Chapter 2

LITERATURE REVIEW & THEORETICAL ISSUES

Supply of Motorvehicles

This thesis concerns the automotive parts which selected for the study is car fabric upholstery. Demand for the upholstery consists of two categories. They are demand as original parts and demand as replacement parts. As it is a strong intention of this study, the research aims to produce a system prepared for the optimum production in which deserving the automobile industry in Thailand. It is meant to provide only the original parts, it is closely related with the demand of motorvehicles especially passenger cars and one-ton pick up trucks in Thailand.

As *Figure 1.1* presents the supply data for the entire automotive sector, however, includes the land vehicles such as tractors, trailers, etc. in addition to the passenger cars and one-ton pick up mentioned above. Due to hardly fabric upholstery usage in the heavy commercial vehicles, that group is not considered in this study.

Review Forecasting Technique

Before becoming discussed in the basis of forecasting tools and applications, it is worthwhile to discuss the purpose of forecasting from the perspective of a business organisation. The goal of a business forecaster is to provide management with information that will facilitate the decision making process. Forecasters do not know what will happen in the future, but they can

work to reduce the range of uncertainty surrounding a business decision. Therefore, the appropriate forecasting method must be determined.

Forecasting technique can be grouped into two general categories - qualitative and quantitative.

Qualitative techniques, or technological methods sometimes referred to as judgmental, nonstatistical, nonscientific which generally rely on expert opinion. Since this techniques require little or no statistical analysis of historical data, experts are called upon to present intuitive judgments and to assign subjective probabilities to the alternative scenarios. The inputs required depend on the specific method and are mainly the product of intuitive thinking, judgment, and accumulated knowledge.

Technological approaches often require inputs from a number of specially trained people. This technique can be divided into two subdivisions of 1) exploratory methods and 2) normative methods.

Exploratory methods

The more common of these approaches make use of the Delphi Method, S-curves, analogies, and morphological research. These methods begin with the past and present as their starting point and move toward the future in a heuristic manner, often looking at all available possibilities.

For example of situations, predicting the speed of transportation around the year 2000. Also forecasting how a large increase in oil prices will affect the consumption of oil.

Normative methods

These approaches make use of the decision matrices, relevance trees, and system analysis. Starting with the future by determining future goals and objectives, then work backwards to see if these can be achieved, given the constraints, resources, and technologies available.

For example of situations, predicting how automobiles will look in the year 2000. Additionally, having predicted the oil embargo which followed the Arab-Israeli war.

Technological or qualitative techniques vary widely in cost, complexity, and value. They can be used separately but are more often used in combination with each other in conjunction with quantitative methods.

It is difficult to measure the usefulness of technological forecasts. They are used mainly to provide hints, to aid the planner, and to supplement quantitative forecasts, rather than to provide a specific numerical forecast. Because of their nature and cost, they are used almost exclusively for medium and long-range situations such as formulating strategy, developing new products and technologies, and developing long-rang plans.

Quantitative techniques, or statistical techniques are based on the assumption of constancy or historical continuity. The underlying economic patterns in the historical data file must continue into the future. This need not imply that economic activity is static or unchanging, but it does assume that the pattern or structure of institutional relationships that exists in the historical data continues into the future. That means quantitative forecasting can be applied when three conditions exist :

1. Information about the past is available.
2. This information can be quantified in the form of numerical data.
3. It can be assumed that some aspects of the past pattern will continue into the future.

There are two major types of forecasting models : 1) time-series, and 2) regression models.

Time-series models, or autoregressive models, forecasts future values are based entirely on the past values of a variable and/ or errors. The objective of such time-series forecasting methods is to discover the pattern in the historical data series and extrapolate that pattern into the future.

For example, a simple time-series model for automobile sales might be formulated as :

$$AS_{t+1} = C_0 + C_1AS_t + C_2AS_{t-1} \quad \text{..... (i)}$$

AS_t refers to the sales in the current period, AS_{t-1} to last period's sales, and AS_{t+1} to sales in the next period. Since the forecast of automobile sales is based solely on historical observations, this type of model is most satisfactory when cyclical conditions are expected to remain the same.

Generally, the practical significance of this technique is the classical time-series analysis in which attempts to segregate and analyze influenced factors in a systematic fashion. That means, this process involves not only decomposition into component parts but also an analysis of the manner in which these forces interact.

The most widely relied upon model for time-series data is :

$$Y_t = T_t + C_t + S_t + H_t \ ;$$

Y_t = the observed value of the series in period t

T_t = trend component in period t

C_t = cyclical component in period t

S_t = seasonal component in period t

H_t = horizontal component in period t

Actually, in other words, an important step in selecting an appropriate time-series method is to consider the types of data patterns, so that the methods most appropriate to those patterns can be tested.

Four types of data patterns can be distinguished as following :

1) **A trend (T) pattern** exists when there is a long-term secular increase or decrease in the data. The sales of many companies, the gross national product (GNP), and many other business or economic indicators follow a trend pattern in their movement over time.

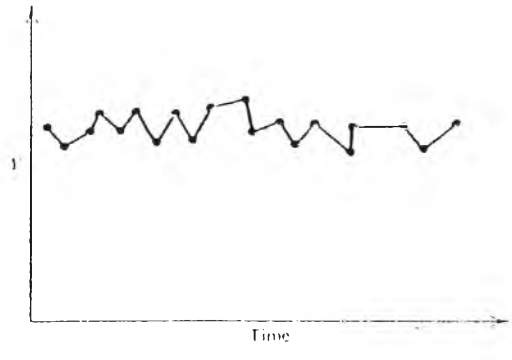
2) **A cyclical (C) pattern** exists when the data are influenced by longer-term economic fluctuations such as those associated with the business cycle. The sales of product such as automobiles, steel, and major appliances exhibit this type of pattern. The major distinction between a seasonal and a cyclical pattern is that the former is of a constant length and recurs on a regular periodic basis, while the latter varies in length and magnitude.

3) **A seasonal (S) pattern** exists when a series is influenced by seasonal factors (e.g., the quarter of the year, the month, r day of the week). Sales of products such as soft drinks, ice creams, and heating oil all exhibit this type of pattern. For quarterly seasonal pattern the data might be similar to figure illustrated below.

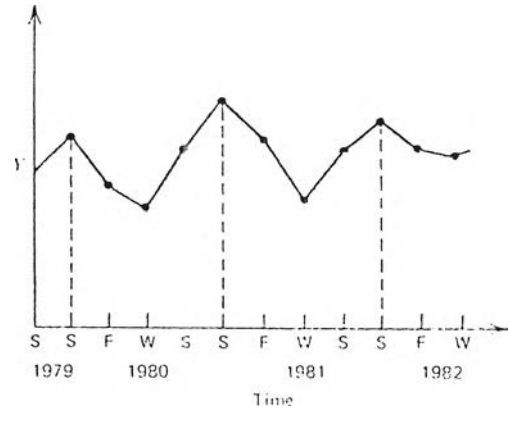
4) **A horizontal (H) pattern** exists when the data values fluctuated around a constant mean. (Such a series is "stationary" in its mean.) A product whose sales do not increase or decrease over time would

be of this type. Similarly, a quality control situation involving sampling from a continuous production process that theoretically does not change would also be of this type.

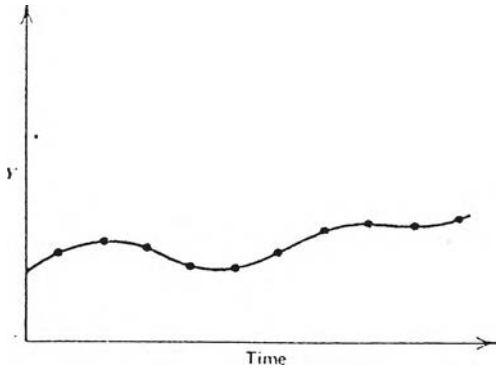
The process of isolating time-series components is commonly referred to as the decomposition of a time series. Accordingly, an understanding of the historical movements of a time series is a necessary prerequisite to forecasting. In fact, an understanding of why a specific activity behaved as it did sharpens our insight into its future behavior.



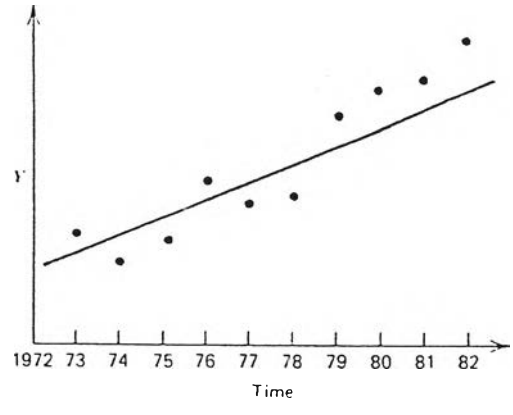
HORIZONTAL DATA PATTERN



SEASONAL DATA PATTERN



CYCLICAL DATA PATTERN



TREND DATA PATTERN

Regression models

In the preceding section, described the forecasting technique implicitly assigned a causal role to the passage of time. However, in many circumstances, the analyst has access to economic data that display a cause-and-effect relationship. Thus, regression models are based on insights from economic theory. In other words, this method assume that the factor to be forecasted exhibits a cause-effect relationship with one or more independent variables. The purpose of this model is to discover the form of that relationship and use it to forecast future values of the dependent variable.

For example, in place of the time-series model for automobile sales in equation (i), a regression model might take the form that :

$$\text{Sales} = f(\text{income, prices, advertising, competition, etc.})$$

Therefore,

$$AS_t = b_0 + b_1 DI_t + b_2 CPI_t \quad \text{.....(ii)}$$

At this point, the sales in the current period (As_t) are linked to disposable income (DI_t) and the current value of the customer price index (CPI_t). The goal in fitting a regression equation is to find the exact form of the relationship between sales, income, and prices -that means, it is necessary to derive estimates of the regression coefficients (b_0 , b_1 , b_2) that embody the historical or structural relationship among the three variables.

Regression analysis is the most widely used technique for quantifying the behavioral relationships between two or more economic factors. As previous example of model similar to equation (ii) can be used to provide management with an estimate of the change in sales resulting from a change in prices.

The variable to be estimated, the automobile sales, is referred to as the dependent variable, and the other variables (disposal income and prices) are called independent variables. The equations that utilize more than one independent variable as equation (ii) are referred to as multiple regression equation.

Fundamentally, the study begin with the simplest possible case : the two-variable linear regression model. The starting point is an equation (model) that postulates a causal relationship between variables.

These relationships are quantified by means of an equation such as :

$$Y = \beta_0 + \beta_1 X \quad \text{..... (iii)}$$

This equation provides estimates of an unknown variable, Y (the dependent variable), when the value of another variable, X (the independent variable), is known and the parameters, β_0 and β_1, have been specified. The unknown parameters, β_0 and β_1, are estimated with available sample data, and a fitted equation is obtained.

As an example, the 16-year sample data of automobile sales that related to the real disposable income of individual are described as following :

Automobile sales and real disposable income, 1962-1977

Year	*X* *Real Disposable Income* *($ Billions)*	*Y* *Retail Sales of Cars* *(Thousand units)*
1962	522	6,700
1963	539	7,316
1964	577	7,658
1965	613	8,784
1966	644	8,408
1967	670	7,583
1968	695	8,600
1969	713	8,442
1970	741	7,158
1971	769	8,683
1972	801	9,317
1973	855	9,675
1974	842	7,542
1975	860	7,084
1976	890	8,612
1977	926	9,119

Source : "Business Fluctuations -Forecasting Techniques and Applications," ch.5, p.144

Let us define the best regression line, there are many possible ways to minimize error but the most frequently relied upon criterion is the least-square model. That is, to find values for β_0 and β_1 , these values are referred to as the regression coefficient estimated .

Mathematically, it may be shown that the estimated values of β_0 and β_1 must simultaneously satisfy the following expressions, referred to as the normal equation :

$$\Sigma Yi = n\beta_0 + \beta_1 \Sigma Xi \quad , \text{and}$$

$$\Sigma XiYi = \beta_0 \Sigma Xi + \beta_1 \Sigma X^2 i$$

Solving these two equation, then the following definition formula :

$$\beta_1 = \frac{n\Sigma XiYi - \Sigma Xi \, \Sigma Yi}{n\Sigma X^2 i - (\Sigma Xi)^2}$$

$$\beta_0 = \frac{\Sigma Yi}{n} - \beta_1 \frac{\Sigma Xi}{n} \quad , \text{or}$$

$$\beta_0 = Y - \beta_1 X$$

In the last three equations, the symbols are defined as follows :

n = number of sample observations

Σ = summation of observations

Xi = independent variable

Yi = dependent variable

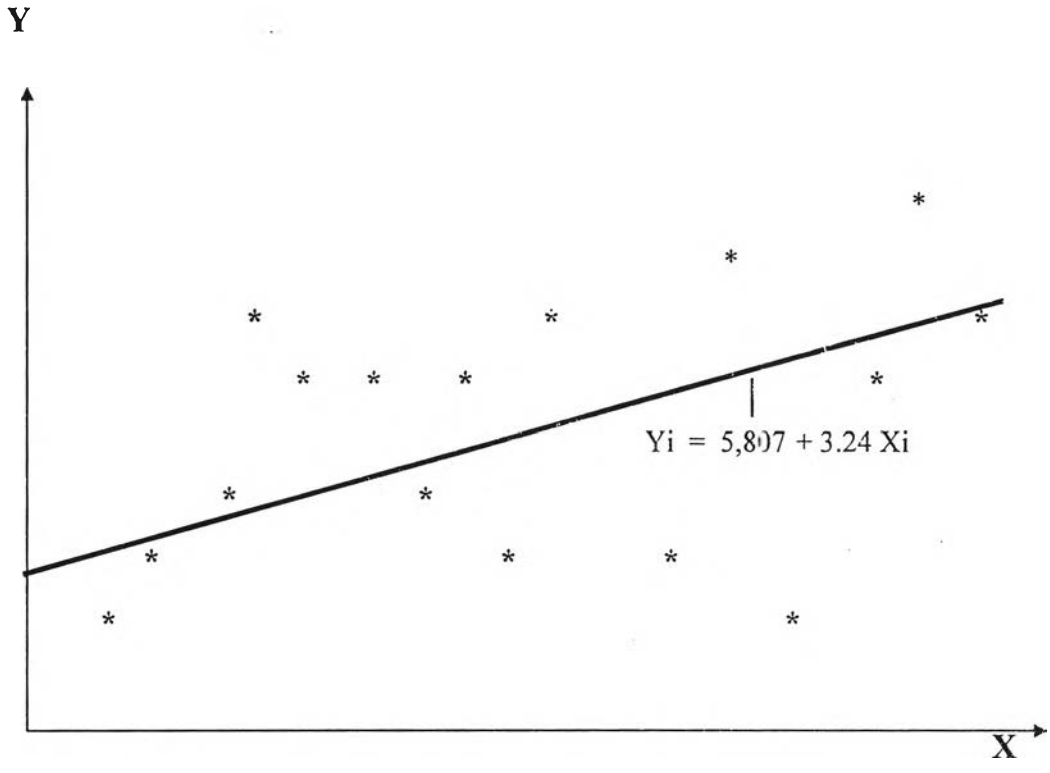
Y = arithmetic mean of Y

X = arithmetic mean of X

Calculations for β_0 and β_1 are carried out, the regression equation can now be stated as :

$$Yi = 5{,}807 + 3.24 \, Xi \quad \text{..... (iv)}$$

This estimated line is graphed, along with the actual data points, as illustrated following.



That means, historical estimates of automobile sales for any given income level are easily obtainable from equation (iv). For example, if disposable income of $801 billion were used, the estimate of automobile sales would be :

$$\begin{aligned} Yi &= 5{,}807 + 3.24\ Xi \\ &= 5{,}807 + 3.24\ (801) \\ &= 8{,}402 \end{aligned}$$

It represents that if we input the actual value of income $801 billion in 1972, we can estimate sales at 8,402 million cars, compared to the actual value of 9,317 -an under-estimate of 915 thousand cars.

What, precisely, do the regression coefficients tell us ? The slope of the line, β_1 , is an estimate of the change in Y resulting from a one-unit change in X. That is for every $1 billion change in disposable income, automobile sales will change by 3,240 units. The interpretation of the intercept, β_0 , depends entirely on whether observations near X= 0 are available. If so, β_0 may be

interpreted as the estimated of Y when X equals zero. Strictly speaking, we would predict sales of 5,807 million cars when disposable income equals zero! However, if sufficient observations near X = 0 are not available (generally true in business and economic data, and clearly true in this case), then the intercept is simply the height of the least-squares regression line. The majority of computer programs simply refer to β_0 as the constant; in most cases, therefore it has no meaningful economic interpretation.

To utilize the regression line, one must distinguish between interpolation and extrapolation. The former uses the regression equation to estimate Y based on an X value within the data-base range, whereas extrapolation produces an estimate based on an X value falling outside the actual data base.

The estimate of 8,402 million units for automobile sales was based on income of $801 billion, an income level actually contained within the data base. If, however, we were to estimate automobile sales based on an income level of 0, we would obtain :

$$\begin{aligned} Yi &= 5{,}807 + 3.24\ Xi \\ &= 5{,}807 + 3.24\ (0) \\ &= 5{,}807 \end{aligned}$$

The reliability of this estimate is questionable both statistically (we have no sample observations with which to compare) and logically (we would not expect people to buy almost 6 million automobiles without income).

Obviously, as a result the quantitative and qualitative method can be used separately but are more frequently used in combination with each other or in conjunction. Particularly in the qualitative forecasting, it often provides very useful information and/ or hint for management. Therefore, forecasters has a wide range of methods available that vary in accuracy, scope, time horizon, and cost. Key tasks are deciding which method to apply in each situation, how much

reliance to place on the method itself, and how much modification is required to incorporate personal judgment before predictions are used as a basis for planning future actions.

Economics / Business Cycles and Forecasting

This concept reflects for historical experience contributes to the acquisition of the perspective so necessary for worthwhile analysis and forecasting. It represents a survey of some of the important historical features of the fluctuations or cycles in the aggregate economy. Even today, these early theories provide valuable insight into the process of forecasting activity.

Particularly whether in business or government policy, without some explicit or implicit forecast, the goal should be to make the best forecast possible with the techniques and information available.

Capacity Planning

To determine the optimal capacity of production, it is planned in order to matching with its forecasting volume produced at a specific timing.

Short-Term Operating Budget

This budget states management's plan of action for the coming year in quantitative terms. Also this budget is a useful tool for planning, performance evaluation, and employee motivation.

Budgets, Tools for Financial Planning

To build up the financial plan of the investment, management develops a formal integrated plan of action, called a budget. The budget is like an architect's set of drawings. It presents management with a comprehensive picture of the expected financial effects of its decisions on the firm as a whole. In other words, budgets are estimated of financial statements prepared before the actual transactions occur.

As tools for planning, budgets are generally static ; that is, the firm develops budgets for a particular expected level of activity, such as sales, manufacturing costs, selling and administrative expenses, and profit in the static budget.

Moreover, budgets provide estimates of expected performance. As such they serve as standards for evaluating performance. Comparing budgeted with actual results provides a basis for evaluating past performance and guiding future action.

Financial Planning

Basically, accountants record the revenue received and expenditure incurred by a company so that its overall performance over a period of time and its financial position at a point in time can be ascertained.

The financial accounting system, which is frequently integrated with the management accounting system, classifies, records, and interprets in term of money, transactions and events of a financial character. These facts and figures are summarized and presented to management and outside parties in the form of periodic financial reports and statements.

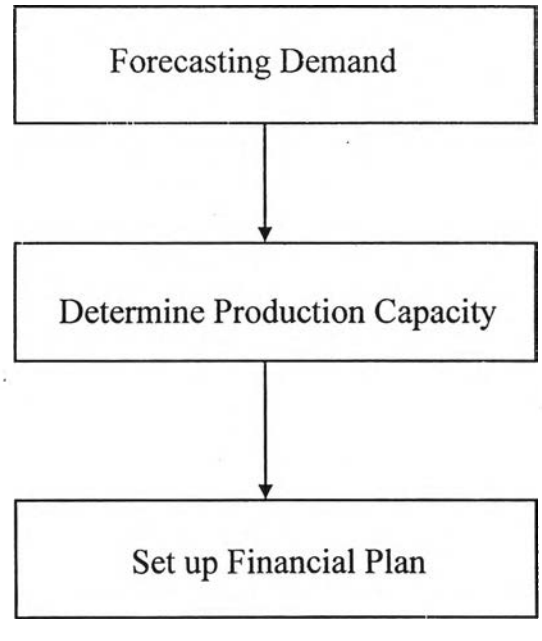
The periodic reports of a manufacturing company will normally be prepared in three principal financial statements as following :

1) Balance Sheet
2) Income Statement
3) Cash flow or fund flow Statement

Overall Comprehension

According to the forecasting system, there are able to give the system for predicting the future movement of the system in which influenced by changing the significant factors.

System Flow Chart



In other words, actually it is planned and controlled in order that the principal features of business operation may be supplied to the demanding manufacturing by an optimal quantity, at maximum benefits.