

Chapter 3

Feasibility study & Margin forecast

3.1 Feasibility study

This feasibility study is contemplated because this company has to invest storage tanks for customers who will use its fuel oil. Hence, the marketing department of the company has to make sure that investment will be economically viable. This study will create a tool for analyzing the investment. The properties that are concerned are margin and investment costs, which the company has committed to its customers. Basically, the investors have to know about the knowledge of margin and investment costs.

3.1.1 Investment Decision

Investment decision rules can be classified broadly into three groups. The first set of rules is based on accounting income and includes a number of the profitability measures, such as return on equity and return on assets. The second set of measures is based on cashflows and reflects the differences that often arise between accounting income and cashflows. The final set of measures is based on discounted cashflows and factors in both the time value of money and the uncertainty associated with the cashflows.

These three decision rules are developed in succession for the best investment decision.

3.1.1.1 accounting income-based decision rules

This decision rule is the basic investment decision rule. It has been drawn from the accounting statements and from accounting measures of income. The indicator that is shown for this decision rule is *Return On Capital*. The concept is to calculate percentage of expected overall income from the project on the total investment requirement.

$\text{Return On Capital (pretax)}^1 = \frac{\text{Earning before interest and taxes}}{\text{Average book value of total investment in project}}$

* For after tax, Return On Capital (pretax) x (1 – tax rate)

Before decision the investment, the investors have to compare return on capital (after tax) with cost of capital that is defined consistently. If it is over from cost of capital, the project should be accepted.

There are many weak points that effect with decision.

3.1.1.1.1 Expected income is estimation and some expenses are not included.

3.1.1.1.2 The average return on capital does not differentiate between profits made in the early years of a project and profits made in later years.

3.1.1.1.3 The book value of total investment in project may not be a very good measurement such as depreciation methods that used for calculation the book value.

¹ Aswath Damodaran, Corporate Finance, 2nd printing (USA: John Wiley & Sons, Inc., 1997), p. 164.

3.1.1.2 Cashflows – Based Decision Rules

There are many reasons that are different between accounting income and cashflows.

First, a number of noncash, such as depreciation and amortization, reduce net income but not cashflows.

Second, an income statement contains significant cash outflows that are not expenses, such as capital expenditures and working capital needs. Especially, increases in working capital, such as inventory and accounts receivable, are cash outflows that are not reflected in the net income. Hence, cashflows is very close estimate incomes for the project.

This decision rule is very easy for evaluation. It just compares between earning and investment in the project. Payback is a measure of how quickly the cashflows generated by the project cover the initial investment or the length of time it will take for nominal cashflows from the project to cover the initial investment.

The weak point of payback rule is money value because the money has time value.

3.1.1.3 Discounted Cash-flow Measures

As above, money has time value. The cashflows that occur earlier in time are worth more than cashflows that occur later, differences that are accentuated as inflation and interest rates increase. For cover this case, there are two rules that can apply.

- First is net present value.

- Second is the internal rate of return.

3.1.1.3.1 Net Present Value (NPV)

Net present value is a method for improving the effectiveness of project evaluations. It relies on discounted cashflows methodology. The net present value of a project is the cumulating of the present value of each of the cashflows that occur over the life of the project.

The formulation of the net present value rule is as follow:

$$\text{NPV of Project} = \sum_{t=0}^n \left[\frac{CF_t}{(1+r)^t} \right]$$

Where CF_t = Cashflows in period t
 r = Discount rate or the project's cost of capital
 n = Life of the project

The investors can use the result of net present value for making decision as followed:

Decision of NPV for Independent projects ²	
NPV > 0	—————> Accept the projects
NPV < 0	—————> Reject the projects

The weak points of net present value have two items.

² Aswath Damodaran, Corporate Finance, 2nd printing (USA: John Wiley & Sons, Inc., 1997), p. 177.

1. The net present value is declared in absolute rather than relative terms and does not factor in the scale of the projects. Example, NPV of project A may be higher than project B, but project A may require more money for investment than project B.
2. The net present value does not limit the life of the project. Hence, when comparing two projects with different lifetimes, the net present value is supported toward accepting longer lifetime projects.

3.1.1.3.2 Internal Rate of Return (IRR)

The internal rate of return is the discount rate that makes the net present value of a project equal to zero.

The internal rate of return can make the investors to decide whether or not to take a project. The internal rate of return has to be compared to the cost of capital. If the IRR is greater than cost of capital, the project is a good economical one; otherwise, the project should be rejected.

Decision of IRR for Independent projects ³	
If the IRR > cost of capital	————> Accept the project.
If the IRR < cost of capital	————> Reject the project.

There are two weak points that have some serious limitations.

³ Aswath Damodaran, Corporate Finance, 2nd printing (USA: John Wiley & Sons, Inc., 1997), p. 182.

1. Because the IRR is a scaled measure, it tends to bias decision-makers toward smaller project, which are much more likely to yield high percentage returns, over larger ones.
2. There are some cases that the internal rate of return cannot be computed or cannot be a decision tool. The first case is the project that uses a very small initial investment and is spread over time. The second case occurs when there is more than one internal rate of return.

After study all of above, net present value and internal rate of return are the good tools for investment decision making. From the net present value theory, the investors have to know the cashflows on the project.

3.1.2 Cashflows Ingredients

In general project, there are three categories in the cashflows.

3.1.2.1 The Initial Investment

This category is the case of equipment purchase. This case is always assumed to occur at the beginning of a project's life, however it could occur at any time during its life.

3.1.2.2 Operating cashflows

It is the cashflows or the money that generated during the project's life. Operating cashflows can be both of positive and negative values because some periods of the project's life can generate profit but some cannot.

3.1.2.3 The salvage value

At the end of the project life, value of the remaining assets in the project, both fixed and current, are assumed to be liquidated. This liquidation is the salvage value.

As above, the company would like to offer the storage tank of fuel oil for its customers. So, the investment is build and installation the storage tank for customers.

3.1.3 Steps for investment decision

For this study, it is the investment decision of oil companies' perspective. Hence, the decision is separated into three parts. First is cash outflows that are about first period of investment. Second is cash inflows that are the income after tax from fuel oil sell. Last one is analysis of investment.

3.1.3.1 Cash outflows

Cash outflows for this case study are about investment cost of build and installation storage tanks for customers.

Firstly, the investors should know about the types of storage tanks. In this company, there are two types of storage tanks.

3.1.3.1.1 Type of storage tanks for fuel oil

1. Horizontal tanks

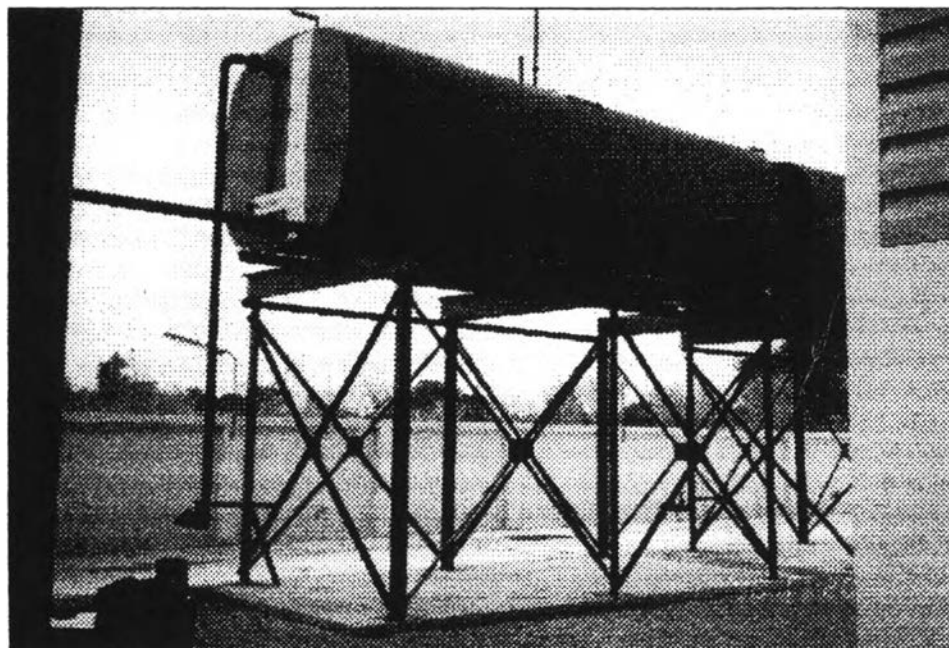
This type of tanks is very suitable for customers who don't use a lot of fuel oil. The tanks are easy for installation and movement

because they have two sizes, 15,000 and 20,000 liter, which are not big. The size depends on the consumption volume of the customers. Not only the sizes but the company will offer the 3 meters or 6 meters stand for the tanks. Often this company would like to offer 3 meters stand for its customers because the customers will not use pumps, which are very expensive, to force flow rate of fuel oil. The stand can accelerate the flow rate of fuel oil by gravity and can save the expenses of electric pump.

2. Vertical tanks

This type of tanks is suitable for the customers who consume a lot of fuel oil. The size of tank is more than 100,000 liter. So, the customers who need to use this tank have to have more area for installation.

In this study, horizontal tanks and a 3 meters stand are used to study because most of customers would like to use them for storage.



Picture 3.1 : Horizontal storage tank and 3 meter stand for fuel oil

Secondly, the investors should know about the cost of storage tanks. This cost includes the tank cost and its equipment, the installation cost and the stand for the customers who need to use it. These costs can be changed because they depend on the market.

3.1.3.1.2 The cost for installation a horizontal tank (no stand)

	Sizes	
	15,000 liter	20,000 liter
1. a tank cost and its equipment (Baht)	50,000.-	60,000.-
2. Installation cost (Baht)	15,000.-	15,000.-
Total cost (Baht)	65,000.-	75,000.-

3.1.3.1.3 The cost for a horizontal tank with stand 3 meters

	Sizes	
	15,000 liter	20,000 liter
1. a tank cost and its equipment (Baht)	50,000.-	60,000.-
2. a stand (Baht)	39,000.-	39,000.-
3. Installation cost (Baht)	55,000.-	55,000.-
Total cost (Baht)	144,000.-	154,000.-

*Option: a stand 6 meters, plus 15,000.- Baht.

Source: from the evaluation investment data of operation department as year 1997

This project life the company has set for five years. So, it set the salvage value of the storage tank at year 5th equals zero. For depreciation, straight line depreciation is applied. This depreciation method is claimed each period for the life of the storage tank. Hence, the depreciation of the tank equal total cost of each type of tanks divide by the number of life service years of the tank, 5 years.

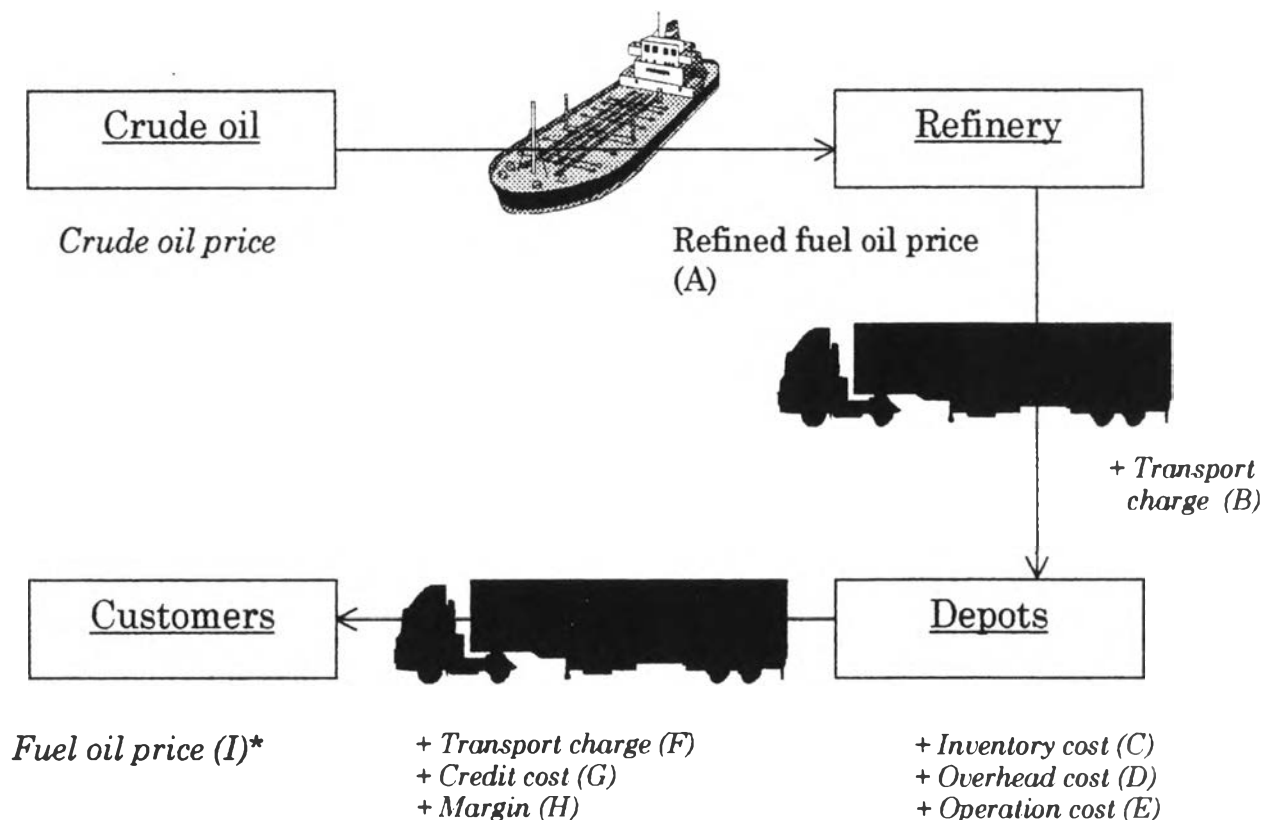
3.1.3.2 Cash Inflows

Cash inflows in this study are the net income after tax (NIAT) in each month from selling the fuel oil. However it is necessary to explain the price structure of the fuel oil that this company sells. The fuel oil that used for this case study is fuel oil grade A because it is the high quality one and makes much profit the company.

3.1.3.2.1 Price structure

The price structure of fuel oil grade A is very complex. There are many levels of cost, which have to include in the fuel oil product cost. Firstly, it should know about product cost of fuel oil A. The fuel oil A is produced from crude oil distillation in the refinery plant. So, the product cost of fuel oil A varies follow the price of crude oil that refers to the world oil price. (See from Appendix B) After that crude oil have to pass through refined processes. There are many products occurred, such as Diesel oil, Gasoline oil, including fuel oil A. This processes use more operation cost for distillation. The operation cost is charged in the product cost. Later, the fuel oil A is transferred to each depots around the country for inventory stock. Hence, it occurs inventory cost, operation cost, and transport expense in each depots. These costs are included in the fuel oil A cost also. Finally, the another transport expense that occurred between each depots and customers, credit cost and margin is added in the product.

As above, it can conclude and write as the flow chart below:



$$* I = A + B + C + D + E + F + G + H$$

Figure 3.1 Flow chart of price structure

After studying the price structure of fuel oil A, cash inflows can be calculated from the unit margin multiple with each volume that the customers consumed per month. Now there are two factors for cash inflows, unit margin and volume per month.

3.1.3.2.2 Unit margin

Margin (I) for this company is added to the product costs which is the refined fuel oil price, transport charge and total cost as show in the figure 3.1. In Thailand, there are about five big oil companies in fuel oil market. Especially, all of these oil companies like to engage the price. Now they plan to use facility such as inventory together. So, the

main factors that affect with the margin are crude oil price and exchange rate (Baht/USD). Otherwise, there are many factors that affect with the margin such as, CPI rate, GDP rate, world economy, world event and so on. In this case study, there are four factors that are studied. First is crude oil price, second is exchange rate between USD and Baht, third is CPI rate and fourth is GDP rate.

As above, the four factors will be studied for forecast the unit margin that will shown in next part (section 3.2).

3.1.3.2.3 Volume per month

As the cash outflow, there are two kinds of storage tank, first is 15,000 liter and second is 20,000 liter. Normally, customers have to order the fuel oil enough for their need because their boilers have many specifications. Some customers have to run the boiler all days all nights because their production cannot stop. Some boilers consume more fuel oil because they are big capacity.

As the conservative method (see as section 3.2.3), the consumption volume will be planned to use at the minimum volume that equal to the size of the storage tanks, which are 15,000 or 20,000 liter per month. This volume is the minimum volume that customers committed with the company.

3.1.3.3 Analysis of investment

The theory that attends to use for making decision of this investment is net present value and internal rate of return. From the above, both data, cash inflows and cash outflow, will be applied for this theory.

Not only these two data, this analysis still need to use the interest rate for the net present value formula, and income tax rate.

+ Interest rate

Interest rate is the discount rate in the net present value formula. It can affect the net present value result because each interest rate can give different result. Because interest rate often changes, so this study has to set the suitable interest that match with the five years life project. This study looks for the bond that government has issued for five years because this interest rate is constant covered five years project. One is government bond is sold by Financial Institutions Development Fund (FIDF). The interest rate of this bond is 8.25 % as 14 October 1998. [See Appendix D]

+ Income tax

Government sets income tax for development the country. In Thailand, the income tax rate is 30 % of earning before tax.

After all of values are searched, they will be calculated for payback period, net present value and internal rate of return for each investment in the next chapter.

3.2 Margin forecast

In this study, forecasting of the unit margin, margin per liter, will use these three methods for calculation.

- Regression method
- Probability distribution method
- Conservative method

3.2.1 Regression method

Regression method will be applied for calculation the equation that cover four factors above. This regression result is calculated from SPSS software by stepwise selection as follow:

Calculation 3.1 Regression result

Regression

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	GDP		Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	EXCHANGE		Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent Variable: MARGIN

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.839 ^a	.704	.695	.100993
2	.862 ^b	.742	.725	9.59E-02

a. Predictors: (Constant), GDP

b. Predictors: (Constant), GDP, EXCHANGE

ANOVA^c

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.729	1	.729	71.521	.000 ^a
	Residual	.306	30	1.020E-02		
	Total	1.035	31			
2	Regression	.769	2	.384	41.810	.000 ^b
	Residual	.267	29	9.194E-03		
	Total	1.035	31			

a. Predictors: (Constant), GDP

b. Predictors: (Constant), GDP, EXCHANGE

c. Dependent Variable: MARGIN

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.684	.024		28.012	.000
	GDP	-2.7E-02	.003	-.839	-8.457	.000
2	(Constant)	.452	.114		3.950	.000
	GDP	-2.4E-02	.003	-.756	-7.386	.000
	EXCHANGE	6.196E-03	.003	.212	2.069	.048

a. Dependent Variable: MARGIN

Excluded Variables^c

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	CPI	-.139 ^a	-1.347	.188	-.243	.905
	CRUDEOIL	-.365 ^a	-1.408	.170	-.253	.142
	EXCHANGE	.212 ^a	2.069	.048	.359	.847
2	CPI	-.099 ^b	-.975	.338	-.181	.863
	CRUDEOIL	-.370 ^b	-1.508	.143	-.274	.142

a. Predictors in the Model: (Constant), GDP

b. Predictors in the Model: (Constant), GDP, EXCHANGE

c. Dependent Variable: MARGIN

[The unit margin data that used for this calculation is modified to hide the confidential real data], (the data are showed in Appendix C)

The result shows that decision coefficient of model 2 is 74% which from R Square in the model summary. The decision coefficient can make the company trust in the equation that generated from crude oil price and exchange rate. Not only R Square, absolute t-values for each factor are also high.

The equation is:

$$\text{Unit margin} = 0.452 - 0.024(\text{GDP rate}) + 0.006196(\text{Exchange rate})$$

$$R^2 = 0.742$$

$$\text{Constant-t} = 3.950$$

$$\text{GDP rate-t} = (-7.386)$$

$$\text{Exchange rate-t} = 2.069$$

As the equation, It shows that GDP rate and exchange rate affect with the unit margin. It suggests that if the GDP rate grows, the customers will need more fuel oil for production. Hence, it can affect with the fuel oil price. For exchange rate, the oil companies do not risk with this factor so they push this risk to their customers. For the other factors, they do not affect directly with the unit margin because the oil companies can push *crude oil cost* to their customers and *CPI rate* relates directly with GDP rate.

From the equation, it still have two problems that make this study cannot forecast the accurate unit margin.

First is economy crisis, which has occurred since June 1997. This crisis forced government to change the basket exchange rate system to

Managed Float system. It has made the exchange rate (Baht/USD) swing. (See from Appendix B)

Second is number of unit margin data, which can be collected only 32 numbers after Managed Float system. These numbers are very small for forecast the accurate unit margin.

3.2.2 Probability distribution method

In Statistics, there is a theory that can search the suitable unit margin and proof confidence. Statistics can make an estimate, prediction, or decision about a population based on sample data. Because population is almost always very large, investigating each member of the population would be impractical and expensive. It is far easier and cheaper to take a sample from the population of interest and draw conclusions or make estimates about the population based on information provided by the sample. However, such conclusions and estimates are not always going to be correct. For this reason, statistics build a measure of reliability called the confidence level or the significance level.

Because unit margin data swings, it is necessary to find the least unit margin, which can make the company decide for the project. The confidence of the least unit margin which can make the company decide for the project. The confidence of the least unit margin should be more than 99 %. At this unit margin, it will make sure that it will get the least cash from selling. If the unit margin in some orders is more than the least unit margin, it will speed up the return of investment on the project.

Before calculation the least unit margin, the data should be tested that what distribution is its pattern. There are two main

distributions in Statistics theory. First is discrete distribution. It is a mutually exclusive listing of all possible numerical outcomes for that random variable such that a particular probability of occurrence is associated with each outcome. Second is continuous probability distribution. Continuous patterns have important applications in engineering and the physical sciences as well as in business and the social sciences. It has an uncountable infinite number of possible values and can assume any value in the interval between two points.

The distribution that match with the unit margin data is continuous probability distribution because the result of unit margin in each period can be more than zero baht. There are three special continuous distributions: the uniform, the exponential and the normal. The normal distribution is particularly important, as it is perhaps the most widely used distribution.

There are three reasons of normal distribution that is vitally important in statistics.

First, numerous continuous phenomena seem to follow it or can be approximated by it.

Second, it can use to approximate various discrete probability distributions.

Third, it provides the basis for classical statistical inference, which is the process of drawing conclusions about population parameters on the basic of sample information because its relationship to the central limit theorem that the sampling distribution of \bar{X} is approximately normally distributed if the sample size is large. It is able to demonstrate that several important sample statistics tend towards its as the sample size increases.

In practice, some of the variables may only approximate these theoretical properties. This occurs for two reasons:

1. The underlying population distribution may be only approximately normal.
2. Any actual sample may deviate from the theoretically expected characteristics.

For some phenomenon that may be approximated by the normal distribution model,

1. Its polygon may be only approximately bell – shaped and symmetrical in appearance.
2. Its measures of central tendency may differ slightly from each other.
3. The value of its interquartile range, which is the difference between the third and first quartiles in a set of data, may differ slightly from 1.33 standard deviations.
4. Its practical range will not be infinite but will generally lie within 3 standard deviations above and below the mean.

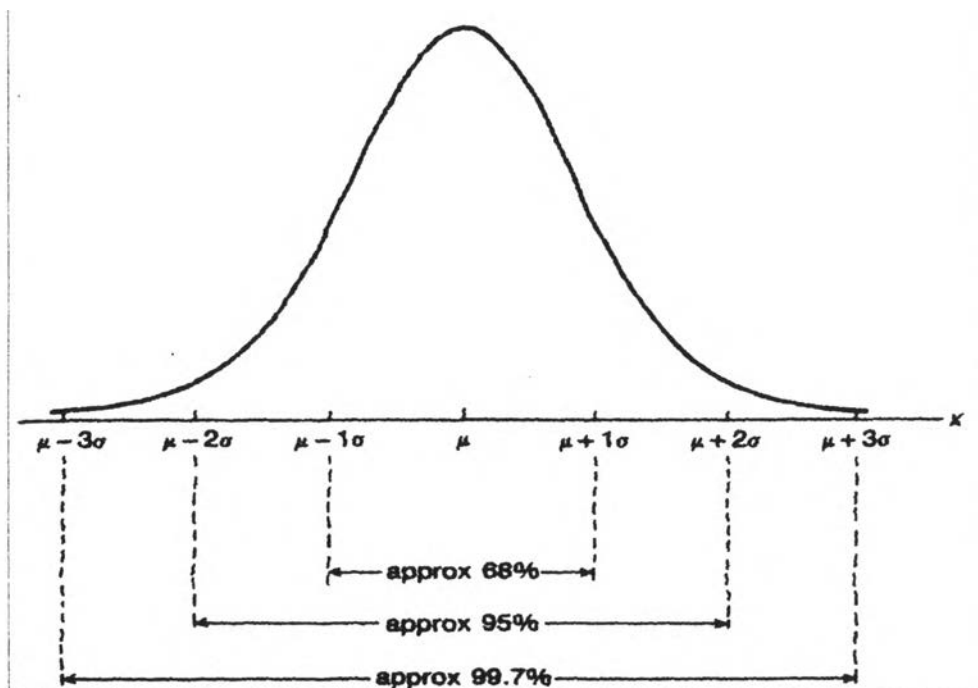


Figure 3.2 Properties of the normal distribution

Figure 3.2 shows that the total area under any normal curve denotes the total probability and thus has the value of 1 – 100 percent. It will be shown that the range of $\mu \pm 3\sigma$ encompasses virtually all possible values of X about 99.73 percent of all observations.

The least unit margin that is objective is at this point, $\mu - 3\sigma$. It is confidence at 99.73 percent that make this study sure in the least margin.

3.2.2.1 Normality test

From the continuous probability distribution theory, this unit margin data should be normal distribution because the uniform is that all outcomes of the random variable are equally likely to occur and the exponential distribution can be used to measure the time that elapses between occurrences of an event. For the best decision, it has to test for normality.

Firstly, the data that are used for this method are collected after Managed Float system. The reason for using these data is difference of exchange rate between before and after Managed Float. Especially, exchange rate effects with the cost of import crude oil.

Secondly, SPSS software is used for test of normality. In SPSS software, there are many test methods for implement. One way to do this is with a normal probability plot. Each observed value is paired with its expected value from the normal distribution in a normal probability plot. If the sample is from a normal distribution, the points should fall more or less on a straight line. Another one is a detrended normal plot. It plots the actual deviations of the points from a straight line. If the sample is from a normal population, the points should cluster around a horizontal line through 0, and there should be no

pattern. From the above analysis plots, they provide a visual basis for checking normality. It is often request to compute a statistical test of the hypothesis that the data as from a normal distribution.⁴ The commonly used test is the Lilliefors test. The Lilliefors test, based on a modification of the Kolmogorov-Smirnov test, is used when means and variances are not known but must be estimated from the data. The Kolmogorov-Smirnov test can be used to test for any distribution because it likes the chi-square test. The hypotheses of this test are:

H_0 = Data are drawn from a normal distribution

H_1 = Data are not drawn from a normal distribution

The result is calculated by SPSS software is significance level (α). If the significance level is less than 0.05, the investors will reject the null hypothesis. So, the data aren't drawn from a normal distribution. The followed results are calculated by SPSS software:

⁴ Marija J. Norusis, SPSS for Windows Base System User's Guide, Release 6.0 (USA: SPSS, Inc., 1993), pp. 189-191.

Calculation 3.2 Normality test of unit margin after Managed Float system of exchange rate

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
MARGIN	32	100.0%	0	.0%	32	100.0%

Descriptives

		Statistic	Std. Error
MARGIN	Mean	.824675	3.23E-02
	99.73% Lower Bound	.719321	
	Confidence Interval for Mean Upper Bound	.930029	
	5% Trimmed Mean	.812799	
	Median	.772750	
	Variance	3.340E-02	
	Std. Deviation	.182763	
	Minimum	.5860	
	Maximum	1.2815	
	Range	.6955	
	Interquartile Range	.200625	
	Skewness	1.062	.414
	Kurtosis	.506	.809

Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MARGIN	.140	32	.116	.892	32	.010**

** . This is an upper bound of the true significance.

a. Lilliefors Significance Correction

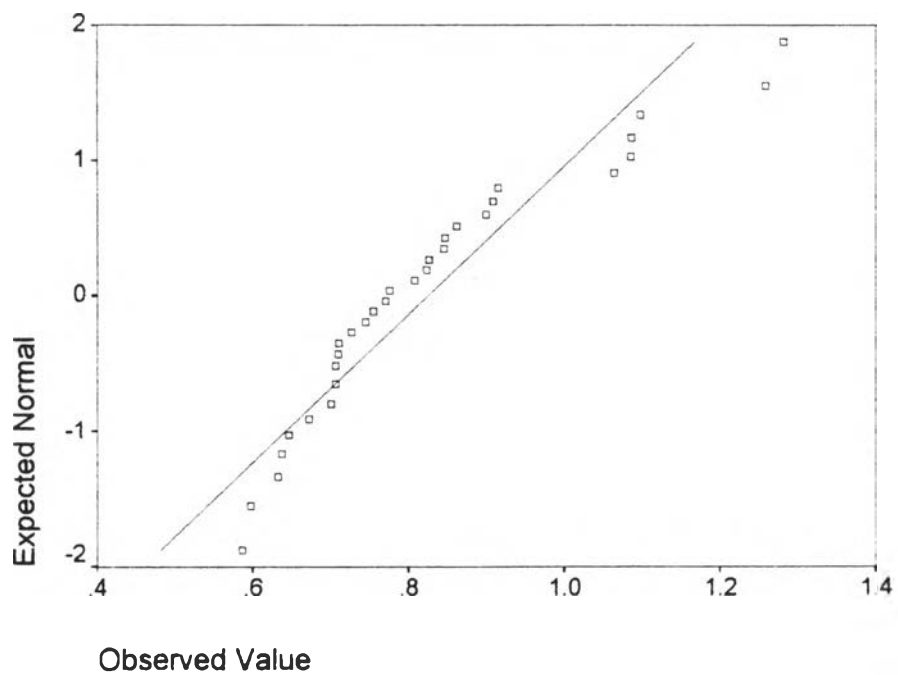
MARGIN

MARGIN Stem-and-Leaf Plot

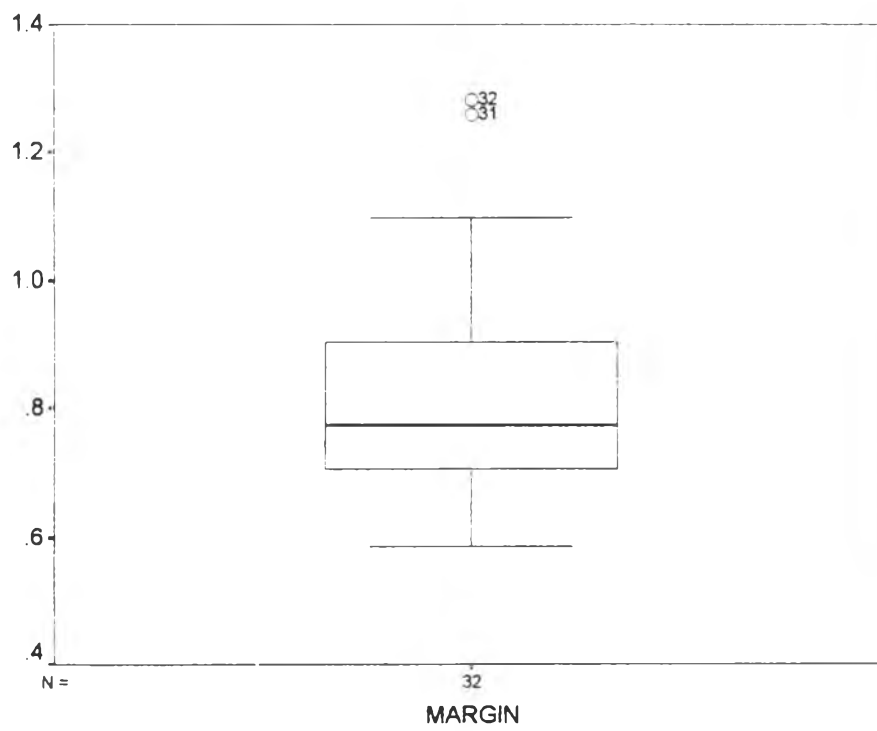
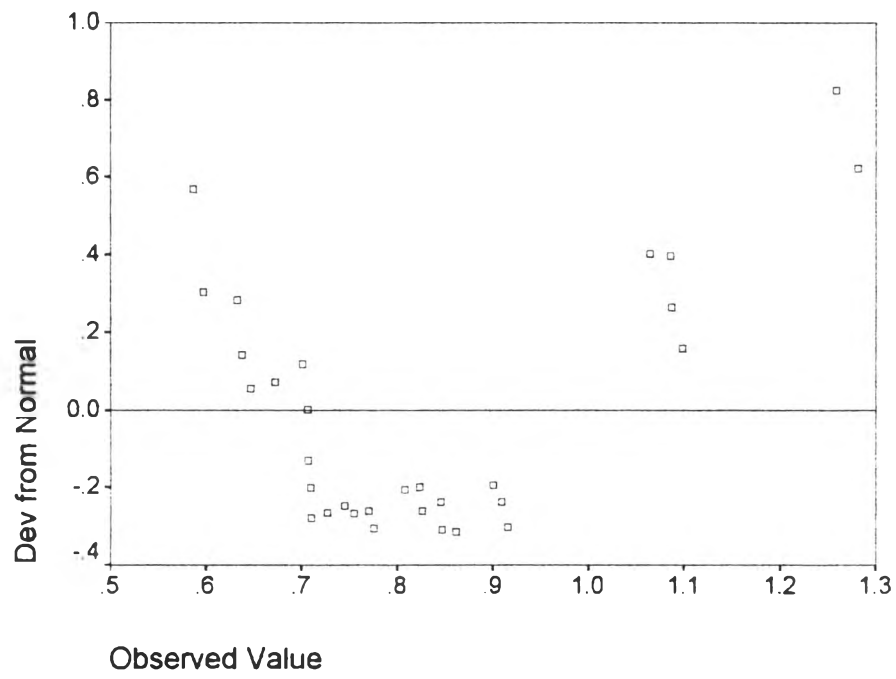
Frequency	Stem &	Leaf
2.00	5 .	89
4.00	6 .	3347
11.00	7 .	00000124577
7.00	8 .	0224469
2.00	9 .	01
4.00	10 .	6889
2.00	Extremes	(>=1.26)

Stem width: .1000
Each leaf: 1 case(s)

Normal Q-Q Plot of MARGIN



Detrended Normal Q-Q Plot of MARGIN



The results can conclude as follow:

+ After Managed Float

- Test of Normality : This test have to use the result of Shapiro-Wilk because the sample size is less than 50. So, significance level, 0.01, is less than 0.05.
- Normal probability plot : the points are not plotted on the straight line and not plotted closely also.
- Detrended normal plot : the points are not cluster around the horizontal line.

From the above result, it is shown that the data are not drawn from a normal distribution.

3.2.3 Conservative method

When the result of probability distribution method are shown like this, it cannot find the least unit margin at 99.73 percent confidence. Hence, conservative method is used to find the minimum value by using the least unit margin ever occurred since Managed Float. From the past records, the least unit margin is 0.5860 Baht (see Appendix B). The actual unit margin that will occur in the future should be more than this estimated unit margin. So, the total margin, multiple between actual unit margin and actual volume per month, will more than the estimated total margin also.