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Author 1	Mokhtar, Suraya Hanim
Author 2	Nassir, Annuar Md
Author 3	Hassan, Taufiq
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Detecting Rational Speculative Bubbles in the Malaysian Stock Market

Suraya Hanim Mokhtar
University Putra Malaysia, Bintulu Campus
97008, Bintulu Sarawak
E-mail: surayahanim@putra.upm.edu.my
Tel: +6 086 855366

Annuar Md.Nassir
University Putra Malaysia, Serdang

Taufiq Hassan
University Putra Malaysia, Serdang

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Keywords: rational speculative bubbles, duration dependence test, behavioral finance
JEL Classification: G14

I. Introduction

Empirical evidence in the past have shown that stock market represents the well being of the economy, a leading economic indicator and a predictor of the performance of aggregate economy due to its vulnerability to fall during recession and rise before economic recovery. Theoretically, the functions of stock market are to encourage the accumulation of capital, to allocate existing supplies of capital to their most valuable uses, to facilitate and encourage capital accumulation by channeling short-term savings into long-term investments and to allocate limited capital to the most valued social uses. Participants in the stock market will receive profit either in terms of dividend or capital gain. Once the stock market is efficient, prices of stock provide an accurate signal for optimal resource allocation.

However, problems tend to emerge when the stock market is influenced by speculative trading. Speculators are the likely candidates to cause rational speculative bubbles. Speculators create true mania, producing price bubbles that sooner or later burst and cause asset price to decline. A price bubble is defined as the asset price movement that is unexplainable by the fundamentals (Garber, 1990). A bubble can also be identified as a sharp rise in the price of an asset in a continuous process (Kindlerbeger, 1978). Meanwhile, rational speculative bubbles can be defined as an attempt to identify the behavior of investors who act irrationally, such as when herding occurs (Cuthbertson, 1996). Statman (1998) identifies the irrational behavior of investors as an investor who trade because of personal satisfaction. An important feature of rational speculative bubbles is that investors realise share prices exceed their fundamental value but they believe that there is a high probability that the bubble will continue to expand and lead to a high return, which compensates them for the probability of crash. This justifies the rationality of staying in the market despite overvaluation (Chan et al., 1998). This idea can be described as the greater fool theory. It implies that although one may be a fool for buying an asset which is overpriced, one will profit if there are greater fools who will pay even more for it (James, 2003).

Market based on the greater fool theory always collapse. Once the greatest fool is found, the rising stock price process cannot continue. In many ways, a speculative binge is like a chain letter. Everyone involved in a chain letter believes that he or she will get rich. However, a chain letter is like a zero-sum game. It implies that if someone does get rich, others must get poorer. Furthermore, Sheilfer and Summers (1990) stated that rational speculative bubbles would divert financial flows from investment in real capital and focus on short-term investment. Rational speculative bubbles also create additional price risk and increase the instability of the economy (Binwanger, 1999).

The Malaysian economy has it share of ups and downs throughout the 90s and until 2003, more significantly during the 1997 Asian financial crisis. Do rational speculative bubbles exist in the Malaysian stock market? This is the motivation of this study. Moreover, identifying the level of speculative bubbles in the market is always an issue for policy makers. Experienced from the recent Asian financial crisis suggest that investors, as well as policy makers, did not realise the level of speculative trading in the market until the bubbles burst. The detection of rational speculative bubbles in Malaysian stock market provide an essential implication for both investors and policy makers. From the investors' point of view, even-though price bubbles allow them to earn abnormal profits, the existence of price bubbles itself will make them aware of the size of bubbles that can assist them to detect early signals on the possibility of stock price crash. At the same time, this information forces the investors to act rationally by selling the assets and adjusting the share prices toward their fair value, as well as transmitting the market to be efficient. Moreover, inferring the existence and size of price bubbles provides several implications to policy makers on how to protect the market. The protection of the market may be conducted through manipulating policies in order to minimise the price bubbles in the stock market. Furthermore, as time goes, market efficiency improves. Thus, by recognizing the level of speculative trading and the size of price bubbles, specific actions can be imposed to stabilise the stock market.

Employing the duration dependence test developed by McQueen and Thorley (1994), this study examines the possible existence of rational speculative bubbles between 1994 and 2003, in the Bursa Malaysia Composite Index and Sectoral Indices, namely the Finance Index, Property Index, Plantation Index, Construction Index, Trading and Services Index, Consumer Product Index and Industrial Product Index. Specifically, this study aims to detect the rational speculative bubbles over the period for before (1994-1996) during (1997-1998) and after the Asian Financial Crisis (1999-2003).Duration dependence test has been widely utilized to investigate the presence of rational speculative bubbles in equity and real estate markets (e.g., Chan, McQueen and Thorley, 1998; and Lavin and Zorn, 2001). Duration dependence tests address nonlinearity by allowing the parameters (probabilities of ending a run) to vary depending on the length of the run and on whether the run is of positive or negative abnormal returns. This model suggests that the probability that a run (sequence of observations of the same signs) of positive abnormal returns will end should decline with the length of the run (negative hazard functions). This model implies that if security prices contain bubbles, then runs of positive abnormal returns will exhibit positive duration dependence. That is, the longer the bubble persists, the lower the hazard probability of a crash. In contrast, the hazard probability of runs of negative abnormal returns will be independent of the duration of the run. McQueen and Thorley (1994) argued that this pattern of duration dependence is indicative of the existence of bubbles since it cannot be the result of asymmetric or leptokurtic innovations in fundamental alone. The central concept in this technique is commonly specified in terms of the conditional probability of exit or the hazard function. Application of the hazard function is known to be particularly useful when concern is turned to situation when the probability of leaving the state in question depends on the time spent in the state. If the hazard function is increasing, then the probability that a spell of an event will be completed is increasing with the duration of the event. For the proposes of this study, the Weibull's hazard model and Log Logistic hazard model are chosen primary because of their flexibility in hazard rate distribution. This is because investors would not ordinarily expect a linear response if there are explosive price changes (Harman and Zuehlke, 2004).

Our results suggest that the rational speculative bubbles exist in the Malaysian stock market during, pre- (1994-1996) and post-crisis periods (1999-2003). The findings also discovered that the size of bubbles during post-crisis periods was smaller compared to those during pre-crisis periods.

This remainder of the study unfolds as follows. The following provides a brief review of the literature on rational speculative bubbles, section III describes the methodology, then reports the results of duration dependence test using the Weibull's hazard model and Log Logistic hazard model. The paper's conclusions are presented in section IV.

II. Literature Review

The majority of published studies examining the existence of speculative bubbles are concentrated on the techniques used to detect rational speculative bubbles in the stock market. There are several techniques and approaches that are used to detect the price bubbles in the stock price. These techniques can be grouped into four main categories: tests for bubble premiums, tests for excess volatility and tests for the cointegration of dividends and prices and duration dependence test.

A bubble premium is the excess returns the investor demand above the fundamental return in the presence of speculative bubble. This return has an explosive nature as it increases geometrically through time. This return incorporates the actual excess return of the stock over the risk free rate. Among the researchers which used this technique to detect rational speculative bubbles are Hardouvelis, 1988; Rappoport and White, 1993; DeLong et al., 1990 and Liu et al., 1995. The broad consensus of the literature is that tests for the presence of a bubble premium face serious problems and are not able to prove or adequately disprove the existence of rational speculative bubbles. A different method of testing for bubble existence is by examination of the stock market's variance and the application of tests for excess volatility. In general, if a speculative bubble is present, the variance of the stock price will be greater than the variance of the fundamental price. Among the researchers that used this technique are Friedman, 1953; Hart and Kreps 1986; Baumol, 1957; Kohn, 1978; Shiller ,1981; Marsh and Merton, 1986; Shiller ,1997; Kleidon,1986; LeRoy and Porter, 1981; Dezhbakhsh and Demirguc-Kunt, 1990; West, 1987; Flood and Garber, 1980.

The other method is non-stationary and cointegration test. Diba and Grossman (1988a and 1988b) showed that if stock price depends exclusively on future dividends, if there are no rational speculative bubbles and if dividends are stationary in the mean, then prices will be stationary. However, even if dividends and prices are non-stationary and cointegrated, then the no-bubble hypothesis cannot be rejected. Nevertheless, the lack of cointegration is not a sufficient condition to prove the existence of bubbles since the model might exclude significant variables that affect stock prices and that are not stationary. In their survey, Diba and Grossman discovered that the dividend and price series for the S&P 500 have different stationarity so they reject the bubble hypothesis. Similarly after testing for cointegration, they verified their result of no bubble as prices and dividends were bound to be cointegrated. Among the researchers who's used and improved this technique are Campbell and Shiller ,1987; Craine, 1993; Fama and French, 1988 and Summers,1986. However, Johansen (1991) showed that a lack of cointegration of dividends and prices might not be caused by the presence of a bubble but by the lack of cointegration, which in reality, is caused by other factors. In addition, Evans (1991) stated that cointegration tests cannot detect a large category of bubbles that are based on fundamental. These intrinsic bubbles follow the same evolutionary process as the expected dividend and so they cannot be detected. As a result of all of these problems, stationarity and cointegration tests have very low power of prediction (Mattey and Meese, 1986). This approach has been criticized by Wu and Xiau (2002) and Charemza and Deadman (1995) for having serious drawbacks in detecting bubbles. The three groups of techniques in detecting bubbles, namely tests for bubble premiums, tests for excess volatility and tests for the cointegration of dividends and prices have received their gain share of critics and comments from various scholars because of their lack of robustness in testing the existence of bubbles.

There are several researchers that have used duration dependence test using Log-Logistic hazard model to detect rational speculative bubbles in stock market; among them are Chan et al., (1998). Chan et al. detected rational speculative bubbles in Asian (Hong Kong, Japan, Korea, Malaysia, Thailand and Taiwan) and the U.S stock markets. Harman and Zuehlke (2001) also used Duration Dependence Test but using Weibull's hazard model to detect rational speculative bubbles in the New York Stock Exchange. Recently, Watanapalachaikul and Sardar (2003) did a study on rational speculative bubbles in the Thailand stock market. They also employed Duration Dependence Test but using two hazard models: (1) Log-Logistic hazard model and (2) Weibull's hazard model. Their study provided an evidence of rational speculative bubbles in the Thailand stock market, especially before and after the Asian Financial Crisis in 1997. The Duration Dependence Test using Log Logistic and Weibull Hazard Model are more widely accepted in detecting rational speculative bubbles in stock price (Fung, 2001 and Harman and Zuehlke 2001).

III. Methodology

This study tests for the existence of rational speculative bubbles in Malaysian Stock Market using the duration dependence methodology developed by McQueen and Thorley (1994). This duration dependence test builds on the rational expectations model and the statistical theory of duration dependence. In an asset market experiencing a bubble, investors are aware that prices of securities exceed their fundamental values. However, these investors may still want to purchase securities because they believe that prices will appreciate further, enabling them to generate a high return. The bubble is rational only if the probability of a higher return rises to compensate for the increased probability of crash. According to the duration dependence method, the probability that a run of positive abnormal ends should decrease with the length of the run (sequence of he returns of the same sign) if bubbles exists in the security market.

To apply the duration dependence test, first we transform the return into series of run lengths on positive and negative observed abnormal returns. For example, a return series of four positive abnormal return followed by three negative, two positive and finally four negative abnormal returns is transformed into two data sets: a set for runs of positive abnormal returns with values of 4 and 2 and a set for turns of negative abnormal returns with values 3 and 4. The separation of return into two states is similar in nature to the tests by Blanchard and Watson (1982), Evans (1986), and McQueen and Thorley (1991).

Formally, the data consists of a set S_T, of T observations on the random run length, I. A run is defined as a sequence of abnormal returns of the same signs. Thus, I is a positive valued discrete random variable generated by some discrete density function, $f_i \equiv \text{Prob}\ (I = i)$, and corresponding cumulative density function, $F_i \equiv \text{Prob}\ (I < i)$, Define N_i as the count of completed runs of lengths i in the sample. The density function of the log likelihood is:

$$L (\theta \mid S_T) = \sum_{i=1}^{\infty} N_i \ln f_i + P_i \,\text{Ln}\, (1-F_t) \tag{1}$$

where θ is a vector parameters.The hazard function $h_i \equiv \text{Prob}\ (I = i \mid I \geq i)$, represents the probability that a run ends at i, given that it lasts at least until i.

A hazard function specification describes data in terms of conditional probabilities in contrast to the density function specification which focuses on unconditional probabilities. The choice between a hazard and density specification depends on the economic question of interest.

This study questions whether the probability that return run continues depends on the length of the run; consequently, the hazard specification is appropriate. The hazard function is related to the density function by:

$$h_i = \frac{f_i}{(1- F_i)} \quad \text{and} \quad f_i = h_i \prod_{j=1}^{i-1}(1-h_j) \tag{2}$$

Using the relationship above, the hazard function version of the log likelihood is:

$$L(\theta \mid S_T) = \sum_{i=1}^{\infty} N_i \,\text{Ln}\, h_i + M_i \,\text{Ln}\,(1-h_i) + Q_i \,\text{Ln}\,(1-h_i) \tag{3}$$

where M_i is the count of runs with a length greater than i, respectively. The terms containing P_i and Q_i in the log likelihood (Equations (1) and (2) are included to incorporate information contained in partial runs and may be ignored in large samples. To perform test of duration dependence, a functional form must be chosen from the hazard function. This study used Weibull Hazard Model as a hazard function.

The Weibull hazard Model is defined as (Harman and Zuehlke 2001):

$$S(t) = \exp(-\alpha t^{bt+1}) \tag{4}$$

where $S(t)$ is the probability of survival in a state to at least time (t), The corresponding hazard function is:

$$h(t) = \alpha(\beta + 1)t^{\beta} \tag{5}$$

where α is the shape parameter of the Weibull distribution, and β is the duration elasticity of the hazard function. The fundamental assumption of the Weibull Hazard model is a linear relationship between the log of the hazard function and the log of duration, where:

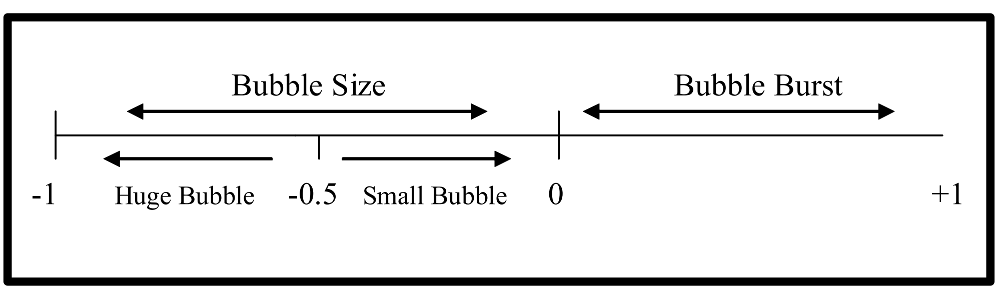
$$\ln[h(t)] = \ln[\alpha(\beta + 1] + \beta \ln(t) \tag{6}$$

The null hypothesis of no duration dependence or "no presence of bubble" requires a constant hazard rate. The alternative hypothesis support that positive runs' ending should decrease with the length of the runs increasing, or a decreasing hazard rate (longer survival time).

IV. Empirical Results

Rational speculative bubbles in this study are indicated when the beta (β) coefficient is positive. Beta (β) is estimated coefficients of length of run in accelerated failure-time form (AFT). This means that, longer bubbles period indicate longer bubbles survival (decreasing hazard rate).Moreover, the rational speculative bubbles are also indicated when the alpha (α) is negative. A positive alpha (α) represents the time of bubble burst. The range of bubble size is illustrated in Figure 1.1 below.

Figure 1.1: Range of Bubble Size.



Based on Figure 1.1 above, it shows that a small bubble is in the range between 0 to -0.5 while, a huge bubble is in the range between -0.5 to -1. Bubble in the "small size" group is considered a controllable bubble. Meanwhile, actions should be taken to eliminate the bubble burst among the huge bubbles.

The results of Weibull's Hazard Model for the CI are presented in Table 1.1, while those for the Property Index, the Finance Index and the Construction Index are available in Table 1.2. Table 1.3 shows the results on the Plantation Index, Trading and Services Index, Consumer Product Index and Industrial Product Index.

Table 1.1: Findings on Composite Index (Weibull Hazard Model)

Year	α	β	LRT of Ho: β = 0	(P-value)
1994	-0.106	0.361	6.38	(0.0115)*
1995	-0.694	0.694	33.51	(0.0001)*
1996	-0.399	0.442	12.53	(0.0004)*
1997	**0.178**	**0.319**	**2.64**	**(0.1043)**
1998	**0.045**	**0.356**	**2.96**	**(0.0853)**
1999	-0.469	0.518	7.72	(0.0054)*
2000	-0.419	0.549	10.49	(0.0012)*
2001	-0.693	0.693	82.94	(0.0001)*
2002	-0.145	0.27	7.54	(0.0006)*
2003	-0.349	0.506	13.05	(0.0003)*
Average size of bubble (Before Crisis): -0.4				
Average size of bubble (After Crisis) : -0.4				

Note: α is the size of bubbles. β is the estimated coefficients of length of run in accelerate failure-time form (AFT). The log likelihood ratio test (LRT) is the joint probability density function. The LRT is for null hypothesis of no duration dependence. The LRT statistics is asymptotically χ^2 with 1 degree of freedom.* indicate rejection of null hypothesis at 5 percent significant level. Results obtained from the STATA.

Table 1.2: Findings on Property Index, Finance Index, Construction Index (Weibull Hazard Model)

	Property Index				Finance Index				Construction Index			
Year	α	β	LRT of Ho: β = 0	(P-value)	α	β	LRT of Ho: β = 0	(P-value)	α	β	LRT of Ho: β = 0	(P-value)
1994	-0.411	0.529	11.9	(0.0006)*	-0.382	0.518	8.69	(0.0032)*	-0.344	0.503	8.46	(0.0036)*
1995	-0.706	0.707	48.51	(0.0001)*	-0.705	0.706	64.51	(0.0001)*	-0.693	0.692	48.26	(0.0001)*
1996	-0.693	0.692	50.37	(0.0001)*	-0.692	0.693	70.45	(0.0001)*	-0.692	0.693	58.85	(0.0001)*
1997	0.284	0.259	2.93	(0.0867)	0.437	0.199	3.1	(0.0784)	0.225	0.298	2.77	(0.0558)
1998	0.232	0.305	3.61	(0.051)	0.202	0.293	2.9	(0.0888)	0.299	0.513	3.77	(0.0522)
1999	0.193	0.441	5.93	(0.053)	0.045	0.356	2.96	(0.0853)	-0.005	0.349	5.39	(0.0202)*
2000	0.17	0.352	37.27	(0.051)	0.113	0.422	3.55	(0.0596)	-0.081	0.326	34.56	(0.0001)*
2001	-0.128	0.366	7.07	(0.0078)*	-0.007	0.289	7.02	(0.0081)*	-0.018	0.481	16.47	(0.0001)*
2002	-0.234	0.419	8.72	(0.0032)*	-0.388	0.491	8.69	(0.0001)*	-0.333	0.472	10.68	(0.0011)*
2003	-0.298	0.389	8.74	(0.0031)*	-0.358	0.358	51.12	(0.0032)*	-0.256	0.261	32.12	(0.0001)*
	Average size of bubble (Before Crisis): -0.6				**Average size of bubble (Before Crisis): -0.6**				**Average size of bubble (Before Crisis): -0.6**			
	Average size of bubble (After Crisis) : -0.2				**Average size of bubble (After Crisis) : -0.3**				**Average size of bubble (After Crisis) : -0.1**			

Note: α is the size of bubbles. β is the estimated coefficients of length of run in accelerated failure-time form (AFT).
The log likelihood ratio test (LRT) is the joint probability density function. The LRT is for the null hypothesis of no duration dependence. The LRT statistics is asymptotically χ^2 with 1 degree of freedom.* indicate rejection of null hypothesis at 5 percent significance level. Results obtained from STATA.

Table 1.3: Finding on Plantation Index, Consumer Product Index, Trading and Services Index, Industrial Product Index (Weibull Hazard Model)

	Plantation Index				Consumer Product Index				Trading and Services Index				Industrial Product Index			
Year	α	β	LRT of Ho: β = 0	(P-value)	α	β	LRT of Ho: β = 0	(P-value)	α	β	LRT Ho: β = 0of	(P-value)	α	β	LRT of Ho: β = 0	(P-value)
1994	-0.411	0.523	11.9	(0.0006)*	-0.498	0.582	11.47	(0.0007)*	-0.033	0.369	9.76	(0.0018)*	-0.411	0.523	11.9	(0.0006)*
1995	-0.426	0.538	12.74	(0.0001)*	-0.391	0.518	15.1	(0.0001)*	-0.693	0.693	50.87	(0.0001)*	-0.426	0.538	12.74	(0.0004)*
1996	-0.424	0.499	10.46	(0.0012)*	-0.331	0.458	16.61	(0.0001)*	-0.166	0.398	9.76	(0.0018)*	-0.392	0.505	13.38	(0.0003)*
1997	0.332	0.255	39.63	(0.0625)	0.045	0.356	2.96	(0.0853)	0.225	0.298	2.77	(0.0958)	0.204	0.319	2.56	(0.1097)
1998	0.225	0.298	2.77	(0.0958)	0.174	0.312	2.89	(0.0891)	0.045	0.356	2.96	(0.0853)	0.01	0.362	3.71	(0.0541)
1999	-0.418	0.549	10.49	(0.0012)*	-0.411	0.522	11.9	(0.0006)*	-0.448	0.553	8.85	(0.0029)*	-0.069	0.326	6.31	(0.012)*
2000	-0.235	0.288	20.15	(0.0001)*	-0.571	0.693	12.96	(0.0003)*	-0.582	0.625	18.46	(0.0001)*	-0.571	0.633	12.96	(0.0003)*
2001	-0.234	0.419	8.72	(0.0032)*	-0.118	0.405	53.45	(0.0001)*	-0.528	0.551	11.75	(0.0006)*	-0.352	0.517	11.33	(0.0008)*
2002	-0.106	0.389	7.4	(0.0065)*	-0.548	0.549	40.88	(0.0001)*	-0.462	0.462	62.29	(0.0001)*	-0.236	0.288	34.41	(0.0001)*
2003	-0.462	0.462	65.82	(0.0001)*	0.061	0.305	7.61	(0.058)	-0.402	0.402	70.57	(0.0001*	-0.297	0.297	20.77	(0.0001)*
	Average size of bubble (Before Crisis): -0.4				Average size of bubble (Before Crisis): -0.4				Average size of bubble (Before Crisis): -0.3				Average size of bubble (Before Crisis): -0.4			
	Average size of bubble (After Crisis) : -0.3				Average size of bubble (After Crisis) : -0.4				Average size of bubble (After Crisis) : -0.5				Average size of bubble (After Crisis) : -0.1			

Note: α is the size of bubbles. β is the estimated coefficients of length of run in accelerated failure-time form (AFT).
The log likelihood ratio test (LRT) is the joint probability density function. The LRT is for the null hypothesis of no duration dependence.
The LRT statistics is asymptotically χ^2 with 1 degree of freedom.* indicate rejection of null hypothesis at 5 percent significant level.
Results obtained from STATA

Meanwhile, results of Log Logistic Hazard Model for the CI are presented in Table 1.4, while those for the Property Index, the Finance Index and the Construction Index are available in Table 1.5. Table 1.6 shows the results on the Plantation Index, Trading and Services Index, Consumer Product Index and Industrial Product Index.

Table 1.4: Findings on Composite Index (Log Logistic Hazard Model)

Year	α	B	LRT of Ho: β = 0	(P-value)
1994	-0.251	0.355	8.26	(0.0041)*
1995	-0.693	0.693	125.07	(0.0001)*
1996	-0.384	0.416	13.33	(0.0003)*
1997	**0.019**	**0.354**	**3.46**	**(0.063)**
1998	**0.125**	**0.4**	**3.66**	**(0.0558)**
1999	-0.451	0.488	8.47	(0.0036)*
2000	-0.451	0.549	10.92	(0.0001)*
2001	-0.693	0.693	308.26	(0.0001)*
2002	-0.088	0.3	7.88	(0.005)*
2003	-0.41	0.522	12.7	(0.0004)*
Average size of bubble (Before Crisis): -0.4				
Average size of bubble (After Crisis) : -0.4				

Note: α is the size of bubbles. β is the estimated coefficients of length of run in accelerated failure-time form (AFT). The log likelihood ratio test (LRT) is the joint probability density function. The LRT is for the null hypothesis of no duration dependence. The LRT statistics is asymptotically χ^2 with 1 degree of freedom.* indicate rejection of null hypothesis at 5 percent significance level. Results obtained from STAT

Table 1.5: Findings on Property Index, Finance Index, Construction Index (Log Logistic Hazard Model)

	Property Index				**Finance Index**				**Construction Index**			
Year	**α**	**β**	**LRT of Ho: β =0**	**(P-value)**	**α**	**β**	**LRT of Ho: β=0**	**(P-value)**	**α**	**β**	**LRT of Ho: β = 0**	**(P-value)**
1994	-0.501	0.539	15.71	(0.0001)*	-0.501	0.545	11.21	(0.0008)*	-0.469	0.534	10.77	(0.001)*
1995	-0.706	0.621	212.92	(0.0001)*	-0.693	0.693	286.26	(0.0001)*	-0.693	0.693	188.2	(0.0001)*
1996	-0.693	0.615	190.04	(0.0001)*	-0.693	0.693	247.39	(0.0001)*	-0.693	0.693	213.74	(0.0001)*
1997	0.124	0.288	3.33	(0.051)	0.27	0.219	3.38	(0.065)	0.038	0.321	3.61	(0.051)
1998	0.004	0.356	4.78	(0.056)	0.046	0.327	3.36	(0.066)	0.386	0.529	4.76	(0.059)
1999	0.019	0.354	3.46	(0.063)	0.125	0.4	3.66	(0.055)	-0.013	0.378	5.45	(0.011)*
2000	0.103	0.362	6.67	(0.058)	-0.222	0.315	8.58	(0.0034)*	-0.079	0.205	124.92	(0.0001)*
2001	-0.132	0.379	4.55	(0.033)*	-0.388	0.476	9.66	(0.0019)*	-0.022	0.316	16.51	(0.0001)*
2002	-0.134	0.332	8.11	(0.0044)*	-0.234	0.44	4.46	(0.0346)*	-0.195	0.288	12.72	(0.0004)*
2003	-0.298	0.389	8.74	(0.0031)*	-0.358	0.358	202.16	(0.0001)*	-0.255	0.263	137.27	(0.0001)*
	Average size of bubble (Before Crisis): -0.6				**Average size of bubble (Before Crisis): -0.6**				**Average size of bubble (Before Crisis): -0.6**			
	Average size of bubble (After Crisis) : -0.2				**Average size of bubble (After Crisis) : -0.2**				**Average size of bubble (After Crisis) : -0.1**			

Note: α is the size of bubbles. β is the estimated coefficients of length of run in accelerated failure-time form (AFT).The log likelihood ratio test (LRT) is the joint probability density function. The LRT is for the null hypothesis of no duration dependence. The LRT statistics is asymptotically χ^2 with 1 degree of freedom.* indicate rejection of null hypothesis at 5 percent significance level. Results obtained from STATA.

Table 1.6: Findings on Plantation Index, Consumer Product Index, Trading andServicesIndex, Industrial Product Index (Log logistic Hazard Model)

	Plantation Index				Consumer Product Index				Trading and Services Index				Industrial Product Index			
Year	**α**	**β**	**LRT of Ho: β = 0**	**(P-value)**	**α**	**β**	**LRT of Ho: β = 0**	**(P-value)**	**α**	**β**	**LRT of Ho: β = 0**	**(P-value)**	**α**	**β**	**LRT of Ho: β = 0**	**(P-value)**
1994	-0.5	0.539	15.71	(0.0032)*	-0.514	0.558	12.93	(0.003)*	-0.125	0.398	9.12	(0.0025)*	-0.501	0.539	15.71	(0.0001)*
1995	-0.697	0.697	205.56	(0.0001)*	-0.463	0.532	14.94	(0.0001)*	-0.693	0.693	197.02	(0.0001)*	-0.476	0.543	13.16	(0.0003)*
1996	-0.422	0.469	11.8	(0.0006)*	-0.409	0.456	17.92	(0.0001)*	-0.291	0.427	9.72	(0.0018)*	-0.402	0.479	13.56	(0.0002)*
1997	0.255	0.33	179.96	(0.0511)	0.125	0.4	3.66	(0.0558)	0.0379	0.321	3.61	(0.0574)	0.012	0.338	3.48	(0.062)
1998	0.037	0.321	3.61	(0.0574)	0.019	0.333	3.77	(0.0522)	0.125	0.4	3.66	(0.0558)	0.132	0.379	4.55	(0.055)
1999	-0.453	0.549	10.92	(0.0001)*	-0.501	0.539	15.71	(0.0001)*	-0.489	0.543	10.66	(0.0011)*	-0.103	0.362	6.67	(0.0098)*
2000	-0.177	0.307	68.24	(0.0001)*	-0.526	0.578	13.68	(0.0001)*	-0.538	0.577	18.16	(0.0001)*	-0.526	0.578	13.68	(0.0002)*
2001	-0.269	0.41	9.16	(0.0025)*	-0.117	0.405	220.69	(0.0001)*	-0.481	0.513	11.61	(0.0007)*	-0.404	0.529	11.46	(0.0007)*
2002	-0.241	0.425	7.66	(0.005)*	-0.549	0.549	178.62	(0.0001)*	-0.462	0.462	278.68	(0.0001)*	-0.236	0.288	166.6	(0.0001)*
2003	-0.462	0.462	322.6	(0.0032)*	-0.134	0.332	8.11	(0.0044)*	-0.402	0.402	270.02	(0.0001)*	-0.297	0.297	200.14	(0.0001)*
	Average size of bubble (Before Crisis): 0.5				**Average size of bubble (Before Crisis): -0.5**				**Average size of bubble (Before Crisis): -0.4**				**Average size of bubble (Before Crisis): -0.5**			
	Average size of bubble (After Crisis) : -0.3				**Average size of bubble (After Crisis) : -0.4**				**Average size of bubble (After Crisis) : -0.5**				**Average size of bubble (After Crisis) : -0.3**			

By employing duration dependence test using the Log Logistic Hazard Model and the Weibull Hazard Model, this study revealed the existence of rational speculative bubbles in Malaysian stock market before (1994-1996) and after (1999-2003) the Asian financial crisis 1997. This study also discovered larger average bubbles sized in most indices (except for Composite Index and Trading and Services Index) in both models during before (1994-1996) the Asian Financial Crisis compared to those after (1999-2003) the Asian Financial Crisis. The summary of average size of bubbles based on both models is present in the Table 1.7.

Table 1.8: Average Size of Bubbles

Indices	Log Logistic		Weibull	
Composite Index	BeforeCrisis	-0.4	Before Crisis	-0.4
	After Crisis	-0.4	After Crisis	-0.4
Property	Before Crisis	-0.6	Before Crisis	-0.6
	After Crisis	-0.2	After Crisis	-0.2
Finance	Before Crisis	-0.6	Before Crisis	-0.6
	After Crisis	-0.3	After Crisis	-0.3
Construction	Before Crisis	-0.6	Before Crisis	-0.6
	After Crisis	-0.1	After Crisis	-0.1
Plantation	Before Crisis	-0.5	Before Crisis	-0.4
	After Crisis	-0.3	After Crisis	-0.3
Consumer Product	Before Crisis	-0.5	Before Crisis	-0.4
	After Crisis	-0.4	After Crisis	-0.4
Trading and Services	Before Crisis	-0.4	Before Crisis	-0.3
	After Crisis	-0.5	After Crisis	-0.5
Industrial Product	Before Crisis	-0.5	Before Crisis	-0.4
	After Crisis	-0.3	After Crisis	-0.1

V. Conclusions

This study investigates the existence of rational speculative bubbles in Bursa Malaysia Composite Index and Sectoral Indices. This study covered the duration of ten years using abnormal monthly real returns observations starting from January 1994 to December 2003. The time frame is divided into three time ranges: before the Asian financial crisis (1994-1996), during the Asian financial crisis (1997-1998) and after the Asian financial crisis (1999-2003). The objectives of this study are achieved by employing duration dependence test using the Weibull's hazard model and Log Logistic hazard model.

This study revealed the existence of rational speculative bubbles in the Malaysian stock market during, pre- (1994-1996) and post-crisis periods (1999-2003). The findings also discovered that the size of bubbles during post-crisis periods was smaller compared to those during pre-crisis periods. During 1994 until 1996 (pre-crisis periods), Malaysia was an expanding economy. There are huge amounts of foreign capital inflows and Malaysia was overly reliant on the capital provided by international portfolio funds for financing growth during those periods. However, after the crisis, a few actions was taken through capital and currency controls to resort the economy. Among the actions were ownership rules, liberalization of investment rules, improvement of banking sector prudential regulation, capital market reform, corporate governance reforms and corporate restructuring. These measures successfully brought confidence among local as well as foreign investors towards the Malaysian stock market. As a conclusion, the amendment of economic policy to build up the economic fundamentals through capital and currency control have improved market efficiency, since there were only small sized bubbles detected during the post-crisis period.

Furthermore, this study also revealed that the Log Logistic hazard model and Weibull hazard models can be applied to detecting rational speculative bubble in Malaysian stock market since the results are reliable and the error of bubble size between these models is small.

This study provides various implications to the academicians' investors and most importantly to the policy makers. There is no published evidence on the existence of rational speculative bubbles in the Malaysian stock market especially for the year of 1994 until 2003. Therefore this study makes a significant contribution to the literature particularly in emerging market. Moreover, from the investors' point of view, even-though price bubble allow them to earn abnormal profits, the existence of price bubble itself will make them aware of the size of bubble subsequently assists them to detect early signals before the stock price crash. Furthermore, this information forces investors to act rationally by selling the assets and adjusting the share price toward their fair value, as well as transmitting the market to be efficient.

The existence of rational speculative bubbles indicates the imperfections of market. This is because, a sharp asset price bubbles lead to sizeable debt build-ups, weakened balance sheets and financial imbalance. Such bubbles promote instability in the financial system and the macro economy. In such cases, policy makers should intervene in order to prevent monetary disruption and imbalances to limit future deterioration of bank balance sheets, stabilize the financial system and to steering the economy away from these severe asset price bubbles. One of the ways to reduce the huge share price bubble in the market is by increasing the interest rate. Other regulations, such as restrictions on short-selling of stocks and actions towards insider trading activities can also add to control the share price bubbles. Furthermore, the policy maker also can increase the brokerage fees and stamp duty in order to edge the new investors in the market.

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