CHAPTER 2

Theoretical Foundation and Literature Review

2.1 Financial Market Theory

2.1.1 In terms of financial market, the investment can be generally classified into two types which are Financial Asset and Non-Financial Asset. The investment in financial assets is an act through financial markets which are created and developed to support the trading of financial assets. That provides investors with a convenient and accessible way to invest in financial assets, and makes the evolution of financial markets continued. The financial markets are now able to offer a financial asset or financial instrument that is diverse and complex. This will satisfy the investors and the objective of the investment is more spacious. Therefore, financial market is a market to mobilize savings and short-term credit in money market and financial activities such as transfer of funds, securities trading, fund supply for businesses, the credit to individuals, businesses, and governments. Financial market is divided into two categories as follows (Yangyuen, 2013).

1) Money Market is the market for trading financial securities which not more than one year. It includes bill of exchange, promissory notes, certificates of deposit, financial negotiable note, etc. The objectives of this kind of market are providing short-term loans and rotating internal affairs.

2) Capital Market is the market for trading financial securities more than one year. They are common stock, debenture, government bond, etc. The objective is offering funds to long-term projects. These are the examples of capital markets;

2.1) Stock market is the market for trading financial securities which is the capital of the company. The equity securities holders of the company will represent ownership of the entity such as common stock, preferred stock, etc.

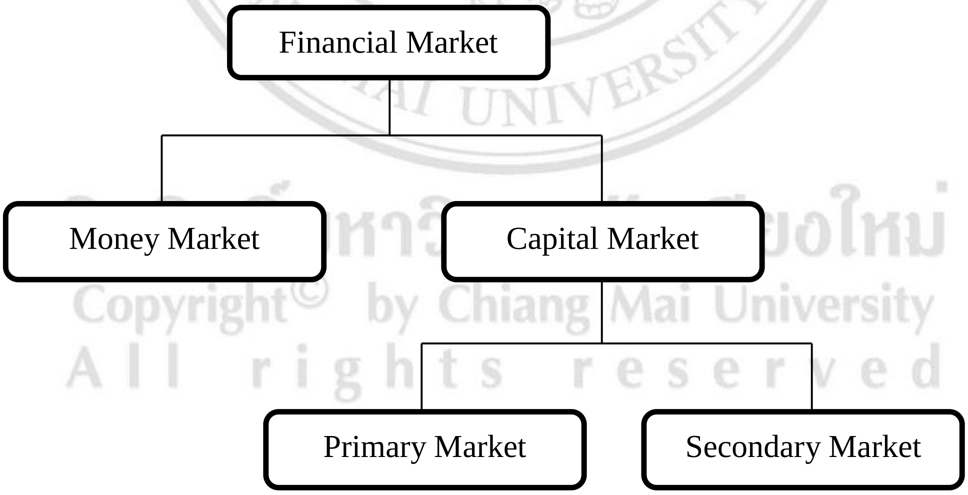
2.2) Debt market is the market for trading financial securities. To clarify, issuers act as debtors and the holders act as creditors. The government bond, agency bond, debenture are examples of debt market.

2.3) Derivative market is a financial market that relates and refers to an equity instrument and a bond. It is a tool for reducing risk from investment in options and futures.

Besides, the capital market is divided into two types;

1) Primary market means the issuer directly sells many types of financial instruments to the investors that are done for the first time.

2) Secondary market is trading many the financial instruments from primary market. If the secondary market of any financial instruments has high liquidity, investors can flexibly trade financial instruments that brings about the interesting financial instruments.



Source: Introducing Broker Agent: IBA (2014)

Figure 2.1: Financial market structure

2.1.2 By investment theory, the investment in economics means the resources are utilized to produce products and services which are counted as a real investment. Investment concerns about considering the benefits gained from the products or services whether the marginal cost of investment is worthy. However, it must depend on the received benefits. That is to say, if the cost-effective goes well but the benefit is less than the cost, it means the investment is poor. In general, the investment involves a risk. High return rate has a higher risk but it is not necessary for higher risk to give a high return rate. Most investors should invest in less risk if return rate is equal, but if it turns out that the risk is equal, then investors should invest more return rate. Thus, investors should consider the investment cautiously. This is because the return rate in the past cannot guarantee the return rate in the future. Investors should study the information, related information, and learn about investment data. The investment is composed of 3 following factors (Maneerat, 2007).

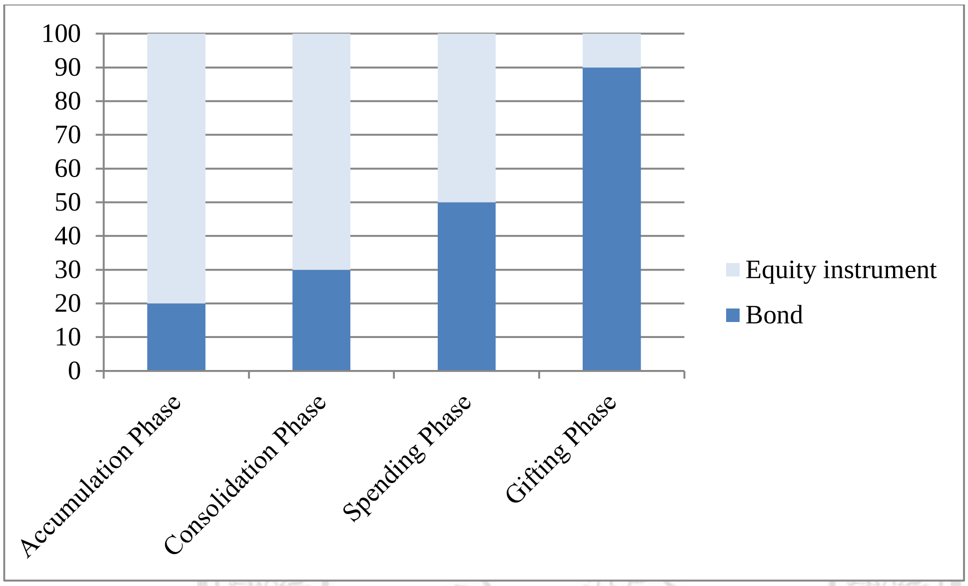
1) Income: it is the receiving reward that is the money at a desired time such as earnings per share from operations during the period, interest from bonds or debentures, etc.

2) Capital appreciation: it refers to the growth rate of investment over the period of the initial investment. In growing business, the common stock will provide a relative high return. The receiving return is a profit from stock sales. However, this is uncertain. It depends on the operating policy and the company's investment environment.

3) Safety: the investors must examine the uncertainty of the investment. Wherefore, whatever kind of investment is, the investors should attentively consider the uncertainty (First step into investment in stock market, 2002).

In the investment, investors must accept the risk. The appropriate levels of risk are various depending on the age of the investors. Nowadays, the number of new investors in stock market increases. With a certain period of money accumulation, most of them often invest in securities that have a high risk and expect high return. Then, if the investment does not go well, they are still able to accumulate new assets. On the other hand, the old investors often invest in securities that have a low risk while the chance of accumulation assets is less.

The bar graph below shows the age range of investors. This theory represents investors' behavior in each investment stage which can be divided as follows (Chutinunwarodom, 2013).



Source: Finansa Wealth Management (2013).

Figure 2.2: The age range of investors.

1) Stage 1: accumulation phase is an early stage of life with the beginning of working and the investors have started accumulating money. During this period, the investors may have liabilities more than holding assets. Also, the income is still low, but it will be increasing in the future because they need to buy or own some assets such as cars, houses, etc. Investors in this stage can start accumulating new assets if the investment is not successful. These groups of investors are still young and have a second chance to re-invest. From the graph, it indicates that the ratio of appropriate investment for this age range is 20 % of bond investment and 80 % of equity instrument.

2) Stage 2: consolidation phase means the period that most investors begin to have a complete family and the financial status becomes more stable. To start a family, it means lots of expenses are waiting such as common household expense, expenses for children, and future saving for their children. Therefore, investors should reduce risk in their investments. The ratio of appropriate investment for this age range is 30 % of bond investments and 70 % of equity instrument.

3) Stage 3: spending phase means most investors whose financial status is stable. These investors plan to get early retirement. Most expenses are spent for a family and education of their children. However, although these investors have a strong financial status, the remaining time for savings before retirement is less. Thus investors should reduce their stakes in the high-risk assets. They should increase the investment in low risk assets which give a consistent return instead. The ratio of appropriate investment for this age range is investing in bond 50 to 70 % and equity instrument 30 to 50 %.

4) Stage 4: gifting phase refers to the investors who have already retired. Their children have a job. The expenses are greatly reduced while they don't have income from work. Accordingly, investors should reduce investing in the assets which have a high risk. On the contrary, they should invest in the assets that provide consistent returns. The ratio of appropriate investment for this age range is 90 % of bond investment and 10 % of equity instrument.

Therefore, the suitable investment should be considered both risk factors and the age range of investment. By doing this, it helps reduce risk and also increases the efficiency of investment. Apart from these factors, the investors should consider other factors such as political situation in that country and so on. These factors should be contemplated because they can affect the investment. Moreover, the investors should study background and information of the company which they want to invest in order to achieve the investment efficiency and ultimate goal regarding to their anticipations (Chutinunwarodom, 2013).

2.2 Risk Management Theory

Investors cannot avoid the risk but investors are able to reduce the risk which depends on factors of reducing risk. Investors should study the approach to manage the risk for the effective investment. The risk management includes mitigating any risk that may occur in the future or responding to it instantly. Investors should study the risk management in the organization which they want to invest. It can be said that if the organization has an ability to manage the risk, the efficient investment will follow. Indeed, ASEAN does not have a high public debt like other economic zones. That is because ASEAN uses balanced policy every year thus the economic crisis is hard to occur. As ASEAN major trading partners, the United States and Europe have reduced purchasing power so it has a negative effect on ASEAN export. The global economic crisis has a negative effect on ASEAN economy as well. These are the risks for ASEAN therefore the investors should follow the news (Sangkanonkkul, 2013).

Investors should analyze the Bivariate Value to see the relationship of securities and the stock market. After that, investors should implement the risk management in order to reduce the risks and control it to the acceptable level.

Committee of Sponsoring Organization of the Tread Way Commission (COSO) mentioned about enterprise risk management that it is a process of formulating strategy for risk identification that has an impact on the organization. This process can also help manage the risk into acceptable level for the organization and the management can assure that the set goals will be achieved. Everyone in the organization has a role to participate in risk managing plan such as the board, administrators, and all employees. This research has adopted the concept of COSO to use for study which are divided into 3 categories as follows (Prukthada, 2005);

2.2.1 Internal Environment is an important basis for the risk management framework. This environment influences the strategy and goal of the organization and customizes activities, identification, assessment, and risk management. Internal environment consists of several factors such as ethics, executive function methods, the philosophy, and culture of risk management. Risk Appetite is the most important part of internal environment and it influences the strategies to be implemented for returns and growth. Each strategy has different risks. The risk management strategy can help administrators to determine acceptable risk of the organization.

2.2.2 Risk Management Process**:** administrators must plan and perform according to the following steps.

1) Objective setting: this is the first step for risk management process. Organizations should ensure that established objectives are consistent with the strategic objectives and the risk that affects the organization is accepted. Generally, objectives

and strategies should be recorded in writing in order to be a clear reference for all parties involved.

2) Event identification**:** the business often encounters uncertain situations and the organization is not able to identify which situation will occur. In the process of identifying, the administrators should consider several elements such as the risk factors that may occur, sources of risk both internal and external, and the relationship between the incidents.

3) Risk assessment**:** this step is focused on assessing the likelihood and consequences of events which may occur in low impact. The continuous incident may have an impact on high-level objectives. Risk assessment can be qualitative and quantitative evaluation by considering the entire external and internal of the organization. In addition, the risk assessment should be performed in inherent risk and after risk management.

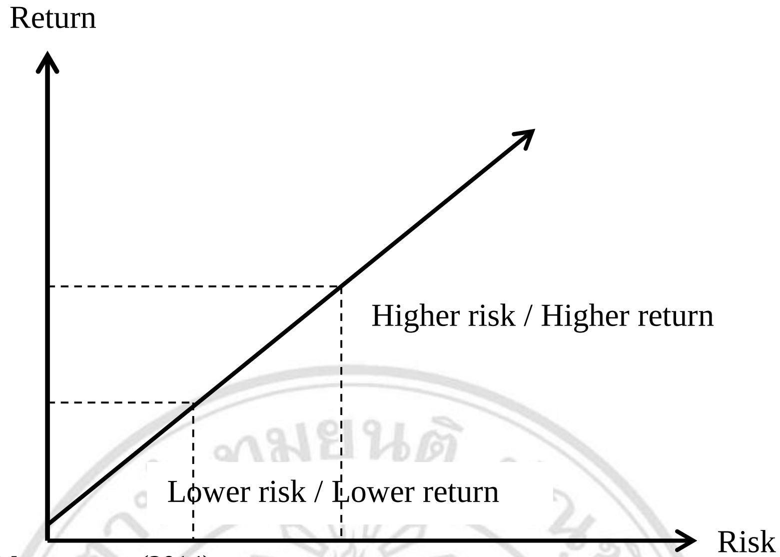
4) Risk response**:** the risks have been identified and assessed the importance. The administrators must assess the risk management process, which can put into action and manage those risks. To consider alternatives in the operation, the acceptable risk and the comparison of cost and benefit should be taken into account. The administrators may need to choose any risk management process or a combination of process that can decrease the likelihood and impact of events in the organization to the acceptable level. There are 4 risk reactions as follows;

4.1) Avoid the risk is an operation to avoid events that cause a risk. The administrators may decide to take some actions. Avoiding some risks can reduce the damage.

4.2) Share the risk by joining other organizations in order to share the responsibility of managing risk.

4.3) Reduce the risk is additional action to reduce the likelihood or impact of any risks to an acceptable level.

4.4) Accept the risk means the acceptance of current risk without actions.



Source: MFC Asset Management (2014)

Figure 2.3: Level of return on investment in securities.

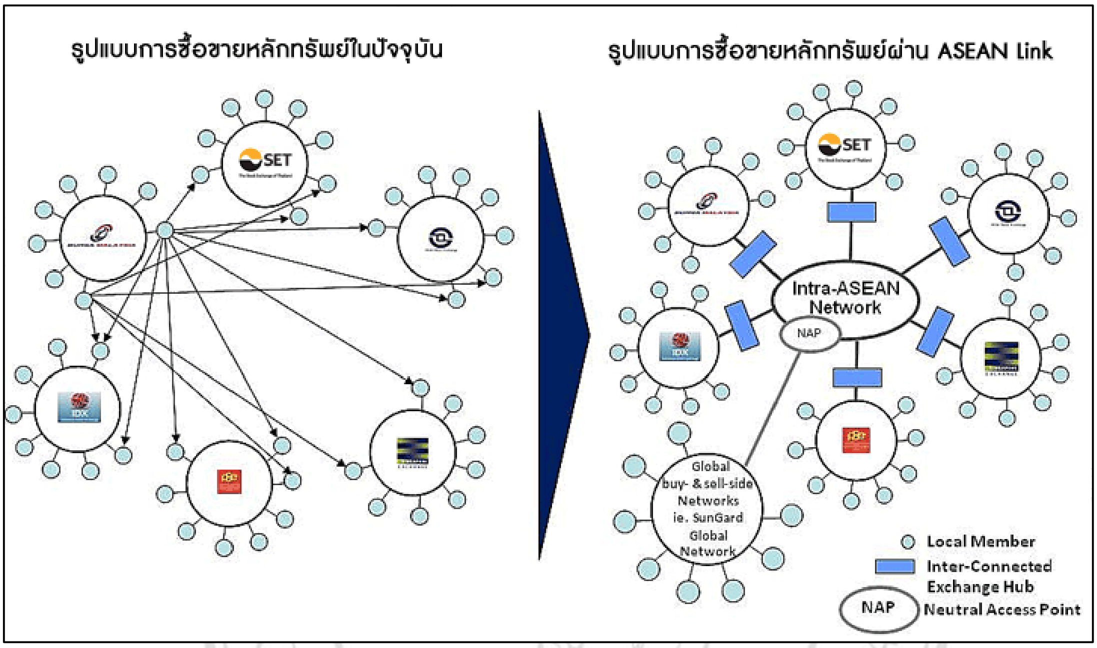
5) Control activities are the policies and operations that ensure the risk management. This is because each organization has its own objectives and specific technical implementations thus the controls of activities are different. The controls are a reflection of the internal environment, nature of the organization, and culture of the organization.

6) Monitoring is a measure to control the quality of risk management. The administrators should conduct this measure regularly to respond to the changes in a timely manner because the business has changed all the time. Hence, it requires appropriate measures to determine whether it is a temporary or continuous.

2.2.3 Information & communication: information is essential for organizations to identify, assess, and manage risks. Internal and external information of organization should be recorded and communicated suitably, both in form and in time to help related personnel to respond immediately and efficiently.

The efficient risk management should use the information from the past and present to consider. Historical data shows that actual performance comparing to target conveys the trend of events helps predict future performance. Data in the past can provide early warning about the risks that may arise. The current data are useful for administrators to consider the risks involved in the process line or agency. This allows organizations to modify the control activities as necessaries which provide an acceptable risk.

2.3 ASEAN Link



Source: The Stock Exchange of Thailand (2014).

Figure 2.4: ASEAN Trading Link

ASEAN Link is the connection of trading system of stock markets in ASEAN. Investors can trade across countries which help increasing efficiency of trading securities. Investors can trade, make a payment, transfer securities, and distribute data by local brokers. However, this system connects trading system which is Inter-Connected Exchange Hub as gateway in order to route and broadcast market data (The Stock Exchange of Thailand, 2015).

2.4 Econometrics

2.4.1 Unit Root Test: Unit root test is a statistical test of time series to see whether data variable is stationary [integrated of order d = I(d), d>0] . Property of the stationary is the mean variance and covariance depending on the lag between period of times. If the features change over the time, it is non-stationary [integrated of order 0 = I(0)]. The equations are as follows (Kanjanaudomkarn, 2010):

Mean: $E(X_t) = \text{constant} = \mu$ (1)

Variance: $V(X_t) = \text{constant} = \sigma^2$ (2)

Covariance: $COV(X_t, X_{t+k}) = E(X_t-\mu)(X_{t+k} - \mu) = \sigma_k - \mu$ (3)

By X_t is Time series data

Therefore, it is important to test if the variable is stationary or not. It means this is a unit root test or not if using time series data.

2.4.2 Augmented Dickey-Fuller test (ADF): Augmented Dickey-Fuller (ADF) test is a test method by adding autoregressive process in the regression process of the variable Dickey-Fuller test (DF). ADF test is a test case of serial correlation in the error term (e_t). The term lagged change into the equation are as follows;

Non-constant & Time trend case: $\Delta X_t = \theta X_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Xt\text{-}1 + e_t$ (4)

Constant case: $\Delta X_t = \alpha + \theta X_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Xt\text{-}1 + e_t$ (5)

Constant & Time trend case: $\Delta X_t = \alpha + \beta_t + \theta X_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Xt\text{-}1 + e_t$ (6)

By hypothesis:

$H_0 : \theta = 0$ if accept H_0, X_t is stationary or unit root

$H_1 : \theta < 0$ if accept H_1, X_t is non-stationary or non-unit root

In the stationary test, ADF test developed from DF test for serial correlation by t-statistic from calculating and comparing with appropriate values which presents in Dickey-Fuller tables (Enders, 1995) or MacKinnon critical values (Gujarati, 1995 cited in Sriboonjit, 2004).

2.4.3 Phillips-Perron test (PP test): Phillips and Perron (1988) developed from unit root test for analyzing time series data. PP test will use serial correlation and Heteroskedasticity in error term. PP test can be general from of Heteroskedasticity in the error term over ADF test and does not have to specify a lag length for the test regression. ADF test uses auto regression nearly from ARMA, but Phillips-Perron doesn't need serial correlation in regression test. The Phillips-Perron test involves with fitting the regression:

$$y_i = \alpha + \rho y_{i-1} + \varepsilon_i \tag{7}$$

In a trend term, there are two statistics, Z_P and Z_T, calculating as;

$$Z_P = n(\hat{\rho}_n - 1) - \frac{1}{2}\frac{n^2\hat{\rho}^2}{s_n^2}(\hat{\lambda}_n^2 - \hat{\gamma}_{0,n}) \tag{8}$$

$$Z_T = \sqrt{\frac{\hat{\gamma}_{0,n}}{\hat{\lambda}_n^2}}\frac{\hat{\rho}_n - 1}{\hat{\sigma}} - \frac{1}{2}(\hat{\lambda}_n^2 - \hat{\gamma}_{0,n})\frac{1}{\hat{\lambda}_n}\frac{n\hat{\sigma}}{s_n} \tag{9}$$

$$\hat{\gamma}_{j,n} = \frac{1}{n}\sum_{i=j+1}^{n} \hat{u}_i \hat{u}_{i-j} \tag{10}$$

$$\hat{\lambda}_n^2 = \hat{\gamma}_{0,n} + 2\sum_{j=1}^{q}\left(1 - \frac{j}{q+1}\right)\hat{\gamma}_{j,n} \tag{11}$$

$$s_n^2 = \frac{1}{n-k}\sum_{i=1}^{n} \hat{u}_i^2 \tag{12}$$

Where u_i is the residual, k is the number of covariates in regression. Q is the number of Newey-West lags to use in calculating $\hat{\lambda}_n^2$ and $\hat{\sigma}$ is the OLS standard error of $\hat{\rho}$ (Hudson, 2013).

In null hypothesis at $\hat{\gamma} = 0$, PP test of Z_P and Z_T has asymptotic expansion like t-statistic of ADF. Phillips-Perron test has efficiency in general form of Heteroskedasticity in error term ε_i. This is an advantage of Phillips-Perron test over Augmented Dickey-Fuller test and there is no need to use lag in regression test.

Hypothesis following:

H_0 : Time series data variable at t time is non-stationary

H_1 : Time series data variable at t time is stationary

If statistic value of Phillips-Perron test is more than critical value, null hypothesis is acceptable. Therefore, the time series data variable at t time is a unit root or non-stationary. Likewise, if statistic value of Phillips-Perron test is less than critical value, it agrees with the alternative hypothesis which means the time series data variable at t time is non-unit root or stationary.

2.5 Bivariate Extreme Value Distribution (BEVD)

Bivariate Extreme Value Distribution (BEVD): following ways ;

2.5.1 Bivariate Generalized Extreme Value distribution (BGEV) by Bivariate Maxima Method: this method is used in parametric and non-parametric case over a given period of time. When a bivariate random vector expresses the component-wise maxima of an i.i.d. sequence under the appropriate conditions in the distribution of (X,Y), it assumes that (X,Y) indicates the bivariate random vector. It can be approximated by a bivariate extreme-value distribution (BEVD) with cdf G. By applying Pickands dependence function A with margins G_1 and G_2 being EVD, the formula can determine the BEVD (Rakonczai and Tajvidi, 2010).

$$G(x,y) = \exp\left\{\log\left(G_1(x)G_2(y)\right) A\left(\frac{\log(G_2(y))}{\log(G_1(x)G_2(y))}\right)\right\} \quad (13)$$

A(t) is responsible for the structural relationships between the margins. The Pickands dependence function (or shortly dependence function) A is a necessary convex and binding the upper left and right corners at points (0,1), (1,1) and (1/2,1/2) in the triangle defined. A(t) satisfies the following three properties.

1. A(t) is convex
2. $\max\{(1-t), t\} \leq A(t) \leq t$
3. A(0) = A(1) = 1.

The second lower bound of property of A accords with the complete dependence $G(x, y) = \min\{G_1(x),G_2(y)\}$ while the upper bound accords with the (complete) dependence.

$G(x, y) = \min\{G_1(x),G_2(y)\}$. The probability integral transforms $U_i = G_i(X_i)$, i = 1, 2. Therefore, instead of the general formula (2.13) BEVD will set the standard assumptions of exponential margins:

$$A_{log}(t) = \left((1-t)^{\alpha} + t^{\alpha}\right)^{\frac{1}{\alpha}} \quad (14)$$

At $\alpha \geq 0$.The independence case corresponds to $\alpha = 1$.

$$A_{asy.log}(t) = ((\theta(1\text{-}t))^{\alpha} + (\emptyset t)^{\alpha})^{\frac{1}{\alpha}} + (\theta - \emptyset)t + 1 = 0 \quad (15)$$

As $\theta \geq 0$, $\emptyset \leq 1$, $\alpha \geq 1$ and if $\theta = \emptyset = 1$ the model will reduce to symmetric logistic model. Independence obtains by $\theta = 0$ together with $\emptyset = 0$ or $\alpha = 1$.

For approximation of non-parametric, A(t) is modified by the approximation of Pickands (Rakonczai and Tajvidi, 2010), by random vector is ;

$$G_{*}(x,y) \exp(- \left(\frac{1}{x} + \frac{1}{y}\right) A \left(\frac{x}{x+y}\right)) \quad (16)$$

2.5.2 Bivariate Generalized Pareto Distribution (BGPD) by Bivariate Threshold Exceedances: this method is used for exceedance in higher dimension. It is defined into 2 types; the first is reasonable distribution with notice $\{(x,y) \mid (x,y) > (u_x,u_y)\}$, where u_x and u_y is appropriate threshold value of each margins. The second one is at appropriate distribution $\{(x,y) \mid (x,y) \not< (u_x,u_y)\}$, where u_x and u_y have defined earlier. Therefore, this distribution is Bivariate Generalized Pareto Distributions (BGPD) type 1 and 2 (Choungchid, 2012).

For first type from equation $K(y) = 1\text{-}(1+ \frac{\varepsilon y}{\sigma})^{\frac{-1}{\varepsilon}}$, a detailed estimated tail of x as follows;

$$K(x) = 1 - \eta_u(1+ \varepsilon \frac{x-u}{\sigma})^{\frac{-1}{\varepsilon}} , x \geq u \quad (17)$$

$$\eta_u = P (X > u)$$

This means the parameters are η, σ and ε and for the huge threshold u is $F(x) \approx G(x)$, where $x > u$. It is supposed $(x_1,y_1), \ldots, (x_n,y_n)$ thus it is a random independent variable (X,Y) with distribute function F(x,y) on bounds of $x > u_x$, $y > u_y$, where u_x and u_y large enough. Marginal distribution of each F is estimated from equation (17) with parameters $(\eta_x,\sigma_x,\varepsilon_x)$ and $(\eta_y,\sigma_y,\varepsilon_y)$ respectively (Coles, 2001, as cited in Choungchid, 2012).

Transform:

$$\tilde{X} = -\left(\ln\left\{1-\eta_x\left[1+\varepsilon_x\frac{X-u_x}{\sigma_x}\right]^{\frac{-1}{\varepsilon_x}}\right\}\right)^{-1} \tag{18}$$

And

$$\tilde{Y} = -\left(\ln\left\{1-\eta_y\left[1+\varepsilon_y\frac{Y-u_y}{\sigma_y}\right]^{\frac{-1}{\varepsilon_y}}\right\}\right)^{-1} \tag{19}$$

Let $(\tilde{X},\tilde{Y})$ of distribution function $\tilde{F}$ has standard of Frechet's margins for $x > u_x$, $y < u_y$

By

$$G(x,y) = \exp\{-V(x,y)\},\ x > 0,\ y > 0,\ \text{for large } n$$

$\tilde{F}(\tilde{X},\tilde{Y}) \approx \exp\{-V(\tilde{X},\tilde{Y})\}$, the homogenetic of V are follows:

$$F(x,y) \approx G(x,y) = \exp\{-V(\tilde{X},\tilde{Y})\}, x > u_x,\ y < u_y \tag{20}$$

$\tilde{X}$ and $\tilde{Y}$ are defined in terms of x and y in equation (18) and (19). Supposing t is a threshold of u_x and u_y for large to show scope of estimation G(x,y) (Coles, 2001, as cited in Choungchid, 2012).

In case of second type (BGPD), given (Z_1,Z_2) is observed random variable, given(u_1,u_2) is threshold vector, and $(X,Y) = (Z_1-u_1,Z_2-u_2)$ is exceedance vector by the objective is defined Bivariate Generalized Pareto Distribution (Subsequently BGPD) of exceedance from G function in (2.13) as paper of Rootzen and Tajvidi (2006) (cited in Choungchid, 2012).

$$K(x,y) = \frac{-1}{\log G(0,0)} \log \frac{G(x,y)}{G(\min\{x,0\}, \min\{y,0\})} \quad (21)$$

For BEVD E, where 0 <G(0,0) < 1

From the definition of BGPD, it has a model for observation in a single extreme component as well as the twice in Extreme component. Density of BGPD comes from single extreme component calculation (Rakonczai and Tajvidi, 2010) x.

$$k(x,y) = \frac{T_1'(x)T_2'(y)}{c_0}\eta A''(\varepsilon), \quad (22)$$

Where

$$T_i(x) = -\log G_i(x) = \left(1+\gamma_i \frac{x-u_i}{\sigma_i}\right)^{\frac{1}{\gamma_i}}, i = 1, 2$$

$$T_i'(x) = -\frac{1}{\sigma_i}\left(1+\gamma_i \frac{x-u_i}{\sigma_i}\right)^{\frac{1}{\gamma_i}-1}, i = 1, 2$$

$$\varepsilon = \frac{T_2(y)}{T_1(x)+ T_2(y)}$$

$$\eta = \frac{T_1(x)T_2(y)}{(T_1(x)+ T_2(y))^3}$$

$$c0 = -(T_1(0) + T_2(0)) A\left(\frac{T_2(0)}{T_1(0) + T_2(0)}\right) \quad (23)$$

2.5.3 Parametric Bivariate Extreme Value Distribution Model is divided into 9 following models:

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

The bivariate logistic distribution function with parameter dep = r is

$$E(z_1,z_2) = \exp\left[\left(y_1^{\frac{1}{r}}+ y_2^{\frac{1}{r}}\right)^r\right] \quad (24)$$

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.

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

The bivariate asymmetric logistic distribution function with parameter dep = r and asy = (t_1,t_2) is

$$E(z_1,z_2) = \exp\left\{-\left(1-t_1\right)y_1 - \left(1-t_2\right)y_2 - \left(\left(t_1y_1\right)^{\frac{1}{r}} + \left(t_2y_2\right)^{\frac{1}{r}}\right)^{r}\right\} \tag{25}$$

where $0 < r \leq 1$ and $0 \leq t_1, t_2 \leq 1$. When $t_1 = t_2 = 1$, asymmetric logistic model will equal to logistic model. Independence is obtained either r = 1, $t_1 = 0$ or $t_2 = 0$. Complete dependence is obtained in the limit when $t_1 = t_2 = 1$ and r approaches zero. Different limit occurs when t_1 and t_2 are fixed and r approaches 0.

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

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

$$E(z_1,z_2) = \exp\left(-y_1\emptyset\left\{r^{-1} + \frac{1}{2}r\left[\log\frac{y_1}{y_2}\right]\right\} - y_2\emptyset\left\{r^{-1} + \frac{1}{2}r\left[\log\frac{y_2}{y_1}\right]\right\}\right) \tag{26}$$

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.

4) Model 4 (M4): Model = "neglog" (Galambos, 1975)

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

$$E(z_1,z_2) = \exp\left\{-y_1 - y_2 + \left[y_1^{-r} + y_2^{-r}\right]^{\frac{-1}{r}}\right\} \tag{27}$$

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).

5) Model 5 (M5): Model = “aneglog” (Joe, 1990)

The bivariate asymmetric negative logistic distribution function with parameter dep = r and asy = (t_1,t_2) is

$$E(z_1,z_2) = \exp\left\{- y_1 - y_2 + \left[(t_1y_1)^{-r} + (t_2y_2)^{-r}\right]^{\frac{-1}{r}}\right\} \tag{28}$$

where $r > 0$ and $0 < t_1, t_2 \leq 1$. When $t_1 = t_2 = 1$ the asymmetric negative logistic model equal to the negative logistic. Independence is obtained when the limit as either r, t_1 or t_2 approaches 0. Complete dependence is obtained when $t_1 = t_2 = 1$ and r tends to infinity. Different limit occurs when t_1 and t_2 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.

6) Model 6 (M6): Model = “bilog” (Smith, 1990)

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

$$E(z_1,z_2) = \exp\left\{- y_1q^{1-\alpha} - y_2(1-q)^{1-\beta}\right\} \tag{29}$$

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

$$(1-\alpha)y_1(1-q)^{\beta} - (1-\beta)y_2q^{\alpha} = 0$$

$0 < \alpha, \beta < 1$. 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 $\alpha = \beta$ as approaches 1 and when one of α, β are fixed and the other approaches 1. A different limit occurs when one of α, β fixed and the other approaches 0. This bilogistic model is fitted in Smith (1990), who first introduced the model.

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

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

$$E(z_1,z_2) = \exp\left\{- y_1 - y_2 + y_1q^{1+\alpha} + y_2(1-q)^{1+\beta}\right\} \tag{30}$$

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

$$(1-\alpha)y_1 q^{\alpha} - (1-\beta)y_2(1-q)^{\beta} = 0$$

$\alpha > 0$ and $\beta > 0$. When $\alpha = \beta$ the negative bilogistic model is equal to negative logistic model with the dependence parameter dep = $\frac{1}{\alpha} = \frac{1}{\beta}$. Independence is obtained as $\alpha = \beta$ tends to infinity. Complete dependence is obtained in the limit as $\alpha = \beta$ 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.

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

The Coles-Town's distribution function with parameter alpha = $\alpha > 0$ and beta = $\beta > 0$ is

$$E(z_1,z_2) = \exp\{-y_1[\,1 - Be(q;\alpha+1,\beta)\,] - y_2 Be(q;\alpha,\beta+1)\} \tag{31}$$

where $q = \frac{\alpha y_2}{\alpha y_2 + \beta y_2}$ and $Be(q; \alpha,\beta)$. This is the beta distribution function evaluated at q with shape 1 = α and shape 2 = β. Independence is obtained as $\alpha = \beta$ approaches 0. Complete dependence is obtained in the limit as $\alpha = \beta$ 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.

9) Model 9 (M9): Model = "amix" (Tawn, 1988)

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

$$A(t) = 1-(\alpha+\beta)t + \alpha t^2 + \beta t^3 \tag{32}$$

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 lies in the interval [0,1.5], 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.

2.6 Literature Review

Rattanawiboolsom (2003) analyzed the factors influencing the stock index in building and furnishing materials sector in The Stock Exchange of Thailand (SET). This study used Cointegration Test and Error Correction Models. The observation data was from January 1998 to December 2002: 60 total data used for analysis. The factors that affected the stock index in this group were inflation rate, interest rate, trading volume, exchange rate of Bath for U.S. dollars, private investment index, credits from commercial banks, and 2 dummy variables (credit allowed by the Government Pension Fund for accommodations and a measure concerning taxation for recovering real estate business). Then, after testing the stationary from variables with Unit Root Test, the researcher found exclusion of three variables namely inflation rate, interest rate, and private investment index. This was because the order of integration value of 3 invalid variables was I(0). Other variables had the order of integration equal of I(1). Thus, this finding had led to the testing the relationship in the long-term correlation and short-term adaption. The result showed that the model of stock indices in building and furnishing materials sector without the dummy and the model of stock indices in building and furnishing materials sector did not have relationship in the long-term correlation and short-term adaption.

Treampattana (2003) did an analysis of the risk of selected securities in the Building and Furnishing Materials Sector in the Stock Exchange of Thailand (SET) by using Cointegration Method. This study used the return rate of market and four securities including Siam Cement Public Company Limited (SCC), TPI Polene Public Company Limited (TPIPL), Siam City Cement Public Company Limited (SCCC), and Sahaviriya Steel Industries Public Company Limited (SSI). Data used for analyzing was from weekly closing prices from January 4, 1998 to December 8, 2002. This study also applied the Capital Asset Pricing Model (CAPM) and simple regression to estimate the risk parameter (β). An average of three months' fixed deposit interest rate from the five major bank including Bangkok Bank Public Company Limited (BBL), Siam Commercial Bank Public Company Limited (SCB), Thai Farmers Bank Public Company Limited (TFB), Bank of Ayudhaya Public Company Limited (BAY), and Krung Thai Public Company Limited represented the return rate for risk free investment. The result founded that 4 securities were higher than the market. The SSI yielded the highest return rate of 0.84% per week and SCC had the lowest return rate of 0.64% per week. After that the unit root test was used to test the stationary and also founded that 4 securities had stationary process I(0) at 1% significance level. The result of risk parameter (β) of 4 securities founded that 3 securities including SCC, TPIPL, and SSI had the risk parameter more than 1. It implied that the changes in the return rate of 3 securities were much more than those of the whole market. Of those 3 securities, Aggressive Stock and SCCC had the risk parameter equal to 1 which meant the change in return rate was equal to the whole market. The result founded that 4 securities were above Securities Market Line (SML) which meant the values of the securities were under value. The prices of these securities were expected to increase in the future.

Boonlohn (2004) analyzed the return from investment in building material and furnishing sector securities by using Stochastic Frontier Method. In this study, it covered 4 securities which were Siam Cement Public Company Limited, Sahaviriya Steel Industries Public Company Limited, TPI Polene Public Company Limited, and Dynasty Ceramic Public Company Limited. Data used for analysis was weekly closing prices starting from January 1999 to December 2003: 261 weeks in total. The result of Unit Root Test for test of stationary implied that all data sets were stationary. Therefore, implementing the stochastic frontier technique, it was found that no stochastic frontier in all securities. Finally, Ordinary Least Square (OLS) was used to determine the return of securities which was found that Siam Cement Public Company Limited, Sahaviriya Steel Industries Public Company Limited, and TPI Polene Public Company Limited had the risk coefficient more than 1. This proved that the return rate of these securities was greater than the return rate of the market while the risk coefficient of Dynasty Ceramic Public Company Limited was less than 1. The rate of return of this security was less than the rate of return of market. The comparison between the expected rate of return with the Security Market Line (SML) revealed that the expected rate of return of all securities were over SML line which meant that all securities were under value. The investor should invest in these securities.

Cholanakasem (2004) analyzed efficiency of technical analysis tools in order to predict the price of the 18 stocks in the building and furnishing materials sector of the stock exchange of Thailand (SET) by Fifteen Technical analysis tools from January 3, 2001 to December 31, 2003. The results of the technical analysis were summarized by the net return for 3 years, rate of return per years, rate of return per trading time, and expected value of Baht investment per trading time respectively. The result revealed that 25 days Simple Moving Average (SMA25) had the highest average net return that made 28,785.81 Baht average net returns. The 200 days Exponential Moving Average (EMA200) had the highest rate of average return per year that made a return by 110.55 percent a year. The 200 days Simple Moving Average (SMA200) had the highest average expected value of 10,000 Baht investment per trading time that made 10,513.82 Baht of expected value. The study founded that Moving Average Convergence Divergence (MACD) was the best tool in terms of net return. The best tool in terms of rate return per trading time was 200 days Exponential Moving Average (EMA200). Finally, the best tool in terms of expected value of 10,000 Baht investments per trading time was 25 days Simple Moving Average (SMA200).

Tanunvichita (2005) did an analysis of the relationship between securities price and volume in the building and furnishing materials sector in the Stock Exchange of Thailand by using Cointegration Method. In this study 5 securities were used with highest turnover. They were Siam Cement Public Company Limited (SCC), Siam City Cement Public Company Limited (SCCC), Sahaviriya Steel Industries Public Company Limited (SSI), TPI Polene Public Company Limited (TPIPL), and Vanachai Group Public Company Limited (VNG). Data used for analysis was weekly closing prices of 313 weeks starting from January2002 to December 2004. The results of unit root test showed that both securities price and volume had the same order of integration with an I(1) and the other from regression model had the stationary with an I(0) process. Thus, it meant that securities price and volume had a long-term relationship. When testing with Error Correction Mechanism (ECM) and Granger Causality Test, it was found that the price and volume of securities had a short-term and long term relationship.

Graison (2008) analyzed the volatility of asset prices in the future in construction and decoration as well as in materials sector with optimal model of estimating. In this study, data was used based on time series of 4 assets prices in this sector including Siam Cement Public Company Limited (SCC), Siam City Cement Public Company Limited

(SCCC), TPI Polene Public Company Limited (TPIPL), and Dynasty Ceramic Public Company Limited (DCC). Data used for analyzing was daily closing prices during 10 year periods from April 30, 1998 to April 30, 2008: total 2610 observations. First, stationary test by Augmented Dickey-Fuller test (ADF) was used in order to test data whether it was stationary. The result of ADF–test indicated the rates of return to the four assets in the construction and decoration materials sector were stationary at level I(0). Next, the study developed the optimal models for the three GARCH approaches including ARIMA-GARCH, E-GARCH and T-GARCH through inspection of Correlograms. The result founded that SCC asset had AR(15)MA(15) and T-GARCH (2,1), SCCC asset had AR(15)MA(15) and T-GARCH (2,1), TPIPL asset had AR(2) and GARCH (1,1), DCC asset had AR(1) and T-GARCH (2,2) as its optimal models. Then, on modeling the best three GARCH models, it led to the concept of each security. It forecasted the future estimation by the Root Mean Square Error (RMSE). The optimal model had lowest Root Mean Square Error value that showed higher forecast potential. The result founded that SCC, SCCC, TPIPL, and DCC assets had lowest average rate of return at 1.00057, 1.00043, 1.000711, and 1.002084, respectively. Lastly, the optimal models for the different assets were utilized to forecast the volatility of asset returns in 5 future periods from May 2, 2008 to May 9, 2008. The result founded that SCC asset had the variation values of rate of returns for the five periods at 0.000159, 0.000139, 0.000132, 0.000129 and 0.000128. SCCC asset had the variation values of rate of returns for the five periods at 0.000368, 0.000287, 0.000288, 0.000288, and 0.000289. TPIPL asset had the variation values of rate of returns for the five periods at 0.000527, 0.000512, 0.000500, 0.000489, and 0.000479. DCC asset had the variation values of rate of returns for the five periods at 0.000190, 0.000163, 0.000145, 0.000134, and 0.000127, respectively.

Kamtansombat (2009) analyzed the relationship between exchange rates and stock prices of property and construction in Stock Exchange of Thailand (SET). The objective was to study the relationship of exchange rate changes that had an effect on the price of the property and construction in SET both short and long term. This study referred to 5 companies which involved with price securities in the property and construction. They were the Chor Karnchang Public Company Limited (CK), Italian-Thai Development Public Company Limited (ITD), Central Pattana Public Company

Limited (CPN), Land & Houses Public Company Limited (LH), and Quality Houses Public Company Limited (QH). The currency exchange rate was Baht per US Dollar. The information in the past was used for studying the relationship between variables with secondary data on the monthly closing prices of 132 months starting from January 1998 to December 2008 in logarithm. Unit root test results showed that the exchange rate and the price of securities shared the same orders of the integration at an I(1) process. Thus, it led to the analysis of the Cointregration test which showed that all securities had a long-term relationship. Using Error Correction Mechanism (ECM), it pointed that all securities have a short-term relationship, and Granger Causality Test showed that the securities CK and CPN had no causal relationship in both directions. The ITD, LH and QH were a single directional causality of the exchange rates.

Chaungchid (2012) analyzed the energy crop price by using the applications of Extreme Value Theory (EVT) on the basis of three purposes. First purpose was the main purpose which was using univariate EVT, namely Block Maxima (BM) and Peak-Over-Threshold (POT) models, for predicting palm oil prices in the future. The study found that palm oil prices would rise considerably in 5, 10, 25, 50 and, 100 years by the accelerated increase in the future. The second purpose was using Bivariate BM and POT to analyze the relationship between palm oil prices and affecting factors that were soybean oil and crude oil prices. The result illustrated that the growth of palm oil and soybean oil were related in terms of the dependence in the extremes, but the growth rate of palm oil prices and crude oil prices had little dependence or even independence in the extreme. The last purpose was the analysis of the dependence structure between the returns on palm oil price in three futures markets, namely Malaysian futures markets (KLSE), Dalian Commodity Exchange (DCE), and Singapore Exchange Derivatives Trading Limited (SGX-DT) by using the Extreme Value Copulas which was the Gumbel and HuslerReiss copula approach. The result of this purpose suggested that the returns on palm oil futures price among KLSE and SGX-DT had extreme dependence whereas the returns on palm oil futures price among KLSE and DCE; SGX-DT and DCE did not have extreme dependence.

Boonsue (2013) analyzed Value-at-Risk to stock indices in South East Asian countries by operating Extreme Value Estimators. The main purpose of this study was to use Generalized Extreme Value Distribution (GEV) and Generalized Pareto Distribution (GPD) for analyzing Value at Risk in Extreme Value. Another purpose of this study was forecasting Value at Risk in Extreme Value in South East Asian countries as their government sector adjusted investment policy in other countries and private sector adjusted investment in high risk stock market. The study used the data from daily stock indices of each country since 1 September 1999 to 1 September 2012. The result found that the Kuala Lumpur Composite Index (Malaysia) was the best for investment in South East Asia stock markets when evaluating by risk.

Kammoon (2013) analyzed the factor affecting the satisfaction of construction materials customers in Chiang Mai Province by using descriptive statistics and Multiple Regression equation of primary data collected from questionnaires distributed to 385 consumers who purchased construction materials from retailers that had a registered capital at least 10 million Baht. The result found there were 3 parts of information. Firstly, general information, most customers were male (55.85 %) whose age under 30 years old (41.82 %), graduated from Bachelor Degree (55.06 %), worked as the employees of private companies (36.01 percent), their income was 10,000 to 20,000 Baht per month (29.09 %), and marital status was single (45.97 %). Secondly, in terms of construction material buying behavior, it showed that most customers bought construction materials at Homepro (56.62 %), bought sanitary ware as construction materials (60.52 %), bought materials for repairing homes (41.56 %). Some customers needed a suggestion from sale officers (86.49 %), and those people had a medium level of knowledge about construction materials (50.65 %). Customers chose to shop there because of cheaper price when compared to other shop (41.04 %). The participating person was family (67.79 %). The buying frequency for construction materials was 1 to 2 time(s) a week (27.27 %). In each time, they spent between 5,000 to 20,000 Baht for buying construction materials (61.82 %). They also decided where to shop after checking from 2 shops (48.57 %) and most customers just checked price and detail only once before buying (51.17 %). Lastly, the study of the factors affecting the satisfaction of construction materials customers in Chiang Mai found that customers were satisfied with the product, prices, places, promotions, persons, and physical characteristics at a high level with total mean of 4.24, 4.31, 4.08, 3.94, 4.32, and 4.16 respectively. The results of multiple regression analysis found that a factor affecting customer satisfaction towards buying construction materials were statistically significant at level 0.05 which was the gender of the customers. Factors that were statistically significant at the level 0.01 are age, income, product, price, place, promotion, person, and the physical property. This research referred to numerous literature reviews such as the analysis of relationship between exchange rates and stock prices of property and construction in Stock of Thailand (Kamtansombat, 2009), the analysis of the relationship between securities price and volume in the building and furnishing materials sector in the Stock Exchange of Thailand which was done by Cointegration Method (Tanunvichita, 2005), the analysis of return from investment in building material and furnishing sector securities which was done by Stochastic Frontier Method (Boonlohn, 2004), the analysis of energy crop price was done by the applications of Extreme Value Theory (Chaungchid, 2012), the analysis of factors influencing the stock index in building and furnishing materials sector in The Stock Exchange of Thailand (SET) which was done by using Cointegration Test and Error Correction Models (Rattanawiboolsom, 2003), and also the volatility of asset prices in the future in the construction and decoration, materials sector with optimal model of estimation (Graison, 2008). Furthermore, the efficiency of technical analysis tools was used to predict the price of the 18 stocks in the building and furnishing materials sector of the stock exchange of Thailand (SET) by Fifteen Technical analysis tools (Cholanakasem, 2004). The risk of selected securities in the Building and Furnishing Materials Sector in the Stock Exchange of Thailand (SET) was studied by using Cointegration Method (Treampattana, 2003). The analysis of Value-at-Risk to stock indices in South East Asian countries used the Extreme Value Estimators (Boonsue, 2013), and lastly, the factors affecting the satisfaction of construction materials customers in Chiang Mai Province was another issue that was studied (Kammoon, 2013). Most of all above methods and tools concerned with the relationship of construction industry and stock market. Although lots of tools were used, the most frequently-used tool was a unit root which used to check the stationary. According to the research of Chaungchid the Extreme Value Theory, Block Maxima, and Peak-Over-Threshold were used but the tool used in energy was crop price.