CHAPTER 3

Research Methodology

3.1 Calculation to Return of the Securities

3.1.1 To find stock price index of Thailand Stock Exchange (SET) by using following formula.

$$\text{SET Index} = \ln\left(\frac{SET_t}{SET_{t-1}}\right) \tag{33}$$

SET_t is closing price of stock price index of SET at t day on office hours and SET_{t-1} is closing price of stock price index of SET at before t day on office hours.

Calculate to return of Siam Cement Public Company Limited (SCC) asset:

$$R_{SCC} = \ln\left(\frac{SCC_t}{SCC_{t-1}}\right) \tag{34}$$

Where SCC_t is closing price of SCC at t day on office hours and SCC_{t-1} is closing price of SCC at before t day on office hours.

Calculate to return of Siam City Cement Public Company Limited (SCCC) asset:

$$R_{SCCC} = \ln\left(\frac{SCCC_t}{SCCC_{t-1}}\right) \tag{35}$$

Where $SCCC_t$ is closing price of SCCC at t day on office hours and SET_{t-1} is closing price of SCCC at before t day on office hours.

3.1.2 To find stock price index of Bursa Malaysia (MYX) by using following formula.

$$\text{MYX Index} = \ln\left(\frac{MYX_t}{MYX_{t-1}}\right) \quad (36)$$

Where MYX_t is closing price of stock price index of MYX at t day on office hours and MYX_{t-1} is closing price of stock price index of MYX at before t day on office hours.

Calculate to return of Gamuda Berhad (GAM) asset:

$$R_{GAM} = \ln\left(\frac{GAM_t}{GAM_{t-1}}\right) \quad (37)$$

Where GAM_t is closing price of GAM at t day on office hours and GAM_{t-1} is closing price of GAM at before t day on office hours.

Calculate to return of IJM Corporation Berhad (IJM) asset:

$$R_{JIM} = \ln\left(\frac{JIM_t}{JIM_{t-1}}\right) \quad (38)$$

Where JIM_t is closing price of JIM at t day on office hours and JIM_{t-1} is closing price of JIM at before t day on office hours.

3.1.3 To find stock price index of Singapore Exchange (SGX) by using following formula.

$$\text{SGX Index} = \ln\left(\frac{SGX_t}{SGX_{t-1}}\right) \quad (39)$$

Where SGX_t is closing price of stock price index of SGX at t day on office hours and SGX_{t-1} is closing price of stock price index of SGX at before t day on office hours.

Calculate to return of Chip Eng Seng Corperation Limited (CES) asset:

$$R_{CES} = \ln\left(\frac{CES_t}{CES_{t-1}}\right) \quad (40)$$

Where CES_t is closing price of CES at t day on office hours and CES_{t-1} is closing price of CES at before t day on office hours.

Calculate to return of Low KengHuat Limited (LKH) asset:

$$R_{LKH} = \ln\left(\frac{LKH_t}{LKH_{t-1}}\right) \quad (41)$$

Where LKH_t is closing price of LKH at t day on office hours and LKH_{t-1} is closing price of LKH at before t day on office hours.

3.2 Unit Root Test

Since the data in this study is time series data, which may be stationary or non-stationary, it needs to do a stationary test which are Augmented Dickey-Fuller test (ADF test) and Phillips-Perron test (PP test).

1.2.1 Augmented Dickey-Fuller test (ADF test)

Hypothesis:

SET H_0: Time series data of SET has non-stationary at t time
H_1: Time series data of SET has stationary at t time

SCC H_0: Time series data of SCC has non-stationary at t time
H_1: Time series data of SCC has stationary at t time

SCCC H_0: Time series data of SCCC has non-stationary at t time
H_1: Time series data of SCCC has stationary at t time

MYX H_0: Time series data of MYX has non-stationary at t time
H_1: Time series data of MYX has stationary at t time

GAM H_0: Time series data of GAM has non-stationary at t time
H_1: Time series data of GAM has stationary at t time

IJM H_0: Time series data of IJM has non-stationary at t time
H_1: Time series data of IJM has stationary at t time

SGX H_0: Time series data of SGX has non-stationary at t time
H_1: Time series data of SGX has stationary at t time

Z25 H_0: Time series data of Z25 has non-stationary at t time
H_1: Time series data of Z25 has stationary at t time

5IC H_0: Time series data of 5IC has non-stationary at t time

H_1: Time series data of 5IC has stationary at t time

1.2.2 Phillips-Perron test (PP test)

Hypothesis:

SET H_0: Time series data of SET has non-stationary at t time

H_1: Time series data of SET has stationary at t time

SCC H_0: Time series data of SCC has non-stationary at t time

H_1: Time series data of SCC has stationary at t time

SCCC H_0: Time series data of SCCC has non-stationary at t time

H_1: Time series data of SCCC has stationary at t time

MYX H_0: Time series data of MYX has non-stationary at t time

H_1: Time series data of MYX has stationary at t time

GAM H_0: Time series data of GAM has non-stationary at t time

H_1: Time series data of GAM has stationary at t time

IJM H_0: Time series data of IJM has non-stationary at t time

H_1: Time series data of IJM has stationary at t time

SGX H_0: Time series data of SGX has non-stationary at t time

H_1: Time series data of SGX has stationary at t time

Z25 H_0: Time series data of Z25 has non-stationary at t time

H_1: Time series data of Z25 has stationary at t time

5IC H_0: Time series data of 5IC has non-stationary at t time

H_1: Time series data of 5IC has stationary at t time

3.3 Bivariate Extreme Value Analysis

This analysis used R-Project to run 9 models, which 2 approximations of following methods:

3.3.1 Bivariate Generalized Extreme Value distribution (BGEV) using Bivariate Block Maxima Method: this approximation method used Block Maxima Method calculating with Maxima method to find maximum returns on natural logarithm in each variable a given time period. The maximum returns on natural logarithm were Siam Cement Public Company Limited (SCC) stock price, Siam City Cement Public Company Limited (SCCC) stock price, Gamuda Berhad (GAM) stock price, IJM Corporation Berhad (IJM) stock price, Chip Eng Seng Corperation Limited (CES) stock price, Low Keng Huat Limited (LKH) stock price. Besides, the natural logarithm returns on stock price index were from Thailand Stock Exchange (SET), Bursa Malaysia (MYX) and Singapore Exchange (SGX). Then, the finding of the Bivariate Extreme Value of stock price based on Bivariate Block Maxima Method models was done. That could generate the relationship model between SET with SCC, SET with SCCC, MYX with GAM, MYX with IJM, SGX with CES and SGX with LKH as follows;

$$\mathrm{E(SET,SCC)} = \exp\left\{\log\left(\mathrm{E_1(SET)E_2(SCC)}\right) \times \mathrm{A}\left(\frac{\log\left(\mathrm{E_2(SCC)}\right)}{\log\left(\mathrm{E_1(SET)E_2(SCC)}\right)}\right)\right\} \tag{42}$$

$$\mathrm{E(SET,SCCC)} = \exp\left\{\log\left(\mathrm{E_1(SET)E_2(SCCC)}\right) \times \mathrm{A}\left(\frac{\log\left(\mathrm{E_2(SCCC)}\right)}{\log\left(\mathrm{E_1(SET)E_2(SCCC)}\right)}\right)\right\} \tag{43}$$

By SET is stock price index of Thailand Stock Exchange.

SCC is stock price of Siam Cement Public Company Limited.

SCCC is stock price of Siam City Cement Public Company Limited.

$$\mathrm{E(MYX,GAM)} = \exp\left\{\log\left(\mathrm{E_1(MYX)E_2(GAM)}\right) \times \mathrm{A}\left(\frac{\log\left(\mathrm{E_2(GAM)}\right)}{\log\left(\mathrm{E_1(MYX)E_2(GAM)}\right)}\right)\right\} \tag{44}$$

$$\mathrm{E(MYX,IJM)} = \exp\left\{\log\left(\mathrm{E_1(MYX)E_2(IJM)}\right) \times \mathrm{A}\left(\frac{\log\left(\mathrm{E_2(IJM)}\right)}{\log\left(\mathrm{E_1(SET)E_2(IJM)}\right)}\right)\right\} \tag{45}$$

By MYX is stock price index of Bursa Malaysia.

GAM is stock price of Gamuda Berhad.

IJM is stock price of IJM Corporation Berhad.

$$E(SGX,CES) = \exp\left\{\log\left(E_1(SGX)E_2(CES)\right) \times A\left(\frac{\log\left(E_2(CES)\right)}{\log\left(E_1(SGX)E_2(CES)\right)}\right)\right\} \quad (46)$$

$$E(SGX,LKH) = \exp\left\{\log\left(E_1(SGX)E_2(LKH)\right) \times A\left(\frac{\log\left(E_2(LKH)\right)}{\log\left(E_1(SGX)E_2(LKH)\right)}\right)\right\} \quad (47)$$

By SGX is stock price index of Singapore Exchange.

CES is stock price of Chip Eng Seng Corperation Limited.

LKH is stock price of Low Keng Huat Limited.

3.3.2 Bivariate Generalized Pareto Distribution (BGPD) by using Bivariate Threshold Exceedances Method: this approximation method used Threshold Exceedances method which was choosing data to analyze and differentiated from Block Maxima Method. This method would set a Threshold value to determine an excess of that Threshold value. Then data was analyzed. In this study Threshold value was different depending on space of analyzed data.

1) Threshold value setting: This was the analysis of data over large Threshold value. Then, set Threshold value used Diagnostic Plot to observe from the point of the data began to change and at straight line data point. That set point Threshold value by setting the start Threshold value was a distribution of data x as follows;

$$F_u(y) = \Pr\{X - u \leq y|X > u\} = \frac{F(y+u)-F(u)}{1-F(u)} \quad (48)$$

By $F_u(y)$ is probability of x value, which more than Threshold value. Given y is x, which x more than start point (u). From Balkema and de Hann (1974) and Pickands (1975) show a high sufficient start point. Set formula is as follows;

SET: $$F_{u_1}(y_1) = \Pr\{X_1 - u_1 \leq y_1|X_1 > u_1\} = \frac{F(y_1+u_1)-F(u_1)}{1-F(u_1)} \quad (49)$$

SCC: $$F_{u_2}(y_2) = \Pr\{X_2 - u_2 \leq y_2|X_2 > u_2\} = \frac{F(y_2+u_2)-F(u_2)}{1-F(u_2)} \quad (50)$$

SCCC: $$F_{u_3}(y_3) = \Pr\{X_3 - u_3 \leq y_3|X_3 > u_3\} = \frac{F(y_3+u_3)-F(u_3)}{1-F(u_3)} \quad (51)$$

MYX: $$F_{u_4}(y_4) = \Pr\{X_4 - u_4 \leq y_4 | X_4 > u_4\} = \frac{F(y_4+u_4)-F(u_4)}{1-F(u_4)} \quad (52)$$

GAM: $$F_{u_5}(y_5) = \Pr\{X_5 - u_5 \leq y_5 | X_5 > u_5\} = \frac{F(y_5+u_5)-F(u_5)}{1-F(u_5)} \quad (53)$$

IJM: $$F_{u_6}(y_6) = \Pr\{X_6 - u_6 \leq y_6 | X_6 > u_6\} = \frac{F(y_6+u_6)-F(u_6)}{1-F(u_6)} \quad (54)$$

SGX: $$F_{u_7}(y_7) = \Pr\{X_7 - u_7 \leq y_7 | X_7 > u_7\} = \frac{F(y_7+u_7)-F(u_7)}{1-F(u_7)} \quad (55)$$

CES: $$F_{u_8}(y_8) = \Pr\{X_8 - u_8 \leq y_8 | X_8 > u_8\} = \frac{F(y_8+u_8)-F(u_8)}{1-F(u_8)} \quad (56)$$

LKH: $$F_{u_9}(y_9) = \Pr\{X_9 - u_9 \leq y_9 | X_9 > u_9\} = \frac{F(y_9+u_9)-F(u_9)}{1-F(u_9)} \quad (57)$$

2) Bivariate Threshold Exceedances Model: this was used to find the relationship which depending on the data, including maximum returns on natural logarithm of Siam Cement Public Company Limited (SCC) stock price, Siam City Cement Public Company Limited (SCCC) stock price, Gamuda Berhad (GAM) stock price, Ijm Corporation Berhad (IJM) stock price, Chip Eng Seng Corperation Limited (CES) stock price, Low Keng Huat Limited (LKH) stock price. And the natural logarithm returns on stock price index were from Stock Exchange of Thailand (SET), Bursa Malaysia (MYX), and Singapore Exchange (SGX) estimating by using Exceedance of Bivariate Extreme Value distribution, which used BGPD model type 1. Set of relationship is as follows;

$$E(SET,SCC) = \exp\{-V(SET,SCC)\},\ SET > 0,\ SCC > 0 \quad (58)$$

$$E(SET,SCCC) = \exp\{-V(SET,SCCC)\},\ SET > 0,\ SCCC > 0 \quad (59)$$

By SET is stock price index of Thailand Stock Exchange.

SCC is stock price of Siam Cement Public Company Limited.

SCCC is stock price of Siam City Cement Public Company Limited.

$$E(MYX,GAM) = \exp\{-V(MYX,GAM)\},\ MYX > 0,\ GAM > 0 \quad (60)$$

$$E(MYX,IJM) = \exp\{-V(MYX,IJM)\},\ MYX > 0,\ IJM > 0 \quad (61)$$

By MYX is stock price index of Bursa Malaysia.

GAM is stock price of GamudaBerhad.

IJM is stock price of IJM Corporation Berhad.

$$E(SGX,CES) = \exp\{-V(SGX,CES)\},\ SGX > 0,\ CES > 0 \qquad (62)$$

$$E(SGX,LKH) = \exp\{-V(SGX,LKH)\},\ SGX > 0,\ LKH > 0 \qquad (63)$$

By SGX is stock price index of Singapore Exchange.

CES is stock price of Chip Eng Seng Corperation Limited.

LKH is stock price of Low Keng Huat Limited.

3) Parametric Bivariate Extreme Value Distribution Model

Model 1 (M1): Model = “log” (Gumbel, 1960)

The bivariate logistic distribution function with parameter dep = r is

$$E(z_{SET},z_{SCC}) = \exp\left[\left(y_{SET}^{\frac{1}{r}} + y_{SCC}^{\frac{1}{r}}\right)^{r}\right] \qquad (64)$$

$$E(z_{SET},z_{SCCC}) = \exp\left[\left(y_{SET}^{\frac{1}{r}} + y_{SCCC}^{\frac{1}{r}}\right)^{r}\right] \qquad (65)$$

$$E(z_{MYX},z_{GAM}) = \exp\left[\left(y_{MYX}^{\frac{1}{r}} + y_{GAM}^{\frac{1}{r}}\right)^{r}\right] \qquad (66)$$

$$E(z_{MYX},z_{IJM}) = \exp\left[\left(y_{MYX}^{\frac{1}{r}} + y_{IJM}^{\frac{1}{r}}\right)^{r}\right] \qquad (67)$$

$$E(z_{SGX},z_{CES}) = \exp\left[\left(y_{SGX}^{\frac{1}{r}} + y_{CES}^{\frac{1}{r}}\right)^{r}\right] \qquad (68)$$

$$E(z_{SGX},z_{LKH}) = \exp\left[\left(y_{SGX}^{\frac{1}{r}} + y_{LKH}^{\frac{1}{r}}\right)^{r}\right] \qquad (69)$$

- where $0 < r \leq 1$. This is specific case of bivariate asymmetric logistic model.
- Complete dependence is obtained in the limit as r approaches zero.
- Independence is obtained r=1.

Model 2 (M2): Model = "alog"(Tawn, 1988)

The bivariate asymmetric logistic distribution function with parameter dep = r and asy = (t_{SET},$t_{SCC/SCCC}$ or t_{MYX},$t_{GAM/IJM}$ or t_{SGX},$t_{CES/LKH}$) is

$$E(z_{SET},z_{SCC}) = \exp\left\{-\left(1\text{-}t_{SET}\right)y_{SET}-\left(1\text{-}t_{SCC}\right)y_{SCC}-\left((t_{SET}y_{SET})^{\frac{1}{r}}+(t_{SCC}y_{SCC})^{\frac{1}{r}}\right)^{r}\right\} \quad (70)$$

$$E(z_{SET},z_{SCCC}) = \exp\left\{\begin{matrix}-\left(1\text{-}t_{SET}\right)y_{SET}-\left(1\text{-}t_{SCCC}\right)y_{SCCC}\\ -\left((t_{SET}y_{SET})^{\frac{1}{r}}+(t_{SCCC}y_{SCCC})^{\frac{1}{r}}\right)^{r}\end{matrix}\right\} \quad (71)$$

$$E(z_{MYX},z_{GAM}) = \exp\left\{\begin{matrix}-\left(1\text{-}t_{MYX}\right)y_{MYX}-\left(1\text{-}t_{GAM}\right)y_{GAM}\\ -\left((t_{MYX}y_{MYX})^{\frac{1}{r}}+(t_{GAM}y_{GAM})^{\frac{1}{r}}\right)^{r}\end{matrix}\right\} \quad (72)$$

$$E(z_{MYX},z_{IJM}) = \exp\left\{-\left(1\text{-}t_{MYX}\right)y_{MYX}-\left(1\text{-}t_{IJM}\right)y_{IJM}-\left((t_{MYX}y_{MYX})^{\frac{1}{r}}+\left(t_{IJM}y_{IJM}\right)^{\frac{1}{r}}\right)^{r}\right\} \quad (73)$$

$$E(z_{SGX},z_{CES}) = \exp\left\{-\left(1\text{-}t_{SGX}\right)y_{SGX}-\left(1\text{-}t_{CES}\right)y_{CES}-\left((t_{SGX}y_{SGX})^{\frac{1}{r}}+(t_{CES}y_{CES})^{\frac{1}{r}}\right)^{r}\right\} \quad (74)$$

$$E(z_{SGX},z_{LKH}) = \exp\left\{-\left(1\text{-}t_{SGX}\right)y_{SGX}-\left(1\text{-}t_{LKH}\right)y_{LKH}-\left((t_{SGX}y_{SGX})^{\frac{1}{r}}+(t_{LKH}y_{LKH})^{\frac{1}{r}}\right)^{r}\right\} \quad (75)$$

- where $0 < r \leq 1$ and $0 \leq t_{SET\,/\,MYX\,/\,SGX}$, $t_{SCC\,/\,SCCC\,,GAM\,/\,IJM\,,CES\,/\,LKH} \leq 1$, when $t_{SET\,/\,MYX\,/\,SGX} = t_{SCC\,/\,SCCC\,,GAM\,/\,IJM\,,CES\,/\,LKH} = 1$ asymmetric logistic model will equal to logistic model.
- Independence is obtained either r = 1, $t_{SET\,/\,MYX\,/\,SGX} = 0$ or $t_{SCC\,/\,SCCC\,,GAM\,/\,IJM\,,CES\,/\,LKH} = 0$.
- Complete dependence is obtained in the limit when $t_{SET\,/\,MYX\,/\,SGX} = t_{SCC\,/\,SCCC\,,GAM\,/\,IJM\,,CES\,/\,LKH} = 1$ and r approaches is zero.
- Different limit occurs when $t_{SET\,/\,MYX\,/\,SGX}$ and $t_{SCC\,/\,SCCC\,,GAM\,/\,IJM\,,CES\,/\,LKH}$ are fixed and r approaches 0.

Model 3 (M3): Model = "hr" (Husler and Reiss, 1989)

The Husler – Reiss's distribution function with parameter dep = r is

$$E(z_{SET},z_{SCC}) = \exp\left(-y_{SET}\text{Ø}\left\{r^{-1}+\frac{1}{2}r\left[\log\frac{y_{SET}}{y_{SCC}}\right]\right\}-y_{SCC}\text{Ø}\left\{r^{-1}+\frac{1}{2}r\left[\log\frac{y_{SCC}}{y_{SET}}\right]\right\}\right) \quad (76)$$

$$E(z_{SET},z_{SCCC}) = \exp\left(-y_{SET}\emptyset\left\{r^{-1}+\frac{1}{2}r\left[\log\frac{y_{SET}}{y_{SCCC}}\right]\right\}-y_{SCCC}\emptyset\left\{r^{-1}+\frac{1}{2}r\left[\log\frac{y_{SCCC}}{y_{SET}}\right]\right\}\right) \quad (77)$$

$$E(z_{MYX},z_{GAM}) = \exp\left(-y_{MYX}\emptyset\left\{r^{-1}+\frac{1}{2}r\left[\log\frac{y_{MYX}}{y_{GAM}}\right]\right\}-y_{GAM}\emptyset\left\{r^{-1}+\frac{1}{2}r\left[\log\frac{y_{GAM}}{y_{MYX}}\right]\right\}\right) \quad (78)$$

$$E(z_{MYX},z_{IJM}) = \exp\left(-y_{MYX}\emptyset\left\{r^{-1}+\frac{1}{2}r\left[\log\frac{y_{MYX}}{y_{IJM}}\right]\right\}-y_{IJM}\emptyset\left\{r^{-1}+\frac{1}{2}r\left[\log\frac{y_{IJM}}{y_{MYX}}\right]\right\}\right) \quad (79)$$

$$E(z_{SGX},z_{CES}) = \exp\left(-y_{SGX}\emptyset\left\{r^{-1}+\frac{1}{2}r\left[\log\frac{y_{SGX}}{y_{CES}}\right]\right\}-y_{CES}\emptyset\left\{r^{-1}+\frac{1}{2}r\left[\log\frac{y_{CES}}{y_{SGX}}\right]\right\}\right) \quad (80)$$

$$E(z_{SGX},z_{LKH}) = \exp\left(-y_{SGX}\emptyset\left\{r^{-1}+\frac{1}{2}r\left[\log\frac{y_{SGX}}{y_{LKH}}\right]\right\}-y_{LKH}\emptyset\left\{r^{-1}+\frac{1}{2}r\left[\log\frac{y_{LKH}}{y_{SGX}}\right]\right\}\right) \quad (81)$$

- where $\emptyset$ is standard normal distribution function and $r > 0$.
- Independence is obtained in the limit as r approaches 0.
- Complete dependence is obtained when r tends to infinity.

Model 4 (M4): Model = “neglog” (Galambos, 1975)

The bivariate negative logistic distribution function with parameter dep = r is

$$E(z_{SET},z_{SCC}) = \exp\left\{-y_{SET}-y_{SCC}+\left[y_{SET}^{-r}+y_{SCC}^{-r}\right]^{\frac{-1}{r}}\right\} \quad (82)$$

$$E(z_{SET},z_{SCCC}) = \exp\left\{-y_{SET}-y_{SCCC}+\left[y_{SET}^{-r}+y_{SCCC}^{-r}\right]^{\frac{-1}{r}}\right\} \quad (83)$$

$$E(z_{MYX},z_{GAM}) = \exp\left\{-y_{MYX}-y_{GAM}+\left[y_{MYX}^{-r}+y_{GAM}^{-r}\right]^{\frac{-1}{r}}\right\} \quad (84)$$

$$E(z_{MYX},z_{IJM}) = \exp\left\{-y_{MYX}-y_{IJM}+\left[y_{MYX}^{-r}+y_{IJM}^{-r}\right]^{\frac{-1}{r}}\right\} \quad (85)$$

$$E(z_{SGX},z_{CES}) = \exp\left\{-y_{SGX}-y_{CES}+\left[y_{SGX}^{-r}+y_{CES}^{-r}\right]^{\frac{-1}{r}}\right\} \quad (86)$$

$$E(z_{SGX},z_{LKH}) = \exp\left\{- y_{SGX} - y_{LKH} + \left[y_{SGX}^{-r} + y_{LKH}^{-r}\right]^{\frac{-1}{r}}\right\} \qquad (87)$$

- where r > 0, this is a special case of the bivariate asymmetric negative logistic model.
- Independence is obtained in the limit as r approaches 0.
- Complete dependence is obtained when r tends to infinity cited in Galambos's model (1975, Section 4).

Model 5 (M5): Model = "aneglog" (Joe, 1990)

The bivariate asymmetric negative logistic distribution function with parameter dep = r and asy = ($t_{SET\,/\,MYX\,/\,SGX}$, $t_{SCC\,/\,SCCC\,,GAM\,/\,IJM\,,CES\,/\,LKH}$) is

$$E(z_{SET},z_{SCC}) = \exp\left\{- y_{SET} - y_{SCC} + \left[(t_{SET}y_{SET})^{-r} + (t_{SCC}y_{SCC})^{-r}\right]^{\frac{-1}{r}}\right\} \qquad (88)$$

$$E(z_{SET},z_{SCCC}) = \exp\left\{- y_{SET} - y_{SCCC} + \left[(t_{SET}y_{SET})^{-r} + (t_{SCCC}y_{SCCC})^{-r}\right]^{\frac{-1}{r}}\right\} \qquad (89)$$

$$E(z_{MYX},z_{GAM}) = \exp\left\{- y_{MYX} - y_{GAM} + \left[(t_{MYX}y_{MYX})^{-r} + (t_{GAM}y_{GAM})^{-r}\right]^{\frac{-1}{r}}\right\} \qquad (90)$$

$$E(z_{MYX},z_{IJM}) = \exp\left\{- y_{MYX} - y_{IJM} + \left[(t_{MYX}y_{MYX})^{-r} + (t_{IJM}y_{IJM})^{-r}\right]^{\frac{-1}{r}}\right\} \qquad (91)$$

$$E(z_{SGX},z_{CES}) = \exp\left\{- y_{SGX} - y_{CES} + \left[(t_{SGX}y_{SGX})^{-r} + (t_{CES}y_{CES})^{-r}\right]^{\frac{-1}{r}}\right\} \qquad (92)$$

$$E(z_{SGX},z_{LKH}) = \exp\left\{- y_{SGX} - y_{LKH} + \left[(t_{SGX}y_{SGX})^{-r} + (t_{LKH}y_{LKH})^{-r}\right]^{\frac{-1}{r}}\right\} \qquad (93)$$

- where r > 0 and 0 < $t_{SET\,/\,MYX\,/\,SGX}$, $t_{SCC\,/\,SCCC\,,GAM\,/\,IJM\,,CES\,/\,LKH} \leq 1$,when $t_{SET\,/\,MYX\,/\,SGX}$ = $t_{SCC\,/\,SCCC\,,GAM\,/\,IJM\,,CES\,/\,LKH}$ =1 the asymmetric negative logistic model equal to the negative logistic.
- Independence is obtained when the limit as either r, $t_{SET\,/\,MYX\,/\,SGX}$ or $t_{SCC\,/\,SCCC\,,GAM\,/\,IJM\,,CES\,/\,LKH}$ approaches 0.
- Complete dependence is obtained when $t_{SET\,/\,MYX\,/\,SGX}$ = $t_{SCC\,/\,SCCC\,,GAM\,/\,IJM\,,CES\,/\,LKH}$ = 1 and r tends to infinity.

- Different limit occurs when $t_{SET / MYX / SGX}$ and $t_{SCC / SCCC ,GAM / IJM ,CES / LKH}$ are fixed and r tends to infinity cited from Joe (1990)'s model, who introduced a multivariate extreme value distribution which reduces $E(z_1,z_2)$ in the bivariate case.

Model 6 (M6): Model = "bilog" (Smith, 1990)

The bilogistic distribution function with parameter alpha = α and beta = β is

$$E(z_{SET},z_{SCC}) = \exp\left\{- y_{SET}q^{1-\alpha} - y_{SCC}(1-q)^{1-\beta}\right\} \quad (94)$$

$$E(z_{SET},z_{SCCC}) = \exp\left\{- y_{SET}q^{1-\alpha} - y_{SCCC}(1-q)^{1-\beta}\right\} \quad (95)$$

$$E(z_{MYX},z_{GAM}) = \exp\left\{- y_{MYX}q^{1-\alpha} - y_{GAM}(1-q)^{1-\beta}\right\} \quad (96)$$

$$E(z_{MYX},z_{IJM}) = \exp\left\{- y_{MYX}q^{1-\alpha} - y_{IJM}(1-q)^{1-\beta}\right\} \quad (97)$$

$$E(z_{SGX},z_{CES}) = \exp\left\{- y_{SGX}q^{1-\alpha} - y_{CES}(1-q)^{1-\beta}\right\} \quad (98)$$

$$E(z_{SGX},z_{LKH}) = \exp\left\{- y_{SGX}q^{1-\alpha} - y_{LKH}(1-q)^{1-\beta}\right\} \quad (99)$$

where $q = q(y_1,y_2; \alpha,\beta)$ is the root of equation

$$(1-\alpha)y_{SET}(1-q)^{\beta} - (1-\beta)y_{SCC}q^{\alpha} = 0 \quad (100)$$

$$(1-\alpha)y_{SET}(1-q)^{\beta} - (1-\beta)y_{SCCC}q^{\alpha} = 0 \quad (101)$$

$$(1-\alpha)y_{MYX}(1-q)^{\beta} - (1-\beta)y_{GAM}q^{\alpha} = 0 \quad (102)$$

$$(1-\alpha)y_{MYX}(1-q)^{\beta} - (1-\beta)y_{IJM}q^{\alpha} = 0 \quad (103)$$

$$(1-\alpha)y_{SGX}(1-q)^{\beta} - (1-\beta)y_{CES}q^{\alpha} = 0 \quad (104)$$

$$(1-\alpha)y_{SGX}(1-q)^{\beta} - (1-\beta)y_{LKH}q^{\alpha} = 0 \quad (105)$$

- $0 < \alpha, \beta < 1$, when $\alpha = \beta$ the bilogistic model equal to logistic model with the dependence parameter dep = $\alpha = \beta$.
- Complete dependence is obtained in the limit as $\alpha = \beta$ approaches 0.

- Independence is obtained when α = β as approaches 1and when one of α, β are fixed and the other approaches 1.
- Different limit occurs when one of α, β fixed and the other approaches 0, this bilogistic model is fitted in Smith (1990), which who first introduced.

Model 7 (M7): Model = "negbilog" (Coles and Tawn, 1994)

The negative bilogistic distribution function with parameter alpha = α and beta = β is

$$E(z_{SET},z_{SCC}) = \exp\left\{- y_{SET}- y_{SCC}+ y_{SET}q^{1+\alpha}+ y_{SCC}(1-q)^{1+\beta}\right\} \quad (106)$$

$$E(z_{SET},z_{SCCC}) = \exp\left\{- y_{SET}- y_{SCCC}+ y_{SET}q^{1+\alpha}+ y_{SCCC}(1-q)^{1+\beta}\right\} \quad (107)$$

$$E(z_{MYX},z_{GAM}) = \exp\left\{- y_{MYX}- y_{GAM}+ y_{MYX}q^{1+\alpha}+ y_{GAM}(1-q)^{1+\beta}\right\} \quad (108)$$

$$E(z_{MYX},z_{IJM}) = \exp\left\{- y_{MYX}- y_{IJM}+ y_{MYX}q^{1+\alpha}+ y_{IJM}(1-q)^{1+\beta}\right\} \quad (109)$$

$$E(z_{SGX},z_{CES}) = \exp\left\{- y_{SGX}- y_{CES}+ y_{SGX}q^{1+\alpha}+ y_{CES}(1-q)^{1+\beta}\right\} \quad (110)$$

$$E(z_{SGX},z_{LKH}) = \exp\left\{- y_{SGX}- y_{LKH}+ y_{SGX}q^{1+\alpha}+ y_{LKH}(1-q)^{1+\beta}\right\} \quad (111)$$

Where $q = q(y_1,y_2; \alpha,\beta)$ is the root of equation

$$(1- \alpha)y_{SET}q^{\alpha}- (1 - \beta)y_{SCC}(1-q)^{\beta} = 0 \quad (112)$$

$$(1- \alpha)y_{SET}q^{\alpha}- (1 - \beta)y_{SCCC}(1-q)^{\beta} = 0 \quad (113)$$

$$(1- \alpha)y_{MYX}q^{\alpha}- (1 - \beta)y_{GAM}(1-q)^{\beta} = 0 \quad (114)$$

$$(1- \alpha)y_{MYX}q^{\alpha}- (1 - \beta)y_{IJM}(1-q)^{\beta} = 0 \quad (115)$$

$$(1- \alpha)y_{SGX}q^{\alpha}- (1 - \beta)y_{CES}(1-q)^{\beta} = 0 \quad (116)$$

$$(1- \alpha)y_{SGX}q^{\alpha}- (1 - \beta)y_{LKH}(1-q)^{\beta} = 0 \quad (117)$$

- α> 0 and β> 0, when α = β the negative bilogistic model equal to negative logistic model with the dependence parameter dep = $\frac{1}{\alpha} = \frac{1}{\beta}$.
- Independence is obtained as α = β tends to infinity.
- Complete dependence is obtained in the limit as α = β approaches 0 and when one of α, β are fixed and the other tends to infinity.

- Different limit occur when one of α, β fixed and the other approaches 0.

Model 8 (M8): Model = “et” (Coles and Town, 1991)

The Coles-Town’s distribution function with parameter alpha = α> 0 and beta = β > 0 is

$$E(z_{SET},z_{SCC}) = \exp\{-y_{SET}[1 - Be(q;\alpha+1,\beta)] - y_{SCC}Be(q;\alpha,\beta+1)\} \quad (118)$$

$$E(z_{SET},z_{SCCC}) = \exp\{-y_{SET}[1 - Be(q;\alpha+1,\beta)] - y_{SCCC}Be(q;\alpha,\beta+1)\} \quad (119)$$

$$E(z_{MYX},z_{GAM}) = \exp\{-y_{MYX}[1 - Be(q;\alpha+1,\beta)] - y_{GAM}Be(q;\alpha,\beta+1)\} \quad (120)$$

$$E(z_{MYX},z_{IJM}) = \exp\{-y_{MYX}[1 - Be(q;\alpha+1,\beta)] - y_{IJM}Be(q;\alpha,\beta+1)\} \quad (121)$$

$$E(z_{SGX},z_{CES}) = \exp\{-y_{SGX}[1 - Be(q;\alpha+1,\beta)] - y_{CES}Be(q;\alpha,\beta+1)\} \quad (122)$$

$$E(z_{SGX},z_{LKH}) = \exp\{-y_{SGX}[1 - Be(q;\alpha+1,\beta)] - y_{LKH}Be(q;\alpha,\beta+1)\} \quad (123)$$

- where $q = \frac{\alpha y_{SCC\,/\,SCCC\,,GAM\,/\,IJM\,,CES\,/\,LKH}}{\alpha y_{SCC\,/\,SCCC\,,GAM\,/\,IJM\,,CES\,/\,LKH} + \beta y_{SET\,/\,MYX\,/\,SGX}}$ and Be(q; α,β), this is the beta distribution function evaluated at q with shape 1 = α and shape 2 = β.
- Independence is obtained as α = β as approaches 0.
- Complete dependence is obtained in the limit as α = β tends to infinity and when one of α, β is fixed and the other approaches are 0.
- Different limit occurs when one of α, β fixed and the other tends to infinity.

Model 9 (M9): Model = “amix” (Tawn, 1988)

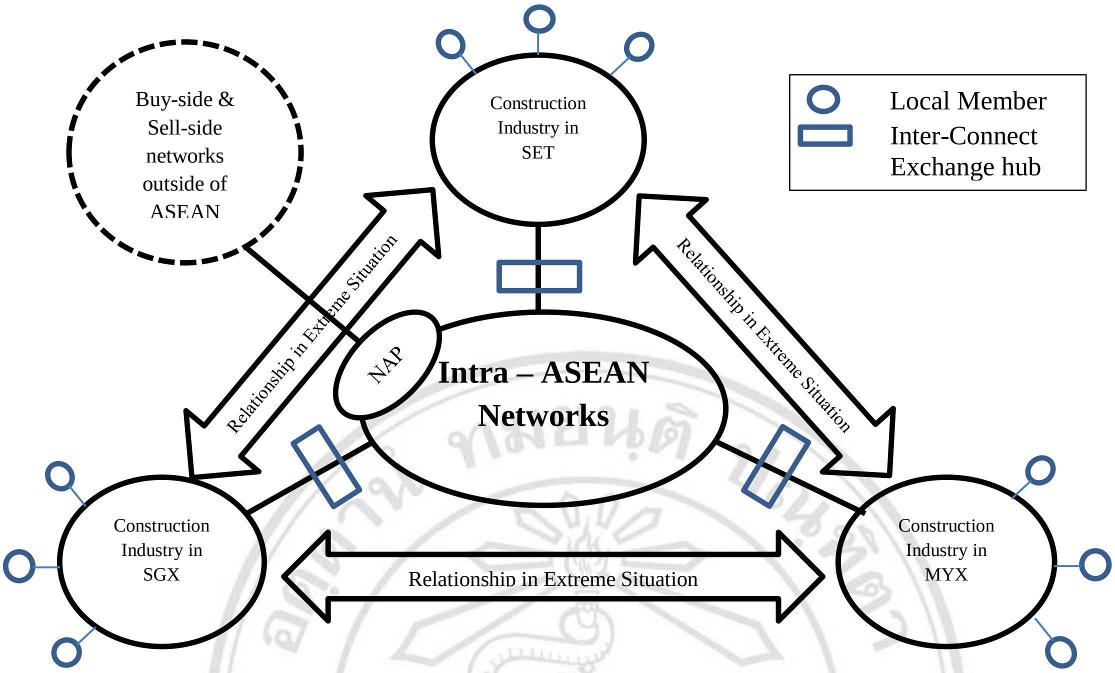
The asymmetric mixed distribution function with parameter alpha = α and beta = β has a dependence function with the following cubic polynomial from.

$$A(t) = 1-(\alpha+\beta)t + \alpha t^2 + \beta t^3 \quad (124)$$

- α and α is + 3β, this is non-negative and when α + β and α + 2β are less than or equal to 1.
- These constraints imply that beta lies in the interval [-0.5,-0.5] and when α line in the interval [0,1.5], which α can only be greater than 1 if beta is negative.
- Independence is obtained as both parameters are 0.
- Complete dependence cannot be obtained.
- The strength of dependence increases for increasing alpha (for fixed beta).
- For the definition of a dependence function, see above.

3.4 Conceptual Framework

In conceptual framework adapted from ASEAN Link, this thesis had an aim to study relationship between stock prices and stock indexes in chosen ASEAN Exchange. First, the process calculated the return of the securities. Next, Unit Root test was used to test time series data whether it was a stationary. Likewise, Augmented Dickey-Fuller test and Phillips-Perron test were used at the same way for testing time series data whether it was a stationary. Then, Bivariate Extreme Value analysis was divided into 2 types which were Bivariate Generalized Extreme Value distribution (BGEV) by using Bivariate Block Maxima Method and Bivariate Generalized Pareto Distribution (BGPD) by using Bivariate Threshold Exceedances Method. The analysis ran by R program to test the relationship between the securities and the stock market. If the result from the data is significantly related, investors should consider risk by using a Risk Management and COSO. Moreover, investors should pay attention to age range of investors and financial market for choosing investment in reasonable securities. Conversely, if the result hasn't related or has no relationship, investors should consider all risks before investing. After that, investors can trade interesting securities from Inter-Connect Exchange Hub or Neutral Access Point (NAP) and trade cross global networks. And local members are the companies.



Source: Adapted from http://www.set.or.th/th/asean_exchanges/asean_link.html

Figure 3.1: Conceptual Framework