Analysis on the Bank Financial Management with Goal Programming Model

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Abstract

Asset and liability management (ALM) is essential to balance the assets and liability of a company. Liquidity and interest rate changes are the main concern for ALM. Besides that, company has to consider various goals in order to obtain a satisfactory solution. Hence, the multi-attributes decision making (MADM) can be solved by using goal programming model. Decision makers can decide the weights of the goal and set the constraints. The robustness of goal programming model is that it can solve multiple objectives simultaneously and obtain an optimal solution that satisfy all the objectives and constraints. This study aims to develop a goal programming model to investigate the financial management of AmBank Group in Malaysia based on multiple goals such as total assets, total liability, total equity, profits, earnings and total goal achievements. The results of this study show that AmBank is able to achieve all goals based on the optimal solution of goal programming model. Furthermore, potential improvement of target values are identified in maximizing assets, equity and profit of the bank. This study is significant because it helps to identify the financial strength and potential improvements for AmBank Group in Malaysia.

1. Introduction

Asset and liability management (ALM) is crucial for every bank and financial institution because ALM is a mechanism to minimize company's risk due to a mismatch between assets and liabilities [1]. Company's liquidity and interest rate changes are the main concern for ALM. If both aspects are handled properly, it can increase the profits of the bank and company. The earnings can determine the company's financial strength that direct influence the company's future development. It is tough to compete with other competitors, innovate as well as reformation without a strong financial base. Bank financial management involves achieving multiple objectives simultaneously [2]. Today's decision will affect tomorrow performance [3]. Therefore, banks should monitor their asset and liability management consistently to reduce the risk. Since management level have to consider multi-attributes in order to achieve their goals, Multi-Attributes

Decision Making (MADM) method best suit for this dilemma. This is due to the reason of satisfying multiple goals concurrently and to determine a optimal solution.

Goal programming model was invented by Charnes, et al. [4, 5] to cope with MADM problems. Goal programming model can solve multiple objectives problem simultaneously and obtain the optimal solution that satisfy all the constraints. Goal programming model has been developed to optimize the financial management of the banks [6-11].

In this study, a goal programming model is developed to investigate and optimize the financial management of AmBank Group (AmBank) in Malaysia. AmBank is a Malaysian financial services group that has operated for 42 years and had been listed in Bursa Malaysia since 1988 [12]. The main objective for this study is to develop a goal programming model in identifying the goal achievement of AmBank as well as potential improvement on the goal. The common goals are total assets, total liabilities, total equity, profitability, earnings and total goal achievement [9, 10].

The next section of this paper discusses about the data and methodology. Section 3 presents the results and discussion. The last section concludes the paper.

2. Data and Methodology

2.1. Data

The financial management of AmBank is investigated in this study from year 2012 until 2016. The data is obtained from AmBank's annual report.

2.2. Goal Programming Model

The multiple goals achievement nowadays have revealed the importance of accomplishing multiple goals simultaneously. Hence, there is a demand for mathematical model to solve these problems in order to obtain an optimal solution. Goal programming model can solve multiple objectives simultaneously by determining the optimal and compromise solution to achieve all objectives. Since the bank has to achieve contradict goals such as maximizing assets while minimizing liability, goal programming model is best suit to solve the problem.

In goal programming model, the weights will be assigned as the coefficient of the variables indicating the importance of each goal. The goal programming is formulated as follows.

$$\text{Min } z = w_1 G_1 + w_2 G_2 + \cdots + w_i G_i \qquad (1)$$

where $i = 1,2,3,...,n$.

Subject to

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

$$x_j, d_i^-, d_i^+ \geq 0$$

where

$z =$ objective function;

$w_i =$ weight for $i = 1,2,3,...,n.$;

$d_i^- =$ negative deviation variable (underachievement) for $i = 1,2,3,...,n.$;

$d_i^+ =$ positive deviation variable (overachievement) for $i = 1,2,3,...,n.$;

$x_j =$ decision variable for $j = 1,2,3,...,m$;

$a_{ij} =$ parameter for decision variable;

$g_i =$ aspiration level for $i = 1,2,3,...,n.$.

d_i^- and d_i^+ are added to the constraints as undersatisfying or oversatisfying of a goal. The deviation variables are used to determine the underachievement or overachievement of each goal [13].

In this study, six important goals are solved simultaneously with goal programming model. Table 1 indicates the six important goals of bank financial management.

Table 1. Goals of Bank Financial Management.

Goal	Objective
1	Maximizing total assets
2	Minimizing total liabilities
3	Maximizing total equity
4	Maximizing profitability
5	Maximizing earnings
6	Maximizing total goal achievements

Table 2 displays the financial data which is obtained from AmBank's annual report. Table 2 is converted into Table 3 in coded form for further analysis in developing a goal programming model [9, 10].

Table 2. Financial Data of AmBank.

Goal	Group (RM'000)					Total
	2012	2013	2014	2015	2016	
Asset	111855350	126993290	132353257	133803824	133764000	638769721
Liability	100340832	113860060	118258868	118296400	117644612	568400772
Equity	11514518	13133230	14094389	15507424	16119388	70368949
Profit	1566155	1693200	1871055	2044553	1399479	8574442
Earnings	4217459	4374308	4731359	4724644	3695808	21743578
Total	229494314	260054088	271308928	274376845	272623287	1307857462

Table 3. Financial Data in Coded Form.

Goal	Group (RM'trillion)					Total
	2012	2013	2014	2015	2016	
Asset	0.11186	0.12699	0.13235	0.13380	0.13376	0.63877
Liability	0.10034	0.11386	0.11826	0.11830	0.11764	0.56840
Equity	0.01151	0.01313	0.01409	0.01551	0.01612	0.07037
Profit	0.00157	0.00169	0.00187	0.00204	0.00140	0.00857
Earnings	0.00422	0.00437	0.00473	0.00472	0.00370	0.02174
Total	0.22949	0.26005	0.27131	0.27438	0.27262	1.30786

According to Equation (2), x_j represents the total amount for each item in each year as shown below.

Decision variables:

x_1 = total amount for the item in financial statement in year 2012

x_2 = total amount for the item in financial statement in year 2013

x_3 = total amount for the item in financial statement in year 2014

x_4 = total amount for the item in financial statement in year 2015

x_5 = total amount for the item in financial statement in year 2016

The following shows the goal constraints derived from each goal in goal programming model.

Asset:

$$0.1119x_1 + 0.1270x_2 + 0.1324x_3 + 0.1338x_4 + 0.1338x_5 \geq 0.6388$$

Liability:

$$0.1003x_1 + 0.1139x_2 + 0.1183x_3 + 0.1183x_4 + 0.1176x_5 \leq 0.5684$$

Equity:

$$0.0115x_1 + 0.0131x_2 + 0.0141x_3 + 0.0155x_4 + 0.0161x_5 \geq 0.0704$$

Profit:

$$0.0016x_1 + 0.0017x_2 + 0.0019x_3 + 0.0020x_4 + 0.0014x_5 \geq 0.0086$$

Earnings:

$$0.0042x_1 + 0.0044x_2 + 0.0047x_3 + 0.0047x_4 + 0.0037x_5 \geq 0.0217$$

Total goal achievement:

$$0.2295x_1 + 0.2601x_2 + 0.2713x_3 + 0.2744x_4 + 0.2726x_5 \geq 1.3079$$

Asset, equity, profit, earnings and total goal achievement are maximized in bank financial management except liability reduction. Due to the variables are uncertain values, positive and negative deviation variables are added into the constraints to determine the increment or decrement of the goals. Based on the goal constraints identified, the goal programming model is developed and formulated as follows.

Objective function:

$$\text{Min} = d_1^- + d_2^+ + d_3^- + d_4^- + d_5^- + d_6^-$$

Subject to

$$0.1119\,x_1 + 0.1270\,x_2 + 0.1324\,x_3 + 0.1338\,x_4 + 0.1338\,x_5 + d_1^- - d_1^+ = 0.6388$$

$$0.1003\,x_1 + 0.1139\,x_2 + 0.1183\,x_3 + 0.1183\,x_4 + 0.1176\,x_5 + d_2^- - d_2^+ = 0.5684$$

$$0.0115\,x_1 + 0.0131\,x_2 + 0.0141\,x_3 + 0.0155\,x_4 + 0.0161\,x_5 + d_3^- - d_3^+ = 0.0704$$

$$0.0016\,x_1 + 0.0017\,x_2 + 0.0019\,x_3 + 0.0020\,x_4 + 0.0014\,x_5 + d_4^- - d_4^+ = 0.0086$$

$$0.0042\,x_1 + 0.0044\,x_2 + 0.0047\,x_3 + 0.0047\,x_4 + 0.0037\,x_5 + d_5^- - d_5^+ = 0.0217$$

$$0.2295\,x_1 + 0.2601\,x_2 + 0.2713\,x_3 + 0.2744\,x_4 + 0.2726\,x_5 + d_6^- - d_6^+ = 1.3079$$

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

In this study, the goal programming model is solved with LINGO software. LINGO is an optimization modelling software for solving linear programming model, non-linear programming model, goal programming model and integer programming model [14-23].

3. Result and Discussion

Table 4 presents the AmBank's goal achievement for each goal based on the optimal solution of developed goal programming model.

Table 4. Goal Achievement.

Goals	Deviation Variable	Goals Achievement
G1	$d_1^- = 0$	Achieved
G2	$d_2^+ = 0$	Achieved
G3	$d_3^- = 0$	Achieved
G4	$d_4^- = 0$	Achieved
G5	$d_5^- = 0$	Achieved
G6	$d_6^- = 0$	Achieved

According to Table 4, deviation variables for all goals give

zero value which implies that AmBank is able to achieve all the goals throughout the five years. This shows that the financial performance of AmBank is good and stable. Table 5 shows the potential improvement on the target value based on the optimal solution of goal programming model which gives the positive value of deviation variable

Table 5. *Potential Improvement.*

Goals	d_i^-	d_i^+
G1	0	1.1362×10^{-4}
G2	0	0
G3	0	2.2875×10^{-5}
G4	0	1.4156×10^{-4}
G5	0	0
G6	0	0

Based on Table 5, there are three potential improvements identified among the goals. Potential increment or decrement can be detected based on the positive values of deviation variables. For maximization problem, increment can be determined through positive deviation variable and vice versa for minimization problem.

For this case, d_1^+ shows 1.1362×10^{-4} reveals that AmBank has the ability to increase their total assets by RM 0.00011 trillion over the coming five years. The new values for total assets will be RM 0.63888 trillion. For second goal of minimizing total liability, the positive and negative deviation variables are zero values which imply that this goal remains at RM 0.56840 trillion. For the third goal which is maximizing total equity, the goal is fully achieved because d_3^- is zero while the value in d_3^+ is 2.2875×10^{-5}. Total equity can be further increased by RM 0.00002 trillion for continuous improvement. Therefore, the final value is RM 0.07039 trillion. The forth goal has the same condition with third goal as negative deviation is zero while positive deviation is 1.4156×10^{-4}. Therefore, the profits of AmBank has the potential improvement by RM 0.00014 trillion and achieve RM 0.00871 trillion throughout the next five years. The fifth and last goals are maximizing AmBank's earnings and total goal achievement. For the last two goals, both positive and negative deviation variables are zero values which indicate that both goals are fully achieved. The total values of earnings and total goal achievement remain at RM 0.02174 trillion and RM 1.30786 trillion respectively based on the optimal solution of goal programming model.

4. Conclusion

This study aims to develop a goal programming model to examine and optimize the financial management of AmBank in Malaysia. The results of this study show that AmBank is able to achieve all goals based on the optimal solution of goal programming model. Besides that, there are potential improvements identified on maximization of total assets, total equity and profits for AmBank. Therefore, this study helps to identify the new target values for the bank's goal for further improvement.

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