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HERDING MEASURES IN EQUITY MARKETS: A CASE STUDY OF BURSA MALAYSIA

Yoke-Chen Wong [a] , **Kim-Lian Kok** [b] [1]

Sunway University College [a]
Stamford College [b]

Abstract

This study examines the issue of herding in the Malaysian equity market over the period 1993 – 2004. Using the method proposed by Christie and Huang (1995), we did not detect any evidence of herding for the whole market, the large firms or the small firms during the pre-crisis, crisis and the post-crisis periods. The modified method of Christie and Huang (1995) produced similar findings. However, using the method proposed by Chang *et al.* (2000), herding was found in the overall market in the whole period. In the pre-crisis period, herding in the market during the market decline could be attributed to both the large and small firms. Rather surprisingly, there was no herding in the crisis period. In the post-crisis period, herding was detected in the market during market rise and this could be attributed to the small firms. Large firms, on the other hand, witnessed herding during market decline. The modified method of Chang *et al.* (2000) detected more evidence of herding with the use of cross-sectional inter-quartile range but less evidence of herding when cross-sectional standard deviation is used.

JEL Classifications: G12, G14, G15
Keywords: Herding, Asian financial crisis, cross-sectional standard deviation, cross-sectional absolute deviation, cross-sectional inter-quartile range

[1] Corresponding author: Kok Kim-Lian, Stamford College, Lot 7A, Jalan 223, Section 14, 46100 Petaling Jaya, Selangor, Malaysia. Email: kok.kim.lian@stamford.edu.my

1. Introduction

Herding refers to a situation in which a group of individuals act collectively and coherently. In equity markets, herding of a sufficiently large group of investors can lead eventually to bubbles and crashes. Following dramatic financial crises in the last two decades, this behaviour has emerged as a topic of intense interest as it offers the means to study and understand investors' collective behaviour that leads to these dramatic market movements.

Herding arises from both cognition and emotion. As a cognitive response, herding results from receiving knowledge and taking a logical action based on that knowledge. However, a far more powerful drive is the emotional response. Objective knowledge is very often tempered with the strong emotions of fear and greed. In an emotionally charged situation, decisions based on rational knowledge often do not prevail over fear-induced panic behaviour. Similarly, in a rallying bubble economy, the emotions of greed induce irrational behaviour that is not supported by objective knowledge. Since fear is a stronger emotion than greed, it is theorised that herding behaviour should be more apparent in times of crises.

In an oft-quoted prize-winning essay on global finance, Persaud (2000) has this to say: "There are three main explanations for why bankers and investors herd. First, in a world of uncertainty, the best way of exploiting the information of others is by copying what they are doing. Second, bankers and investors are often measured and rewarded by relative performance, so it literally does not pay for a risk-averse player to stray too far from the pack. Third, investors and bankers are more likely to be sacked for being wrong and alone than being wrong and in company."

Knowledge on herding may be useful to investment managers in the areas of portfolio diversification based on the simple reason that portfolio risk is expected to increase if all the stocks in one's portfolio have the tendency to move in the same direction. Prevalent herding among stocks could be due to certain characteristics of these stocks or could be linked to certain market conditions or events. By understanding the possible causes and reasons for herding, the investment managers could perhaps make better informed decisions when forming the composition of their portfolios, as well as choosing the more appropriate time and situation to do so.

Being a non-quantifiable behaviour, herding cannot be measured directly but can only be inferred by studying related measurable parameters. The models to measure herding are developed according to how researchers define herding, and currently there are two main definitions.

The first definition of herding focuses on the trading activities of the individual investors. Herding is said to have occurred when the individuals intentionally copy the behaviour of other investors by trading in the same direction over a period of time. Thus, to measure herding, data is collected on the trading activities of investors and changes in their investment portfolios. Examples of such measures are the LSV measure by Lakonishok *et al.* (1992) and the PCM measure by Wermers (1995).

In the second definition, the presence of herding behaviour is indicated by the group effect of collective buying and selling actions of the investors in an attempt to follow the performance of the market. This group effect is detected by exploiting the information contained in the cross-sectional stock price movements. Christie and Huang (1995), Chang *et al.* (2000) and Hwang and Salmon (2001, 2004) are contributors of such measures.

2. Objective and Significance of Study

So far there is no known study which focuses exclusively on the Malaysian equity market with regard to the issue on herding behaviour. Being one of the countries severely affected by the 1997 Asian financial crisis, it would be interesting to study the herding behaviour in the periods prior to, during and after this crisis. To this end, we intend to use the herd measures developed by Christie and Huang (1995) and Chang *et al.* (2000). Their studies aim to detect herding by analysing the behaviour of the stock price movements.

Christie and Huang's (1995) method used the cross-sectional standard deviation (CSSD) of stock returns while Chang *et al.*'s (2000) method used the cross-sectional absolute deviation (CSAD) of stock returns. In this study, besides the use of CSSD in Christie and Huang's (1995) method, we shall also use CSAD and cross-sectional inter-quartile range (CSIQR). Similarly, in Chang *et al.*'s (2000) method, we use CSSD and CSIQR to detect herding in addition to using CSAD.

3. Literature Review

One of the earliest studies that attempt to detect empirically herding behaviour in the financial markets comes from Christie and Huang (1995). They contend that if herding behaviour occurs in an equity market during period of stress or high volatility, the dispersion should increase at a decreasing rate or simply a negative function of price movements in the case of severe herding. The rationale is that if the

individuals ignore their beliefs and base their decisions solely on the market consensus during periods of relatively large price movements, the stock returns will not deviate too far from the market return. In short, the dispersion should decrease during periods of extreme price movements when there is herding behaviour and this is contradictory to the capital asset pricing models which predict that the dispersion should increase with absolute value of the market return.

Using daily data, Christie and Huang (1995) applied their method to detect herding during market stress among the NYSE and Amex firms for the period July 1962 to December 1988. In order not to restrict to the assumption that herding is a short-lived phenomenon, they ran a parallel study using monthlydata for NYSE firms for the period December 1925 to December 1988. They found no evidence of herding in the periods of extreme price movements.

Premised on a similar intuition, Chang *et al.* (2000) modified the Christie and Huang's (1995) approach and applied their method to examine daily herding behaviour in the markets of the US, Hong Kong, Japan, South Korea and Taiwan. In place of *CSSD*, they use the cross-sectional absolute deviation of returns (*CSAD*) as a measure of dispersion. Their alternative empirical model is based on the emphasis that capital asset pricing models predict not only that the dispersions are an increasing function of the market return, it is also linear. Thus, in the presence of herding behaviour the linear and increasing relation between dispersion and market return will no longer be true. Instead, the relation is increasing non-linearly or even decreasing.

Just as in Christie and Huang's study, they found no evidence of herding, during market swings, among the NYSE and Amex firms for the period January 1963 - December 1997. Similarly, no significant herding is detected among the Hong Kong firms during the market's stressful times in the period from January 1981 to December 1995. However, partial evidence of herding is found in the Japanese market (January 1996 – December 1995) . Interestingly, in each of the two emerging markets of South Korea and Taiwan, herding among firms is evidently detected when the market was under duress.

4. Methodology

Christie and Huang's (1995) Method

In this method, the cross-sectional standard deviation is used as a measure of dispersion, and it is computed as follows:

$$CSSD_t = \sqrt{\frac{\sum_{i=1}^{N}(r_{it} - r_{mt})^2}{N-1}}, \quad (1)$$

where r_{it} and r_{mt} are, respectively, the observed daily return of stock *i* and the market on day *t*, and *N* is the number of stocks in the portfolio.

In this test, market stress is associated with the condition when the market returns lie in the upper and lower 5% or 10% of the market return distribution. In the presence of herding behaviour, the coefficients of β_1 and β_2 in the following regression should be significantly negative:

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

where D_t^U is equal to 1 if the market return on day *t* lies in the extreme upper tail of the distribution, and equal to 0, otherwise; and D_t^L is equal to 1 if the market return on day *t* lies in the extreme lower tail of the distribution, and equal to 0, otherwise. These dummy variables are incorporated to capture differences in investor behaviour in extreme up or down markets against relatively normal markets. If both the coefficients of these dummy variables are significantly positive, then we would empirically conclude that herding behaviour is not detected.

Besides the use of CSSD in Christie and Huang's (1995) method, the other measures of dispersion, CSAD and CSIQR, are also used for the analysis in this study. The CSAD is defined as:

$$CSAD_t = \frac{1}{N}\sum_{i=1}^{N}|r_{it} - r_{mt}| \quad (3)$$

while CSIQR is the inter-quartile range of the *N* values of the daily stock return r_{it}. Therefore, the 2 additional models used for the analysis are modifications of equation (2) where CSSD is replaced by CSAD and CSIQR.

Chang *et al.*'s (2000) Method

To accommodate the possibility that the degree of herding may be asymmetric in the up and the down markets, Chang *et al.* (2000) run two separate regression models as given below and the presence of herding in the up and the down markets is concluded by examining non-linearity in these relationships.

$$CSAD_t^{Up} = \alpha + \gamma_1^{Up}\left|r_{mt}^{Up}\right| + \gamma_2^{Up}\left(r_{mt}^{Up}\right)^2 + \varepsilon_t \quad (4)$$

$$CSAD_t^{Down} = \alpha + \gamma_1^{Down}\left|r_{mt}^{Down}\right| + \gamma_2^{Down}\left(r_{mt}^{Down}\right)^2 + \varepsilon_t \quad (5)$$

where $CSAD_t$ is the average absolute value of the deviation of stock i relative to the return of the market portfolio, r_{mt}, in period t. Based on the capital asset pricing models, large swings in price movements should elicit large increase in $CSAD_t$. In other words, there should be a positive linear relationship between $CSAD_t$ and r_{mt}. If the market participants do follow the collective actions of the market, then we should obtain a negative linear relationship or a non-linear relationship between $CSAD_t$ and the average market return. The non-linearity would be captured by a significantly positive or negative γ_2 coefficient. So, in the interpretation of results, if γ_1 is significantly negative or γ_2 is significantly positive or negative, then we shall conclude that herding behaviour is detected in the market.

Similarly, the two additional sets of models based on Chang *et al.* (2000) method are obtained from equations (4) and (5) by replacing CSAD with CSSD and CSIQR.

5. Data

A total of 69 stocks listed on the Main Board of Bursa Malaysia are selected to study herding towards the market. They comprise 35 small cap stocks and 34 large cap stocks. These stocks are given in Appendix 1. The Kuala Lumpur Composite Index (KLCI) is used as a proxy for the market portfolio. The study covers a period of 12 years, from 1993 to 2004 and the daily stock returns and market returns are computed as follows:

$$r_{it} = ln\left(\frac{p_{it}}{p_{i,t-1}}\right) \text{ and } r_{m,t} = ln\left(\frac{p_{mt}}{p_{m,t-1}}\right),$$

where p_{it} and p_{mt} represent the daily closing price on day t for stock i and the market, respectively.

In identifying the three periods as divided by the Asian financial crisis, we follow the same structural break points obtained by Goh *et al.* (2005). In their study, the break points marking the beginning and the end of the crisis period are estimated using the Sup Wald test proposed by Vogelsang (1997). They identified 29 July 1997 to 1 September 1998 as the crisis period of the Malaysian stock market. Hence the three periods used in this study are as follows:

Pre-crisis period – January 1993 to July 1997
Crisis period – August 1997 to August 1998
Post-crisis period – September 1998 to December 2004

6. Results

Table 1 presents the regression results obtained using the method suggested by Christie and Huang (1995) for the whole period and the 3 sub-periods. For the whole period 1993-2004, the β_1 and β_2 coefficients are significantly positive for the market at both 5 percent and 10 percent criteria. Thus, the hypothesis of herding can be rejected during this period. The Wald test results also show that there is no asymmetry of relationship between the daily CSSD and market returns except for large firms in the whole period using the 10 percent criterion. Generally, these results are consistent with those obtained by Christie and Huang (1995) on the US market, Chang *et al.* (2000) on the five Asia-Pacific markets of US, Hong Kong, Japan, South Korea and Taiwan, and Caparrelli *et al.* (2004) on the Italian Stock Exchange.

-Table 1 about here-

The results for the large firms and the small firms also show significantly positive β_1 and β_2 coefficients, and therefore the evidence of herding is again refuted. Similarly, there is some evidence of asymmetry of relationship between the daily CSSD and market returns for all firms and large firms in the crisis period. Sub-period analysis also reveals similar evidence of no herding in all 3 sub-periods not only for the whole market but also for large firms and small firms.

The results of the modified methods of Christie and Huang (1995) whereby CSAD and CSIQR are used in place of CSSD are given in Tables 2 and 3, respectively. They are consistent with those in Table 1 where CSSD is used except for the asymmetrical relationship between the daily CSIQR and market returns in the whole period using the 10 percent criterion. Chang *et al.* (2000) also obtained similar findings when CSAD was used instead of CSSD in Christie and Huang's (1995) method.

-Table 2 about here-

-Table 3 about here-

The regression results in Table 4 obtained using the method of Chang *et al.* (2000) reveal very different findings. Contrary to the findings obtained using the method of Christie and Huang (1995), there is a significant quadratic relationship between the daily CSAD and the market returns in both the rising market and the falling market for the

whole period as shown by the significance of the β_2 coefficient values, thereby confirming the evidence of existence of herding during this period. This is consistent with the findings of Caparrelli *et al.* (2004) on the Italian stock market. It is also consistent with the findings of Chang *et al.* (2000) who detected evidence of herding in the less developed and smaller markets of South Korea and Taiwan, and limited evidence of herding in the down market of Japan but did not detect herding in the larger and more established markets of US and Hong Kong.

Large firms and small firms interestingly exhibit quite contrasting characteristics. Large firms showed herding only in the down market while small firms showed herding in the up market. Since institutional and foreign fund investors generally invest in large firms, it appears therefore that they only herd during the market decline and not during the market rise. The reason could be that these investors normally have an investment trading strategy whereby they accumulate stocks over a period of time but are quick to exit the market to maximise profits or minimise losses. On the other hand, since retail investors generally invest in small firms, they exhibit the opposite behaviour as compared to the institutional investors. They herd during the market advance and not during the market decline. This could be because they tend to trade on rumours and do not have an exit strategy. Chang *et al.* (2000) also observed this phenomenon of herding for the large firms during the market decline and small firms during the market advance in the US market. Similarly, Caparrelli *et al.* (2004) also did not detect evidence of herding in the down market for small firms on the Italian stock market.

-Table 4 about here-

Sub-period analysis reveals very different findings for the pre-crisis, crisis and post-crisis periods. In the pre-crisis period January 1993 - July 1997, there was herding only during the market decline not only for the whole market but also for the large and the small firms. There was no herding during the market advance. Rather surprisingly, in the crisis period August 1997 - August 1998, there was no evidence of herding during the advancing or declining market phases not only for the whole market but also for large and small firms. This could be explained by the fact that investors probably drove up or drove down the market in response to common fundamental economic and financial factors. In the post-crisis period, herding occurred in the whole market only during the phase of market advance. This could be attributed to the existence of herding in the small firms. However, herding occurred in both large and small firms during the market decline. While the institutional investors continue to have a trading strategy, the retail investors could have improved on their trading ability and have an exit strategy. The detection of herding in the large and small firms and in the 3 sub-periods using the

method of Chang *et al.* (2000) and its modifications is neatly summarised in Table 7.

The regression results obtained using the modified methods of Chang *et al.* (2000) where CSAD is replaced by CSSD and CSIQR are presented in Tables 5 and 6, respectively. The results in Table 5 are similar to those in Table 4 except that no evidence of herding was detected in small firms during the phase of market advance of the post-crisis period. However, the results in Table 6 are substantially different from those in Table 4. Here, using CSIQR as the dispersion measure revealed herding of large firms during market advance phase not only in the whole period but also in each sub-period. This is summarised in Table 7. These results are rather surprising. Since CSIQR is the least variable of the three dispersion measures, we would normally expect a less significant relationship between this measure and the market returns. Instead, the converse is the case. This is also shown in the higher adjusted R-squared values as compared to those in Tables 4 and 5 for every period and size of firms.

-Table 5 about here-

-Table 6 about here-

-Table 7 about here-

7. Conclusion

In this study, we examined the issue of herding in the Malaysian stock market by using the methods proposed by Christie and Huang (1995) and Chang *et al.* (2000) and their modifications. We obtained quite contradictory findings from these 2 methods. Using the method by Christie and Huang (1995) or its modified methods, we could not find any evidence of herding in the overall market not only for the period of our study but also for all sub-periods and size of firms.

However, the method by Chang *et al.* (2000) yielded some interesting results. Herding was detected in the overall market during the market decline in the whole period and this could be attributed to the herding by institutional investors in the large firms. In the pre-crisis period, however, herding was detected only in the down market and it was both the large and the small firms that contributed to it. There was no evidence of herding in the crisis period. In the post-crisis period, herding was only detected in the market during the market advance. This could be attributed to herding in the small firms. The absence of evidence of

herding in the market during the market decline, however, could have masked evidence of herding especially in large firms if size of firm was not taken into account.

The use of CSSD and CSIQR in place of CSAD in Chang *et al.*'s (2000) method produced some variations to the findings. These are vividly indicated by the arrows in Table 7. Generally, more evidence of herding is detected with the use of CSIQR while the converse is true with the use of CSSD.

The different patterns of herding for large and small firms especially in the post-crisis period reveal the need for investment education for the retail investors. Bursa Malaysia may need to conduct courses on basic investment regularly for the retail investors so that they base their investment trading on sound stock fundamentals and not on rumours.

This study is not without its limitations. Essentially, these limitations are due to the methods used. Both Christie and Huang (1995) and Chang *et al.* (2000) attempt to detect evidence of herding for the whole duration under study. Their methods can not be used to identify whether there is herding in any particular point within the period under study. The method by Christie and Huang (1995) involves the use of dummy variables and therefore may introduce some form of bias since the meaning of "extreme" distribution is rather subjective. Furthermore, both methods measure herding by considering only market stress as indicated by large price swings and, hence, may have excluded other forms of herding (see Hwang and Salmon, 2004). Similarly, the modified methods of Christie and Huang (1995) and Chang *et al.* (2000) suffer from the same shortcomings. Finally, in using dispersions of the individual stock returns, the problem of cross-sectional volatility and time series volatility arises.

References

Caparrelli, F., D'Arcangelis, A.M. and Cassuto, A. (2004) Herding in the Italian Stock Market: A Case of Behavioral Finance. *Journal of Behavioral Finance*, 5(4), 222-230.

Chang, E.C., Cheng, J.W. and Khorana, A. (2000) An examination of Herd Behavior in Equity Markets: An international Perspective. *Journal of Banking and Finance*, 24(10), 1651-1679.

Christie, W.G. and Huang, R.D. (1995) Following the Pied Piper: Do Individual Returns Herd Around the Market. *Financial Analysts Journal*, 51(4), 31-37.

Goh, K.L., Wong, Y.C. and Kok, K.L. (2005) Financial Crisis and Intertemporal Linkages Across the ASEAN-5 Stock Markets. *Review of Quantitative Finance and Accounting*, 24, 359-377.

Hwang, S. and Salmon, M. (2001) A new measure of Herding and Empirical Evidence for the US, UK, and South Korean Stock Markets. Working Paper, Centre for Economic Policy Research Discussion Paper, London.

Hwang, S. and Salmon, M. (2004) Market Stress and Herding. *Journal of Empirical Finance*, 11(4), 585-616.

Lakonishok, J., Shleifer, A. and Vishny, R. (1992) The Impact of Institutional and Individual Trading on Stock Prices. *Journal of Financial Economics*, 32, 23-43.

Persaud, A. (2000) Sending the Herd off the Cliff. First prize essay on Global Finance for the year 2000, in the Institute of International Finance competition in honour of Jacques de Larosiere.

Vogelsang, T.J. (1997) Wald-Type Tests for Detecting Breaks in the Trend Function of a Dynamic Time Series. *Econometric Theory*, 13, 818-849.

Wermers, R. (1999) Mutual Fund Herding and the Impact on Stock Prices. *Journal of Finance*, 43, 639-656.

Table 1
Regression Results of Christie and Huang's (1995) Method Using Daily CSSD During Periods of Market Stress

		5 Percent Criterion			10 Percent Criterion		
Period	**Market**	**α**	**β_1**	**β_2**	**α**	**β_1**	**β_2**
Whole Period: Jan.1993-Dec.2004	All firms	0.0213 (63.48)	0.0173 (10.78)	0.0181 (8.47)	0.0205 (63.90)	0.0119 (9.55)	0.0105 (9.78)
			F=0.16 (0.69)			F=1.60 (0.21)	
	Large firms	0.0193 (57.10)	0.0170 (10.76)	0.0157 (8.05)	0.0185 (56.66)	0.0117 (9.18)	0.0094 (9.38)
			F=0.84 (0.36)			F=4.27 (0.04)	
	Small firms	0.0221 (62.13)	0.0168 (9.59)	0.0189 (7.80)	0.0213 (62.76)	0.0117 (9.33)	0.0108 (9.26)
			F=0.72 (0.40)			F=0.50 (0.48)	
Pre-crisis Period: Jan.1993-July 1997	All firms	0.0217 (40.96)	0.0120 (3.57)	0.0159 (3.17)	0.0213 (38.99)	0.0058 (3.02)	0.0073 (4.49)
			F=0.44 (0.51)			F=0.40 (0.53)	
	Large firms	0.0202 (37.52)	0.0114 (3.43)	0.0104 (3.30)	0.0198 (35.23)	0.0052 (2.71)	0.0063 (4.75)
			F=0.05 (0.81)			F=0.30 (0.58)	
	Small firms	0.0219 (38.68)	0.0121 (3.21)	0.0188 (2.78)	0.0214 (37.19)	0.0065 (3.12)	0.0081 (3.99)
			F=0.80 (0.37)			F=0.33 (0.57)	
Crisis Period: Aug.1997-Aug.1998	All firms	0.0331 (24.50)	0.0080 (4.41)	0.0169 (5.09)	0.0315 (24.11)	0.0084 (5.24)	0.0126 (4.76)
			F=4.99 (0.03)			F=2.80 (0.10)	
	Large firms	0.0317 (23.84)	0.0084 (4.51)	0.0176 (5.33)	0.0302 (23.06)	0.0090 (5.30)	0.0122 (4.48)
			F=6.62 (0.01)			F=1.77 (0.19)	
	Small firms	0.0332 (22.40)	0.0074 (3.77)	0.0142 (4.19)	0.0317 (21.55)	0.0074 (4.33)	0.0115 (4.33)
			F=2.49 (0.12)			F=2.22 (0.14)	
Post-crisis Period: Sept.1998-Dec.2004	All firms	0.0197 (63.57)	0.0185 (5.28)	0.0157 (5.88)	0.0190 (63.91)	0.0103 (5.55)	0.0097 (7.50)
			F=1.97 (0.16)			F=0.26 (0.61)	
	Large firms	0.0172 (58.64)	0.0163 (5.18)	0.0131 (5.09)	0.0166 (57.57)	0.0092 (5.60)	0.0083 (6.91)
			F=2.46 (0.12)			F=0.33 (0.57)	
	Small firms	0.0211 (58.85)	0.0187 (4.67)	0.0172 (5.94)	0.0204 (59.24)	0.0108 (5.25)	0.0102 (7.10)
			F=0.34 (0.56)			F=0.12 (0.73)	

Notes: (1) The t statistics for α, β_1 and β_2 are given in parentheses. (2) The F statistics are the Wald test statistics for equality of β_1 and β_2 with their p- values given in parentheses.

Table 2
Regression Results of Christie and Huang's (1995) Modified Method Using
Daily CSAD During Periods of Market Stress

		5 Percent Criterion			10 Percent Criterion		
Period	**Market**	**α**	**β_1**	**β_2**	**α**	**β_1**	**β_2**
Whole Period: Jan.1993-Dec.2004	All firms	0.0148 (69.36)	0.0144 (11.93)	0.0145 (9.81)	0.0104 (73.69)	0.0102 (11.08)	0.0088 (11.24)
		F=0.01 (0.91)			F=3.78 (0.05)		
	Large firms	0.0137 (63.75)	0.0138 (12.15)	0.0131 (8.80)	0.0130 (66.94)	0.0098 (10.72)	0.0080 (10.68)
		F=0.28 (0.59)			F=5.53 (0.02)		
	Small firms	0.0156 (67.19)	0.0140 (10.46)	0.0148 (9.48)	0.0149 (70.08)	0.0099 (10.43)	0.0088 (10.68)
		F=0.29 (0.59)			F=1.88 (0.17)		
Pre-crisis Period: Jan.1993-July 1997	All firms	0.0148 (52.89)	0.0102 (3.94)	0.0110 (5.86)	0.0143 (53.41)	0.0058 (4.05)	0.0060 (7.30)
		F=0.09 (0.76)			F=0.02 (0.89)		
	Large firms	0.0141 (49.80)	0.0093 (4.22)	0.0089 (4.77)	0.0136 (49.30)	0.0051 (3.92)	0.0056 (7.01)
		F=0.02 (0.89)			F=0.18 (0.67)		
	Small firms	0.0153 (47.83)	0.0109 (3.58)	0.0126 (5.13)	0.0148 (47.58)	0.0062 (3.75)	0.0062 (6.35)
		F=0.26 (0.61)			F=0.00 (0.99)		
Crisis Period: Aug.1997-Aug.1998	All firms	0.0235 (25.66)	0.0074 (5.89)	0.0144 (5.69)	0.0222 (26.02)	0.0074 (6.59)	0.0108 (5.17)
		F=5.48 (0.02)			F=3.01 (0.08)		
	Large firms	0.0232 (25.39)	0.0072 (5.38)	0.0146 (5.46)	0.0220 (25.33)	0.0073 (6.05)	0.0102 (4.48)
		F=6.73 (0.01)			F=2.49 (0.12)		
	Small firms	0.0234 (23.29)	0.0070 (5.25)	0.0125 (4.60)	0.0222 (22.65)	0.0068 (5.59)	0.0098 (4.38)
		F=2.62 (0.11)			F=1.80 (0.18)		
Post-crisis Period: Sept.1998-Dec.2004	All firms	0.0138 (62.91)	0.0155 (5.68)	0.0131 (6.13)	0.0131 (64.51)	0.0091 (6.33)	0.0082 (8.08)
		F=2.33 (0.13)			F=0.81 (0.37)		
	Large firms	0.0123 (60.89)	0.0135 (5.72)	0.0112 (5.35)	0.0118 (61.74)	0.0081 (6.56)	0.0071 (7.41)
		F=2.07 (0.15)			F=1.02 (0.31)		
	Small firms	0.0149 (57.62)	0.0159 (5.09)	0.0141 (6.24)	0.0143 (59.09)	0.0094 (5.88)	0.0087 (7.84)
		F=0.84 (0.36)			F=0.45 (0.50)		

Notes: (1) The t statistics for α, β_1 and β_2 are given in parentheses. (2) The F statistics are the Wald test statistics for equality of β_1 and β_2 with their p-values given in parentheses.

Table 3
Regression Results of Christie and Huang's (1995) Modified Method Using
Daily CSIQR During Periods of Market Stress

		5 Percent Criterion			10 Percent Criterion		
Period	**Market**	**α**	**β_1**	**β_2**	**α**	**β_1**	**β_2**
Whole Period: Jan.1993-Dec.2004	All firms	0.0197 (63.50)	0.0259 (12.83)	0.0257 (10.56)	0.0183 (67.25)	0.0190 (13.16)	0.0159 (12.47)
		F=0.02 (0.90)			F=6.50 (0.01)		
	Large firms	0.0186 (61.53)	0.0240 (13.49)	0.0235 (9.56)	0.0173 (65.10)	0.0179 (13.24)	0.0145 (11.87)
		F=0.04 (0.84)			F=7.97 (0.00)		
	Small firms	0.0207 (60.23)	0.0258 (11.04)	0.0262 (9.57)	0.0193 (62.06)	0.0186 (11.83)	0.0160 (11.26)
		F=0.03 (0.86)			F=3.21 (0.07)		
Pre-crisis Period: Jan.1993-July 1997	All firms	0.0199 (49.56)	0.0216 (4.25)	0.0185 (8.09)	0.0188 (50.97)	0.0135 (4.95)	0.0112 (9.40)
		F=0.45 (0.50)			F=0.89 (0.35)		
	Large firms	0.0189 (48.83)	0.0181 (4.31)	0.0158 (6.89)	0.0179 (50.05)	0.0117 (5.03)	0.0104 (9.02)
		F=0.28 (0.60)			F=0.29 (0.59)		
	Small firms	0.0205 (46.42)	0.0222 (4.03)	0.0210 (7.56)	0.0195 (47.04)	0.0134 (4.55)	0.0112 (7.82)
		F=0.06 (0.81)			F=0.66 (0.42)		
Crisis Period: Aug.1997-Aug.1998	All firms	0.0317 (25.95)	0.0150 (7.97)	0.0269 (6.48)	0.0296 (28.15)	0.0138 (8.21)	0.0200 (5.74)
		F=6.08 (0.01)			F=3.40 (0.07)		
	Large firms	0.0322 (27.50)	0.0137 (6.50)	0.0253 (5.37)	0.0306 (29.47)	0.0123 (6.64)	0.0176 (4.99)
		F=5.93 (0.02)			F=2.68 (0.10)		
	Small firms	0.0307 (21.30)	0.0153 (7.14)	0.0258 (4.76)	0.0290 (20.11)	0.0134 (6.82)	0.0188 (4.27)
		F=2.67 (0.10)			F=1.39 (0.24)		
Post-crisis Period: Sept.1998-Dec.2004	All firms	0.0182 (53.10)	0.0289 (6.33)	0.0243 (6.55)	0.0169 (55.52)	0.0184 (7.73)	0.0155 (8.76)
		F=2.64 (0.10)			F=3.03 (0.08)		
	Large firms	0.0169 (55.49)	0.0246 (6.55)	0.0216 (5.79)	0.0157 (57.54)	0.0164 (8.53)	0.0136 (7.96)
		F=0.98 (0.32)			F=0.30 (0.07)		
	Small firms	0.0197 (45.71)	0.0302 (5.49)	0.0253 (6.36)	0.0183 (46.84)	0.0192 (6.88)	0.0163 (8.47)
		F=1.51 (0.22)			F=1.81 (0.18)		

Notes: (1) The t statistics for α, β_1 and β_2 are given in parentheses. (2) The F statistics are the Wald test statistics for equality of β_1 and β_2 with their p-values given in parentheses.

Table 4
Regression Results of Chang *et al.*'s (2000) Method Using Daily CSAD During Periods of Market Stress

		Up Market				Down Market			
Period	**Market**	**α**	**γ_1**	**γ_2**	**Adjusted R^2**	**α**	**γ_1**	**γ_2**	**Adjusted R^2**
Whole Period: Jan.1993-Dec.2004	All firms	0.0120 (57.56)**	0.4559 (21.36)**	-0.4597 (-3.90)**	0.554	0.0114 (57.18)**	0.4541 (19.76)**	-0.3352 (-2.99)**	0.511
	Large firms	0.0110 (51.17)**	0.4095 (17.32)**	-0.1290 (-0.93)ns	0.535	0.0104 (45.11)**	0.4677 (18.28)**	-0.8110 (-5.50)**	0.441
	Small firms	0.0128 (47.17)**	0.4659 (16.48)**	-0.7137 (-4.44)**	0.396	0.0125 (52.95)**	0.4066 (14.96)**	0.1796 (1.51)ns	0.446
Pre-crisis Period: Jan.1993-July 1997	All firms								
	Large firms	0.0133 (33.40)**	0.3309 (6.22)**	0.4032 (0.61)ns	0.251	0.0129 (36.37)**	0.0928 (1.58)ns	6.7204 (4.29)**	0.350
	Small firms	0.0126 (37.05)**	0.3239 (7.45)**	-0.3981 (-0.79)ns	0.200	0.0124 (33.63)**	0.0962 (1.35)ns	7.2839 (4.05)**	0.247
Crisis Period: Aug.1997-Aug.1998	All firms	0.0140 (22.77)**	0.3138 (3.79)**	1.3838 (1.37)ns	0171	0.0133 (31.80)**	0.0561 (0.55)ns	9.3744 (4.13)**	0.313
	Large firms								
	Small firms	0.0192 (15.00)**	0.3990 (5.16)**	-0.3702 (-0.97)ns	0.611	0.0213 (15.66)**	0.2276 (2.81)**	0.5897 (0.76)ns	0.241
Post-crisis Period: Sept.1998-Dec.2004	All firms	0.0187 (12.99)**	0.3733 (4.15)**	0.0373 (0.08)ns	0.680	0.0208 (13.00)**	0.2442 (2.62)**	0.3373 (0.40)ns	0.207
	Large firms	0.0197 (12.48)**	0.3691 (3.96)**	-0.6842 (-1.55)ns	0.333	0.0220 (16.55)**	0.1630 (1.99)*	1.1833 (1.41)ns	0.185
	Small firms								
		0.0111 (58.83)**	0.4334 (22.00)**	-0.3298 (-2.91)**	0.648	0.0109 (50.01)**	0.4236 (17.50)**	-0.18571 (-1.62)ns	0.631
		0.0100 (53.49)**	0.3715 (18.67)**	-0.0757 (-0.70)ns	0.634	0.0095 (34.24)**	0.4200 (12.08)**	-0.6012 (-3.60)**	0.568
		0.01223 (48.35)**	0.4581 (16.52)**	-0.4206 (-2.61)**	0.512	0.0123 (40.60)**	0.3763 (9.69)**	0.3300 (2.05)*	0.531

Notes: The t statistics for α, γ_1 and γ_2 are given in parentheses. * denotes significance at 5%. ** denotes significance at 1%.

Table 5
Regression Results of Chang *et al.*'s (2000) Modified Method Using Daily CSSD During Periods of Market Stress

		Up Market				Down Market			
Period	**Market**	**α**	**γ_1**	**γ_2**	**Adjusted R^2**	**α**	**γ_1**	**γ_2**	**Adjusted R^2**
Whole Period: Jan.1993-Dec.2004	All firms	0.0182 (43.43)**	0.5439 (12.77)**	-0.5021 (-2.09)*	0.306	0.0173 (51.25)**	0.5289 (15.97)**	-0.2448 (-1.41)ns	0.350
	Large firms	0.0163 (44.09)**	0.4806 (13.53)**	-0.0895 (-0.43)ns	0.341	0.0153 (38.31)**	0.5477 (14.19)**	-0.7613 (-3.54)**	0.269
	Small firms	0.0190 (35.73)**	0.5681 (10.13)**	-0.8258 (-2.54)*	0.212	0.0182 (54.75)**	0.4899 (14.33)**	0.2446 (1.56)ns	0.336
Pre-crisis Period: Jan.1993-July 1997	All firms								
	Large firms	0.0205 (17.24)**	0.3793 (2.38)*	0.9448 (0.53)ns	0.064	0.0199 (24.70)**	0.0380 (0.33)ns	10.53 (3.95)**	0.139
	Small firms	0.0189 (25.24)**	0.3502 (4.18)**	-0.3690 (-0.38)ns	0.059	0.0192 (18.56)**	-0.0962 (-0.74)ns	10.6098 (3.73)**	0.071
Crisis Period: Aug.1997-Aug.1998	All firms	0.0206 (12.70)**	0.4102 (1.83)ns	1.8920 (0.76)ns	0.055	0.0194 (31.80)**	0.0561 (0.55)ns	9.3744 (4.13)**	0.189
	Large firms								
	Small firms	0.0276 (16.20)**	0.4680 (4.40)**	-0.3937 (-0.74)ns	0.527	0.0311 (14.88)**	0.2108 (1.66)ns	1.2415 (1.01)ns	0.154
Post-crisis Period: Sept.1998-Dec.2004	All firms	0.0259 (13.08)**	0.4613 (3.90)**	-0.0456 (-0.08)ns	0.609	0.0291 (13.11)**	0.2774 (2.18)*	0.5952 (0.51)ns	0.147
	Large firms	0.0290 (15.25)**	0.4059 (3.59)**	-0.6498 (-1.18)ns	0.278	0.0319 (13.86)**	0.1271 (0.92)ns	2.0511 (1.48)ns	0.117
	Small firms								
		0.0167 (56.62)**	0.5088 (16.46)**	-0.2797 (-1.55)ns	0.531	0.0163 (48.40)**	0.4920 (13.79)**	-0.0731 (-0.43)ns	0.487
		0.0145 (49.29)**	0.4304 (14.42)**	0.0205 (0.13)ns	0.496	0.0139 (36.94)**	0.4791 (11.08)**	-0.4699 (-2.29)*	0.434
		0.0180 (48.57)**	0.5361 (13.31)**	-0.2907 (-1.22)ns	0.429	0.0178 (49.22)**	0.4542 (12.29)**	0.4167 (2.54)*	0.403

Notes: The t statistics for α, γ_1 and γ_2 are given in parentheses. * denotes significance at 5%. ** denotes significance at 1%.

Table 6
Regression Results of Chang *et al.*'s (2000) Modified Method Using Daily CSIQR During Periods of Market Stress

		Up Market				Down Market			
Period	**Market**	**α**	**γ_1**	**γ_2**	**Adjusted R^2**	**α**	**γ_1**	**γ_2**	**Adjusted R^2**
Whole Period: Jan.1993-Dec.2004	All firms	0.0143 (46.48)**	0.8226 (24.79)**	-1.0130 (-5.83)**	0.628	0.0138 (40.44)**	0.8557 (21.10)**	-1.0144 (-5.80)**	0.588
	Large firms	0.0137 (39.95)**	0.7427 (19.67)**	-0.4312 (-2.03)*	0.614	0.0127 (34.05)**	0.8556 (20.23)**	-1.8523 (-7.27)**	0.538
	Small firms	0.0149 (34.41)**	0.8730 (17.61)**	-1.5872 (-6.50)**	0.471	0.0155 (30.25)**	0.7641 (11.98)**	-0.1569 (-0.49)ns	0.471
Pre-crisis Period: Jan.1993-July 1997	All firms	0.0164 (32.51)**	0.6280 (9.81)**	0.0341 (0.04)ns	0.366	0.0157 (28.91)**	0.4037 (3.80)**	9.4836 (2.97)**	0.441
	Large firms	0.0155 (32.08)**	0.6445 (10.47)**	-1.7945 (-2.21)*	0.311	0.0149 (31.19)**	0.3861 (5.19)**	6.3761 (4.15)**	0.391
	Small firms	0.0167 (25.22)**	0.6510 (7.31)**	0.5226 (0.46)ns	0.298	0.0164 (23.54)**	0.4069 (2.94)**	9.6279 (2.41)*	0.363
Crisis Period: Aug.1997-Aug.1998	All firms	0.0250 (13.99)**	0.7054 (6.73)**	-0.7759 (-1.52)ns	0.642	0.0266 (13.91)**	0.5054 (4.39)**	0.3597 (0.32)ns	0.389
	Large firms	0.0254 (10.33)**	0.6370 (4.29)**	-0.0211 (-0.03)ns	0.695	0.0279 (11.67)**	0.4136 (3.02)**	1.2369 (0.98)ns	0.342
	Small firms	0.0227 (7.07)**	0.7871 (4.14)**	-1.7540 (-2.05)*	0.356	0.0270 (12.75)**	0.4333 (3.26)**	1.0223 (0.73)ns	0.284
Post-crisis Period: Sept.1998-Dec.2004	All firms	0.0128 (41.10**	0.8220 (24.87)**	-0.9117 (-4.86)**	0.694	0.0128 (33.80)**	0.8486 (19.75)**	-0.9355 (-4.81)**	0.665
	Large firms	0.0122 (40.73)**	0.7153 (21.79)**	-0.3852 (-2.07)ns	0.680	0.0115 (21.03)**	0.8364 (11.52)**	-1.7739 (-5.28)**	0.586
	Small firms	0.0139 (33.70)**	0.8876 (20.22)**	-1.3033 (-5.18)**	0.531	0.0150 (17.50)**	0.7417 (6.00)**	-0.0115 (-0.02)ns	0.506

Notes: The t statistics for α, γ_1 and γ_2 are given in parentheses. * denotes significance at 5%. ** denotes significance at 1%.

Table 7
Existence of Herding in Up and Down Market Using Chang *et al.*'s (2000) Method on Daily CSSD, CSAD and CSIQR

Period	Dispersion Measure	Large Firms		Small Firms		All Firms	
		Up Market	Down Market	Up Market	Down Market	Up Market	Down Market
Whole Period: Jan.1993-Dec.2004	CSSD	No herding	Herding	Herding	No herding	Herding	No herding ↓ Herding
	CSAD	No herding ↓ Herding	Herding	Herding	No herding	Herding	
	CSIQR		Herding	Herding	No herding	Herding	Herding
Pre-crisis Period: Jan.1993-July 1997	CSSD	No herding	Herding	No herding	Herding	No herding	Herding
	CSAD	No herding ↓ Herding	Herding	No herding	Herding	No herding	Herding
	CSIQR		Herding	No herding	Herding	No herding	Herding
Crisis Period: Aug.1997-Aug.1998	CSSD	No herding	No herding	No herding	No herding	No herding	No herding
	CSAD	No herding	No herding	No herding ↓ Herding	No herding	No herding	No herding
	CSIQR	No herding	No herding		No herding	No herding	No herding
Post-crisis Period: Sept.1998-Dec.2004	CSSD	No herding	Herding	No herding ↓ Herding	Herding	No herding ↓ Herding	No herding
	CSAD	No herding ↓ Herding	Herding		Herding ↓ No herding		No herding ↓ Herding
	CSIQR		Herding	Herding		Herding	

Appendix 1

Sample List of 69 Stocks

No.	Name of Stock	Market Cap.*	
1	AMDB BHD	72.3	S
2	NYLEX (M) BHD	128.1	S
3	LEADER UNIVERSAL HOLDINGS BHD	137.5	S
4	SELANGOR DREDGING BHD	151.3	S
5	MALAYAN UNITED INDUSTRIES BHD	155.2	S
6	ALUMINIUM COMPANY OF MALAYSIA BHD	211.8	S
7	KIM HIN INDUSTRIES BHD	215.3	S
8	TIME ENGINEERING BHD	235.6	S
9	TRADEWINDS (M) BHD	370.7	S
10	BANDAR RAYA DEVELOPMENTS BHD	397.8	S
11	JOHN HANCOCK LIFE INSURANCE (M) BHD	438.2	S
12	KIAN JOO CAN FACTORY BHD	547.7	S
13	SHANGRI-LA HOTELS (M) BHD	550.0	S
14	NEW STRAITS TIMES PRESS (M) BHD	556.1	S
15	WTK HOLDINGS BHD	576.8	S
16	LINGUI DEVELOPMENT BHD	633.2	S
17	KULIM (M) BHD	662.3	S
18	HONG LEONG INDUSTRIES BHD	672.9	S
19	JAYA TIASA HOLDINGS BHD	703.5	S
20	MULPHA INTERNATIONAL BHD	815.7	S
21	TA ENTERPRISE BHD	823.7	S
22	HUME INDUSTRIES (M) BHD	826.0	S
23	SELANGOR PROPERTIES BHD	845.3	S
24	TAN CHONG MOTOR HOLDINGS BHD	873.6	S
25	MALAYSIAN INDUSTRIAL DEV. FINANCE BHD	1032.8	S
26	CHEMICAL COMPANY OF MALAYSIA BHD	1042.9	S
27	JT INTERNATIONAL BHD	1046.1	S
28	NCB HOLDINGS BHD	1109.8	S
29	HAP SENG INDUSTRIES BHD	1245.3	S
30	LION DIVERSIFIED HOLDINGS BHD	1404.1	S
31	UNITED PLANTATIONS BHD	1436.1	S
32	GUINNESS ANCHOR BHD	1616.2	S
33	CARLSBERG BREWERY MALAYSIA BHD	1617.4	S
34	IGB CORPORATION BHD	1650.4	S
35	LAFARGE MALAYAN CEMENT BHD	1681.2	S

Appendix 1 (continued)

No.	Name of Stock	**Market Cap.	
36	MALAYSIAN OXYGEN BHD	1744.0	L
37	SARAWAK ENTERPRISE CORPORATION BHD	1792.4	L
38	AFFIN HOLDINGS BHD	1875.7	L
39	MALAYSIAN PACIFIC INDUSTRIES BHD	1972.8	L
40	ORIENTAL HOLDINGS BHD	2119.7	L
41	IJM CORPORATION BHD	2161.1	L
42	KUMPULAN GUTHRIE BHD	2315.9	L
43	GAMUDA BHD	2726.0	L
44	MMC CORPORATION BHD	2953.7	L
45	MAGNUM CORPORATION BHD	2981.7	L
46	UMW HOLDINGS BHD	2991.1	L
47	SHELL REFINING CO (F.O.M.) BHD	3090.0	L
48	PROTON HOLDINGS BHD	3432.6	L
49	EON CAPITAL BHD	3535.4	L
50	MALAYSIAN AIRLINE SYSTEM BHD	3546.7	L
51	PPB GROUP BHD	4860.6	L
52	AMMB HOLDINGS BHD	4878.9	L
53	NESTLE (M) BHD	5604.6	L
54	TANJONG PUBLIC LIMITED COMPANY	5726.2	L
55	BERJAYA SPORTS TOTO BHD	5728.4	L
56	GOLDEN HOPE PLANTATIONS BHD	5750.9	L
57	KUALA LUMPUR KEPONG BHD	5842.6	L
58	SOUTHERN BANK BHD	6036.2	L
59	MALAKOFF BHD	6982.8	L
60	YTL CORPORATION BHD	8301.3	L
61	BRITISH AMERICAN TOBACCO (M) BHD	11349.8	L
62	RESORTS WORLD BHD	11683.0	L
63	IOI CORPORATION BHD	13849.0	L
64	COMMERCE ASSET-HOLDING BHD	14699.8	L
65	SIME DARBY BHD	14940.1	L
66	PUBLIC BANK BHD	21697.1	L
67	TENAGA NASIONAL BHD	31039.1	L
68	TELEKOM MALAYSIA BHD	31534.9	L
69	MALAYSIA INTERNATIONAL SHIPPING CORPORATION	36082.3	L

Notess: **Market Capitalisation @ 2-12-05. S denotes small stock; L denotes large stock