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ECONOMICS OF FUNDING INSTRUMENTS:
AN EMPIRICAL ANALYSIS OF CONVENTIONAL AND ISLAMIC INSTRUMENTS

By

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ABSTRACT

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ECONOMICS OF FUNDING INSTRUMENTS: AN EMPIRICAL ANALYSIS OF CONVENTIONAL AND ISLAMIC INSTRUMENTS

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Various funding instruments have been developed today in order to fulfil the funding needs of business entities. These funding instruments come in various form, some being based on conventional methods and some on Islamic principles. This thesis focuses on the efficiency of funding instruments used by Public Listed Companies (PLCs) in Malaysia. A Data Envelopment Analysis (DEA) model of efficiency is formulated and tested for empirical evidence on PLCs in the manufacturing sector for the period 1996, and 1998 to 2000. An overall efficiency index is computed using this model, reflecting the average efficiency achieved by the PLCs at both stages of sourcing and utilisation of funding process. It is found that only one PLC, AMST is found to have attained an overall efficiency index of 1. Hence, it is able to put itself onto the efficiency frontier for the whole period under study. A second empirical study is also undertaken to determine the choice of funding instruments by PLCs. A prediction model of choice is designed using Partial Least Square (PLS) approach. The findings of the study showed that firm's size, earning volatility, profitability, asset structure, religion and firm's age are significant factors in explaining the choice of funding instruments by PLCs. The thesis contributes to the current literature on (i) the study of efficiency of funding instruments in terms of (a) evaluation of the funding instruments via the two stages of funding process, (b) the use of financial leverage and operating liability leverage as proxies of funding instruments, and (c) the comparative analysis on the effect of financial leverage and operating liability leverage on performance of PLCs, and the effect of the Islamic and conventional funding instrument, and (ii) the study on the determinant of choice of funding instruments via (a) the prediction model of choice using the PLS approach, and (b) the introduction of the variable 'Religion' into the analysis.

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I began the story of the journey to my PhD with a quote from the verse of the Qur'an "Man can have nothing but what he strives for" [Surah 53 Verse 39]. It has never been easy, but nevertheless a self fulfilling one. It's a journey of discovering myself, my strength and my belief in the Allah, the Creator.

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I end this acknowledgment with a quote from the Qur'an, O ye who believe! Persevere in patience and constancy; vie in such perseverance; strengthen each other; and fear Allah that ye may prosper" [Surah 2 Verse 200].

CHAPTER 1

INTRODUCTION

The Malaysian economy grew rapidly during the 1980s, by an average of 13 per cent from 1987 through 1991[1], and from 1991 to 2000 at an average of 7 per cent per annum. The economy contracted by 7.4% in 1998, following the financial crisis, but recovered in 1999, and grew by 8.5% in 2000. With the growth of the economy, capital market funding also rose[2]. This was to meet the increasing demand for funding by companies. This growth in the capital market can be seen in terms of market capitalization and the number of listed companies. The rapid increase in economic growth has also greatly increased the number of companies in Malaysia. Over almost two decades, the number of listed companies has grown by 71.6% (734) to 1025 as at the end of January 2006, compared with 291 in 1987. As a result, the demand for funds has also increased tremendously.

Various financial intermediaries exist today in order to fulfil the funding needs of these business entities. The financial services provided come in the form of various funding instruments, some being based on conventional methods and some on Islamic principles. Malaysia has been recognized as the pioneer in Islamic finance after being in the business for more than two decades. At present, Malaysia has surpassed other Muslim countries in terms of market infrastructure, with continuous support by the government providing the impetus for the growth of the local Islamic capital market[3]. Therefore there are various funding options available to Public Listed Companies (PLCs). Bearing this in mind, the study focuses on both conventional and Islamic funding instruments.

This study focuses on the efficient use of the funding resources of the PLCs in Malaysia. The word economic refers to the efficient use of the funding resources that the PLCs have, that is, using the minimum resources available in the most effective way. The term funding resources refers to funding instruments in the form of the short-term to long-term debt and trade credits available to the PLCs. The period of study is within the Seventh Malaysia Plan (SMP), that is from 1996 to 2000. This period enables analysis to be undertaken both before and after the crisis of 1997. During this period, the number of PLCs grew by 39.4 per cent

[1] See Harwood, A. in Scott, H.S. and Wellons, P.A. (eds.)
[2] See Singh, R.A. and Yusof, Z.A.
[3] www.busarmalaysia.com

(404) to 1025 as at the end of January 2006, as compared to 621 in 1996. Hence, over the period of the SMP, the number of listed companies increased by 24 per cent.

This study is motivated by three previous studies undertaken by Ahmad and Haron (2002), Hassan and Ahmad (2002) and Dar and Presley (1999). These three studies produced intriguing findings. Firstly, the study undertaken by Ahmad and Haron (2002) showed that in terms of percentage of the banking facilities provided, on average the Islamic trade financing (in the form of overdraft, bank guarantee, letter of credit, trust receipts and banker's acceptance) used was only 7.5% as compared with 62.7% for conventional instruments. Secondly, the findings by Hassan and Ahmad (2002) have shown that out of the 400 respondents interviewed, 67% perceived that trading- and rental-based modes of investment do not differ much from interest-based transactions. As long as this perception exists, Islamic instruments will not be attractive as it should have been to the Muslim. This is taking in consideration that they are in line with the teaching of Islam, hence they are interest free. Finally, there is finding by Dar and Presley (1999) that out of the sample of 300 Muslims interviewed, one-third were still prepared to pay interest even if there was an Islamic bank present. This probably points to the lack of awareness and knowledge in the religion. Many studies have been conducted on the urgency of educating and creating awareness among Muslims and non-Muslims alike with regard to Islamic banking and finance. In terms of the usage of Islamic trade financing instruments, it has been shown that it was lower. This is due to the fact that companies are still ignorant about the availability and/or the differences between Islamic and conventional financing instruments. This is because of all respondents interviewed, 65.9% indicated that they had limited knowledge in Islamic banking system (Ahmad and Haron, 2002).

Malaysia is a multi-racial country, with Muslims being the majority, accounting for 60.4%.[4] Despite the increase in the variety of funding instruments being introduced in the markets, as evidenced in the study undertaken by Ahmad and Haron (2002), the usage of Islamic instruments fares poorly in comparison with that of conventional instruments. Since Malaysia is a Muslim country, one would expect that the Muslim business community would choose a mode of funding that is Shariah-compliant[5]. One possible reason for the poor take-up of the Islamic funding

[4] Census 2000. Department of Statistics Malaysia.
[5] This refers to compliance with the teaching of the Qu'ran.

instruments is perception by businesses that conventional instruments are more efficient, hence the motivation of this study is to evaluate if there is a significant difference in term of efficiency between the conventional and Islamic funding instrument.

The literature to date has concentrated on the study of different types of mode of funding by Islamic banking and financial institutions. Such studies were meant to educate Muslims and non-Muslims alike on Islamic finance. However, despite such efforts, not much work has been carried out in the comparison of funding instruments, specifically on the efficiency of funding instruments. Hence, the aim of this research is to fill this void in the literature that has to date concentrated on the study of funding instruments by PLCs which have focussed on either productive efficiency or allocative efficiency.

Hence, this thesis sets to analyse the efficiency of funding instruments. It comprises three main chapters. Chapter 1 lays out the methodological framework for evaluating the efficiency of the funding instruments. The approach used in chapter is based on the combination of ideas of the partial efficiency approach by Roll and Cook (1993) and the two-stage approach to evaluating efficiency by Zhu (2004). Combining these ideas, a Data Envelopment Analysis (DEA) model of efficiency is formulated. The evaluation of funding instruments is undertaken in two stages associated with the funding process of production, that is, the sourcing of the funding process and the utilization of the funding process. Companies need to be efficient in both stages in order to be considered efficient. This efficiency index is used as a proxy of the efficiency of the funding instruments. This study differs from previous studies on efficiency in that it uses both financial leverage and operating liability leverage in order to evaluate the performance of the funding instruments. This is of great significance as it enables the PLCs to determine which form of funding instrument is more cost-effective in funding the production activity. In this way, the PLCs would utilise only those forms of funding instruments which will render the PLCs efficient. Hence in this sense, chapter 1 provides a few contributions to the current literature on efficiency. Firstly, previous studies have mainly concentrated on the efficiency of either profit or non-profit organisation. This study focuses on efficiency of the funding instruments used by this organisation. Secondly, the study following Nissim and Penman (2003) uses financial leverage and operating liability leverage as proxies for funding instruments. Thirdly, another contribution of the study that departs from the current literature is that it

analyses efficiency at two stages of the funding process. This is also significant as it enables PLCs to identify at which stage of the funding processes that they need to focus on in order to improve their performance. Lastly, the DEA model of efficiency enables comparison to be made between the funding instruments namely; (a) financial leverage and operating liability leverage, and (b) between Islamic and conventional funding instruments.

The empirical analysis of the efficiency of funding instruments is undertaken in Chapter 3 of the thesis. Here, empirical evidence is obtained based on Malaysian PLCs. The aim of the study is to analyse the performance of a sample of PLCs irrespective of what funding instruments they used and to try to identify whether any particular instruments have placed the company at its relative efficiency level. Therefore, various models are developed in order to come up with the most appropriate model for the study. Principal component analysis is used in order to select a suitable model to undertake the evaluation. Using the DEA model of efficiency that has been formulated in chapter 2, the efficiency index is computed. An efficiency index of 1 indicates that the PLC is efficient. However, in order for the PLC to be considered overall efficient and to be located on the efficiency frontier as its peers, the PLC must achieved an efficiency index of 1 at both stages of the funding process. Henceforth, the main objective of this study is to analyse how a mixture of funding instruments, if there is one, can affect the performance of a PLC. In order to achieve this main objective, the study attempts (i) to identify, using Data Envelopment Analysis (DEA), the best-performing company among the PLCs based on their funding decisions; (ii) to demonstrate that the performance of the PLC is affected by the choice of funding instruments adopted; and (iii) to identify whether the PLCs are efficient both in terms of obtaining funding resources and in terms of utilising the funding resources in their production activities. This study undertakes five analyses: one, analysis of PLCs' descriptive analysis; two, analysis of the PLCs' performance based on selected models; three, analysis of the relative efficiency of the funding processes of the selected PLCs; four, analysis of the effect of the different funding instruments on the PLCs' performance and five, analysis of sample responding PLCs.

In Chapter 4, the study investigates the factors that determine PLCs' choice of funding mode. It aims at determining whether efficiency is one of the criteria for PLCs' choice of funding. Financial data needed for the study was collected from secondary sources. However, some information was not available from secondary databases. Hence, a survey

was undertaken in order to collect the relevant information. This study departs from the previous studies on capital structure or factors determining the choice of funding modes by companies, in that it uses a path analysis approach and a Partial Least Square (PLS) method to analyse the factors that determine the choice of funding instruments by PLCs. A multivariate regression method is also undertaken in order to compare the results obtained via PLS. The contributions of this study to the current conventional and Islamic literature are (i) the evaluation of the efficiency of the funding instruments via the funding processes, (ii) the comparative analysis of conventional and Islamic funding instruments, and (iii) the determinants of the choice of funding instruments using path analysis via the PLS method. The significance of this study is that it may create awareness among PLCs on the effects of funding instruments on the performance of their companies. It is also hoped that this study will be able to put into perspective the need to promote Islamic funding instruments among corporate players in order to increase demand for these instruments. This is especially important as Malaysia has been considered a pioneer in Islamic finance and there are various incentives given by the government in order to develop more Islamic instrument. With the increase in supply of these instruments and a poor response will defeat the objective of the government.

The thesis is structured as follows. Chapter 2 provides the methodological framework for the evaluation of the efficiency of the funding instruments. The following Chapter 3 presents the empirical evidence from Malaysia. Chapter 4 discusses the factors that determine the choice of funding instruments. Chapter 5 summarizes and concludes the thesis.

CHAPTER 2

EVALUATING THE RELATIVE EFFICIENCY OF ISLAMIC AND CONVENTIONAL FUNDING INSTRUMENTS: A METHODOLOGICAL FRAMEWORK

2.0. INTRODUCTION

There is keen interest in the study of efficiency in the business world. This interest stems from the desire of business firms to improve their performance. Since the economy of the country depends on the performance of these firms, it is thus important that the business sector performs well in order to ensure the economy of the country is in good health. This partly explains why the literature on the performance of firms has seen an increase in studies of the productivity, profitability and efficiency of business entities. There have been studies of how business performs, what factors drive business performance, what factors cause the firm to fail, how to improve firms' performance and so forth. There are also many studies that have modelled the efficiency of business firms, banks and financial institutions. In such studies, the choice of funding instruments is a significant part of a firm's cost structure. Hence, it is important to analyse how these instruments affect the performance of a firm.

At this juncture, however, the writer is not aware of any study that has examined the relative efficiency of funding instruments used by firms. In particular, there has been no comparative study of the efficiency of Islamic and traditional funding instruments. There are significant differences between the two types of funding instruments, in that the conventional funding instrument is based on interest and the lender is guaranteed a fixed return from the money loaned out. However, for an Islamic funding instrument, no interest is charged, but profit will be given instead for the business venture. The study focuses on three types of funding instruments, namely short-term loans, long-term loans and trade credit from both conventional and Islamic modes of funding.

The aim of this paper is to analyse how the funding instruments affect the efficiency of the firm, and to develop a methodological framework for assessing the efficiency of the firm in relation to the efficiency of the funding resources. This is accomplished by analysing the performance of both Islamic and conventional funding instruments. Hence, this paper

attempts to construct a methodological framework for the evaluation of the funding instruments by developing a model of efficiency based on Data Envelopment Analysis (DEA).

In evaluating the performance of the firm, efficiency is one criterion that can affect a firm's performance. In this study, the concept of efficiency refers to the efficiency of the funding resources used by the firm. Hence, it relates to how these resources, which are scarce, are later utilised in production, and which are considered the most productive and to yield the highest return. In order to evaluate the efficiency of the firm, this study looks at the funding decisions that are concerned with the financial leverage and the operating liability leverage of the firm. Financial leverage focuses on the firm's demand for external funding in the form of long- and short-term bank loans, and operating liability leverage focuses on the creditor's supply of funding. Both are potential sources of funding for firms. The study thus focuses on long- and short-term funding instruments as well trade credits from suppliers.

Since the study involves a comparative analysis of Islamic and conventional funding instruments, a partial approach[6] is used in order to analyse the efficiency of the different instruments. In the case of a firm adopting both modes of funding, the analysis of leverage is broken into two parts, that is, the amount raised from Islamic funding and the amount raised from conventional funding. From this analysis, the impact of each funding instrument on the firm's performance is derived. This is then used as a proxy for the relative efficiency of the instruments used. This is because by using these instruments firms can be located on the efficiency frontier in comparison with their peers.

In the literature of financial management, measurement of the performance of firms can be performed via various financial variables such as profits, receivables, total credit sales, total debt, etc. These variables form the financial ratios needed to indicate the performance of the firms. Financial ratios have often been used as indicators of whether a firm is operating at an efficient level or not, and are thus analysed to determine financial performance. Since the focus of the study is to examine the efficiency of the funding instruments, firms' debt ratios or financial leverage will be analysed. The total leverage will comprise both financial and operating liability leverage. The financial leverage is used to evaluate a firm's ability to meet its obligations, while the operating liability leverage is used to lever the rate of return

[6] An analysis that looks into an event not in totality. It is assumed that only the variables that are analysed will be assumed to be changing or affecting the event, others are assumed to be unchanged.

from its production activities. However, in the literature of Islamic finance, the concept of debt differs from conventional perspectives. Discussion of the differences is beyond the scope of this paper.

In this study the firm's leverage is considered as the measurement of its performance since it is part of the firm's cost structure. It also determines whether the firm will be located on the efficient frontier or not. This study departs from the current literature on funding structure in that it takes into consideration the effect of both financial leverage and operating liability leverage as compared to the norm of taking the leverage as a total amount. The ratio that is used to measure the financial leverage is the debt ratio, while the ratios that are used to measure the operating liability leverage are the receivables turnover ratio, the trade debt, which is the ratio of trade payables (trade credit) to total assets, and amount of pension incurred to employees. By incorporating the financial ratios that are commonly used as comparators in the assessment of the financial performance of firms in the DEA model, the efficient firm can be identified. This can then be used as a basis for deriving an index of efficiency for the funding instruments. This DEA equivalent of the measurement of efficiency is used to evaluate both the long-term as well as the short-term funding decisions of firms. The DEA approach is used as it is found to be superior to others, in the sense that it is able to (i) capture the interactions of multiple inputs and outputs, and (ii) incorporate different types of goal of the firm, such as both objective and subjective goals.

Bearing in mind what has been discussed above, this study aims to contribute to current research on efficiency, in terms of (i) evaluation of the overall performance of the funding instruments via the funding processes of the firm; (ii) the combination of the idea of a partial approach[7] to the evaluation of efficiency and the two-stage evaluation of efficiency[8] in order to derive the DEA model of efficiency index for the funding instruments; (iii) comparative analysis of Islamic and conventional funding instruments; and (iv) comparative analysis of the impact of financial leverage and operating liability leverage on the performance of firms.

The chapter is organised as follows. Section 2 discusses the methodological framework of the study of efficiency, where a review of the literature on efficiency from both conventional and Islamic perspectives will be undertaken. A review of the measurement of efficiency is undertaken in section 3, in which a comparison between two common approaches, namely

[7] Roll and Cook
[8] Zhu (2004)

the parametric and non-parametric, will be undertaken. The model of efficiency is elaborated in section 4, and section 5 concludes the discussion.

2.1 LITERATURE REVIEW

2.1.1 Concept of Efficiency

2.1.1.1 Non-Financial Concept of Efficiency

In general, the term efficiency refers to the utilisation of resources at the minimum cost and the production of output at the maximum level. However, it may have different meanings to different people. For example, to a producer or a businessman, efficiency may refer to management or managerial efficiency. It relates to how well the management makes decisions. In a way, it can be said that economic efficiency depends not only on the technical aspects of production but also on the personal factors. That is, production is affected not only by the capital cost of plant and equipment, the layout of the factory, and the flow of the production through the factory, but also by the supervisory function of the organisation and its administration. It relates to how efficient the organisation is in making profits. Hence, profitability can be used as a test of efficiency of the management (Hawkins, 1950).

However, to an economist, efficiency means more than the physical definition of production. It also relates to the cost incurred in order to produce the goods. Efficiency will only be achieved if the cost of producing the goods is at the minimum and the amount produced is at the maximum. Literature in the study of efficiency has identified two types of efficiency in economics, namely technical efficiency and price efficiency. A firm is said to be more technically or productively efficient than another if it consistently produces larger quantities of output from the same quantities of resources. This concept refers to the physical concept of efficiency. A firm is also said to be efficient if it produces the same quantity of output with less cost or (iii) same quantity of output in less time. On the other hand, a firm is said to be price efficient if it maximises profits, that is produces maximum output at the lowest possible cost. The maximisation of profit implies the equalisation of the values of the

marginal product of each variable input to its price (Yotopoulous and Lau, 1973; Kalirajan, 1990; Fukuyama and Weber, 1999; Worthington and Hurley, 2002). However, Fukuyama and Weber; Worthington and Hurley have included another concept of efficiency, namely cost efficiency, which refers to the combination of both technical and allocative efficiency. Hence this concept of efficiency can be equated with the concept of overall efficiency.

Studies have shown that differences in economic efficiency among a group of firms may actually be caused by differences in technical and/or price efficiency. According to Kalirajan (1990), levels of application of inputs, which affect allocative efficiency, and the method of applying these inputs, which affects technical efficiency, are the two major sources affecting economic efficiency. Allocative efficiency is achieved when resources are distributed among alternative uses such that the goods and services produced are those most highly valued by customers. No reallocation of resources can make someone better off without making someone else worse off. This economic state, in which it is impossible to make one person better off without making someone else correspondingly worse off, is called Pareto optimal (Lacker, 1989).

At the societal level, efficiency is referred to as social efficiency. It relates to the allocation of resources to produce whatever goods and services people want, and the utilisation of society's resources to produce as much output as possible without hurting anyone else in the process. The outcome of the production process whereby there is no other outcome that makes someone better off without making someone worse off is known as Pareto optimal.

If the concept of efficiency is to be analysed at the governmental level, it relates to how efficiently the government utilises public funds in order to maximise social welfare. The means would be from taxes (zakat in an Islamic society), which are collected and utilised for the production of public goods for the benefit of the society at large. Hence, the benefits from production would have to be evaluated against the cost incurred by society in order to have such production.

2.1.1.2 Financial Efficiency

The concept of efficiency this paper focuses on is financial efficiency. Financial efficiency can be examined at both the macro and micro level. At the macro level, it refers to the process of welfare creation, which leads to a reduction of the intermediation costs between savers and investors and an improvement of the resource allocation process. Financial efficiency will induce greater efficiency in non-financial human activities such as trading or consumption activities, thereby lowering the costs of production and consumption, and thus contributing to the creation of real economic wealth (Fontela, 1998).

At the micro or firm level, however, according to Carlson (1975), financial efficiency refers to the effective utilisation of the resources available to the firm. Hence, financial decision making in a firm concerning investment, financing, and dividends should lead to an efficient utilisation of the available resources. In other words, in the process of production, an efficient decision should lead to an effective utilisation of the resources available to the firm. In his study of financial efficiency, seven independent ratios, namely current ratio, cash turnover, inventory turnover, receivables turnover, fixed asset turnover, debt ratio and dividend payout, have been used to derive an index to reflect efficiency. Carlson utilised a non-parametric approach; however, no reference was made as to which type of non-parametric approach was utilised. In that study, the share price is used as the indicator of the firm's performance.

2.1.1.3 Islamic Perspectives

Efficiency from the Islamic perspective is different from the conventional perspectives in terms of its interpretation of the concept of justice and fairness. This is so as the absence of interest should reduce the cost of funding and hence, less burdensome and more cost effective for debtors. The concept of justice also requires some other considerations, such as the type of production and whether it is the production of permissible goods and services. In Islam, scarce resources must be utilised to produce outputs that are not only

permissible but are also needed by a larger percentage of the population. It means that the benefits derived from production should cater for the needs of everyone and not only those who can afford to pay for the goods. According to Obaidullah (2001), the principle of Maslaha Mursalah (unrestricted public interest) ensures maximum net social benefits and costs in the production process.

According to Mills and Presley (1999), Islam looks at production not only in terms of trying to maximise profits but also in terms of the maximisation of welfare. The enjoyment of a return on financial capital is justified only by the service provided to society and at the same time the sharing of the risks inherent in the productive process. Financial instruments that yield a guarantee of ante return (for example, interest-bearing loans and some leasing contracts) are not acceptable. However, according to them, Muslims, with the introduction of non-interest, return-bearing forms of trade credit, have managed to overcome this problem. It was also stressed that if the actual profit of the usage of funds cannot be determined, then the firm's average return on capital can be imputed or a fixed service charge can be levied. Another solution to the prohibition of interest-bearing loans and the like is the short-term credit that can be offered based on the Islamic mode. Since many businesses substitute borrowing by overdraft for raising equity capital, semi-permanent trade finance via profit and loss sharing, lending, or share purchases can be offered by Islamic institutions. Islamic banks then need only charge administration costs for overdraft facilities, since they can be financed from interest-free current accounts. Hence, this may provide alternative funding instruments for a Muslim business firm that would like to opt for permissible modes of funding.

In many developed countries, another major source of funding is the stock market. Therefore efficiency in the stock market has been given much attention by the policy makers and regulators of stock markets in terms of enhancing both efficiency and ethics. In an Islamic stock market, ethical concerns predominate and must be met even at the cost of efficiency[9]. According to Obaidullah (2002), an uncontrolled stock market could

[9] For further detail see Obaidullah, M. (2002).

destabilise the economy, which would then have an adverse effect on firms in the long run. However, for many medium-scale or small-scale firms, the stock market may not be able to assist much in terms of fulfilling their financial needs. This is because obtaining funds via the stock market is costly for small firms.

Nevertheless, Islam has attempted to fulfil this need through ethics instead of law. It is prescribed by Qur'anic injunction that lending money to the needy is a good deed and that the earning of any undue profit out of this money is interest. It can be seen through history that even centuries before the advent of Islam, the use of credit was necessary with the expansion of trade in the Arab continent. But Muslim scholars maintain that when a person loans money, the funds are used to create either a debt or an asset in the form of investment. Therefore there is no justification for a lender to receive any return from that debt regardless of how the borrowed money is used.

Actually Islam has no objection to true profits, which is a return to entrepreneurial effort, and to financial capital. Islam has encouraged the gaining of profit from any productive activity. Hence any amount of money that is advanced for the purpose of trade and production can be contracted to receive a share of the profit. This is because the supplier of money becomes part owner of capital, sharing in the risks of enterprise. He is thus entitled to receive a share of the profits of the firm, as he is in fact a partner in the enterprise and not a creditor (Al-Hasani and Mirakhor (ed.), 1989).

In order to facilitate business or production activities, providing or using credit is actually allowable in Islam. The question now is how efficient are these credit facilities in enhancing the performance of business firms. Irrespective of what credit facilities are used by business firms, at the end of the day, the cost effectiveness of the funding instruments will be the main criteria for using such instruments. This is true as business firms are profit maximizers. They would want an instrument that would render their firms efficient. While it is worthwhile to recognize various dimensions of efficiency, it is only fair to examine the efficiency of the Islamic instruments on common ground with the conventional framework. Hence, the concept of

justice and fairness in the concept of Islamic efficiency will not be addressed here.

2.1.2 Measurement of Efficiency

In the literature of methodological aspects of measurement of efficiency, the production function of a fully efficient firm is assumed to be known. However, in reality it is never known. In fact it has to be estimated from the sample data. Farrell (1957) whose work has laid down the foundation of the study of efficiency has suggested the use of either (i) a parametric function, such as the Cobb-Douglas form fitted to the data, or (ii) a non-parametric piece-wise linear function. The suggestion on the use of this non-parametric form was taken up by Charnes, Cooper and Rhodes (1978), resulting in the development of the Data Envelopment Analysis (DEA hereafter) approach (Coelli, 1997).

Hence in studies of efficiency, these two different methodologies, namely the parametric and non-parametric approaches, have normally been employed by researchers to measure efficiency. The parametric approach has been commonly used in applied economic analysis. The non-parametric approach more frequently used in the study of efficiency is DEA.

The parametric approach according to Lovell (1993) is stochastic in nature as it tries to distinguish the effects of noise from the effects of inefficiency. It is also prone to the effects of misspecification of functional forms if one is not careful in choosing the right functional form. However, the nonparametric approach is non-stochastic as it combines noise and inefficiency together and terms it inefficiency. It is also less prone to the effects of misspecification errors. The two types of approach will be discussed in detail in the following section.

2.2.2.1 Parametric approach

The parametric approach estimates the parametric production function[10] using econometric or statistical methods. Here, the functional form of the production function is either assumed to be known or is estimated statistically.

[10] The production function is referred to in many textbooks of economics as a relationship between inputs and outputs. However, in the literature of efficiency, the term frontier is commonly used as it tends to stress the maximal property of the function. See Coelli.

The production functions or production frontiers are normally specified in parametric form, for example, the Cobb-Douglas function or the stochastic frontier model. There are two methods that can be used to assess efficiency. One is using Ordinary Least Square[11] (OLS), whereby the model does not explicitly make any allowance for inefficiency in production by the units being assessed, and the second is the stochastic frontier model, which makes an allowance for any inefficiency in production by the units (Thanassoulis, 2003).

Using OLS regression to illustrate the analysis of efficiency will give only the average measurement of efficiency. In this sense, the parametric approach therefore provides a summary measure of performance in terms of average efficiency of the Decision Making Unit[12] (DMU) being assessed.

In any parametric empirical application, the selection of an appropriate functional form, which ranges from a simple form such as the Cobb-Douglas production function to a more complex one such as the translog, is necessary. Hence, problems such as misspecification can occur, as this method requires the model estimated to be hypothesised as linear, non-linear or logarithmic, which can lead to a misspecified model. According to Coelli (1997), even though the Cobb-Douglas function is easy to estimate and manipulate mathematically, there are restrictions in the properties of the production function such as assumption of a fixed return to scale and the elasticity of substitution, which is equal to unity. The translog function, however, does not impose these restrictions; nevertheless, it is more difficult to manipulate mathematically, and can suffer from degrees of freedom and multicollinearity problems. Another problem is that this approach is not able to deal with multiple inputs and multiple outputs analysis. However, this problem can be overcome by using the non-parametric method.

In order to illustrate the differences between the two approaches, the following explanation, which is adopted from Thanassoulis (2001), is given. It is assumed that the DMUs that are being assessed use a single input to produce a single output. The OLS regression method will yield an average

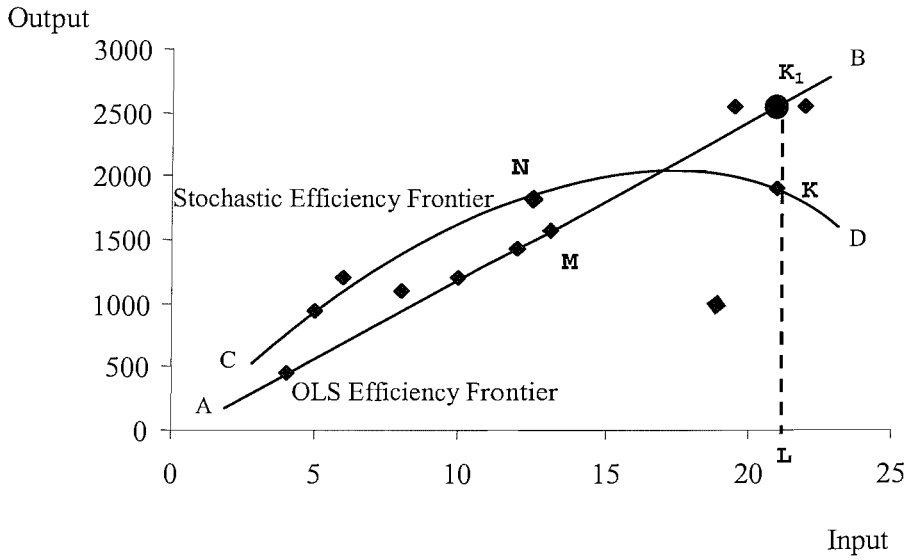
[11] It is a statistical technique that uses sample data to estimate the relationship between two variables from a true population.
[12] This refers to the firm or organisation.

level of output that can be produced with a given level of input. If the output and input are assumed to have a linear relationship, it can be predicted that the output level will therefore lie on the line AB in figure 2.1. The output levels on AB can be used as benchmarks to measure performance, hence curve AB is the OLS efficiency frontier.

With reference to Figure 2.1, for a given input level of L units, an average output level K_1 can be produced. Therefore, the measure of efficiency $= \frac{LK}{LK_1}$. This is the fraction unit K that on the average can be produced for the given output level.

Figure 2.1

Parametric Approach to Efficiency Measurement



If the stochastic frontier method is applied to the same data as has been used by the OLS regression in the figure above, the maximum output level that can be obtained lies on CD which actually is the Stochastic efficiency frontier. The estimated output efficiency of a unit such as at point M reflects the difference between its observed output at point M and the estimated maximum output feasible at point N. This is reflected by MN. With less input, the firm can produce more output at point N. It is considered efficient since it produces more output as compare to if it produces at point M.

2.1.2.2 Non-parametric approach

The non-parametric production function, however, uses mathematical programming. This approach has been found by many researchers to be superior to others in terms of its various attractive features. One of the methods in this approach, which has gained wide popularity in the study of firms' performance, is DEA. This can be seen by the number of studies using this approach that have been published in the last two decades. It was originally designed in 1978 by Charnes, Cooper and Rhodes to measure the relative efficiency of non-profit-making organisations, where market prices are absent. However, due to the many advantages (which will be discussed in detail in the later part of this section) found in DEA that are not found in other traditional financial analysis methodologies such as ratio analysis or regression analysis, it has been widely applied to various profit-making sectors in the economy.

The following explanation is also adopted from Thanassoulis (2003). In DEA, there is no requirement for having a hypothesis about the functional form that links inputs to outputs. Using the same DMUs as in the previous example of Figure 2.1, a production possibility set (PPS) from the observed input and output combinations of the DMUs being assessed is constructed. The PPS[13] in principle contains all the feasible input-output combinations, including those observed at the units being assessed. In the construction of the PPS, there are assumptions to be made with regard to (i) the interpolation between feasible input-output combinations, which leads to new feasible input-output combinations; (ii) an inefficient production being possible; and (iii) the PPS being the smallest set meeting the foregoing assumptions and including all input-output combinations observed at the DMUs being assessed.

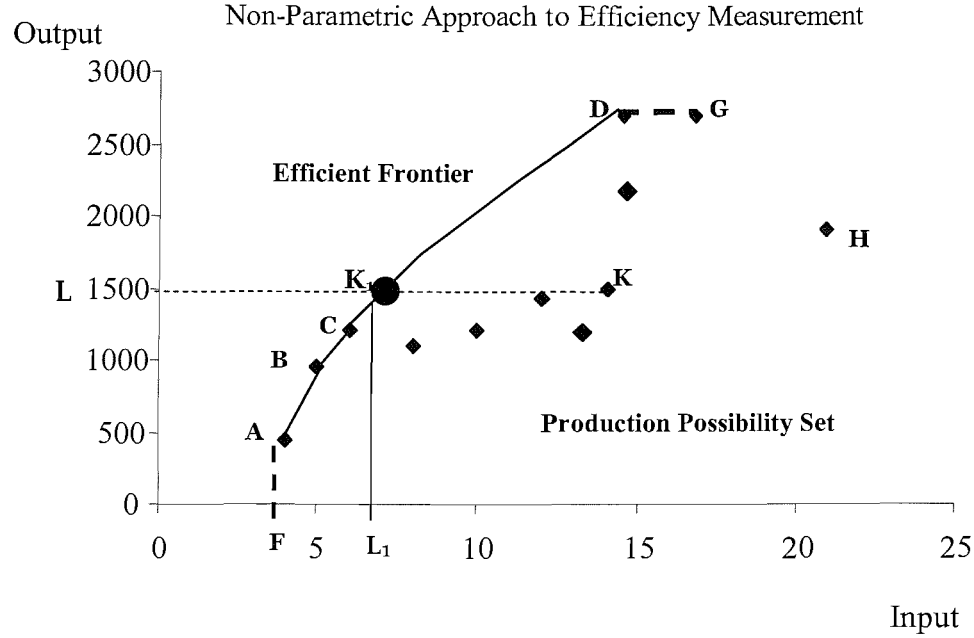
In reference to Figure 2.2, in principle, input combinations along the linear segments AB, BC are feasible. Since inefficient production is also possible, the horizontal extension from D to G, and vertical drop from A to F are also feasible. Regarding inefficient production, that is, all input combinations to

[13] It should be called the piecewise linear production possibility set assumption, since it is not guaranteed that the (true) boundary of this region is piecewise linear, i.e. formed of linear segments like the segment connecting E and D and the segment connecting D and C.

the right and below the linear boundary FABCDG, these are also feasible in principle. Hence, the space that contains the boundary FABCDG and the space to the right and below this boundary are identified as the smallest PPS satisfying the above assumption, and contain the DMUs being assessed.

Figure 2.2

Non-Parametric Approach to Efficiency Measurement



The PPS will be constructed from the same DMUs as in Figure 2.1. The name DEA is derived from its feature of enveloping the observed input-output combinations in the course of carrying out an assessment of performance. Once the PPS is derived, in order to estimate the efficiency of a unit such as K, using the frontier as a reference, e.g. in input orientation (i.e. controlling for the output level) a horizontal line for K is drawn, and the DMUs output levels corresponding to the DMUs input level at K_1 is found. Therefore, Efficiency = $\frac{L_1K_1}{L_1K}$ which is the fraction to which unit K could in principle lower its input level. The efficiency frontier can be drawn by joining the points A, B, C and D. Since firm A, B, C, K_1 and D lie on the efficiency frontier, they are regarded as the best firms. Their performances are the best achievable.

Firms that do not lie on the efficiency frontier are termed inefficient firms. Firms A, B, C, K_1 and D can be called peers for firms K and G. Let us take

K_1 as the reference DMU. The assumption behind the computation of relative efficiency is that if a given firm K_1 is capable of producing unit of outputs = \$1500 using \$6.30 worth of inputs, then other firms should also be able to do the same if they were to operate efficiently. Therefore, performance targets for the inefficient firms can be set to reach 100 per cent relative efficiency in comparison with the most efficient firm K_1. Firm K_1 has operated in an environment similar to the others and hence its performance can be used as a benchmark.

For the inefficient firm, assuming that K has a relative efficiency of 45, therefore the input target is the amount of input employed that will enable the firm to have the same ratio of value added to input employed as firm K_1.

For Firm K, Input Target = Actual Input x Relative Efficiency/100

= 14 x 45/100

= 6.3

This means that if firm K operates using \$6.30 worth of inputs and produces \$1500 worth of value-added outputs, then it would be considered as efficient as firm K_1.

The difference between actual input and input target is input slack. This refers to the excess inputs used in the production process. In the example:

Input slack for firm K = Actual Input – Input Target

= 14 – 6.3

= 7.7

Input slack can also be expressed as a percentage:

$$\text{Input Slack \%} = \frac{\text{Input Slack}}{\text{Actual Input}} \times 100$$

$$= \frac{6.3}{14} \times 100$$

$$= 45$$

It means that if firm K has to be as efficient as firm K_1, it should produce the same output using 45% less input.

In DEA, ABCD is the implicit piecewise linear function where each linear segment is considered as a local approximation to the unknown efficient

frontier of the production process operated by the units being assessed. The data implicitly determine how many different linear segments are needed to approximate the efficient boundary. Unlike the parametric methods, the user does not need to specify the general shape of the boundary and run a risk of wrongly specifying it.

The evaluation process by DEA provides more information than mere evaluation of the efficiency of a DMU. For example, the target input for unit K in Figure 2 can be identified at K_1, which in turn is based on the interpolation of the performance of units C and D. Identifying units such as C and D with reference to unit K is important. They are on the boundary of the PPS and operate relatively efficiently compared with other DMUs or combinations of DMUs, in the sense that they are able to produce more output for a given input or use less input for a given output.

There are many attractive features of DEA. Among others are its ability to assess multiple independent and multiple dependent variables simultaneously. This is achieved by developing a single aggregate measure of performance that is able to capture multiple interactions between variables. Therefore, DEA is able to compute an aggregate performance measure from several financial ratios.

DEA does not require a priori specification of a production function. That is, it does not need any assumptions to be made about the functional form of the production function, such as in this case the financial production. However, a best-practice function is built empirically from observed inputs and outputs.

The DEA approach also enables input slacks to be computed. This is useful as DMU will be able to identify the inputs that need to be reduced in order for them to achieve efficiency.

It has the ability to capture the condition of Pareto optimality. This means that the DEA model can reflect Pareto optimality since the related input variable reduction or output variable augmentation can be achieved without worsening any other variables in the model (Bowlin, 1999).

It can account for the different types of objectives of firms. According to Basso and Funari (2001), a new performance measure such as DEA is a promising technique to analyse better the ethical contents of a financial investment. For instance, it is able to take into account conflicting objectives such as the return on the investment and the pursuit of social objectives.

Hence, features of DEA such as its ability to assess multiple independent and multiple dependent variables simultaneously and it does not require a priori specification of the production function have made it a useful and widely used method in the evaluation of the performance of both profit and non-profit organisations.

As in many methods of computing efficiency, DEA is not free from problems. Among the limitation of DEA are firstly, misspecification problems DEA does not require the specification of a functional form to be fitted. This may cause a problem of fitting the wrong function. According to Silkman (1986), DEA estimations that rely on extremal points or observations are most sensitive to all types of specification problems, including variable selection, model specification, and coding or data entry errors. The selection of variables does not follow either statistical association or causal relationships between the inputs and outputs of the observed DMUs. Hence, failure to include a valid input or output will either produce biased results for the users of the input or may reflect biased results for producers of outputs. Lastly, according to Sengupta (2002), due to random error, the same set of inputs can lead to different levels of output, and may lead one to believe that efficiency estimation by DEA is not robust.

Banker (1993) has provided a formal statistical foundation for DEA by identifying the conditions under which DEA estimators are statistically consistent. There are also hypothesis tests for comparing efficiency between groups of DMUs. In order to address the sensitivity problem, Zhu (2001) provide the super-efficiency model to analyse the sensitivity of DEA efficiency classification.

Despite its limitations, DEA continues to progress. Since its first introduction by Charnes, Cooper, and Rhodes (1978), the DEA approach has been applied in a wide range of situations, such as the study of the performance of an organisation, both profit-making such as banks, postal services, business firms, credit co-operatives (Zhu, 2000; Athanassopolous and Ballantine, 1995; Bowlin, 1999; Shashua and Goldshmidt 1974; Yeh, 1996), and non-profit making organisations such as hospitals, educational institutions and utility companies (Ozcan and McCue, 1996; Thanassoulis, 1993). Other areas of research utilising this approach are in the study of financial instruments such as securities (Fukuyama and Weber, 1997), mutual funds (Choi and Murthi, 2001; Basso and Funari, 2001), insurance (Worthington and Hurley, 2002), sets of portfolios (Murthi et al., 1997), and economic consequences studies, for example economic regulation (Feroz et al., 2001).

However, to our knowledge, no study has been undertaken to evaluate the efficiency of the funding decisions undertaken by a firm or specifically the funding instruments used by a firm in funding its production or business activities. This paper takes a step further in the study of efficiency by evaluating funding instruments by incorporating financial leverage and operating liability leverage into the DEA model, in order to evaluate the efficiency of these funding instruments. This paper also focuses on the relative efficiency of firms that use different form of modes of funding, specifically traditional and Islamic funding. The study of the efficiency of the Islamic modes of funding has attracted a great interest in the wake of the development of Islamic finance around the world. The question is to what extent are Islamic funding instruments economically efficient in comparison with their counterparts.

In this context the ability of DEA to assess various forms of funding instruments simultaneously, it does not require a priori specification of a production function and that it is able to identify inputs which are in excess have made it a suitable choice to be used in this study. However, despite its attractive features, its limitation in the form of misspecification problems may result in DEA estimation to be sensitive to variable selection, model specification and data entry errors. Failures to ensure the inclusion of only

valid inputs or outputs will produce bias result. However, the super efficiency model provided by Zhu (2001) will be able to solve this problem.

2.1.2.3 *Comparison between the Parametric and Non-parametric Approach*

A number of studies (Silkman, 1986; Thanassoulis, 1993; Thanassoulis et al., 1996; Athanassopoulos and Ballantine, 1995; Feroz et al., 2003) have been undertaken to compare the parametric and non-parametric approaches to measurement of efficiency. It can be concluded from the parametric studies, efficiency is measured relative to average performance rather than best performance as compared to DEA, which allows efficiency to be measured relative to all other units that need attention. However, in Ratio Analysis (RA), more than one summary of the values of a multitude of performance indicators such as profitability is needed in order to evaluate the overall performance of firms. Hence, choosing different ratios will lead to different results. However, DEA measures overall efficiency and takes into account the simultaneous interaction of all the input and output levels of a unit.

Despite the limitations of RA in efficiency analysis, studies (Athanassoupoulos and Ballantine, 1995; Feroz et al., 2003) have also proved that RA can complement DEA in order to provide useful insight into the firm's performance.

2.1.2.4 Types of Measurement Aspects

The literature on the use of DEA in measuring efficiency is voluminous. Research relevant to this study will be reviewed in accordance with (i) the use of DEA in the measurement of efficiency of organisations, and (ii) the incorporation of financial ratios into the DEA model in measuring efficiency. Charnes, Cooper and Rhodes (1978) first introduced the DEA model as a linear programming method for calculating the relative efficiencies of a set of organisations that possess some common functional features, but whose efficiency may vary due to internal differences such as management style (El-Mahgary and Lahdelma, 1995).

There are basically two types of measurement of efficiency relevant to this study, namely; relative efficiency and partial efficiency. As was mentioned earlier in the introduction, DEA has also been used to assess the comparative performance of units within an organisation, such as branches of a bank or financial institution, schools within a local education authority, sales outlets of a retailer or performance of a hospital in comparison with other hospitals. These units must perform similar functions so that it is easy to make comparison, even if they vary in size, environment and resources used.

DEA seeks to measure efficiency in terms of how well each unit performs when compared with its peers. Hence, the efficiency of each firm is computed in the relative sense and not absolute. It is relative to the best performing DMU (or DMUs if there is more than one best-performing DMUs). The best-performing DMU is assigned an efficiency score of unity or 100 per cent, and the performance of other DMUs varies between 0 and 100 per cent relative to this best performance (Ramanathan, 2003).

In terms of the literature of partial efficiency in economics, it is more limited as compared to that in the field of the sciences. Nevertheless, the concept of partial efficiency has been applied in many economic analyses. Partial efficiency refers to efficiency from one aspect of observation, be it from the aspect of a particular input or a particular variable in that sense. There are some reservations in performing partial analysis. Can the conclusions drawn from the analysis be valid? Based on the assumption of ceteris paribus, when an observation on the effect of a change in one variable is made, the others are held constant. This is because if everything is observed to be changing at the same time, then it is not possible to understand the effect of changes of a particular variable on economic phenomena today.

Partial efficiencies can be obtained from the ratios of standard inputs to actual ones, for a given output mix. These partial efficiency figures may be combined into an aggregate efficiency measure, indicating the overall efficiency of the said unit across all the dimensions of its activity (Charnes et al., 1994). According to Roll and Cook (1993), there are cases in which partial indices are required for different activities within the same decision-making

unit. It is therefore appropriate to evaluate the efficiency of the various functions in the DMUs. These partial indices would then be aggregated into an overall measure in order to obtain the overall performance of the unit.
In one study of partial efficiency by Diaz and Gascon (1997), it was found that the different measures of partial efficiency such as production costs, systematic risk, specific risk and branch network distribution are linked to stock performance. However, when employing DEA, the multicollinearity problem seems to exist as some of the variables used are correlated. A technique called Tabu search is used to search for artificial instrumental variables, which can avoid collinearity and allow the weighting of the underlying efficiency criteria. The study, however, did not discuss in depth the relationship between stock performance and the different measures of partial efficiency.

Meanwhile, Agrell and Wikner (1996) proposed a weighted partial efficiency index to replace technical efficiency measures in a situation where partial productivity has changed significantly over time. Hence, a weighted partial efficiency is defined for a unit, be it one production activity, a cluster or a system. From the partial efficiency measurement, analysis of how the productivity has changed with respect to relevant costs is enabled. The productivity of different activities that has changed in an organisation can be decomposed into different partial productivities. This analysis can be later aggregated into higher-level units or clusters in an organisation. But how this integrated efficiency measure can be applied in model-based economic assessment is not proposed. However, this shows that partial analysis can be undertaken in studies where productivity may result from more than one source.

Sengupta (2002) in his study emphasised the economic basis of the DEA approach to efficiency measurement. This bridges the gap between the economists who emphasise allocative or market efficiency, and the operations researchers who employ the DEA model to measure production or technical efficiency. According to him, developments in the DEA approach have enabled measurement of the overall efficiency (OE) of a firm to be undertaken. It is later decomposed into two parts, technical efficiency (TE),

which measures the firm's success in producing maximum output from a given set of inputs, and allocative efficiency (AE), which measures the firm's success in choosing an optimal set of inputs with a given set of input-output prices or costs. In this way, it enables firms to determine their target objectives of improving either technological or allocative efficiency. Hence the study of efficiency can be partial. This enables identification of the factors that need to be looked at in order to improve them. if a problem such as inefficiency exists.

2.1.3 Incorporation of Financial Ratios into DEA Model

Financial ratios have been applied in many areas of business. They are indicators of the economic phenomena that underlie the operations of firms. Hence, ratios are signs of the economic condition of firms, which can provide guidelines for the management of the firms. The literature generally suggests that an economic relationship should exist between numerator values and denominator values (Lev, 1974), for instance in the ratio of sales to total fixed assets. This indicates the sales effectiveness of capital (either owned or borrowed) that has been invested in non-current or productive assets. The economic justification for investing capital lies in the possibility of its being employed in order to earn a return (Wall, 1936).

In earlier studies of firms' performance, indices of financial ratios have been used. However, many of these studies adopted a univariate approach in which only a single ratio was considered individually. There were shortcomings in this approach; for example, the interdependencies among various ratios were ignored as well as the ambiguity in interpretations of a firm's performance and the lack of a theoretical background for choosing the various types of financial indicators. This was then overcome by the use of multivariate analysis in which several ratios are combined into a model or an index that is able to provide a single signal. However, this later met with problems that relate to issues such as multicollinearity and normality. Nevertheless, despite these problems, financial ratios analysis has advanced further in academic research.

Many studies on financial performance have incorporated financial ratios into the DEA model and found that DEA can augment traditional ratio analysis and provide

additional insights into the performance of firms. A number of studies have been undertaken, such as Feroz et al. (2003) on economic regulation; Bacchetti and Sierra (2003) on manufacturing firms; Feroz et al. (2001) and Zhu (2000) on companies; Bowlin (1999) on defence and non-defence business segments of industry; Yurdakul and Ic Tansel (2004), Tser (2002) and Yeh (1996) on banks; Thore et al. (1994) on the computer industry; and Worthington (1998) on gold producers.

Specifically, studies such as Feroz et al. (2001), Yeh (1996), Bowlin (1999), and Worthington (1998) have shown that DEA can be applied in the analysis of performance of any organisation such as banks and business firms by incorporating financial ratios into the DEA model in order to obtain the overall efficiency equivalents. Feroz et al. (2003) use the DEA equivalent of the income efficiency model to measure the success of long-term investing and financing decisions as well as the short-term operating decisions of firms. However, by incorporating these ratios into the DEA model, some problems associated with multicollinearity[14] and issues relating to sensitivity may have to be dealt with. This is because the high correlation in the variables will lead to bias results.

Yeh (1996) noted that an efficiency measure by DEA is sensitive to the combination of inputs and outputs. This issue of sensitivity could to be dealt with by applying sensitivity analysis in order to examine the reliability of the best-practice frontier (Zhu, 2000; Smith, 1990). However, these authors did not offer any solutions to overcome issues of correlations among the variables.

Hence for financial ratios to give an accurate interpretation of the performance of the firms, problems such as multicollinearity must not exist in the analysis. Feroz et al. (2003) tried to prove that there is no relationship between DEA efficiency scores and those of financial ratios as measures of firm performance. Their findings did indicate that there is no relationship between the deviations from optimum DEA efficiency scores and deviations from optimum financial ratios. However, indications of correlations existing between the DEA deviations and ratio deviations were noted, but no solution was offered to overcome the problem.

[14] A situation in multiple regression whereby the predictor variables are themselves highly correlated with each other.

In the use of financial ratios, weight assignment to each indicator will give rise to problems. Hence deciding which indicators to select and how to assign weight to each of these indicators requires some judgment. Thus, according to Tser (2002), experience and knowledge is as valuable as the data that is used. He incorporated the judgment of bank managers on selection of appropriate indicators to reflect a bank's performance. He tried to overcome the problem of weight assignment by using DEA.

In the use of financial ratios, caution must also be taken in order to ensure that the correct model and method are used. This is because, according to Hollingsworth and Smith (2003), financial indicators, which are normally in the form of financial ratios, could can lead to technically incorrect interpretations of the model, for example the CCR model, which was actually the model adopted by Tser (2002) in his study of bank efficiency. A wrong interpretation could arise if for example the denominator of financial ratios is the same for all inputs and outputs. This causes the DEA efficiency results to be highly misleading as input and output are correlated. Therefore, the use of ratios will lead to a loss of information about the size of the unit and the implicit assumption of the constant returns to scale in the operation of the units. In fact, in practice many applications do not use identical denominators for all ratios. This would lead to multicollinearity, which could distort the result of the analysis. Nevertheless, according to them, incorporating ratios will not lead to major difficulties as long as the weight used in DEA is carefully considered.

2.1.3.1 Issues in the Use of Financial Ratios alongside DEA

In the use of financial ratios alongside DEA, studies have shown that there are problems. Hence one needs to be cautious when deciding to use these ratios in a study. Nevertheless, a substantial number of studies have been undertaken to address these issues. Three such issues that need to be addressed are first, the problem of multicollinearity, where studies such as Horrigan (1968) and Meric and Meric (1994) have shown that high intercorrelation among certain financial ratio can lead to problems of multicollinearity. They suggested using principal components analysis to overcome this problem. This technique reduces the original set of correlated financial ratios to a smaller set of uncorrelated principal components representing various financial ratios of the firm.

In the issue of the stability of the variables used, Cowen and Hoffer (1982) attempt to address the issue of data instability by using factor analysis to minimise the intercorrelation between the variables and identify the information redundancy of ratios. Related to this issue is the issue of selection of ratios to be used. Pinches et al. (1975) have attempted to classify financial ratios based upon empirical similarities among the objects of interest without consideration of any a priori groupings. According to them, the selection of appropriate financial ratios to be used in the analysis not only needs careful consideration but should also be based on knowledge of the predictive significance of individual indicators. It should represent the different aspects of a firm's operations.

Associated with the absence of assumptions regarding the statistical distribution of variables is the problem of small numbers of observations, and the difficulty of making judgements about firms employing unusual mixes of inputs, or producing unusual mixes of outputs. Smith (1990) acknowledges the absence of appropriate devices to guide inputs and outputs selection to be used in the model. According to Lev and Sunder (1979), the use of financial ratios by practitioners and researchers alike has been often motivated by tradition and convenience rather than by careful methodological analysis.

Hollingsworth and Smith (2003) caution on the use of ratios as data in DEA. When they are used in the standard CCR model[15], this may lead to technically wrong results. Instead, a BCC model[16] should be adopted. According to them, when ratios rather than absolute numbers are used as indicators of inputs and outputs in DEA will produce the same result, hence causing the analysis to be unchanged. For example, if output per head of population is divided by cost per head of population, it will mean that the analysis is unchanged. Some steps have been suggested in order to avoid the problems. One, use of ratios implicitly assumes constant returns to scale in the operation, as the size of the unit is not relevant in the analysis. Two, using different denominators for all ratios creates a variety of performance indicators, based on different denominators. This then facilitates comparison between units. Three, the DEA weights should represent the value of a unit

[15] Charnes, Cooper and Rhodes model (1978)
[16] Banker, Charnes and Cooper model (1984)

increase in one ratio relative to a unit increase in another. Fourth, if ratio form is used then BCC should be specified, as this ensures that all comparison between units is by interpolation only, and that extrapolation of behaviour to unfeasible performance is ruled out.

From the various studies that have incorporated financial ratios into DEA, it is the standard financial data that are used to carry out the DEA calculation. The interaction of input and output in the analysis will produce results in the form of financial ratios that are needed in order to obtain a meaningful interpretation of the performance of firms. However, in all these studies that have incorporated financial ratios into DEA, no theoretical background is given for the choice of financial data used. It merely depends on the researcher's choice and is based on the relevance of the data to the study.

2.2 DEVELOPMENT OF A MODEL OF EFFICIENCY OF FUNDING INSTRUMENTS

2.2.1 Conceptual Framework for the Model

In the literature of the study of financial performance of firms, there are three key issues in decision making: firstly, issues relating to allocation of funds to income-generating activities, known as investment decisions; secondly, issues that concern obtaining funds, either internally or externally, at the lowest cost possible, known as financing decisions; and lastly, issues pertaining to payments of dividend, known as dividend decisions.

According to Carlson (1975), these three major financial decisions help determine the firm's efficiency of operations. The investment decision focuses on (i) working capital management, which determines the cash, inventory, and receivable levels, and (ii) allocation of capital to long-term purposes. The financing decision focuses on (i) long-term funds such as term loans, conditional sales contracts, and leases, and (ii) short-term funds such as trade credit, commercial paper, receivables and inventories. The dividend decision focuses on (i) active and (ii) passive or residual dividend. Debt financing has been considered as less expensive by firms because of the interest expense. However, in equity financing, the dividend is tax deductible. Stiglitz (1974) includes both the investment and dividend decisions as financing decisions. This

study, however, considers both the investment and financing decisions as one financing decision, since both require financing instruments in order to finance them. This will give rise to both financial and operating liability leverage.

These financing decisions are found to be related to the leverage of the firm, which in the past has been viewed as arising from funding activities. That is, a firm borrows in order to obtain funds for its operations. According to Nissim and Penman (2003), there are two sources of a firm's leverage, one that arises from its funding activities and another from its operating activities. Both of these activities determine the sources of leverage namely, financial leverage and operating liability leverage. Leverage is measured by dividing total liabilities by equity. The sources of liabilities come from both funding activities, such as bank loans and bonds issued, and operating activities such as trade payables, deferred revenues and pension. Examples of the operating activities are firms' transactions with suppliers, customers and employees in conducting operations. Their study shows that shareholder profitability is related to financial leverage and operating liability leverage. Hence, leverage indicators can be used to analyse a firm's performance in term of production profitability.

In this study, in order to measure the efficiency of the funding instruments, there is a need to evaluate the outcome of the funding decisions of the firm. This outcome is considered as the proxy of efficiency for the funding instruments used. This could be equal to the specific funding vehicles that are used to bring about the desired funds needed by the firm. Since the financial variables related to leverage provide a useful insight into the study of the efficiency of the firm's decision making, they will therefore be incorporated into the DEA model for analysing the efficiency of the instruments. The study departs from the traditional view of leverage in that it incorporates leverage from not only the funding activities but also the operating activities.

The nature of the funding instruments under study is the short- and long-term funds used by these firms in funding their production activities. Short-term funds are funds that have to be repaid within 6 months to 1 year, while long-term funds are funds that need to be paid within a period of more than 1 year to 10 years. Trade payables arise from the supplier's side in the form of operating liability leverage.

The model in the study will specifically be able to identify (i) relatively efficient firms in terms of the overall efficiency, and (ii) the factor-specific efficiency measure that relates to the partial efficiency of the financial decision making of the firm. It means that the analysis will focus on the specific funding methods used by the firm. These methods will be analysed by looking at the specific sources of funding, that is, financial leverage and operating liability leverage. For financial leverage, the long-term to short-term loans will be analysed, while the operating liability leverage will look into trade credits and receivables.

2.2.2 Methodological Framework of the Model

2.2.2.1 Data

The data to be used in the study is quantitative (financial data), and is compiled from both secondary and primary sources. The reason for the use of financial data is that, when incorporated into DEA, they can form the financial ratios needed in the analysis of the performance of the DMUs. This can also act a proxy for the efficiency of the funding decision making of the DMUs. Financial variables in the form of ratios can control for the effect of size on the variables under examination, and also the effect of technology, which affects all firms within a homogeneous group, such as within an industry (Lev and Sunder, 1979).

The second source is the primary source, in the form of a survey undertaken in order to obtain information such as that which relates to specific data on modes of funding, for example the proportions of Islamic and conventional funding undertaken by the DMUs, the types of funding used by the DMUs, and the total amount of each type of funding. Such information is not available in the conventional balance sheet or profit and loss reports.

2.2.2.2 Selection of Variables

According to Ramanathan (2003), the criteria for selection of inputs and outputs in DEA are quite subjective. There is no specific rule in determining the procedure for selection of inputs and outputs. However, the guideline is

that it should start with an exhaustive initial list of inputs and outputs that are considered relevant for the study. All the inputs and outputs that have a bearing on the performance of the DMU should be listed. Screening procedures, which may be quantitative (e.g. statistical) or qualitative (judgemental, using expert advice or using methods such as Analytical Hierarchy Process), may be used to pick up the most important inputs and outputs and therefore reduce the total number to a reasonable level.

Since the literature of DEA does not propose any specific criteria for selection of inputs and outputs, no specific rule is made in determining the procedure for selection of inputs and outputs. Due to the nature of the study, which is focused on the performance of funding instruments via the financial performance of companies, the variables are selected based on their relevance to the study. This approach is considered suitable, since in the literature of financial management, the measurement of the success of firms can be performed via the financial performance of the firm. Various financial variables, which form the financial ratios, have been used as indicators of success, namely sales, profits, profits margin, return on capital employed, debt cover, interest cover, etc.

The variables that are selected enable information pertaining to efficiency of DMUs operations to be obtained. Hence, these variables will indicate whether a DMU is operating at an efficient level or not, and are thus selected based on the analysis of the financial performance of DMUs. The independent variables selected will be the efficiency yardstick of the funding decision made in the DMU. The number of financial ratios is limitless. However, the ones that are applicable to this study are those that affect the funding decisions that the DMUs undertake. The ratios are incorporated into the DEA model and used as an index of efficiency.

According to Nissim and Penman (2003), funding decisions include both financial leverage and operating liability leverage. Both will affect the firm's performance and can render a firm efficient or not. If usage of such instruments put a firm into an efficient ranking, then it can be concluded that such an instrument is efficient. However, a firm's performance can also be

affected by other factors such as the efficiency of physical inputs and managerial capability of the company. Since the focus of this study is the efficiency of the financial input, other factors are assumed constant.

The variables that make up the funding decisions of firm are;

(i) Financial Leverage which is measured by the debt ratio of the firm.

$$\text{Debt ratio} = \frac{\text{LT Financial Debt + ST Financial Debt}}{\text{Total Assets}}$$

This ratio measures the efficiency of the funding decision. It is used to evaluate a firm's ability to meet its obligation, especially its long-term obligation. Hence it is a measure of the long- to short-term financial policy of a firm.

(ii) Operating Liability Leverage which according to Nissim and Penman (2003), is used to lever the rate of return from the operations, a firm will incur opportunity cost for the funds. The credits that are given are not interest-free. This is because the suppliers providing such credit normally charge higher prices for the goods and services supplied.

$$\text{The operating liability leverage} = \frac{\text{Operating Liabilities}}{\text{Net Operating Assets}}$$

Operating liabilities comprise trade payables, pension, and amount of credit sales. Since only trade payables, which is the accounts payable for goods received from suppliers, is available in the report, it is used as indication of the funding decision of the firm. Pension refers to the deferred wages that the firms owe to employees and constitutes part of the operating expenses. The amount of credit sales is the deferred revenues to be realised in the future. The interaction of the financial data in the DEA will form the required financial ratios that are needed for the analysis.

2.2.2.3 Assumption of the Model

There are four assumptions about the models namely; (i) The instruments are made available in the market to all DMUs. (ii) The DMU has full knowledge of the availability of funding instruments available in the market. (iii) The DMU is maximising its profits when it uses the funding instruments. (iv)

There is perfect information on the availability of the funding instruments in the markets among the decision makers of the DMUs, that is, they are aware of the different types of funding instruments that are available for them to use.

Since an instrument is considered efficient if a PLC is found to be efficient, therefore it is assumed that the objective of the PLC in using the funding instruments is to maximise its profit. Hence an efficient PLC that is located on the efficiency frontier would mean that it has utilised the instruments efficiently thus enabling it to be located on the efficiency frontier. However, there are issues that the PLCs might be on the frontier due to outliers. In view that the nature of the approach taken to evaluate efficiency is at the two stages of the funding process, the problem of outliers are minimised.

2.2.2.4 Foundations of DEA

In term of model specification, DEA requires the following prpoperty to exist in order that the DEA model is true. (i) Positivity Property in which the formulation of a DEA model requires the input and output variables to be positive, that is, greater than zero. (ii) Isotonicity Property which means that an increase in any input would result in some output increase and not decrease. If the input variable coefficient obtained from the correlation analysis is positive and significant, the isotonicity assumption is not violated. (iii) In terms of number of DMUs,according to the literature of DEA, in order to determine the number of DMUs is that the sample size should be at least two or three times larger than the sum of the number of inputs and outputs. That is, two or three decision-making units are needed for each input and output variable used in the model. This is to ensure that there are sufficient degrees of freedom for a meaningful analysis. If less than three DMUs per input and output variable are included in the data set, it would lead to a distorted finding whereby an excessive number of DMUs would be efficient. Pedraja et.al (1999) concluded that the sample size depends not only on the number of inputs and outputs, but also on their correlation structure. (iv) With regards to the number of inputs-outputs, the number of inputs and outputs needs to be as small as possible. This is in order to retain discriminative power for the comparative efficiencies of the units being

assessed (Sengupta, 2003). Nevertheless, in order that the efficiency scores reflect this principle, a smaller input number and a larger output number would be preferable (Cooper et.al., 1999).

In term of weights, they are determined by solving the DEA model. Using linear programming, each DMU is assigned a best set of weights with values that may vary from one DMU to another. These weights are computed such that the organisation under evaluation is placed in the best position in relation to other units in the data set. The weights developed via DEA may not represent the same relative weight that management applies regarding the relative importance of the variables (especially the output variables). The optimal weights may generally vary from one DMU to another DMU. Thus, the "weights" in DEA are derived from the data instead of being fixed in advance. (v) With regards to homogeneity of DMUs, DEA requires a relatively homogenous set of entities. That is, all entities included in the evaluation set should have identical inputs and outputs characterising performance. (vi) As for the measurement units of different inputs and outputs, they need not be measured in the same units.

2.2.2.5 Statistical Testing

Since DEA efficiencies are very sensitive to even small errors, sensitivity analysis needs to be conducted to verify the result. A set of potential input-output variables can also be refined using a combination of statistical tests and/or sensitivity analysis. Statistical tests of association between proposed input-output variables can be carried out, for instance, the correlation analysis of variance in OLS regression. Regression analysis may be used prior to running a DEA assessment to identify the factors most likely to fit the input-output correspondence being proposed.

Sensitivity analysis will help to refine a proposed input-output set. For example, input-output variables that are considered as having a secondary role can be assessed for their impact on the results by running assessments with

and without the variables concerned. If only a few DMUs are impacted by such secondary variables, the variables can be dropped from the assessment.

According to Sengupta (2002), statistical tests of efficiency scores on the DEA model depend on the underlying stochastic data used in the model, whereby Kolmogorov-Smirnov (KS) statistics may be used to test the statistical fit of the distribution over the set of efficient outputs as determined by the DEA model.

It is a good practice to check for the presence of extreme values, but the modelling practice adopted in this study will highlight the presence of such values.

2.2.3 The DEA Model

The basic DEA model for this study is adopted from the BCC model of Banker et al. (1984). It is an input-oriented model in which the objective is to produce the observed outputs with a minimum resource level. The BCC model is adopted as it allows maximal movement toward the frontier through proportional reduction of inputs. It also allows for the analysis of variable returns to scale. This BCC model enables the measurement of efficiency for cases with multiple-input multiple-output interactions (Charnes et al., 1994).

Hence this input-oriented variable returns to scale BCC model in ratio form identifies the best practice frontier by analysing the optimal combination of the various financial ratios depicting the funding decisions of the firms or DMUs. The linear programming formula computes the efficiency index for the DMU.

2.2.3.1 Efficiency Index (EI)

In general, the BCC model evaluates the efficiency of DMU by solving the ratio form by linear program. By considering o DMUs of which each is producing s different outputs using m different inputs, each of the DMUs becomes a focal DMU when its efficiency score is computed. The efficiency in this study concerns the efficiency of the DMU's funding decision. The

efficiency of the DMU can be measured by calculating an index of efficiency, where it represents the funding performance index for a group of peer DMUs called an efficiency index (EI).

$$\mathrm{EI}_o = \frac{\sum_{r=1}^{s} u_r y_{ro} + u_o}{\sum_{i=1}^{m} v_i x_{io}} \qquad (1)$$

where,

y_{ro} = the quantity of the rth output produced by the oth DMU during the period observation.

x_{io} = the quantity of the ith input used by the oth DMU during the period under observation.

u_r = the output weight that will be determined by solving the model.

v_i = the input weight that will be determined by solving the model.

u_o = variable that efficiently allows for variable returns to scale in the DMU under evaluation and is determined from solving the model.

i = unit for the input from 1 to m.

r = unit for output from 1 to s.

o = a focal DMU that takes a value from 1 ,...., n

The EI_o ratio is maximised subject to the following:

$$\frac{\sum_{r=1}^{s} u_r y_{ro} + u_o}{\sum_{i=1}^{m} v_i x_{io}} \leq 1,$$

$$\frac{u_r}{\sum_{i=1}^{m} v_i x_{io}} \geq \varepsilon$$

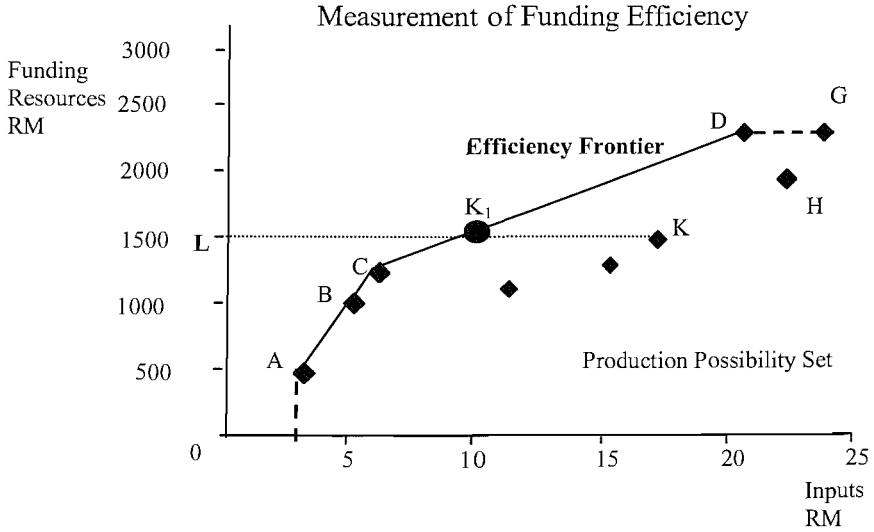
$$\frac{v_i}{\sum_{i=1}^{m} v_i x_{io}} \geq \varepsilon$$

The input and output values are assumed to be greater than or equal to 1. The weight *ur* for each DMU is determined entirely from the output data of all DMUs in the peer group. The weight used for each DMU is that which maximises the DMU's efficiency indices.

The DEA program identifies a group of optimally performing DMUs that are defined as DMUs with perfect EI and assigns them a score of one[17]. These DMUs with perfect EI are then used to create a frontier, against which all other DMUs are compared. In theory, DMUs that require relatively more weighted inputs to produce weighted outputs or, alternatively, produce less weighted output per weighted inputs as compared to those DMUs with the perfect EI, are considered as financially poor performers[18]. They are given EI scores of less than one, but greater than zero. A DMU being classified as a non-frontier DMU means that one or more of its ratios might be deficient with respect to the DMUs on the frontier.

Figure 2.3

Non-Parametric Approach to
Measurement of Funding Efficiency



EI scores for individual DMUs are not absolute, but are computed relative to the group of 'peer' DMUs. Each unit is compared with those operating with a similar input and /or output value. This is done in order to determine its

[17] Perfect EI DMUs are identified by the ability to utilise the same level of inputs and produce the same level or higher outputs. In economic terms, these DMUs define the revealed best-practice frontier. DEA then uses a mathematical method to calculate a performance measure for each DMU relative to all other DMUs based on the requirement that all observations lie on or below the frontier.

[18] Any DMU that lies above the frontier is considered to be financially inefficient, hence a poor financial performer. These DMUs could actually improve their performance to be on the frontier.

location on the frontier or to identify its reference set for a subsequent improvement in the areas where it is considered inefficient.

Referring to Figure 2.3, DMUs that are on the frontier such as those of A, B, C, K_1 and D, are financially efficient DMUs. That is to say that, these DMUs minimise usage of inputs in the form of assets in order to obtain a maximum amount of output in the form of funding resources or funding instruments. This funding instrument is cost-effective because a minimum amount of assets in the form of free assets used as collateral and equity is needed to obtain a maximum amount of funding instrument. These funding instruments put the DMU in the range of the efficient frontier compared with their peers. Hence, the DMU is termed a financially efficient DMU.

This DMU can then be considered as the referent (efficient) DMU for the other inefficient DMUs to emulate. The inefficient DMUs may find themselves in a situation where they have to obtain the same level of funding facilities as their efficient peers but at a higher amount of inputs. That is, for the same amount of funding instruments that they used, they have to use more assets, etc.. Hence, their mode of funding is not cost effective. They are thus not able to place their DMU in the efficient frontier, unlike their efficient peers. The efficiency index then shows how much each firm would have to save in order for it to be efficient (Ozcan and McCue: 1996).

Those DMUs that lie below the efficiency frontier are those that are performing below standard. They can emulate the performance of their efficient peers in order to improve their efficiency. The DEA program allows all peer groups of DMUs to use a weighting scheme that is most advantageous to the group's members. This increases their ability to be recognised as a frontier DMU. That is, a frontier DMU does not necessarily have to perform extremely well on all ratios to be considered a good performer. Instead, some degree of freedom is given to the DMU financial manager to alter various financial performance measures in order for the DMU to continue to stay financially viable.

Since the ratio of the EI is in the form of a linear programming, it has a dual, which can be represented as:

Minimise z_o $= \theta - \varepsilon \sum_{r=1} s_r^+ + \sum_{j=1} s_r^+$

subject to $\sum \lambda_j Y_j - s^+ = Y_o$

$$\theta X_j - \sum_j \lambda_j X_j - s^- = 0$$

$$\lambda_j, s_i^+, s_i^- \geq 0,$$

where,

Y is the j x s matrix of output measures,

X is the m x j matrix of input measures.

The variable θ is the (proportional) reduction applied to all inputs of DMU_o, that is the DMU being assessed in order to improve efficiency. This reduction is applied simultaneously to all inputs and results in a radial movement towards the envelopment surface. Hence, a DMU is efficient if and only if the following condition is satisfied:

(i) $\theta^* = 1$, that is all slacks are zero.

The ε is a non-Archimedean (infinitesimal) constant, which effectively allows the minimisation of θ to pre-empt the optimisation involving the slacks (s_i^+ and s_i^-). Therefore, a DMU is efficient only if all slacks are zero. The non-zero slacks and the value of $\theta \leq 1$ identify the sources and amount of any inefficiency that may be present.

2.2.3.2 Selection of Inputs and Outputs

Since there is no theoretical basis for the selection of variables in DEA, the variables are selected based on their relevance and usefulness in analysing the funding efficiency of the DMU, particularly in relation to their funding decisions. The variables selected are as follows. In stage 1, the inputs are total assets of the previous year (X_1^1), equity of the previous year (X_2^1) and previous year trade receivables (X_3^1). The outputs are Long Term Debt

(Y_1^1), Short-term Debt (Y_2^1) and Trade Payables (Y_3^1). In stage 2, the inputs are Long Term Debt (X_1^2), Short-term Debt (X_2^2) and Trade Payables (X_3^2). The outputs are Sales (Y_1^2), Total Assets at current year (Y_2^2) and Equity at current year (Y_3^2).

The selection process was adopted similar to the one used by Thore et.al. (1994). It is based on the following: one, the relation of their characteristics to the financial-production process, where a DMU attempts to produce profits (an output) by using its assets (an input) (in this study, the profits will only be realised when the funding instruments are used to fund the production activity); and two, the relationship of the variables to the funding decisions of the DMUs. The variables chosen are the ones normally used to calculate financial ratios.

In stage 1, variables such as long-term debt, short-term debt and trade payables are considered as outputs because they are the medium required in the funding process of the production activities. Variables such as previous total assets and previous equity are considered as inputs because they are factors used in the process of production. These inputs are used to obtain the outputs that enable the DMUs to be located on the efficiency frontier. This is true only if maximising debt relative to assets is conditional on firms taking a 'sensible' attitude towards risk, that is, it subject to the market. Leverage should neither be too low or too high.

In cases where the DMU undertakes both Islamic and conventional funding modes, the analysis for each variable will be broken into two, in order to incorporate both Islamic and conventional instruments. Definition of each of the variables is given in Appendix 2.1.

2.2.3.3 Measurements of Firm's Funding Instruments

Since a DMU that has a high leverage is likely to fail compared with those with low leverage (Köke, 2002; Kwansa and Cho, 1995), it is thus assumed that the group of DMUs that have lower financial and operating liability

leverage is able to put the DMU on the efficiency frontier. Hence, the DMU's leverage is used as measurement of its performance. In order to determine whether the DMU's leverage is at the optimal level or not, evaluation of the performance of the firm's funding instruments is undertaken. In this case, the DMU's funding decision is used as a proxy. The decision is evaluated to determine whether it has a positive or negative impact on the DMU's performance. It is therefore necessary for the DMU to minimise the long-term debt of total assets and short-term debt in order to maximise outputs, thereafter maximising sales and increasing revenues.

Financial ratios that are commonly used as comparators in the assessment of the financial performance of DMUs are systematically incorporated into the definition of the model of efficiency of funding instruments. This is done in order to derive the DEA equivalent of the efficiency model of measurement of the success of the intermediate-term funding decisions as well as the short-term operating decisions of the DMUs. The funding decisions of the DMUs can be reflected by the financial ratios such as, first, the financial ratio that relates to long-term funding decisions such as the intermediate-term debt ratio = intermediate-term debt / total assets; second, short-term funding decisions such as the short term debt ratio = short-term debt / total assets; and third, dividend decisions such as the dividend payout ratio = earnings available to common shareholders / cash dividend paid to common shareholders.

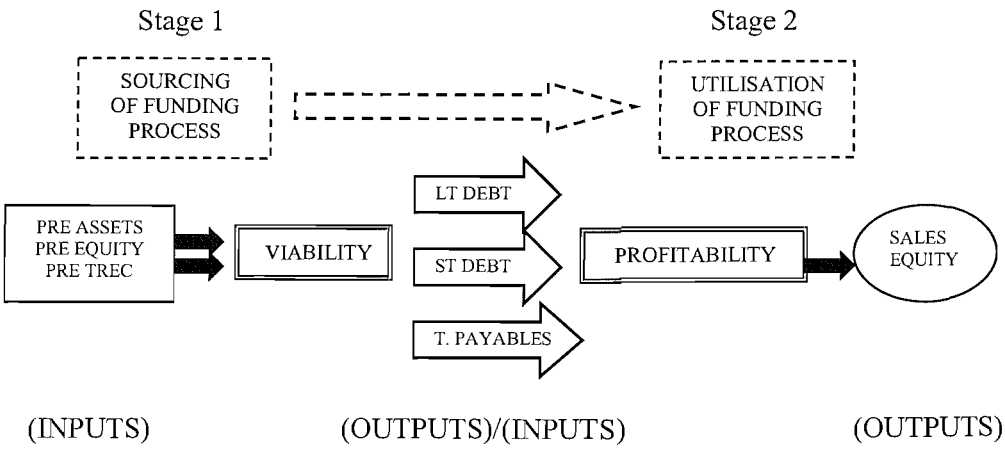
The definition of the model of efficiency of funding instruments incorporates the financial ratios that are commonly used as comparators in the assessment of the financial performance of DMUs. This is done in order to derive the DEA equivalent of the efficiency model of measurement of the success of the long-term funding decisions as well as the short-term operating decision of the DMUs. The funding decisions of the DMUs can be reflected by financial ratios such as first, the financial ratio that relates to long-term funding decisions such as the long-term debt ratio = long-term debt / total assets; and second, short-term funding decisions such as the short term debt ratio = short-term debt / total assets.

This study is motivated in part by the idea of partial efficiency[19] indices (Roll and Cook, 1993) and in part by the work of Zhu (2004) on the performance evaluation of Fortune 500 companies via a two-stage transformation process. In this study, the funding of a production activity involves two stages of process, namely stage one, the sourcing of funding process, and stage two, the utilisation of the funding process. The DEA model employed will attempt to obtain an overall efficiency index. This is undertaken by reconciling the funding instruments variables via the two-stage funding process described in Figure 2.4.

In stage 1, performance concerns the viability of the funding process. It relates to the ability of the company to attract funding instruments such as LT debt, ST debt and trade payables based on the assets and equity that it possesses. This stage is also known as the process of sourcing of the funding resources of the production. In Stage 2, performance concerns the profitability of the production process. This refers to the DMU's ability to generate revenues from sales by utilising the funding instruments that they have been able to attract, such as LT debt, ST debt and trade payables. This also refers to the utilisation stage of the funding process. It relates to the ability of the DMU to utilise the funding resources and generate profits.

Figure 2.4

Relationship among the Funding Instruments
via the Two Stages of Funding Process



[19] Please refer to 2.2.2 (b) on partial efficiency aspect of measurement.

In order to obtain an index of efficiency (EI), an operational form of DEA model of funding efficiency in two stages is formulated, namely:

Stage 1: The Viability Ratio – This stage is equated to the process of sourcing of funding resources. In this stage a BCC model in ratio form is used to compute the Sourcing of Funding Efficiency Index (SFEI) The inputs at this stage are total assets of the previous year (X_1^1), equity of the previous year (X_2^1) and previous year trade receivables (X_3^1). The outputs are Long Term Debt (Y_1^1), Short-term Debt (Y_2^1) and Trade Payables (Y_3^1).

Stage 2: The Profitability Ratio – This stage is equated to the process of utilisation of funding resources. In this stage, the BCC model in ratio form is also used to compute the Utilisation of Funding Efficiency Index (UFEI). The inputs are Long Term Debt (X_1^2), Short-term Debt (X_2^2) and Trade Payables (X_3^2) while the outputs are Sales (Y_1^2), Total Assets at current year (Y_2^2) and Equity at current year (Y_3^2).

Since this study aims to investigate the efficiency at both stages, and one of doing this is to take the average. Another alternative is to multiply the efficiency rates of the two stages together. This would give the same effect. Hence, in this study in order to compute the overall funding efficiency index, the efficiency rates of both stages are added and averaged out. Since this approach adopts the input-oriented VRS envelopment model to identify the best-practice frontier, a DMU is considered to be efficient if it is on the best production frontier in both stage 1 and stage 2. This is where the study differs from Zhu (2004), in that (i) it combines the efficiency rates of both stages of the funding process and considers the average efficiency rate for the efficiency index, and (ii) it relates the relationship of the process of sourcing of funding resources and the process of utilisation of funding resources to the overall efficiency of a particular DMU.

2.3 CONCLUSION

The DEA approach adopted in this study will enable an index of funding efficiency to be computed. The index gives DMUs an indication of whether the funding decisions that they have undertaken are efficient or not. An index of 1 would mean that DMUs are relatively efficient in their funding processes and are located on the efficiency frontier in comparison with their peers who are not. An index of less than 1 would mean DMUs are inefficient. For the overall performance of the funding process, an overall funding efficiency index for DMUs is obtained by averaging the efficiency performance in the two stages of the funding process.

Since DEA is able to analyse the interactions of multiple inputs and outputs simultaneously, hence this study is able to analyse the impact of different instruments on the efficiency of the DMUs. In this manner, the study will allow analysis of different aspects of the funding instruments, namely to analyse the impact of financial leverage and operating liability leverage on DMU's efficiency, and to analyse the different between the impact of the Islamic and conventional funding instruments on the DMU's efficiency.

The components of both financial leverage and operating liability leverage are analysed in order to determine the components that provide the highest impact on efficiency. The partial efficiency concept is applied to investigate the impact of the two stages of the funding process. The partial efficiency approach also relates to the analysis undertaken on the impact of funding instruments on the efficiency of a particular DMU. The financial leverage looks at the funding decision of the DMU, which relates to the funding activities of the DMUs, while the operating liability leverage relates to the operating activities of the DMU. Hence this relates to the efficiency of the use of funding instruments made by the DMU. Analysis in totality provides the overall efficiency of the DMUs in their decision making regarding funding resources.

The partial analysis approach enables an analysis to be made of factors that affect the DMU's performance. This approach allows analysis of specific funding instruments to be made and enables DMUs to identify which particular instruments have a greater impact on their performance. This approach allows comparative analysis between Islamic and traditional funding instruments to be made. However, for this to be done, DMUs must have specific information on the amount of each funding instrument used and the cost of each

funding instrument. The cost refers to the amount of interest or profit paid for the use of the funding instruments. With information on the amount of interest paid or profit received, DMUs will be able to incorporate this information in the analysis. Based on this data, this study will be able to create an efficient frontier for the group of DMUs understudied.

Another feature of DEA that will enable evaluation of the impact of the specific funding instrument on the efficiency of the DMUs is the ability to identify funding instruments that are excess in quantity. Due to this excess it has render the DMU inefficient and therefore there is a need for the DMU to reduce the usage of that particular instrument. In this aspect, the analysis can be performed on both the Islamic and conventional instruments.

Despite the attractive features of DEA, it has certain setback. DEA is sensitive to selection of variables used in the analysis. Since there is no statistical or causal relationship between inputs and outputs, there is a possibility of inclusion of invalid inputs or outputs. Hence, researchers intending to adopt DEA have to take precaution in choosing the appropriate inputs and outputs so as to achieve good analysis.

Nevertheless, this study has made some significant contribution in the current literature on efficiency in term of the DEA model of efficiency formulated in chapter 1 enables the study to (i) evaluate the efficiency of the funding instruments using the financial leverage and operating liability leverage as proxies for funding instruments, (ii) compare the effect of the different funding instruments on the performance of DMUs namely; (a) financial leverage versus operating liability leverage, and (b) Islamic versus conventional funding instruments.

CHAPTER 3

EFFICIENCY OF ISLAMIC AND CONVENTIONAL FUNDING INSTRUMENTS: EMPIRICAL EVIDENCE FROM MALAYSIA

3.0 INTRODUCTION

Malaysia has been involved in the Islamic finance business since 1983. A variety of funding instruments have been developed by banks since then. However, some reservation still exists among companies pertaining to the cost-effectiveness of these instruments in comparison to their counterparts, the conventional instruments.

The aim of the study is to analyse the performance of a sample of Malaysian public listed companies (PLCs) irrespective of what funding instruments they used and to try to identify whether any particular instruments have placed the company at its relative efficiency level. The main objective of this study is to analyse how a mixture of funding instruments, if there is one, can affect the performance of a company. In order to achieve this main objective, the study attempts (i) to identify, using Data Envelopment Analysis (DEA), the best-performing company among the PLCs based on their funding decisions; (ii) to demonstrate that the performance of the company is affected by the choice of funding instruments adopted; and (iii) to identify whether the companies are efficient both in terms of obtaining funding resources and in terms of utilising the resources in the production of goods.

The study adopts a non-parametric approach to the measurement of the company's performance in terms of funding the production process. Specifically, the study analyses the relative efficiency of PLCs in Malaysia. The data cover the Seventh Malaysia Plan from 1996, 1998–2000, which is a period of four years. The period is divided into three phases of analysis: 1996, which is prior to the 1997 crisis; 1998, which is in the aftermath of the crisis; and 1999–2000, the post-crisis period. This approach is chosen to enable analysis to be made before and after the crisis. This enables the study to evaluate the performance of these instruments in adverse economic conditions.

The target population includes 96 PLCs that are registered in the states of Kuala Lumpur and Selangor and listed on Bursa Malaysia (Malaysia Exchange). These companies are selected based on the following criteria, namely: (i) the PLC is registered in Kuala Lumpur

and the state of Selangor, (ii) the PLC was listed during the period under study, and (iii) the PLC is involved in the manufacturing of either consumer, industrial or technological products.

This study uses leverage, which comprises both financial leverage and operating liability leverage. It is considered that the instruments that influence the performance of the company make up both forms of leverage of the company. According to Pomerleano (1998), it is known that leverage if unchecked can be detrimental to a firm's health. He concluded that excess leverage at the micro level and also poor profitability resulted in the East Asian crisis in 1997.

This study adopts a combination of the ideas of partial efficiency (Roll and Cook, 1993) and the two-stage approach of efficiency evaluation developed by Zhu (2004) to determine the efficiency of the instruments. Stage 1 involves the sourcing of the funding process. Stage 2 involves the utilisation of the funding process. Hence the variables that are selected for the study are as follows. In stage 1, the input comprises the total assets and receivables. The long-term debt, short-term debt and trade payables are considered as the outputs because they are the consequence of the funding of the production process. In stage 2, long-term debt, short-term debt and trade payables are the inputs, and sales is the output. These variables are considered as inputs as they are the factors that are used in the process of production. This two-stage approach ensures that the funding instruments used by the companies are efficient overall. The approach will be able to demonstrate whether companies that are efficient in obtaining funds are also efficient in obtaining revenues from sales.

Since the literature on DEA does not provide any theoretical basis for the selection of the variables, the variables in this study are selected based on their relevance and usefulness in analysing the efficiency of the company. These variables interact in the DEA model to provide the financial ratios needed to interpret the company's performance. The ratios referred to are (i) the debt ratio, (ii) the receivables turnover ratio, and (iii) the trade credit to total assets ratio. The first ratio forms the financial leverage and the last two form the operating leverage. Together they form the total leverage of the company. Hence, companies that are efficient based on their leverage will be located on the efficiency frontier. The study will then analyse the impact of these instruments on the performance of the companies, thereby deriving a proxy for the performance of the instrument itself.

The analyses of the study are undertaken in four parts, namely (i) analysis of PLCs' descriptive statistics, (ii) analysis of the relative efficiency of the funding processes of the selected PLCs, (iii) analysis of the impact of different funding instruments on PLCs performance, and (iv) analysis of the performance of the responding PLCs. The study departs from current literature on efficiency in the following respects, namely (i) evaluation of the funding instruments via the funding process of PLCs in Malaysia, and (ii) comparative evaluation of the impact of (a) operating liability leverage and financial leverage, and (b) conventional funding instruments and Islamic funding instruments on the efficiency of the PLCs.

Hence, the contributions of this study to current literature are firstly, in areas of evaluation of efficiency of the funding instruments Secondly, this evaluation is undertaken via the two stages of funding process. Thirdly, the use of financial leverage and operating liability leverage in the evaluation of efficiency. This will enable the evaluation between the two instruments be determined. Lastly, the comparative analysis between the conventional and Islamic instruments.

The remaining part of the paper is structured as follows. Section 2 provides an overview of the manufacturing sector in Malaysia. The following section 3 describes the methodology used. The empirical analyses and results will be presented in section 4. Section 5 concludes the discussion.

3.1 OVERVIEW OF THE MANUFACTURING SECTOR

Since the mid-1980s, the Malaysian economy has undergone significant changes. The government has turned the direction of the economy towards a manufacturing-based industrial economy. Manufactured products contribute to about half of export revenues, oil about 30%, and other commodities about 20%. Of the manufactured exports, electronics represent the largest component, which is about 15%. Overall the manufacturing sector in Malaysia contributes approximately 35% of the country's gross domestic product, accounting for 80% of total exports (Economic Report, 2001).

The Malaysian economy has seen a shift from an agriculturally based economy in the early 1980s to an industrial economy. Over time total factor productivity has increased. Specifically, over the period 1996 to 2000, the Malaysian economy has witnessed positive

total factor productivity growth at a rate of 5.7% to 6.1%. Of this overall growth, the manufacturing sector continued to be the major contributor, registering an increase in growth rate from 5.8% in 1998 to 11.1% in 2000. This indicates that there was an efficient utilisation and management of resources, materials and inputs necessary for the production of goods and services (NPC, 1998)[20]. Many of the studies undertaken on the performance of the manufacturing sector have been on productivity, which is the usage of physical inputs in the production of goods and services. However, in terms of the efficiency of usage of financial input, no study has been undertaken. Hence, this study attempts to evaluate the performance of the funding instruments used in the production of outputs.

3.3 METHODOLOGY

3.3.1 Target Population

The target population in this study comprises the PLCs that are registered in the states of Selangor and Kuala Lumpur. These companies are mainly involved in the manufacturing sectors and have been in operation for 10 or more years[21].

Initially the target population included all companies involved in the manufacturing of consumer, industrial and technological products that were registered in the states of Kuala Lumpur and Selangor. However, a few of these companies are no longer listed, and some do not have enough data required for the analysis, hence finally reducing the population size to 96 companies.

The study uses quantitative data in the form of financial data, which is compiled from both secondary and primary sources. The main source is the secondary data taken from the Annual Companies handbook, which was produced by Bursa Malaysia (Malaysia Exchange). Since the sample comprises PLCs, their annual reports can be obtained from Bursa Malaysia. The reason for the use of financial data in this study is that financial data when incorporated into DEA can form the financial ratios needed in the analysis of the performance of the companies. These ratios can act as proxies for the funding decision-making of the companies.

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[20] Productivity Report 1996-2001. National Productivity Corporation (NPC), Malaysia. www.npc.org.my.

[21] Reasons for the choice of sample were discussed in Chapter 2 of this thesis.

The second source is a primary source in the form of a survey undertaken in order to obtain information such as that which relates to specific data on modes of funding, for example the proportions of Islamic and conventional funding undertaken by the companies, the types of funding used by the companies, and the total amount of each type of funding. All this information is not available in the conventional balance sheet or profit and loss reports. However, many companies are not willing to reveal specific details on the breakdown of the amount of funding into Islamic and conventional funding, except in percentage form. Hence, a rough estimation is made into order to obtain the specific breakdown in figures.

Due to the unavailability of data, this study divides the analysis into 3 phases, which are 1996, 1998 and 1999–2000. This time frame is sufficient to analyse the efficiency of the financial decision-making of the companies. It also allows the evaluation of performance before the crisis of 1997 and in the post-crisis period.

3.3.2 Variables

Since the literature of DEA does not propose any specific criteria for the selection of inputs and outputs, no specific rule is made in determining the procedure for selection of inputs and outputs. Due to the nature of the study, which is focused on the performance of funding instruments via the financial performance of companies, the variables are selected based on their relevance to the study.

The various financial variables that are selected enable information pertaining to the efficiency of company's operations to be obtained. Hence, these variables indicate whether a company is operating at an efficient level or not, and are thus selected based on the analysis of the financial performance of companies. The independent variables selected would be the efficiency yardstick of the funding decisions made in the company. They are the ones that affect the funding decisions that the companies made.

Following Nissim and Penman (2003), funding or financing decisions[22] include both financial leverage and operating liabilities leverage. Both will affect the company's performance and can render a company efficient or not. If usage of such instruments

[22] In the study funding decision and financing decision are treated as synonymous. Hence the term funding decision will be used throughout the discussion whenever financing decision are referred to.

puts a company into an efficient ranking, then it can be concluded that such an instrument is efficient. However, a company's performance may also be affected by other factors, such as the efficiency of physical inputs and the managerial capability of the company. Since the focus of this study is on the efficiency of the funding instruments, other factors are assumed to be constant.

The variables that affect the funding decision of firms are namely one, financial leverage, which measures the degree to which debt is used in funding a company's production activity. Hence it measures the degree to which a company depends on debt financing.

$$\text{Debt ratio} = \frac{\text{LT Financial Debt + ST Financial Debt}}{\text{Total Assets}}$$

This ratio is used as the indicator for financial leverage. Two, operating liability leverage[23] which according to Nissim and Penman (2003), measures the degree to which other liabilities such as trade payables, deferred revenues, and pension liabilities are used in running the production operations of the company. The

$$\text{operating liability leverage} = \frac{\text{Operating Liabilities}}{\text{Net Operating Assets}}$$

Operating liabilities comprise trade payables, pension and amount of credit sales. However, only trade payables, which is accounts payable for goods received from suppliers, is available in the report, hence it is used to indicate part of the funding decisions of the companies. Pension, which refers to the deferred wages that the companies owed to employees, and the amount of credit sales are not available; therefore, these two variables are omitted from the calculation of operating liabilities leverage.

3.3.3 DEA Model of Efficiency

In order to evaluate the efficiency of the funding decision of the company, a DEA model is used to rank the companies in terms of their financial performance. The DEA model used is based on the BCC model in ratio form with variable returns to scale, and the radial input-oriented approach where the inputs are minimised while the outputs are kept at their current level. By considering o PLCs of which each is

[23] It is different from operating leverage, which measures the degree to which fixed assets are used in the running the production activity of the company. In term of its fixed cost and variable costs, it relates to the cost structure of the companies.

producing s different outputs using m different inputs, each of the PLCs becomes a focal PLC when its efficiency score is computed. Efficiency in this study concerns the efficiency of the PLC's funding decisions. The efficiency of the PLC can be measured by calculating an index of efficiency, where it represents the funding performance index for a group of peer PLCs, called an Efficiency Index (EI).

$$\mathrm{EI}_o = \frac{\sum_{r=1}^{s} u_r y_{ro} + u_o}{\sum_{i=1}^{m} v_i x_{io}} \qquad (1)$$

where,

y_{ro} = the quantity of the rth output produced by the oth PLC during the period under observation.

x_{io} = the quantity of the ith input used by the oth PLC during the period under observation.

u_r = the output weight which will be determined by solving the model.

v_i = the input weight which will be determined by the solving the model.

u_o = variable that efficiently allows for variable returns to scale in the PLC under evaluation and is determined from solving the model.

i = unit for the input from 1 to m.

r = unit for output from 1 to s.

o = a focal PLC that take a value from 1 ,...., n

The EI_o ratio is maximised subject to the following:

$$\frac{\sum_{r=1}^{s} u_r y_{ro} + u_o}{\sum_{i=1}^{m} v_i x_{io}} \leq 1,$$

$$\frac{u_r}{\sum_{i=1}^{m} v_i x_{io}} \geq \varepsilon$$

$$\frac{v_i}{\sum_{i=1}^{m} v_i x_{io}} \geq \varepsilon$$

The input and output values as well as all inputs are assumed to be greater than or equal to 1. The weights u_r for each PLC maximise the PLC's efficiency indices. The DEA program identifies a group of optimally performing PLCs that are defined as DMUs with perfect EI, and assigns them a score of one. These perfect EI PLCs are then used to create a frontier, against which all other PLCs are compared. If a PLC is classified as a non-frontier PLC, it means that one or more ratios of that PLC might be deficient with respect to the PLCs on the frontier[24].

In order to achieve the measure of overall funding efficiency, the following operational forms of a two-stage DEA model developed based on Zhu (2004) are formulated. There are two stages involved in determining the overall efficiency of the funding instruments, namely:

Stage 1: The Viability Stage – This stage is equated to the process of sourcing of funding resources. In this stage a BCC model in ratio form is used to compute the Sourcing of Funding Efficiency Index (SFEI) The inputs at this stage are total assets of the previous year (X_1^1), equity of the previous year (X_2^1) and previous year trade receivables (X_3^1). The outputs are Long Term Debt (Y_1^1), Short-term Debt (Y_2^1) and Trade Payables (Y_3^1). These variables are considered as the outputs because they are the final consequences of the available assets. Even though they are the medium required in the funding process of the production activities, in this stage they are the final outcome of the funding process.

Variables such as previous total assets and previous equity are considered as inputs because they are factors that are instrumental in ensuring that the company is able to produce sufficient short-term to long-term funding for its production activity. They are used as collateral for either long-term or short-term debt. This is true, as studies have shown that collateral is needed in order to secure a loan, and usually assets are used as collateral (Allen, 1981; Leeth and Scott, 1989; Rajan and Winton, 1995; Bevan and Danbolt, 2004).

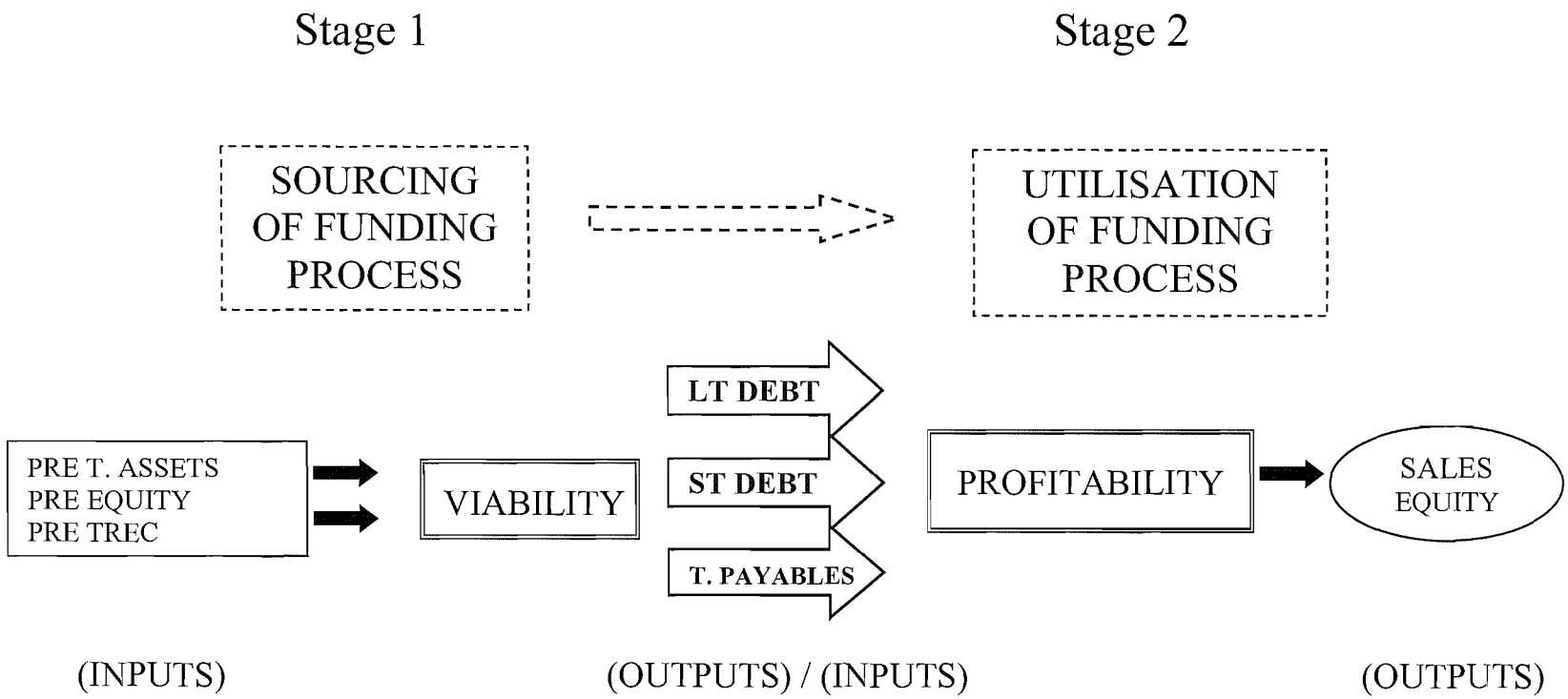
[24] Perfect EI PLCs are identified by their ability to utilise the same level of inputs and produce the same level or higher outputs. In economics, these PLCs define the revealed best-practice frontier. DEA then uses a mathematical method to calculate a performance measure for each PLC relative to all other PLCs, based on the requirement that all observations lie on or below the frontier (Ramanathan, 2000).

Stage 2: The Profitability Stage – This stage is equated to the process of utilisation of funding resources. In this stage, the BCC model in ratio form is also used to compute the Utilisation of Funding Efficiency Index (UFEI). The inputs are Long Term Debt (X_1^2), Short-term Debt (X_2^2) and Trade Payables (X_3^2) while the outputs are Sales (Y_1^2), Total Assets at current year (Y_2^2) and Equity at current year (Y_3^2). Long-term debt, short-term debt and trade payables are considered as inputs, as they are used as the medium of funding the production activities of the companies. Sales or revenues received from sales and equity are considered as outputs, since they are the final outputs of the whole production process (Feroz et al., 2001; Zhu, 2000 and Zhu; 2004). Equity shows the value of a company and can be viewed as collateral in order to obtain funding in the future. Revenues from sales can be used to purchase fixed assets, which later may also be used as collateral. All the variables listed are measured in Ringgit Malaysia, as the monetary term is a better indicator of the quantity of high tech products rather than the physical term.

This approach will ensure that the funding instruments used by the companies are efficient. This is because the company has to achieve efficiency in both stages, that is both SFEI and UFEI must be equal to 1 in order for it to be considered efficient.

(Refer to Figure 3.1
for a visual presentation of the whole process).

Figure 3.1: Relationship Among The Funding Instruments Via The Two Stages of Funding Process.



(Adopted with modification from Zhu, 2004.)

Hence, in the evaluation of the performance of companies, all these inputs are used to obtain the outputs that enable the PLCs to be located on the efficiency frontier. In cases where the PLC undertakes a mix of Islamic and conventional funding instruments, the analysis for each variable will be broken down into two, to incorporate both Islamic and conventional instruments. Definitions of the variables are given in Appendix 3.1.

3.3.4 Issues In DEA

The Issue of dimensionality relates to the number of variables (inputs and outputs) and/or sample size (Hughes and Yaisawarng, 2004). They studied the dimensionality effect from varying numbers of variables for a fixed sample size. According to them, the number of variables in relation to sample size may overstate the number of efficient units, hence there is a need to test the effect of dimensions on the model. A model selection technique based on a multivariate statistical analysis was proposed by Serrano Cinca and Mar Molinero (2001). They have developed various models based on a dataset for Chinese cities. According to them, it is possible to find out why a particular DMU performed better under some models and not under other models. A PROperty-FITting (ProFit) technique[25] is used in order to assess this phenomenon.

In trying to resolve the dimensionality issue, this study adopted a similar approach to that used by Serrano Cinca and Mar Molinero (2001) to select the best model in order to distinguish the most efficient company in the sample. There are 27 efficiency models developed for each stage of the production process. The average efficiency for the two stages will then be calculated and used as an index of the performance of the funding instruments for the PLC.

Another issue is sensitivity, in which case the DEA performance index can also be sensitive to the choice of (i) sample size, (ii) number of variables and (iii) association

[25] ProFit was developed by .D. Carrol and Chang in 1968. It provides external analysis of a configuration by a set of property ratings or rankings in row-conditional format by a scalar products (vector) model using either a linear or continuity transformation of the data. A "property" is a characteristic of each data point in the representation (Mar Molinero, 2006)

among variables used in the model (Galagedera and Silvapulle, 2004). According to Zhu (2004), calculated frontiers of DEA models are stable if the frontier DMUs that determine the DEA frontier remain on the frontier after particular data perturbations are made. He provides a super-efficiency model to compute a stability region in which a particular PLC remains efficient. According to Zhu (2001), using the super-efficiency model to analyse the sensitivity of DEA efficiency classification can be easily achieved and the results are stable. This is because the approach uses optimal values.

For this study, various models are designed by varying the variables and sample size in order to come up with a suitable model. A super-efficiency test will be undertaken on the chosen model to determine its stability. The average efficiency achieved by each company will be calculated based on the efficiency rates achieved in both stages of production. An average efficiency rate of one will indicate that the company is on the efficiency frontier and those that achieve less than one indicate that they lie below the efficiency frontier. Software called the Efficiency Measurement System (EMS)[26] is used to calculate the efficiency of the funding instruments.

3.3.5 Selection of the Efficiency Model

In order to identify the efficient companies, one model of efficiency is required. Researchers in DEA have accepted that DEA efficiency can be affected by the different combination of inputs and outputs. Hence many researchers such as Zhu (1998), Serrano Cinca and Mar Molinero (2003) have come up with various means of dealing with the problem. Hence, in order to choose a suitable model, this study takes similar approach by these earlier researchers where various different models are developed and later analysed from combinations of various inputs and outputs. The approach enables different models with different combination of inputs and outputs to enable the PLCs to attain efficient level. However, due to time constraints and the complexity involved in massive datasets involving multiple inputs and outputs combinations, this study settled for combinations of 3 inputs and 3 outputs.

[26] The software is free for academic users. It can be found at the following web address. http://www.wiso.uni-dortmund.de/lsfg/or/scheel/ems/#feat

Table 3.1 shows the various inputs and outputs in the two stages of production. In stage 1, the previous year's total assets (X_1), previous year's equity (X_2) and previous year's receivables (X_3) use the symbols A, B and C respectively. The outputs such as long-term debts (Y_1), short-term debt (Y_2) and total payables (Y_3) are 1, 2 and 3 respectively. These symbols are used in order to make model identification easier later in the analysis. While in stage 2, long-term debts (X_1), short-term debts (X_2), and total payables (X_3) are a, b and c respectively. The outputs such as sales (Y_1), total assets (Y_2) and equity (Y_3) are 1, 2 and 3 respectively.

The twenty-seven models developed for each of the respective stages of production together with their factor loadings are shown in Table 3.3. Factor loading refers to a coefficient that appears in a factor pattern matrix or a factor structure matrix. On orthogonal analysis, factor loadings are equivalent to bivariate correlations between the observed variables and its components (Hatcher and Stepanski (2004).

Table 3.1

Inputs and Outputs for DEA Model of Efficiency

Stage 1:			Stage 2:		
Inputs (X):		Symbol	Inputs:		Symbol
Pre Total Assets	X_1	A	Long-Term Debts	X_1	a
Pre Equity	X_2	B	Short-Term Debts	X_2	b
Pre Receivables	X_3	C	Total Payables	X_3	c
Outputs:			Outputs:		
Long-Term Debts	Y_1	1	Sales	Y_1	1
Short-Term Debts	Y_2	2	Total Assets	Y_2	2
Total Payables	Y_3	3	Equity	Y_3	3

In order to select the suitable model, Principal Components Analysis (PCA) is used. PCA is chosen because it is considered to be better compared to, for example, Multidimensional Scaling (MDS). Particularly in relation to this study, the MDS procedure was found to be inappropriate as it imposes certain limits on the dataset. It requires reduction of either the sample size or the variables, which this study cannot

afford to do as it might further reduce the sample size. This decision is further supported by the work of Zhu (1998), Premachandra (2001) and Serrano Cinca and Mar Molinero (2001a, 2003), in which PCA has been proven to be a good support for DEA in the evaluation of the performance of DMUs.

A Property Fitting (ProFit) procedure is used in order to determine the fit of the model. This study uses the multiple regression method to perform the analysis. With the combination of this method and PCA, a selection of the suitable model is undertaken. Using DEA, this chosen model is then used to evaluate the efficiency of the PLCs.

3.3.5.1 Principal Components Analysis (PCA)

PCA is used as a data reduction technique and can be used as a measure to address the dimensionality issue. It is a method for producing the small number of constructed variables desired from the larger number of variables that were originally collected. It is carried out to determine which efficiency model accounts for a larger portion of the total variance in the original set of the models. A factor analysis is then conducted for the two underlying factors, which explains the relative positions of the various efficiency models.

The principal component extracted is the linear combination of optimally weighted models. The component scores are then plotted onto a graph, showing the similarities and differences between the various models. The ProFit procedure is used to plot the PCA graph on the efficiency models. Here a similar approach to that taken by Serrano Cinca and Mar Molinero (2001a) is adopted, whereby models are treated as variables while the efficiency rating is treated as observation.

Table 3.2 shows the principal component scores for the 2 stages of funding process. In stage 1 five components are retained, while in stage 2 only four components are retained.

Table 3.2

Principal Component Scores for the Two Stages of Funding Process

Stage 1			
Component	Eigenvalue	Proportion	Cumulative
1	16.60	0.62	0.62
2	3.39	0.13	0.74
3	2.00	0.07	0.81
4	1.70	0.06	0.88
5	1.21	0.05	0.92
Stage 2			
Component	Eigenvalue	Proportion	Cumulative
1	16.31	0.61	0.61
2	5.29	0.20	0.80
3	1.80	0.07	0.87
4	1.51	0.06	0.92

A component that has eigenvalue of more than 1 will be retained and interpreted. This is because each of the observed variables in the component contributes one unit of variance to the total variance in the data set. Hence, a component that has eigenvalue greater than 1 would mean it has accounted for a greater amount of variance that has been contributed by one variable. This component accounts for a considerable meaningful amount of variance that is worthy of being retained (Hatcher and Stephanski, 2004).

The next step is to look at the loadings of these models. These loadings can determine the performance ranking of the model. Table 3.3 shows the models and their factor loadings[27]. The first component extracted accounts for a maximal amount of total variance[28] in the observed variables.

[27] Factor loading is the weight given to a variable in the construction of a principal component. It also represents the correlation between an original value and its factor.

[28] The total variance refers to the sum of the variances of the observed variables.

Table 3.3

Factor Loadings of the First Principal Component for the Two Stages of Funding Process

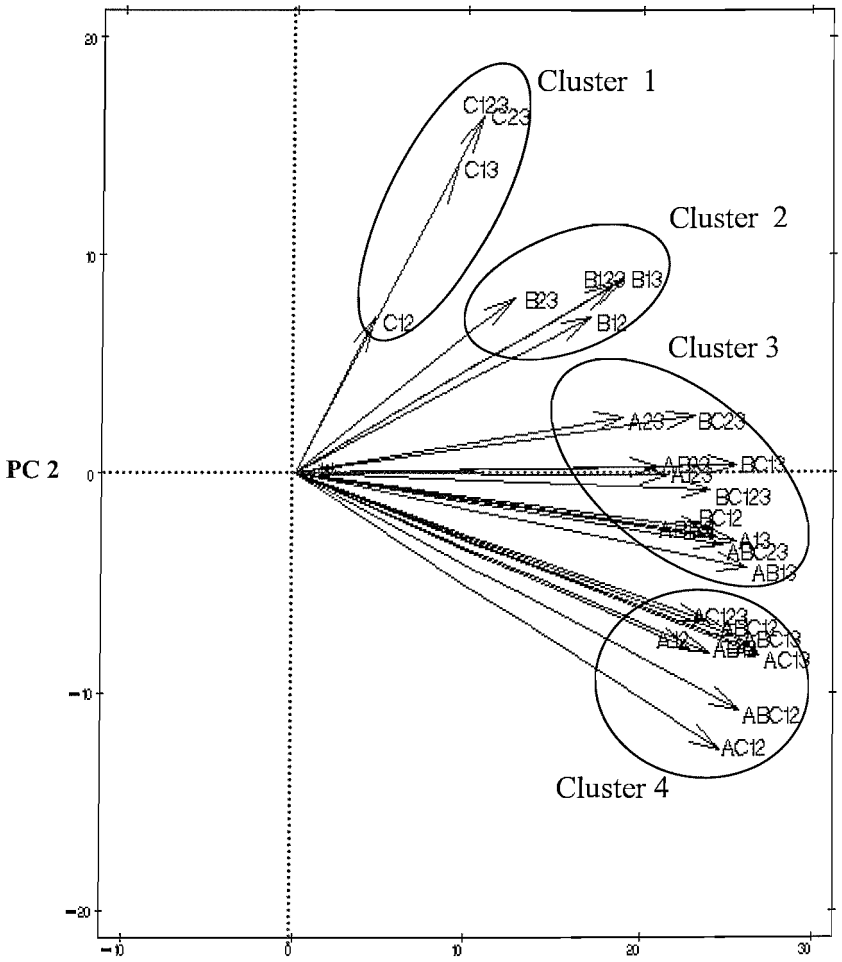
	Stage 1			Stage 2	
Models	PC1	PC2	Models	PC1	PC2
A12	88	22	a1	12	16
A13	84	19	a12	11	32
A23	76	25	a13	16	39
A123*	47	11	a23	14	48
AB12	83	36	a123	14	48
AB13	80	33	ab1	28	59
AB23	70	42	ab12	29	88
AB123*	46	29	ab13	33	75
ABC12	62	70	ab23	24	87
ABC13	63	66	ab123	24	87
ABC23	49	76	abc1*	89	5
ABC123*	28	63	abc12*	91	34
AC12	64	69	abc13*	92	18
AC13	64	66	abc123*	91	34
AC123*	24	62	ac1	88	2
B12	26	24	ac12	90	22
B13	25	25	ac13	90	23
B23	27	28	ac23	90	14
B123*	19	24	ac123	77	23
BC12	31	82	b12	25	89
BC13	29	80	b13	25	91
BC23	25	83	b23	29	79
BC123*	9	75	b123	21	90
C12	22	13	bc12	91	34
C13	0	8	bc13	92	34
C23	11	13	bc23	92	19
C123*	11	13	bc123	79	35

Since the purpose of the study is to evaluate the efficiency of the funding instruments, it is appropriate that the three instruments should be present in the model of efficiency. Models shown in Table 3.3 with an asterisk indicate that they include all the three funding instruments. Analysing these models in Figure 3.2, it can be seen that the full model ABC123 in stage 1 has a factor loading of 28, which is very low. The minimum acceptable cut off for a factor loading is 30. For a sample size of less than 100, the lowest factor loading to be considered significant is ± 30 (Hair et al., 1998). Hence in

stage 1 it did not even obtain the minimum. The model that attained the highest score of 47 and contained the three funding instruments is A123. The second highest score is attained by model AB123 with a score of 46. A choice between these two models has to be made.

Figure 3.2

Principal Components of the Efficiency Models: Stage 1

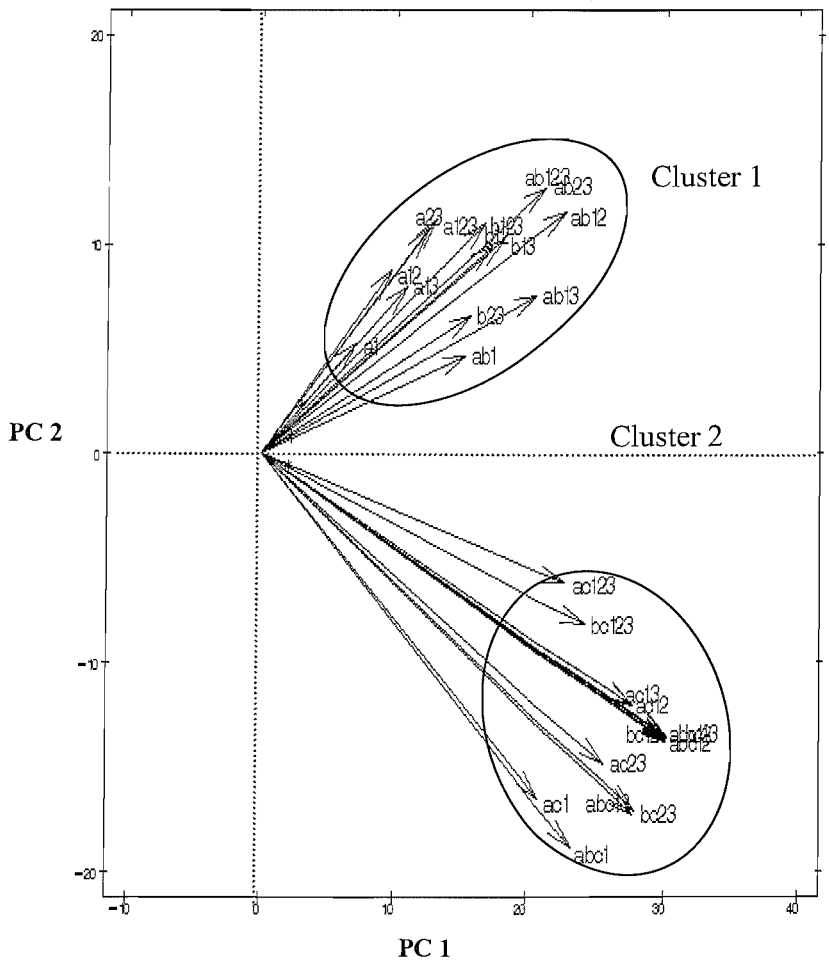


In reference to Figure 3.2, there are four distinct clusters of models. The observed similarity between DMUs, based on a set of relevant "features" among them, are represented as clusters of the DMUs under study (Arabie et. al. (1998). These clusters indicate that models within one cluster share some similarities. All these clusters of model are located on the positive side of the

graph. This indicates that all the models have positive factor loadings in the first principal component. Cluster 1 contains models that have the previous year's receivables as the input while in terms of output trade payables is present in all the models. Cluster 2 contains previous year's equity as input and again trade payables are present in three of the four models. Cluster 3 contains a mixture of A, AB, BC and ABC models, while cluster 4 contains A, AC and ABC models. Model AB123 is found in cluster 3.

Figure 3.3

Principal Components of the Efficiency Models: Stage 2



In stage 2 the full model abc123 has a factor loading of 91. With reference to Figure 3.3, it can be seen that in stage 2 there are only two distinct clusters of models. Each model in a cluster has some similarities; hence it would make

no difference to choose one over the others. Since the three funding instruments have to be present in the model, the appropriate models would be those that have all the three instruments present. Such models would be abc1, abc12, abc13 and abc123. These models all have higher factor loadings, with abc13 having the highest, abc12 and abc123 each with a score of 91, and abc1 having 89. Hence it is appropriate to choose abc13 over the others, since it contains output such as sales and equity.

Models which have a single input such as a or b and a combination of a and b form one cluster called cluster 1, while models that has combination of inputs such as a and c, b and c and abc form another cluster, cluster 2. All these clusters of model are also located on the positive side of the graph, indicating that all the models have positive factor loadings in the first principal component.

Hence it can be concluded that choosing model AB123 over A123 will be appropriate, as it has previous total assets and previous equity$_1$. This is because the sample comprises PLCs in which equity is a main source of funding.

This choice is further supported by the choice of the model in stage 2, that is, abc13, which produced outputs such as sales and equity. It is most appropriate in terms of the funding process where the output equity could be used as input in the future. It will increase the company's credibility in generating more funding instruments to fund its production activities. Sales would mean more revenues to enable assets to be accumulated and later used as input to generate more funding in the future. Therefore it is most appropriate that this model is chosen. However, it is also interesting to consider the performance of the PLCs under the full model abc123. Hence a comparison will be undertaken to see if there is any difference in performance of the PLCs under these two models. This is undertaken 3.4.3.

3.4. ANALYSIS

3.4.1 Analysis of PLCs' Descriptive Statistics

Table 3.4 shows the descriptive statistics for the 96 PLCs in the sample. The funding instruments in terms of long-term, short-term and trade payables that these PLCs have acquired and utilised ranges from a minimum of 0 to a maximum of RM3188490, a minimum of 0 to a maximum of RM7216780, and a minimum of RM680 to a maximum of RM2413339, respectively. On the average PLCs acquired and utilised RM123164, RM775414 and RM167681 of long-term debt, short-term debt and trade payables respectively.

In order to acquire these funding instruments, the PLCs have utilised on average previous assets and previous equity amounting to RM11057945 and RM409581 respectively. In terms of output generated from these funding processes there are sales, equity and total assets on average amounting to RM725085, RM377817 and RM1020410 respectively.

Table 3.4

Descriptive Statistics for PLCs

Variable	Mean	Std Dev	Minimum	Maximum
Stage 1				
Previous Assets	11057945	2094712	11510	14317532
Previous Equity	409581	717906	2555	4792475
Long-Term Debt	123164	381843	0	3188490
Short-Term Debt	217337	775415	0	7216780
Trade Payables	167681	384873	680	2413339
Stage 2				
Long-Term Debt	123164	381843	0	3188490
Short-Term Debt	217337	775415	0	7216780
Trade Payables	167681	384873	680	2413339
Sales	725085	1292030	15589	6496724
Equity	377817	669834	7559	5062161
Total Assets	1020410	1962626	34297	13272057

3.4.2 Analysis on the Sensitivity Test on the Selected Models

Table 3.5

Sensitivity Test for Selected Models

No	DMU	2000			1999			1998			1996		
		AB123	**abc13**	**abc123**	**AB123**	**abc13**	**abc123**	**AB123**	**abc13**	**abc123**	**AB123**	**abc13**	**abc123**
1	AMST	Infeasible	Infeasible	Infeasible	Infeasible	6.57%	Infeasible	Infeasible	42.32%	Infeasible	Infeasible	Infeasible	Infeasible
2	CIHG	9.18%	0.00%	0.00%	14.29%	100.00%	100.00%	26.82%	169.92%	176.02%	7.72%	84328.66%	478.36%
3	DLY	18.46%	100.00%	100.00%	Infeasible	100.00%	100.00%	42.01%	25.94%	25.94%	27.20%	100.00%	1.61%
4	ESO	71.68%	Infeasible	Infeasible	Infeasible	32.42%	34.23%	59.03%	16.24%	Infeasible	17.82%	0.00%	6.09%
5	FCVV	12.21%	21.20%	4.15%	26.90%	0.00%	0.00%	25.97%	8.84%	22.14%	7.35%	34774.88%	5568.42%
6	FHB	124.18%	0.00%	0.00%	20.72%	0.00%	0.00%	69.67%	0.39%	0.95%	90.40%	0.00%	0.99%
7	FFEM	30.52%	Infeasible	Infeasible	Infeasible	Infeasible	Infeasible	47.38%	Infeasible	Infeasible	32.99%	4739.53%	4739.53%
8	LNDV	57.46%	22.64%	26.96%	18.64%	0.44%	13.58%	68.83%	3.57%	21.02%	124.38%	2.97%	20.94%
9	MCA	11.68%	Infeasible	Infeasible	34.04%	100.00%	15.48%	33.30%	7.52%	10.40%	25.26%	0.00%	4.28%
10	MTRD	22.96%	54.54%	8.86%	55.96%	100.00%	100.00%	46.27%	84.20%	84.20%	14.12%	24.55%	28.57%
11	MVE	43.85%	0.00%	0.00%	20.38%	0.00%	0.37%	48.21%	4.45%	12.44%	20.84%	0.00%	1.22%
12	NSTL	58.24%	23.45%	19.55%	66.78%	100.00%	100.00%	62.76%	100.00%	61.41%	8.38%	Infeasible	Infeasible
13	OYEL	93.16%	45.54%	45.54%	72.99%	51.50%	Infeasible	93.61%	25.76%	30.04%	74.82%	0.06%	13.73%
14	PHNC	56.88%	0.00%	0.00%	44.00%	0.00%	0.00%	76.36%	125.98%	Infeasible	73.93%	0.00%	0.37%
15	PEMC	16.23%	Infeasible	Infeasible	3.56%	Infeasible	Infeasible	29.33%	150.34%	150.34%	1.80%	Infeasible	1225.00%
16	PRTN	107.89%	Infeasible	Infeasible	42.71%	Infeasible	Infeasible	88.38%	81.96%	Infeasible	86.65%	Infeasible	Infeasible
17	PTGS	Infeasible	Infeasible	Infeasible	Infeasible	Infeasible	Infeasible	88.39%	Infeasible	Infeasible	Infeasible	Infeasible	Infeasible
18	PMTL	80.42%	0.00%	0.00%	25.66%	0.00%	0.00%	53.70%	1.44%	Infeasible	6.07%	0.00%	1.01%
19	RHJU	28.55%	0.00%	0.00%	18.84%	0.00%	0.00%	32.20%	1.87%	11.28%	35.18%	0.13%	3.98%
20	SPTC	95.63%	8.06%	0.00%	16.68%	0.00%	0.17%	43.65%	0.79%	15.26%	Infeasible	0.00%	0.44%
21	UASI	9.08%	100.00%	100.00%	29.94%	100.00%	100.00%	26.02%	2766.50%	2766.50%	13.74%	0.46%	11.26%
22	UMVV	16.85%	166.62%	Infeasible	7.74%	71.35%	86.20%	20.81%	Infeasible	Infeasible	41.22%	0.50%	11.99%
23	UBEE	78.94%	Infeasible	Infeasible	69.84%	Infeasible	Infeasible	105.90%	30.78%	30.78%	127.94%	361.66%	362.26%
24	UNZ	21.23%	29.68%	29.68%	41.13%	0.00%	0.00%	40.28%	Infeasible	Infeasible	35.86%	100.00%	Infeasible
25	YLCT	4.00%	0.19%	0.19%	11.08%	0.00%	0.24%	43.84%	Infeasible	Infeasible	265.68%	0.00%	1.36%

Using super-efficiency DEA model, the sensitivity analysis of DEA efficiency classification can be easily achieved. Since the approach uses optimal values to various super-efficiency DEA models, the result are stable and unique. The larger optimal values to the super-efficiency DEA models correspond to greater stability of the test DMU in preserving efficiency when the inputs and outputs of all DMUs are changed simultaneously and unequally. DMUs that are found that PLCs that are found to be efficient remain efficient even after the data perturbation in all DMUs is performed. The infeasibility of the super-efficiency DEA model is estimated with

extreme-efficient DMUs and indicates efficiency stability to data perturbation in all DMUs (Zhu, 2001). Referring to Table 3.5, it is found that all the PLCs that are infeasible indicate that they remain efficient when the test is undertaken. This indicates efficiency stability in those PLCs.

3.4.3 Analysis of PLCs' Performance Based on Selected Models

Table 3.6

Performance of PLCs under Various Models for Year 2000

Stage 1 Models	No of DMUs Efficiency 100%	No of DMUs Efficiency <10%	No of DMUs Efficiency >10%	Stage 2 Models	No of DMUs Efficiency 100%	No of DMUs Efficiency <10%	No of DMUs Efficiency >10%
A12	8	71	17	a1	4	4	88
A13	13	71	12	a12	5	9	82
A23	5	76	15	a13	5	6	85
A123	13	76	7	a23	5	10	81
AB12	11	76	9	a123	6	9	81
AB13	13	71	12	ab1	12	14	70
AB23	8	77	11	ab12	14	25	57
AB123	14	77	5	ab13	14	15	67
ABC12	16	76	4	ab23	15	24	57
ABC13	15	71	10	ab123	15	24	47
ABC23	14	74	8	abc1	17	48	31
ABC123	18	75	3	abc12	23	51	22
AC12	14	78	4	abc13	15	45	33
AC13	12	74	10	abc123	23	51	22
AC123	18	75	3	ac1	9	55	32
B12	5	23	68	ac12	14	57	25
B13	10	69	17	ac13	12	52	32
B23	3	17	76	ac23	10	57	29
B123	6	24	66	ac123	14	58	24
BC12	10	73	13	b12	10	18	68
BC13	10	69	17	b13	9	10	77
BC23	11	68	17	b23	10	17	49
BC123	12	73	11	b123	10	18	68
C12	3	2	91	bc12	18	52	16
C13	5	0	91	bc13	17	45	34
C23	6	2	88	bc23	13	55	28
C123	6	2	88	bc123	18	52	26

Table 3.6 shows the performance of PLCs under various models for the fiscal year 2000. The performance of PLCs under the combination of models AB123 and abc13 as compared to AB123 and abc123 is seen as lower. That is, they do not perform extremely well or extremely poorly. Models with more inputs and outputs combination performed slightly better than those with less inputs and outputs combination. This reflects that increase in inputs and outputs combination will increase number of DMUs being efficient.

With respect to Table 3.6, it can be seen that the number of PLCs obtaining 100% efficiency rate under AB123 is 14, and number of PLCs obtaining less than 10% is 11. In Stage 2, for model abc13, the number of PLCs obtaining 100% efficiency rate is 15 and for less than 10% it is 33.

Hence, taking into considerations all the factors discussed earlier, these models are considered to be appropriate in the evaluation of the performance of the instruments. Since the data is massive if analysis on all 96 PLCs are undertaken, only 25 PLCs are selected in order to facilitate analysis. These PLCs are randomly selected from the best, the worst and moderately performed PLCs. By looking at the performance of these 25 selected PLCs under the twenty-seven models in Table 3.7, it can be seen that different models that incorporate different combinations of variables have put different PLCs onto the efficiency frontier. However, the same companies managed to appear on the frontier consistently for either all or most of the models. AMST, for instance, is found to be 100% efficient for all the models in stage 1. However, in stage 2, only 17 out of the 27 models were found to be 100% efficient.

In stage 1, PLCs such as MCA, PRTN, PTGS and UBEE all obtained 100% efficiency rate in 12, 16, 24 and 11 of the models respectively, while in stage 2, they obtained 100% efficiency rate in 13, 25, 22 and 11 of the models respectively. These PLCs, except PRTN, obtained efficiency rates of less than 10% for some of the models. Twelve PLCs were found to be inefficient for all the models. PLCs such as CIHG and YLCT in stage 1 and CIHG and MTRD in stage 2 obtained efficiency rates of less than 10%. This shows that only CIHG performed badly for all stages of

funding process and for all models. The rest of the PLCs seem to be in between the two extremes.

This study uses a combination of models AB123 and abc123 to evaluate the performance of the funding instruments. As discussed in the earlier part of the paper, the efficiency of the funding instruments has to be accessed in both stages of funding process.

Table 3.7

Performance of Selected PLCs under the 27 Models for Year 2000

Stage 1					Stage 2				
No	DMU	Efficiency 100%	Efficiency ≥ 10%	Efficiency < 10%	No	DMU	Efficiency 100%	Efficiency ≥ 10%	Efficiency < 10%
1	AMST	27	0	0	1	AMST	17	5	5
2	CIHG	0	0	27	2	CIHG	0	0	27
3	DLY	0	19	8	3	DLY	13	0	26
4	ESO	0	22	5	4	ESO	11	11	5
5	FCVV	0	18	9	5	FCVV	0	0	27
6	FHB	11	12	4	6	FHB	0	7	20
7	FFEM	0	15	12	7	FFEM	22	5	0
8	LNDV	0	22	5	8	LNDV	0	14	13
9	MCA	12	8	7	9	MCA	13	5	9
10	MTRD	0	19	8	10	MTRD	0	0	27
11	MVE	0	20	7	11	MVE	0	8	19
12	NSTL	0	23	4	12	NSTL	0	19	8
13	OYEL	0	23	4	13	OYEL	0	22	5
14	PHNC	0	20	7	14	PHNC	0	13	14
15	PEMC	0	15	12	15	PEMC	13	11	3
16	PRTN	16	11	2	16	PRTN	25	2	0
17	PTGS	24	2	1	17	PTGS	22	3	2
18	PMTL	0	19	8	18	PMTL	0	0	27
19	RHJU	0	20	7	19	RHJU	0	8	19
20	SPTC	0	23	4	20	SPTC	0	0	27
21	UASI	0	15	12	21	UASI	1	12	14
22	UMVV	0	15	12	22	UMVV	12	10	5
23	UBEE	11	9	7	23	UBEE	11	2	14
24	UNZ	0	19	8	24	UNZ	1	0	26
25	YLCT	0	0	27	25	YLCT	0	13	14

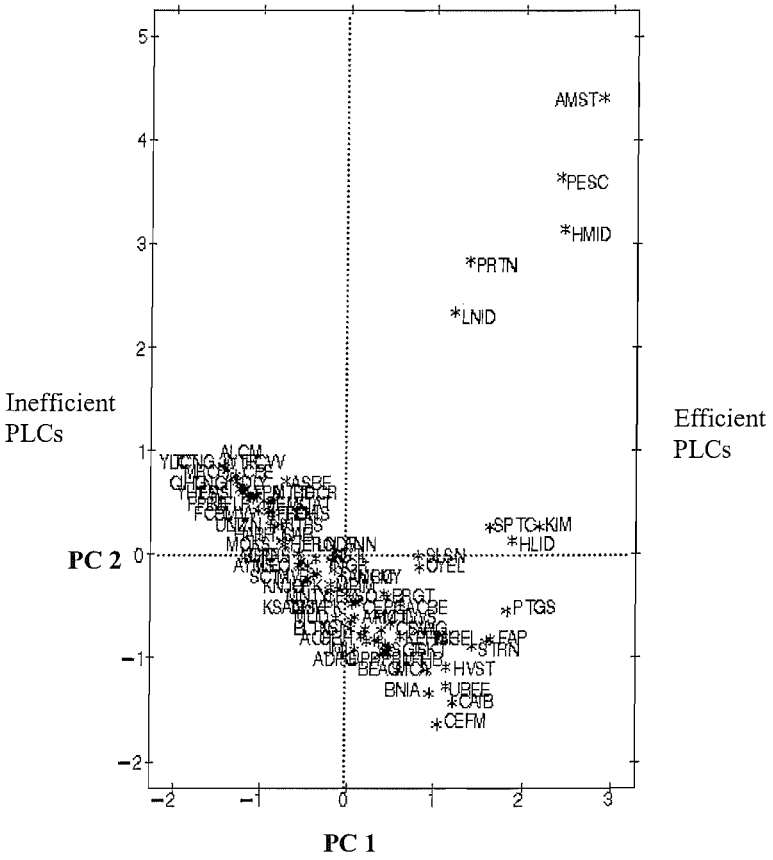
An average performance will be taken in order to determine whether the PLC is on the frontier or not. The average performance is taken because the efficiency index is computed based on the average of the efficiency rate of the two stages of funding

process. An average efficiency of 100% would mean that the PLC was on the frontier. A PLC needs to be efficient in both stages in order to be considered efficient. Such a PLC will thus be located on the efficiency frontier. Hence, the average efficiency rate achieved by the PLC will indicate the rate of efficiency of the PLC. In order to determine the factors contributing to the efficiency, the inputs will be analysed. Since the inputs in the physical production, that is, the final state of the funding process, are the funding instruments, they are thus considered as the proxy for the efficiency of the funding instruments.

3.4.4 Analysis of the Relative Efficiency of the Funding Process of Selected PLCs

Figure 3.4

PCA Analysis on the Performance of PLCs based on Funding Instruments: Stage 1



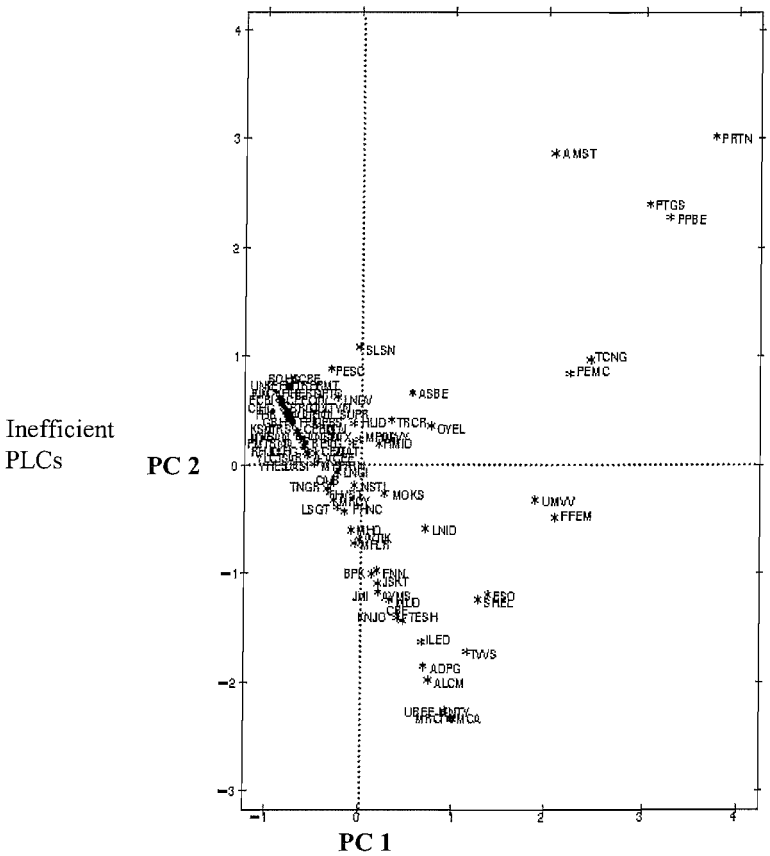
The analysis is undertaken based on year 2000 data. Figure 3.4 above shows the

location of the efficient and inefficient PLCs based on their funding instruments in the PCA graph for the stage 1 funding process of production.

PLCs on the right quadrant of the graph comprise efficient PLCs, while those on the left side comprise the inefficient PLCs. AMST, PESC, HMID, PRTN, and LNID all lie on the upper right-hand of the quadrant. This indicates that in stage 1 these PLCs have some similarities in terms of sourcing of funding process. PTGS, KIM, SPTC, UBEE and a few others lie on the lower right-hand side of the quadrant. These PLCs also possess some similarities in terms of their sourcing of funding process.

Figure 3.5

PCA Analysis on the Performance of PLCs based on Funding Instruments: Stage 2



In Figure 3.5, for stage 2, the process of utilization of funding has shown that PRTN, PPBE, AMST and PTGS are found to be on top of the upper right-hand side of the

graph. This indicates that in terms of utilization of funding, these PLCs have some similarities. It means that they are similar in terms of the mixture of funding used in order to produce the output.

In term of analysis of the performance of the funding instruments via the PLCs' performance, this study will not discuss all the 96 PLCs. Instead the 25 selected PLCs discussed earlier will be used. This number 25 is taken in order to maintain consistent with earlier analysis on performance of 25 selected PLCs. The 25 PLCs is also viewed as representative of then96 PLCs. The selected PLCs comprise efficient PLCs that achieved 100% in most of the models under study, inefficient PLCs that obtained the lowest level of efficiency rate of less than 10%, and those that obtained more than 10% but less than 100% efficiency rate. In reference to Table 5, there are two PLCs, namely PRTN and PTGS, that achieved an average efficiency rate of 100% for the year 2000, and two, that is CIHG and YLCT, that achieved less than 10% efficiency rate. The rest of the PLCs lie in between.

The summary of overall efficient PLCs based on two different combinations of models is shown in Table 3.8. In order to make comparison easier, the combination of models AB123/abc13 is termed as Model 1 and the combination of models AB123/abc123 as model 2. For these models in stage 1, the percentage of efficient PLCs is the same for the years 1999 and 2000. For the year 1996 and 1998, there is a slight difference. However, in stage 2, there are differences in the number of efficient PLCs for all the years under study except 1998 (Please refer to Table 3.7).

With reference to Table 3.8, for model 1, no PLC achieved efficiency consistently over the period 1996–2000. PTGS achieved efficiency for all years except 1998. For model 2, AMST achieved efficiency for all the years, and again PTGS achieved efficiency for all years except 1998. It can be seen that PTGS did not perform well in 1998 in both models, while AMST performed well for model 2. In fact, AMST did not perform well for model 1 for all the years.

Table 3.8

Summary of Overall Efficient PLCs for Period 1996, 1998 - 2000

Year:	2000	1999	1998	1996	OVERALL EFFICIENT PLCs (1996-2000)
Model 1: AB123/abc13					
Stage 1	14.6%	9.4%	12.5%	19%	
Stage 2	20.8	30.2%	30.2%	30.2%	
Overall Efficient PLCs	2 PLCs: PRTN, PTGS	2 PLCs: FFEM, PTGS	3 PLCs: ADPG, JMI, UBEE	4 PLCs: AVPG, PTGS, TCNG, UBEE	NIL
Model 2: AB123/abc123					
Stage 1	14.6%	9.4%	13.5%	19.8%	
Stage 2	24%	17.7%	30.2%	24%	
Overall Efficient PCLs	3 PLCs: AMST, PRTN, PTGS	3 PLCs: AMST, FFEM, PTGS	3 PLCs: ADPG, AMST, SHEL	19 PLCs: ADPG, AMST, BEAG, CEFM, CEPC, CSVY, ESO, FNN, HVST, HLID, HMID, KIM, LNDV, PTGS, SPTC, TCNG, UBEE, YLCT	AMST

For model 2 in 1996, before the crisis, there were 19 PLCs that attained efficiency level. However, after the crisis, out of the 19 PLCs only 2 remained efficient; these were ADPG and AMST. SHL attained efficiency only in 1998. With reference to Appendix 3.5, SHL was found to be efficient in stage 1 for all years except 1996. It performed badly before the crisis; however, it improved from 1998 onwards. However, in stage 2, it improved in 1998, but fell short in attaining the efficiency level from 1999 onwards. For model 1, SHL performed about the same as for model 2, except that in 1998 it did not attain the efficiency level.

For model 1, none of the PLCs is found to be consistently performing efficiently during the period under study. PTGS was able to achieve the efficiency level in 1996 before the crisis, and in 1999–2000 after the crisis. In stage 1, model 1 has previous year equity and previous year total assets for inputs and the three funding instruments for outputs, while in stage 2, it has the three funding instruments as inputs and sales and equity as outputs. This means that, with the available assets such as equity and total assets that they have, the efficient PLCs have successfully attracted significant amounts of funds and credits to enable them to fund their production operations and

put themselves onto the efficiency frontier. This may be the result of good past performance and also the credibility of the PLC.

For model 1, AMST was not able to attain the efficiency level at all. However, looking at model 2, AMST was found to be efficient for all the years. The difference between model 1 and model 2 is that the output in stage 2 takes into account the total assets of the PLCs. With this output, it has managed to put AMST on the efficiency frontier. This shows that AMST has a considerable amount of assets in comparison with the other PLCs. For model 1, PLCs such as PTGS were efficient most years. This shows that sales and equity had a considerable impact on its performance. Even when model 2 is used and total assets is considered as an output, it was still able to put itself on the efficiency frontier for the same years. However, AMST depends on its total assets to put itself on the frontier.

TCNG was found to slip down after the crisis. It performed well in 1996 before the crisis. However, from 1998 to 2000 it was not able to improve. Analysing the stages of the funding process, it was found that for all years, it actually attained the efficiency level in stage 2. Hence, in terms of utilisation of the available funding resources, it was able to be efficient. In terms of sourcing of funding resources, it was not able to. It may have used up a lot of inputs to acquire the funding instruments in comparison with its peer AMST.

With reference to Table 3.8, PLCs such as PTGS and ADPG performed well before the crisis. While ADPG continued to do well in 1998, PTGS did not. However, PTGS was able to do well in 1999 and 2000. But ADPG was found to have continue to deteriorate after 1998. Looking at the characteristics of both PLCs, both are involved in the manufacturing of industrial products. However PTGS is on the main board while ADPG is on the second board. It means in term of size and capitalization, PTGS is larger as compare to ADPG. The possible reasons for the poor performance of PTGS in 1998 are that PTGS is involve in the producing gas of which the price is affected during this crisis and it has overseas operations as well which may also affect its performance. ADPG on the other hand is relatively small and hence the impact is slow. It could be seen that the impact was felt only in 1999 and later.

AMST on the other hand is also involved in manufacturing industrial products and it has overseas operations as well. Apparently it has accumulated large amount of assets that enable it to cushion itself against the adverse effect of the crisis which other PLCs failed to keep up with their performance during the aftermath of the crisis.

The rest of the sample PLCs experienced efficiency in either one of the two stages. In this aspect, there are two cases to be considered: case I, whereby a PLC is found to be efficient in stage 1 and not in stage 2; and case II, whereby a PLC is not efficient in stage 1 but is efficient in stage 2.

With reference to Appendix 3.4, for case I, efficiency in stage 1 indicates that a PLC has been able to attract significant amounts of funds and credits with its available assets. It may be due to the PLC's credibility that financial institutions and suppliers are willing to extend loans and credits. However, in stage 2, this PLC has failed to utilise its funding resources efficiently. For example, it may have slack long-term debt input and be producing slack trade receivables output. Slack input indicates that the PLC is utilising excess inputs, and slack output indicates that the PLC is producing a lower amount of output than is required to put itself onto the efficiency frontier. Hence, in order to be on the frontier, it needs to reduce its input usage and increase its output. For example, in stage 1, PLCs such as AMST and FHB were found to be efficient in year 2000; AMST was found to be also efficient in years 1996, 1998–1999. However, it was not efficient in stage 2. Hence this brought down the overall performance for those years.

In case II, inefficiency occurs in stage 1 but not in stage 2. This indicates that there may not be an optimal mix between the assets that the PLC has and the amount of funds and credits that it could have obtained. This is probably due to the credibility of the PLC in convincing financial institutions and suppliers to extend credits and funding resources. Efficiency in stage 2 indicates that the level of funding instruments obtained and the output that it was able to produce enabled the PLC to be located on the efficiency frontier. PLCs such as DLY, ESO, FFEM, MCA, PEMC, UASI, UMVV and UBEE in year 2000 were all efficient in stage 2 of funding

process. In fact it can be seen that FFEM, PEMC and UASI were 100% efficient in stage 2 of the unding process for all the 4-year period of study.

In reference to Appendix 3.7, for model 1 in stage 1 for the year 2000 for instance, PLCs that experience slack inputs are those such as CIHG, OYEL, UBEE. Hence, in order for them to be on the efficiency frontier, they should have used less input in the form of previous equity. For example, CIHG, with the amount of previous equity of RM593 that it has, could have used less input to acquire the funding that it obtained. OYEL, with previous equity of RM218463, could have attracted more long-term debt and/or trade payables, instead of just short-term debt which resulted in an excess of RM215506.

In stage 2, PLCs such as AMST, FHB, OYEL, PMTL etc. are among those that experienced slack input. AMST, for example, experienced slack input in the form of both long-term and short-term debt. It used an excess of these forms of funding, amounting to RM70 and RM14310 respectively. However, it produced in excess of RM201129 equity. It could have increased sales and generated more revenues.

A PLC that falls under either one of the cases needs to analyse what factors have contributed to its inefficiency. In order to become an overall efficient PLC, it needs to rectify the problems before it can achieve the efficiency target and be on the same frontier as its peers.

3.4.5 Analysis on the Effect of the Different Funding Instruments on the Performance of PLCs

3.4.5.1 Islamic versus Conventional Funding Instruments

For the target population of PLCs, only two are found to have used Islamic funding instruments, namely PTGS and FHB. An attempt has been made to incorporate the different amounts of Islamic funding for these two PLCs. However, there is not much information to make it possible to undertake a rigorous analysis of this aspect.

Based on the limitation with regard to data on Islamic funding, this study managed to draw conclusions based only on the two available PLCs. Since the financial data on Islamic funding is given as part of the total leverage of the PLCs, incorporating them into the calculation of efficiency seems to provide evidence that PTGS is efficient for all years except 1998 while FHB is found to be inefficient for all the years under study. Hence, there is no evidence to suggest that these PLCs exhibit any differences in their performance based on the choice of funding instruments, or any evidence to show that the Islamic instruments affect the performance of the PLC differently from the conventional instruments.

The reason might be that the mechanisms used by the mode of funding are similar if not the same. The procedure used in the calculation of the rate of interest on loan and credits is similar. The rate of profit sharing or fees charged is based on the market interest rate. The only difference is that the rate of profit or fees is fixed once the contract is agreed upon. However, the conventional rate of interest or fees is flexible and is based on the current market interest rate. Hence a PLC that undertook an Islamic facility knows what it is in for, while one that takes a conventional loan is uncertain as to what the future holds for it.

In terms of choice between the Islamic and conventional instruments, the impact of either Islamic or conventional instruments cannot be determined. This is due to the similarities in terms of the mechanisms used by both the funding instruments. However, a significant impact of the different funding instruments can be achieved if the analysis takes into consideration the specific amount of interest/profit/fees charged on funding instruments and its significance is incorporated into the analysis. Due to unavailability of data not only of the breakdown amount of Islamic funding and conventional funding but also of the

total amount of interest, profit and dividend expenses for each particular instrument, this cannot be undertaken.

3.4.5.2 Financial Leverage versus Operating Liability Leverage

In terms of the overall effect of either financial leverage or operating liability leverage on the performance of PLCs, a multivariate regression is undertaken to determine whether there is any significant difference between the two. The multivariate regression models for the test of significance on the differences in the no overall effect of the funding instruments on PLCs's performance are as follows:

Stage 1: $SFEI = \alpha + \beta_1 FE + \beta_2 OL + \varepsilon$

The dependent variable is Sourcing of funding efficient index (SFEI) and the independent variables are financial leverage (FE) and operating liability leverage (OL).

Stage 2: $UFEI = \alpha + \beta_1 AL + \beta_2 ST + \varepsilon$

The dependent variable is Utilization of funding efficiency index (UFEI) and the independent variables are assets/liabilities ratio (AL) and sales/trade payables ratio (ST).

Using Proc GLM procedure in SAS, the following equations are regressed and the discussion of the results are undertaken preceding this.

Table 3.9

Analysis of Variance on Performance of PLCs in Stage 1

Dependent Variable SFEI				
Source	Sum of Squares	Mean Square	F Value	Pr > F
Model	45904	7.04145	51.47	<0.0001
Error	41471	0.43275	446	
Corrected Total	87375			
Root MSE	21.117	R Square	0.5254	
Dependent Mean	61.092	Coefficient Var	34.566	

From Table 3.9, it shows that the value of R square is about 53%. This means that about 53% of the variability in the sourcing of funding efficiency is accounted for by the funding leverage in the model. The F statistics for the overall model is highly significant and this indicates that the model explains a significant portion of the variation in the data.

A multivariate analysis of variance was performed to test the significant of no overall effect of the financial leverage on PLCs' performance. The results are shown in Table 3.10. It was found that in terms of financial leverage, Wilks' Lambda is 0.486, and F value 99.51 and p value=0.0001 < 0.05 is highly significant. Hence, it could be concluded that there is significant no overall effect of financial leverage on PLCs' performance. As for the operating liability leverage, Wilks' Lambda is 0.988, F value is 1.09 and p value is 0.298 >0.05, it could be concluded that there is overall effect of operating leverage on the performance of PLCs' performance. Hence the null hypothesis stating that there is no different in overall effect between financial leverage and operating leverage on PLCs' performance can be rejected. There is evidence to show that there are differences between the two funding instruments on their overall effect on the PLCs' performance.

Table 3.10

Mulitvariate Analysis of No Overall Effect of

Financial and Operating Leverage on Performance of PLCs in Stage 1

Financial Leverage:		*Operating Leverage:*	
Wilks' Lambda	0.486	Wilks' Lambda	0.988
F value	99.51	F Value	1.09
p value	<.0001	p value	0.2983

Table 3.11 shows the result of the same regression procedure that is undertaken in stage 2. The result however shows that only 25% of the variability of the utilization of funding efficiency are accounted for by the operating liability leverage. The F statistics for the overall model is highly

significant, hence indicating that the model explains a significant portion of the variation in the data.

Table 3.11

Analysis of Variance on Performance of PLCs in Stage 2

Dependent Variable SFEI				
Source	Sum of Squares	Mean Square	F Value	Pr > F
Model	33586	16793	15.77	<0.0001
Error	99031	1065		
Corrected Total	132617			
Root MSE	32.632	R Square	0.253	
Dependent Mean	48.237	Coefficient Var	67.650	

A multivariate analysis of variance was also performed to test the significant of no overall effect of the assets/liabilities ratio on PLCs' performance. Referring to Table 3.12, for the assets/liabilities ratio, the Wilks' Lambda is 0.960, F value is 3.88 and p value = 0.052 >0.05 thus showing that it has overall effect on the performance of PLCs.

Table 3.12

Mulitvariate Analysis of Variance No Overall Effect of Assets/Liabilities and Sales/Trade Payables Ratios on Performance of PLCs in Stage 2

Assets/Liabilities Ratio:		*Sales/TrPayables Ratio:*	
Wilks' Lambda	0.960	Wilks' Lambda	0.805
F Value	3.88	F Value	22.49
p value	0.052	p value	<.0001

While the sales/trade payables ratio, the Wilks' lambda is 0.805, F value is 22.49 and p value=0.0001 < 0.05 is highly significant and hence can be concluded that there is significant no overall effect of sales/trade payables ratio on the performance of PLCs. It can be concluded that in stage 2, the null hypothesis stating that there is no different in overall effect between assets/liabilities ratio and sales/trade payables ratio on PLCs' performance

can be rejected. There is evidence to show that there are differences in term of their overall effect on PLCs' performance between the two ratios. This goes to show that there are significant differences between the funding instruments that are utilised in order to obtain the outputs in the form of sales and assets

Therefore, it can be concluded that the overall effect of both the funding instruments together with the assets/liabilities ratio and sales/trade payables ratio on PLCs performance are significantly different, hence PLCs need to be cautious in their choice of funding instruments sourced and used.

3.4.6 Analysis of Sample Responding PLCs

The sample of responding PLCs that responded numbered 20. The responded PLCs might shade some lights on the overall sample if they possess similar characteristics. However, out of the 20 only 10 are in the study, as the remaining 10 had either been suspended or there was a lack of the information required by the study.

Table 3.13

Descriptive Statistics For Responding PLCs

Variable	Mean	Std Dev	Minimum	Maximum
Stage 1				
Previous Assets	3396430	4750969	120736	134317532
Previous Equity	1402708	1657274	31792	4792475
Long-Term Debt	450790	980087	0	3188490
Short-Term Debt	925077	2221890	0	7216780
Trade Payables	549245	839494	16506	2413339
Stage 2				
Long-Term Debt	450790	980087	0	3188490
Short-Term Debt	925077	2221890	0	7216780
Trade Payables	549245	839494	16506	2413339
Sales	1412814	2012184	146302	6496724
Equity	1058770	1632879	15364	5062161
Total Assets	3471226	4676184	127909	1327057

Table 3.13 shows the descriptive statistics for the PLCs that responded to the survey. The funding instruments in terms of long-term debt, short-term debt and trade payables that these PLCs have acquired and utilised ranges from a minimum of 0 to a maximum of RM3188490, a minimum of 0 to a maximum of RM7216780, and a minimum of 0 to a maximum of RM2413339 respectively. On the average, PLCs acquired and utilised RM450790, RM925077 and RM549245 of long-term debt, short-term debt and trade payables respectively.

In order to acquire these funding instruments, the PLCs have utilised on average previous assets and previous equity amounting to RM3396430 and RM1402708 respectively. In terms of output generated from these funding processes such as sales, equity and total assets on the average amounted to RM1412814, RM1058770 and RM3471226 respectively.

The descriptive statistics shows that the whole target population and responding sample population have certain similar characteristics in terms of the maximum amount of funding instruments acquired in the sourcing process and also in term of the utilisation process (Please refer to Table 3.4 for descriptive statistics for the whole target population of PLCs). Hence, it can be concluded that analysis on the responding sample can be extended to the whole target population.

Table 3.14

Performance of PLCs under Model 1 and Model 2

		Model 1				Model 2			
No	DMU	2000	1999	1998	1996	2000	1999	1998	1996
1	AMST	50.11%	55.33%	55.33%	55.33%	100.00%	100.00%	100.00%	100.00%
2	DLY	60.41%	51.26%	71.06%	73.06%	60.41%	22.72%	42.52%	38.48%
3	FFEM	65.26%	100.00%	73.69%	69.13%	65.26%	100.00%	73.69%	69.13%
4	LNDV	33.04%	13.64%	38.86%	54.32%	50.29%	20.87%	46.10%	64.84%
5	MUD	65.04%	35.75%	43.61%	28.49%	70.22%	41.76%	41.86%	28.15%
6	PRTN	100.00%	71.36%	94.19%	93.33%	100.00%	71.36%	94.19%	93.33%
7	PTGS	100.00%	100.00%	94.20%	100.00%	100.00%	100.00%	94.20%	100.00%
8	PMTL	44.64%	16.25%	29.63%	11.15%	44.64%	23.28%	36.67%	14.12%
9	SPTC	49.74%	10.06%	23.77%	50.85%	51.19%	21.57%	35.28%	54.94%
10	UNZ	27.90%	70.57%	70.14%	70.86%	27.90%	70.57%	70.14%	44.82%

Table 3.14 shows the performance of the 10 PLCs under model 1 and model 2. For model 1, AMST did not perform well. In fact none of the PLCs in the group achieved efficiency for all the years under study. PTGS attained efficiency for three years but failed to do so in 1998. Efficiency for PLCs such as DLY, LNDV, PTGS, SPTC and UNZ fell in 1998. DLY, LNDV, MUD and SPTC continued to fall in 1999. However, for 2000, there is an improvement in their performance. FFEM, MUD PRTN and PMTL experienced an increase in their performance in 1998, and FFEM continued to do so in 1999 but deteriorated in 2000.

3.5 CONCLUSION

In this study it is found that the efficiency of PLCs is determined by the mixture of funding instruments, irrespective of whatever type of instrument it utilises. The study cannot determine whether Islamic funding instruments have a greater impact on the efficiency of PLCs. However, if data on profit rate and amount of Islamic funding were available, analysis could then be undertaken to evaluate the impact of these instruments on a PLC's performance.

The issue of dimensionality was resolved by creating dimensions of model that were used to evaluate the performance of the instruments, while the issue of the sensitivity of the models was resolved by performing sensitivity tests[29] on the models. The result shows that PLCs that are already on the frontier do not exhibit changes when the test is performed. This goes to show that the models used are stable in evaluating the efficiency of the PLCs. The PLCs remained stable when sensitivity test are performed on all the models used in the computation of the efficiency index in stage 1 and stage 2 of the finding process.

From the analysis of the efficiency of the target population PLCs, based on the overall average rate of efficiency that was achieved, it can be concluded that only for model 1 no PLC was found to be efficient overall throughout the years under study. PTGS was found to be an overall efficient PLC for 3 of the 4 years. It continued to show the same

[29] The EMS used in this study has an avenue for sensitivity testing in the form of a super-efficiency technique.

performance for model 2. For AMST, for model 1 it did not show good performance for any years. However, for model 2, it was an overall efficient PLC for the 4 years under study. It has been shown that AMST depends on its total assets to put itself on the efficiency frontier. It could also be said that the assets that it has, enable it to cushion itself against the adverse effect of the 1997 crisis.

While AMST uses only conventional funding, PTGS utilises a combination of both. Hence it could not be concluded what is the optimal mix of funding instruments, in terms of the types and amount to prove the ability of the PLCs to perform. A test cannot be undertaken as there is not sufficient data to enable such a test to be taken.

However, a test of significance was undertaken on the effect of financial and operating liability leverage on the performance of PLCs. It was found that there is significant difference between the two types of leverage in their impact on the PLCs' performance. In stage 1, it was found that there is significant effect of financial leverage on PLCs' performance. However, operating leverage is found to be not significant. Hence it could be concluded that there is different effect between financial leverage and operating leverage on PLCs' performance. In stage 2, the assets/liabilities ratio was found to have no significant overall effect on the performance of PLCs. While the sales/trade payables ratio has a significant overall effect on the performance of PLCs. This thus proved that there are significant differences between the funding instruments that are utilised in order to obtain the outputs in the form of sales, assets and trade credits. Therefore, since the effect of the funding instruments on PLCs performance is significantly different, PLCs need to be cautious in their choice of funding instruments used.

This study originally believed that there would be a significant number of PLCs in the manufacturing sector that would be using Islamic funding instruments. This would have allowed a comparative study to be undertaken on the impact of Islamic and conventional funding instruments. However, from the survey, of which only 10 PLCs responded, only 3 PLCs were using Islamic funding instruments. Hence the study is not able to perform an extensive analysis on this instrument and to compare its performance against the conventional instrument.

Due to the unavailability of data on Islamic funding instruments and the lack of cooperation from the PLCs themselves to this study, evaluation on the impact of such funding instruments on the performance of PLCs. Future research may need (i) to look seriously into the questions of why many PLCs did not choose Islamic funding instruments; (ii) to take into consideration the amount of Islamic funding instruments and the amount of profit/fees paid out for use of such instruments in order to access the direct impact of these instruments on PLCs' performance; and (iii) to cover a wider range of PLCs across industries and not to limit the study only to the manufacturing sector. This will enable the study to capture those PLCs in other sectors that use Islamic funding instruments and hence make the sample size of those PLCs using Islamic funding larger.

The sample of responding PLCs have similar characteristics as the target population. Hence, it could be concluded that the analysis on this 10 responding PLCs would hold true for the whole target population as well. One of the responding PLCs that performed well using model 2 is AMST. However, it did poorly using model 1. This shows that assets play a great role in putting AMST on the efficiency frontier as the different between these two models is assets, whereby model 2 incorporated total assets as part of the variables. Another PLC PTGS did not perform well after the crisis for both models. However it managed to gain back its performance after 1999 onwards. This would be due to its production of gas whose price was affected by the crisis, and its overseas operation.

Even though this study has some limitations, its contributions to the current literature are in terms of (i) the evaluation of efficiency of PLCs in Malaysia via the funding instruments, (ii) the comparative analysis between (a) the financial leverage and operating liability leverage, and (b) the Islamic and conventional funding instruments.

CHAPTER 4

MODEL OF CHOICE OF FUNDING INSTRUMENTS: EMPIRICAL EVIDENCE FROM MALAYSIA

4.0 INTRODUCTION

Over the past decade, the capital market in Malaysia has developed in terms of market size, range of instruments and efficiency. This is especially so as the government is committed to ensuring that more funding choices are made to fulfil corporate funding needs, especially for the Muslim business community. This is achieved by giving financial institutions incentives to develop more instruments. Muslims account for 60.4% of the total population[30] in Malaysia. Hence, one would expect that Islamic modes of funding would be popular among the Muslim business community, particularly the Bumiputra[31] Public Listed Companies (PLCs) of Malay origin. However, studies such as those by Ahmad and Haron (2002), Hassan and Ahmad (2002) and Dar and Presley (1999) have shown otherwise.

Hence the motivation of this study stems from interest in finding out what actually determines the funding choices of firms, particularly of Muslim PLCs. The main objective of this study is to determine what influences the choice of PLCs' funding instruments. It attempts to (i) identify the factors that determine the choice of funding instruments by PLCs in Malaysia, (ii) examine whether Muslim PLCs are different from non-Muslim PLCs in their choice of funding instruments, and (iii) investigate whether PLCs exhibit the pecking order theory when choosing their funding instruments.

An econometric model in the form of a Partial Least Square (PLS) regression model is developed in order to analyse the determinants of PLCs' funding choice. The model is then estimated using procedures in SAS. In order to validate the PLS model, another model in

[30] Census 2000. Department of Statistics Malaysia.

[31] This means 'Children of the soil', which includes the Malays, the 'Orang Asli' or Aborigines of Peninsular Malaysia, and the various tribal groups in Sabah and Sarawak in East Malaysia. The Malays are Muslims by birth.

the form of an Multivariate (MV) econometric model is developed. The results from these two models are then analysed and compared.

In chapter 3, discussion of how PLCs' performance is affected by the level of its leverage was undertaken. The concept of leverage used in the analysis of the PLCs' performance incorporates both financial leverage and operating liability leverage. In this paper, both forms of leverage will be considered. Procedures in PLS regression enable multivariable independent variables to be incorporated into the model. Hence in the analysis of the factors that determine the PLCs' choice of funding instruments, the measures of leverage are broken down into two, namely financial leverage and operating liability leverage.

In chapter 3, the differences in the concept of leverage in Islamic finance were also discussed briefly. Even though many of the Islamic modes of funding offered today were used by traders in pre-Islamic times, many of these instruments, as shown by studies, are not popular with contemporary Muslim traders or business PLCs. However, some of the instruments are adopted today because of their conformity with the Islamic principles of being just due to the absent of riba' (interest). This therefore points to the fact that in order for Islamic instruments to be accepted globally especially among Muslims and the non-Muslim business community, research is needed not only to demonstrate that the Islamic mode of funding is different from the conventional mode, but at the same time, it must also be able to fulfil the needs of modern day trading requirements, such as efficiency. This relates not only to lowering transaction costs but also to reducing the risk associated with a particular instrument. If study shows that these instruments do not differ from conventional ones, then further study needs to be undertaken in order to develop instruments that are not only Shariah-compliant[32] but also efficient, so that they are more readily accepted by the Muslim community and the world in general.

The study in this chapter attempts to identify the factors that influence a PLC's choice of funding instrument. The literature on capital structure has shown that size, profitability, growth opportunities, asset structure, risk, non-debt tax shield, earning volatility and age are among the factors that determine a firm's funding choice. Wiwattanakantang (1999),

[32] This refers to compliance with the teaching of the Qu'ran.

Colombo (2001) and Revoltella (2001) included a foreign partnership dummy variable in their studies in order to analyse the impact of foreign ownership on a firm's funding structure. This study, apart from recognising the various factors mentioned earlier, also takes into account the impact not only of foreign participation but also of religion on the funding choice of business companies. The dummy variables for foreign participation and for Muslim PLCs are incorporated as indicators for the latent variables foreign participation and Muslim PLCs respectively. Therefore, from the various factors selected in order to reflect the PLC's funding choice, the sources of the PLC's funding can also be captured.

Studies on capital structure (among others Bhaduri, 2002; Cassar and Holmes, 2003; Colombo, 2001; De Haan and Hinhooper, 2003; DeMiguel and Pindado, 2001; Panno, 2003; Ramano et al., 2000; Titman and Wessels, 1988; Wiwattanakantang, 1999) have shown that obtaining external funding is more expensive than internal funding, and these studies have shown that firms prefer internal funding to external funding. Their preference seems to reveal a particular pattern, which is known as the pecking order theory. It shows that the funding behaviour of PLCs reveals that internal funding is preferred to bank borrowing, bank borrowing is preferred to bond issuance, and bond issuance is preferred to issuance of shares.

However, at this juncture the writer is not aware of any comparative study that has examined the factors that determine the choice of funding instruments and patterns of funding behaviour between Muslim and non-Muslim business companies. Hence, this study will form an addition to the existing literature on capital structure. Another contribution is the role of religion in determining the choice of funding instruments. The discussion of this chapter is structured in the following manner. In section 2, the literature on capital structure, determinants of firm's leverage and sources of funding is reviewed. Section 3 explains the research methodology adopted. Analysis of the results and their implications on company's funding choices will be undertaken in section 4, and section 5 concludes.

4.1 LITERATURE REVIEW

4.1.1 Capital Structure vs. Financial Structure

There is a significant difference between the capital structure and the financial structure of a firm. Capital structure concerns a company's permanent long-term funding. This includes long-term debt, common stocks and preferred stocks, and retained earnings. However, financial structure is a broader concept in that it also includes short-term debt and accounts payable. The broader definition of financial structure is a more relevant measure of financial risk because of the high degree of substitutability between long- and short-term debt (Schwartz and Aronson, 1967). Therefore, in discussing financial structure one cannot help but discuss the capital structure of companies as well.

In the literature of capital structure, various issues have been discussed. The focus of the discussion of capital or financial structure has been on those issues centred around (i) types of business ownership; (ii) factors influencing the capital or financial structure of companies, that is, what determines PLCs' funding choices; (iii) methodology in the analysis of the capital structure; and (iv) the theoretical findings of particular studies on capital structure. The nature of capital structure across countries differs due to different institutional settings. Hirota (1999) in his study showed that Japanese corporate funding decisions differ from those in the US due to the inherent institutional features of Japanese capital markets. De Miguel and Pindado (2001) showed how company characteristics, which are determinants of capital structure, are affected by institutional characteristics.

4.1.1 Type of business ownership

The type of ownership structure has an influence on the capital or financial structure of a firm. Wiwattanakantang (1999) presented empirical evidence on the influence of ownership structure on financial policy, in which his study showed that single-family-owned firms have significantly higher debt levels. Romano et al. (2000),

using a structural equation model of the financing[33] antecedents of family businesses, found that firm size, family control, business planning, and business objectives are significantly associated with debt.

However, in the study of private small business entities, the status of the business plays a role in the firm's access to financing facilities. For example Ruiz-Vargas (2000) in his study on native small business owners showed that status of wealth and economic power have an influence on the business firm's access to credit facilities.
For PLCs, Panno (2003), using Logit and Probit estimation procedures on British companies listed in the London Stock Exchange and Italian companies from the Milan Stock Exchange between 1992 and 1996, found that there is evidence supporting the positive effects of size and profitability, and the negative impacts of liquidity conditions and bankruptcy risk on the financial leverage of companies. This together with the negative effect showed by the available reserves lends support to the pecking order theory of capital structure.

Colombo (2001) investigated the capital structure choice of 110 Hungarian firms from the manufacturing and service sectors during the period from 1992 to 1996 with a cross-section and panel data approach, using a Tobit regression analysis. The independent variables identified are logarithm of net sales, cash flow over total assets, tangible assets over total assets, inventories over total assets, investment over total assets, dummy for foreign ownership, shares of net sales over total sales in the four digits industry, dummy for employment, dummy for ownership. The results, similar to Panno (2003), provide evidence for the existence of a 'pecking order' in firms' funding choices.

Titman and Wessels (1988) used a model known as linear structural modelling to measure unobserved or latent variables estimated using an application of the LISREL system to study the determinants of the capital structure of manufacturing firms for the period from 1974 through 1982. No evidence supports the theory that debt ratios are related to a firm's expected growth, non-debt tax shields, volatility, or the

[33] In this study, funding decision and financing decision are treated as synonymous. Hence the term funding decision will be used throughout the discussion whenever funding decision is referred to.

collateral value of its assets. However, evidence supports the proposition that profitable firms have relatively less debt relative to the market value of their equity.

Another study by Bhaduri (2002) on the capital structure choices of Indian manufacturing firms for the years 1989 to 1995 shows evidence that the optimal capital structure choice could be influenced by factors such as growth, cash flow, size and product, and industry characteristics. The result also confirms the existence of restructuring costs in attaining an optimal capital structure.

4.1.3 Determinants of Firm's Leverage

In the literature of corporate financing, the funding choices of a firm depend on the cost of available capital. This in turn is determined by two main factors, namely (i) country-specific factors that relate to a country's unique institutional setting such as bank relationship, regulation of new equity issue, banking and securities markets, structure of corporate governance, earning volatility and inflation rate; and (ii) generic factors that relate to the factors common to all countries, such as commercial laws governing international trade. The country-specific factors are further broken into (a) firm-specific factors, among others profitability, size, and earning volatility, and (b) macroeconomic factors that are common to all firms, such as structure of corporate governance and GDP growth rate.

A company's financial structure is measured by the company's accumulated leverage, that is, the total debt to equity ratio. Change in the company's financial structure reflects the funding behaviour of the company. Hence, the funding decisions of a company can be influenced by change in the leverage of a company (Romano et al., 2000). In Chapter 3, leverage comprises financial and operating leverage. Financial leverage focuses on the company's demand for external funding in the form of intermediate and short-term bank loans, and is used to evaluate a company's ability to meet its obligations. Operating leverage focuses on the creditor's supply of funding and is used to lever the rate of return from its production activities.

In the literature of corporate financing, there are basically three measures of leverage quoted. These measures, which define the concept of leverage, are non-equity liabilities to total assets, debt to capital, adjusted debt to adjusted capital. In many of the previous studies, the capital structure of a firm is represented by financial leverage. This study, however, adopts a different approach in defining leverage, whereby it includes a broader definition of leverage. It incorporates the value of operating liability leverage as well as financial leverage.

In Islam, the debt-equity ratio of a company does not have any significant influence either on the output level of the company or on the value of its shares. Nevertheless, this view does not hold for Islamic companies because of the prohibition of interest (Sarker, 1999). This would therefore mean that the PLCs would be operating either solely equity-based or on a profit-sharing-based form of transaction.

4.1.4 Determinants of Choice of Funding Instruments

Both financial leverage and operating leverage relate to the funding instruments used by PLCs to fund their productive activities. Hence, factors that affect a PLC's leverage would also be the factors that affect the funding instruments utilised by the PLCs. These factors are analysed in the light of theories of capital structure, and they are known as constructs or latent variables[34] in the regression analysis later in the discussion.

4.1.4.1 Company Size

The literature of corporate finance quotes Modigliani and Miller's theory (1958) suggesting that the size of a company does not affect its financial structure; however, studies have shown that there is a link between the two. The relationship between size and leverage ratio depends on the type of size used as a proxy.

[34] A construct or latent variable is derived from an observed or measured variable. This construct cannot be directly measured.

There is considerable evidence that the funding patterns of companies vary with firm size. Larger companies tend to have a higher capacity to borrow than smaller firms. Hence, the relationship between large company and leverage will be positive. According to Titman and Wessels (1988), company size influences the cost of issuing debt and equity. A small company pays more to issue new equity and even more for issuing long-term debt compared with large companies. Thus, small companies may be more leveraged compared with large companies. These small companies prefer to borrow short term through bank loans rather than issue long-term debt instruments. Hence, a small company will have a negative relationship with leverage. However, large companies are expected to acquire external finance at the lowest cost. This is because (i) larger companies are better known by market participants, and this therefore would limit the asymmetry of information between insiders and outsiders, and (ii) the cost of making public issues is relatively less burdensome for large companies.

Ferri and Jones (1979) employed four different measures of firm size in their study. These are (i) total sales, (ii) total firm size in their study, and two long-term measures of size in the form of (iii) average level of total assets over the current and preceding four years, and (iv) average level of sales over the same time interval. According to him, the average measures would give a truer indication of firm's size.

Other studies that have considered size as a factor that determines capital structure are, among others, Bhaduri (2002), Bevan et al. (2002), Cassar and Holmes (2003), Ferri and Jones (1979), De Haan and Hinloopen (2003), Gupta (1969), Hirota (1999), Panno (2003), Ramano et al. (2000), Titman and Wessels (1988) and Wiwattanakantang (1999).

There are various measures of organisational size, of which the three most commonly used are natural logarithm of sales (Hirota, 1999), number of employees, and net assets or natural log of total assets (Hay and Luori, 1996; Cassar and Holmes, 2003). Krishnan and Moyer (1997) and Suto (2003)

used logarithm of total assets as the proxy for size. This study uses the logarithm of sales value since this measure relates more to the economic performance of the company. Another measure used will be the logarithm of total assets. This is because total assets accumulated by firms will grow over time as firms get bigger and bigger. Hence, in this study both these indicators are used to measure the latent variables or constructs for firm size.

4.1.4.2 Profitability

Studies that have considered profitability as a determinant of capital structure are among others Bhaduri (2002), Cassar and Holmes (2003), De Haan and Hinloopen (2003), Gupta (1969), Hirota (1999), Panno (2003), Revoltella (2001) and Wiwattanakantang (1999).

Since profitable companies are likely to have more retained earnings, the presumption would be that a negative relationship would exist between leverage and the past profitability of the company. According to Revoltella (2001), current profitability is considered to be a proxy for future profitability, and is used by companies to signal their quality. Therefore, more profitable companies can fund themselves and are less dependent on debt funding. The past profitability of a company in the form of retained earnings available is an important determinant of current capital structure.

According to Cassar and Holmes (2003) firms have a preference for internal funding over external funding, as the cost of capital obtained from external sources would be greater for the firm. This would affect the profitability of the firm in the long run. Krishnan and Moyer (1997) used five-year average pre-tax margin (ratio of operating income to sales) as a measure of profitability. Bhaduri (2002) uses two indicators as proxies for profitability: the ratio of cash flow over total assets and the ratio of cash flow over sales.

The indicators for the latent variable or construct profitability are (i) ratio of operating income over sales and (ii) ratio of operating income over total

assets. Since profitable companies have more retained earnings than do marketable ones, they can fund with plenty of internal funds rather than debt. Therefore, the effect of profitability on leverage should be negative. The indicator used to measure the constructs in this study is return on assets (ROA). This is the ratio of earnings before interest and taxes to total assets. This will provide a good indicator of how well the firms are performing and how profitable they are.

4.1.4.3 Growth Opportunities

Studies that have considered growth as a factor influencing capital structure are as follows: Bevan and Danbolt (2002), Cassar and Holmes (2003), Hay and Luori (1996), Hirota (1999), Gupta (1969), Ramano et al. (2000) and Titman and Wessels (1988). Industries that are growing tend to have greater uses of debt in their financial structure because their demand for investment funds exceeds their internally generated funds.

Titman and Wessels (1988) are of the opinion that growth opportunities are the capital assets that add value to a company but cannot be collateralised and do not generate current taxable income. Leverage and growth opportunities are found to be negatively related. Growing companies place a greater demand on internally generated funds. Companies with relatively high growth will seek external sources to fund the growth. Therefore, these companies will look for short-term less secured debts rather than longer-term more secured debt for their funding needs. Hence, companies with relatively higher growth tend to be more leveraged.

Depreciation is also used in the literature as a proxy for growth opportunities. Companies with a higher depreciation ratio tend to have relatively more tangible assets, and thus relatively fewer growth options. Other indicators of growth include (i) the ratio of capital expenditures over total assets which refers to the depreciation ratio, (ii) the growth of total assets measured by the percentage change in total assets, and (iii) the ratio of research and

development over sales, which also serves as an indicator of growth, as firms are generally involved in R&D to generate future investment. This study uses the second indicator for construct growth opportunities since the growth in the total assets reflect the growth of the firms too.

4.1.4.4 Asset Structure

In the literature of capital structure theories, it has been suggested that the composition of assets owned by a company affects its choice of financial structure. Companies that have assets that can be used as collateral may have advantages in the issuance of more debt. This is because to issue securities incurs costs to companies. Therefore, issuing such debt secured by property with a known value can eliminate costs. However, collateralised assets impose a restriction on companies. A negative relationship between collateralised assets and debt is then expected.

According to Krishnan and Moyer (1997), the composition of the asset structure determines the amount of loan that can be secured with collateral. Fixed assets can be used to collateralise borrowing. Titman and Wessels (1988) used two indicators for collateral value, namely (i) the ratio of intangible assets to total assets, which is negatively related to collateral value, and (ii) the ratio of inventory plus gross plant and equipment to total assets, which is negatively related to collateral value.

Other studies include Bhaduri (2002), Cassar and Holmes (2003), and Krishnan and Moyer (1997). Bhaduri uses three proxies for the collateralised assets, namely (i) ratio of land and buildings to total assets, (ii) ratio of plant and equipment to total assets, and (iii) ratio of inventories to total assets. The indicators for this construct are (i) ratio of inventory plus gross plant and equipment to total assets and (ii) ratio of fixed assets to total assets. This is very important as these assets will be used as collaterals in attaining funding instruments.

4.1.4.5 Risk

According to Schwartz (1959), there are two types of risk faced by a company, internal or financial risk and external or business risk. The internal risk of the company is the financial risk of its capital structure and is set by the types of liability that the company carries and the amounts of these liabilities in proportion to the equity capital owned by the company. According to Wippern (1966), financial risk is that element of uncertainty arising from inclusion of fixed-commitment funding in the company's capital structure. External risk is a composite of the stability of the earnings or cash flow of the company, and the liquidity, safety, and marketability of the assets typically held by the company. This depends on the nature of the industry the firm is involved in, while business risk includes all the elements of uncertainty of the income stream of the firm resulting from transactions other than financing.

According to Wiwattanakantang (1999), risky firms or firms that have high possibility of defaulting should not be highly levered. Hence, a negative relationship will be expected between risk and leverage. The volatility of a company's operating income is often used as a direct proxy for the firm's observable risk and the probability of financial distress.

The variables used to measure business risk are the standard deviation of the standardized growth in sales and the standard deviation of the standardized growth in cash flow (Ferri and Jones, 1979). This is generally considered to include all the elements of uncertainty of the income stream of the company resulting from other than funding transactions, such as the firm's competitive position, the determinants of demand for its products, and the structure of its cost. Studies that consider risk are Cassar and Holmes (2003), Ferri and Jones (1979), Wippern (1966) and Wiwattanakantang (1999).

The indicator for the construct risk is the standard deviation of the firm's difference in sales, scaled by the average value of the firm's total assets over

that period. Since risk cannot be directly computed hence a proxy taken from the difference in sales over time come close to give the overall picture of the risk that firms have.

4.1.1.6 Non-Debt Tax Shields

In the finance literature, the Modigliani and Miller (1958) theory of capital structure, the tax exemption of interest payments is quoted as an important tax shield for debt financing, and depreciation is cited as another major tax shield. Stiglitz (1988) wrote that optimal financial structure depends on tax rates. The tax-based model suggests that the major benefit of using debt funding is corporate tax deduction. Debt payments are deductible under corporation tax, which gives debt a little advantage over equity. Companies can use other non-interest items such as depreciation, tax credits, and pension funds to reduce corporate tax payments. Hence, a positive relationship is expected.

It has been argued that non-debt tax shields (NDTS) are a substitute for the tax benefits of debt funding. Therefore a company with large non-debt tax shields is likely to be less leveraged, according to De Miguel and Pindado (2001), Hirota (1999), Titman and Wessels (1988) and Wiwattanakantang (1999).

Indicators of non-debt tax shields include (i) the ratio of investment tax credit over total assets, (ii) depreciation and overdrafts, (iii) a direct estimate of the ratio of non-debt tax shield over total assets, and (iv) the ratio of depreciation (D) less taxes (T) over earnings before interest and taxes (EBIT). According to Toy et al. (1974), EBIT variability indicates business risk, while EBT variability contains the effects of both business and financial risks.

This study adopts this measurement of NDTS, which is (i) the ratio of depreciation to total assets; NDTS = $\frac{D-T}{EBIT}$ as the indicator for the construct NDTS. This indicator is chosen based on the availability of information in the PLCs annual reports.

4.1.4.7 Earning Volatility

In any business, debt involves commitment to periodic payments. Therefore, highly leveraged companies are vulnerable to problems of financial distress. This tends to cause companies with volatile incomes to be less leveraged. The indicator is the standard deviation of a percentage change in operating income multiplied by the probability of financial distress.

Titman and Wessels (1988) considered earning volatility as a determinant of capital structure. According to Boyle and Eckhold (1997), in general companies whose earnings are volatile have a greater risk of not being able to meet their debt commitments, hence incurring costs of financial distress. All other things being equal, there should be a negative relationship between debt usage and earnings volatility.

A company's optimal debt level is a decreasing function of earning volatility. One indicator of volatility that cannot be affected directly by a company's debt level is the standard deviation of the percentage change in operating income.

Measure of earning volatility = $\frac{\sigma(EBIT)}{\overline{EBIT}}$ where $\overline{EBIT}$ and $\sigma(EBIT)$ are respectively the mean and standard deviation of annual earnings before interest and taxes calculated over the period centred around the year of observation. For this study, the indicator for the construct earning volatility is the standard deviation of operating income, since volatility of the firms' earning is affected by its operating income.

4.1.1.8 Age

Young companies are more likely to face the problem of asymmetric information. This is because they are not well known enough to acquire funding through equity. Therefore, they will avoid the equity market, and depend on leverage instruments. The relationship will be a negative one. Bhaduri (2002) uses a dummy as an indicator of age, whereby age takes the value of 1 if the company is below 20 years old and zero otherwise. Ruiz-Vargas (2000) also includes age as a factor that determines capital structure.

This study adopts a different approach in determining a firm's age. The indicator for the construct firm's age is number of years that the firms have been in operation.

4.1.4.9 Foreign Partnership

There are basically two types of foreign investments quoted in the finance literature, namely (i) foreign financial institutions, and (ii) foreign multinational corporations (MNCs) or individuals who engage in direct investment. Foreign partnership refers to having foreign participation in the running of the business, and the ability to influence the funding choices of firms.

According to Revoltella (2001), there are two possible effects of foreign participation. One is looked at from the demand side, where a foreign partner will be able to attract other sources of funding than debt, for instance the capital market. This is where more investment by investors provides the funds that are needed. This is due to the confidence that investors have in a foreign partner. Hence, the relationship will be negative. Two, looked at from the supply side, a foreign partner may provide greater access to the credit market on better conditions where funding in foreign currency is possible. Therefore, there is a positive relationship between foreign partnership and leverage.

A dummy variable for foreign participation is equal to 1 if the firm has at least one foreign shareholder with a stake of more than 10% and zero otherwise (Wiwattanakantang, 1999), while Revoltella (2001) considered foreign participation as having more than 5% stake in the business. Colombo (2001) also includes foreign participation in his study.

This study adopts Revoltella's demand-side view as it focuses on choice of funding by PLCs. For this study, the indicator for foreign participation is the construct dummy foreign participation, where it is equal to 1 if the firm has more than 5% foreigners as key decision makers in the company and zero otherwise. A 5% threshold is taken as the minimum requirement to account for foreign participation since these firms even with the small percentage of foreign participation do benefit from it.

4.1.1.10Religion

In an Islamic society where interest is prohibited, religion will be a significant factor in the determination of mode of funding. Hence in order to undertake a comparative study between the Islamic and conventional funding, religion is an important factor to look at. Since it is difficult to quantify religion, a proxy is used. In Peninsular Malaysia, the majority of the Bumiputra are Muslim and hence identified with Islam. Therefore, Bumiputra PLCs are considered as Muslim and non-Bumiputra-owned PLCs as non-Muslim. A PLC is considered as Bumiputra-owned when the ownership of Bumiputra is more than 50%.

The indicator for the construct religion is the dummy religion, which takes the value of 1 if the religion of the PLC's major stakeholder is Muslim and zero if otherwise. It is predicted that when the PLC comprises of more religious persons, the amount of total debt will decrease, as large amounts of debt instruments are normally interest- based. Hence, one would expect that religion will be negatively related to funding instruments that are interest-based and positively related to non-interest-based funding.

4.1.5 Methodology in the Analysis of Capital Structure

4.1.5.1 Structural Equation

Romano et al. (2000) use a structural equation model to determine the capital structure of a family business. Their study revealed that the pecking order theory provides a useful explanation for family business finance, where internal funds are favoured by owner-managers. However, it was found that family businesses tend to source capital through external funding in private equity and debt markets rather than through public markets. Titman and Wessels (1988) use this method to study the determinants of capital structure theory. They introduced a factor-analytic technique for estimating the impact of unobservable attributes on the choice of corporate debt ratios. Barclays et al. (2003) examine theories of leverage and debt maturity using the structural equation model. The findings show that in leverage regression firm size and marginal tax-rate and tangibility coefficients are positive, and the tax-rate coefficient is statistically significant. Firm size and asset maturity are associated with more long-term debt, and the commercial paper dummy is associated with less long-term debt. Other studies using this method are Revoltella (2001) and Bhaduri (2002).

4.1.5.2 Probit and Logit Analysis

De Haan and Hinloopen (2003) in their study use (i) Multinomial Logit estimation in order to capture evidence to show the determinants of a firm's incremental funding choices, and (ii) an Ordered Probit model to show the whether a hierarchy of financing types exists as predicted by the pecking order theory. Panno (2003) uses Logit and Probit estimation procedures to estimate the descriptive model of choice between equity and debt. In general, the study confirms the pecking order theory.

4.1.5.3 Ordinary Least Square

Toy et al. (1997) use Ordinary Least Square (OLS) to estimate the debt ratio as expressed in the form of a linear function of growth, profitability and risk across five different countries, namely France, Japan, the Netherlands (Holland), Norway and the United States. They concluded that cross-national differences in debt ratio relate to different country's reactions to the levels of the various financial performance measures.

Hirota (1999) undertook a study to determine whether differences in the determinants of debt–equity choice existed between Japan and the Unites States. His study shows that there are similarities in terms of real factors and differences in terms of the institutional and regulatory features of capital markets, affecting the choices of funding decisions between the two countries.

Suto (2003) used a cross-sectional regression model estimated with OLS and found evidence for Malaysian firms showing that increasing dependency on debt-financing caused excess investment before the 1997 financial crisis. She found that foreign ownership contributed to reducing the agency cost of equity financing by disciplined corporate management.

Bevan and Danbolt (2004) analysed the determinants of capital structure using pooled OLS and fixed-effects panel estimation. They found that OLS pooled results are consistent with prior literature; however, the fixed-effects panel estimation provided contradictory results to previous studies. Cassar and Holmes (2003) provide evidence that asset structure, profitability and growth are important determinants of capital structure and financing.

4.1.6 Theoretical Findings on Study of Capital Structure

There are various market imperfections that influence the capital structure of companies, among others personal taxes, bankruptcy and agency costs, and information asymmetries. Ample evidence is also found in the study of capital

structure to show that, in general, companies prefer internal (retained earnings) to external funding, and among external funding types, prefer bank loans to bonds and bonds over shares (De Haan and Hinloopen, 2003; Wiwattanakantang, 1999; Kjellman and Hansen, 1995; Romano et al., 2000; Colombo, 2001; Titman and Wessels, 1988). There is also evidence to show the inverse relationship between financial structures and leverage (Ferri and Jones, 1979).

4.2. Sources of Funding

There are basically two sources from which a company may fund its investment activities, namely (a) retained earnings or (b) issuance of new securities. There are a number of different financial instruments that can be used, such as common stock, bonds, preferred stocks, convertible bonds, etc. Each of these financial instruments carries with it different contractual rights with respect to the distribution of the gross profits of the firm, and the role the owner of those instruments can play in the decision making of the company[35]. There are some advantages of debt over equity, the most commonly cited advantage of debt being the corporate tax deductibility of interest payments, and the most cited disadvantage of debt being bankruptcy costs (Blazenko, 1987).

The literature on corporate finance discusses extensively the capital structure theory whereby the capital structure choices of business suggest that there is a hierarchical preference in sources of funding. This is known as the pecking order hypothesis. It implies that internal funding is preferred to external funding. The reason for this has been explained by (i) the transaction cost of issuing debt and equity (Oliner and Rodebusch, 1992), and (ii) the presence of the problem of information asymmetries in the financial market (Colombo, 2001). In the presence of asymmetric information, if the managers of a company are not able to convey inside information to outsiders, then they prefer internal funding to external funding. This then implies that the company would follow a pecking order preference. However, if internal funding cannot be counted on, then the company would issue debt; the issuance of equity will be the last resort. The financial source preferences for small businesses seem to agree with the predictions of the pecking order

[35] For detailed discussion on the differences in the distribution and roles owners of financial instruments play in the decision making of the firm, see Stiglitz (1974).

hypothesis (Ozer and Yamak, 2000). In comparison with domestic companies, MNCs tend to carry less debt in their capital structure than domestic companies (Singh et al., 2003).

Companies that want to raise new funds have two main sources. They can look for funds either internally in the company or externally through the capital market or financial institutions. In Malaysia, companies have further a choice of either conventional funding or Islamic funding sources. In line with the government's aspiration to develop Malaysia into an international financial centre, many Islamic products and services have been developed and are offered in the market. But Ahmad and Haron (2002) have shown in their study that the usage of such instruments is still low in comparison to that of the traditional instruments that have long existed in the market. The various funding sources available for the business community are discussed in the following sections.

4.2.1 Conventional Instruments

There are two sources of conventional instruments namely; internal source and external source. The internal source refers to funds obtained within the company or the members of the company. One source is the family loan. This is normally the first and closest source from which a company can raise funds. However, funds raised in this way are usually made up of significantly smaller amounts compared with loans from financial institutions (Bates, 1997). Therefore, they cannot fulfil the needs of serious long-term investment.

Another source is the amount of earnings retained within the company. However, there is an opportunity cost to retained earnings. This is because the profits that are reinvested into the business could be given out as dividend to the shareholders. Nevertheless, the advantage of using retained earnings to fund new investments, rather than raising new equity for new investment, is that this does not incur cost as in the issuance of new shares or debentures. It also avoids the possibility of a change in control, which may result from an issue of new shares. Internal funding has been the most preferred form of funding as it is the safest (De Haan and Hinloopen, 2003; Ramano et al., 2000).

While the external source comes from two forms, namely; the long-term funding. This form of funding involves a long period of time, normally 10 or more years. Among commonly discussed sources in the finance literature are equity, bonds, bank loans, foreign loans, finance leasing, and hire purchase.[36] The short-term funding traditionally offered by the banks in the form of short-term loans, overdrafts, short-term loans, banker acceptances, trade credit and medium-term loans, which are commonly offered nowadays.[37] A short-term loan is for a period of up to three years, while a medium-term loan is for a period of three to ten years.

4.2.2 Islamic Instruments

Islamic funding is based on the concept of justice. The sources of funds available to businessmen intending to expand their business are also from two main sources, internal and external. However, the sources of both the internal and external sources may differ.

Islamic funding modes are based on three principles: sharing, sale and leasing. Sharing implies that there is expectation of a share in the return. There are two forms

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[36] Equity in the form of ordinary or preference shares refers to shares issued to the owners of a company. Ordinary shareholders put funds into the company by paying for a new issue of shares or through retained profits. Preference shares are shares that provide a specific dividend, which is paid before any dividends are paid to common stock holders. Bonds are, however, securities, which represent debt owed by companies to investors. That is, in a way companies borrow money from the bondholders who purchase their bonds. The companies agree to pay the bondholders interest in return for the use of their money plus the principal amount borrowed.

Another important source of funds for a company is bank loans, which are borrowings from banks. The loans can be long-term, which is for a period of more than ten years, and is usually for the purchase of property, hence in the form of a mortgage. Another source of funds is in the form of loans from foreign banks or foreign markets. This can be an attractive source of funds for larger firms involved in international trade.

Fund leases are lease agreements between the user of the leased asset (the lessee) and a provider of funds (the lessor) for most, or all, of the asset's expected useful life. Hire purchase is a form of instalment credit, which is similar to leasing. The difference is that ownership of the goods passes to the hire purchase customer on payment of the final credit instalment. However, in a lease, the lessee does not become the owner of the goods.

[37] An overdraft by which the company can withdraw in excess of the funds that it has in its current account is in fact a loan or an advance
given by the bank to the company, whereby interest at the rate determined by the bank will be charged on the overdraft amount at the
end of the month. Banker Acceptance, which is an issuance bill of exchange drawn by the customer on the bank and accepted by the bank, and which may be discounted with the accepting bank and the proceeds utilised to finance purchases/import bills or credit sales/exports, is a cheap way of financing purchases of imports or sales/exports.

Trade Credit is the credit one firm grants to another firm for the purchase of goods and services.

of sharing, full equity sharing and non-voting equity funding. In the sale modes, the bank is asked to buy goods and sell them to users (producers/ consumers) against future payment. Leasing modes are used in the funding and importation of equipment, machinery and other fixed assets[38].

If one were to go back in time, during the pre-Islamic era right through the period of Islam, both equity funding and debt funding existed in pre-Islamic society (Mahyudin, 1997). It can be seen that before the advent of Islam, there were a huge number of commercial contracts that traders entered into in the course of their trading and commercial activities. Arab traders practised both equity funding and debt funding in their trade and commerce.

Equity funding was undertaken through the contracts of profit sharing, namely (i) Al-Mudharabah (trustee profit-sharing) and (ii) Al-Musharakah (joint-venture profit-sharing). Debt funding was achieved through both deferred contracts of exchange, such as among others Al-Bai Bithaman Ajil (deferred instalment sale), Bai al-Murabaha (deferred lump-sum sale), Al-Ijarah (Leasing), Bai al-Salam (salam sale), Bai al-Istisna' (sale on order), and "Riba-based-lending" contracts. Since "Riba" is synonymous with modern-day interest, it is also referred to as interest-based lending. It is not based on the contract of exchange; rather it is based on lending where the contractual relationship is that of debtor to creditor. At the time of lending, the lender lends the money to the borrower, and at the time of repayment, the borrower repays the lender the principal amount of money lent out, plus an 'additional' in the form of interest. Interest-based lending creates a debt, and is therefore a debt-funding instrument.[39]

Islam has allowed both equity funding and debt funding. The Shariah[40] has never prohibited debt. If one looks at permissible Shariah contracts, such as deferred payment sale, Murabaha and Salam, all these contracts create debt (Nik Hassan and Musa, 2000). Debt securities are the oldest negotiable funding instruments. In a

[38] For detailed explanation of these concepts, please read Nik Hassan and Musa (ed.) (2000).
[39] Bank Islam Malaysia Berhad (1994).
[40] Refers to corpus of Islamic law based on divine guidance as given by the Qur'an and the Sunnah and embodies all aspects of the Islamic faith, including beliefs and practices. Iqbal and Llewellyn (eds.) (2002).

Salam contract, the Salam instrument is a sale contract that enables a company in need of cash to borrow from the bank or to issue bonds. Actually, debt is not prohibited in Islam. In fact, according Iqbal and Llewellyn (2002), it is not illegal to use short-term debt for funding the purchase and sale of real goods and services. The lending of money is allowable in Islam, but it has to be without interest. This type of lending is known as "al-Qard al-Hasan" or benevolent loan[41]. In terms of short-term funding, bank overdrafts, banker acceptances and trade credit are also provided to fulfil the funding needs of a company. However, a detailed discussion of these sources of funding instruments is beyond the scope of this paper.

According to Sadr and Iqbal (2002), Islam has offered a combination of both equity- and non-equity-based instruments; however, there seems to be a preference for equity contracts. This is because the prohibition of debt contracts has provided incentives for Islamic banks to concentrate on low-risk trade funding instruments when faced with asymmetric information[42]. Hence it may be likely that the preference of business firms is moulded by the availability of funding instruments in the market. It may not be that they are not interested in using Islamic funding instruments, but that the availability of the instruments is limited, or what is available may seem similar to the current conventional instruments that they have previously used, hence there is no point in switching. In Islam there are basically four key differences between debt contracts and equity-type contracts, namely:

i. The degree and form of risk-sharing
ii. The absence of any ownership stake in debt contracts
iii. The presence of an ownership stake in equity contracts
iv. The incentives

[41] This contract is therefore more relevant in the social welfare sector of the economy, or where there is a social implication such as in dealing with government, rather than in the private or commercial sector of the economy.
[42] Please refer to Iqbal and Llewellyn (eds) (2002).

4.3 METHODOLOGY

4.3.1 Target Population

The target population comprises a population from a list of companies involved in the manufacturing of consumer, industrial and technological products, which are listed on Bursa Malaysia and are selected based on the following criteria:

i. The company is registered within Kuala Lumpur and Selangor, and is involved in manufacturing of consumer, industrial and technological products.
ii. The company has been in operation for 10 or more years.
iii. The company is listed during the period under study.

The target population is limited to only companies registered in the states of Selangor and Kuala Lumpur. One disadvantage of limiting the sample is the loss in power associated with reducing the variation in the independent variables. The most important advantage is that it accounts for the unobserved heterogeneity among the cross-sectional company over time in the form of unobserved company-specific effects.

There are 96 PLCs that have been in operation for 10 or more years. The method of selecting the target population is a stratified sampling procedure. This method is adopted due to the shortage of funds available to conduct the survey to cover the whole of Malaysia. Using the registered office as the basis for selection is an attempt to reduce bias, as some of the companies selected were found to be located in other parts of the country.

The target population is also characterised by different forms of key decision-makers in the companies, whereby they are Bumiputra, non-Bumiputra or foreign. Bumiputra in Peninsular Malaysia are mainly of Malay origin and are all assumed to be Muslim. The non-Bumiputra comprise the Chinese, Indians and others of

Eurasian origin, assumed to be non-Muslim. Foreigners comprise the personnel employed by MNC companies operating in Malaysia.

4.3.2 Data

Ramano et al. (2000) considers that in order to explain capital structure decision-making, there is a need to go beyond the use of the publicly available information found on extensive databases or income reports to include matters that most owner-managers might regard as privileged information. This study carries out this particular procedure in order in gain information that is not publicly available. It uses both primary and secondary data to analyse the factors that determine the choice of funding instruments among the PLCs involved in the manufacturing of consumer, industrial and technological products.

A survey was undertaken to collect data on a series of questions related to the mode of funding or specifically the Islamic funding instruments used by these PLCs. The financial data set for these companies from 1995 to 2000 was collected from secondary sources such as the annual reports of the respective companies and the companies' handbooks. However, due to the strict policy of some PLCs and lack of personnel commitment, only 20 PLCs responded to the survey. Among these 20 responses, 10 companies have been removed from the sample of responding PLCs either due to insolvency or because they provided very little of the information required by the study.

4.3.3 MODEL OF CHOICE OF FUNDING INSTRUMENTS

4.3.3.1 Conceptual Framework of the Model

An econometric model of choice was formulated based on the PLS regression technique. The PLS method was originally developed by an econometrician by the name of Herman Wold in the mid-1960s. Various studies using this approach among others are Fornell and Lacker (1981a and

1981b), Fornell and Bookstein (1982), Cool et al. (1989), Johansson and Yip (1994), Barclay et al. (1995) and Chin (1998).

PLS is a multivariate data analysis technique, which can be used to relate several response (Y) variables to several explanatory (X) variables. The method aims to identify the underlying factors (a linear combination of the X variables) that best model the Y dependent variables. It is a statistical tool that was designed to deal with multiple regression problems where the number of observations is limited, missing data are numerous, and the correlations between the predictor variables are high. As a multiple linear regression model, PLS shares the assumptions of multiple regression.

PLS is chosen because of its ability to (i) work with quite small sample sizes, (ii) predict the PLCs' choice regarding funding instruments, (iii) model multiple dependents as well as multiple independents, (iv) handle multicollinearity among the independents, (v) provide a robust prediction in the face of data noise and missing data, and (vi) allow a stronger prediction.

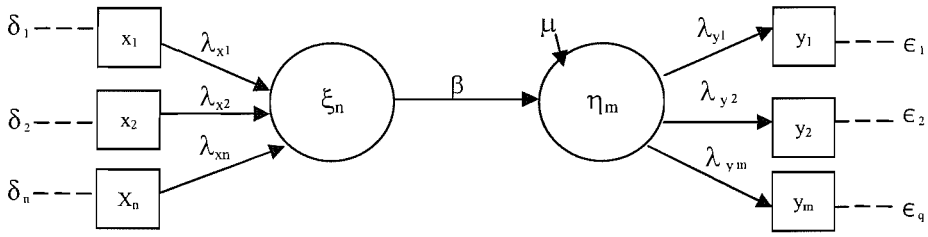
PLS is a components-based structural equation modelling technique. It is similar to regression, but simultaneously models the structural paths, which are the theoretical relationships among latent variables, and the measurement paths, which are the relationships between a latent variable or construct and its indicators (Chin et al., 2003).

Independent variables or predictors are viewed as latent independent variables or constructs, which are ideas that cannot be measured directly. Therefore, measures or indicators for these variables need to be obtained. These variables are also known as manifest variables. Each of these indicators reflects the underlying construct or latent variable. The dependent or response variables are viewed as latent dependent variables or constructs. The indicators that reflect the underlying constructs or latent variables are also obtained. The PLS procedure is then used to estimate the latent

variables as an exact linear combination of its indicators. The purpose is to maximise the explained variance for the indicators and latent variables.

A simple path analysis model consists of a series of exogenous constructs, which are consistent with the idea of independent variables, specified by ξ. The endogenous construct, which is consistent with the idea of the dependent variable, is specified by η (Barclay et al.1995). In order to relate the unobservable factors to the observable data, a formative indicator model is suitable[43]. The model, therefore, consists of only formative indicators, which are viewed as the cause variables. They provide the conditions under which the latent variables they are connected with are formed (Chin, 1998). This relationship is depicted by a simple diagram and shown in Figure 4.1.

Figure 4.1
Relationship Among the Latent and Manifest Variables



ξ_n : a series of exogenous constructs or latent independent variables

η_m : an endogenous construct or latent dependent variable

x_n : x observed variables, measures or indicators

y_m : y observed variables, measures or indicators

λ_n : regression coefficients of y on η

λ_m : regression coefficients of x on ξ

ϵ_m : error terms for endogenous constructs

δ_n : error terms for exogenous construct

μ : residual in the structural model

β : coefficient between ξ_n and η_m

[43] Observable variables or indicators are formative if they are intended to account for the observable variances. For more detailed explanation on this, see Fornell and Bookstein (1982) and Chin (1998).

The unobserved constructs can be viewed either as underlying factors or as indices produced by the observable variables. That is, the observed indicators can be treated as reflective or formative. Reflective indicators are invoked in an attempt to account for observed variances or covariances. Formative indicators are designed to account for observed variables (Fornell and Bookstein, 1982).

This simple path analysis model is then extended to incorporate the model of choice of funding instruments for this study[44]. In terms of the variables used in this model, the dependent latent variable is choice of funding instruments which is measured by the observed variables such as the amount of conventional and Islamic funding in the form of amount of financial leverage (TD) and operating liability leverage (TP) utilised by the PLCs. The independent latent variables such as growth opportunities (GO), non-debt tax shield (NT), assets structure (AS), firm's size (FS), risk (RS), age (FA), profitability (PR), earning volatility (EV), religion (RL), and foreign participation (FP) are explained respectively by the independent observed variables such as percentage change in total assets, earning before interest and tax (EBIT), ratio of inventory and gross plant and equipment to total assets, natural log (ln) sales and (ln) total assets, standard deviation of the firm's differences in sales, age, return on assets (ROA), and standard deviation of the percentage change in operating income, dummy religion and dummy foreign participation. The choice of the variables is related to data availability.

The measurement validation is performed by conducting reliability analysis and construct validity analysis. The reliability test is conducted by assessing the internal consistency of the indicators that form part of and each construct (Mar Molinero and Serrano Cinca, 2006). Internal consistency reliability (ICR) is also known as composite reliability and it is computed using the following formula:

[44] Please refer to Appendix 4.3 for illustration of the path diagram for the full model choice of funding instruments.

$$ICR = \left(\sum \lambda_i\right)^2 \Big/ \left[\left(\sum \lambda_i\right)^2 + \sum\left(1-\lambda_i^{\,2}\right)\right]$$

where λ_i is the standardized component loading of a manifest indicator on a latent construct. ICR = 0.7 or higher are considered adequate (Yi and Davis, 2003)

While the convergent and discriminant validity are assessed by applying the two criteria:

(i) The square root of the average variance extracted (AVE) by a construct from its indicators should be at least 0.7 and should exceed that construct's correlation with other constructs. The square root of the AVE is computed by taking the square root of the following formula:

$$AVE = \sum \lambda_i^2 / \left[\sum \lambda_i^2 + \sum \left(1 - \lambda_i^2\right)\right]$$

This study uses the Proc PLS by SAS to determine the variables that has significance in predicting the model of choice, hence the predictive power of the model is determine by the value of the R^2 and Q^2. These two tests will show the predictive relevance of the variables in predicting the choice of funding instruments.

4.3.3.2 Methodology to Determine the Model of Choice

The model of choice is shown by the following equation;

$$TD + TP = \alpha + \beta_1 GO + \beta_2 NT + \beta_3 AS + \beta_4 FS + \beta_5 RS + \beta_6 PR + \beta_7 EV + \beta_8 FA + \beta_9 FP + \beta_{10} RL + \varepsilon$$

Where (TD) is the financial leverage and (TP) is the operating liability leverage are the dependent latent variables. While the independent latent variables are (GO) is growth opportunities, (NT) is non-debt tax shield, (AS) is assets structure, (FS) is firm's size, (RS) is risk, (FA) is age, (PR) is

profitability, (EV) is earning volatility, (RL) is religion, and (FP) is foreign participation. Description on these variables can be found in Appendix 4.1 and 4.2.

In order to determine the best model of choice, the study applies a three-stage method adapted from SAS Proc PLS procedure. To find the PLS factors or components or latent variables, the PLS model need to be fitted. Hence, when fitting a PLS model, there is a need to find a few PLS factors that would explain most of the variation in both the predictors and the responses. This is because the factors that explain the response variation well will provide a good predictive model for new responses. The factors that explain the predictor variation well are well represented by the observed values of the predictors.

The three-stage method for determining the model of choice comprises three stages. First, in stage 1, a part of the data called the training set will be fitted to the model. After fitting the model to the part of the data that is called the training set, the quality of the fit will be judged by how well it predicts the other part of the data for the prediction set. Those variables that are found to be not significant to the model will be eliminated. Then in stage 2, the reduced model of choice will be fitted to the training set once again. In the final stage 3, the reduced model will then be fitted to the remaining part of the data, called the prediction set.[45]

Another model of choice is later regressed based on MV approach as verification purposes. This is to verify that the PLS model of choice is the appropriate model of choice to determine the choice of funding instruments by PLCs in Malaysia.

[45] For a detailed discussion of this procedure, refer to Examples Using PLS Procedure, SAS.

4.5 ANALYSIS

4.5.1 Analysis of factors determining choice of funding instruments of PLCs in Malaysia.

4.5.1.1 Partial Least Square (PLS) Procedure:

In order to find a model that explains the relationship between the factors that determine the choice of funding instruments, regression analysis is performed on a panel data[46] of 96 PLCs from 1996 to 2000, except 1997, resulting in a total of 384 observations. In order to accomplish this, the model is fitted to the training set[47].

Table 4.1

Percentage Variation Accounted for by PLS Factors for the Training Set

Number of Extracted Factors	Model Effects		Dependent Variation	
	Current	Total	Current	Total
1	17.7913	17.7913	40.7641	40.7641
2	8.6117	26.4030	17.1478	57.9119

Table 4.1 above shows how much of the predictor and response variations are explained by each PLS component factor. It can be seen that 57.9% of the response variation is already explained; however, only 26.4% of the predictor variation is explained by the model. In order to improve the model fit, the value of the regression coefficient and variable importance for the projection (VIP) for each of the factors need to be analysed. This is in order to analyse the contribution of the variables or predictors to the model. Predictors with small coefficients in absolute value will make a small contribution to the response prediction. Therefore, the regression coefficients represent the importance of each factor or predictor in the prediction of the response, while the VIP represents the value of each predictor in fitting the PLS model for both the predictor and response variables. It reflects the importance of a predictor in the model both with

[46] A panel data approach is useful when the target population size is small. This is because it can increase the number of observations.
[47] The procedure used in this study is adopted from SAS examples for proc PLS.

respect to the response variable, and with respect to the predictors. If the absolute value of the coefficient for the predictor is relatively small and the value of the VIP is also small, then the factor will be dropped from the model.

By referring to Table 4.2, variables RS, PR2, GO, AS1, NT, RL, FP and FA are negatively related to both TD and TP. Hence, the result is in line with the theory of finance in which risk (RS), profitability (PR2), growth opportunities (GO), asset structure (AS1), non-debt tax shields (NT), Religion (RL), foreign participation (FP) and firm's age (FA) are negatively related to both financial leverage (TD) and operating liability leverage (TP). FP is in line with the priori from the demand side, which is in line with the focus of the study. Religion (RL), which is a new variable added in this study, shows that it is negatively related to both leverages. This is a surprising outcome, but it is rational to accept it as the more religiously conscious the management personnel are the less leverage the PLCs will incur. This is true as normally the funding instruments are interest-based.

Table 4.2

Estimated PLS Regression Coefficients and VIP

Obs	X_Var	B1	B2	VIP
1	FS1	0.22441	0.18217	1.30012
2	FS2	0.21052	0.15057	1.43576
3	RS	-0.12806	-0.13707	0.47010*
4	EV	0.17233	0.11727	1.24150
5	PR1	0.12344	0.22909	1.12383
6	PR2	-0.60180	-0.66725	2.11107
7	GO	-0.04618	-0.06077	0.17331*
8	AS1	-0.01380	0.00418	0.26307*
9	AS2	0.10132	0.14929	0.50237
10	NT	-0.01277	-0.00297	0.15934*
11	RL	-0.08958	-0.07229	0.52341
12	FP	-0.11169	-0.14888	0.43031*
13	FA	-0.15912	-0.25216	0.96449

* Indicates that the values of both Coefficients and VIP are below 0.5.

However, variables such as RS, GO, AS1, NT and FA are found to have small values for both coefficient and VIP, hence they will be dropped from the model. These predictors are least related to the dependent variable financial leverage (TD) and operating liability leverage (TP). Therefore, the PLS factors will be better represented without them.

The insignificant factors are then dropped and refitted into the training set. The following Table 4.3 shows the results for the new reduced model with eight variables. When the model is fitted with the remaining eight variables, the R-squared values for X improve to 40.5% for the 2 PLS components. However, the response variation has decreased, as it explained about 56.4%.

Finally, when refitting the PLS model to the prediction set, a surprising outcome is obtained. As shown in Table 4.3, it is found that the PLS reduced model for the prediction set improves to 41.7% of the variation in predictors, while the variation in response has gone down to 30.8%. There is an indication that the overall model has improved and hence could be a good model to explain the determinants of choice of funding among PLCs in Malaysia.

Table 4.3

Percentage Variation Accounted for by PLS Factors for the Reduced Model

Number of Extracted Factors	Model Effects		Dependent Variation	
	Current	Total	Current	Total
Training Set				
1	28.6057	28.6057	39.3024	39.3024
2	11.8413	40.4471	17.0968	56.3992
Prediction Set				
1	25.9697	25.9697	28.6045	28.6045
2	15.7600	41.7296	2.1843	30.7887

For the purpose of verification that the reduced model is the best model, another approach is undertaken and later used as a comparison with the former approach. In this approach, the data set is not divided into different

sets. Instead the PLS analysis is directly undertaken on the whole data set; the result of the variation is shown in Table 4.4.

Table 4.4

Percentage Variation Accounted for by PLS Factors for the Full Model

Number of Extracted Factors	Model Effects		Dependent Variation	
	Current	Total	Current	Total
1	16.1234	16.1234	29.5613	29.5613
2	11.9660	28.0895	3.3311	32.8924

The result shows that in adopting the current approach, the percentage of response variation explained by the model is slightly higher, about 32.9% as compared to 30.8% for the reduced model with the former approach. The percentage of predictor variation explained by the model using the current approach is only 28.1%, while for the former approach it is about 41.7%. The R square for the overall model is higher for the reduced model, hence it can be concluded that the reduced model is a better model than the current approach. The reduced model is a better overall model to explain the model of choice of funding instruments. Since the observed variables such as FS1, FS2, EV, PR1 and PR2 have VIP more than 1, hence the latent variables or constructs that they measure, such as firm's size, earning volatility, and profitability respectively, are significant in explaining the choice of funding instruments among PLCs in Malaysia.

Table 4.5

Cross Validation for the Number of Extracted Factors

Number of Factors	Root Mean PRESS	Total Q^2 %	Cum Total Q^2 %
1	0.880622	22.9	22.9
2	0.925467	(10.4)	14.8

Finally, Table 4.5 shows the cross validation for the extracted factors. The overall index Q^2 is a measure of how well the observed values are reconstructed by the model and its parameter estimates without loss of degrees of freedom. That is, it is used as a measure of the model predictive

ability and indirectly as a measure of robustness to missing data. The higher is the value of Q^2, the better the predictive ability of the model. If $Q^2 = 1$, the observed endogenous variables can be perfectly reconstructed by the model. The model is said to have predictive relevance if $Q^2 > 0$ (Fornell and Bookstein,1982).

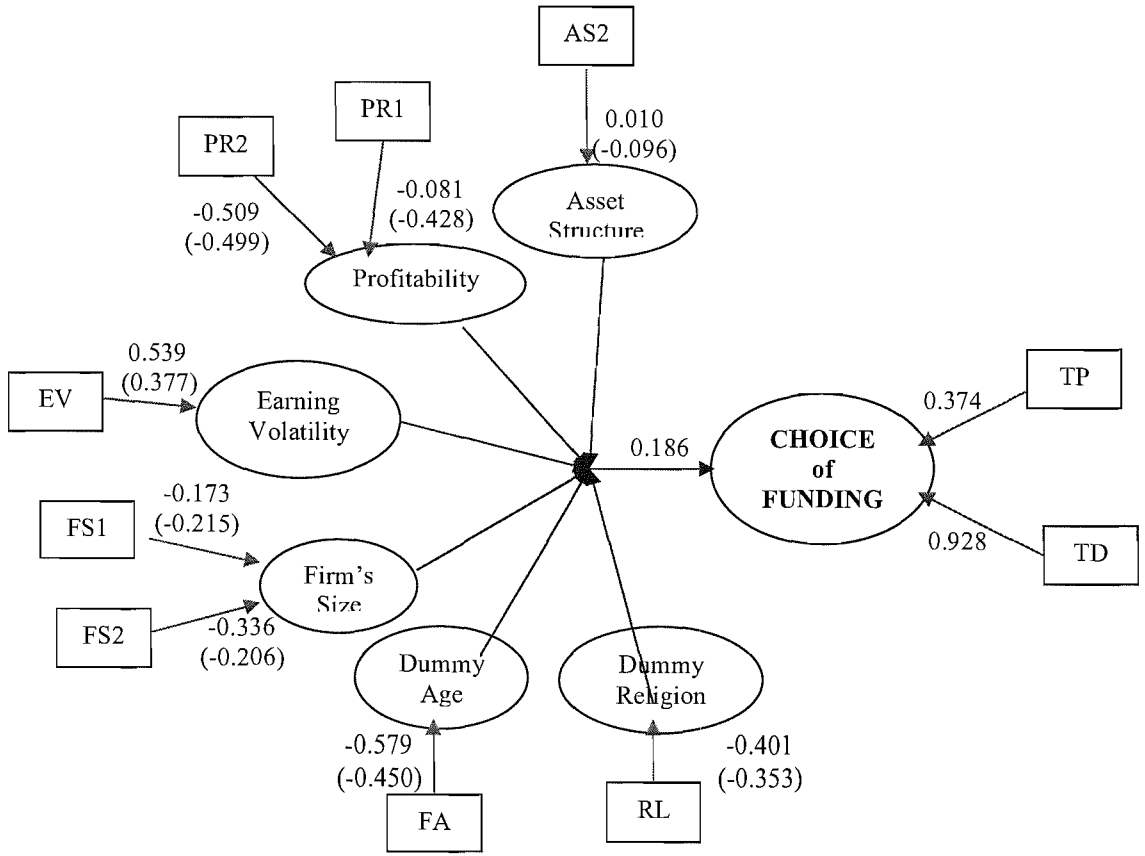
The cumulative Q^2 for the final prediction set is 14.8%, which means that the model does have some predictive relevance. The model of choice of funding instruments is relevant for predicting the observed funding instrument indicators, namely financial leverage and operating liability leverage.

Another measure of the predictive power of a model is the R^2 value for the endogenous constructs (Barclays et al.,2003). It indicates the amount of variance in the constructs that is explained by the model. Hence, it can be concluded that the model has predictive relevance, as 30.8% of the variance in the constructs is explained by the model of choice of funding instruments.

Referring to Figure 4.2, the parameter estimates for FS1, FS2, EV, PR2 and AS2 are found to be positive for both TD and TP, while FS1 and FS2 indicate that the firms are relatively large firms. This is reasonable as the sample comprises PLCs that are listed on Bursa Malaysia.

Since the predictors PR2 and AS1 are found to be negative for TD, this is not according to the priori. Predictor FA is also found to be negative for TP, which is according to priori. Finally, the predictor variables PR2 and RL are found to be negative, which is in line with the theory of finance. The fact that religion is negative indicates that PLCs viewed the leverages as interest-based. Since the mode of calculating profit is still based on the market interest rate, the element of the influence of interest on leverage is inevitable. Hence this may account for the fact that RL is negative.

Figure 4.2: PATH DIAGRAM FOR MODEL OF CHOICE OF FUNDING INSTRUMENTS VIA PARTIAL LEAST SQUARE REGRESSION



DependentVariable: TD & TP :
$R^2 = 40.5\%$
$Q^2 = 14.8\%$

Parameter Estimates

	TD	TP
Intercept	-2.1838	-0.6479
FS1	0.2702	0.0767
FS2	0.1960	0.0600
EV	2.7828	0.6496
PR1	-0.2009	-0.0459
PR2	-0.3294	-0.0653
AS2	0.0028	0.0003
RL	-0.0915	-0.0134
FA	-0.0018	0.0003

Note: The values in the parenthesis are the weights on indicators of the construct that shows the direct effect of the latent independent construct to the dependent construct in the model. The inner regression coefficient is equal to 0.186.

4.5.1.2 Multivariate (MV) Regression Procedure:

In order to confirm the reliability of the result produced by PLS, an MV regression analysis is undertaken using the SAS procedure. During the process of regression, the data was found to be not normally distributed. Hence, a transformation procedure in SAS using Proc Transreg was undertaken in order to resolve this problem. Proc Transreg is a procedure designed to find transformations of data to optimize some criterion. This procedure provides methods to find transformations that optimize the R square between a transformation of one or more dependent variables and transformations of a set of predictor variables. It generalizes the methods of linear regression, canonical correlation, and analysis of variance. The results will be used as a comparison with and confirmation of the results produced by PLS.

Table 4.6

Analysis of Variance

Dependent Variable TD				
Source	Sum of Squares	Mean Square	F Value	Pr > F
Model	371.2730	28.5595	52.31	<0.0001
Error	202.004	0.5460		
Corrected Total	573.277			
Root MSE	0.7389	R Square	0.6476	
Dependent Mean	-1.9809	Adj R-Sq	0.6353	
Coefficient Var	-37.2999			

Dependent Variable TP				
Source	Sum of Squares	Mean Square	F Value	Pr > F
Model	227.4378	17.49522	33.13	<0.0001
Error	195.4115	0.52814		
Corrected Total	422.8493			
Root MSE	0.72673	R Square	0.5379	
Dependent Mean	-2.6887	Adj R-Sq	0.5216	
Coefficient Var	-27.0292			

Table 4.6 above shows the results for the regression analysis incorporating both dependent variable TD and TP. The R square shows the percentage of the variance explained by the model. The values of the R square for TD and TP are 0.6476 and 0.5379 respectively. This means that approximately 64.8% of the

variability of TD and about 53.8% of the variability of TP are accounted for by the variables in the model. The F statistics for the overall model are highly significant (F=52.31, p<.0001 for TD and F=33.13, p<.0001 for TP). This indicates that the model explains a significant portion of the variation in the data.

For the test of multicollinearity, the variables that have a value of variance inflation factor (VIF) greater than 10 require investigation. The tolerance level is used to check the degree of collinearity. Therefore, if a tolerance value is lower than 0.1, it is comparable to a VIF of 10, which means that collinearity exists among the predictor variables. In the table above, the results show that there is no predictor that has either a tolerance level lower than 0.1 or a VIF greater than 10. The t statistics and the corresponding p-value for each parameter will show whether each of the parameters is significantly different from zero.

Table 4.7

Parameter Estimates for Dependent Variable TD

Variable	Parameter Estimate	Standard Error	T value	Pr > | t |	Tolerance	Variance Inflation
Intercept	-9.3564	0.3557	-26.30	<.0001*		0
FS1	1.1535	0.1008	11.44	<.0001*	0.32349	3.09130
FS2	0.2713	0.0864	3.14	0.0018*	0.36490	2.74046
RS	-0.3418	0.0620	-5.51	<.0001*	0.73899	1.35320
EV	2.3120	0.4622	5.00	<.0001*	0.84061	1.18962
PR1	-0.8970	0.4403	-2.04	0.0423*	0.27985	3.57336
PR2	0.0116	0.1987	0.06	0.9536	0.28933	3.45623
GO	-0.00002	0.0006	-0.03	0.9770	0.76234	1.31175
AS1	-0.4901	0.2232	-2.20	0.0288*	0.17610	5.67851
AS2	0.8711	0.2523	3.45	0.0006*	0.16857	5.93228
NT	0.0055	0.0095	0.57	0.5667	0.98516	1.01506
RL	-0.1681	0.0691	-2.43	0.0155*	0.90035	1.11068
FP	-0.0140	0.0026	-5.46	<.0001*	0.87818	1.13872
FA	-0.0002	0.0032	-0.06	0.9507	0.85326	1.17197

* Significance at 0.05 confidence level

Table 4.7 above shows the parameter estimates for the predictors for the dependent variable TD. It is found that only 4 out of the 13 predictors are highly significant, that is FS1, RS, EV and FP. Predictors such as FS2, PR1, AS1, AS2 and RL are also found to be significant to explain the choice of financial leverage. However, predictors such as PR2, GO, NT and FA are found to be insignificant. It

can also be seen that the parameters for variables RS, PR1, GO, AS1, RL, FP, and FA are negative, while NT is found to be positive. The result is according to the priori. However PR2, EV and AS2 are found to be not in line with the priori. Since PR2, GO, NT and FA are found to be insignificant, these variables can be ignored.

It is found that RL is negative. This gives an indication that the leverage is interest-based. Since FP is also found to be negative, this provides an indication that the Malaysian PLCs viewed FP as a mean of obtaining alternative funding. This is line with the point of view of the demander. As for FS1 and FS2, being positive provides evidence that the firms are relatively large.

For the dependent variable TP, as shown in Table 4.8, it is also found that there is no predictor that has either a tolerance level lower than 0.1 or a VIF greater than 10.

Table 4.8

Parameter Estimates for Dependent Variable TP

Variable	Parameter Estimate	Standard Error	T value	Pr > | t |	Tolerance	Variance Inflation
Intercept	-9.0035	0.3499	-25.73	<.0001*		0
FS1	1.4513	0.0992	14.63	<.0001*	0.29326	3.40994
FS2	-0.2611	0.0849	-3.07	0.0023*	0.30625	3.26532
RS	-0.3629	0.0610	-5.95	<.0001*	0.63589	1.57261
EV	-0.0599	0.4546	-0.13	0.8953	0.83821	1.19302
PR1	0.8719	0.4331	2.01	0.0448*	0.27662	3.61510
PR2	-0.7297	0.1954	-3.73	0.0002*	0.28858	3.46526
GO	0.0006	0.0005	1.20	0.2309	0.75534	1.32391
AS1	0.1844	0.2196	0.84	0.4017	0.17652	5.66517
AS2	-0.2591	0.2481	-1.04	0.2971	0.16812	5.94812
NT	-0.0032	0.0094	-0.34	0.7364	0.97402	1.02667
RL	0.01530	0.0680	0.23	0.8220	0.90223	1.10837
FP	-0.0055	0.0025	-2.75	0.0307*	0.86873	1.15111
FA	0.0034	0.0031	1.07	0.2849	0.85300	1.17233

* Significance at 0.05 confidence level

The parameter estimates for the predictors shown in Table 4.8 show that only FS1 and RS are found to be highly significant, while predictors such as FS2, PR1, PR2 and FP are also found to be significant. However, EV, GO, AS1, AS2, NT, RL and FA are found to be insignificant in explaining the choice of operating liability

leverage. For TP, the variables FS, RS, EV, PR2, AS2, NT and FP are found to be negative. This finding is according to the priori, except for NT which is supposed to be positive. Since it is insignificant, this can be ignored. However, there are contradicting results for FS1 and FS2. FS1 is found to be positive, which could be an indication that the PLCs are large, while FS2 is found to be negative, which indicates that the PLCs are small. Since FS1 is highly significant, this would be a better choice. This is also in line with the results found for TD. GO, AS1 and RL are not significant, hence these variables can be ignored.

Summarising the results produced by both PLS and MVM methods in Table 4.9, it can be concluded that, using the PLS method, FS1, FS2, EV, PR1 and PR2 are highly significant factors that determine the choice of funding instruments by PLCs in Malaysia. Using the PLS approach to analyse the determinants that affect PLCs choice of funding modes, it can also be said that factors such as AS2, RL and FA are also significant factors that influence the choice of PLCs' funding modes, while RS, GO, AS1, NT and FP do not significantly affect their funding decisions.

Table 4.9

Summary of the Predictors for the Model of Choice of Funding

Variable	PLS	MVM	
	TD&TP	TD	TP
FS1	Highly significant	Highly significant	Highly significant
FS2	Highly significant	Significant	Significant
RS	Insignificant	Highly significant	Highly significant
EV	Highly significant	Highly significant	Insignificant
PR1	Highly significant	Significant	Significant
PR2	Highly significant	Insignificant	Significant
GO	Insignificant	Insignificant	Insignificant
AS1	Insignificant	Significant	Insignificant
AS2	Significant	Significant	Insignificant
NT	Insignificant	Insignificant	Insignificant
RL	Significant	Significant	Insignificant
FP	Insignificant	Highly significant	Significant
FA	Significant	Insignificant	Insignificant

Comparing with the results produced by MVM method, it can be concluded that FS1 and RS are all found to be highly significant, while other variables such as EV, PR1, PR2, AS1, AS2, RL, FP and FA are found to show mixed results. However, for TP, only FS1 is highly significant, while FS2, RS, PR2 and FP are significant. Variables such as GO and NT are found to be insignificant. Both methods found GO and NT to be insignificant for both TD and TP. The other variables are found to be of mixed outcome between significant and insignificant for both TD and TP.

Taking into account the sign of the parameter estimates, it can be found that using the PLS approach has produced similar results to the MVM approach for TD. FS1, FS2, EV, PR1, AS2 and RL produce similar results. Since PLS takes into account both TD and TP at the same time, it can be concluded that the results produced by PLS reveals almost the same outcome as that produced by MVM. Hence, the model produced by PLS can be used to determine the choice of funding instruments by PLCs in Malaysia.

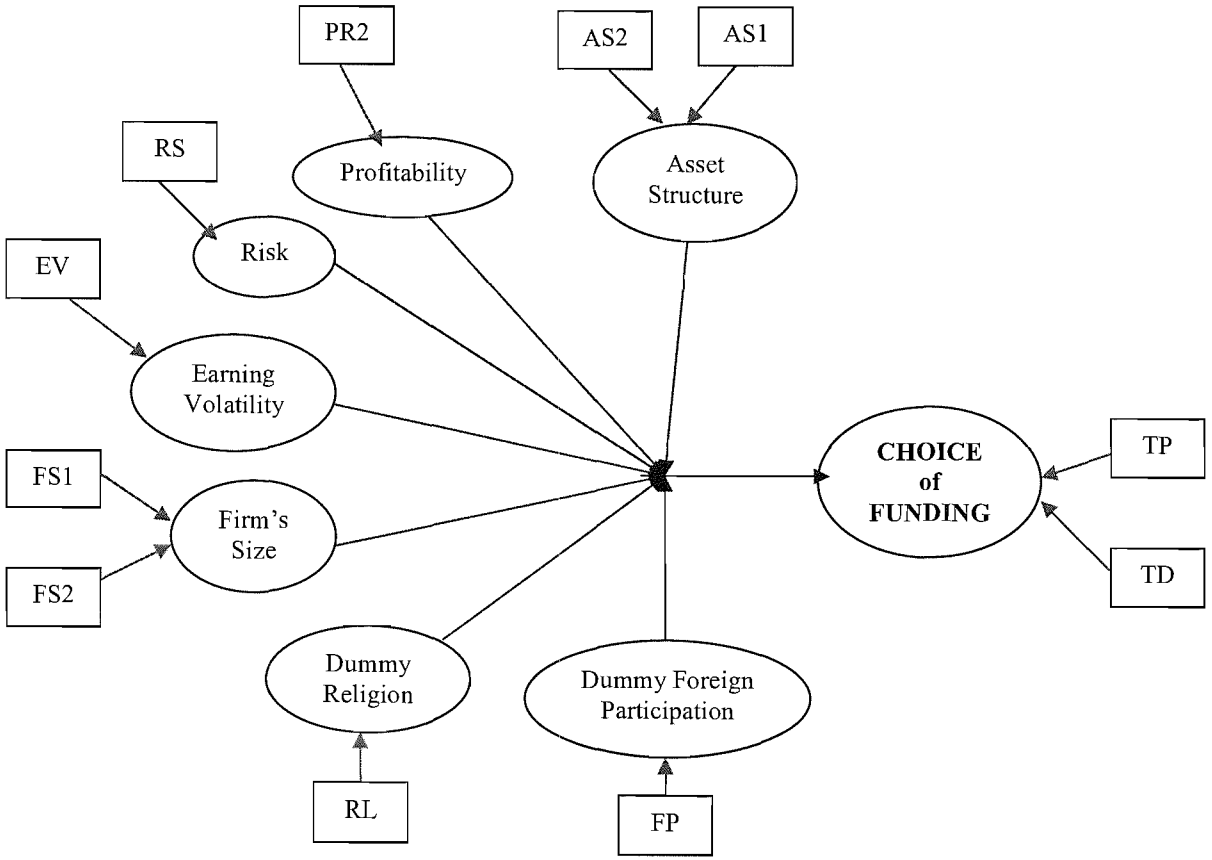
Figure 4.3: PATH ANALYSIS FOR MODEL OF CHOICE OF FUNDING INSTRUMENTS VIA MULTIVARIATE REGRESSION ANALYSIS:

DV:
TD : F = 47.74 R^2 = 0.627

IV:	Coefficient	T-Value	Std Est
GO	-0.00002	-0.03	-0.001
NT	0.0055	0.57	0.018
AS1	-0.4901	-2.20	-0.161
AS2	0.8711	3.45	0.260
PR1	-0.8970	-2.04	-0.119
PR2	0.0116	0.06	0.003
RS	-0.3418	-5.51	-0.198
EV	2.3120	5.00*	0.168
FS1	1.1535	11.44*	0.621
FS2	0.2713	3.14	0.161
FA	-0.0002	-0.06	-0.002
RL	-0.1681	-2.43	-0.079
FP	-0.0140	-5.46*	-0.180

DV:
TP : F = 27.66 R^2 = 0.494

IV:	Coefficient	T-Value	Std Est
GO	0.0006	1.20	0.0486
NT	-0.0032	-0.34	-0.012
AS1	0.184	0.84	0.071
AS2	-0.259	-1.04	-0.090
PR1	0.8719	2.01	0.135
PR2	-0.7297	-3.73	-0.245
RS	-0.3629	-5.95	-0.245
EV	-0.0599	-0.13	-0.005
FS1	1.4513	14.63*	0.909
FS2	-0.2611	-3.07	-0.180
FA	0.0034	1.07	0.041
RL	-0.0153	-0.23	-0.008
FP	-0.0055	-2.17	-0.082



Note: * Significant level is at 0.05.

The path coefficient is a standardized regression coefficient showing the direct effect from each of the latent independent construct to a dependent construct in the model. It is the arrow pointing from each of the latent independent construct to the dependent construct of Choice of funding.

4.5.2 Analysis of Factors Determining Choice of Funding Instruments of a Sample of Responding PLCs

The survey began with the whole population of PLCs involved in the manufacturing of consumer, industrial and technological products. However, only 20 PLCs responded to the survey. Some PLCs have become insolvent due to financial problems, and some do not have enough of the information required for the analysis. Hence, the final number of PLCs in the sample was 96, and out of that only 10 responded, which is a response rate of only 10.4%.

4.5.2.1 Partial Least Square

The same procedure for finding the appropriate model is undertaken. The results are summarised in Table 4.11. The following Table 4.10 shows the results of the VIP[48] for all the 13 variables.

Table 4.10

Estimated PLS Regression Coefficients and VIP for Sample Responding PLCs

Obs	X_Var	B1	B2	VIP
1	FS1	0.30791	0.36298	1.75134
2	FS2	0.25745	0.19905	1.50678
3	RS	-0.09155	0.08080	0.95130
4	EV	0.16626	-0.01547	1.28360
5	PR1	-0.10693	-0.09363	0.61587
6	PR2	-0.26052	-0.49118	1.73246
7	GO	-0.05470	-0.05224	0.31240*
8	AS1	-0.02562	-0.13583	0.49535*
9	AS2	0.08302	-0.06042	0.81597
10	NT	-0.07518	-0.13368	0.48243*
11	RL	0.02185	0.04559	0.15325*
12	FP	-0.09991	-0.04734	0.62976
13	FA	0.04233	0.02507	0.25801*

* Indicates that the values of both coefficients are small and VIP is below 0.5.

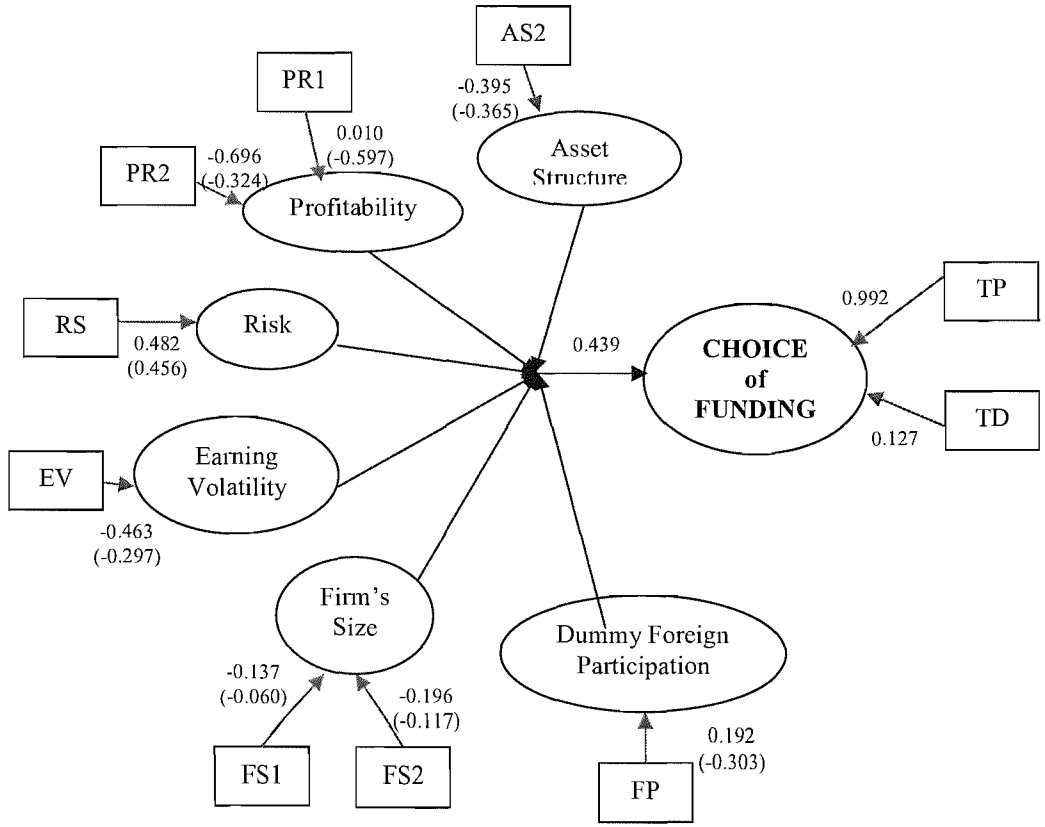
Only 5 variables, that is GO, AS1, NT, RL and FA, are found to be insignificant, as both the coefficients and VIP are lower than 0.5. These variables will be dropped from the analysis. Hence only 8 variables that are found to be significant will be retained in the final refitting of the model of choice for the responding PLCs. Of these 8 variables, 4, FS1, FS2, EV and PR2, are found to be highly significant.

[48] Variable Important for the Projection (VIP) represents the value of each predictor in fitting the PLS model for both the predictor and response variables.

Referring to Figure 4.4, the parameter estimates for FS1, FS2, EV and AS2 are found to be positive for TD, while FS1, FS2 and RS are found to be positive for TP. This indicates that according to the theory of finance, the sample PLCs that responded fall into the category of large firms, as FS1 and FS2 are found to be positively related with TD and TP, while EV and AS2 are found not to contradict the priori. RS, PR1, PR2 and FP are found to be negative for TD, and for TP, variables EV, PR1, PR2, GO, AS1, AS2, NT and FP are negative. For FP, since this is negative for both TD and TP, it can be concluded that the PLCs are viewed from the demand side. However, RS, AS2, PR1 and PR2 are found to be in line with the theory of finance.

In reference to Figure 4.4, it can be found that the parameter estimates for FS1 and FS2 are positive for both TD and TP, while EV and AS2 are positive for TD and negative for TP. For PR1, PR2, GO, AS1, NT and FP, the findings show that they are negative, while RS is negative for TD and positive for TP. For FS1 and FS2, the findings are consistent with the results for the whole target population. It hence confirms that the PLCs are large firms.

Figure 4.4: PATH DIAGRAM FOR MODEL OF CHOICE OF FUNDING INSTRUMENTS VIA PLS APPROACH FOR SAMPLE RESPONDING PLCs



Dependent Variable: TD & TP:
R^2 = 46.7%
Q^2 = 22.1%

Parameter Estimates:

	TD	TP
Intercept	-7.3442	-2.1500
FS1	0.9022	0.3156
FS2	0.5877	0.1325
RS	-0.3725	0.1380
EV	1.4104	-0.0500
PR1	-2.3829	-0.6515
PR2	-1.2354	-0.6766
AS2	0.6588	-0.1950
FP	-0.0106	-0.0007

Note: The values in the parenthesis are the weights on indicators of the construct that shows the direct effect of the latent independent construct to the dependent construct in the model. The inner regression coefficient is equal to 0.439.

Table 4.11

Percentage Variation Accounted for by PLS Factors
for the Sample Responding PLCs

Number of Extracted Factors	Model Effects		Dependent Variation	
	Current	Total	Current	Total
Training Set				
1	16.6816	16.6816	43.7722	43.7722
2	13.9289	30.6105	13.8039	57.5761
Prediction Set				
1	27.2497	27.2497	42.2146	42.2146
2	19.4470	46.6967	15.0160	57.2307

The R square for the final overall model of choice is 46.7%. This means that only 46.7% of the variation in the predictor is explained by the model, while the response variation explained by the model is about 57.2%. This is later checked against the result produced by the multivariate regression procedure.

Table 4.12

Cross Validation For The Number Of Extracted Factors

Number of Factors	Root Mean PRESS	Total Q^2 %	Cum Total Q^2 %
1	0.948626	14.5	14.5
2	0.905225	8.9	22.1

The cumulative Q^2 is 22.1%, which means that the model has predictive relevance. Since the R square is 57.2%, it can be concluded that the model has predictive relevance, as more than 50% of the variance in the constructs is explained by the model of choice of funding instruments.

4.5.2.2 Multivariate (MV) Regression Procedure

The results using this approach are shown in Table 4.13. The values of R square for TD and TP are 0.8905 and 0.8995 respectively. This means that approximately 89% of the variability of TD and about 90% of the variability of TP are accounted for by the variables in the model. The F statistics for the overall model are highly significant ($F=16.27$, $p<.0001$ for TD and $F=16.27$, $p<.0001$ for TP). This indicates that the model explains a significant portion of the variation in the data.

The results show a promising outcome. However, the diagnostic test result in Table 4.12 will verify whether the information in Table 10 is robust as it seems. Table 13 shows the analysis of variance. It is found that for TD, the value of R square is 89.05% while for TP it is 89.95%. This means that approximately 89.05% of the variability of TD and about 89.95% of the variability of TP are accounted for by the variables in the model. The F statistics for the overall model are highly significant (F=16.27, p<.0001 for TD and F=17.90, p<.0001 for TP). This indicates that the model explains a significant portion of the variation in the data.

Table 4.13

Analysis of Variance for Responding PLCs

Dependent Variable TD				
Source	Sum of Squares	Mean Square	F Value	Pr > F
Model	91.53883	7.04145	16.27	<0.0001
Error	11.25150	0.43275		
Corrected Total	102.79034			
Root MSE	0.65784	R Square	0.8905	
Dependent Mean	-1.00698	Adj R-Sq	0.8358	
Coefficient Var	-65.32773			

Dependent Variable TP				
Source	Sum of Squares	Mean Square	F Value	Pr > F
Model	72.18726	5.55287	17.90	<0.0001
Error	8.06360	0.31014		
Corrected Total	80.25087			
Root MSE	0.55690	R Square	0.8995	
Dependent Mean	-2.22529	Adj R-Sq	0.8493	
Coefficient Var	-25.02595			

From Table 4.14, it is found that no predictors have either a tolerance level more than 0.1 or a VIF less than 10. The t statistics and the corresponding p-value for each parameter will show whether each of the parameters is not significantly different from zero. The p-value (t=-8.64, p= <.0001) indicates that the intercept estimate is also highly significant. Looking at the parameter estimates for the predictors for the dependent variable TD, it is found that none of the predictors is highly significant and only 4 predictors, FS1, RS, PR2 and AS2, are significant. The remaining 9 predictors are found to be insignificant to the model of choice of funding instruments for the sample of responding PLCS.

Table 4.14

Diagnostic Test for Parameter Estimates for Dependent Variable TD

Variable	Parameter Estimate	Standard Error	T value	Pr > | t |	Tolerance	Variance Inflation
Intercept	-9.96574	1.15298	-8.64	<.0001*		0
FS1	1.19830	0.31223	3.84	0.0007*	0.2662	3.7567
FS2	0.41578	0.23523	1.77	0.0889	0.3034	3.2958
RS	-1.49383	0.46987	-3.18	0.0038*	0.3184	3.1408
EV	0.44652	0.64427	0.69	0.4944	0.6260	1.5974
PR1	2.12290	2.37071	0.90	0.3788	0.2766	3.6160
PR2	-1.70800	0.44482	-3.84	0.0007*	0.3079	3.2480
GO	0.00295	0.00181	1.63	0.1144	0.3096	3.2304
AS1	-0.69739	0.56117	-1.24	0.2251	0.3831	2.6101
AS2	3.15300	0.88039	3.58	0.0014*	0.3315	3.0168
NT	-0.08126	0.04744	-1.71	0.0987	0.7455	1.3413
RL	0.18347	0.28929	0.63	0.5315	0.5386	1.8566
FP	-0.00206	0.01408	-0.15	0.8851	0.2048	4.8834
FA	-0.02268	0.02503	-0.91	0.3733	0.2440	4.0986

* Significance at 0.05 confidence level

In terms of the sign of the parameters, 6 predictors, that is RS, PR2, AS1, NT, FP and FA, are found to have a negative sign, indicating a negative relationship with the dependent variable TD. The results for all except NT are according to the priori. However, NT is insignificant and hence is ignored. As for FP, the negative sign indicates that the PLCs are viewed from the demand side, while FA being negative indicates that the PLCs are relatively young firms.

Table 4.13 shows the result for the dependent variable TP. For the test of multicollinearity, it is also found that there is no predictor that has either a tolerance level lower than 0.1 or a VIF greater than 10. The t statistics and the corresponding p-value for each parameter will show whether each of the parameters is significantly different from zero. The p-value (t= -8.64, p= <.0001) indicates that the intercept estimate is highly significant.

With reference to Table 4.14, there are 3 highly significant predictors for this dependent variable TP, namely FS1, FS2 and PR2. EV, AS2, FP and FA are found to be significant, and the remaining predictors, such as RS, PR1, GO, AS1, NT and RL, do not show any indication that they are significant. As for the sign of the parameters, it is found that FS2, RS, EV, PR2, AS2, NT, RL and FP are negative. Similar to the findings for TD, NT is not according to the priori; however, since it is insignificant, it is ignored.

FS2 being negative gives an indication that the firms are large. This finding is similar to that for TD. As for RL, the fact that it is negative gives an indication that PLCs viewed leverage as interest-based. Similar to the finding for TD, the negative FP indicates that PLCs also viewed themselves as demanders.

Table 4.15

Diagnostic Test for Parameter Estimates for Dependent Variable TP

Variable	Parameter Estimate	Standard Error	T value	Pr > | t |	Tolerance	Variance Inflation
Intercept	-9.86720	0.97607	-10.11	<.0001*		0
FS1	2.37597	0.26432	8.99	<.0001*	0.2662	3.7566
FS2	-0.99524	0.19914	-5.00	<.0001*	0.3034	3.2958
RS	-0.33870	0.39777	-0.85	0.4023	0.3184	3.1408
EV	-1.12321	0.54542	-2.06	0.0496*	0.6260	1.5974
PR1	3.22438	2.00696	1.61	0.1202	0.2766	3.6160
PR2	-2.13186	0.37657	-5.66	<.0001*	0.3079	3.2480
GO	0.00134	0.00153	0.88	0.3889	0.3086	3.2304
AS1	0.02382	0.47507	0.05	0.9604	0.3831	2.6101
AS2	-2.57441	0.74531	-3.45	0.0019*	0.3315	3.0168
NT	-0.04909	0.04016	-1.22	0.2326	0.7455	1.3413
RL	-0.13481	0.24491	-0.55	0.5867	0.5386	1.8566
FP	-0.02613	0.01192	-2.19	0.0375*	0.2048	4.8834
FA	0.05246	0.02119	2.48	0.0201*	0.2440	4.0986

* Significance at 0.05 confidence level

As for FS1, PR1, GO and AS1, they are found to be positive. The results here are found to be contrary to the priori. FS1 seems to contradict the earlier findings for FS2, which is negative. As PR1 and GO are not significant, they can be ignored; however, AS1 is significant.

Summarising the results produced by both PLS and MV methods in Table 4.16, it can be concluded that, using the PLS method, FS1, FS2, EV and PR2 are highly significant factors that determine the choice of funding instruments by PLCs in Malaysia. Using the PLS approach to analyse the determinants that affect PLCs' choice of funding modes, it can also be said that factors such as RS, PR1, AS2 and FP are significant factors that influence the choice of PLCs' funding modes, while GO, AS1, NT and RL do not significantly affect their funding decisions.

Comparing the results with those produced by MVM method, it can be concluded that there are mixed results for both TD and TP. Variables such as FS1 and PR2 are found to

be significant for TD, whereas FS1 and PR2 are found to be highly significant for TP. Other variables such as FS2, RS, EV, PR1, FP and FA are found to show mixed results, between significant and insignificant. Results for the responding PLCs revealed a similar pattern to the results produced for the whole sample.

Table 4.16

Summary of the Predictors for the Model of Choice of Funding for Responding PLCs

Variable	PLS	MVM	
	TD&TP	TD	TP
FS1	Highly significant	Significant	Highly significant
FS2	Highly significant	Insignificant	Highly significant
RS	Significant	Significant	Insignificant
EV	Highly significant	Insignificant	Significant
PR1	Significant	Insignificant	Insignificant
PR2	Highly significant	Significant	Highly significant
GO	Insignificant	Insignificant	Insignificant
AS1	Insignificant	Insignificant	Insignificant
AS2	Significant	Significant	Significant
NT	Insignificant	Insignificant	Insignificant
RL	Insignificant	Insignificant	Insignificant
FP	Significant	Insignificant	Significant
FA	Insignificant	Insignificant	Significant

It can be concluded that the results produced by MV regression revealed almost the same outcome. However, on the contrary, the PLS results also found the variables FS1, FS2, and PR2 to be highly significant for TP. Variable that is found to be significant for TD is RS, while PR1 is found to have contradictory outcomes from both models. The variables that are found to be insignificant are GO, AS1 and RL, for both models.

Taking into account the sign of the parameter estimates, it can be seen that using the PLS approach has produced similar results to the MV approach for TD. FS1, RS, PR2 and AS2 are significant. Since PLS takes into account both TD and TP at the same time, it can be concluded that the results produced by PLS reveal almost the same outcome as the one produced by MV. The findings for the whole sample and responding sample have some similarity too, especially in terms of predictors FS1, FS2, EV, AS2, and PR2.

Hence, the model produced by PLS can be used to determine the choice of funding instruments by PLCs in Malaysia.

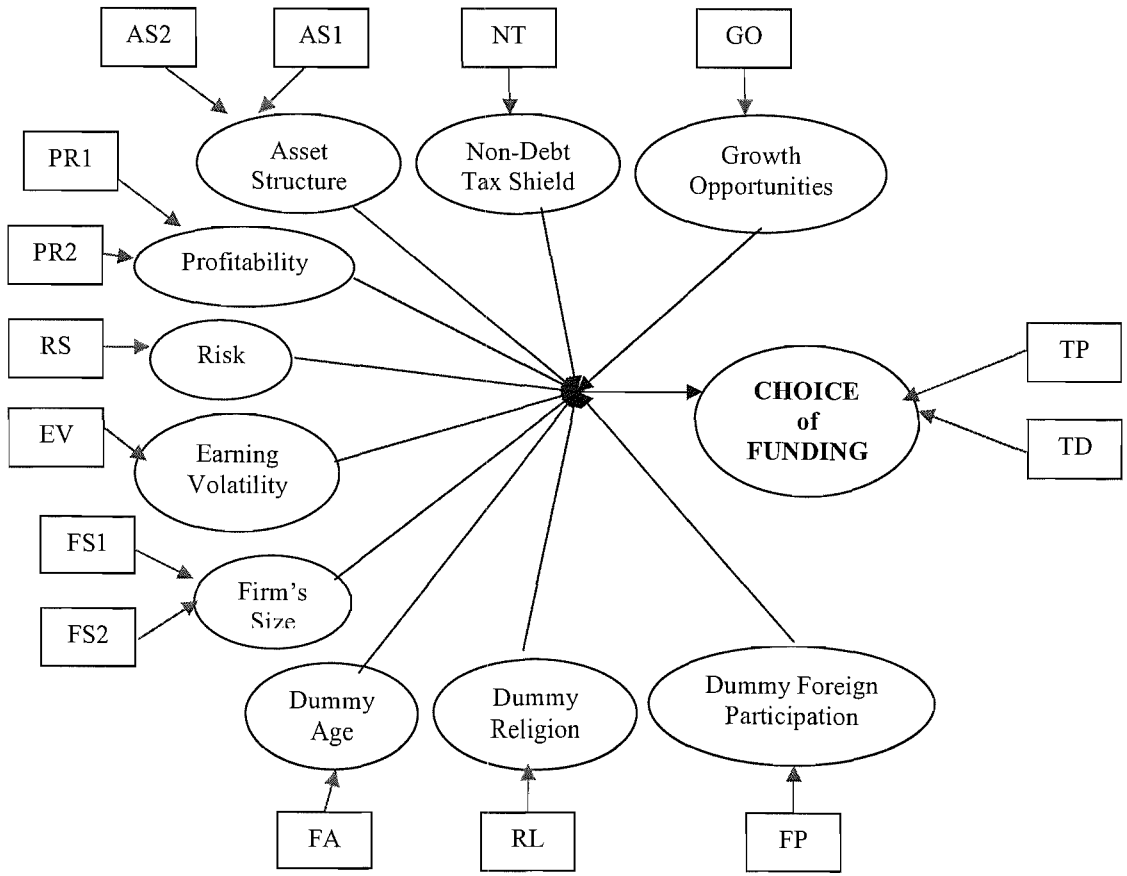
Figure 4.4: PATH DIAGRAM FOR MODEL OF CHOICE OF FUNDING INSTRUMENTS VIA MV REGRESSION FOR SAMPLE RESPONDING PLCs

DV:
TD : F = 16.27 R^2 = 0.8905

IV:	Coefficient	T-Value	Std Est
GO	0.0030	1.63	0.191
NT	-0.0813	-1.71	-0.129
AS1	-0.6974	-1.24	-0130
AS2	3.1530	3.58	0.404
PR1	2.1229	0.90	0.111
PR2	-1.7080	-3.84	-0.449
RS	-1.4938	-3.18	-0.366
EV	0.4465	0.69	0.0568
FS1	1.1983	3.84	0.483
FS2	0.4158	1.77	0.208
FA	-0.0227	-0.91	-0.119
RL	0.1835	0.63	0.056
FP	-0.0021	-0.15	-0.021

DV:
TP : F = 17.90 R^2 = 0.8995

IV:	Coefficient	T-Value	Std Est
GO	0.0013	0.88	0.098
NT	-0.0491	-1.22	-0.088
AS1	0.0238	0.05	0.005
AS2	-2.5744	-3.45	-0.373
PR1	3.2244	1.61	0.190
PR2	-2.1319	-5.66	-0.634
RS	-0.3387	-0.85	-0.094
EV	-1.1232	-2.06	-0.162
FS1	2.3760	8.99	1.083
FS2	-0.9952	-5.00	-0.564
FA	0.0525	2.48	0.312
RL	-0.1348	-0.55	-0.047
FP	-0.0261	-2.19	-0.301



Note: Significant level is at 0.05.

The path coefficient is a standardized regression coefficient showing the direct effect from each of the latent independent construct to a dependent construct in the model. It is the arrows pointing from each of the latent independent constructs to the dependent construct of Choice of funding.

4.5.3 Analysis of Criteria of Choice of Funding Instruments from Responding PLCs

Table 4.17 below shows the response rate for each survey question[49]. The response rate for the survey is 10.4%. The table below summarises the survey results with the respective response rate.

Table 4.17

Summary of the Response Rate for the Survey on Choice of Funding Instruments ny PLCS

Details	% Response
Using Islamic funding instruments	30
Using conventional	90
Company owned capital	20
Yes seriously considered using Islamic funding instruments	40
Not considering using Islamic funding instruments	60
Reasons for considering Islamic funding instruments :	
Disagreed with religious obligation	40
Totally agreed with cost effectiveness	20
Indifferent	50
Availability of Islamic funding instruments	10
Basis for using Islamic funding instruments:	
Totally disagreed that it is based on Islamic faith	40
Agreed that it is based on Islamic faith	10
Agreed that it is based on intention to earn profit	40
Disagreed that it is based on intention to earn profit	10
Totally agreed that it is based on avoidance of interest	40
Totally disagreed that it is to ensure justice in financial transactions	10
Disagreed that it is based on contributing to the overall welfare of society	10
Agreed that it is based on contributing to the overall welfare of society	10
Present mode of Islamic funding is the same as interest-based funding	20
Present mode of Islamic funding is the different from interest-based funding	10
Agreed that Islamic funding is the same as interest-based funding as both give same effect on business results	40
Agreed that Islamic funding is the same as interest as both are justice and welfare free	10
Agreed that Islamic funding is the same as interest-based as both work in society that has same values	30
Do Muslim business companies use Islamic funding?	
Yes	40
No	30
Agreed that companies not using Islamic funding because find no differences between Islamic & conventional funding	30
Totally disagreed that companies are unaware of Islamic funding	10
Totally disagreed that companies are confused on Islamic funding	10
Are companies interested in using Islamic funding?	
Interested	30
Not interested	10
Agreed that companies are not interested because repayment to bank are based on instalment	10
Agreed that companies are not interested because failure to pay instalment creates additional liability	10
Disagreed that companies are not interested because Islamic banks do not consider business loss.	10

[49] Some of these survey questions have been adopted from Hassan and Ahmad (2002).

In term of modes of funding, only 30% of the responding PLCs used Islamic funding instruments, while 90% used conventional funding instruments and 20% used company- owned capital. No PLCs used 100% Islamic funding, while 20% used 100% conventional funding. Most companies used a combination of both Islamic and conventional funding. Twenty per cent of the PLCs used company-owned capital. Hence 50% used a combination of either Islamic and conventional or conventional and company-owned capital. In relation to usage of Islamic funding instruments, 40% of the respondents are seriously considering using Islamic funding instruments while the remaining 60% are not. For those considering using an Islamic funding mode, religious obligation is not the reason for choosing the instruments. This can be seen from the response whereby 40% totally disagreed that the reason for considering Islamic funding is religious obligation, while 20% totally agreed it is because of the cost effectiveness of the instruments. However, 10% agreed that the availability of instruments would also be the reason for using the instruments.

In terms of the basis for using Islamic instruments, 40% totally disagreed that it is based on the Islamic faith, but more on the intention to earn profit. As for the avoidance of interest, 40% totally agreed that it is to avoid interest, while only 10% totally disagreed with this. In term of ensuring justice in financial transactions, 10% totally disagreed. In terms of the difference between Islamic and conventional funding modes, 20% of the respondents agreed that Islamic and conventional funding is the same, while 10% disagreed. As for the reasons for believing that they are the same, 40% gave the reason that they have the same effect on business results.

About 40% of the respondents believe that Muslim business companies used Islamic funding while 30% do not believe so. The reasons given for not using are that 30% agreed that companies find no difference between the two funding instruments, while 10% totally disagreed that companies are unaware of the availability of the instruments. Ten per cent totally disagreed that companies are confused about the Islamic funding mode.

In terms of whether companies are interested or not in using Islamic instruments, 30% are interested, while 10% are not. The reasons they believe for the lack of interest in using the instruments are that 10% believed that the repayments to bank are based on instalments, and 10% believed that the failure to pay instalments creates additional

liability, while 10% disagreed that companies are not interested because Islamic banks do not consider business loss.

In term of general feedback on the lack of usage of the Islamic funding instruments, the business community has given the following as the reasons why Islamic funding modes are not popularly used, namely (i) there is a lack of support from financial institutions in terms of availability and promotion of the instruments; (ii) the system has not been in play long enough for the business community to adopt it, that is in terms of enough information about the instruments and the security that the instruments have in order for people to adopt them with ease; (iii) there is a lot of paperwork, which will reduce efficiency of the transaction, that is in terms of getting the funding; and (iv) many Muslim countries still lack a system to implement Islamic funding efficiently.

4.5.4 Analysis of Descriptive Statistics for the Responding PLCs

Table 4.18 below shows the descriptive statistics for the responding PLCs. The information will be used to show whether there are similar features between the whole target population and the sub-sample of responding PLCs.

Table 4.18

Descriptive Statistics for Responding PLCs

Variable	Mean	Std Dev	Minimum	Maximum
TD	1.045997	1.831117	0	7.778222
TP	0.263457	0.526740	0	2.413339
FS1	5.669039	0.653899	4.515079	6.830000
FS2	5.683344	0.812962	4.076750	7.200000
RS	0.423724	0.397307	0	1.048210
EV	0.105111	0.206647	0	1.099994
PR1	0.059980	0.084493	-0.146320	0.240000
PR2	0.0835590	0.426790	-1.744330	1.000000
GO	40.997929	104.882258	-7.302062	479.026868
AS1	0.596989	0.303264	0.170000	2.040021
AS2	0.414857	0.207819	0.080000	0.956626
NT	0.910538	2.571530	-1.809967	13.500000
RL	0.400000	0.496139	0	1.000000
FP	7.743000	16.527921	0	54.460000
FA	26.200000	8.519059	13.00000	42.000000

Based on the descriptive statistics for the responding PLCs in Table 4.18 and for all PLCs in Appendix 4.2, the average financial leverage for the whole sample of PLCs is RM0.28 million while for the responding PLCs is RM1.05. In term of operating

liability leverage for whole sample of PLCs is RM0.73 millions while for responding PLCs is RM0.26 millions. The range of funding instruments in terms of financial leverage for the whole PLCs and responding PLCs is the same, that is, from a minimum of 0 to a maximum of RM7.78 million while for the operating liability leverage is between 0 and RM2.41 million. Hence, it can be said that the sample of responding PLCs possessed some similar characteristics to the PLCs in the whole target population. Thus whatever conclusion from the analysis of the survey findings for these 10 PLCs could be generalised to the other PLCs especially in term of the general feedback given by the responding PLCs in relation to the lack of usage of the Islamic funding instruments

4.6 CONCLUSION

In terms of analysing the factors that determine the choice of funding instruments by PLCs in Malaysia, the study found that the MV regression approach to analyse the data for PLCs in Malaysia was not appropriate. This is due to (i) the high collinearity among the variables and (ii) the small sample size of the population. Therefore, the PLS method was adopted. This is because the results produced by the PLS approach and the MV regression approach are almost the similar. Hence, it could be concluded that since the result produced by PLS method is almost similar to the MV method, the conclusion pertaining to factors affecting the choice of funding instruments is reliable. Since PLS is a better method in term of its ability (i) to work with small sample size, (ii) to handle multicollinearity and (iii) to give a robust prediction in the face of data noise and missing data, the PLS result would provide a stronger prediction compare to MV.

By using the PLS approach, the study on the whole target population of 96 PLCs found that firm's size (FS), earning volatility (EV), profitability (PR), asset structure (AS), religion (RL), and firm's age (FA) are significant in explaining the model of choice of funding instruments among PLCs in Malaysia. It is also found that firm's size, earning volatility and assets structure are positively related to the leverages, while profitability and religion are found to be negatively related to both leverages. The fact that firm's size is positively related to leverage indicates that the PLCs are large firms. This can be considered reasonable as in order for firms to be listed they must have acquired a certain amount of assets and capitalization. Hence only large firms would be able to be listed.

Another interesting finding is on the predictor religion. It was found that religion is negatively related to leverage. This indicates that the higher the interest, the less leverage would be incurred by PLCs. This is an interesting finding as it shows that PLCs perceived that the leverages are interest-based. This is rational as conventional funding is based on interest and the profit for Islamic funding is calculated based on market interest rate.

The results for the responding sample PLCs found that firm's size, earning volatility, profitability and risk are found to be significant. This finding is similar for the whole sample. However, religion and growth opportunities are found to be insignificant. The finding for growth structure is similar for the target population. However, the finding for religion is different from the finding for the whole sample. Religion is found to be an insignificant predictor for the responding PLCs. This is another interesting finding, as it shows that the responding PLCs do not consider religion as an important factor in determining their funding choice. This finding is in line with the result of the survey. From the survey, the response for the question on 'reasons for considering Islamic funding instruments' shows that 40% disagreed that it is because of religious obligation. In another response to the question, 'basis for using Islamic funding instruments', 40% totally disagreed that it is based on the Islamic faith.

During the course of the survey, some feedback on the lack of usage of Islamic funding instruments was given. Some reasons were given as to why Islamic funding modes were not popularly used, namely (i) there is a lack of support from financial institutions in terms of availability and promotion of the instruments; (ii) the system has not been in play long enough for the business community to adopt it, that is in terms of having enough information about the instruments and the security that the instruments have in order for people to adopt them with ease; (iii) there is a lot of paperwork, which will reduce efficiency of the transaction, that is in terms of getting the funding; and (iv) many Muslim countries still lack a system to implement Islamic funding efficiently.

Malaysia has come a long way to become the leader in Islamic finance. Despite being in the business more than two decades, there is more to be done in order to compete with the interest-based system, which has been in existence for many thousands of years. The mode of computing the rate of profit needs to be looked into seriously. Ways need to be found to ensure that the method of computation of the rates of profit and return differs.

It is noted that as with any empirical study, the present study has its limitations, including time, financial considerations, and nature of the research design to conduct a larger scale survey. However, an extensive research on the subject matter has been undertaken, nevertheless the results may not be as robust as it should be. This is due a number of factors, namely; (i) Limitations that were encountered in doing the survey: a) Due to financial constraint, the target population size for the study is limited to the manufacturing sector only, hence making it a small population size. This thus affects the results of the findings (Future research in this area may include a wider sector of the economy in order to increase population size). This may lead to generalizability of the results to be limited. b) Out of this small population, only about 10% of response rate is achieved. This is due to the poor response given by the PLCs themselves. c) The number of observed variables for each construct is limited. The rule of thumb is more than one observable variable per construct. Due to the unavailability of relevant data in order to perform this, the study works within constraints. Future research may have and want to include more observable variables per construct. Lastly, due to the non-response bias that arises due to the small response rate, one needs to be cautious in interpreting these findings. This is because even though the responding PLCs share some similarity with the whole target population PLCs, there is also the possibility that the non-respondent will differ from the respondents with respect to their views on the chosen variables in the survey.

CHAPTER 5

SUMMARY AND CONCLUSION

Funding resources are vital for the survival of the firms. Hence it is important that firms with their available assets are able to source and utilise the appropriate amount of funding resources. This is in order to render their performance efficient and be located on the efficient frontier in relation to their peers. This thesis on the economics of funding instruments explores the relevance of efficiency in relation to funding instruments used by Public Listed Companies (PLCs) in Malaysia. It focus on what factors that have led to PLCs being located on the efficiency frontier in relation to their peers and what factors determine their choice of funding instruments.

In Chapter 2, a methodological framework is formulated in order to evaluate the efficiency of funding instruments via the two stages of funding process, namely the sourcing of funding instruments and the utilization of funding instruments. An overall efficiency index is computed by averaging the efficiency rate achieved by the respective DMU for the two stages. An efficiency Index equals to 1 would mean the DMU is efficient in both of the stages of funding process. It can be concluded that the Data Envelopment Analysis (DEA) model of efficiency can be used to evaluate the performance of funding instruments in various funding process. This approach enables DMU to identify at which stage of the funding processes the DMUs failed to attain efficiency. This would then enable the respective MDUs to rectify their weaknesses in order to attain an overall efficiency level and put their companies onto the efficiency frontier. In this respect, this study made a few contributions to the current literature on funding instruments namely; in term of the methodology (i) to evaluate these instruments, (ii) to evaluate the efficiency of the instruments at the two stages of the funding process and (iii) to enable comparison between the different funding instruments being undertaken namely, (a) the financial leverage and operating liability leverage, and (b) the Islamic and conventional funding instruments.

The model of efficiency formulated in Chapter 2 is then tested on empirical data in Chapter 3 where a study was undertaken on a target population of 96 PLCs involved in manufacturing sector in Malaysia for the period 1996, 1998 to 2000. Various models using different combination of inputs and outputs are developed. Two suitable models to measure efficiency

of the PLCs are later chosen. The results from the study showed that different models put different PLCs onto the efficiency frontier. Information obtained from these different models is then used to determine the strong points on which PLCs could capitalise, as well as the weak points that they could resolve. For the period 1996, 1998 to 2000, the study showed that model 1 which takes in account sales and equity as output in stage 2 has not put any PLCs onto the efficiency frontier. Meanwhile model 2 which takes in account sales, total assets, and equity in stage 2 has put AMST onto the frontier. The difference between these two models is the taking into consideration of the amount of total assets that a PLC has produced out of the funding process. This variable has enabled AMST to attain an overall efficiency level during the period under study. This has proved that total asset which is later used as collateral in order to source for more funding resources in the future is an important variable for this PLC to perform well in relation to other PLCs. With respect to this empirical study, a few contributions to the current literature on funding instruments specifically in context of Malaysia are made namely; (i) the evaluation the funding instruments used by PLCs, (ii) the evaluation of the efficiency of the instruments at the two stages of the funding process for PLCs and (iii) the comparison of the effect of the different funding instruments namely, the financial leverage and operating liability leverage, and the Islamic and conventional funding instruments on the performance of PLCs.

In Chapter 2 and 3, it could be seen that some PLCs performed better than others based on the funding resources that have utilised in their production activities. What factors determine PLCs choice of funding instruments? In Chapter 4, a model of prediction is designed using the Partial Least Square (PLS) approach in order to predict the factors that determine the choice of funding instruments used by PLCs in Malaysia. In order to validate the results produce by PLS, a Multivariate (MV) regression procedure is performed. The results produced by both these approaches are then analysed and compared. The two approaches produce almost similar results. Since PLS has the advantage of producing robust prediction, the result produced by PLS is used in this study. It is found that firm's size, earning volatility, profitability, asset structures, religion and firm's age have a significant impact on the choice of funding used. Similar results were found when analysis was undertaken both for the whole target population PLCs and also for the PLCs that respond to the survey. From the responses of the PLCs who have participated in the survey, it was found that the cost effectiveness of the funding instruments is one of the important criteria for choosing a funding mode. The concept of cost effectiveness related to the concept of efficiency is

discussed in the introduction of this study. Hence, the main criteria for choosing one instruments over the other is the efficiency of the funding instrument, irrespective of type. Other factors are availability of the instruments, and their being less cumbersome and time-consuming in terms of paperwork, ensuring that funds are available to borrowers as soon as possible. With respect to this empirical study, a few contributions to the current literature on capital structure specifically in context of Malaysia are made namely; (i) formulation of a prediction model of choice of funding instruments by PLCs using PLS approach, (ii) the introduction of the variable 'religion' into the analysis of the determinants of choice of funding instruments and (iii) the analysis on the Islamic funding instruments provided by responding PLCs.

The overall contributions of this thesis to the current literature on funding instruments are as follows. (i) In terms of the methodology used in evaluating the efficiency of the funding instruments, a DEA model is used to analyse the overall efficiency of funding instruments used by PLCs in Malaysia. This approach takes into account efficiency not only at the stage of the sourcing of funding instruments but also at the stage of utilising the funding instruments. (ii) In terms of the variables used in the analysis of the efficiency of the funding instruments, this study uses both financial leverage and operating liability leverage. No study thus far has been undertaken to evaluate the performance of the funding instruments via these two concepts of leverages. (iii) In terms of determining the factors that affect PLCs' choice of funding instruments, this study designed a prediction model using a PLS approach. This is new in the economics literature, as there is not much research undertaken using this approach. (iv) A new variable, 'Religion', is included in this study. In terms of the findings that could add to the current literature, the finding on the variable 'Religion' is interesting. It shows not only that PLCs in Malaysia perceived leverages as interest-based, but also that religion is not a significant factor in determining the choice of funding. This finding is supported by the responses given by the sample of PLCs that participated in the survey. (v) In terms of a comparative study between different funding instruments, this thesis has produce a comparative studies on the Islamic and conventional funding instruments in terms of the analysis of efficiency of the funding instruments and also the analysis on the factors that determine the funding mode of PLCs.

Despite all the extensive research on the subject matter undertaken, the studies in the thesis like any study have certain limitations. Hence the result of findings may not be as robust as we would like them to be. This is due to a number of factors. Firstly, limitations that were

encountered in doing the survey such a) Time and financial constraint, hence, the population size for the study is limited to the manufacturing sector only, hence making it a small population size. This thus affects the results of the findings (Future research in this area may include a wider sector of the economy in order to increase population size). This thus limit the generalizability of the results. b) Low response rate in which out of this small population, only about 10% of response rate is achieved. This is due to the poor response given by the PLCs themselves and, c) Unavailability of pertinent and relevant data to undertake the comparative analysis of the efficiency of both conventional and Islamic funding instruments. Therefore the study works within these constraints. Future research may have and want to include more variables. Secondly, Lack of transparency of PLCs in reporting their annual reports has made pertinent and important information unavailable. This view is also supported by the lack of cooperation of some of the PLCs' personnel to participate in the survey conducted. Lastly, due to the non-response bias that may arise due to the small response rate, one needs to be cautious in interpreting the findings. This is because even though the responding PLCs share some similarity with the whole population PLCs, there is also the possibility that the non-respondent will differ from the respondents with respect to their views on the chosen variables in the survey.

Bearing in mind the weaknesses mentioned earlier, a conclusive finding could not be made. However, efforts were made to ensure that the results of the analysis conform to the norm for econometrics studies. Various regression methods and diagnostic tests were undertaken in order to validate the results obtained.

APPENDICES

Appendix 2.1: Definition of Variables

The definition adopted in this study is taken from the definition by Corporate Handbook – Malaysia Kuala Lumpur Stock Exchange. Where ever necessary they are modified to suit the study. The variable in asterisk is taken from Carlson (1975).

1. *Total assets:*
   The sum of current assets, fixed assets, and investment and advances. Excludes intangibles assets.

2. *Current Assets*:*
   It represents cash and other assets which in the next twelve months are expected to be realised in cash or used up in the production of revenue.

3. *Cash:*
   It includes all cash, government marketable, and other securities listed in the current assets, letter of credits.

4 *Financial Assets:*
   It includes cash, bank balances, term deposits, short-term investments, marketable securities, and government issued treasury bills.

5. *Conventional Long-term Debt:*
   It includes secured and unsecured term loans, loan stocks, fixed income securities (bonds), floating rate notes payable after 12 months from balance sheet date. They are based on the interest rate.

6. *Islamic Long-term Debt:*
   It includes secured and unsecured term loans, loan stocks, fixed income securities (bonds), floating rate notes payable after 12 months from balance sheet date. They are based on rate of profit or dividend.

Appendix 2.1 (continued)

7. *Islamic Short-term Debt:*

It includes bank borrowings, bank overdraft, bankers' acceptances, loan stocks, trust receipts, floating rate notes payable within the next 12 months from the balance sheet date. They are based on the Islamic contract which is interest free.

8. *Conventional Short-term Debt:*

It includes bank borrowings, bank overdraft, bankers' acceptances, loan stocks, trust receipts, floating rate notes payable within the next 12 months from the balance sheet date. They are based on market interest rate.

9. *Conventional Trade Payables:*

Trade notes and accounts payable based on rate of interest.

10. *Islamic Trade Payables:*

Trade notes and accounts payable based on rate of profit, commission or rate of dividend.

11. Conventional *Receivables*:*

It represents claims against others (after applicable reserves) collectible in money generally within twelve months. This includes, but is not limited to trade, miscellaneous, and other receivables etc.

12 *Islamic Receivables:*

It represents claims against others (after applicable reserves) collectible in money generally within twelve months. This includes, but is not limited to trade, miscellaneous, and other receivables based on Islamic contract.

13 *Sales:*

Sales Revenue represents the value of the gross sales of goods less returns, discounts and sales tax.

14. *Equity:*

Shareholders' fund less minority interest and taxation.

Appendix 2.1 (continued)

15. *Stock:*

Includes inventory for sale, stores and spares and work-in-progress.

16. *Intangibles*

Includes goodwill, patents, trademarks, rights, royalties and franchise fees.

17. *Fixed Assets*

As disclosed in the financial statement net of depreciation.

18. *Previous Total Assets*

It is the total assets of the year before.

19. *Previous Equity*

It is the total equity of the year before.

20. *Previous Receivables*

It is the receivables of the year before.

21. *Previous Stock*

It is the stock of the year before.

22. *Previous Intangibles*

It is the intangibles of the year before.

23. *Previous Fixed Assets*

It is the Total fixed assets of the year before.

Appendix 3.1: Definition of Variables Used in the Empirical Study

The definition adopted in this study is taken from the definition by Corporate Handbook – Malaysia Kuala Lumpur Stock Exchange. Where ever necessary they are modified to suit the study. The variable in asterisk is taken from Carlson (1975).

1. *Total assets:*

   The sum of current assets, fixed assets, and investment and advances. Excludes intangibles assets.

2. *Current Assets*:*

   It represents cash and other assets which in the next twelve months are expected to be realised in cash or used up in the production of revenue.

3. *Cash:*

   It includes all cash, government marketable, and other securities listed in the current assets, letter of credits.

4 *Financial Assets:*

   It includes cash, bank balances, term deposits, short-term investments, marketable securities, and government issued treasury bills.

5. *Conventional Long-term Debt:*

   It includes secured and unsecured term loans, loan stocks, fixed income securities (bonds), floating rate notes payable after 12 months from balance sheet date. They are based on the interest rate.

6. *Islamic Long-term Debt:*

   It includes secured and unsecured term loans, loan stocks, fixed income securities (bonds), floating rate notes payable after 12 months from balance sheet date. They are based on rate of profit or dividend.

Appendix 3.1 (continued)

7. *Islamic Short-term Debt:*

It includes bank borrowings, bank overdraft, bankers' acceptances, loan stocks, trust receipts, floating rate notes payable within the next 12 months from the balance sheet date. They are based on the Islamic contract which is interest free.

8. *Conventional Short-term Debt:*

It includes bank borrowings, bank overdraft, bankers' acceptances, loan stocks, trust receipts, floating rate notes payable within the next 12 months from the balance sheet date. They are based on market interest rate.

9. *Conventional Trade Payables:*

Trade notes and accounts payable based on rate of interest.

10. *Islamic Trade Payables:*

Trade notes and accounts payable based on rate of profit, commission or rate of dividend.

11. Conventional *Receivables*:*

It represents claims against others (after applicable reserves) collectible in money generally within twelve months. This includes, but is not limited to trade, miscellaneous, and other receivables etc.

12 *Islamic Receivables:*

It represents claims against others (after applicable reserves) collectible in money generally within twelve months. This includes, but is not limited to trade, miscellaneous, and other receivables based on Islamic contract.

13 *Sales:*

Sales Revenue represents the value of the gross sales of goods less returns, discounts and sales tax.

14. *Equity:*

Shareholders' fund less minority interest and taxation.

Appendix 3.1 (continued)

15. *Stock:*

Includes inventory for sale, stores and spares and work-in-progress.

16. *Intangibles*

Includes goodwill, patents, trademarks, rights, royalties and franchise fees.

17. *Fixed Assets*

As disclosed in the financial statement net of depreciation.

18. *Previous Total Assets*

It is the total assets of the year before.

19. *Previous Equity*

It is the total equity of the year before.

20. *Previous Receivables*

It is the receivables of the year before.

21. *Previous Stock*

It is the stock of the year before.

22. *Previous Intangibles*

It is the intangibles of the year before.

23. *Previous Fixed Assets*

It is the Total fixed assets of the year before.

Appendix 3.2: ANALYSIS ON SENSITIVITY TEST

DMU No.	DMU Name	2000			1999			1998			1996		
		AB123	abc13	abc123	AB123	abc13	abc123	AB123	abc13	abc123	AB123	abc13	abc123
1	ACPE	0.71032	0.00000	0.02273	0.18162	0.00000	0.00775	0.43313	1.10811	1.10876	0.43013	0.00000	0.00545
2	ASBE	0.15922	0.00000	Infeasible	0.08643	0.00557	2.06306	0.23847	Infeasible	5.66725	0.08430	0.61651	Infeasible
3	ADPG	0.25551	79329.03226	79329.03226	0.94039	22501.95443	22501.95443	1.07624	6254882.58512	6254882.70323	1.06635	1.00000	1.00000
4	AAIC	0.67932	0.00000	0.00000	0.28285	0.00000	0.00000	0.48690	0.01251	0.15173	0.32027	0.00000	0.00685
5	ALCM	0.04267	Infeasible	Infeasible	0.12403	Infeasible	8515272.66986	0.17739	0.98942	1.18069	0.06417	Infeasible	3.26632
6	ACBE	0.83768	0.00000	0.00000	0.13944	0.00000	0.00197	Infeasible	0.02799	0.05301	0.65107	0.03937	0.14038
7	AMST	Infeasible	Infeasible	Infeasible	Infeasible	0.06568	Infeasible	Infeasible	0.42320	Infeasible	Infeasible	Infeasible	Infeasible
8	ANCM	0.55609	0.09666	0.00799	0.15162	0.00000	0.00000	0.32539	0.05916	Infeasible	0.17237	0.00147	0.06346
9	SLSN	0.92207	20.08988	0.36586	0.74671	0.03017	0.10841	Infeasible	Infeasible	0.09713	0.51158	0.00009	0.07966
10	AYMS	0.26301	0.00000	0.00000	0.31232	0.02904	0.02904	0.35193	2.39448	2.39448	0.26410	Infeasible	3.57158
11	BEAG	0.64025	0.00000	0.00000	0.54697	0.00000	0.00000	0.75267	0.00064	0.00142	1.01017	0.00000	0.00331
12	BNIA	0.81786	0.00000	0.00000	0.40704	0.00000	0.00000	0.92363	Infeasible	0.04771	0.75866	0.00000	0.00548
13	BPK	0.14210	0.71589	0.71589	0.47826	1.00000	1.00000	0.48110	37.46459	50.49404	0.42176	1.00000	1.00000
14	BRGT	0.53650	0.00000	0.00000	0.49947	0.00000	0.00000	0.98527	Infeasible	Infeasible	0.93659	0.00000	0.00238
15	CAIB	3.64631	0.39286	0.39286	0.88459	0.03004	Infeasible	0.96940	1.00000	0.00409	0.99908	1.00000	Infeasible
16	CEM	0.58825	0.00000	0.05199	0.17174	0.00946	0.03188	0.34958	0.12704	0.25031	0.13830	Infeasible	Infeasible
17	CIHG	0.09184	0.00003	0.00003	0.14290	1.00000	1.00000	0.26815	1.69920	1.76023	0.07716	843.28660	4.78355
18	CEFM	1.26740	0.00000	0.00000	0.53823	0.00000	0.00000	0.71071	Infeasible	0.00589	0.72080	Infeasible	Infeasible
19	CEPC	0.66355	0.00000	0.00000	0.36292	0.00001	0.00001	0.72364	0.00434	0.00930	1.71677	0.00000	0.00419
20	CSVY	0.79297	0.08046	0.30898	0.46489	0.07620	Infeasible	0.78547	Infeasible	0.14620	1.30346	0.00000	0.05506
21	CBE	0.12865	578614.78083	88098.03030	1.48887	0.11639	0.28587	0.12710	6.65546	6.65546	1.01301	1.00000	0.05359
22	DLY	0.18460	1.00000	1.00000	Infeasible	1.00000	1.00000	0.42005	0.25936	0.25936	0.27200	1.00000	0.01609
23	ESO	0.71677	Infeasible	Infeasible	Infeasible	0.32416	0.34231	0.59030	0.16242	Infeasible	0.17824	0.00000	0.06086
24	FAP	3.78225	0.12966	0.00011	0.03041	0.01353	0.01385	0.52097	0.08289	0.15054	1.29467	0.00000	0.00683
25	FCBI	0.16104	0.00000	0.00000	0.57497	0.00000	0.00000	0.29319	0.05803	0.22428	0.17325	0.00000	0.02077
26	FCVV	0.12208	0.21202	0.04147	0.26899	0.00000	0.00000	0.25970	0.08842	0.22139	0.07347	347.74880	55.68419
27	FHB	1.24179	0.00000	0.00000	0.20724	0.00000	0.00000	0.69669	0.00386	0.00947	0.90399	0.00000	0.00987

Appendix 3.2: (continued)

28	FFEM	0.30517	Infeasible	Infeasible	Infeasible	Infeasible	Infeasible	0.47380	Infeasible	Infeasible	0.32988	47.39530	47.39530
29	FPAI	0.17765	0.00001	0.00001	0.42488	0.00000	0.00000	0.05529	Infeasible	0.35903	0.40186	0.00000	0.00480
30	FNN	0.56966	Infeasible	0.37807	0.15973	0.05145	0.08149	0.43588	Infeasible	0.16950	4.32230	0.00000	0.05221
31	GBH	0.71994	0.00000	0.00000	0.31519	0.00002	0.00002	0.62867	0.00512	0.03700	0.32172	0.00000	0.01845
32	GPRS	0.39349	0.00000	0.00000	0.22618	0.00000	0.00000	0.45893	0.02458	0.04163	0.46888	0.00000	0.00576
33	HVST	1.51863	0.00000	0.00000	0.56759	0.00000	0.00000	0.85133	Infeasible	0.00200	1.80991	0.00000	0.00318
34	HAIL	0.11018	0.15493	0.10150	0.27766	0.00000	0.00000	0.47926	0.22563	0.25111	0.48349	6188.44256	7854.63877
35	HERO	0.51737	0.00000	0.00000	0.58184	1.00000	1.00000	0.52369	601241.93823	601241.93823	0.73024	Infeasible	6.03986
36	HLID	Infeasible	0.11226	Infeasible	0.23080	1.00000	0.85414	0.97397	0.05525	Infeasible	1.87820	0.00215	0.09612
37	HMID	Infeasible	0.23104	0.24868	Infeasible	Infeasible	0.50194	Infeasible	0.00651	0.25389	Infeasible	0.00088	0.14144
38	ITRS	0.19066	0.00001	0.00001	0.77126	0.00000	0.00000	0.40116	0.01132	0.01132	0.70487	0.00000	0.00380
39	ILEO	0.45595	2.26880	2.42850	0.14077	0.13668	0.13668	0.58958	0.18300	0.18306	0.21715	0.03305	0.13485
40	JSKT	0.23184	0.88603	0.88603	0.69421	1.00000	1.00000	0.81158	1.30000	1.30000	0.69101	0.00000	0.01300
41	JMI	0.72437	0.11126	0.11126	0.16560	69989.27618	69989.27618	1.61035	0.02011	0.02086	0.06516	0.00000	0.00398
42	KSM	0.35030	0.00000	0.00000	0.46214	0.06430	0.06695	0.52466	1.46596	1.46909	0.66626	0.00000	0.01956
43	KNJO	0.49942	0.03012	0.59033	0.12210	0.02264	0.24957	0.33915	0.38198	Infeasible	0.03890	0.10438	0.34634
44	KSAN	0.53336	0.00000	0.00000	0.37086	0.00000	0.00000	0.48938	0.01945	Infeasible	0.58492	0.00000	0.00343
45	KEFM	0.79191	0.00003	0.00003	0.65905	0.01380	0.01380	0.75314	0.42676	0.42676	0.77175	0.06225	0.15234
46	BLTN	0.73372	0.00000	0.00000	0.31195	0.00000	0.00000	0.82292	0.00108	Infeasible	0.54646	0.00000	0.00309
47	KIM	Infeasible	0.00000	0.00000	0.27211	0.00000	0.00000	0.88404	0.00184	Infeasible	Infeasible	0.00000	0.00611
48	LYHG	0.34140	0.00000	0.00000	0.75126	0.00001	0.00001	0.83665	0.01760	0.01760	0.88158	0.00001	0.01378
49	LNGI	0.23001	0.00611	0.07509	0.15720	0.01932	0.03350	0.20825	0.27773	0.27865	0.17201	0.01147	0.15870
50	LNDV	0.57456	0.22635	0.26963	0.18641	0.00441	0.13577	0.68832	0.03571	0.21017	1.24380	0.02974	0.20935
51	LNID	0.87751	0.07968	10.95652	0.79597	0.07665	0.14794	Infeasible	0.06626	0.14623	0.65040	Infeasible	Infeasible
52	LTYN	0.33694	0.00000	0.00000	0.16275	1.01065	1.01065	0.54748	0.02531	0.04927	0.77890	0.00000	0.00426
53	LSGT	0.24345	1.00000	1.00000	0.84995	1.00000	1.00000	0.75306	1.80779	1.80779	0.69087	1.00000	1.00000
54	MFLR	0.19757	0.21668	0.27044	0.16033	0.00303	0.00303	0.32474	0.15444	0.21906	0.25921	Infeasible	Infeasible
55	MCA	0.11683	Infeasible	Infeasible	0.34040	1.00000	0.15481	0.33299	0.07515	0.10396	0.25262	0.00000	0.04284
56	MYPK	0.26407	0.14296	0.14296	0.80868	0.00000	0.00000	0.81363	1.00000	1.00000	0.83207	1.00000	1.00000

Appendix 3.2: (continued)

57	MOKS	0.36738	0.00000	Infeasible	0.18969	30663.52243	119141.89894	0.43136	Infeasible	Infeasible	0.04753	0.18445	0.88140
58	MPIM	0.68557	0.11913	0.32024	0.18249	0.01699	0.09563	0.58755	Infeasible	Infeasible	0.33465	Infeasible	0.14620
59	MRCI	0.02958	Infeasible	Infeasible	0.07925	22406828.68307	22406828.76577	0.22631	Infeasible	Infeasible	0.18260	5.12513	5.22039
60	MRCY	0.18217	0.00249	0.00249	0.73938	0.48971	0.50706	0.22354	0.87003	1.28824	0.20398	0.00173	0.13915
61	MTRD	0.22960	0.54540	0.08859	0.55961	1.00000	1.00000	0.46271	0.84202	0.84202	0.14118	0.24546	0.28571
62	MHO	0.45124	0.00000	0.00000	0.32772	0.00000	0.04393	0.10323	0.74380	1.43345	0.20890	0.00011	0.13197
63	MNTY	0.15805	Infeasible	Infeasible	0.44225	1442880.00936	1442879.96214	0.50219	0.10239	0.10292	0.54030	0.00675	0.24359
64	MUD	0.69853	0.00084	0.13700	0.39326	0.00039	0.03768	0.53955	0.19611	0.21545	0.27036	0.03070	0.11080
65	MVE	0.43848	0.00000	0.00000	0.20378	0.00000	0.00370	0.48207	0.04452	0.12444	0.20835	0.00000	0.01216
66	NSTL	0.58236	0.23450	0.19548	0.66776	1.00000	1.00000	0.62759	1.00000	0.61414	0.08383	Infeasible	Infeasible
67	OYEL	0.93163	0.45541	0.45541	0.72987	0.51502	Infeasible	0.93609	0.25760	0.30035	0.74823	0.00058	0.13731
68	PHNC	0.56880	0.00000	0.00000	0.43997	0.00000	0.00000	0.76363	1.25982	Infeasible	0.73926	0.00000	0.00373
69	PEMC	0.16229	Infeasible	Infeasible	0.03559	Infeasible	Infeasible	0.29329	1.50336	1.50336	0.01803	Infeasible	12.25004
70	PRTN	1.07894	Infeasible	Infeasible	0.42708	Infeasible	Infeasible	0.88382	0.81961	Infeasible	0.86645	Infeasible	Infeasible
71	PTGS	Infeasible	Infeasible	Infeasible	Infeasible	Infeasible	Infeasible	0.88393	Infeasible	Infeasible	Infeasible	Infeasible	Infeasible
72	PPBE	0.22560	Infeasible	Infeasible	0.23045	Infeasible	Infeasible	0.10221	Infeasible	Infeasible	0.61104	Infeasible	28.91307
73	PMTL	0.80418	0.00000	0.00000	0.25664	0.00000	0.00000	0.53699	0.01436	Infeasible	0.06068	0.00000	0.01012
74	PRMT	0.84953	0.00000	0.00000	0.27794	0.00000	0.00000	0.20851	Infeasible	Infeasible	0.59293	0.00000	0.00291
75	PESC	Infeasible	1.62183	0.34726	Infeasible	0.00069	0.19667	Infeasible	0.00587	Infeasible	0.51289	0.00000	0.06994
76	ROHS	0.24075	0.00003	0.00003	0.52567	1.00000	1.00000	0.54121	0.03880	0.03880	0.67774	0.00000	0.00533
77	RHJU	0.28552	0.00000	0.00000	0.18836	0.00000	0.00000	0.32198	0.01870	0.11275	0.35181	0.00126	0.03983
78	SPTC	0.95627	0.08058	0.00000	0.16683	0.00000	0.00171	0.43647	0.00787	0.15258	Infeasible	0.00000	0.00435
79	SCTX	0.43993	0.00000	0.00000	0.19236	0.00000	0.00000	0.38588	Infeasible	Infeasible	0.26839	0.00016	0.06925
80	STRN	2.55095	0.05969	0.05969	Infeasible	0.00038	0.00038	Infeasible	0.07310	0.07310	1.74905	0.00001	0.00674
81	SHL	1.06403	0.96791	0.96791	Infeasible	Infeasible	0.92905	2.50361	Infeasible	Infeasible	0.44429	Infeasible	Infeasible
82	STAT	0.08717	0.00008	0.00008	0.35401	0.00000	0.00000	0.92094	0.00156	0.03657	0.63677	0.00000	0.00519
83	SAB	0.34902	0.00000	0.00000	0.24498	0.00000	0.00000	0.52107	0.96072	Infeasible	0.33695	0.01158	0.24870
84	SUPR	0.54924	0.00000	0.00000	0.66645	0.00000	0.00000	1.02379	0.00214	0.00241	0.74243	0.00000	0.00537
85	TCNG	0.06849	59.30205	59.30205	0.05617	68.93454	68.93454	0.07551	Infeasible	Infeasible	1.02421	0.44107	0.49233

Appendix 3.2: (continued)\

86	TNGR	0.43121	0.00000	0.00000	0.16607	0.00000	0.00000	1.22522	Infeasible	0.09730	0.30707	0.00000	0.02362
87	TRCR	0.34406	Infeasible	0.63404	0.20759	0.07181	1.00000	0.34286	12.12813	22.19921	0.11041	1604972.22740	Infeasible
88	TVVS	0.67863	Infeasible	Infeasible	0.11077	Infeasible	1.38144	0.29797	Infeasible	Infeasible	0.07728	8.17570	6.55913
89	TESH	0.56097	0.00000	0.00000	0.33239	0.00000	0.00000	0.99727	0.21336	Infeasible	0.28890	0.00896	0.05960
90	UASI	0.09083	1.00000	1.00000	0.29937	1.00000	1.00000	0.26023	27.66501	27.66501	0.13738	0.00455	0.11259
91	UMVV	0.16850	1.66618	Infeasible	0.07735	0.71345	0.86200	0.20814	Infeasible	Infeasible	0.41216	0.00496	0.11991
92	UBEE	0.78941	Infeasible	Infeasible	0.69840	Infeasible	Infeasible	1.05899	0.30779	0.30779	1.27944	3.61657	3.62256
93	UNZ	0.21230	0.29683	0.29683	0.41132	0.00000	0.00000	0.40280	Infeasible	Infeasible	0.35859	1.00000	Infeasible
94	WTIK	0.16966	0.15121	0.28580	0.10522	0.00779	0.01022	0.26105	Infeasible	Infeasible	0.16240	0.00150	0.03610
95	YHES	0.11174	0.00000	0.00000	0.19059	0.00110	0.00110	0.23136	0.23990	Infeasible	0.16950	0.00000	0.01446
96	YLCT	0.03997	0.00194	0.00194	0.11080	0.00000	0.00243	0.43842	Infeasible	Infeasible	2.65678	0.00000	0.01362

Appendix 3.3: EFFICIENCY OF DMUs UNDER VARIOUS MODELS FOR YEAR 2000

Stage 1

DMU	A12	A13	A23	A123	AB12	AB13	AB23	AB 123	ABC 12	ABC 13	ABC 23	ABC 123	AC 12	AC13	AC 123	B12	B13	B23	B123	BC12	BC13	BC23	BC 123	C12	C13	C23	C 123
ACPE	69	71	5	71	69	71	7	71	69	71	9	71	69	71	71	13	13	1	13	27	27	6	27	0	0	0	0
ASBE	15	16	1	16	36	36	3	36	36	36	4	36	15	16	16	36	36	1	36	36	36	4	36	0	0	0	0
ADPG	26	26	26	26	47	47	47	47	93	93	93	93	93	93	93	7	7	7	7	59	59	59	59	0	0	0	0
AAIC	65	68	15	68	67	69	15	69	67	69	17	69	65	68	68	15	15	2	15	34	34	12	34	0	0	0	0
ALCM	4	4	4	4	8	8	8	8	20	20	20	20	20	20	20	1	1	1	1	13	13	13	13	0	0	0	0
ACBE	82	84	84	12	82	84	84	17	86	87	87	17	86	87	12	25	25	25	3	75	75	75	14	0	0	0	0
AMST	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
ANCM	49	56	44	41	49	56	44	41	54	60	53	41	54	60	41	7	10	9	9	41	41	41	23	0	0	0	0
SLSN	86	92	92	36	86	92	92	36	86	92	92	36	86	92	36	35	39	39	16	37	39	39	16	11	3	14	14
AYMS	25	26	9	26	29	29	19	29	45	45	35	45	45	45	45	3	3	3	3	33	33	26	33	0	0	0	0
BEAG	63	64	47	45	63	64	55	56	87	87	69	72	87	87	72	8	8	8	8	52	52	43	52	0	0	0	0
BNIA	82	82	43	62	82	82	50	74	100	100	61	93	100	100	83	7	7	7	7	83	83	55	83	0	0	0	0
BPK	14	14	14	14	26	26	26	26	54	54	54	54	54	54	54	4	4	4	4	34	34	34	34	0	0	0	0
BRGT	46	49	42	31	59	64	64	59	72	73	70	66	69	70	58	17	17	17	17	68	69	68	64	0	0	0	0
CAIB	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	11	11	11	11	36	36	36	36	0	0	0	0
CEM	58	59	51	23	58	59	51	23	59	59	54	23	59	59	23	5	5	5	1	32	32	32	10	0	0	0	0
CIHG	7	9	9	8	8	9	9	8	8	9	9	8	8	9	8	1	1	1	1	3	4	4	4	0	0	0	0
CEFM	100	100	12	100	100	100	28	100	100	100	47	100	100	100	100	5	5	5	5	80	80	39	80	0	0	0	0
CEPC	59	66	54	42	59	66	61	52	63	67	61	58	62	67	42	8	8	8	8	27	27	27	26	0	0	0	0
CSVY	77	79	36	79	77	79	36	79	77	79	36	79	77	79	79	32	32	6	32	32	32	9	32	0	0	0	0
CBE	2	13	13	13	4	13	13	13	11	13	13	13	11	13	13	1	2	2	2	7	8	8	8	0	0	0	0
DLY	6	18	18	18	15	21	21	21	19	22	22	22	19	22	22	2	2	2	2	12	12	12	12	0	0	0	0
ESO	71	72	40	61	71	72	40	64	71	72	47	64	71	72	61	34	34	10	33	41	41	41	37	0	0	0	0
FAP	53	100	100	100	62	100	100	100	100	100	100	100	100	100	100	9	38	38	38	100	100	100	100	0	0	0	0
FCBI	9	16	11	16	12	17	14	17	20	21	18	21	20	21	21	2	2	2	2	16	16	14	16	0	0	0	0
FCVV	9	12	12	10	10	12	12	11	18	18	18	17	18	18	17	1	1	1	1	12	12	12	12	0	0	0	0
FHB	100	100	100	20	100	100	100	35	100	100	100	39	100	100	32	10	10	10	10	67	67	67	29	0	0	0	0
FFEM	28	31	31	8	28	31	31	8	31	33	33	8	31	33	8	2	2	2	1	20	20	20	3	0	0	0	0

Appendix 3.3 (continued)

FPAI	8	18	17	18	23	30	29	30	23	30	29	30	19	21	21	6	6	6	6	16	19	19	19	0	0	0	0
FNN	57	57	57	5	57	57	57	7	58	59	59	7	58	59	5	13	13	13	2	46	46	46	6	0	0	0	0
GBH	72	72	48	44	72	72	48	44	77	77	53	45	77	77	45	3	3	3	3	34	34	27	32	0	0	0	0
GPRS	36	39	33	23	36	39	33	25	44	45	38	30	44	45	30	3	3	3	3	21	21	20	20	0	0	0	0
HVST	100	100	70	70	100	100	100	100	100	100	100	100	100	100	70	28	28	28	28	28	28	28	28	0	0	0	0
HAIL	6	11	11	11	15	18	18	18	30	30	30	30	30	30	30	3	3	3	3	25	25	25	25	0	0	0	0
HERO	26	52	40	52	31	52	40	52	36	52	40	52	36	52	52	4	4	4	4	17	19	19	19	0	0	0	0
HLID	100	100	57	100	100	100	57	100	100	100	57	100	100	100	100	100	100	19	99	100	100	38	99	7	9	18	18
HMID	77	100	61	100	100	100	61	100	100	100	100	100	85	100	100	100	100	39	100	100	100	100	100	14	100	100	100
ITRS	13	19	17	19	33	36	35	36	33	37	35	37	28	29	29	7	7	7	7	20	21	21	21	0	0	0	0
ILEO	41	46	7	46	41	46	7	46	41	46	10	46	41	46	46	4	4	1	4	21	21	6	21	0	0	0	0
JSKT	23	23	23	23	41	41	41	41	97	97	97	97	97	97	97	6	6	6	6	58	58	58	58	0	0	0	0
JMI	72	72	33	61	72	72	33	61	77	77	38	61	77	77	61	1	1	1	1	21	21	11	21	0	0	0	0
KSM	31	35	15	35	36	38	27	38	87	87	73	87	87	87	87	4	4	4	4	63	63	51	63	0	0	0	0
KNJO	50	50	9	49	50	50	9	49	50	50	10	49	50	50	49	7	7	1	7	16	16	4	16	0	0	0	0
KSAN	52	53	42	32	52	53	42	35	61	61	48	42	61	61	42	4	4	4	4	25	25	22	25	0	0	0	0
KEFM	67	78	78	42	77	86	86	66	80	87	87	66	75	80	56	11	11	11	11	43	44	44	41	0	0	0	0
BLTN	73	73	53	40	73	73	53	42	77	77	58	43	77	77	42	3	3	3	3	34	34	30	30	0	0	0	0
KIM	97	100	72	70	100	100	100	100	100	100	100	100	99	100	70	100	100	100	100	100	100	100	100	0	0	0	0
LYHG	33	34	23	33	45	46	41	46	87	87	81	87	87	87	87	7	7	7	7	64	64	59	64	0	0	0	0
LNGI	18	23	23	8	18	23	23	8	19	23	23	8	19	23	8	0	1	1	1	9	9	9	4	0	0	0	0
LNDV	44	57	42	57	44	57	42	57	44	57	42	57	44	57	57	13	15	8	15	16	18	17	18	0	3	3	3
LNID	88	88	88	6	88	88	88	6	100	100	100	6	100	100	6	19	19	19	1	100	100	100	3	100	0	100	100
LTYN	32	34	32	12	32	34	32	12	32	34	32	12	32	34	12	1	1	1	1	8	8	8	5	0	0	0	0
LSGT	24	24	24	24	46	46	46	46	88	88	88	88	88	88	88	7	7	7	7	58	58	58	58	0	0	0	0
MFLR	18	20	20	5	18	20	20	7	20	20	20	8	20	20	8	1	1	1	1	9	9	9	6	0	0	0	0
MCA	12	12	12	12	22	22	22	22	100	100	100	100	100	100	100	3	3	3	3	100	100	100	100	0	0	0	0
MYPK	25	26	26	26	53	53	53	53	69	69	69	69	69	69	69	8	8	8	8	40	40	40	40	0	0	0	0
MOKS	33	37	5	37	33	37	6	37	33	37	7	37	33	37	37	5	5	1	5	19	19	5	19	0	0	0	0

Appendix 3.3 (continued)

MPIM	63	69	45	62	63	69	45	62	63	69	45	62	63	69	62	18	18	7	17	18	18	18	17	0	0	0	0
MRCI	3	3	3	3	5	5	5	5	14	14	14	14	14	14	14		1	1	1	8	8	8	8	0	0	0	0
MRCY	18	18	18	18	41	41	41	41	64	64	64	64	64	64	64	7	7	7	7	46	46	46	46	0	0	0	0
MTRD	5	23	23	23	12	23	23	23	20	25	25	25	20	25	25	2	2	2	2	16	17	17	17	0	0	0	0
MHO	45	45	32	21	45	45	32	21	47	47	38	21	47	47	21	1	1	1	1	24	24	24	17	0	0	0	0
MNTY	16	16	13	16	26	26	26	26	58	58	57	58	58	58	58	4	4	4	4	37	37	37	37	0	0	0	0
MUD	70	70	55	28	70	70	55	28	70	70	56	28	70	70	28	0	0	0	0	15	15	15	4	0	0	0	0
MVE	41	44	23	39	41	44	23	39	42	44	24	39	42	44	39	4	4	1	4	20	20	15	20	0	0	0	0
NSTL	52	58	48	41	52	58	48	41	52	58	48	41	52	58	41	11	13	11	11	21	21	21	13	0	0	0	0
OYEL	53	93	59	93	60	93	59	93	60	93	59	93	53	93	93	38	43	19	43	38	43	19	43	0	8	8	8
PHNC	56	57	46	34	56	57	49	42	86	86	71	80	86	86	80	6	6	6	6	67	67	56	67	0	0	0	0
PEMC	16	16	16	4	16	16	16	4	31	33	33	5	31	33	5	1	1	1	0	23	23	23	4	0	0	0	0
PRTN	21	100	97	100	21	100	97	100	21	100	100	100	21	100	100	6	16	13	16	10	100	100	100	0	100	100	100
PTGS	100	100	18	100	100	100	18	100	100	100	100	100	100	100	100	100	100	2	100	100	100	100	100	0	0	0	0
PPBE	19	23	23	11	19	23	23	11	21	24	24	11	21	24	11	3	3	3	2	15	15	15	5	0	1	1	1
PMTL	79	80	77	22	79	80	77	24	79	80	77	25	79	80	22	4	4	4	2	31	31	31	12	0	0	0	0
PRMT	84	85	36	75	86	86	37	85	87	87	38	85	85	85	75	11	11	4	11	46	46	26	46	0	0	0	0
PESC	46	100	100	100	54	100	100	100	92	100	100	100	60	100	100	54	100	100	100	92	100	100	100	0	100	100	100
ROHS	15	24	23	24	27	31	31	31	31	33	33	33	31	33	33	4	4	4	4	15	15	15	15	0	0	0	0
RHJU	27	29	28	10	27	29	28	12	34	34	33	20	34	34	20	2	2	2	2	16	17	17	15	0	0	0	0
SPTC	76	85	61	66	85	97	82	92	85	97	82	92	76	85	66	84	97	65	92	84	97	65	92	0	0	0	0
SCTX	44	44	17	38	44	44	17	38	44	44	20	38	44	44	38	2	2	2	2	23	23	12	23	0	0	0	0
STRN	42	44	44	32	100	100	100	100	100	100	100	100	100	100	100	33	33	33	33	100	100	100	100	0	0	0	0
SHL	100	100	47	100	100	100	47	100	100	100	86	100	100	100	100	55	55	11	55	87	87	80	87	0	4	4	4
STAT	9	9	9	4	14	14	14	11	35	35	35	35	26	26	25	3	3	3	3	35	35	35	35	0	0	0	0
SAB	33	35	8	34	33	35	10	34	35	36	17	35	35	36	35	1	1	1	1	24	24	12	24	0	0	0	0
SUPR	51	55	24	54	58	63	44	63	82	83	64	83	82	83	83	7	7	7	7	60	60	49	60	0	0	0	0
TCNG	1	7	7	7	2	7	7	7	7	7	7	7	7	7	7	0	1	1	1	4	4	4	4	0	0	0	0
TNGR	43	43	34	18	43	43	34	20	53	53	44	36	53	53	35	2	2	2	2	39	39	39	34	0	0	0	0
TRCR	7	34	34	34	7	34	34	34	8	34	34	34	8	34	34	0	5	5	5	4	12	12	12	0	0	0	0

Appendix 3.3 (continued)

TVVS	68	68	38	46	68	68	38	46	80	80	78	46	80	80	46	11	11	3	10	66	66	66	32	0	0	0	0
TESH	56	56	28	42	56	56	28	44	68	68	37	60	68	68	58	3	3	3	3	55	55	28	55	0	0	0	0
UASI	5	9	9	9	11	12	12	12	16	17	17	17	16	17	17	2	2	2	2	10	10	10	10	0	0	0	0
UMVV	14	17	14	13	14	17	14	13	15	17	16	13	15	17	13	1	2	2	1	9	10	10	5	0	0	0	0
UBEE	79	79	79	11	79	79	79	33	100	100	100	100	100	100	88	8	8	8	8	100	100	100	100	0	0	0	0
UNZ	10	21	21	21	20	26	26	26	26	28	28	28	26	28	28	3	3	3	3	14	14	14	14	0	0	0	0
WTIK	16	17	17	6	16	17	17	6	16	17	17	7	16	17	7	0	0	0	0	6	6	6	4	0	0	0	0
YHES	6	11	10	11	8	12	11	12	13	14	13	14	13	14	14	1	1	1	1	8	8	8	8	0	0	0	0
YLCT	3	4	4	4	6	7	7	7	8	8	8	8	8	8	8	1	1	1	1	7	7	7	7	0	0	0	0

Appendix 3.3 (continued)

Stage 2

DMU	a1	a12	a13	a23	a123	ab1	ab12	ab13	ab23	ab123	abc1	abc12	abc13	abc123	ac1	ac12	ac13	ac23	ac123	b12	b13	b23	b123	bc12	bc13	bc23	bc123
ACPE	0	0	0	0	0	0	0	0	0	0	7	45	8	45	7	16	16	8	16	0	0	0	0	45	45	8	45
ASBE	0	0	1	0	0	0	53	0	53	53	5	95	5	95	5	23	23	5	23	53	53	0	53	95	95	5	95
ADPG	0	0	0	0	0	0	0	100	0	0	100	100	100	100	59	59	59	59	59	0	0	0	0	100	100	100	100
AAIC	0	0	0	0	0	0	0	0	0	0	7	7	7	7	7	7	7	7	7	0	0	0	0	7	7	7	7
ALCM	0	0	0	0	0	0	0	100	0	0	91	91	91	91	91	91	91	91	61	0	0	0	0	90	90	90	64
ACBE	0	0	0	0	0	0	0	0	0	0	3	12	3	12	3	12	12	3	12	0	0	0	0	8	8	3	8
AMST	0	100	0	100	100	0	100	0	100	100	0	100	0	100	0	100	100	0	100	100	100	0	100	100	100	0	100
ANCM	0	0	0	0	0	0	1	0	1	1	13	21	13	21	13	16	16	13	9	1	1	0	1	20	20	13	17
SLSN	0	37	0	37	37	2	37	100	37	37	12	37	12	37	12	37	37	12	37	6	6	1	6	17	17	11	13
AYMS	0	0	0	0	0	0	0	0	0	0	66	66	66	66	66	66	66	66	18	0	0	0	0	66	66	66	20
BEAG	0	0	0	0	0	0	0	0	0	0	17	17	17	17	17	17	17	17	16	0	0	0	0	17	17	17	17
BNIA	0	0	0	0	0	0	0	100	0	0	17	17	17	17	16	17	17	16	14	0	0	0	0	17	17	17	14
BPK	0	0	0	0	0	0	0	0	0	0	68	68	68	68	46	46	46	46	34	0	0	0	0	57	57	57	54
BRGT	0	0	0	0	0	0	0	0	0	0	7	7	7	7	5	5	5	5	4	0	0	0	0	5	5	5	5
CAIB	0	0	0	0	0	0	0	100	0	0	35	35	35	35	29	29	29	29	24	0	0	0	0	26	26	26	26
CEM	0	0	0	0	0	0	3	0	3	3	16	27	16	27	16	27	27	16	19	2	2	0	2	25	25	16	20
CIHG	0	0	0	0	0	0	0	0	0	0	6	9	9	9	5	9	9	9	9	0	0	0	0	9	9	9	9
CEFM	0	0	0	0	0	0	0	0	0	0	13	14	13	14	11	12	12	11	11	0	0	0	0	14	14	13	14
CEPC	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3	3	3	2	0	0	0	0	3	3	3	3
CSVY	0	0	0	0	0	4	19	4	19	19	24	42	26	42	23	29	29	24	17	19	19	4	19	41	41	26	35
CBE	0	0	0	0	0	0	0	100	0	0	100	100	100	100	17	25	25	17	25	0	0	0	0	100	100	100	100
DLY	0	0	0	0	0	0	0	100	0	0	8	8	8	8	8	8	8	8	3	0	0	0	0	8	8	8	5
ESO	1	1	1	0	1	49	49	49	16	16	100	100	100	100	100	100	100	100	18	40	40	40	13	100	100	100	29
FAP	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1
FCBI	0	0	0	0	0	0	0	0	0	0	6	7	6	7	5	6	6	5	6	0	0	0	0	7	7	6	7
FCVV	0	0	0	0	0	0	0	100	0	0	5	6	5	6	4	5	5	4	5	0	0	0	0	5	5	4	5
FHB	0	0	0	0	0	0	0	0	0	0	6	10	6	10	6	10	10	6	10	0	0	0	0	10	10	6	10
FFEM	0	0	0	0	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	32	32	32	26	100	100	100	47

Appendix 3.3 (continued)

FPAI	0	0	0	0	0	0	0	0	0	0	11	11	11	11	11	11	11	11	5	0	0	0	0	11	11	11	6
FNN	0	0	0	0	0	7	7	100	0	0	62	62	62	62	62	62	62	62	30	3	3	3	0	58	60	60	10
GBH	0	0	0	0	0	0	0	0	0	0	4	9	5	9	4	9	9	5	9	0	0	0	0	9	9	5	9
GPRS	0	0	0	0	0	0	0	0	0	0	8	8	8	8	8	8	8	8	5	0	0	0	0	8	8	8	6
HVST	0	0	0	0	0	0	0	0	0	0	31	31	31	31	31	31	31	31	31	0	0	0	0	31	31	31	31
HAIL	0	0	0	0	0	0	0	100	0	0	4	8	7	8	3	6	6	5	6	0	0	0	0	8	8	6	8
HERO	0	0	0	0	0	0	0	0	0	0	3	4	3	4	2	3	3	2	3	0	0	0	0	4	4	3	4
HLID	0	1	0	1	1	7	22	7	22	22	19	42	19	42	18	30	30	19	23	21	21	7	21	38	38	19	33
HMID	1	1	1	1	1	23	24	23	24	24	46	47	46	47	28	28	28	28	15	22	22	21	22	47	47	46	33
ITRS	0	0	0	0	0	0	0	0	0	0	10	10	10	10	7	7	7	7	5	0	0	0	0	8	8	8	8
ILEO	0	0	0	0	0	8	8	8	0	0	100	100	100	100	65	65	65	65	13	8	8	8	0	100	100	100	45
JSKT	0	0	0	0	0	0	0	100	0	0	71	71	71	71	41	41	41	41	38	0	0	0	0	70	70	70	65
JMI	0	0	0	0	0	0	0	0	0	0	66	66	66	66	66	66	66	66	18	0	0	0	0	66	66	66	18
KSM	0	0	0	0	0	0	0	0	0	0	9	10	9	10	7	8	8	7	7	0	0	0	0	10	10	9	10
KNJO	0	0	0	0	0	0	0	0	0	0	61	84	63	84	61	69	69	63	43	0	0	0	0	84	84	63	64
KSAN	0	0	0	0	0	0	0	0	0	0	15	15	15	15	14	14	14	14	11	0	0	0	0	15	15	15	11
KEFM	0	0	0	0	0	0	0	0	0	0	5	5	5	5	4	4	4	4	2	0	0	0	0	4	4	4	3
BLTN	0	0	0	0	0	0	0	0	0	0	6	9	6	9	6	9	9	6	9	0	0	0	0	9	9	6	9
KIM	0	0	0	0	0	0	0	0	0	0	1	3	1	3	1	3	3	1	3	0	0	0	0	3	3	1	3
LYHG	0	0	0	0	0	0	0	0	0	0	20	20	20	20	19	19	19	19	13	0	0	0	0	20	20	20	14
LNGI	0	0	0	0	0	0	8	1	8	8	17	44	29	44	15	36	36	25	36	4	4	1	4	32	32	23	32
LNDV	0	0	0	0	0	0	27	0	27	27	7	43	9	43	6	14	14	7	11	21	21	0	21	34	34	9	34
LNID	0	16	0	16	16	0	22	8	22	22	27	100	40	100	27	100	100	40	100	9	9	4	9	70	70	38	68
LTYN	0	0	0	0	0	0	0	0	0	0	4	11	9	11	3	11	11	9	11	0	0	0	0	11	11	9	11
LSGT	0	0	0	0	0	0	0	100	0	0	43	43	43	43	24	24	24	24	23	0	0	0	0	43	43	43	40
MFLR	0	0	0	0	0	0	0	100	0	0	50	50	50	50	50	50	50	50	28	0	0	0	0	47	47	47	15
MCA	0	0	0	0	0	0	0	100	0	0	100	100	100	100	100	100	100	100	100	0	0	0	0	100	100	100	100
MYPK	0	0	0	0	0	0	0	100	0	0	28	28	28	28	20	20	20	20	14	0	0	0	0	20	20	20	18
MOKS	0	0	0	0	0	0	19	0	19	19	17	100	22	100	11	21	21	12	18	19	19	0	19	100	100	22	100
MPIM	0	0	0	0	0	7	25	7	25	25	27	44	27	44	25	31	31	25	16	19	19	6	19	42	42	27	35

Appendix 3.3 (continued)

MRCI	0	0	0	0	0	0	0	100	0	0	100	100	100	100	100	100	100	100	100	0	0	0	0	100	100	100	100
MRCY	0	0	0	0	0	0	0	0	0	0	40	41	40	41	25	25	25	25	25	0	0	0	0	36	36	36	36
MTRD	0	0	0	0	0	0	0	100	0	0	2	3	2	3	2	2	2	2	2	0	0	0	0	3	3	2	3
MHO	0	0	0	0	0	0	0	0	0	0	41	44	41	44	41	44	44	41	44	0	0	0	0	44	44	41	44
MNTY	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	92	0	0	0	0	100	100	100	100
MUD	0	0	0	0	0	0	0	0	0	0	60	71	60	71	60	71	71	60	58	0	0	0	0	70	70	60	52
MVE	0	0	0	0	0	0	0	0	0	0	1	19	3	19	1	10	10	3	10	0	0	0	0	16	16	3	16
NSTL	0	0	0	0	0	19	20	19	0	0	41	42	41	42	39	39	39	39	6	12	12	12	0	41	41	40	9
OYEL	1	1	1	1	1	45	45	45	35	35	65	70	65	70	26	26	26	26	10	45	45	45	35	70	70	65	48
PHNC	0	0	0	0	0	0	0	0	0	0	11	11	56	56	11	11	56	56	56	0	0	0	0	11	56	56	56
PEMC	0	4	34	34	34	0	82	100	100	100	12	100	100	100	12	100	100	100	100	37	73	73	73	99	100	100	100
PRTN	100	100	100	85	100	100	100	100	100	100	100	100	100	100	100	100	100	100	85	100	100	100	100	100	100	100	100
PTGS	0	11	100	100	100	4	100	100	100	100	28	100	100	100	28	100	100	100	100	100	100	100	100	100	100	100	100
PPBE	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	42	42	42	42	100	100	100	69
PMTL	0	0	0	0	0	0	0	0	0	0	9	9	9	9	9	9	9	9	7	0	0	0	0	9	9	9	7
PRMT	0	0	0	0	0	0	0	0	0	0	2	5	2	5	2	5	5	2	5	0	0	0	0	5	5	2	5
PESC	0	2	0	2	2	0	35	0	35	35	3	35	3	35	2	9	9	2	9	19	19	0	19	27	27	2	27
ROHS	0	0	0	0	0	0	0	0	0	0	8	8	8	8	6	6	6	6	4	0	0	0	0	7	7	7	7
RHJU	0	0	0	0	0	0	0	0	0	0	8	10	8	10	7	10	10	8	10	0	0	0	0	10	10	8	10
SPTC	0	0	0	0	0	0	0	0	0	0	2	5	2	5	2	4	4	2	4	0	0	0	0	5	5	2	5
SCTX	0	0	0	0	0	0	0	0	0	0	12	18	12	18	12	18	18	12	18	0	0	0	0	18	18	12	18
STRN	0	0	0	0	0	0	0	100	0	0	21	21	21	21	19	19	19	19	10	0	0	0	0	18	18	18	10
SHL	1	1	1	0	1	36	36	36	18	18	98	98	98	98	98	98	98	98	20	36	36	36	18	98	98	98	32
STAT	0	0	0	0	0	0	0	0	0	0	18	18	18	18	16	16	16	16	16	0	0	0	0	17	17	15	17
SAB	0	0	0	0	0	0	0	0	0	0	12	13	12	13	12	13	13	12	13	0	0	0	0	13	13	12	13
SUPR	0	0	0	0	0	0	0	0	0	0	9	9	9	9	8	8	8	8	6	0	0	0	0	9	9	9	8
TCNG	0	0	0	0	0	100	100	100	100	100	100	100	100	100	52	52	60	60	60	100	100	100	100	100	100	100	100
TNGR	0	0	0	0	0	0	0	0	0	0	13	39	1	39	13	39	39	21	39	0	0	0	0	39	39	21	39
TRCR	0	0	0	0	0	16	63	100	63	63	42	63	42	63	24	26	26	24	26	17	17	7	17	43	43	38	39
TVVS	0	0	0	0	0	0	19	12	19	19	67	100	100	100	67	100	100	100	100	14	14	11	14	100	100	100	100

Appendix 3.3 (continued)

TESH	0	0	0	0	0	0	0	0	0	0	64	76	64	76	63	76	76	64	76	0	0	0	0	76	76	64	76
UASI	0	0	0	0	0	0	0	100	0	0	13	13	13	13	12	12	12	12	9	0	0	0	0	13	13	13	11
UMVV	0	0	0	0	0	100	100	100	43	43	100	100	100	100	90	90	90	90	15	60	60	60	34	100	100	100	46
UBEE	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	73	0	0	0	0	100	100	100	73
UNZ	0	0	0	0	0	0	0	100	0	0	7	7	7	7	6	6	6	6	3	0	0	0	0	7	7	7	5
WTIK	0	0	0	0	0	0	0	1	1	1	38	52	47	52	38	52	52	47	45	0	1	1	1	49	50	47	37
YHES	0	0	0	0	0	0	0	0	0	0	23	23	23	23	19	19	19	19	6	0	0	0	0	21	21	21	6
YLCT	0	0	0	0	0	0	0	0	0	0	12	15	12	15	12	15	15	12	15	0	0	0	0	15	15	12	15

Appendix 3.4: Efficiency of Selected PLCs under Model 1 for the years 1996 – 2000.

No	DMU	2000			1999			1998			1996		
		AB123	abc13	Ave Eff	AB123	abc13	Ave Eff	AB123	abc13	Ave Eff	AB123	abc13	Ave Eff
1	AMST	100.00%	0.21%	50.11%	100.00%	10.66%	55.33%	100.00%	10.66%	55.33%	100.00%	10.66%	55.33%
2	CIHG	9.18%	8.80%	8.99%	14.29%	100.00%	57.15%	27.02%	100.00%	63.51%	16.01%	100.00%	58.01%
3	DLY	20.81%	100.00%	60.41%	2.51%	100.00%	51.26%	42.11%	100.00%	71.06%	46.11%	100.00%	73.06%
4	ESO	71.68%	100.00%	85.84%	100.00%	38.73%	69.37%	59.97%	38.73%	49.35%	48.47%	38.73%	43.60%
5	FCVV	12.21%	8.80%	10.51%	26.90%	100.00%	63.45%	25.97%	100.00%	62.99%	15.58%	100.00%	57.79%
6	FHB	100.00%	5.91%	52.96%	20.72%	3.01%	11.87%	71.24%	3.01%	37.13%	92.52%	3.01%	47.77%
7	FFEM	30.52%	100.00%	65.26%	100.00%	100.00%	100.00%	47.38%	100.00%	73.69%	38.26%	100.00%	69.13%
8	LNDV	57.46%	8.62%	33.04%	18.64%	8.63%	13.64%	69.09%	8.63%	38.86%	100.00%	8.63%	54.32%
9	MCA	21.60%	100.00%	60.80%	34.04%	100.00%	67.02%	33.30%	100.00%	66.65%	33.17%	100.00%	66.59%
10	MTRD	22.96%	8.86%	15.91%	55.96%	100.00%	77.98%	46.05%	100.00%	73.03%	20.85%	100.00%	60.43%
11	MUD	69.85%	60.23%	65.04%	41.56%	29.94%	35.75%	57.28%	29.94%	43.61%	27.04%	29.94%	28.49%
12	MVE	43.85%	3.10%	23.48%	20.38%	10.44%	15.41%	51.11%	10.44%	30.78%	31.43%	10.44%	20.94%
13	NSTL	58.24%	41.22%	49.73%	66.78%	31.40%	49.09%	62.76%	31.40%	47.08%	28.06%	31.40%	29.73%
14	OYEL	93.16%	64.82%	78.99%	72.99%	58.69%	65.84%	93.61%	58.69%	76.15%	79.56%	58.69%	69.13%
15	PEMC	16.23%	100.00%	58.12%	3.56%	100.00%	51.78%	29.33%	100.00%	64.67%	10.30%	100.00%	55.15%
16	PRTN	100.00%	100.00%	100.00%	42.71%	100.00%	71.36%	88.38%	100.00%	94.19%	86.65%	100.00%	93.33%
17	PTGS	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	88.39%	100.00%	94.20%	100.00%	100.00%	100.00%
18	PMTL	80.42%	8.85%	44.64%	26.93%	5.56%	16.25%	53.70%	5.56%	29.63%	16.73%	5.56%	11.15%
19	RHJU	28.55%	7.78%	18.17%	18.84%	7.00%	12.92%	33.05%	7.00%	20.03%	40.26%	7.00%	23.63%
20	SPTC	96.98%	2.50%	49.74%	18.42%	1.69%	10.06%	45.85%	1.69%	23.77%	100.00%	1.69%	50.85%
21	UASI	12.38%	100.00%	56.19%	29.94%	100.00%	64.97%	26.02%	100.00%	63.01%	22.19%	100.00%	61.10%
22	UMVV	16.85%	100.00%	58.43%	7.93%	76.12%	42.03%	21.24%	76.12%	48.68%	41.22%	76.12%	58.67%
23	UBEE	78.94%	100.00%	89.47%	69.84%	100.00%	84.92%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
24	UNZ	26.12%	29.68%	27.90%	41.13%	100.00%	70.57%	40.28%	100.00%	70.14%	41.71%	100.00%	70.86%
25	YLCT	6.72%	12.38%	9.55%	11.25%	4.31%	7.78%	44.76%	4.31%	24.54%	100.00%	4.31%	52.16%

Appendix 3.5: Efficiency Rate of Selected PLCs under Model 2 for years 1996 – 2000.

	DMU	2000			1999			1998			1996		
		AB123	abc123	Ave Eff	AB123	abc123	Ave Eff	AB123	abc123	Ave Eff	AB123	abc123	Ave Eff
1	AMST	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
2	CIHG	9.18%	9.45%	9.32%	14.29%	100.00%	57.15%	27.02%	100.00%	63.51%	16.01%	100.00%	58.01%
3	DLY	20.81%	100.00%	60.41%	2.51%	42.93%	22.72%	42.11%	42.93%	42.52%	46.11%	30.85%	38.48%
4	ESO	71.68%	100.00%	85.84%	100.00%	21.14%	60.57%	59.97%	21.14%	40.56%	48.47%	30.09%	39.28%
5	FCVV	12.21%	8.80%	10.51%	26.90%	57.76%	42.33%	25.97%	57.76%	41.87%	15.58%	100.00%	57.79%
6	FHB	100.00%	9.65%	54.83%	20.72%	11.33%	16.03%	71.24%	11.33%	41.29%	92.52%	8.33%	50.43%
7	FFEM	30.52%	100.00%	65.26%	100.00%	100.00%	100.00%	47.38%	100.00%	73.69%	38.26%	100.00%	69.13%
8	LNDV	57.46%	43.12%	50.29%	18.64%	23.10%	20.87%	69.09%	23.10%	46.10%	100.00%	29.68%	64.84%
9	MCA	21.60%	100.00%	60.80%	34.04%	40.32%	37.18%	33.30%	40.32%	36.81%	33.17%	25.33%	29.25%
10	MTRD	22.96%	8.86%	15.91%	55.96%	89.90%	72.93%	46.05%	89.90%	67.98%	20.85%	60.62%	40.74%
11	MUD	69.85%	70.59%	70.22%	41.56%	41.96%	41.76%	57.28%	26.44%	41.86%	27.04%	29.25%	28.15%
12	MVE	43.85%	18.58%	31.22%	20.38%	21.31%	20.85%	51.11%	21.31%	36.21%	31.43%	13.96%	22.70%
13	NSTL	58.24%	41.61%	49.93%	66.78%	67.37%	67.08%	62.76%	67.37%	65.07%	28.06%	100.00%	64.03%
14	OYEL	93.16%	69.94%	81.55%	72.99%	30.04%	51.52%	93.61%	30.04%	61.83%	79.56%	27.30%	53.43%
15	PEMC	16.23%	100.00%	58.12%	3.56%	100.00%	51.78%	29.33%	100.00%	64.67%	10.30%	100.00%	55.15%
16	PRTN	100.00%	100.00%	100.00%	42.71%	100.00%	71.36%	88.38%	100.00%	94.19%	86.65%	100.00%	93.33%
17	PTGS	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	88.39%	100.00%	94.20%	100.00%	100.00%	100.00%
18	PMTL	80.42%	8.85%	44.64%	26.93%	19.63%	23.28%	53.70%	19.63%	36.67%	16.73%	11.51%	14.12%
19	RHJU	28.55%	10.09%	19.32%	18.84%	20.77%	19.81%	33.05%	20.77%	26.91%	40.26%	32.04%	36.15%
20	SPTC	96.98%	5.39%	51.19%	18.42%	24.71%	21.57%	45.85%	24.71%	35.28%	100.00%	9.87%	54.94%
21	UASI	12.38%	100.00%	56.19%	29.94%	100.00%	64.97%	26.02%	100.00%	63.01%	22.19%	62.99%	42.59%
22	UMVV	16.85%	100.00%	58.43%	7.93%	54.38%	31.16%	21.24%	54.38%	37.81%	41.22%	39.89%	40.56%
23	UBEE	78.94%	100.00%	89.47%	69.84%	50.48%	60.16%	100.00%	50.48%	75.24%	100.00%	100.00%	100.00%
24	UNZ	26.12%	29.68%	27.90%	41.13%	100.00%	70.57%	40.28%	100.00%	70.14%	41.71%	47.93%	44.82%
25	YLCT	6.72%	15.38%	11.05%	11.25%	41.08%	26.17%	44.76%	41.08%	42.92%	100.00%	12.66%	56.33%

Appendix 3.6: Efficiency Rate of PLCs under Model 1 for years 1996 and 1998 – 2000.

		2000			1999			1998			1996		
No	DMU	AB123	abc13	Ave Eff	AB123	abc13	Ave Eff	AB123	abc13	Ave Eff	AB123	abc13	Ave Eff
1	ACPE	71.03%	45.14%	58.09%	18.83%	15.17%	17.00%	57.39%	100.00%	78.70%	47.94%	49.37%	48.66%
2	ASBE	35.86%	94.98%	65.42%	42.04%	100.00%	71.02%	94.96%	100.00%	97.48%	17.50%	85.78%	51.64%
3	ADPG	46.77%	100.00%	73.39%	94.04%	100.00%	97.02%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
4	AAIC	69.25%	7.38%	38.32%	28.29%	4.88%	16.59%	50.22%	33.22%	41.72%	44.90%	60.61%	52.76%
5	ALCM	8.15%	100.00%	54.08%	12.40%	100.00%	56.20%	17.74%	100.00%	58.87%	15.38%	20.72%	18.05%
6	ACBE	83.77%	11.68%	47.73%	50.24%	6.25%	28.25%	100.00%	14.29%	57.15%	69.05%	69.05%	69.05%
7	AMST	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
8	ANCM	55.61%	21.40%	38.51%	15.16%	6.25%	10.71%	33.07%	29.47%	31.27%	23.38%	26.60%	24.99%
9	SLSN	92.21%	36.59%	64.40%	74.67%	12.72%	43.70%	100.00%	11.81%	55.91%	60.16%	60.16%	60.16%
10	AYMS	29.39%	65.79%	47.59%	31.23%	58.71%	44.97%	35.19%	100.00%	67.60%	35.14%	42.06%	38.60%
11	BEAG	64.03%	16.64%	40.34%	54.70%	11.93%	33.32%	75.27%	21.91%	48.59%	100.00%	100.00%	100.00%
12	BNIA	81.79%	17.39%	49.59%	55.53%	17.90%	36.72%	92.36%	22.49%	57.43%	81.61%	81.61%	81.61%
13	BPK	26.33%	82.37%	54.35%	47.83%	40.75%	44.29%	48.11%	100.00%	74.06%	49.35%	50.36%	49.86%
14	BRGT	64.00%	6.58%	35.29%	73.13%	2.56%	37.85%	98.62%	100.00%	99.31%	95.31%	97.30%	96.31%
15	CAIB	100.00%	66.27%	83.14%	88.46%	45.90%	67.18%	96.94%	59.13%	78.04%	99.94%	100.00%	99.97%
16	CEM	58.83%	26.59%	42.71%	20.28%	23.34%	21.81%	36.19%	37.64%	36.92%	31.24%	31.24%	31.24%
17	CIHG	9.18%	9.45%	9.32%	14.29%	6.56%	10.43%	27.02%	100.00%	63.51%	16.01%	25.48%	20.75%
18	CEFM	100.00%	13.96%	56.98%	53.82%	11.28%	32.55%	71.45%	19.44%	45.45%	75.88%	80.80%	78.34%
19	CEPC	66.36%	3.47%	34.92%	37.31%	2.74%	20.03%	74.79%	8.47%	41.63%	100.00%	100.00%	100.00%
20	CSVY	79.30%	42.26%	60.78%	53.94%	24.00%	38.97%	79.69%	23.95%	51.82%	100.00%	100.00%	100.00%
21	CBE	12.86%	100.00%	56.43%	100.00%	55.44%	77.72%	12.79%	100.00%	56.40%	100.00%	100.00%	100.00%
22	DLY	20.81%	100.00%	60.41%	2.51%	12.01%	7.26%	42.11%	42.93%	42.52%	46.11%	47.90%	47.01%
23	ESO	71.68%	100.00%	85.84%	100.00%	40.34%	70.17%	59.97%	21.14%	40.56%	48.47%	62.21%	55.34%
24	FAP	100.00%	0.95%	50.48%	3.09%	50.11%	26.60%	52.66%	41.70%	47.18%	100.00%	100.00%	100.00%
25	FCBI	16.95%	6.51%	11.73%	57.50%	6.33%	31.92%	29.35%	53.17%	41.26%	36.96%	36.96%	36.96%
26	FCVV	12.21%	8.80%	10.51%	26.90%	2.98%	14.94%	25.97%	57.76%	41.87%	15.58%	38.54%	27.06%
27	FHB	100.00%	9.65%	54.83%	20.72%	5.43%	13.08%	71.24%	11.33%	41.29%	92.52%	92.99%	92.76%

Appendix 3.6 (continued)

28	FFEM	30.52%	100.00%	65.26%	100.00%	100.00%	100.00%	47.38%	100.00%	73.69%	38.26%	38.26%	38.26%
29	FPAI	29.68%	11.11%	20.40%	42.49%	6.82%	24.66%	5.53%	69.64%	37.59%	55.31%	55.68%	55.50%
30	FNN	56.97%	63.42%	60.20%	32.17%	31.59%	31.88%	45.57%	24.32%	34.95%	100.00%	100.00%	100.00%
31	GBH	71.99%	9.34%	40.67%	31.52%	6.97%	19.25%	65.16%	14.28%	39.72%	39.83%	39.85%	39.84%
32	GPRS	39.35%	7.92%	23.64%	22.62%	14.04%	18.33%	47.01%	19.48%	33.25%	60.95%	63.04%	62.00%
33	HVST	100.00%	31.45%	65.73%	57.06%	20.50%	38.78%	85.13%	18.64%	51.89%	100.00%	100.00%	100.00%
34	HAIL	17.68%	13.82%	15.75%	27.77%	5.27%	16.52%	47.93%	39.17%	43.55%	55.86%	65.68%	60.77%
35	HERO	51.74%	3.94%	27.84%	58.18%	10.28%	34.23%	52.44%	100.00%	76.22%	76.64%	80.60%	78.62%
36	HLID	100.00%	41.68%	70.84%	23.08%	85.41%	54.25%	97.40%	20.23%	58.82%	100.00%	100.00%	100.00%
7	HID	100.00%	46.72%	73.36%	100.00%	51.60%	75.80%	100.00%	25.39%	62.70%	100.00%	100.00%	100.00%
38	ITRS	36.37%	9.61%	22.99%	96.07%	6.50%	51.29%	41.11%	8.84%	24.98%	78.13%	83.22%	80.68%
39	ILEO	45.60%	100.00%	72.80%	14.08%	63.30%	38.69%	58.97%	27.81%	43.39%	31.80%	35.27%	33.54%
40	JSKT	40.69%	88.60%	64.65%	69.42%	81.42%	75.42%	81.16%	100.00%	90.58%	74.27%	74.68%	74.48%
41	JMI	72.44%	66.00%	69.22%	18.19%	100.00%	59.10%	100.00%	13.84%	56.92%	9.70%	29.23%	19.47%
42	KSM	38.31%	9.85%	24.08%	46.21%	50.12%	48.17%	53.16%	100.00%	76.58%	74.57%	87.74%	81.16%
43	KNJO	49.94%	84.20%	67.07%	12.21%	65.88%	39.05%	33.81%	52.13%	42.97%	17.90%	17.96%	17.93%
44	KSAN	53.34%	14.94%	34.14%	37.09%	11.29%	24.19%	48.94%	17.78%	33.36%	63.95%	71.65%	67.80%
45	KEFM	85.97%	5.06%	45.52%	65.92%	66.92%	66.42%	75.31%	58.80%	67.06%	81.39%	81.39%	81.39%
46	BLTN	73.37%	9.17%	41.27%	47.11%	11.00%	29.06%	82.70%	9.88%	46.29%	59.94%	59.94%	59.94%
47	KIM	100.00%	2.79%	51.40%	30.18%	2.61%	16.40%	89.04%	9.83%	49.44%	100.00%	100.00%	100.00%
48	LYHG	45.54%	20.46%	33.00%	75.13%	14.76%	44.95%	83.66%	37.44%	60.55%	90.63%	100.00%	95.32%
49	LNGI	23.00%	44.45%	33.73%	15.72%	24.26%	19.99%	20.82%	40.35%	30.59%	25.01%	30.76%	27.89%
50	LNDV	57.46%	43.12%	50.29%	18.64%	17.06%	17.85%	69.09%	23.10%	46.10%	100.00%	100.00%	100.00%
51	LNID	87.75%	100.00%	93.88%	79.60%	16.34%	47.97%	100.00%	29.91%	64.96%	65.04%	81.65%	73.35%
52	LTYN	33.69%	11.40%	22.55%	16.27%	100.00%	58.14%	56.73%	21.32%	39.03%	80.31%	80.31%	80.31%
53	LSGT	45.88%	100.00%	72.94%	85.00%	58.28%	71.64%	75.31%	100.00%	87.66%	77.79%	78.88%	78.34%
54	MFLR	19.76%	53.87%	36.82%	16.42%	37.08%	26.75%	33.20%	31.17%	32.19%	37.01%	37.01%	37.01%
55	MCA	21.60%	100.00%	60.80%	34.04%	92.55%	63.30%	33.30%	40.32%	36.81%	33.17%	36.54%	34.86%
56	MYPK	52.89%	51.49%	52.19%	80.87%	12.79%	46.83%	81.36%	26.62%	53.99%	89.68%	91.15%	90.42%
57	MOKS	36.74%	100.00%	68.37%	21.62%	100.00%	60.81%	43.14%	73.24%	58.19%	31.92%	31.96%	31.94%
58	MPIM	68.56%	43.80%	56.18%	18.25%	19.24%	18.75%	59.50%	23.01%	41.26%	45.02%	45.02%	45.02%

Appendix 3.6 (continued)

59	MRCI	4.77%	100.00%	52.39%	7.92%	100.00%	53.96%	22.72%	100.00%	61.36%	22.47%	22.47%	22.47%
60	MRCY	40.78%	41.23%	41.01%	73.94%	81.19%	77.57%	22.35%	100.00%	61.18%	32.90%	53.73%	43.32%
61	MTRD	22.96%	8.86%	15.91%	55.96%	20.75%	38.36%	46.05%	89.90%	67.98%	20.85%	22.62%	21.74%
62	MHO	45.12%	44.27%	44.70%	41.43%	29.91%	35.67%	10.32%	100.00%	55.16%	47.22%	47.26%	47.24%
63	MNTY	26.21%	100.00%	63.11%	44.23%	100.00%	72.12%	50.22%	51.60%	50.91%	59.03%	63.78%	61.41%
64	MUD	69.85%	70.59%	70.22%	41.56%	41.96%	41.76%	57.28%	26.44%	41.86%	27.04%	29.25%	28.15%
65	MVE	43.85%	18.58%	31.22%	20.38%	15.34%	17.86%	51.11%	21.31%	36.21%	31.43%	33.48%	32.46%
66	NSTL	58.24%	41.61%	49.93%	66.78%	33.14%	49.96%	62.76%	67.37%	65.07%	28.06%	28.06%	28.06%
67	OYEL	93.16%	69.94%	81.55%	72.99%	69.33%	71.16%	93.61%	30.04%	61.83%	79.56%	79.56%	79.56%
68	PHNC	56.88%	56.43%	56.66%	44.00%	7.20%	25.60%	76.36%	100.00%	88.18%	77.53%	86.37%	81.95%
69	PEMC	16.23%	100.00%	58.12%	3.56%	100.00%	51.78%	29.33%	100.00%	64.67%	10.30%	100.00%	55.15%
70	PRTN	100.00%	100.00%	100.00%	42.71%	100.00%	71.36%	88.38%	100.00%	94.19%	86.65%	86.65%	86.65%
71	PTGS	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	88.39%	100.00%	94.20%	100.00%	100.00%	100.00%
72	PPBE	22.56%	100.00%	61.28%	23.05%	100.00%	61.53%	10.29%	100.00%	55.15%	61.10%	100.00%	80.55%
73	PMTL	80.42%	8.85%	44.64%	26.93%	6.20%	16.57%	53.70%	19.63%	36.67%	16.73%	26.37%	21.55%
74	PRMT	86.28%	5.50%	45.89%	37.20%	5.56%	21.38%	23.84%	24.24%	24.04%	68.66%	68.66%	68.66%
75	PESC	100.00%	34.73%	67.37%	100.00%	19.67%	59.84%	100.00%	30.40%	65.20%	58.49%	81.51%	70.00%
76	ROHS	31.27%	7.97%	19.62%	52.57%	7.89%	30.23%	54.12%	24.16%	39.14%	71.92%	76.15%	74.04%
77	RHJU	28.55%	10.09%	19.32%	18.84%	9.64%	14.24%	33.05%	20.77%	26.91%	40.26%	48.68%	44.47%
78	SPTC	96.98%	5.39%	51.19%	18.42%	4.99%	11.71%	45.85%	24.71%	35.28%	100.00%	100.00%	100.00%
79	SCTX	43.99%	18.08%	31.04%	19.24%	12.85%	16.05%	38.59%	32.29%	35.44%	32.77%	32.77%	32.77%
80	STRN	100.00%	39.53%	69.77%	100.00%	9.57%	54.79%	100.00%	24.84%	62.42%	100.00%	100.00%	100.00%
81	SHL	100.00%	97.90%	98.95%	100.00%	93.27%	96.64%	100.00%	100.00%	100.00%	52.38%	69.53%	60.96%
82	STAT	13.61%	18.48%	16.05%	87.51%	4.34%	45.93%	92.61%	14.99%	53.80%	83.02%	83.02%	83.02%
83	SAB	34.90%	13.12%	24.01%	24.50%	32.55%	28.53%	52.16%	98.53%	75.35%	59.92%	60.12%	60.02%
84	SUPR	62.57%	9.16%	35.87%	66.64%	9.32%	37.98%	100.00%	19.30%	59.65%	81.51%	83.02%	82.27%
85	TCNG	6.85%	100.00%	53.43%	5.62%	100.00%	52.81%	7.55%	100.00%	53.78%	100.00%	100.00%	100.00%
86	TNGR	43.12%	39.46%	41.29%	17.39%	17.50%	17.45%	100.00%	17.98%	58.99%	51.85%	52.68%	52.27%
87	TRCR	34.41%	92.40%	63.41%	20.76%	23.65%	22.21%	34.57%	100.00%	67.29%	25.87%	25.87%	25.87%
88	TVVS	67.86%	100.00%	83.93%	11.08%	100.00%	55.54%	29.80%	100.00%	64.90%	8.95%	18.56%	13.76%
89	TESH	56.10%	76.37%	66.24%	34.73%	30.34%	32.54%	99.73%	32.70%	66.22%	52.52%	83.46%	67.99%

Appendix 3.6 (continued)

90	UASI	12.38%	100.00%	56.19%	29.94%	5.93%	17.94%	26.02%	100.00%	63.01%	22.19%	25.22%	23.71%
91	UMVV	16.85%	100.00%	58.43%	7.93%	87.89%	47.91%	21.24%	54.38%	37.81%	41.22%	41.22%	41.22%
92	UBEE	78.94%	100.00%	89.47%	69.84%	100.00%	84.92%	100.00%	50.48%	75.24%	100.00%	100.00%	100.00%
93	UNZ	26.12%	29.68%	27.90%	41.13%	5.49%	23.31%	40.28%	100.00%	70.14%	41.71%	49.43%	45.57%
94	WTIK	16.97%	51.70%	34.34%	10.52%	39.63%	25.08%	28.52%	57.49%	43.01%	18.50%	19.92%	19.21%
95	YHES	11.53%	23.34%	17.44%	19.06%	23.76%	21.41%	23.13%	46.62%	34.88%	39.21%	39.21%	39.21%
96	YLCT	6.72%	15.38%	11.05%	11.25%	14.65%	12.95%	44.76%	41.08%	42.92%	100.00%	100.00%	100.00%

Appendix 3.7: Efficiency Rate of PLCs under Model 2 for years 1996 and 1998 – 2000.

		2000			1999			199			1996		
	DMU	AB123	abc123	Ave Eff	AB123	abc123	Ave Eff	AB123	abc123	Ave Eff	AB123	abc123	Ave Eff
1	ACPE	71.03%	8.46%	39.75%	18.83%	5.67%	12.25%	57.39%	5.67%	31.53%	47.94%	5.67%	26.81%
2	ASBE	35.86%	4.87%	20.37%	42.04%	10.42%	26.23%	94.96%	10.42%	52.69%	17.50%	10.42%	13.96%
3	ADPG	46.77%	100.00%	73.39%	94.04%	100.00%	97.02%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
4	AAIC	69.25%	7.29%	38.27%	28.29%	3.60%	15.95%	50.22%	3.60%	26.91%	44.90%	3.60%	24.25%
5	ALCM	8.15%	100.00%	54.08%	12.40%	100.00%	56.20%	17.74%	100.00%	58.87%	15.38%	100.00%	57.69%
6	ACBE	83.77%	3.32%	43.55%	50.24%	1.86%	26.05%	100.00%	1.86%	50.93%	69.05%	1.86%	35.46%
7	AMST	100.00%	0.21%	50.11%	100.00%	10.66%	55.33%	100.00%	10.66%	55.33%	100.00%	10.66%	55.33%
8	ANCM	55.61%	13.29%	34.45%	15.16%	5.00%	10.08%	33.07%	5.00%	19.04%	23.38%	5.00%	14.19%
9	SLSN	92.21%	12.02%	52.12%	74.67%	6.54%	40.61%	100.00%	6.54%	53.27%	60.16%	6.54%	33.35%
10	AYMS	29.39%	65.79%	47.59%	31.23%	58.71%	44.97%	35.19%	58.71%	46.95%	35.14%	58.71%	46.93%
11	BEAG	64.03%	16.64%	40.34%	54.70%	11.93%	33.32%	75.27%	11.93%	43.60%	100.00%	11.93%	55.97%
12	BNIA	81.79%	17.13%	49.46%	55.53%	16.65%	36.09%	92.36%	16.65%	54.51%	81.61%	16.65%	49.13%
13	BPK	26.33%	82.37%	54.35%	47.83%	100.00%	73.92%	48.11%	100.00%	74.06%	49.35%	100.00%	74.68%
14	BRGT	64.00%	6.58%	35.29%	73.13%	2.48%	37.81%	98.62%	2.48%	50.55%	95.31%	2.48%	48.90%
15	CAIB	100.00%	66.27%	83.14%	88.46%	100.00%	94.23%	96.94%	100.00%	98.47%	99.94%	100.00%	99.97%
16	CEM	58.83%	16.36%	37.60%	20.28%	14.68%	17.48%	36.19%	14.68%	25.44%	31.24%	14.68%	22.96%
17	CIHG	9.18%	8.80%	8.99%	14.29%	100.00%	57.15%	27.02%	100.00%	63.51%	16.01%	100.00%	58.01%
18	CEFM	100.00%	12.58%	56.29%	53.82%	9.92%	31.87%	71.45%	9.92%	40.69%	75.88%	9.92%	42.90%
19	CEPC	66.36%	3.47%	34.92%	37.31%	2.44%	19.88%	74.79%	2.44%	38.62%	100.00%	2.44%	51.22%
20	CSVY	79.30%	25.57%	52.44%	53.94%	16.40%	35.17%	79.69%	16.40%	48.05%	100.00%	16.40%	58.20%
21	CBE	12.86%	100.00%	56.43%	100.00%	47.96%	73.98%	12.79%	47.96%	30.38%	100.00%	47.96%	73.98%
22	DLY	20.81%	100.00%	60.41%	2.51%	100.00%	51.26%	42.11%	100.00%	71.06%	46.11%	100.00%	73.06%
23	ESO	71.68%	100.00%	85.84%	100.00%	38.73%	69.37%	59.97%	38.73%	49.35%	48.47%	38.73%	43.60%
24	FAP	100.00%	0.80%	50.40%	3.09%	50.11%	26.60%	52.66%	50.11%	51.39%	100.00%	50.11%	75.06%
25	FCBI	16.95%	5.89%	11.42%	57.50%	5.83%	31.67%	29.35%	5.83%	17.59%	36.96%	5.83%	21.40%
26	FCVV	12.21%	8.80%	10.51%	26.90%	100.00%	63.45%	25.97%	100.00%	62.99%	15.58%	100.00%	57.79%
27	FHB	100.00%	5.91%	52.96%	20.72%	3.01%	11.87%	71.24%	3.01%	37.13%	92.52%	3.01%	47.77%
28	FFEM	30.52%	100.00%	65.26%	100.00%	100.00%	100.00%	47.38%	100.00%	73.69%	38.26%	100.00%	69.13%
29	FPAI	29.68%	11.11%	20.40%	42.49%	6.82%	24.66%	5.53%	6.82%	6.18%	55.31%	6.82%	31.07%

Appendix 3.7 (continued)

30	FNN	56.97%	63.42%	60.20%	32.17%	27.39%	29.78%	45.57%	27.39%	36.48%	100.00%	27.39%	63.70%
31	GBH	71.99%	4.92%	38.46%	31.52%	3.95%	17.74%	65.16%	3.95%	34.56%	39.83%	3.95%	21.89%
32	GPRS	39.35%	7.92%	23.64%	22.62%	13.58%	18.10%	47.01%	13.58%	30.30%	60.95%	13.58%	37.27%
33	HVST	100.00%	31.45%	65.73%	57.06%	20.50%	38.78%	85.13%	20.50%	52.82%	100.00%	20.50%	60.25%
34	HAIL	17.68%	13.82%	15.75%	27.77%	2.66%	15.22%	47.93%	2.66%	25.30%	55.86%	2.66%	29.26%
35	HERO	51.74%	3.41%	27.58%	58.18%	100.00%	79.09%	52.44%	100.00%	76.22%	76.64%	100.00%	88.32%
36	HLID	100.00%	19.23%	59.62%	23.08%	85.41%	54.25%	97.40%	85.41%	91.41%	100.00%	85.41%	92.71%
37	HMID	100.00%	45.85%	72.93%	100.00%	44.01%	72.01%	100.00%	44.01%	72.01%	100.00%	44.01%	72.01%
38	ITRS	36.37%	9.61%	22.99%	96.07%	6.50%	51.29%	41.11%	6.50%	23.81%	78.13%	6.50%	42.32%
39	ILEO	45.60%	100.00%	72.80%	14.08%	63.30%	38.69%	58.97%	63.30%	61.14%	31.80%	63.30%	47.55%
40	JSKT	40.69%	88.60%	64.65%	69.42%	100.00%	84.71%	81.16%	100.00%	90.58%	74.27%	100.00%	87.14%
41	JMI	72.44%	66.00%	69.22%	18.19%	100.00%	59.10%	100.00%	100.00%	100.00%	9.70%	100.00%	54.85%
42	KSM	38.31%	9.23%	23.77%	46.21%	50.12%	48.17%	53.16%	50.12%	51.64%	74.57%	50.12%	62.35%
43	KNJO	49.94%	63.03%	56.49%	12.21%	56.78%	34.50%	33.81%	56.78%	45.30%	17.90%	56.78%	37.34%
44	KSAN	53.34%	14.94%	34.14%	37.09%	11.29%	24.19%	48.94%	11.29%	30.12%	63.95%	11.29%	37.62%
45	KEFM	85.97%	5.06%	45.52%	65.92%	66.92%	66.42%	75.31%	66.92%	71.12%	81.39%	66.92%	74.16%
46	BLTN	73.37%	5.80%	39.59%	47.11%	5.99%	26.55%	82.70%	5.99%	44.35%	59.94%	5.99%	32.97%
47	KIM	100.00%	0.93%	50.47%	30.18%	1.09%	15.64%	89.04%	1.09%	45.07%	100.00%	1.09%	50.55%
48	LYHG	45.54%	20.46%	33.00%	75.13%	14.76%	44.95%	83.66%	14.76%	49.21%	90.63%	14.76%	52.70%
49	LNGI	23.00%	28.73%	25.87%	15.72%	17.41%	16.57%	20.82%	17.41%	19.12%	25.01%	17.41%	21.21%
50	LNDV	57.46%	8.62%	33.04%	18.64%	8.63%	13.64%	69.09%	8.63%	38.86%	100.00%	8.63%	54.32%
51	LNID	87.75%	40.17%	63.96%	79.60%	9.89%	44.75%	100.00%	9.89%	54.95%	65.04%	9.89%	37.47%
52	LTYN	33.69%	8.66%	21.18%	16.27%	100.00%	58.14%	56.73%	100.00%	78.37%	80.31%	100.00%	90.16%
53	LSGT	45.88%	100.00%	72.94%	85.00%	100.00%	92.50%	75.31%	100.00%	87.66%	77.79%	100.00%	88.90%
54	MFLR	19.76%	53.87%	36.82%	16.42%	36.27%	26.35%	33.20%	36.27%	34.74%	37.01%	36.27%	36.64%
55	MCA	21.60%	100.00%	60.80%	34.04%	100.00%	67.02%	33.30%	100.00%	66.65%	33.17%	100.00%	66.59%
56	MYPK	52.89%	51.49%	52.19%	80.87%	100.00%	90.44%	81.36%	100.00%	90.68%	89.68%	100.00%	94.84%
57	MOKS	36.74%	22.06%	29.40%	21.62%	100.00%	60.81%	43.14%	100.00%	71.57%	31.92%	100.00%	65.96%
58	MPIM	68.56%	26.92%	47.74%	18.25%	13.70%	15.98%	59.50%	13.70%	36.60%	45.02%	13.70%	29.36%
59	MRCI	4.77%	100.00%	52.39%	7.92%	100.00%	53.96%	22.72%	100.00%	61.36%	22.47%	100.00%	61.24%
60	MRCY	40.78%	40.41%	40.60%	73.94%	81.04%	77.49%	22.35%	81.04%	51.70%	32.90%	81.04%	56.97%

Appendix 3.7 (continued)

61	MTRD	22.96%	8.86%	15.91%	55.96%	100.00%	77.98%	46.05%	100.00%	73.03%	20.85%	100.00%	60.43%
62	MHO	45.12%	40.75%	42.94%	41.43%	26.56%	34.00%	10.32%	26.56%	18.44%	47.22%	26.56%	36.89%
63	MNTY	26.21%	100.00%	63.11%	44.23%	100.00%	72.12%	50.22%	100.00%	75.11%	59.03%	100.00%	79.52%
64	MUD	69.85%	60.23%	65.04%	41.56%	29.94%	35.75%	57.28%	29.94%	43.61%	27.04%	29.94%	28.49%
65	MVE	43.85%	3.10%	23.48%	20.38%	10.44%	15.41%	51.11%	10.44%	30.78%	31.43%	10.44%	20.94%
66	NSTL	58.24%	41.22%	49.73%	66.78%	31.40%	49.09%	62.76%	31.40%	47.08%	28.06%	31.40%	29.73%
67	OYEL	93.16%	64.82%	78.99%	72.99%	58.69%	65.84%	93.61%	58.69%	76.15%	79.56%	58.69%	69.13%
68	PHNC	56.88%	56.43%	56.66%	44.00%	7.04%	25.52%	76.36%	7.04%	41.70%	77.53%	7.04%	42.29%
69	PEMC	16.23%	100.00%	58.12%	3.56%	100.00%	51.78%	29.33%	100.00%	64.67%	10.30%	100.00%	55.15%
70	PRTN	100.00%	100.00%	100.00%	42.71%	100.00%	71.36%	88.38%	100.00%	94.19%	86.65%	100.00%	93.33%
71	PTGS	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	88.39%	100.00%	94.20%	100.00%	100.00%	100.00%
72	PBE	22.56%	100.00%	61.28%	23.05%	100.00%	61.53%	10.29%	100.00%	55.15%	61.10%	100.00%	80.55%
73	PMTL	80.42%	8.85%	44.64%	26.93%	5.56%	16.25%	53.70%	5.56%	29.63%	16.73%	5.56%	11.15%
74	PRMT	86.28%	2.39%	44.34%	37.20%	3.33%	20.27%	23.84%	3.33%	13.59%	68.66%	3.33%	36.00%
75	PESC	100.00%	2.55%	51.28%	100.00%	1.36%	50.68%	100.00%	1.36%	50.68%	58.49%	1.36%	29.93%
76	ROHS	31.27%	7.97%	19.62%	52.57%	100.00%	76.29%	54.12%	100.00%	77.06%	71.92%	100.00%	85.96%
77	RHJU	28.55%	7.78%	18.17%	18.84%	7.00%	12.92%	33.05%	7.00%	20.03%	40.26%	7.00%	23.63%
78	SPTC	96.98%	2.50%	49.74%	18.42%	1.69%	10.06%	45.85%	1.69%	23.77%	100.00%	1.69%	50.85%
79	SCTX	43.99%	12.35%	28.17%	19.24%	8.70%	13.97%	38.59%	8.70%	23.65%	32.77%	8.70%	20.74%
80	STRN	100.00%	39.53%	69.77%	100.00%	9.57%	54.79%	100.00%	9.57%	54.79%	100.00%	9.57%	54.79%
81	SHEL	100.00%	97.90%	98.95%	100.00%	83.05%	91.53%	100.00%	83.05%	91.53%	52.38%	83.05%	67.72%
82	STAT	13.61%	18.24%	15.93%	87.51%	1.78%	44.65%	92.61%	1.78%	47.20%	83.02%	1.78%	42.40%
83	SAB	34.90%	11.80%	23.35%	24.50%	29.01%	26.76%	52.16%	29.01%	40.59%	59.92%	29.01%	44.47%
84	SUPR	62.57%	9.16%	35.87%	66.64%	9.32%	37.98%	100.00%	9.32%	54.66%	81.51%	9.32%	45.42%
85	TCNG	6.85%	100.00%	53.43%	5.62%	100.00%	52.81%	7.55%	100.00%	53.78%	100.00%	100.00%	100.00%
86	TNGR	43.12%	20.90%	32.01%	17.39%	8.45%	12.92%	100.00%	8.45%	54.23%	51.85%	8.45%	30.15%
87	TRCR	34.41%	79.82%	57.12%	20.76%	19.61%	20.19%	34.57%	19.61%	27.09%	25.87%	19.61%	22.74%
88	TVVS	67.86%	100.00%	83.93%	11.08%	100.00%	55.54%	29.80%	100.00%	64.90%	8.95%	100.00%	54.48%
89	TESH	56.10%	63.71%	59.91%	34.73%	30.34%	32.54%	99.73%	30.34%	65.04%	52.52%	30.34%	41.43%
90	UASI	12.38%	100.00%	56.19%	29.94%	100.00%	64.97%	26.02%	100.00%	63.01%	22.19%	100.00%	61.10%
91	UMVV	16.85%	100.00%	58.43%	7.93%	76.12%	42.03%	21.24%	76.12%	48.68%	41.22%	76.12%	58.67%

Appendix 3.7 (continued)

92	UBEE	78.94%	100.00%	89.47%	69.84%	100.00%	84.92%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
93	UNZ	26.12%	29.68%	27.90%	41.13%	100.00%	70.57%	40.28%	100.00%	70.14%	41.71%	100.00%	70.86%
94	WTIK	16.97%	47.37%	32.17%	10.52%	34.33%	22.43%	28.52%	34.33%	31.43%	18.50%	34.33%	26.42%
95	YHES	11.53%	23.34%	17.44%	19.06%	23.76%	21.41%	23.13%	23.76%	23.45%	39.21%	23.76%	31.49%
96	YLCT	6.72%	12.38%	9.55%	11.25%	4.31%	7.78%	44.76%	4.31%	24.54%	100.00%	4.31%	52.16%

Appendix 3.8: Input and Output Slacks for Selected PLCs for Model 1 for Years 1996 and 1998 – 2000

	2000									
	Stage 1					Stage 2				
	INPUT SLACKS		OUTPUT SLACKS			INPUT SLACKS			OUTPUT SLACKS	
DMU	PrTasts	PrEqty	LTDebt	STDebt	Tpay	LTDebt	STDebt	TPay	Sales	Equity
AMST	0	0	0	0	0	70.48	14310.27	0	0	201128.67
CIHG	0	593.95	0	0	0	0	0	0	101599.81	0
DLY	0	0	28.17	15755.71	0	0	0	324.52	29683.82	217410.28
ESO	0	25569.1	0	0	0	0	0	0	0	0
FCVV	0	1562.84	325.86	0	0	0	498.56	0	145321.97	29942.13
FHB	0	0	0	0	0	266.52	925.48	0	0	55424.94
FFEM	0	318731.2	19292.2	0	0	0	0	0	0	0
LNDV	0	185319.5	0	183.6	0	13226.65	0	0	0	0
MCA	0	0	0	5571.31	3520.7	0	0	0	0	0
MTRD	0	1140.09	55.79	12604.42	0	0	0	2227.85	197869.91	85994.48
MUD	0	2259263	0	0	40793.39	29119.15	104006.2	0	0	39560.45
MVE	0	43436.52	0	0	0	2203.87	108.47	0	169063.4	0
NSTL	0	83996.26	0	0	0	0	0	0	0	457376.12
OYEL	0	218463.3	0	315506.3	0	235380.4	0	0	0	1084219.3
PEMC	0	273316.6	0	0	0	0	0	0	0	0
PRTN	0	0	0	0	0	0	0	0	0	0
PTGS	0	0	0	0	0	0	0	0	0	0
PMTL	0	60326.23	0	0	0	1329.87	759.52	0	0	234362.91
RHJU	0	24342.77	0	0	0	0	0	0	0	28169.47
SPTC	6930.23	0	0	0	0	1329.7	3237.61	0	0	411301.37
UASI	0	0	11.05	12532.15	0	0	0	9234.36	872.13	57115.12
UMVV	0	134989.3	0	0	0	0	0	0	0	0
UBEE	0	1973.92	2958.35	0	6585.65	0	0	0	0	0
UNZ	0	0	18.09	11881.98	0	0	0	2921.5	123358.64	120479.27
YLCT	0	0	6.55	719.49	0	0	0	0	0	79296.82

Appendix 3.8 (continued)

	1999									
	Stage 1					Stage 2				
	INPUT SLACKS		OUTPUT SLACKS			INPUT SLACKS			OUTPUT SLACKS	
DMU	PrTasts	PrEqty	LTDebt	STDebt	TPay	LTDebt	STDebt	TPay	Sales	Equity
AMST	0	0	0	0	0	148940.8	242549.6	0	0.02	867788.9
CIHG	0	9641.38	29358.17	53685.2	0	0	3325.86	1267.58	301000.5	130105.3
DLY	0	0	8677.94	108695.9	0	0	0	32868.06	56183.3	124517.2
ESO	0	0	0	0	0	83259.9	0	0	0	580055.1
FCVV	0	1167.79	72562.37	139946.4	0	0	5526.97	41278.18	123307.2	120286.4
FHB	0	23088.05	33845.5	0	27485.06	0	0	0	0	42266.01
FFEM	0	0	0	0	0	0	0	0	0	0
LNDV	0	8610.58	0	159962.9	0	16280.23	0	0	0	0
MCA	0	16881.07	26	9213.99	9917	0	3209.27	3	7390.03	1558.36
MTRD	0	0	38610.39	0	71084.16	0	597.48	9210.7	33068.98	113102.3
MUD	0	12360.23	97044.03	183894	0	0.01	48735.83	0	0	0.04
MVE	0	1266.8	0	134907.7	64960.67	0	895.37	0	0	0.01
NSTL	0	53213.06	214194.5	122453.7	0	0	0.01	36890.03	0.24	580201.6
OYEL	0	18518.47	0	0	0	246423.7	0	0	0	1199366
PEMC	0	25861.99	21707	41367.79	0	0	0	0	0	0
PRTN	0	0	0	0	0	0	0	0	0	0
PTGS	3212.41	0	0	19811.86	18093.2	0	0	0	0	0
PMTL	0	12443.65	2360.5	11030.08	0	0	0	0	0	72222.47
RHJU	0	10904.7	23024.78	0	13802.97	0	0	0	0	0
SPTC	0	0	14978.88	226112.9	0	2149.36	0	0	0	207808.4
UASI	0	17546.39	37246.48	82730.23	0	0	0	27171.76	143684.2	72644.64
UMVV	0	0	95576.76	183078.6	0	59617.6	0	0	0	0
UBEE	0	1483.86	29819.66	0	36677.13	0	0	0	0	0
UNZ	0	10238.2	22795.92	50704.22	0	0	138.48	4317.56	233275.8	94131.88
YLCT	0	0	16624	0	5481.47	0.01	0.01	0	0.01	0.01

Appendix 3.8 (continued)

	1998									
	Stage 1					Stage 2				
	INPUT SLACKS		OUTPUT SLACKS			INPUT SLACKS			OUTPUT SLACKS	
DMU	PrTasts	PrEqty	LTDebt	STDebt	Tpay	LTDebt	STDebt	TPay	Sales	Equity
AMST	0	0	0	0	0	2918060	118909.3	0	1700124	0
CIHG	0	0.02	12111.61	36953.45	0	0	0	0	0	0
DLY	0	0.01	3352.25	15022.4	0	0	0	0	23091.74	0
ESO	0	0	0	0	0	0.01	0	0	0.07	0
FCVV	0	10299.98	1126.9	17695.75	0	0	0	0	0	50072.32
FHB	0	0	0	0	0	0	0	0	15952.38	0
FFEM	0	268532.4	67750.07	0	63426.96	0	0	0	0	0
LNDV	0	0.01	0	0	0	0	0	0	0	65787.08
MCA	0	9170.79	0	0	841.35	0	0	0	0	0
MTRD	0	0	866.52	0	14678.17	0	0	0	77816.4	0
MUD	0	0	0	0	92002.01	0	0	0	0	0
MVE	0	0	1867.41	0	68321.04	0	0	0	0	0
NSTL	0	23161.77	32442.39	0	38027.6	0	0	0	427046.5	0.01
OYEL	0	98197.26	0	23157.67	0	0	0	96287.85	824812.9	0
PEMC	0	201986	0	840.09	0	0	0	0	0	0
PRTN	0	1053490	741247.3	674783.9	0	0	0	1094213	0	0
PTGS	0	2080903	0	0	111636	0	0	0	0	0
PMTL	0	16742.88	0	0	0.23	0	0	0	0	0
RHJU	0	0	0	0	5792.93	0	0	0	0	0
SPTC	0	0.07	0	0	0	0	0	0	69993.46	0
UASI	0	18241.81	0	20190.1	0	0	0	0	0	0
UMVV	0	0	0	0	0	0	0	0	0	121813.9
UBEE	0	0	0	0	0	0	4199.4	0	52051.21	39445.37
UNZ	0	18975.61	204.4	0	10637.02	0	0	0	0	0
YLCT	0	0	0	0	0	0	0	0	0	0

Appendix 3.8 (continued)

	1996									
	Stage 1					Stage 2				
	INPUT SLACKS		OUTPUT SLACKS			INPUT SLACKS			OUTPUT SLACKS	
DMU	PrTasts	PrEqty	LTDebt	STDebt	Tpay	LTDebt	STDebt	TPay	Sales	Equity
AMST	0	0	0	0	0	0	136084.8	0	0	0
CIHG	0	0	8778.77	20880.12	0	0	0	0	0	0
DLY	0	0	25908.86	18060.38	0	0	7745.62	73.51	155658	65961.65
ESO	0	0	137982.1	57259.11	0	0	0	0	0	0
FCVV	0	0	5274.1	15871.86	7187.18	0	0	0	0	0
FHB	0	0	0	41752.96	18702.74	0	934.06	0	7169.2	24060.84
FFEM	0	0	300140.4	0	0	0	0	0	0	0
LNDV	0	0	0	0	0	0	0	0	201754.7	0
MCA	0	0	1467.16	8659.94	14259.92	0	0	0	0	0
MTRD	0	0	0	3751.68	3115.24	0	0	0	0	16822.58
MUD	0	0	0	0	0	0	0	0	27794.58	0
MVE	0	0	10840.41	0	0	0	0	0	9270.61	0
NSTL	0	0	152975.6	113094.2	0	0	0	0	0	0
OYEL	0.01	0.02	0	66063.63	0	0.01	0	0	0	0.01
PEMC	0	0	0	92271.44	96033.37	0	0	0	0	0
PRTN	0	1331348	0.13	521185	0	0	0	0	0	0
PTGS	0	0	0	0	0	0	0	0	0	0
PMTL	0	0	0	25909.25	8392.31	0	0	0	0	0
RHJU	0	0	13119.81	0	0	0	0	0	0	0
SPTC	0	0	0	0	0	0	0	0	0.01	0
UASI	0	0	3126.7	6628.87	1753.58	0	0	0	0	0
UMVV	0	62134	164973.2	0.01	0	0	0	0	0	0
UBEE	0	0	0	0	0	0	0	0	0	0
UNZ	0	0	6379.02	0	7175.78	0	18557.33	686.21	31452.41	9558.11
YLCT	0	0	0	0	0	0	0	0	0	2618.97

Appendix 4.1: List of Latent Variables or Constructs:

(The indicators selected for this study are in italic form).

i. Financial Leverage (TD)

Financial leverage, which refers to the mixture of funding instruments, measures the degree to which debt is used in funding a company's production activity. The indicator for this construct is the *Total amount of Long-term Debt and Short-term debt*

ii. Operating Liability Leverage (TP)

Operating liability leverage measures the degree to which other liabilities such as trade payables, deferred revenues, and pension liabilities are used in running the production operations of the company. The indicator for this construct is *Trade Payables*

iii. Firm's Size (FS)

Indicator is *natural logarithm of sales* and *natural logarithm of total assets.*

iv. Profitability (PR)

The indicators of profitability are *ratio of earning before interest, taxes to total assets* and *ratio of earning before interest and taxes to sales.*

v. Growth Opportunities (GO)

Indicator of growth is *the growth of total assets measured by the percentage change in total assets.*

vi. Asset Structure (AS)

Indicator is *the ratio of inventory plus gross plant and equipment to total assets* and *the ratio of fixed assets to total assets.*

vii. Risk (RS)

Risk proxy is defined as the *standard deviation of the firm difference in sales* for the period under observations scaled by the average value of the firm's total assets over that period.

viii. Non-Debt Tax Shields (NT)

Indicator is the *ratio of depreciation (D) less taxes (T) over earnings before interest and taxes (EBIT).*

Appendix 4.1 (continued)

xi. Earning Volatility (EV)

Indicator is the *standard deviation of the percentage change in operating income* over the period under observation.

x. Age (FA)

Indicator is *age*, whereby age equals to the number of years the firm is in operation.

xi. Religion (RL)

Indicator is *dummy Religion*, whereby religion = 1 if the firm has more than 50 % of the key decision makers are Muslim, and religion = 0 otherwise.

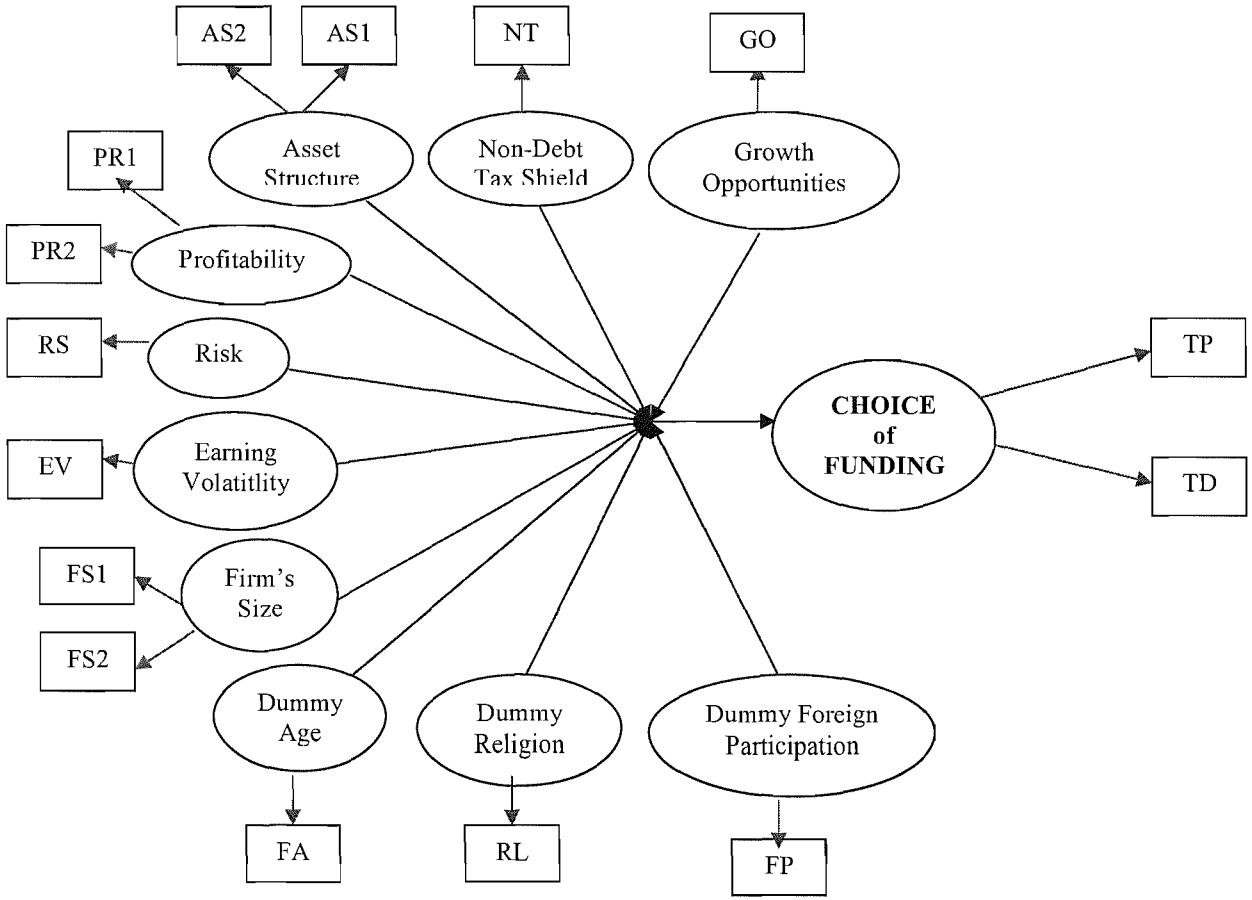
xii. Foreign Participation (FP)

Indicator is *dummy foreign participation*, whereby foreign participation = 1 if the firm has more than 5 % foreigners as key decision makers in the company, and foreign participation = 0 otherwise.

Appendix 4.2: Description of Latent Variables (Construct)

Variable	Description:	
TD	Total Debt	This represents the total amount financial leverage which is the proxy for funding instrument
TP	Trade Payable	This is a proxy for the amount of operating liability leverage which is the proxy for funding instrument in the form of operating instrument
FS1	Firm size 1	This represents the size of the firm
FS2	Firm size 2	This represents the size of the firm
RS	Risk	This represents the risk borne by the firm.
EV	Earning Volatility	This represents volatility in firm's earning.
PR1	Profitability 1	This represents firm's profitability
PR2	Profitability 2	This represents firm's profitability
GO	Growth Opportunities	This represents firm's opportunities for growth
AS1	Assets Structure 1	This represents firm's assets structure
AS2	Assets Structure 2	This represents firm's assets structure
NT	Non-debt tax shield	This represents firm's non debt tax shield
RL	Religion	This represents religion profess by top personnel of the firm
FP	Foreign Participation	This represents foreign participation presents in the firm
FA	Firm's Age	This represents number of years firm has been in operation.

Appendix 4.3: PATH DIAGRAM FOR FULL MODEL OF CHOICE OF FUNDING INSTRUMENTS



Appendix 4.4 Descriptive Statistics for All PLCs

Variable	Mean	Std Dev	Minimum	Maximum
TD	0.286345	0.734128	0	7.778222
TP	0.101443	0.258852	0	2.413339
FS1	5.393380	0.658341	4.192818	7.362575
FS2	5.302250	0.723782	2.987666	7.200000
RS	0.581139	0.708420	0	6.137735
EV	0.033973	0.089093	0	1.099994
PR1	0.068152	0.162087	-1.830000	1.100909
PR2	0.064081	0.353309	-5.370000	1.201163
GO	25.186389	79.218482	-90.169356	802.000000
AS1	0.591979	0.402949	0	4.913775
AS2	0.409576	0.364493	0	4.673297
NT	0.777817	3.993352	-12.850000	68.700000
RL	0.346354	0.575693	0	2.000000
FP	7.845646	15.709891	0	66.740000
FA	30.854167	12.822939	12.000000	85.000000

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