

HERDING, INVESTOR PSYCHOLOGY AND MARKET CONDITIONS

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ABSTRACT

Herding in financial markets refers to a situation whereby a group of investors intentionally adopt the actions of other investors by trading in the same direction over a period of time. Depending on the types of data being used in the herd measure, we can broadly identify two main categories of studies on this behaviour. Studies that focussed directly on the behaviour of the individual investors would require precise information on the trading activities of the investors and the changes in their investment portfolios. The second category of studies attempts to detect herding behaviour among investors by exploiting the information contained in the cross-sectional stock price movements. This study falls in the second category.

We propose a herd measure based on the cross-sectional dispersion of beta to detect the prevalence of herding of a portfolio of stocks towards the market. The confidence interval of the herd measure is obtained by using the bootstrap method. We applied the measure to a portfolio of stocks in the developing Malaysian market around the 1997 Asian financial crisis and found patterns of herding which can be explained by the prevailing market conditions and sentiments. Market-wide herding was found in both rising and falling markets that were preceded by a sharp market reversal. Prolonged market falls – as seen in the financial crisis period and during the times when the market experienced technical corrections after a long period of ascent – practically run in tandem with persistent herding patterns. No significant herding was found when the market was confidently bullish in the pre-crisis period. In contrast, persistent herding was found during the short market rally that occurred when the market responded immediately to the stringent measures taken by the Malaysian government to arrest further deterioration in the financial system caused by the crisis. Overall, our study supports the intuition that herding is related to drastic changes in market conditions, especially so when the atmosphere of uncertainty is prevalent.

Keywords: Herd measure, generalised bootstrap method, cross-sectional dispersion of beta, investor psychology, market conditions

INTRODUCTION

In the last two decades, the theory of behavioural finance has added a new dimension to the study on financial markets. By incorporating psychology into finance and economics, proponents in this field (see Kahneman, Slovic and Tversky, 1982; Thaler, 1992; Shefrin, 1999) attempt to explain how the market participants' perception and reaction to uncertainties could affect investment decisions, which in turn influence security price movements. This theory categorically recognises the role of human behaviour as the driving force behind price movements and therefore, it emphasizes the need to include the human element in all financial studies in order to achieve a better understanding.

In essence, behavioural finance contradicts the efficient market theory which advocates that, in a perfectly efficient market, investors are rational as they buy and sell without emotion and hence, the security prices should fully reflect all available information for all stocks at all times. It assumes that the investors are intuitively aware of a divergence between market price and its intrinsic value. When the market price falls below its perceived intrinsic value, the acquisitions of the stocks by the buyers would raise the price. On the other hand, when the market price is above its intrinsic value, the action of sellers would cause the price to fall. Any mispricings would, therefore, be arbitrated away and a new equilibrium would then set in.

Clearly, these two theories seem to be arguing from opposite camps. The growing popularity of behavioural finance is further spurred on by the uncovering of anomalies which cannot be explained by traditional finance theories. Behavioural finance does not believe in the existence of a rational man – in fact it attributes market aberrations like overreaction to news, herding among stocks, the January effect and other seasonal effects to investors' irrationality. It believes that markets are driven by fear and greed (Shefrin, 1999) and that trading is more often executed on emotional impulse – a fact observed by the US Federal Reserve chairman, Greenspan, who coined the term 'irrational exuberance'

This complex web of emotions involved in trading activities is also expounded in the Prospect Theory of Kahneman and Tversky (1979). This theory posits how people manage risk and uncertainty, and that asymmetry of human choices exists because of

different attitudes towards risks associated with gains (risk-seeking) and risks associated with losses (risk-aversion).

Herding Behaviour and Investor Psychology

The topic of interest in this study is herding behaviour in the stock market. Following the widespread financial crises in the last two decades, the issue of herding has become a topic of intense interest. It is intuitively recognised that in times of uncertainty and fear, many investors imitate the actions of other investors whom they assume to have more reliable information about the market. Prechter (2001) gives an interesting account of this behaviour from a biological point of view. He likens herding behaviour in financial circumstances to an innate primitive tool of survival. He explains that when individuals are faced with emotionally charged situations, unconscious impulses from the brain's limbic system impel an inherent desire among them to "seek signals from others in matters of knowledge and behaviour and therefore to align feelings and convictions with those of the group". When a sufficiently large number of investors flock together, they inadvertently create a prevailing consensus. This effect cumulates as the feeling of safety in numbers overrides individual judgements and perceptions. The impact can be sufficiently large enough to cause markets, sectors or stocks to collectively fall in or out of favour (Valance, 2001).

From the behavioural theorists' point of view, herding is a product of the two opposing emotional forces of fear and greed (Landberg, 2003). With regard to human emotions in trading, we would like to elaborate further. Fear, as associated with risk aversion, is a more powerful force that is linked to Remorse. Remorse is the pain of losing money in making a bad financial decision, but is also the regret one feels when a lost opportunity to make money occurs. However, given a choice, human emotions would choose not to have lost, rather than not to have gained. The pain from a realised loss supersedes that of the regret of an unrealised gain. Greed, however, is linked to Pride which is a pleasurable feeling of having made a right financial decision resulting in a gain. However, the pursuit of pleasure is not as strong a force as the flight from pain, whether real or perceived.

“Following the herd” is a human tendency that confirms the intrinsic overpowering of fear over greed. A decision to go with the herd is more emotionally comfortable because there is reduction in feelings of remorse if the move was wrong, but if the move was right, the loss of pride is a smaller price to pay. Herding however has fewer tendencies to result from greed and pride. The feelings of pleasure are intensified if a successful trade resulted from a brilliant unique idea rather than from following the crowd.

Herding is a gut reaction that is often done emotionally rather than after careful consideration of available information. Since fear is stronger than greed, herding should then theoretically occur more when fear is in abundance. In a fearful crisis situation, very often there is no time for reflection and herding is often a shortcut to a decision. A prolonged downturn is likely to breed fear, which in turn triggers irrational behaviour. En masse panic selling in such times of crisis may be the automatic reaction.

In a prolonged market rally, greed should theoretically result in herding as emotional decisions are made to try to maximize profits. However, the associated emotion of pride puts a dampener on herding – the success is sweeter if one did not follow the crowd.

Perhaps the most comprehensive account of factors driving herding behaviour in financial markets is summarised in an acclaimed essay “Sending the Herd off the Cliff Edge” by Persaud (2000). The author systematically highlights three main factors:

“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.”

Definition of Herding

Herding, being a non-quantifiable behaviour, cannot be measured directly. It can only be inferred by studying related measurable parameters. Generally, it refers to a situation whereby a group of investors intentionally copy the behaviour of other investors by trading in the same direction over a period of time. Depending on the types of data being used in developing the models for herd measure, we can broadly identify two main categories of studies. The first category of studies which focuses directly on the behaviour of the investors requires detailed and explicit information on the trading activities of the investors and the changes in their investment portfolios. Examples of such herd measures are the LSV measure by Lakonishok, Shleifer and Vishny (1992) and the PCM measure by Wermers (1995).

The other category of studies views herding behaviour as a collective buying and selling actions of the individuals in an attempt to follow the performance of the market or any other economic factors or styles. Here, herding is detected by exploiting the information contained in the cross-sectional stock price movements. Christie and Huang (1995), Chang, Cheng and Khorana (2000) and Hwang and Salmon (2001, 2004) are contributors of such measures.

Previous Studies

This study is motivated by the second category of studies on herding. We intend to propose a herd measure and then apply it to investigate the prevalence of herding of a portfolio of Malaysian stocks towards the market. Thus, we shall review only those studies that are concerned with formulation of herd measures based on similar intuition.

One of the earliest studies that attempt to detect empirically herding behaviour in the financial markets comes from Christie and Huang (1995). They rationalise that during market stress – which is characterised by high volatility – herding of stocks towards the market is likely to be present. This is based on their argument that under such extreme market conditions, the investors are more likely to suppress their own beliefs and choose instead to follow the market consensus. The stock prices would then move in tandem with the market and as a result the cross-sectional dispersion of the individual stock returns would be expectedly low. This contradicts the Capital Asset

Pricing Model (CAPM) which predicts that during market stress, large dispersions should be expected since individual stocks have different sensitivities to the market returns. Herding, however, is not implied by mere detection of low cross-sectional dispersion of returns. If the cross-sectional dispersion of the stock returns is low under the existence of large price changes, then the presence of herding is implied. By using the cross-sectional standard deviation of returns (CSSD) as a measure of the average proximity of individual stock returns to the market returns, Christie and Huang (1995) developed an empirical measure to test for herding behaviour in the U.S. equity market. Their results conclude that there was no significant evidence of herding in the period under study.

Chang, Cheng and Khorana (2000) modified the approach suggested by Christie and Huang. In place of CSSD, they use the cross-sectional absolute deviation of returns as a measure of dispersion. Their alternative empirical model also considers the rationale that CAPM not only predicts that the dispersions are an increasing function of the market return, but it is also linear. Thus, in the presence of herding behaviour the linear and increasing relation between dispersion and market return would no longer be true. Instead, the relation is increasing non-linearly or even decreasing. To accommodate the possibility that the degree of herding may be asymmetric in the up and the down markets, they run two separate regression models and the presence of herding in the up and the down markets is concluded by examining non-linearity in these relationships. They found no evidence of herding in the U.S. and Hong Kong markets and only partial herding in the Japanese market during the periods of extreme price movements. The results for the U.S. market are consistent with those obtained by Christie and Huang (1995). However, in the case of the Taiwanese and South Korean markets, they documented a dramatic decrease of return dispersions during both periods of extreme up and down price movements. This leads to their conclusion that there is significant evidence of herding in these emerging markets.

Among the latest to contribute to the development of herd measures are Hwang and Salmon (2001, 2004). By examining the cross-sectional movements of the factor sensitivities instead of the returns, they formulated measures to capture market-wide herding as well as herding towards fundamental factors. The basis of their studies is founded on the discoveries from numerous empirical studies which show that the

betas are in fact not constant as assumed by the conventional CAPM. They infer that this time-variation in betas actually reflects the changes in investor sentiment. In Hwang and Salmon's (2001) working paper, the herd measure is simply the cross-sectional dispersion of betas and evidence of herding is indicated by a reduction in this quantity. The confidence interval for this herd measure is computed based on their postulation that this herd measure follows an F-distribution. In their later paper (2004), they circumvent the necessity to derive a correct distribution for the herd measure by adopting a different approach. They reckon that the action of investors intently following the market performance inadvertently upsets the equilibrium in the risk-return relationship and as a result, the betas become biased. They model the cross-sectional dispersion of the biased betas in a state space model, and using the technique of Kalman filter, they found that market-wide herding is independent of market conditions and the stage of development of the market. Their study on the U.S and South Korean markets revealed evidence of herding towards the market under both bullish and bearish market conditions.

OBJECTIVES OF STUDY

There are two specific objectives to this study. Firstly, we propose a herd measure to detect the degree of herding of a portfolio of stocks towards the market. In constructing this measure, we adopt the same definition of herding as Hwang and Salmon's (2001, 2004) and also their underlying argument that the changes in the cross-sectional dispersion of the betas reflect investors' sentiments towards the market. The measure is intended to detect the prevalence of herding and not the amount. As rightly pointed out by Hwang and Salmon (2004), herding, as related to market sentiment, is a latent and unobservable process. In fact, it is generally believed that herding among stocks or investors is ubiquitous; it is a matter of degree at any given point in time relative to another.

Secondly, we shall apply the herd measure to the realised returns of a portfolio of stocks listed in the Bursa Malaysia (formerly Kuala Lumpur Stock Exchange). To date, most of the studies on herding and its effects are conducted in the context of the markets in developed countries. There is no known study which focuses exclusively on the Malaysian equity market with regard to this phenomenon.

Being one of the countries severely affected by the 1997 Asian financial crisis, it would be interesting to investigate the degrees of herding in relation to this crisis. In each of these periods, a certain mood of investment prevailed. Through this study we hope to determine whether a change in investment sentiment was associated with any significant increase or decrease of market-wide herding. It would be interesting to investigate whether herding was associated with the unseen force driving the bull run of 1993. Rapid and en masse withdrawal of capital by foreign investors is often quoted as the main culprit that precipitated the Asian crisis. Was herding more rampant during the financial crisis period in Malaysia? The differences in herd behaviour may also result from a change in investment atmosphere arising from government intervention. Another interesting issue to investigate is whether the insulation effect from the imposition of capital controls at the beginning of the post-crisis period had in some way effected herding among investors.

METHODOLOGY

Underlying Principle of the Herd Measure

Consider a multivariate linear model:

$$r_{it} = \alpha_{it} + \beta_{imt} r_{mt} + \sum_{k=1}^K \beta_{ikt} f_{kt} + \varepsilon_{it}, \quad i = 1, 2, \dots, N \text{ and } t = 1, 2, \dots, T,$$

where r_{it} is the return of stock i , α_{it} is a constant, and β_{imt} and β_{ikt} are the coefficients on the market portfolio return (denoted by r_{mt}) and the factor k (denoted by f_{kt}), respectively, at time t , and the error ε_{it} satisfies $E(\varepsilon_{it}) = 0$, $var(\varepsilon_{it}) = \sigma_{it}^2$ and $cov(\varepsilon_{it}, \varepsilon_{jt}) = \sigma_{ijt}^2$ for $i \neq j$.

We assume that the time-varying alpha and beta are constant within a short period, say, one month, where there are D trading days. Therefore for stock i , we have

$$r_{i\tau} = \alpha_{it} + \beta_{imt} r_{m\tau} + \sum_{k=1}^K \beta_{ikt} f_{k\tau} + \varepsilon_{i\tau}$$

where $\tau = t - D + d$ and $d = 1, 2, 3, \dots, D$.

The cross-sectional expectation (E_c) of all the individual stocks at time j constitutes the market portfolio return, that is,

$$r_{m\tau} = E_c[r_{i\tau}]$$

$$= E_c[\alpha_{it}] + r_{m\tau} E_c[\beta_{imt}] + \sum_{k=1}^K f_{k\tau} E_c[\beta_{ikt}] + E_c[\varepsilon_{i\tau}]. \quad (*)$$

On taking the ordinary expectation (E) on both sides of equation (*), we obtain

$$E_c[\alpha_{it}] + [E_c(\beta_{imt}) - 1]E[r_{m\tau}] + \sum_{k=1}^K E_c[\beta_{ikt}]f_{k\tau} = 0 \quad (**)$$

In the case when $D > K + 2$, equation (**) shows that

$$E_c[\alpha_{it}] = 0, E_c[\beta_{imt}] = 1 \text{ and } E_c[\beta_{ikt}] = 0, \text{ for } k = 1, 2, 3, \dots, K.$$

Essentially, it means that in cross-sectional analysis, the average of the betas on the market portfolio return, namely β_{imt} , is expected to be equal to 1 while the other coefficients would average out to zero.

Ordinarily, at any given time t , the stock price movements are supposedly independent of each other and we expect a wide range of β_{imt} for the stocks, albeit an average of 1. However, in the presence of significant market-wide herding where more investors are imitating the general movement of the market, the range of β_{imt} for the stocks is expected to be narrower. In effect, it means that a significant decrease in the cross-sectional variance of the beta would signify an increase in the degree of herding towards the market. The herd measure based on the cross-sectional variance of the beta is given by

$$H_t = \text{Var}_c(\beta_{imt}) = E_c[\beta_{imt} - E_c(\beta_{imt})]^2 = E_c(\beta_{imt} - 1)^2, \text{ since } E_c(\beta_{imt}) = 1.$$

Formulation of the Estimated Herd Measure

Consider N stocks. For simplicity, we shall include only one factor (that is, $K = 1$) in the multivariate linear model. Therefore, for stock i , we have

$$r_{it} = X_t \beta_{it} + \varepsilon_{it}$$

$$\text{where } r_{it} = \begin{pmatrix} r_{i,t-D+1} \\ r_{i,t-D+2} \\ \cdot \\ \cdot \\ r_{it} \end{pmatrix}, X_t = \begin{pmatrix} 1 & f_{1,t-D+1} & r_{m,t-D+1} \\ 1 & f_{1,t-D+2} & r_{m,t-D+2} \\ \cdot & \cdot & \cdot \\ 1 & f_{1t} & r_{mt} \end{pmatrix}, \beta_{it} = \begin{pmatrix} \alpha_{it} \\ \beta_{i1t} \\ \beta_{imt} \end{pmatrix} \text{ and } \varepsilon_{it} = \begin{pmatrix} \varepsilon_{i,t-D+1} \\ \varepsilon_{i,t-D+2} \\ \cdot \\ \varepsilon_{it} \end{pmatrix}.$$

Applying Householder transformation to the above equation in order to simplify computation, we obtain

$$\mathbf{H}_t \mathbf{r}_{it} = \mathbf{H}_t \mathbf{X}_t \boldsymbol{\beta}_{it} + \mathbf{H}_t \boldsymbol{\varepsilon}_{it},$$

which is re-expressed as

$$\mathbf{r}_{it}^* = \mathbf{D}_t^U \boldsymbol{\beta}_{it} + \boldsymbol{\varepsilon}_{it}^*,$$

$$\text{where } \mathbf{D}_t^U = \begin{pmatrix} d_{11} & d_{12} & d_{13} \\ 0 & d_{22} & d_{23} \\ 0 & 0 & d_{33} \\ 0 & 0 & 0 \\ \cdot & \cdot & \cdot \\ 0 & 0 & 0 \end{pmatrix}.$$

The following equations are then derived:

$$r_{i,t-D+1}^* = d_{11} \alpha_{it} + d_{12} \beta_{ilt} + d_{13} \beta_{imt} + \varepsilon_{i,t-D+1}^*$$

$$r_{i,t-D+2}^* = d_{22} \beta_{ilt} + d_{23} \beta_{imt} + \varepsilon_{i,t-D+2}^*$$

$$r_{i,t-D+3}^* = d_{33} \beta_{imt} + \varepsilon_{i,t-D+3}^*.$$

Hence, the ordinary least square estimates are $\hat{\alpha}_{it} = \frac{r_{i,t-D+1}^* - d_{12} \hat{\beta}_{ilt} - d_{13} \hat{\beta}_{imt}}{d_{11}}$,

$$b_{imt} = \hat{\beta}_{imt} = \frac{r_{i,t-D+3}^*}{d_{33}} \text{ and } b_{ilt} = \hat{\beta}_{ilt} = \frac{r_{i,t-D+2}^* - d_{23} \hat{\beta}_{imt}}{d_{22}}.$$

Since $\varepsilon_{it}^* \sim N(0, \sigma_{it}^2)$, the first two moments of b_{imt} are given as follows:

$$E(b_{imt}) = E\left(\frac{r_{i,t-D+3}^*}{d_{33}}\right) = E\left(\frac{d_{33} \beta_{imt} + \varepsilon_{i,t-D+3}^*}{d_{33}}\right) = \beta_{imt} \text{ and}$$

$$\begin{aligned} E(b_{imt}^2) &= E\left(\frac{d_{33}^2 \beta_{imt}^2 + \varepsilon_{i,t-D+3}^{*2} + 2d_{33} \beta_{imt} \varepsilon_{i,t-D+3}^*}{d_{33}^2}\right) = \beta_{imt}^2 + \frac{E(\varepsilon_{i,t-D+3}^{*2})}{d_{33}^2} \\ &= \beta_{imt}^2 + \sigma_{it}^2 \psi_t, \end{aligned}$$

where $\psi_t = \frac{1}{d_{33}^2}$.

Thus, the variance of b_{imt} is given by

$$\text{var}(b_{imt}) = E(b_{imt}^2) - E^2(b_{imt}) = \sigma_{it}^2 \psi_t.$$

At time t , the herding effect corresponds to the deviation of β_{imt} from 1 (note that $E_c(\beta_{imt}) = 1$). This deviation may be positive or negative, depending on the value of

β_{imt} . Taking h_{it} as the true but unknown degree of herding towards the market return for stock i at time t , we obtain

$$h_{it} = [\beta_{imt} - E_c(\beta_{imt})]^2 = (\beta_{imt} - 1)^2.$$

The estimated herd measure, $(b_{imt} - 1)^2$, is biased. Hence, we consider an alternative estimated herd measure of stock i at time t which is given by

$$\hat{h}_{it} = (b_{imt} - 1)^2 - s_{it}^2 \psi_t,$$

where $s_{it}^2 = \frac{1}{D-3} \sum_{j=4}^D \varepsilon_{i,t-D+j}^{*2}$ is an unbiased estimate of σ_{it}^2 .

We can show that \hat{h}_{it} is the unbiased estimate of h_{it} :

$$\begin{aligned} E(\hat{h}_{it}) &= E[(b_{imt} - 1)^2 - s_{it}^2 \psi_t] = E[b_{imt}^2 - 2b_{imt} + 1 - s_{it}^2 \psi_t] = \beta_{imt}^2 + \sigma_{it}^2 \psi_t - 2\beta_{imt} + 1 - \sigma_{it}^2 \psi_t \\ &= (\beta_{imt} - 1)^2 = h_{it}. \end{aligned}$$

At time t , the true and the estimated degree of market-wide herding for N stocks are, respectively,

$$H_t = \frac{1}{N} \sum_{i=1}^N (\beta_{imt} - 1)^2 \quad \text{and} \quad \hat{H}_t = \frac{1}{N} \sum_{i=1}^N [(b_{imt} - 1)^2 - s_{it}^2 \psi_t].$$

Confidence Interval of the Herd Measure

The basic Market Model is one in which the f_{kj} are set to zero. In this study, we shall consider only the basic Market Model where the random errors are normally distributed. The distribution of \hat{H}_t is unknown. But by visual inspection, the simulated distribution of \hat{H}_t appears to be uni-modal and slightly positively skewed. Hence, we may use the bootstrap method to obtain the confidence intervals of H_t .

Let $\hat{\alpha}_{it}^*$, \hat{b}_{imt}^* and s_{it}^{*2} be, respectively, the estimated values of the coefficients and the variance of the random errors based on the bootstrap sample. Suppose a total of M^* bootstrap samples are considered. For each of the M^* bootstrap samples, we then compute \hat{h}_{it}^* .

Since the unbiased estimate of h_{it} is given by

$$\hat{h}_{it} = (b_{imt} - 1)^2 - s_{it}^2 \psi_t,$$

the unbiased estimate of \hat{h}_{it} based on the bootstrap sample would be given by

$$\hat{h}_{it}^* = (b_{imt}^* - 1)^2 - 2s_{it}^{*2} \psi_t.$$

Thus,

$$\hat{H}_t^* = \frac{1}{N} \sum_{i=1}^N [(b_{imt}^* - 1)^2 - 2s_{it}^{*2} \psi_t].$$

After arranging the resulting M^* values of \hat{H}_t^* in an ascending order, we obtain the 95% bootstrap confidence interval. The coverage probability of the bootstrap confidence intervals can be estimated by using simulation which involves M generated values of the r_{it} . When we set $N = 10$ stocks and $M = M^* = 2000$, the estimated coverage probability is found to be 0.947 for the first set of chosen values of the coefficients and the variance-covariance matrix of the random errors in the linear factor model. A total of nine other sets of the values of coefficients and variance-covariance matrices are chosen. The corresponding estimated coverage probabilities are found to range from 0.936 to 0.962. Thus, the simulation study indicates that the coverage probability of bootstrap confidence interval is quite close to the target value of 0.95.

APPLICATION OF THE HERD MEASURE

Data

The Kuala Lumpur Composite Index (KLCI) was launched in 1986, with an initial composition of 67 constituent stocks, to provide a better barometer to gauge the performance of the Malaysian stock market. Since then, it has become the leading stock market indicator of the Bursa Malaysia and its movements are closely monitored by the institutional and retail investors. Portfolio fund managers, both local and foreign, often buy only constituent stocks of the KLCI. From the time of the launch, many stocks have been included into and excluded from the KLCI. As of 1998, the number of constituent stocks has been capped at 100.

Keeping in mind that we intend to study the market-wide herding effect over a period spanning the 1998 Asian financial crisis, our portfolio of stocks in this study would be stocks that have been continuously listed in the KLCI since 1993. Altogether, a total of 69 constituent stocks are selected and they constitute, on the average, about 50% of

the total market capitalisation. The Kuala Lumpur Composite Index (KLCI) is used as a proxy for the market portfolio. By using the daily stock returns of these 69 stocks and the daily market returns, the monthly betas are estimated over a period of 12 years, from 1993 to 2004. The daily stock returns and market returns are computed as follows:

$$r_{i,t-D+d} = \ln\left(\frac{P_{i,t-D+d}}{P_{i,t-D+d-1}}\right) \text{ and } r_{m,t-D+d} = \ln\left(\frac{P_{m,t-D+d}}{P_{m,t-D+d-1}}\right),$$

where $P_{i,t-D+d}$ and $P_{m,t-D+d}$ represent the daily closing price on day $t - D + d$ for stock i and the market, respectively.

Herding in relation to stock market volatility is also examined in this study. The market volatility in month t is measured by the standard deviation of the daily closing prices of the market in month t , that is,

$$\sigma_t = \frac{\sqrt{\sum_{d=1}^D (r_{m,t-D+d} - \bar{r}_m)^2}}{D-1},$$

where D is the number of trading days in month t and $\bar{r}_m = \frac{\sum_{d=1}^D r_{m,t-D+d}}{D}$.

Using the formula, we obtain 144 values of \hat{H}_t and corresponding to each of these values, we then obtain 2000 values of \hat{H}_t^* from which we compute the 95% bootstrap confidence interval. The 2.5% point and the 97.5% point of the bootstrap confidence interval are denoted by L_t and U_t , respectively. As emphasized earlier, the formula is not meant to measure the quantity of herding; instead it aims to measure the relative degrees of herding. The arithmetic mean of the 144 values of \hat{H}_t is used as the benchmark for this purpose. At a given time t , we shall conclude with a 95% confidence level that there is herding if U_t has value equal to or less than this benchmark. The lower U_t is, as compared to the benchmark, the higher is the degree of herding towards the market. Furthermore, the smaller the difference between L_t and U_t is, the more reliable is the herd measure associated with it.

Discussion of results

We analyse the occurrence of herding in the three periods as divided by the Asian financial crisis. We follow the same structural break points identified by Goh, Wong and Kok (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 identified for 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

Table 1 shows the properties of the \hat{H}_t obtained. The benchmark for the determination of the existence of herding is 0.345, the arithmetic mean of \hat{H}_t . The distribution of \hat{H}_t is not normal; instead it is slightly positively skewed and is leptokurtic.

Table 1. Properties of \hat{H}_t

Mean	Standard Deviation	Skewness	Kurtosis	Jarque-Bera Statistics
0.345	0.314	3.41	19.34	1880.63** (p-value = 0 000)

The results of L_t , U_t , \hat{H}_t and the monthly market volatility for the period 1993 - 2004 are reported in Table 2. Herding is said to be present in month t if the value of U_t is lower than the benchmark of 0.345. The results in Panel A for the pre-crisis period show that herding occurred in 9 out of 55 months during this period. It is interesting to note that there is no incidence of herding in the whole year of 1993 when the market was bullish but instead herding was recorded after the sharp market decline in early 1994. A higher incidence of herding was witnessed in the much shorter crisis period, with herding occurring in 7 out of 13 months (see Panel B). The results in Panel C for the post-crisis period reveal that persistent herding occurred predominantly in the 3 months of general market advance immediately after the crisis

period. Thereafter, there were scattered pockets of herding which mostly coincided with the months of higher market volatility.

In order to study herding in relation to the prevailing market trends and market volatility, a graphical approach will be more informative. The values of L_t , \hat{H}_t and U_t for each month are plotted in a vertical line which we named as range plot of the herd measure. The graph of range plots, the graph showing the end-of-the-month closing indices of the KLCI and the graph for the monthly market volatilities are charted chronologically in Figure 1. The single horizontal line shown in the graph of range plots is the benchmark line and the vertical lines that traverse all three graphs mark the months where significant herding occurred.

By inspecting the intensity of the vertical lines, it is clear that persistent herding occurred in the following periods:

- (a) December 1994 to February 1995,
- (b) July 1997 to February 1998,
- (c) August 1998 to January 1999.

The months in these periods coincided approximately with the market phases of high price volatility and sharply rising or falling prices.

Can we account for the existence of more prevalent herding in these periods? In the next section, we shall attempt to explain the pattern of herding behaviour that we obtained by linking it chronologically to the market movements, the prevailing market sentiments and the events that had taken place. In their study on herd behaviour in the financial markets, Bikhchandani and Sharma (2001) have pointedly highlighted that “the investment decisions of early investors are likely to be reflected in the subsequent price of the assets”. Without the actions of the investors, obviously there would be no price movements. Therefore, it is certainly justifiable to ‘read’ the intentions and psychology of the investors from the characteristics derived from studies that use realised data. The prevailing market sentiment is a product of the psychology of the investors in general. If the investor psychology is dominated by fear, then the market sentiment propagated would be one that is described by negative adjectives like poor, low, depressing, and it usually brings forth cautious trading. Intuitively, herding is

Table 2. Confidence Interval and Herd Measure

Month/Year	L_t	\hat{H}_t	U_t	Market Volatility	Herding ($U_t \leq 0.345$)
Panel A: Pre-crisis period					
Jan/93	-0.128	0.787	1.529	0.0081	No
Feb/93	-1.067	0.017	0.763	0.0072	No
Mar/93	-1.153	0.404	1.521	0.0047	No
Apr/93	-0.583	0.141	0.691	0.0080	No
Mar/93	-1.049	0.241	1.184	0.0068	No
Jun/93	0.021	0.756	1.374	0.0115	No
Jul/93	-0.178	0.289	0.770	0.0099	No
Aug/93	-0.361	0.336	0.806	0.0067	No
Sep/93	-0.080	0.436	0.896	0.0106	No
Oct/93	-0.500	0.189	0.838	0.0091	No
Nov/93	-0.091	0.194	0.405	0.0156	No
Dec/93	-0.407	0.260	0.834	0.0118	No
Jan/94	-0.026	0.211	0.439	0.0391	No
Feb/94	0.030	0.232	0.387	0.0200	No
Mar/94	0.095	0.374	0.614	0.0181	No
Apr/94	-0.069	0.135	0.336	0.0168	Yes
Mar/94	-0.148	0.192	0.484	0.0106	No
Jun/94	0.092	0.409	0.691	0.0134	No
Jul/94	-0.046	0.225	0.446	0.0086	No
Aug/94	-0.084	0.089	0.219	0.0118	Yes
Sep/94	-0.525	0.025	0.462	0.0081	No
Oct/94	-0.274	0.094	0.397	0.0081	No
Nov/94	-0.039	0.173	0.375	0.0125	No
Dec/94	-0.099	0.067	0.204	0.0160	Yes
Jan/95	0.007	0.155	0.271	0.0171	Yes
Feb/95	0.022	0.204	0.340	0.0208	Yes
Mar/95	0.008	0.259	0.431	0.0124	No
Apr/95	0.137	0.314	0.463	0.0123	No
Mar/95	0.092	0.399	0.633	0.0145	No
Jun/95	-0.006	0.217	0.366	0.0098	No
Jul/95	-0.161	0.205	0.457	0.0071	No
Aug/95	-0.306	0.094	0.392	0.0061	No
Sep/95	-0.220	0.162	0.411	0.0076	No
Oct/95	0.080	0.356	0.562	0.0085	No
Nov/95	0.075	0.261	0.402	0.0119	No
Dec/95	-0.157	0.152	0.371	0.0098	No
Jan/96	0.025	0.215	0.395	0.0129	No
Feb/96	-0.313	0.197	0.576	0.0081	No
Mar/96	0.007	0.160	0.279	0.0126	Yes
Apr/96	-0.528	0.170	0.670	0.0072	No
Mar/96	-0.511	0.099	0.573	0.0060	No
Jun/96	-0.415	0.178	0.599	0.0053	No
Jul/96	-0.091	0.110	0.294	0.0084	Yes
Aug/96	-0.244	0.118	0.356	0.0068	No
Sep/96	-0.161	0.219	0.516	0.0060	No
Oct/96	-0.327	0.220	0.605	0.0049	No
Nov/96	-0.989	0.185	0.982	0.0039	No
Dec/96	-0.317	0.128	0.598	0.0095	No
Jan/97	-0.020	0.490	0.865	0.0068	No
Feb/97	-0.597	0.652	1.473	0.0061	No

Table 2 (continued)

Month/Year	L_t	\hat{H}_t	U_t	Market Volatility	Herding ($U_t \leq 0.345$)
Panel A: Pre-crisis period					
Mar/97	-0.250	0.407	0.931	0.0064	No
Apr/97	0.001	0.109	0.192	0.0147	Yes
May/97	0.018	0.383	0.674	0.0118	No
Jun/97	-0.063	0.285	0.529	0.0082	No
Jul/97	-0.132	0.139	0.337	0.0110	Yes
Panel B: Crisis period					
Aug/97	-0.108	0.103	0.286	0.0214	Yes
Sep/97	0.107	0.239	0.345	0.0383	Yes
Oct/97	0.019	0.130	0.210	0.0233	Yes
Nov/97	0.072	0.167	0.235	0.0421	Yes
Dec/97	0.110	0.227	0.308	0.0416	Yes
Jan/98	0.032	0.210	0.379	0.0397	No
Feb/98	0.054	0.149	0.230	0.0535	Yes
Mar/98	0.215	0.642	1.007	0.0157	No
Apr/98	-0.068	0.203	0.441	0.0149	No
May/98	0.149	0.440	0.648	0.0224	No
Jun/98	0.111	0.297	0.448	0.0229	No
Jul/98	0.048	0.232	0.381	0.0242	No
Aug/98	0.099	0.205	0.288	0.0361	Yes
Panel C: Post-crisis period					
Sep/98	0.104	0.141	0.168	0.0944	Yes
Oct/98	0.043	0.171	0.261	0.0215	Yes
Nov/98	0.005	0.162	0.308	0.0173	Yes
Dec/98	-0.348	0.245	0.842	0.0147	No
Jan/99	-0.032	0.130	0.271	0.0170	Yes
Feb/99	0.098	0.253	0.375	0.0240	No
Mar/99	0.058	0.434	0.767	0.0117	No
Apr/99	0.045	0.342	0.633	0.0178	No
May/99	-0.028	0.222	0.434	0.0202	No
Jun/99	0.226	0.750	1.198	0.0127	No
Jul/99	0.380	1.144	1.761	0.0156	No
Aug/99	0.286	0.601	0.821	0.0275	No
Sep/99	0.043	0.235	0.410	0.0152	No
Oct/99	0.248	0.425	0.587	0.0147	No
Nov/99	-0.014	0.530	0.976	0.0096	No
Dec/99	-0.059	0.370	0.692	0.0093	No
Jan/00	-0.040	0.132	0.278	0.0185	Yes
Feb/00	0.097	1.142	2.018	0.0106	No
Mar/00	0.107	0.414	0.650	0.0140	No
Apr/00	0.076	0.260	0.398	0.0161	No
May/00	0.124	0.270	0.377	0.0131	No
Jun/00	0.032	0.222	0.371	0.0167	No
Jul/00	0.061	0.206	0.344	0.0146	Yes
Aug/00	-0.150	0.139	0.371	0.0076	No
Sep/00	0.031	0.410	0.645	0.0139	No
Oct/00	-0.014	0.281	0.508	0.0158	No
Nov/00	0.103	0.313	0.481	0.0114	No

Table 2 (continued)

Month/Year	L_t	\hat{H}_t	U_t	Market Volatility	Herding ($U_t \leq 0.345$)
Panel C: Post-crisis period					
Dec/00	-0.316	0.750	1.732	0.0105	No
Jan/01	0.619	2.079	3.362	0.0097	No
Feb/01	-0.737	0.257	1.144	0.0058	No
Mar/01	-0.254	0.339	0.730	0.0092	No
Apr/01	0.181	0.341	0.444	0.0206	No
May/01	0.303	0.531	0.725	0.0166	No
Jun/01	0.116	0.412	0.656	0.0098	No
Jul/01	-0.145	0.112	0.313	0.0122	Yes
Aug/01	-0.054	0.441	0.936	0.0083	No
Sep/01	0.199	0.450	0.678	0.0219	No
Oct/01	-0.039	0.222	0.420	0.0081	No
Nov/01	0.209	0.456	0.638	0.0097	No
Dec/01	-1.018	0.245	1.241	0.0057	No
Jan/02	0.047	0.311	0.534	0.0086	No
Feb/02	-0.161	0.391	0.836	0.0081	No
Mar/02	-0.089	0.309	0.641	0.0076	No
Apr/02	-0.362	0.579	1.365	0.0079	No
May/02	-0.101	0.315	0.640	0.0062	No
Jun/02	-0.115	0.408	0.880	0.0096	No
Jul/02	-0.055	0.254	0.468	0.0083	No
Aug/02	-0.502	0.127	0.574	0.0045	No
Sep/02	0.044	0.234	0.412	0.0104	No
Oct/02	-0.471	1.115	2.572	0.0080	No
Nov/02	-0.401	0.393	0.986	0.0050	No
Dec/02	0.216	0.500	0.726	0.0091	No
Jan/03	-0.072	0.764	1.676	0.0105	No
Feb/03	-0.688	0.938	2.231	0.0046	No
Mar/03	0.138	0.869	1.594	0.0076	No
Apr/03	0.014	0.297	0.509	0.0070	No
May/03	0.021	0.665	1.185	0.0062	No
Jun/03	1.052	2.346	3.420	0.0060	No
Jul/03	-0.292	0.362	0.901	0.0081	No
Aug/03	-1.428	-0.059	1.015	0.0037	No
Sep/03	-0.250	0.646	1.388	0.0064	No
Oct/03	0.158	0.670	1.009	0.0081	No
Nov/03	0.000	0.451	0.765	0.0082	No
Dec/03	-0.259	0.133	0.445	0.0068	No
Jan/04	-0.114	0.310	0.642	0.0081	No
Feb/04	-0.199	0.165	0.406	0.0096	No
Mar/04	-0.071	0.302	0.609	0.0077	No
Apr/04	-0.174	0.082	0.291	0.0072	Yes
May/04	0.060	0.309	0.511	0.0113	No
Jun/04	-0.278	0.115	0.398	0.0066	No
Jul/04	-0.074	0.440	0.839	0.0059	No
Aug/04	-0.352	0.162	0.570	0.0051	No
Sep/04	-0.133	0.498	0.974	0.0060	No
Oct/04	0.052	0.786	1.301	0.0046	No
Nov/04	-0.319	0.134	0.456	0.0075	No
Dec/04	-0.555	0.080	0.554	0.0047	No

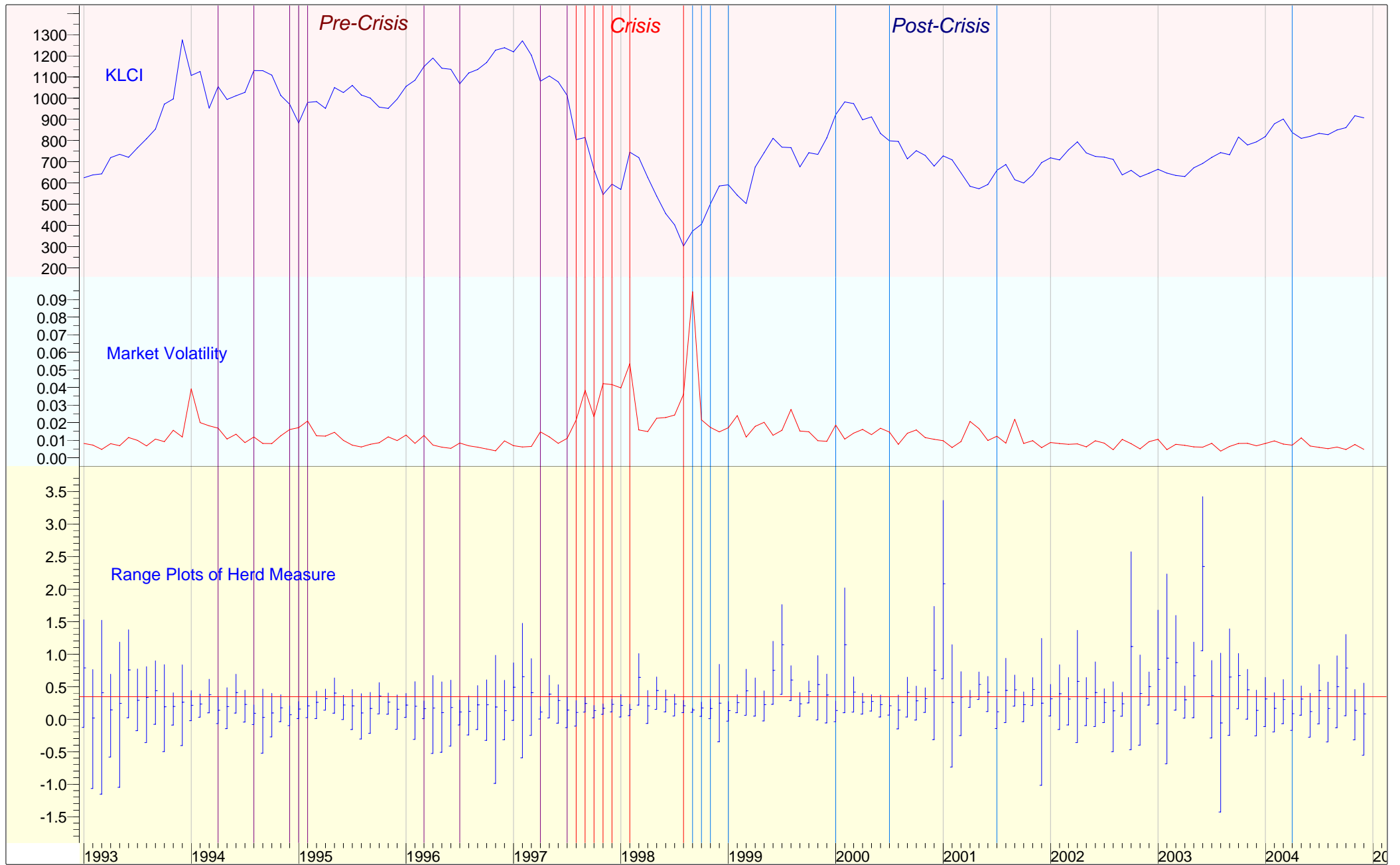


Figure 1. KLCI, Market Volatility and Range Plots of Herd Measure, 1993 - 2004

commonly associated with such market sentiment. In fact, the underlying principle in Christie and Huang's (1995) study is founded on their belief that during market stress, herding is expected to exist. On the other hand, when the investors are high in confidence, a positive market sentiment prevails. In such circumstances, is there more herding? Hwang and Salmon (2004) found evidence of herding in both bullish and bearish markets.

Implication of Results from the Behavioural Finance Perspective

A two-year-long bull run resulted in the KLCI doubling its value from 600 points in late 1991 to 1300 points by the end of 1993. During this market rally, confidence was riding high and investors were likely to make profits regardless of choice of stocks. The element of fear was minimal. There was no necessity to seek safety in numbers since there was no perceived threat. In fact, a correct decision made by individuals who acted independently was probably more gratifying than one made by following the crowd. This is reflected in our study where no herding was found in that period of unrelenting market rise.

Towards the end of 1993, the Bursa Malaysia went into a sudden sharp downturn that caught many investors unprepared. The market-wide herding in the months from December 1994 to February 1995 coincided with the times when the market experienced several technical corrections after a long period of price ascent. The tendency to herd started to appear the moment the market was certain to be heading downwards in April 1994. An increase in trading activities was taking place as this can be implied from the sudden increase in market volatility in this month. For the remaining months in the pre-crisis period, significant herding was still detected, although intermittently, and the market was going through the usual phases of rising and falling prices but generally trending upwards.

The patterns of herding in the two-year period of 1997 to 1998 speak volumes of the effect of the 1998 Asian financial crisis. The Malaysian market tumbled from a peak of 1200 points to less than half its value by August 1998. The clearly persistent market-wide herding shown in the period from July 1997 to February 1998 corresponded to the time of crisis period when the Malaysian ringgit was floated in reaction to the ensuing pandemonium of currency devaluation that spread rapidly

throughout the Southeast Asian region. The high market volatility in this period shows that there were rapid changes in prices. However, rather unexpectedly, significant herding disappeared altogether in the next five months even though the market was falling steeply. There is one plausible explanation for this – in the face of so much uncertainty, the investors were probably adopting a cautious attitude. This postulation is supported by the marked decrease in market volatility during this period. Herding started to reappear when the market reached its lowest point (in August 1998) in the entire twelve-year period of our study.

In order to curb the excessive volatility in the foreign exchange rate, on 1 September 1998, the Malaysian government imposed capital controls that pegged the Malaysian ringgit to the US dollar. The market responded immediately and positively. The market was highly volatile in that month as confirmed by the sharp spike shown in the graph of market volatility. Our results show a pattern of persistent herding in the next six months, but this time in an ascending market. This is an interesting observation as it is in contrast to the period of market rally in 1993 where no herding behaviour was picked up by the measure. This evidence of herding following the imposition of capital controls may well reflect the investors' apprehensive sentiments at that point in time. Such drastic measures adopted by the government were hitherto without precedence and the implementation was fraught with uncertainty and fear. The investors probably believed that the market had hit rock-bottom and they would not want to miss out on the opportunity to reap some profits or to regain their losses. However, under such circumstances, it is not surprising that persistent herding occurred. In contrast, the market sentiments during the continuous rise of 1993 were that of confidence. Perhaps this observation offers circumstantial evidence that herding behaviour is associated with uncertainty and fear.

The general market trend in the year 1999 was upwards and the results do not show any significant evidence of herding. A less dramatic period of market decline occurred in the year 2000. Initially, the range plots appear to approach a herding pattern but it did not persist. From the year 2001 onwards, the market generally drifted sideways, with no marked price swings. Except for the few sporadic cases, the results do not show any persistent herding behaviour in that period.

CONCLUSION

The pattern of market-wide herding behaviour was very pronounced during the 1997 Asian financial crisis. In the crisis period, herding was expected since in the face of uncertainty and fear, investors would seek safety in numbers. Not surprisingly, this period recorded the highest proportion of herding incidences. In the first few months of the post-crisis period, the measure also reveals clear signs of market-wide herding. The stringent measures taken by the Malaysian government to arrest further deterioration of the financial system in September 1998 had indeed prevented a market free-fall and managed to turn the market sharply around. However, the resulting market rally was unlike that in 1993 when the market sentiments were radically different. The evidence of herding at the beginning of the post-crisis period may well reflect the prevailing mood of apprehension in reaction to the measures taken by the government. Only sporadic significant herding was found when the market was listlessly moving sideways with no marked price swings.

Overall, the study supports the intuition that herding is related to drastic changes in market conditions, especially so when the atmosphere of uncertainty is prevalent. To a certain extent, the results support Christie and Huang's (1995) rationale of herding, that is, herding occurs in extreme market conditions. However, as pointed out by Hwang and Salmon (2004), Christie and Huang's method of measuring herding by considering market stress as indicated by large positive or negative returns would exclude other incidences of herd behaviour. The proposed herd measure in this study is not restricted to any particular market condition.

Herding as a pervasive force should not be underestimated. Seemingly, it is part of the vicious cycle of cause and effect of extreme market fluctuations. When certain macroeconomic factors bring about a sudden change in the direction of market movement, the ensuing panic may trigger off herding which, in turn, can impact greatly upon market direction. Since it is inevitable, understanding the factors that cause this behaviour may help an investor to make better informed decisions and to avoid making costly mistakes. As Landberg (2003) cautions, despite the apparent safety it may offer in times of crises, running with the herd can exact a heavy financial price. He advises that the best way to keep emotions from clouding investors' judgements is by being aware of them.

LIMITATION OF STUDY

The number of trading days in a month ranges from 16 to 23, averaging at about 20. Estimation of the monthly beta by using such small sample size may give rise to the problem of sampling variability. If we increase the interval for estimation of beta to, say, two months, a study on herding at a two-monthly interval may not be meaningful. Thus, in this study there is a trade-off between sample size and the need to attain a meaningful study. The rolling regression technique may be used to increase the sample size in the estimation of the time-varying beta but the extensive overlapping of sample periods is likely to give rise to strong autocorrelation among the successive betas.

SUGGESTIONS FOR IMPROVEMENT

In this model we adopt the classical assumptions of a linear regression model. In particular, we assume that the error terms are normally distributed, with mean 0 and a constant variance. If these assumptions are not valid, the proposed confidence intervals may not be satisfactory. It is generally found that most financial data follow a fat-tailed distribution. By considering a fat-tailed distribution instead, we may obtain confidence intervals which are more satisfactory than those based on normality assumptions.

In addition, inclusion of factors that have effects on stock price movements in the basic Market Model may help to enhance the fit of the multivariate linear model.

REFERENCES

- 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.
- Bikhchandani, S. and Sharma, S., (2001). "Herd Behaviour and Financial Markets", *IMF Staff Papers*, 47(3), 279-310.
- Christie, W. G. and Huang, R. D., (1995). "Following the Pied Piper: Do Individual Returns Herd Around the Market", *Financial Analyst 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", a working paper, Cass Business School, U.K.
- _____ (2004). "Market Stress and Herding", *Journal of Empirical Finance*, 11(4), 585-616.
- Kahneman, D., Slovic, P. and Tversky, A., (1982). *Judgement Under Uncertainty*. Cambridge University Press.
- 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.
- Landberg, W., (2003). "Fear, greed and madness of markets", *Journal of Accountancy*, 195(4), 79-82.
- 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.
- Prechter, R.R., (2001). "Unconscious Herding Behavior as the Psychological Basis of Financial Market Trends and Patterns", *The Journal of Psychology and Financial Markets*, 2(3), 120-125.
- Shefrin, H., (1999). *Beyond Greed and Fear: Understanding Behavioral Finance and the Psychology of Investing*. Oxford University Press.
- Thaler, R., (1992). *The Winner's Curse: Paradoxes and Anomalies of Economic Life*. Princeton University Press.
- Valance, N. (2001). "Bright minds, Big theories", *The Magazine for Financial Directors and Treasures*, Dec/Jan. 2001 Feature.
- Vogelsang, T. J., (1997). "Wald-Type Tests for Detecting Breaks in the Trend Function of a Dynamic Time Series", *Economic Theory*, 13, 818-849
- Wermers, R., (1999). "Mutual Fund Herding and the Impact on Stock Prices", *Journal of Finance*, 43, 639-656.