CHAPTER 5

EMPIRICAL RESULTS

5.1) Data Sources and Measurement

Tests for duration dependence in this thesis are performed on secondary data by basing on the monthly data. The major sources of data are from DATASTREAM, library of Stock Exchange of Thailand (SET), library of Bank of Thailand (BOT) and website of Bank of Thailand (BOT).

The tests in this thesis are based on **abnormal continuously compounded real monthly returns** for value-weighted portfolios of all stocks in Stock Exchange of Thailand (SET) from April 1985 to February 2000 excluding the stock market crash period during July 1997 to December 1998. According to chapter 4; to identify positive and negative abnormal returns in step 1 of estimation procedure, we need to use the following data:

5.1.1) Continuously Compounded Monthly Real Return. Monthly continuously compounded nominal and real returns are created and examined. To calculate real returns, continuously compounded monthly inflation rates are subtracted from the nominal rates.

- Continuously compounded monthly nominal return is defined as $Ln(SET_t/SET_{t-1})$
- Continuously compounded monthly inflation rate is defined as $Ln(CPI_t/CPI_{t-1})$

According to Fisher's effect, the real return is defined as

$$\left\{ \frac{(1 + \text{nominal} \quad)}{(1 + \text{inflation} \quad)} \right\} - 1$$

Therefore, the continuously compounded monthly real return is defined as*

$$\left[\frac{1 + Ln\ (\frac{\text{SET}_{t}}{\text{SET}_{t-1}})}{1 + Ln\ (\frac{\text{CPI}_{t}}{\text{CPI}_{t-1}})} \right] - 1$$

5.1.2) Term. Term spread can reflect the risk at that time. Wide spread will reflect high risk, while narrow spread will reflect low risk. According to **McQueen and Thorley (1994)**, term is defined as the different in yield-to-maturity between AAA Corporate Bond and one-month Treasury bill. Unfortunately, the information about AAA Corporate Bond and one-month Treasury bill are not fully available because the bond market has just been started in the last few years in Thailand. Therefore, in this thesis we will apply the **difference in the maximum and average lending rate as a proxy of term spread** which reflects the level of risk.

5.1.3) Dividend Yield. The value-weighted SET portfolio's dividend yield is obtained from DATASTREAM.

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* SET = SET Index and CPI = Consumer Price Index.

5.2) The Result of the Positive and Negative Abnormal returns Identification

To identify both positive and negative abnormal continuously compounded real monthly returns, the above data must be substituted into regression equation (15) in chapter 4. After regressing, results has been as follows:

$$R_t^{vw} = 0.0301 - 0.0028(TERM)_{t-1} + 0.0004(D/P)_{t-1} + 0.2174(R_{t-1}^{vw}) + 0.0381(R_{t-2}^{vw}) - 0.0381(R_{t-3}^{vw}) + \epsilon_t^{vw}$$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.030087	0.022170	1.357135	0.1770
TERM(-1)	-0.002830	0.001053	-2.686901	0.0081
DIVIDEND(-1)	0.000385	0.004653	0.082647	0.9343
REAL(-1)	0.217439	0.083518	2.603495	0.0102
REAL(-2)	0.038120	0.038295	0.995423	0.3213
REAL(-3)	-0.038140	0.038392	-0.993438	0.3222

R-squared	0.123358	**F-statistic**	3.855637
Durbin-Watson stat	1.981000	**Prob(F-statistic)**	0.002670
White Heteroscedasticity Test:			
Obs*R-square	13.25177	**Probability**	0.209934

Table 5.1 The Result of Regression Equation

5.2.1) Investigation for Econometric Problems

In this part, the econometric problems will be investigated and corrected by improving the specification and using more efficient method of estimation in order to obtain the better result.

1) Multicollinearity

Multicollinearity arises when two or more variables are highly correlated with each other. And the following correlation matrix table can be use to investigate the multicollinearility problem.

	DIVIDEND	CPI	SET	TERM
DIVIDEND	1.000000	0.528999	-0.592628	-0.367273
CPI	0.528999	1.000000	-0.629724	-0.403276
SET	-0.592628	-0.629724	1.000000	0.096552
TERM	-0.367273	-0.403276	0.096552	1.000000

Table 5.2 Correlation Matrix

According to the above correlation matrix table, the zero-order coefficient between two regressors is less than 0.8. Therefore, the multicollinearity problem does not exist in this regression equation.

2) Heteroscedasticity

The assumption of the classical linear regression model is that all disturbances (ε_t) have the same variance (σ^2). If the assumption is violated, there is an existence of the heteroscedasticity.

To identify the heteroscedasticity, the following hypotheses must be tested:

H_0 : There is homoscedasticity

H_1 : There is heteroscedasticity

In this thesis, the White Heteroscedasticity Test is used to investigate for heteroscedasticity. From table 5.1, the probability for White Heteroscedasticity Test 0.209934 exceeds 5 percent level of significance. Therefore, the null hypothesis of homoscedasticity cannot be rejected or it can be concluded that the heteroscedasticity does not exist in this regression model.

3) Autocorrelation or Serial Correlation

If the assumption of the classical linear regression model that disturbance terms entering into the population model are uncorrelated is violated, then the problem of autocorrelation arises.

To identify the autocorrelation, the following hypotheses must be tested:

H_0 : No positive autocorrelation

H_1 : No negative autocorrelation

In this thesis, the Durbin-Watson d Test is used to test for the autocorrelation. From table 5.1, the Durbin-Watson statistic is 1.981 (almost equal to 2) which lies within the zone of do not reject H_0. Therefore, the null hypothesis of no positive autocorrelation cannot be rejected and it can be concluded that the autocorrelation problem does not exist in this regression model.

5.2.2) Interpretation of the Regression Equation's Result

From the above result, the coefficient of lagged (-1) term spread and lagged (-1) monthly continuously compounded real return are significant at 5 percent level. The coefficient of lagged (-1) shows negative relationship with monthly continuously compounded real return, implying that monthly continuously compounded real return is negatively influenced by the term spread. While the positive coefficient of lagged (-1) monthly continuously compounded real return implies that monthly continuously compounded real return is positively influenced by the lagged (-1) monthly continuously compounded real return. On the other hand, the coefficient of lagged (-1) dividend yield, lagged (-2) and (-3) monthly continuously compounded real return are all insignificant at 5 percent level. From the 0.002670 Prob(F-statistic), it shows the overall significance of the estimated regression inspite of low R-square. The reason for obtaining low R-square is that it is very hard to anticipate the stock price and return in the stock market accurately.

5.2.3) Identification of Positive and Negative Abnormal Returns

Positive abnormal returns		Negative abnormal returns	
Run length (months)	Actual run counts	Run length (months)	Actual run counts
1	17	1	20
2	9	2	10
3	6	3	2
4	3	4	1
5	0	5	3
6	0	6	1
7	1		

Table 5.3 Positive and Negative Abnormal Returns

Table 5.3 reports the run counts at each horizon. For positive abnormal returns; one of the runs of lasts 7 months, three of the runs last 4 months, six of the runs last 3 months, nine of the runs last 2 months and seventeen of the runs last only 1 month. For negative abnormal returns; one of the runs lasts 6 months, three of the runs last 5 months, one of the run lasts 4 months, two of the runs last 3 months, ten of the runs last 2 months and twenty of the runs lasts only 1 month.

5.3) The Result of Duration Dependence Hypothesis Testing for Runs of Positive and Negative Abnormal Returns by Regression Estimation

5.3.1) The Result of Hypothesis Testing for Runs of Positive Abnormal Return by Regression Estimation at 5% level of significance

Run length (months) (I)	Actual run counts	Sample Hazard rate $\hat{h}_i = \frac{N_i}{(M_i + N_i)}$
1	17	0.472
2	9	0.474
3	6	0.6
4	3	0.75
5	0	0
6	0	0
7	1	1

Table 5.4 Sample Hazard Rates for the Run of Positive Abnormal Returns

Table 5.4 reports the result of sample hazard rates of positive abnormal returns. Then, we perform tests of duration dependence by based on the logistic transformation of the log of i, $h_i = \frac{1}{1 + e^{-(\alpha + \beta Lni)}}$ The null hypothesis and alternative hypothesis are shown by the following:

H_0 : $\beta = 0$

(Constant hazard rate and no bubble and no duration dependence or the abnormal return is serially independent)

H_1 : $\beta < 0$

(Decreasing hazard rate and contain bubble and duration dependence)

After performing the test hypothesis, the results show that:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.317824	0.339540	-0.936043	0.4481
LOG(I)	0.805261	0.357449	2.252797	0.1531

R-squared 0.717318 **F-statistic** 5.075092

Durbin-Watson stat 1.982018 **Prob(F-statistic)** 0.153054

White Heteroscedasticity Test:

Obs*R-square 0.542418 **Probability** 0.762457

Table 5.5 The Regression Result for the Run of Positive Abnormal Returns

From table 5.5, the R-square is 0.717318 which can be interpreted that about 71.73 percent of the variation in the log of odd ratio is explained by the log of run length (*i*). And after identifying the econometric problems, we could not find any of them. The coefficient of log of run length (*i*) shows positive relationship between the log of odd ratio and log of run length (*i*) insignificantly at 5 percent level of significance, implying that the log of odd ratio increases when log of run length (*i*) increases insignificantly. When compared the result and the hypothesis, the result shown that the coefficient of log of run length (*i*) is not significantly different from zero, therefore, the no-bubble null hypothesis is not rejected or the log of odd ratio does not depend on the log of run length (*i*) at 5 % level of significance. Finally, it can be concluded that there is no duration dependence or the abnormal return is serially independent. Therefore, the duration dependence model cannot review or fail to show the bubble existence for the runs of positive abnormal returns.

5.3.2) The Result of Hypothesis Testing for Runs of Negative Abnormal Return by Regression Estimation at 5% level of significance

Run length (months) (I)	Actual run counts	Sample Hazard rate $\hat{h}_i = \frac{N_i}{(M_i + N_i)}$
1	20	0.541
2	10	0.588
3	2	0.286
4	1	0.2
5	3	0.75
6	1	1

Table 5.6 Sample Hazard Rates for the Run of Negative Abnormal Returns

Table 5.6 reports the result of sample hazard rates for negative abnormal returns. Then, we repeat the same procedure as for the run of positive abnormal returns and we obtain the following results:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.016847	1.009672	0.016685	0.9877
LOG(I)	-0.160154	0.906749	-0.176624	0.8711

R-squared	0.010292	**F-statistic**	0.031196
Durbin-Watson stat	2.027633	**Prob(F-statistic)**	0.871055
White Heteroscedasticity Test:			
Obs*R-square	4.929196	**Probability**	0.085043

Table 5.7 The Regression Result for the Run of Negative Abnormal Returns

From table 5.7, the R-square is 0.010292 which can be interpreted that about 1.03 percent of the variation in the log of odd ratio is explained by the log of run length (*i*). And after identifying the econometric problems, we could not find any of them. The coefficient of log of run length (*i)* shows negative relationship between the log of odd ratio and log of run length (*i)* insignificantly at 5 percent level of significance, implying that the log of odd ratio decreases when log of run length (*i)* increases insignificantly. When compared the result and the hypothesis, the result shown that the coefficient of log of run length (*i*) is not significantly different from zero, therefore, the no-bubble null hypothesis is not rejected or the log of odd ratio does not depend on the log of run length (*i*) at 5 % level of significance. Finally, it can be concluded that there is no duration dependence or the abnormal return is serially independent. Therefore, the duration dependence model cannot review or fail to show the bubble existence for the runs of negative abnormal returns.

5.4) The Result of Duration Dependence Hypothesis Testing for Runs of Positive and Negative Abnormal Returns by Logit Regression Estimation

5.4.1) The Result of Hypothesis Testing for Runs of Positive Abnormal Returns by Logit Regression Estimation at 5% level of significance

Log-Logistic Test

α	-0.128640
β	0.264615
LRT of H_0 : $\beta = 0$	0.372526
p-value	0.541630

The null hypothesis and alternative hypothesis are shown by the following:

H_0 : $\beta = 0$

(Constant hazard rate and no bubble and no duration dependence or the abnormal return is serially independent)

H_1 : $\beta < 0$

(Decreasing hazard rate and contain bubble and duration dependence)

From the result of log-logistic test, it shows that the no bubble null hypothesis is rejected with a 0.541630 *p*-value for the runs of positive abnormal returns at 5% level of significance. Hence, it can be concluded that there is no duration dependence or the abnormal return is serially independent. Therefore, the duration dependence model cannot review or fail to show the bubble existence for the runs of positive abnormal returns.

5.4.2) The Result of Hypothesis Testing for Runs of Negative Abnormal Returns by Logit Regression Estimation at 5% level of significance

Log-Logistic Test

α	0.162716
β	-0.159953
LRT of H_0 : $\beta = 0$	0.146162
p-value	0.702230

The null hypothesis and alternative hypothesis are shown by the following:

H_0 : $\beta = 0$

(Constant hazard rate and no bubble and no duration dependence or the abnormal return is serially independent)

H_1 : $\beta < 0$

(Decreasing hazard rate and contain bubble and duration dependence)

From the result of log-logistic test, it shows that the no bubble null hypothesis is rejected with a 0.702230 p-value for the runs of positive abnormal returns at 5% level of significance. Hence, it can be concluded that there is no duration dependence or the abnormal return is serially independent. Therefore, the duration dependence model cannot review or fail to show the bubble existence for the runs of negative abnormal returns.