

# FINANCIAL INDICATORS FOR EARLY WARNING SYSTEM OF AGRICULTURAL COOPERATIVES IN THAILAND

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**ABSTRACT:** Agricultural cooperatives are very important to the Thai economy. The application of logit model for Early Warning System (EWS) to indicate the stability of the cooperative business operation from its financial ratios is necessary to deal with or to prevent financial disasters that might be occurred. The result from the model is a summary of the current operation results from financial data showing which cooperatives groups are “stable” or “unstable” in comparison to general agricultural cooperatives. This will be useful for both stable and unstable cooperatives. Stable cooperatives acknowledge this information and carry out its business operation with carefulness. Unstable cooperatives can take that signal as Early Warning System to improve their business operation before it is too late. 647 cooperatives were analyzed here, classified into 3 different sizes which were the small and medium, large, and very large cooperatives. The findings were as follows;

The financial indicators in the model for small and medium sized agricultural cooperatives consisted of the capital reserve to total asset ratio and the return on asset with coefficient of 10.22416 and 0.56687, respectively. The constant was -3.00182. The accuracy of the model used for early warning was 88.9%.

The financial indicators in the model for large-sized agricultural cooperatives consisted of the return on asset and the capital reserve growth rate with coefficient of 1.77554 and 0.00007, respectively. The constant was -5.71804. The accuracy of the model used for early warning was 85.0%.

The financial indicators in the model for very large-sized agricultural cooperatives consisted of the capital reserve to total asset ratio, the return on asset, the asset growth rate, and the profit growth rate with coefficient of 8.63229, 1.34392, 0.00077, and 0.00006, respectively. The constant was -3.71031. The accuracy of the model used for early warning was 88.9%.

**KEYWORDS:** Early Warning System (EWS), financial ratios

## 1. INTRODUCTION

Cooperative is a large business system which is very important to the Thai economy of Thailand. A number of cooperatives in Thailand according to Cooperative Registration B.E. 2008 is 7,675, classified into 4,320 cooperatives in the agricultural sector and 3,355 cooperatives outside the agricultural sector. There are totally 8,893,388 members of cooperatives. As agricultural cooperative is a business institution which assists a lot of people especially agricultural farmers, the development of the Early Warning System ( EWS ) to indicate the security

of the performance of agricultural cooperatives from financial ratios will be greatly beneficial to deal with or to prevent it from financial disasters (Pranee and Peera, 2002).

### 1.1 Objectives

The objectives of this research are to study the financial ratio which is attempted to considered financial stability or instability of agricultural cooperatives, and to study the appropriate model for the Early Warning System to indicate the financial stability or instability of agricultural cooperatives.

## 2. METHODOLOGY

Scope of the study focuses on the utilization of financial data from general agricultural cooperative in Thailand which have been recorded according to CAMEL principles by Cooperative Auditing Department (CAD). The financial data in 2005 were totally gathered from 647 general agricultural cooperatives. The analysis was classified into 3 sizes of cooperatives which are the small and medium, large, and very large cooperatives in accordance with the classification criteria of Cooperative Auditing Department (2005). The cooperatives in this study were considered from the aspects of working capital, main business income, and cooperative members.

In this study, the Early Warning System ( EWS ) was developed from logit model as indicated by Martin (1977) Kolari, Glennon, Shin and Caputo (2000). The determination of 2 dependant variables, stable and unstable cooperatives were adapted from the study by Suda and Saroj (1994). The financial ratio of each agricultural cooperative will be compared with the financial ratio of overall agricultural cooperatives which was undertaken by Cooperative Auditing Department as in Table 2.1

Score from each cooperative will be calculated. Then, 6.5 score will be the benchmark. If some cooperatives get lower score compared with this benchmark score, it will be unstable on the contrary, if the score is higher than the benchmark score, it will be stable. The cooperatives will be grouped into 3 sizes: small and medium, large, and very large, according to the CAD criteria.

After classifying agricultural cooperatives into 2 groups, 90% of each size will be randomized to develop the logit model (Abdullah and other, 2008) to do early warning sign whether it will be financially stable or unstable as shown in this model;

$$Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_{13} X_{13} + e \quad (2.1)$$

Where  $Y_i$  = financial stability status of agricultural cooperatives

$Y_i = 1$  means financially stable agricultural cooperative

$Y_i = 0$  means financially unstable agricultural cooperative

Table 2.1 Criteria to measure the financial stability status

Financial ratio	Criteria to measure the financial stability status
Debt to equity ratio	less than average is good; get 1 point
Capital reserve to asset ratio	more than average is good; get 1 point
Capital growth ratio	more than average is good; get 1 point
Debt growth ratio	less than average is good; get 1 point
Assets turnover ratio	more than average is good; get 1 point
Return on asset ratio	more than average is good; get 1 point
Asset growth ratio	more than average is good; get 1 point
Business growth ratio	more than average is good; get 1 point
Profit per member ratio	more than average is good; get 1 point
Saving per member ratio	more than average is good; get 1 point
Capital reserve growth ratio	more than average is good; get 1 point
Profit growth ratio	more than average is good; get 1 point
Current ratio	more than average is good; get 1 point

Note: Average used here is an average made by Cooperative Auditing Department.

The probability and likelihood function for the financially stable agricultural cooperatives (P) can be defined as follows:

$$P_i = \frac{e^{Y_i}}{1 + e^{Y_i}} \quad (2.2)$$

And the equation (2.2) is called Logistic Response Function that will be brought to test early warning signal for the rest 10% of each size of agricultural cooperatives. It can be implied that, if the value P is equal or more than 0.5, it is indicated that the cooperative is financially stable.

The coefficient of each variable indicates the relationship direction between each financial ratio ( $X_i$ ) while keeping the others constant, and financial stability status of agricultural cooperatives ( $Y_i$ ). Thus, if EXP(B) is more than 1, financial ratios ( $X_i$ ) and financial stability status of agricultural cooperatives ( $Y_i$ ) will be positively related. And, it is implied that the management of statistically significant financial ratios will influence financial stability status of agricultural cooperatives.

### 3. RESULT OF STUDY

The analyzed logit model determines the input data entry by the method of Forward Stepwise (LR) to get the model consisting of independent variables that have statistically significant to dependent variables, fixing the independent input variables at 0.05 level of significant, and removing the independent variables irrelevant to the dependent variables at 0.10 of significant level.

#### 3.1 Early Warning System of agricultural cooperatives of small and medium size

Out of 87 small & medium sized agricultural Cooperatives, 78 cooperatives were used to develop the model. From the classification, it was found that there were 38 financially stable agricultural cooperatives, and 40 financially unstable agricultural cooperatives. After the logit model development, the findings were that the financial ratios

which were used to consider the stability of the cooperatives were the capital reserve to total asset ratio ( $X_2$ ) and the return on asset ( $X_6$ ), as follows;

$$Y = -3.00182 + 10.22416(X_2) + 0.56687(X_6) \quad (3.1)$$

EXP (B) (27,560.98829) (1.76274)

Table 3.1 Result of the appropriateness of the logit model for small and medium sized agricultural cooperatives

Statistical value	Result
-2 Log likelihood	50.076
Cox & Snell R Square	0.525
Nagelkerke R Square	0.700
Hosmer and Lemeshow Test	
- Chi-square	9.352
- P-Value	0.314

From the above Logit model, Exp (B) or  $e^{b_i}$  is more than 1 for both ratios. It was indicated that if the capital reserve to total asset ratio ( $X_2$ ) or the return on asset ( $X_6$ ) increased, while the other was constant, the chance for small and medium size cooperatives to be more stable increased. That model can be written in the form of Logistic Response Function which can be used as Early Warning System for small & medium sized agricultural cooperatives with the cut of point at 0.5 as follows;

$$P = \frac{e^{-3.00182 + 10.22416(X_2) + 0.56687(X_6)}}{1 + e^{-3.00182 + 10.22416(X_2) + 0.56687(X_6)}} \quad (3.2)$$

When testing the acquired model with 9 small and medium sized agricultural cooperatives, it was found that the accuracy of the model used for early warning was 88.9%, as in Table 3.2

#### 3.2 Early Warning System of Large Agricultural Cooperatives

Out of 204 large-sized agricultural Cooperatives, 184 cooperatives were used to develop the model. It was found that there were 49 financially stable agricultural cooperatives, and 135 financially unstable agricultural

cooperatives. After the logit model development, the findings were that the financial ratios which were used to consider the stability of the cooperatives were the return on asset ( $X_6$ ) and the capital reserve growth rate ( $X_{11}$ ), as follows;

$$Y = -5.71804 + 1.77554(X_6) + 0.00007(X_{11}) \quad (3.3)$$

EXP (B)      (5.90346)      (1.00007)

Table 3.2 The accuracy of the model used for early warning to small and medium sized agricultural cooperatives

Status	The model classified as unstable cooperative	The model classified as stable cooperative	Total
<b>Unstable cooperatives</b>			
-Amount (unit)	7	-	7
-Percentage	100.0	-	100.0
<b>Stable cooperatives</b>			
-Amount (unit)	1	1	2
-Percentage	50.0	50.0	100.0

Note: The accuracy of the model used for early warning was 88.9% of all small and medium sized agricultural cooperatives tested.

Table 3.3 Result of the appropriateness of logit model for large-sized agricultural cooperatives

Statistical value	Result
-2Log likelihood	53.683
Cox & Snell R Square	0.580
Nagelkerke R Square	0.845
<b>Hosmer and Lemeshow Test</b>	
- Chi-square	1.477
- P-Value	0.993

From the above Logit model, Exp (B) or  $e^{b_i}$  was more than 1 for both ratios. It was indicated that if the return on asset ( $X_6$ ) or the capital reserve growth rate ( $X_{11}$ ) increased, while the other was constant, the chance for large size cooperatives to be more stable increased. That model can be written in the form of Logistic Response Function which can be used as Early Warning System for large agricultural cooperatives with the cut of point at 0.5 as follows;

$$P = \frac{e^{-5.71804 + 1.77554(X_6) + 0.00007(X_{11})}}{1 + e^{-5.71804 + 1.77554(X_6) + 0.00007(X_{11})}} \quad (3.4)$$

When testing the acquired model with 20 large agricultural cooperatives, it was found that the accuracy of the model used for early warning was 85.0%, as in Table 3.4

Table 3.4 The accuracy of the model used for early warning to large agricultural cooperatives

Status	The model classified as unstable cooperative	The model classified as stable cooperative	Total
<b>Unstable cooperatives</b>			
-Amount (unit)	14	2	16
-Percentage	87.5	12.5	100.0
<b>Stable cooperatives</b>			
-Amount (unit)	1	3	4
-Percentage	25.0	75.0	100.0

Note: The accuracy of the model used for early warning was 85.0% of all large-sized agricultural cooperatives tested.

### 3.3 Early Warning System of Very Large Agricultural Cooperatives

Out of 356 very large-sized agricultural Cooperatives, 320 cooperatives were used to develop the model. It was found that there were 136 financially stable agricultural cooperatives, and 184 financially unstable agricultural cooperatives. After the logit model development, the findings were that the financial ratios which were used to consider the stability of the cooperatives were the capital reserve to total asset ratio ( $X_2$ ), the return on asset ( $X_6$ ), the asset growth rate ( $X_7$ ), and the profit growth rate ( $X_{12}$ ), as follows;

$$Y = -3.71031 + 8.63299(X_2) + 1.34392(X_6) + 0.00077(X_7) + 0.00006(X_{12}) \quad (3.5)$$

Table 3.5 Result of the appropriateness of logit model for very large-sized agricultural cooperatives

Statistical value	Result
-2Log likelihood	232.749
Cox & Snell R Square	0.471
Nagelkerke R Square	0.633
Hosmer and Lemeshow Test	
- Chi-square	7.731
- P-Value	0.470

From the above Logit model, Exp (B) or  $e^{b_i}$  was more than 1 for the four ratios. It was indicated that if the capital reserve to total asset ratio ( $X_2$ ) or the return on asset ( $X_6$ ) or the asset growth rate ( $X_7$ ) or the profit growth rate ( $X_{12}$ ) increased, while the others were constant, the chance for very large cooperatives to be more stable increased. That model can be written in the form of Logistic Response Function which can be used as Early Warning System for very large agricultural cooperatives with the cut of point at 0.5 as follows;

$$P = \frac{e^{-3.71031+8.63299(X_2)+1.34392(X_6)+0.00077(X_7)+0.00006(X_{12})}}{1 + e^{-3.71031+8.63299(X_2)+1.34392(X_6)+0.00077(X_7)+0.00006(X_{12})}} \quad (3.6)$$

When testing the acquired model with 36 very large agricultural cooperatives, it was found that the model has the accuracy of the model used for early warning was 88.9%, as in Table 3.6.

### 4. Conclusion and Review of Study

The financial indicators in the model for small and medium sized agricultural cooperatives consisted of the capital reserve to total asset ratio and the return on asset with coefficient of 10.22416 and 0.56687, respectively. The constant was -3.00182.

Table 3.6 The accuracy of the model used for early warning to very large agricultural cooperatives

Status	The model classified as unstable cooperative	The model classified as stable cooperative	Total
Unstable cooperatives			
- Amount (unit)	22	-	22
- Percentage	100.0	-	100.0
Stable cooperatives			
- Amount (unit)	4	10	14
- Percentage	28.6	71.4	100.0

Note: The model has the accuracy of the model used for early warning was 88.9% of all very large-sized agricultural cooperatives tested.

The financial indicators in the model for large-sized agricultural cooperatives consisted of the return on asset and the capital reserve growth rate with coefficient of 1.77554 and 0.00007, respectively. The constant was -5.71804.

The financial indicators in the model for very large sized agricultural cooperatives consisted of the capital reserve to total asset ratio, the return on asset, the asset growth rate, and the profit growth rate with coefficient of 8.63229, 1.34392, 0.00077, and 0.00006, respectively. The constant was -3.71031. The accuracy of the model for these three sized cooperatives used for early warning were 88.9, 85.0 and 88.9% respectively.

The result of the study is corresponded with the study of Beaver (1966) referred in Washington (2001) which concludes that if any business is overwhelmed with tremendous debt loads, it is likely to be highly unstable. In addition, the return on asset or the net income per total asset is capable be early warning of measures.

Moreover, it was indicated that the financial ratio from the analysis result used for early warning, regardless of whatever size the cooperative is, always reflects the assets. This is in line with the study result of Martin (1977) and Shirata (1998) which showed that the ratios reflecting assets played the important role to forecast the chance of business bankrupt whether it will be or not.

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