

OPTIMIZATION ON THE FINANCIAL MANAGEMENT OF THE BANK WITH GOAL PROGRAMMING MODEL

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ABSTRACT

Financial management is crucial for planning bank's asset and liabilities while taking consideration for multiple objectives. The objective of this study is to develop a Goal Programming (GP) model to optimize the financial management of Public Bank Berhad in Malaysia. Six goals from the financial statements namely total asset, total liability, total equity, profit, earning and optimum management items are investigated for the period from 2011 to 2015. The results of this study indicate that all six goals are fully achieved by using the GP model. This study is significant because it helps to develop a mathematical model to examine the financial strengths of Public Bank Berhad in Malaysia. Besides that, the potential improvement on liability, equity, profit, earning and optimum management item of Public Bank Berhad can be identified in this study based on the deviation from the target value.

Keywords: Asset; Liability; Equity; Profit; Earning; Optimum Management Items.

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1. INTRODUCTION

Financial management is essential for every company in order to support the quality and quantity of assets as well as taking into account of the company's liability for future planning [1]. For banking sectors, it is important to optimize the profit while minimizing risks that bring about severe losses to the bank [2]. Asset and liabilities management is defined as planning of asset and liability while considering multiple bank management objectives such as reducing risk and enhance liquidity of the bank [3]. Strategic decision is important because it will affect the future of a company [4-5]. The objective of this study is to develop a Goal Programming (GP) model to optimize the financial management of the bank. GP is a mathematical model which aims to solve multiple objectives decision-making problems [6-7]. Some common goals such as asset accumulation, liability reduction, profitability and optimum management items in the financial statement are the main concern in an organization such as bank and financial institution [2]. In this study, the financial statement in the annual report of Public Bank Berhad (PBBANK) from year 2011 to 2015 is investigated. PBBANK is one of the largest banking group in Malaysia and listed in Bursa Malaysia since 1967. It was founded in 1966 and has been operating for the past 50 years. In 2015, Public Bank Berhad was awarded as the Strongest Bank in Malaysia by balance sheet in the Asian Banker 500 Strongest Bank [8].

There are studies done on the bank's financial management by using mathematical model. A mathematical model is designed to determine the optimum management of asset and liabilities of the bank [1, 9]. GP model is developed for generating the optimal solution for six goals which are asset accumulation, liability reduction, equity wealth, earning, profitability as well as optimum management items [2]. Besides that, the financial statement of United Bank of Africa (UBA) is studied using GP model [10].

In the field of financial management, GP model has been applied in portfolio selection [11-14], assets and liability management [15-17], financial planning [18-20], funding allocation [21] and bank balance sheet management [22]. The objective of this paper is to develop a GP model to optimize the financial management of PBBANK in Malaysia. Six goals from the financial statements identified in this study are total asset, total liability, total equity, profit, earning and optimum management items. The rest of the paper is organized as follows. The

next section describes the data and methodology used in this study. Section 3 discusses about the empirical results of the study. Section 4 concludes the paper.

2. METHODOLOGY

In this study, the financial statement in the annual report of PBBANK from year 2011 to 2015 is investigated. A goal programming model is developed to optimize the financial management of the bank in order to achieve multiple goals. This study applies pre-emptive goal programming to determine the optimal solution. Pre-emptive method allows the decision makers to satisfy one goal at a time. It means that the first priority goal (P1) will be satisfied first then followed by the second priority goal (P2) and so on. The formulation for the goal programming model is as shown below

$$\text{Minimize } z = \sum_{i=1}^n [p_i (d_i^- + d_i^+)] \quad (1)$$

subject to

$$\sum_{j=1}^m (a_{ij} x_j + d_i^- - d_i^+) = g_i \quad (2)$$

$$x_j, d_i^-, d_i^+ \geq 0 \quad (3)$$

where p_i is the pre-emptive factor associated with each competitive goal in order of preference, x_j is the decision variable for $j = 1, 2, 3, \dots, m$, a_{ij} represents the parameter of the decision variables, d_i^- represents the negative deviation variable from underachieving i^{th} goal, d_i^+ represents the positive deviation variable from overachieving i^{th} goal and g_i represents the target value or aspiration level for i^{th} goal.

Table 1 shows the summary of financial statement for PBBANK from year 2011 to year 2015. The data includes asset, liability, equity, profit and earning.

Table 1. Financial statement for PBBANK from year 2011 to 2015

Goal	RM'trillion					Total
	2011	2012	2013	2014	2015	
Asset	0.2494	0.2746	0.3057	0.3457	0.3638	1.5392
Liability	0.2339	0.2560	0.2845	0.3168	0.3315	1.4227
Equity	0.0156	0.0186	0.0212	0.0289	0.0323	0.1166
Profit	0.0035	0.0039	0.0041	0.0046	0.0051	0.0212
Earnings	0.0128	0.0141	0.0153	0.0169	0.0192	0.0781
Total	0.5152	0.5672	0.6308	0.7129	0.7519	3.1778

In this study, the priority of the goals is set as follows.

P_1 = First priority goal to maximize total asset

P_2 = Second priority goal to minimize total liabilities

P_3 = Third priority goal to maximize total equity

P_4 = Forth priority goal to maximize profitability

P_5 = Fifth priority goal to maximize earning

P_6 = Sixth priority goal to maximize the proportion of items' value in financial statement

The weight is assigned according to the value of an item in Table 1. Therefore, Table 2 summarizes the weight in relation to the value of the goal based on Table 1.

Table 2. Weight in relation to the value of the goal

Goal	Weight in Relation to the Value of the Goal					Total
	2011	2012	2013	2014	2015	
Asset	0.2494	0.2746	0.3057	0.3457	0.3638	1.5392
Liability	0.2339	0.2560	0.2845	0.3168	0.3315	1.4227
Equity	0.0156	0.0186	0.0212	0.0289	0.0323	0.1166
Profit	0.0035	0.0039	0.0041	0.0046	0.0051	0.0212
Earnings	0.0128	0.0141	0.0153	0.0169	0.0192	0.0781
Total	0.5152	0.5672	0.6308	0.7129	0.7519	3.1778

The decision variables are shown as follows:

x_1 = amount in year 2011 financial statement

x_2 = amount in year 2012 financial statement

x_3 = amount in year 2013 financial statement

x_4 = amount in year 2014 financial statement

x_5 = amount in year 2015 financial statement

Six goal constraints are shown below:

Asset constraint:

$$0.2494x_1 + 0.2746x_2 + 0.3057x_3 + 0.3457x_4 + 0.3638x_5 \geq 1.5392$$

Liability constraint:

$$0.2339x_1 + 0.2560x_2 + 0.2845x_3 + 0.3168x_4 + 0.3315x_5 \leq 1.4227$$

Equity constraint:

$$0.0156x_1 + 0.0186x_2 + 0.0212x_3 + 0.0289x_4 + 0.0323x_5 \geq 0.1166$$

Profit constraint:

$$0.0035x_1 + 0.0039x_2 + 0.0041x_3 + 0.0046x_4 + 0.0051x_5 \geq 0.0212$$

Earning constraint:

$$0.0128x_1 + 0.0141x_2 + 0.0153x_3 + 0.0169x_4 + 0.0192x_5 \geq 0.0781$$

Financial statement managing constraint:

$$0.5152x_1 + 0.5672x_2 + 0.6308x_3 + 0.7129x_4 + 0.7519x_5 \geq 3.1778$$

$$x_1, x_2, x_3, x_4, x_5, d_1^+, d_2^+, d_3^+, d_4^+, d_5^+, d_6^+, d_1^-, d_2^-, d_3^-, d_4^-, d_5^-, d_6^- \geq 0$$

Based on the goals identified, the goal programming model is formulated as follows:

$$\text{Minimizing: } P_1d_1^- + P_2d_2^+ + P_3d_3^- + P_4d_4^- + P_5d_5^- + P_6d_6^-$$

Subject to

$$0.2494x_1 + 0.2746x_2 + 0.3057x_3 + 0.3457x_4 + 0.3638x_5 + d_1^- - d_1^+ = 1.5392$$

$$0.2339x_1 + 0.2560x_2 + 0.2845x_3 + 0.3168x_4 + 0.3315x_5 + d_2^- - d_2^+ = 1.4227$$

$$0.0156x_1 + 0.0186x_2 + 0.0212x_3 + 0.0289x_4 + 0.0323x_5 + d_3^- - d_3^+ = 0.1166$$

$$0.0035x_1 + 0.0039x_2 + 0.0041x_3 + 0.0046x_4 + 0.0051x_5 + d_4^- - d_4^+ = 0.0212$$

$$0.0128x_1 + 0.0141x_2 + 0.0153x_3 + 0.0169x_4 + 0.0192x_5 + d_5^- - d_5^+ = 0.0781$$

$$0.5152x_1 + 0.5672x_2 + 0.6308x_3 + 0.7129x_4 + 0.7519x_5 + d_6^- - d_6^+ = 3.1778$$

In this study, LINGO version 16.0 is used to solve the goal programming model.

3. RESULT AND DISCUSSION

Table 3 presents the empirical result of goal achievement based on the optimal solution obtained from LINGO software.

Table 3. Goals achievement

Goals Priority	Output Value	Goals Achievement
P1	$d_1^- = 0$	Fully Achieved
P2	$d_2^+ = 0$	Fully Achieved
P3	$d_3^- = 0$	Fully Achieved
P4	$d_4^- = 0$	Fully Achieved
P5	$d_5^- = 0$	Fully Achieved
P6	$d_6^- = 0$	Fully Achieved

As shown in Table 3, the output values are zero for all goals. This implies that all the goals are fully achieved for PBBANK. Table 4 shows the values of the deviation variables for all the goals.

Table 4. Results of deviation variables

Goals Priority	d_i^-	d_i^+
P1	0	0
P2	2.015794×10^{-2}	0
P3	0	2.005794×10^{-2}
P4	0	3.775701×10^{-4}
P5	0	3.037049×10^{-3}
P6	0	3.314619×10^{-3}

Based on Table 4, for P1 which maximizes the total assets for the bank, the negative deviation $d_1^- = 0$ indicates that first goal is fully achieved. The positive deviation $d_1^+ = 0$ shows that the total assets remain at RM1, 539,241 million. For P2 which is minimizing total liabilities, the positive deviation $d_2^+ = 0$ indicates the goal is achieved also. The negative deviation $d_2^- = 2.015794 \times 10^{-2}$ implies that the liabilities can be decreased further by RM 0.02016 trillion. For P3 which maximizes the total equity, the goal is achieved and the total equity can be increased by RM 0.02006 trillion. The goal of maximizing profit (P4) can be achieved as well with an increment of RM 0.00038 trillion based on $d_4^+ = 3.775701 \times 10^{-4}$.

$d_5^- = 0$ indicates that the goal for maximizing the earning is achieved. Based on the optimal solution, the total earning can be increased by RM 0.00304 trillion. The final goal (P6) is achieved as well with $d_6^- = 0$ and $d_6^+ = 3.314619 \times 10^{-3}$. This shows that the proportion of the values of items in the financial statement can be increased further by RM 0.00331 trillion.

4. CONCLUSION

In this study, a goal programming model is developed to investigate the financial management of PBBANK in Malaysia. The results of this study show that all the goals are fully achieved. This implies that the financial performance of PBBANK is stable. Besides that, the potential improvement on liability, equity, profit, earning and optimum management item of Public

Bank Berhad have been identified in this study based on the deviation from the target value. This study is significant because it helps to develop a mathematical model to examine the financial strengths of PBBANK in Malaysia. Furthermore, this study helps to determine the new target value for the goals for continuous improvement. The future research of this study should be extended to other countries by using GP model to optimize the financial management of the company.

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