_t$(%)	R_{mt}(%)	$CSAD_t$ (%)	R_{mt} (%)	$CSAD_t$(%)
Mean	0.016	1.040	0.284	1.076	-0.255	1.005
Median	0.002	0.960	0.188	1.002	-0.174	0.927
Maximum	2.719	3.935	2.719	3.935	-0.001	3.369
Minimum	-2.218	0.416	0.000	0.416	-2.218	0.422
Standard Deviation	0.398	0.374	0.307	0.384	0.279	0.360
Skewness	0.252	2.445	2.648	2.451	-2.690	2.465
Kurtosis	5.720	9.290	11.143	9.645	10.641	8.937

This table presents descriptive statistics of daily time series over the sample period from 1stApril 2007 to 31stMarch 2016. $CSAD_t$indicates the cross-sectional absolute deviation of daily returns of individual stocks. $R_{mt}$is the daily market return.

4.2 Analysis of herding behavior using quantile regression method

Table 2 presents the results of the analysis using the quantile regression method. The $\gamma_2$coefficient estimates for the total sample period are negative and statistically significant in most of quantiles up to 60% region. This indicates the existence of herding in the lower and median quantile regions. Further, the results are different when the total sample period is split into up-market and down-market sub-periods. In up-market period, the coefficient estimates for γ_2 are negative and statistically significant in all quantiles up to 65% region. However, the same is observed only in 40% and 50% quantiles in the down-market period.

On the other hand, the results in Table 2 show that the estimates for γ_2 are positive and statistically significant at upper quantile regions in both total sample period and up-market and down-market sub-sample periods. Thus, there is no evidence of herding in the periods of extreme price changes. Accordingly, these evidence reveals that the herding occurs only in return dispersions at the lower and median tail of the distribution and mostly when the market rises. It also finds that investors display more homogeneous trading behavior, particularly on days when the market is declined.

4.3 Analysis of herding behavior using OLS regression method

The model given in Equation (3) is run using the OLS regression procedure for the full sample and up-market and down-market sub-period samples. The results are presented in Table 3.The results show that $\gamma_1$is significantly positive for the total sample and for the up and down market sub-samples. However, the coefficient $\gamma_2$is not significantly negative for both total sample and two sub-samples. Therefore, these results do not reveal the presence of herding during both total sample and two

sub-samples.

Table 2 Results of Herding Behavior Using Quantile Regression Method

Quantile	Total Sample Period			Up-Market Period			Down-Market Period		
	α	γ_1	γ_2	α	γ_1	γ_2	α	γ_1	γ_2
10%	0.632*	0.364*	**-0.009***	0.630*	0.539*	**-0.081***	0.625*	0.304*	-0.008
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.231)
15%	0.665*	0.413*	**-0.029***	0.675*	0.489*	**-0.062***	0.665*	0.268*	0.025*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
20%	0.697*	0.395*	**-0.010***	0.700*	0.535*	**-0.081***	0.699*	0.247*	0.060*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
25%	0.719*	0.429*	**-0.026***	0.722*	0.543*	**-0.088***	0.730*	0.244*	0.068*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
30%	0.742*	0.458*	**-0.044***	0.746*	0.541*	**-0.043***	0.745*	0.278*	0.047*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
35%	0.766*	0.470*	**-0.054***	0.779*	0.534*	**-0.041***	0.768*	0.341*	0.008*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.005)
40%	0.797*	0.447*	**-0.022***	0.804*	0.521*	**-0.041***	0.792*	0.357*	**-0.006****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.025)
45%	0.822*	0.441*	**-0.008***	0.821*	0.537*	**-0.033***	0.816*	0.364*	-0.002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.429)
50%	0.847*	0.429*	0.008*	0.853*	0.561*	**-0.049***	0.838*	0.372*	**-0.014***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
55%	0.872*	0.447*	0.006*	0.882*	0.552*	**-0.029***	0.866*	0.343*	0.017*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
60%	0.899*	0.467*	**-0.005***	0.916*	0.536*	**-0.012***	0.899*	0.312*	0.051*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
65%	0.937*	0.443*	0.025*	0.961*	0.534*	**-0.019***	0.935*	0.287*	0.055*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
70%	0.994*	0.361*	0.109*	1.012*	0.450*	0.092*	0.988*	0.172*	0.188*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
75%	1.040*	0.399*	0.078*	1.073*	0.337*	0.232*	1.028*	0.180*	0.190*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
80%	1.125*	0.248*	0.241*	1.134*	0.291*	0.277*	1.092*	0.199*	0.165*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
85%	1.192*	0.221*	0.298*	1.220*	0.199*	0.382*	1.146*	0.370*	0.065*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
90%	1.274*	0.217*	0.362*	1.270*	0.330*	0.309*	1.251*	0.398*	0.025*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
95%	1.390*	0.475*	0.214*	1.391*	0.426*	0.237*	1.412*	0.304*	0.561*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: (a) The numbers in the parentheses are p-value,
(b) * and ** denotes statistical significance at the 1% and 5% level respectively.

This table reports the estimation results of the Equation (3), in which α, γ_1 and γ_2 are the coefficients of the equation, using quantile regression method. The total sample includes 207 firms listed on CSE during the period from 1st April, 2007 to 31st March, 2016.

Table 3 Results of Herding Behavior Using OLS Regression Method

Sample	No. of Observations	Coefficients			R^2	F-statistic
		α	γ_1	γ_2		
Total Sample	2155	0.922*	0.411*	0.046	13.75%	172.816*
		(0.000)	(0.000)	(0.197)		(0.000)
Up-Market Sample	1084	0.930*	0.496*	0.030	18.33%	122.504*
		(0.000)	(0.000)	(0.507)		(0.000)
Up-Market Sample	1071	0.917*	0.312*	0.056	8.65%	51.690*
		(0.000)	(0.000)	(0.342)		(0.000)

Note: (a) The numbers in the parentheses are p-value,
(b) *denotes statistical significance at the 1% level.

This table reports the estimation results of the equation (3), in which α, γ_1 and γ_2 are the coefficients of the equation, using OLS regression method. The total sample period is from 1st April, 2007 to 31st March, 2016 consisting of 207 firms listed on the CSE.

4.4 Discussion of results

When comparing quantile regression results with those derived from the OLS approach, the results are different for both total sample period and the sub-sample periods. The evidence of herding is presence when quantile regression method is employed whereas no evidence when using OLS regression. The OLS results are consistent with those of Sewwandi, which does not find evidence of herding in the total market and up and down market sub-periods. The reason is OLS approach focuses on mean as a measure of location, while the quantile regression analysis allows the researcher to compute a family of regression curves, each corresponding to a different quantile of the conditional distribution of the dependent variables (Chiang et al., 2010). Further, quantile regression provides a much more overall picture of the conditional distribution between return dispersions and independent variables. Thus, the quantile approach is considered to be more appropriate in this case.

Further, quantile regression results indicate that there is a distinction in herding degree in up and down markets. The level of herd behavior is stronger in rising markets than declining markets. These results are consistent with the studies of other Asian emerging stock markets which advocate that herding is more pronounced under conditions of rising markets (Tan et al.,2008; Lao and Singh, 2011; Prosad et al., 2012; Rahmana et al., 2015; Dang and Lin, 2016). However, the results do not provide support for studies, which attempt to argue that the formation of herds is more likely to be present during periods of large changes in prices studies (Chang et al., 2000). So, we do not find evidence of herding in return dispersions at the upper quantile regions of the distribution.

5 Conclusion

The objective of the study is to investigate whether there exists evidence of herd behavior for a sample of non-financial firms listed on the Sri Lankan stock market. The quantile regression results indicate that the herding is presence only in return dispersions at the lower tail of the distribution. Thus, the formation of a herd is not evident in large changes in prices. Further, there is a distinction in herding degree in up and down markets. The level of herd behavior is stronger in rising markets than declining markets. This reveals that investors are more prone to herd during the upward movements in the market. Moreover, it is evident that the analysis using the quantile regression is appropriate than OLS because the quantile regression provides a more complete picture of the behavior of the independent variables over the entire distribution of the dependent variable of the model.

Since this herding mentality could distort stock prices and create market bubbles and crashes, further studies should be continued to identify its causes and recommend necessary regulatory reforms to minimize such adverse consequences. The herd behavior should also be observed from the point of view of different market participants such as individual investors, institutional investors, local and foreign investors as well as different types of herding such as intentional herding and unintentional herding to further ensure that a fair and efficient stock exchange is operated in the Sri Lankan context.

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