CHAPTER 4

Empirical Results

The aim of this research is to empirically contrast the day of the week effect in the Information and Communication Technology Sector in ASEAN from April 4th 2011 to March 25th 2016producing 6,500 daily observations for study. The thesis uses ICT stock index for investigating the day of the week effect on expected daily returns. By employing the OLS approach along with the appropriately defined dummy variables and GARCH approach models will study not only the expected daily returns but also the daily volatility as well.

4.1 Results from unit root test

Unit root test is operated for testing the daily returns on ICT stock index in ASEAN markets whether a daily time series variable is stationary and does not possess a unit root. The unit root tests in this study are conducted testing the null hypothesis of stationary against the alternative hypothesis of non stationarity. In testing for the optimal lag lengths, the ADF tests are automatically selected by SIC[1] to eliminate the possibility of having autocorrelated errors.

The parameters are not constant: $X_t = \rho X_{t-1} + \varepsilon_t$ (4.1)

Assumption: $H_0 : \rho = 1$

$H_1 : |\rho| < 1$

If accept $H_0 : \rho = 1$, the data is not stationary

If reject $H_0 : \rho = 1$ or accept H1 : $|\rho| < 1$, the data is stationary

[1](SIC) : Schwartz Information Criterion, Min's the SIC is choose for the best model.

Null Hypothesis: H_0= time series is non-stationery

Alternative Hypothesis H_1 = time series is stationery

In the ADF unit root test, null hypothesis: H_0 is that time series data is approximately non-stationery. The null – hypothesis for an ADF test is that the data are non - stationarity Alternative hypothesis: H_1 is that time series data is stationery. If the test statistic of variables is less than critical value (Probability >0.1) or (Probability is 0.000-0.0900) is in absolute terms, and then the null hypotheses cannot be rejected If the absolute value of the test statistic is bigger than the critical value, the alternative hypothesis can state statistical significance and reject the null hypothesis root test.

ADF unit root test can be expressed as the following equations:

$$\Delta Y_t = \alpha_1 + \alpha_2 t + \alpha Y_{t-1} + \sum_{i=1}^{\delta-1} \alpha Y_{t-1} + \varepsilon_t \qquad (4.2)$$

$$\Delta Singapore_t = \alpha_0 + \alpha_1 t + \varphi Singapore_{t\text{-}1} + \sum_{i-1}^{\delta-1} \alpha\, \Delta Singapore_{t-1} + \varepsilon_t \qquad (4.3)$$

$$\Delta Thailand_t = \alpha_0 + \alpha_1 t + \varphi Thailand_{t\text{-}1} + \sum_{i-1}^{\delta-1} \alpha\, \Delta Thailand_{t-1} + \varepsilon_t \qquad (4.4)$$

$$\Delta Indonesia_t = \alpha_0 + \alpha_1 t + \varphi Indonesia_{t\text{-}1} + \sum_{i-1}^{\delta-1} \alpha\, \Delta Indonesia_{t-1} + \varepsilon_t \qquad (4.5)$$

$$\Delta Malaysia_t = \alpha_0 + \alpha_1 t + \varphi Malaysia_{t\text{-}1} + \sum_{i-1}^{\delta-1} \alpha\, \Delta Malaysia + \varepsilon_t \qquad (4.6)$$

$$\Delta Philippines_t = \alpha_0 + \alpha_1 t + \varphi Philippines_{t\text{-}1} + \sum_{i-1}^{\delta-1} \alpha\, \Delta Philippines_{t-1} + \varepsilon_t \qquad (4.7)$$

Where,

t denotes time series as period of the 2011-2016 (5 years)

n denotes lag term

ε_t denotes error term

$\Delta Singapore_t$ denotes a change of daily returns on ICT stock index of Singapore at time t and t-1

$\Delta Thailand_t$ denotes a change of daily returns on ICT stock index of Thailand at time t and t-1

$\Delta Indonesia_t$ denotes a change of daily returns on ICT stock index of Indonesia at time t and t-1

$\Delta Malaysia_t$ denotes a change of daily returns on ICT stock index of Malaysia at time t and t-1

$\Delta Philippines_t$ denotes a change of daily returns on ICT stock index of the Philippines at time t and t-1

The parameter of α_1 is the constant in model that is the test level and intercept. The parameter of α_2 is a coefficient of the time trend in the above model. If the model of unit root test is identified, the study explores to set the α_1 =0 and α_2 =0 to represent the time series data without constant and trend. Moreover, α_2 =0 represents trend data. The study explored to determine if the coefficient $Y_{t-1}$is stationary and non-stationary.

Table 4.1 displays the statistical test value of the daily returns on stock indices of Singapore, Thailand, Indonesia, Malaysia, and Philippines in the case of intercept and trend, intercept, and none. This investigation focuses on intercept and trend because it is more complete than intercept or only trend (Hacker and Hatemi-J, 2009). Daily returns as source data for financial time series exhibit trending behavior because econometric undertaking is to conclude the most suitable form of the trend pattern in the data.

4.1.1. Singapore

The underlying econometric model is assumed to have an intercept and a time trend. The result of ADF – test in terms of trend and intercept in Singapore is -37.8538. Mackinnon Critical Values at 1% is -3.9651.

ADF test statistic in intercept and trend is lower than Mackinon Critical Value at 1% significantly. Hence, the ADF test statistic reject the null hypothesis of a unit root test when log level $(I(0))$ is at the 1% level. As a result, ICT stock indices of Singapore is stationary.

4.1.2. Thailand

The result of ADF – test in terms of trend and intercept in Thailand is -36.1823. Mackinnon Critical Values at 1% is -3.9651, respectively.

ADF test statistic is lower than Mackinon Critical Value at 1% significantly. Hence, ADF test statistic reject the null hypothesis of a unit root test when log level (I(0)) in intercept and trend are at 1% level. As a result, ICT stock indices of Thailand is stationary.

4.1.3. Indonesia

The result of ADF – test in terms of trend and intercept in Indonesia is -21.9000. Mackinnon Critical Values at 1% is -3.9651, respectively.

ADF test statistic is lower than Mackinon Critical Value at 1% significantly. Hence, ADF test statistic reject the null hypothesis of a unit root test when log level (I(0)) in intercept and trend are at 1% levels. As a result, ICT stock indices of Indonesia is stationary.

4.1.4. Malaysia

The result of ADF – test in terms of trend and intercept in Malaysia is -23.0376. Mackinnon Critical Values at 1% is -3.9651, respectively.

ADF test statistic is lower than Mackinon Critical Value at 1% significantly. Hence, ADF test statistic reject the null hypothesis of a unit root test when log level (I(0)) in intercept and trend at 1% levels. As a result, ICT stock indices of Malaysia is stationary.

4.1.5. The Philippines

The result of ADF – test in terms of trend and intercept in the Philippines is -32.3055. Mackinnon Critical Values at 1% is -3.9651, respectively.

ADF test statistic is lower than Mackinon Critical Value at 1% significantly. Hence, ADF test statistic reject the null hypothesis of a unit root test when log level (I(0)) in intercept and trend at 1% levels. As a result, ICT stock indices of the Philippines is stationary.

Table 4.1 Results of unit root test in level

At level ; *I*(0)							
ICT stock returns indexin each countries	**lag**	**None**		**Intercept**		**Trend and Intercept**	
		ADF test Statistic	**% critical value**	**ADF test Statistic**	**% critical value**	**ADF test Statistic**	**% critical value**
SINGAPORE	**0**	**-37.85847*** **	**1% : -2.566743*** **	**-37.84886*** **	**1% : -3.435173*** **	**-37.85386*** **	**1% : -3.965126*** **
			5% : -1.941067* **		**5% : -2.863557*** **		**5% : -3.413274*** **
			10% : -1.616535* **		**10% : -2.567894*** **		**10% : -3.128662*** **
THAILAND	**0**	**-36.01593*** **	**1% : -2.566743*** **	**-36.02126*** **	**1% : -3.435173*** **	**-36.18234*** **	**1% : -3.965126*** **
			5% : -1.941067* **		**5% : -2.863557*** **		**5% : -3.413274*** **
			10% : -1.616535* **		**10% : -2.567894*** **		**10% : -3.128662*** **
INDONESIA	**3**	**-21.90257*** **	**1% : -2.566748*** **	**-21.90876*** **	**1% : -3.435184*** **	**-21.90002*** **	**1% : -3.965142*** **
			5% : -1.941068* **		**5% : -2.863562*** **		**5% : -3.413282*** **
			10% : -1.616535* **		**10% : -2.567896*** **		**10% : -3.128667*** **
MALAYSIA	**1**	**-22.95232*** **	**1% : -2.566745*** **	**-22.94393*** **	**1% : -3.435176*** **	**-23.03765*** **	**1% : -3.965131*** **
			5% : -1.941067* **		**5% : -2.863559*** **		**5% : -3.413277*** **
			10% : -1.616535* **		**10% : -2.567894*** **		**10% : -3.128663*** **
The PHILIPPINES	**0**	**-32.29036*** **	**1% : -2.566743*** **	**-32.27800*** **	**1% : -3.435176*** **	**-32.30559*** **	**1% : -3.965126*** **
			5% : -1.941067* **		**5% : -2.863557*** **		**5% : -3.413274*** **
			10% : -1.616535* **		**10% : -2.567894*** **		**10% : -3.128662*** **

Source: by calculation

Noted: Significance at the 1%, 5% and 10% levels denoted by ***, **, *, respectively.

4.2 Results of Ordinary Least Square (OLS) estimation and GARCH model

The question remains as to whether the presence of a day of the week is either perplexed or demonstrated by the day of the week effects. The overall large early daily returns[2] may be due to the excess returns earned in a day of the week[3]. It is well documented that much of the daily returns effect is noticeable to returns occurring in the day of the week. The expected overall returns for all markets were moderated, as anticipated. However, a positive daily effect was still present and significant at the 0.01 0.05 and 0.10 level in all markets but not the ICT stock returns index of Singapore and the Philippines. The appropriate day of the week effects in ICT stock markets of Thailand, Indonesia and Malaysia (can be seen in 4.2.1-4.2.3). Daily effect is present in the same markets and Singapore (can be seen in 4.2.4)/ the Philippines (see can be seen in 4.2.5) had an antithetical daily returns effect.

4.2.1. The results of investigating in ICT stock returns index of Thailand

This paper investigates the forecasting ability of three different models covering Ordinary Least Square (OLS) estimation and the GARCH models**.** The two GARCH models applied are the bivariate GARCH, and the Modified GARCH. The paper also parallels the anticipating ability of the non-GARCH model the bivariate GARCH models. The methodology of forecasting time-varying betas will be carried out in a number of footsteps. In the first footstep, the actual beta series will be constructed by Ordinary Least Square (OLS) estimation of ICT stock returns and the GARCH models, from April 4th 2011 to March 25th 2016 producing 6,500 daily observations for study. In the second footstep, the forecasting models will be used to forecast ICT stock returns based on the estimated time-varying betas and be paralleled in terms of forecasting accuracy. In the third and last step, the empirical results of performance of a number of models will be created on the basis of hypothesis tests whether the assessment is significantly different from the real value, which will make available confirmation for comparative analysis of evidences of different forecasting models.

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[2] A 'national' ICT index represents the performance of the ICT stock market of a given nation

[3] An asset's beta in the conditional CAPM can be expressed as the ratio of the conditional covariance between the forecast error in the asset's return, and the forecast's error of the market return and the conditional variance of the forecast error of the market return. (Wu)

4.2.1A Results of Ordinary Least Square (OLS)

After the data are stationary, the thesis used OLS estimation to analyze the data. OLS indicates the consistency of the error term's variance. Table 4.2.1 reports the outcomes based on highest volatility and corresponding highest return that the day of the week effect is present in the daily returns on ICT stock indices in Thailand. The residuals from a preliminary OLS estimation can be tested for ARCH. ARCH effect test used to model the data with time-varying volatility by using serial correlation LM test.[4]

The Chi-square probability of Thailand's stock market returns is 0.0948*. Hence, Thailand has a relation with time-varying volatility.

The ICT stock returns index of Thailand, displayed a significant effect. It is well documented that there is a day of the week effect, in the case of a Monday and a Friday effect (at 5%), and a significant negative effect (at 1%) in the case of a Tuesday and effect, a Thursday effect in daily returns on ICT stock indices in Thailand. Although the effect was a significant component of the overall a day of the week effect, the remaining weekly effect in this market which had significant overall a day of the week effect was still significant even with observations interested.

The highest return is observed on Monday and the lowest return is on Tuesday. The second highest return is observed is on Friday followed by Thursday. There is a strong evidence of a day of the week effect. ICT stock returns index was found to have significant evidence of a day of the week effect.

It was also determined that day of the week effect, although significant, results were capable of explaining the presence of day of the week effects. The daily returns on ICT stock indices of Thailand was to exist. However, the support is strong and the data is conclusive.

[4] Hypothesis Tests
H0: α = 0 data has not relation with time-varying volatility
H1: α ≠ 0 data has a relation with time-varying volatility

4.2.1B Results of GARCH model[5]

The thesis employed two different types of models for the returns and volatility. Return Equation chosen from the lowest SIC[6] and AIC. The first type studies a day of the week effect for only the return equation by using GARCH model[7]. The best structure based on this stock returns is GARCH (1, 3). Another type can be assessed by comparing the return forecasts by using Modified-GARCH (1, 3) investigated day of the week effect for returns.

Hypothesis Tests[8]

H_0: $\beta_i = 0$

There is not the time-varying conditional betas estimated that indicates no a dependence of successive stock returns index.

H_a: $\beta_i \neq 0$

There is the time-varying conditional betas estimated that indicates a dependence of successive stock returns index.

The daily returns on ICT stock indices in Thailand displayed a significant effect. It is well documented that there is a day of the week effect, in case of a Monday, and a significant negative effect (at 1%) in case of a Friday (-0.007414***) effect and a Tuesday (-0.135277***) effect, a Thursday (-0.019252***) effect in ICT stock returns index of Thailand. Although the effect was a significant component of the overall a day of the week effect, the remaining effect of daily returns on ICT stock indices in this market which had significant overall day of the week effect was still significant even with observations interested.

The highest daily returns on ICT stock indices in Thailand from GARCH model[9]was observed on Monday and the lowest return is on Tuesday. The second highest daily returns on ICT stock indices in Thailand is observed on Friday followed by

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[5]Model specification exhibits superior forecasting ability to traditional ARCH, exponentially weighted moving average and historical mean models, using daily ICT stock index returns of Thailand.

[6](SIC) : Schwartz Information Criterion, Min's the SIC is choose for the best model.

[7]weak dependence of successive asset price changes may be modelled by means of the GARCH model.

[8]The basic statistics indicate that the time-varying conditional betas estimated by means of the different GARCH models have positive and significant mean values.

[9]conditional betas have a wider range than those constructed by GARCH models

Thursday. There was strong evidence of a day of the week effect. There were found to have significant evidence of a day of the week effect.

It was also determined that, although significant, day of the week effect, results were capable of explaining the presence of day of the week effects that were the daily returns on stock indices of Thailand to exist. However, the support is strong and the data are conclusive.

Another type investigates the day of the week effect for both return and volatility equation by using Modified-GARCH (1, 3) which was compared the models using the lowest SIC[10] and AIC information criteria and by using hypothesis testing.

Hypothesis Tests in order to test whether two stylized facts are present: asymmetry in the error distributions and the leverage effect. Both methods found evidence that the two stylized facts are present in the series analyzed.

H_0: $\beta_i = 0$ and H_a: $\beta_i \neq 0$ [11](Wu)

The alternative hypothesis is accepted meaning that there is one relation between dependent variables as the leverage effectand independent as the error distributions that represented significance at the 1% level respectively. The calculated the ***, **, and * represent significance at 1%, 5% and 10% level respectively. In ICT stock returns index of Thailand, the null hypothesis is rejected meaning that there is asymmetry in the error distributions and the leverage effect on ICT stock indices in Thailand. The results show the leverage effecton ICT stock indices to provide somewhat more accurate forecasts than the other bivariate GARCH models in Thailand that the highest volatility is on Tuesday and the lowest volatility is on Thursday, Monday, respectively.

[10](SIC) : Schwartz Information Criterion, Min's the SIC is choose for the best model.

[11] Given the bivariate GARCH model of the log difference of the firm and the market indices presented above, the time-varying beta can be expressed as:

$$\beta t = \hat{H}12,t / \hat{H}22,t \qquad (4.8)$$

where $\hat{H}12,t$ is the estimated conditional variance between the log difference of the firm index and market index, and $\hat{H}$ 22,t is the estimated conditional variance of the log difference of the market index from the bivariate GARCH model. Given that conditional covariance is time-dependent, the beta will be time-dependent.

Table 4.2.1 Result of Ordinary Least Square (OLS) estimation and GARCH model of ICT stock returns index of Thailand

		OLS	GARCH(1,3)	Modified GARCH (1,3)
Return Equation	Monday	0.125040* (0.056119)	0.064297* (0.061672)	0.076258* (0.063878)
	Tuesday	-0.135277*** (0.057948)	-0.096113*** (0.054150)	-0.097021*** (0.054023)
	Thursday	-0.019252*** (0.061513)	-0.031573*** (0.053416)	-0.056826*** (0.052231)
	Friday	0.064899** (0.069678)	-0.007414*** (0.064295)	-0.003982*** (0.065753)
Volatility Equation	Monday			-0.001247*** (0.001554)
	Tuesday			0.002860** (0.001566)
	Thursday			-0.004558*** (0.001536)
	Friday			0.001170*** (0.001805)
	AIC	-5.097615	-5.332304	-5.333144
	SIC	-5.077718	-5.288530	-5.273452
	LM test	Prob. Chi-Square(13)		0.0948*

Noted: Standard errors are reported under the corresponding estimated coefficients, Significance at the 1%, 5% and 10% levels denoted by ***, **, *, respectively. (AIC): Akaike Information Criterion,

(SIC): Schwartz Information Criterion.If in this study AIC and SIC are not consistent, use SIC for deciding to choose the best model.

4.2.2. The results of investigating in ICT stock returns index of Indonesia

This paper investigates the forecasting ability of three different models covering Ordinary Least Square (OLS) estimation and the GARCH models**.** The two GARCH models applied are the bivariate GARCH, and the Modified GARCH. The paper also parallels the anticipating ability of the non-GARCH model the bivariate GARCH models. The methodology of forecasting time-varying betas will be carried out in a number of footsteps. In the first footstep, the actual beta series will be constructed by Ordinary Least Square (OLS) estimation of ICT stock returns and the GARCH models, from April 4th 2011 to March 25th 2016 producing 6,500 daily observations for study. In the second footstep, the forecasting models will be used to forecast ICT stock returns based on the estimated time-varying betas and be paralleled in terms of forecasting accuracy. In the third and last step, the empirical results of performance of a number of models will be created on the basis of hypothesis tests whether the assessment is significantly different from the real value, which will make available confirmation for comparative analysis of evidences of different forecasting models.

4.2.2A Results of Ordinary Least Square (OLS)

After the data is stationary, the thesis used OLS estimation to analyze the data. OLS indicates the consistency of the error term's variance. Table 4.2.2 reports the outcomes based on highest volatility and corresponding highest returnthat the day of the week effect is present in the daily returns on ICT stock indices in Indonesia. The residuals from a preliminary OLS estimation can betestedforARCH. ARCH effect test was empirically used to investigate the data with time-varying volatility by using serial correlation LM test.[12]

The Chi-square probability of Indonesia's stock market returns is 0.0013***. Hence, Indonesia has a relation with time-varying volatility.

[12] Hypothesis Tests
H0: α = 0 data has not relation with time-varying volatility
H1: α ≠ 0 data has a relation with time-varying volatility

The ICT stock returns index of Indonesia displayed a significant effect. It is well documented that there is a day of the week effect, in the case of a Tuesday (0.051747**) effect (at 5%) and a Thursday (0.093855*) effect (at 1%), and a significant negative effect (at 1%) in case of a Monday (-0.044958***) effect, a Friday (-0.101378***) effect in daily returns on ICT stock indices in Indonesia. Although the effect was a significant component of the overall day of the week effect, the remaining weekly effect in this market which had significant overall a day of the week effect was still significant even with observations interested.

The highest return was observed on Thursday (0.093855*) and the lowest return is on Friday (-0.101378***). The second highest return is observed on Tuesday (0.051747**) followed by Monday (-0.044958***). There is a strong evidence of a day of the week effect. ICT stock returns index was found to have significant evidence of a day of the week effect.

It was also determined that a day of the week effect, although significant, results were capable of explaining the presenceof day of the week effects that were the daily returns on stock indices of Indonesia to exist. However, the support strong and the data areconclusive.

4.2.2B Results of GARCH model[13]

Given the different methods available the empirical question to answer is which econometrical method provides the best forecast. The thesis employed two different types of models for the returns and volatility. Return Equation was chosen from the lowest SIC[14] and AIC. The first type studies the day of the week effect for only the return equation by using GARCH model[15]. The best structure based on this ICT stock returns index is GARCH (2, 1). Another type can be assessed by comparing the return forecasts by using Modified-GARCH (2, 1)investigated a day of the week effect for returns.

[13]Model specification exhibits superior forecasting ability to traditional ARCH, exponentially weighted moving average and historical mean models, using daily ICT stock index returns of Thailand.

[14](SIC) : Schwartz Information Criterion, Min's the SIC is choose for the best model.

[15]Weak dependence of successive asset price changes may be modelled by means of the GARCH model.

Hypothesis Tests[16]

H_0: $\beta_i = 0$

There is not the time-varying conditional betas estimated that indicates no a dependence of successive stock returns index.

H_a: $\beta_i \neq 0$

There is the time-varying conditional betas estimated that indicates a dependence of successive stock returns index.

The daily returns on ICT stock indices in Indonesia displayed a significant effect. It is well documented that there is a day of the week effect, in case of a Tuesday effect and a Thursday, and a significant negative effect (at 1%) in case of a Monday effect and a Friday effect in ICT stock returns index of Indonesia. Although the effect was a significant component of the overall a day of the week effect, the remaining effect of daily returns on ICT stock indices in this market which had significant overall a day of the week effect was still significant even with observations interested.

The highest daily returns on ICT stock indices in Indonesia from GARCH model[17]was observed on Thursday and the lowest return on Friday. The second highest daily returns on ICT stock indices in Thailand is observed is on Tuesday followed by Monday. There strong evidence of a day of the week effect. ICT stock returns index was found to have significant evidence of a day of the week effect.

It was also determined that, although significant, day of the week effect, results were capable of explaining the presences of a day of the week effects that were the daily returns on stock indices of Indonesia exist. However, the support strong and the data are conclusive.

Another type investigates the day of the week effect for both return and volatility equation by using Modified-GARCH (2, 1) which was choosen from the lowest SIC[18]and AIC.

[16]The basic statistics indicate that the time-varying conditional betas estimated by means of the different GARCH models have positive and significant mean values.

[17]conditional betas have a wider range than those constructed by GARCH models

[18](SIC) : Schwartz Information Criterion, Min's the SIC is choose for the best model.

Hypothesis Tests in order to test whether two stylized facts are present: asymmetry in the error distributions and the leverage effect. Both methods found evidence that the two stylized facts are present in the series analyzed.

H_0: $\beta_i = 0$ and H_a: $\beta_i \neq 0$ [19](Wu)

The alternative hypothesis is accepted meaning that there is one relation between the dependent variables as the daily returns of the week effect and independent as error terms that represented significance at the 1% level respectively. The calculated the ***, ** and * represent significance at 1%, 5% and 10% level respectively. In ICT stock returns index of Indonesia, the null hypothesis is rejected meaning that there is relationship between the dependent variables which is returns on ICT stock indices in Indonesia and the independent variables.

The results show a change of daily returns on ICT stock indices in Indonesia that the highest volatility is on Friday and the lowest volatility is on Monday, Thursday, Tuesday, respectively.

[19] Given the bivariate GARCH model of the log difference of the firm and the market indices presented above, the time-varying beta can be expressed as:

$$\beta t = \hat{H}12,t / \hat{H}22,t \qquad (4.9)$$

where $\hat{H}12,t$ is the estimated conditional variance between the log difference of the firm index and market index, and $\hat{H}$ 22,t is the estimated conditional variance of the log difference of the market index from the bivariate GARCH model. Given that conditional covariance is time-dependent, the beta will be time-dependent.

Table 4.2.2 Result of Ordinary Least Square (OLS) estimation and GARCH model of ICT stock returns index of Indonesia

		OLS	GARCH(2,1)	Modified GARCH (2,1)
Return Equation	Monday	0.051747** (0.058708)	-0.010044*** (0.057035)	-0.006358*** (0.056720)
	Tuesday	-0.044958*** (0.066080)	0.016900** (0.065412)	0.024678** (0.065275)
	Thursday	0.093855* (0.060501)	0.054562* (0.061099)	0.053495** (0.060307)
	Friday	-0.101378*** (0.059394)	-0.144486*** (0.056600)	-0.132545*** (0.056644)
Volatility Equation	Monday			-0.001738*** (0.001306)
	Tuesday			-0.000491*** (0.001326)
	Thursday			-0.001365*** (0.001379)
	Friday			-0.000283*** (0.001230)
	AIC	-5.267974	-5.419219	-5.415042
	SIC	-5.248077	-5.379424	-5.359329
	LM test	Prob. Chi-Square(13)		0.0013***

Noted: Standard errors are reported under the corresponding estimated coefficients, Significance at the 1%, 5% and 10% levels denoted by ***, **, *, respectively.(AIC): Akaike Information Criterion, (SIC): Schwartz Information Criterion. If in this study AIC and SIC are not consistent, use SIC for deciding to choose the best model.

4.2.3 The results of investigating in ICT stock returns index of Malaysia

This paper investigates the forecasting ability of three different models covering Ordinary Least Square (OLS) estimation and the GARCH models**.** The two GARCH models applied are the bivariate GARCH, and the Modified GARCH. The paper also parallels the anticipating ability of the non-GARCH model the bivariate GARCH models. The methodology of forecasting time-varying betas will be carried out in a number of footsteps. In the first footstep, the actual beta series will be constructed by Ordinary Least Square (OLS) estimation of ICT stock returns and the GARCH models, from April 4th 2011 to March 25th 2016 producing 6,500 daily observations for study. In the second footstep, the forecasting models will be used to forecast ICT stock returns based on the estimated time-varying betas and be paralleled in terms of forecasting accuracy. In the third and last step, the empirical results of performance of a number of models will be created on the basis of hypothesis tests whether the assessment is significantly different from the real value, which will make available confirmation for comparative analysis of evidences of different forecasting models.

4.2.3A Results of Ordinary Least Square (OLS)

After the data are stationary, the thesis used OLS estimation to analyze the data. OLS indicates the consistency of the error term's variance. Table 4.2.3 reports the outcomes based on highest volatility and corresponding highest return that the day of the week effect is present in the daily returns on ICT stock indices in Malaysia. The residuals from a preliminary OLS estimation can be tested for ARCH. ARCH effect test used to model the data with time-varying volatility by using serial correlation LM test.[20]

The Chi-square probability of Malaysia's stock market returns is 0.0003***. Hence, Malaysia has a relation with time-varying volatility.

The ICT stock returns index of Malaysia displayed a significant effect. It is well documented that there is a day of the week effect, in the case of a Friday and a Tuesday, and a significant negative effect (at 1%) in the case of a Monday effect, a Thursday effect in daily returns on ICT stock indices in Malaysia. Although the effect was a significant component of the overall day of the week effect, the remaining weekly effect in this

[20] Hypothesis Tests
H0: $\alpha = 0$ data has no relation with time-varying volatility
H1: $\alpha \neq 0$ data has a relation with time-varying volatility

market which had significance overall a day of the week effect was still significant even with observations interested.

The highest return is observed on Friday and the lowest return is on Thursday. The second highest return is observed on Tuesday followed by Monday. There is a strong evidence of a day of the week effect. ICT stock returns index was found to have significance evidence of a day of the week effect.

It was also determined that a day of the week effect, although significance, results were capable of explaining the presences of the day of the week effects that were the daily returns on stock indices of Malaysia to exist. However, the support strong and the data are conclusive.

4.2.1B Results of GARCH model[21]

The thesis employed two different types of models for the returns and volatility. Return Equation was chosen from the lowest SIC[22] and AIC. The first type studies a day of the week effect for only the return equation by using GARCH model[23]. The best structure based on this ICT stock returns index is GARCH (1, 1). Another type can be assessed by comparing the return forecasts by using Modified-GARCH (1, 1)investigated a day of the week effect for returns.

Hypothesis Tests[24]

H_0: $\beta_i = 0$

There is not the time-varying conditional betas estimated that indicates no a dependence of successive stock returns index

H_a: $\beta_i \neq 0$

There is the time-varying conditional betas estimated that indicates a dependence of successive stock returns index

The daily returns on ICT stock indices in Malaysia, displayed a significant effect. It is well documented that there is a day of the week effect, in case of a Tuesday, a Monday

[21]Model specification exhibits superior forecasting ability to traditional ARCH, exponentially weighted moving average and historical mean models, using daily ICT stock index returns of Thailand.
[22](SIC) : Schwartz Information Criterion, Min's the SIC is choose for the best model.
[23]Weak dependence of successive asset price changes may be modelled by means of the GARCH model.
[24]The basic statistics indicate that the time-varying conditional betas estimated by means of the different GARCH models have positive and significant mean values.

and a Friday, and a significance negative effect (at 1%) in case of a Thursday effect in ICT stock returns index of Malaysia. Although the effect was a significant component of the overall day of the week effect, the remaining effect of daily returns on ICT stock indices in this market which had significance overall the day of the week effect was still significance even with observations interested.

The highest daily returns on ICT stock indices in Malaysia from GARCH model[25]is observed on Friday and the lowest return on Thursday. The second highest daily returns on ICT stock indices in Thailand are observed is on Tuesday followed by Monday. There strong evidence of a day of the week effect. ICT stock returns index was found to have significance evidence of the day of the week effect.

It was also determined that a day of the week effect, although significance, results were capable of explaining the presences of the day of the week effects that were the daily returns on stock indices of Indonesia exist. However, the support strong and the data are conclusive.

Another type investigates the day of the week effect for both return and volatility equation by using Modified-GARCH (1, 1) which was choosen from the lowest SIC[26] and AIC.

[25]conditional betas have a wider range than those constructed by GARCH models
[26](SIC) : Schwartz Information Criterion, Min's the SIC is choose for the best model.

Hypothesis Tests in order to test whether two stylized facts are present: asymmetry in the error distributions and the leverage effect. Both methods found evidence that the two stylized facts are present in the series analyzed.

H_0: $\beta_i = 0$ and H_a: $\beta_i \neq 0$ [27](Wu)

The alternative hypothesis is accepted meaning that there is one relation between the dependent variables as the daily returns of the week effect and the independent as error terms that represented significance at the 1% level respectively. The calculated the ***, **, and * represent significantce at 1%, 5% and 10% level respectively. In ICT stock returns index of Malaysia, the null hypothesis is rejected meaning that there is asymmetry in the error distributions and the leverage effect on ICT stock indices in Thailand.

The results show a change of daily returns on ICT stock indices in Malaysia that the highest volatility is on Tuesday and the lowest volatility on Monday, Friday, and Thursday, respectively.

[27] Given the bivariate GARCH model of the log difference of the firm and the market indices presented above, the time-varying beta can be expressed as:

$$\beta t = \hat{H}12,t / \hat{H}22,t \qquad (4.10)$$

Where $\hat{H}12,t$ is the estimated conditional variance between the log difference of the firm index and market index, and $\hat{H}$ 22,t is the estimated conditional variance of the log difference of the market index from the bivariate GARCH model. Given that conditional covariance is time-dependent, the beta will be time-dependent.

Table 4.2.3 Result of Ordinary Least Square (OLS) estimation and GARCH model of ICT stock returns index of Malaysia

		OLS	GARCH(1,1)	Modified GARCH (1,1)
Return Equation	Monday	0.175339* (0.070474)	0.006029* (0.048935)	0.019512*** (0.031971)
	Tuesday	-0.060021*** (0.056102)	0.013059*** (0.041303)	0.038244** (0.028362)
	Thursday	-0.047527*** (0.063318)	-0.003823*** (0.045600)	0.009823*** (0.030717)
	Friday	0.070999* (0.058015)	0.056209** (0.043781)	0.052611** (0.032550)
Volatility Equation	Monday			-0.003557*** (0.001750)
	Tuesday			0.003769*** (0.001012)
	Thursday			0.001951*** (0.001747)
	Friday			-0.001294*** (0.001313)
	AIC	-6.467284	-6.720567	-6.664804
	SIC	-6.447386	-6.684751	-6.613071
	LM test	Prob. Chi-Square(13)		0.0003***

Noted: Standard errors are reported under the corresponding estimated coefficients, Significance at the 1%, 5% and 10% levels denoted by ***, **, *, respectively. (AIC): Akaike Information Criterion, (SIC): Schwartz Information Criterion.If in this study AIC and SIC are not consistent, use SIC for deciding to choose the best model.

Table 4.2.4 The comparison of the result from ICT stock indices of Thailand, Indonesia and Malaysia

Thailand					Indonesia					Malaysia				
		OLS	GARCH(1,3)	Modified GARCH (1,3)			OLS	GARCH(2,1)	Modified GARCH (2,1)			OLS	GARCH(1,1)	Modified GARCH (1,1)
Return Equation	Monday	0.125040* (0.056119)	0.064297* (0.061672)	0.076258* (0.063878)	Return Equation	Monday	0.051747** (0.058708)	-0.010044*** (0.057035)	-0.006358*** (0.056720)	Return Equation	Monday	0.175339* (0.070474)	0.006029* (0.048935)	0.019512*** (0.031971)
	Tuesday	-0.135277*** (0.057948)	-0.096113*** (0.054150)	-0.097021*** (0.054023)		Tuesday	-0.044958*** (0.066080)	0.016900** (0.065412)	0.024678** (0.065275)		Tuesday	-0.060021*** (0.056102)	0.013059*** (0.041303)	0.038244** (0.028362)
	Thursday	-0.019252*** (0.061513)	-0.031573*** (0.053416)	-0.056826*** (0.052231)		Thursday	0.093855* (0.060501)	0.054562* (0.061099)	0.053495** (0.060307)		Thursday	-0.047527*** (0.063318)	-0.003823*** (0.045600)	0.009823*** (0.030717)
	Friday	0.064899** (0.069678)	-0.007414*** (0.064295)	-0.003982*** (0.065753)		Friday	-0.101378*** (0.059394)	-0.144486*** (0.056600)	-0.132545*** (0.056644)		Friday	0.070999* (0.058015)	0.056209** (0.043781)	0.052611** (0.032550)
Volatility Equation	Monday			-0.001247*** (0.001554)	Volatility Equation	Monday			-0.001738*** (0.001306)	Volatility Equation	Monday			-0.003557*** (0.001750)
	Tuesday			0.002860** (0.001566)		Tuesday			-0.000491*** (0.001326)		Tuesday			0.003769*** (0.001012)
	Thursday			-0.004558*** (0.001536)		Thursday			-0.001365*** (0.001379)		Thursday			0.001951*** (0.001747)
	Friday			0.001170*** (0.001805)		Friday			-0.000283*** (0.001230)		Friday			-0.001294*** (0.001313)
	AIC	-5.097615	-5.332304	-5.333144		AIC	-5.267974	-5.419219	-5.415042		AIC	-6.467284	-6.720567	-6.664804
	SIC	-5.077718	-5.288530	-5.273452		SIC	-5.248077	-5.379424	-5.359329		SIC	-6.447386	-6.684751	-6.613071

Noted: Standard errors are reported under the corresponding estimated coefficients, Significance at the 1%, 5% and 10% levels denoted by ***, **, *, respectively.(AIC) :Akaike Information Criterion, (SIC) : Schwartz Information Criterion.If in this study AIC and SIC are not consistent, use SIC for deciding to choose the best model.

This paper investigates the nature and characteristics of stock market volatility in Thailand, displays characteristics related to those found in Indonesia and Malaysia emerging stock markets (can be seen in 4.2.5). Various volatility estimators and diagnostic tests indicate volatility combination, i.e., astonishments to the volatility process carry on and the response to news arrival is asymmetrical, meaning that the impact of worthy and immoral news is not the same. Suitable volatility forecast models are used for Thailand, Indonesia and Malaysia. The day-of-the-week effect for daily returns on ICT stock indices are obtainable while the return and volatility do show intra-day. The return and volatility on various day-of-the-week have to a certain degree different. There is mixed evidence of return and volatility spillover between the Thailand, Indonesia and Malaysia markets. The empirical findings would be worthwhile to investors, stock exchange administrators and policy makers by means of these provide evidence of time varying nature of stock market volatility in Thailand, Indonesia and Malaysia markets.

Specifically, policy makers need to consider the findings of the study. For the indices, among the day-of-the-week effect for daily returns on ICT stock indices, Table 4.2.4 reports that Malaysia exhibits highest volatility and corresponding highest returns. The day-of-the-week of Malaysia also exhibits significantly higher volatility but the magnitude is more significant as compared to Thailand, and Indonesia. This implies that, during these day-of-the-week of Malaysia, the conditional volatility tends to increase. This phenomenon could be recognized to probably the most significant economic event of the year[28].

The investors, therefore, should keep away from the market during day-of-the-week after having reserved expert should be stricter to keep excessive volatility under check fits in Malaysia herself. The shadowing regime at the stock exchanges around the financial plan. Similarly, the month of December gives high positive returns without high volatility and, therefore, offers good opportunity to the investors to make safe returns on Thailand, Indonesia and Malaysia markets.

[28] Table 4.2.4 reports the outcomes based on highest volatility and corresponding highest return that the day of the week effect is present in the daily returns on ICT stock indices in Malaysia.

On the contrary, the domestic investors and the stock exchange administrators do not need to lose sleep over turnings in Singapore and the Philippines markets since there is no conclusive evidence of consistent relationship between Singapore and the Philippines markets. The volatility forecast models presented for Singapore and the Philippines cannot be used. The situation is, therefore, not conclusive to investors. The day-of-the-week effect is not present. For other days in Singapore (can be seen in 4.2.5) and the Philippines (see can be seen in 4.2.6), the 'higher (lower) the risk, higher (lower) the return' statement does not hold consistently to provide higher returns with lower volatility making it a good day to invest.

4.2.5 The results of investigating in ICT stock returns index of Singapore

After the data is stationary, the thesis used OLS estimation to analyze the data. OLS does not indicate the consistency of the error term's variance. The Chi-square probability of ICT Singapore's stock market returns is 0.3512. Acceptance of the null hypothesis prove that μ is equal to H_0: $\alpha = 0$ data has no relation with time-varying volatility. The Chi-square probability of ICT Singapore's stock market returns is 0.3512. Hence, the null hypothesis is accepted. Accepting the null hypothesis of Singapore H0: $\alpha = 0$ data has no relation with time-varying volatility and indicates that the residuals are not serially correlated and the equation should be re-specified. ARCH effect test was used to model the data with time-varying volatility by using serial correlation LM test.[29]

Table 4.2.5 reports the outcome based on this model that the day of the week effect is present in the returns on in Singapore.

It is well documented that there is a day of the week effect, a Monday, a Tuesday, a Thursday and a Friday in ICT stock returns index of Singapore. The highest return is observed on Monday and the lowest return on Tuesday. The second highest return is observed is on Thursday, followed by Friday. There is not strong evidence of the day of the week effect. ICT stock returns index was found to have significant positive evidence of a day of the week effect.

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[29] Hypothesis Tests
H0: $\alpha = 0$ data has not relation with time-varying volatility
H1: $\alpha \neq 0$ data has a relation with time-varying volatility
Significance at the 1%, 5% and, 10% levels denoted by ***, **, *, respectively.

It was also determined that a day of the week effect, although significant, results were not capable of explaining the presences of a day of the week effects that were the daily returns on stock indices of Singapore exist. However, the support weak and the data are inconclusive.

The thesis employed two different types of model for the returns and volatility. The first type studied the day of the week effect for only the return equation by using GARCH model. The most structure based on this stock return is GARCH (1, 3) that choosing from the lowest SIC[30] and AIC.

The second model investigates the day of the week effect for both return and volatility equation by using Modified-GARCH (1, 3). In case of Singapore's ICT stock, the results show that the highest volatility is on Tuesday and the lowest volatility is on Monday, Thursday, and Friday, respectively.

[30](SIC) : Schwartz Information Criterion, Min's the SIC is choose for the best model.

Table 4.2.5. Result of Ordinary Least Square (OLS) estimation and GARCH model of ICT stock returns index of Singapore

		OLS	GARCH(1,3)	Modified GARCH (1,3)
Return Equation	Monday	0.016620** (0.065522)	-0.050459*** (0.068161)	-0.017891*** (0.055241)
	Tuesday	-0.085391*** (0.060289)	-0.107162*** (0.060648)	-0.123597*** (0.050527)
	Thursday	-0.032577*** (0.065483)	-0.043976*** (0.061002)	-0.014086*** (0.054283)
	Friday	-0.060873*** (0.055168)	-0.092706*** (0.070474)	-0.066151*** (0.040702)
Volatility Equation				
	Monday			-0.001255*** (0.001410)
	Tuesday			0.000396*** (0.001172)
	Thursday			-0.001159*** (0.001562)
	Friday			-0.000778*** (0.000902)
	AIC	-6.097939	-6.229546	-6.130693
	SIC	-6.078042	-6.185771	-6.071001
	LM test	Prob. Chi-Square(13)		0.3512

Noted: Standard errors are reported under the corresponding estimated coefficients, Significance at the 1%, 5% and 10% levels denoted by ***, **, *, respectively. (AIC) :Akaike Information Criterion, (SIC) : Schwartz Information Criterion. If in this study AIC and SIC are not consistent, use SIC for deciding to choose the best model.

4.2.6 The results of investigating in ICT stock returns index of the Philippines

After the data is stationary, the thesis used OLS estimation to analyze the data. OLS does not indicate the consistency of the error term's variance. The Chi-square probability of ICT the Philippines' stock market returns is 0.1176. Acceptance of the null hypothesis proves that μ is equal to H_0: α = 0 data has no relation with time-varying volatility. Hence, null hypothesis is accepted. Accepting the null hypothesis of the Philippines H_0: α = 0 data has no relation with time-varying volatility and indicates that the residuals are not serially correlated and the equation should be re-specified. ARCH effect test was used to model the data with time-varying volatility by using serial correlation LM test.[31]

Table 4.2.6 reports the outcome based on this model that the day of the week effect is present in the returns on ICT stock returns index in the Philippines.

It is well documented that there is a day of the week effect, a Monday, a Tuesday, a Thursday and a Friday in ICT stock returns index of the Philippines. The highest return observed on Tuesday and the lowest return is on Thursday. The second highest return observed is on Friday, followed by Monday. There is not strong evidence of a day of the week effect. There were found to have significant positive evidence of a day of the week effect.

It was also determined that a day of the week effect, although significant, was not capable of explaining the presences of a day of the week effects that were the daily returns on stock indices of the Philippines exist. However, the support is weak and the data are inconclusive.

The thesis employed two different types of models for the returns and volatility. The first type studied the day of the week effect for only the return equation by using GARCH model. The most structure based on this stock return is GARCH (1, 1) that choosing from the lowest SIC[32] and AIC.

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31 Hypothesis Tests
H0: α = 0 data has not relation with time-varying volatility
H1: α ≠ 0 data has a relation with time-varying volatility
Significance at the 1%, 5% and 10% levels denoted by ***, **, *, respectively.

32(SIC) : Schwartz Information Criterion, Min's the SIC is choose for the best model.

The second model investigates the day of the week effect for both return and volatility equation by using Modified-GARCH (1, 1). In case of the Philippines' ICT stock, the results show that the highest volatility is on Tuesday and the lowest volatility is on Thursday, Monday, and Friday, respectively.

Table 4.2.6 Result of Ordinary Least Square (OLS) estimation and GARCH model of ICT stock returns index of the Philippines

		OLS	GARCH(1,1)	Modified GARCH (1,1)
Return Equation	Monday	0.073072* (0.070474)	0.000155*** (0.070474)	-0.000249*** (0.024158)
	Tuesday	0.164370* (0.070474)	0.013252** (0.070474)	0.164229* (0.034516)
	Thursday	0.031813** (0.070474)	6.53E-05 (0.070474)	0.045402** (0.037985)
	Friday	0.131965* (0.070474)	0.125998* (0.070474)	0.131819* (0.031931)
Volatility Equation				
	Monday			-0.003144*** (0.002691)
	Tuesday			0.002088*** (0.002638)
	Thursday			-0.004643*** (0.002328)
	Friday			-0.002466*** (0.002622)
	AIC	-5.618902	-5.910547	-5.842335
	SIC	-5.599005	-5.858814	-5.774683
	LM test	Prob. Chi-Square(13)		0.1176

Noted: Standard errors are reported under the corresponding estimated coefficients, Significance at the 1%, 5% and 10% levels denoted by ***, **, *, respectively.(AIC): Akaike Information Criterion, (SIC) : Schwartz Information Criterion. If in this study AIC and SIC are not consistent, use SIC for deciding to choose the best model.