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# A Study on Financial Ratio and Prediction of Financial Distress in Financial Markets

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## Abstract

**Purpose** – This study investigates the financial ratio of savings banks and the effect of the ratio having influence upon bankruptcy by quantitative empirical analysis of forecast model to give material of better management and objective evidence of management strategy and way of advancement and risk control.

**Research design, data, and methodology** – The author added two growth indexes, three fluidity indexes, five profitability indexes, and four activity indexes CAMEL rating to not only the balance sheets but also the income statement of thirty savings banks that suspended business from 2011 to 2015 and collected fourteen financial ratio indexes. IBMSPSS VER. 21.0 was used.

**Results** – Variables having influence upon bankruptcy forecast models included total asset increase ratio and operating income increase ratio of growth index and sales to account receivable ratio, and tangible equity ratio and liquidity ratio of liquidity ratio. The study selected total asset operating ratio, and earning and expenditure ratio from profitability index, and receivable turnover ratio of activity index.

**Conclusions** – Financial supervising system should be improved and financial consumers should be protected to develop saving bank and to control risk, and information on financial companies should be strengthened.

**Keywords:** Bankrupt Saving Bank, Discrimination and Analysis, Growth Index, Fluidity Index, Profitability Index.

**JEL Classifications:** C32, G21, G32.

## 1. Introduction

Saving bank grew up based on petty loan for the people to keep high position. The bank that relied upon high interest loan of 20 to 30% for the people lost competitiveness in the latter half of the 1980s at loan expansion of commercial bank and low interest rate to worsen financial soundness. In 1997, saving bank's management environment worsened at Asian Financial Crisis to lessen number of the bank by restructuring (Park, 2009).

The financial crisis triggered by poor sub-prime mortgage made Hedge Fund bankrupt in August 2007, and loss of banks was expanded rapidly and 2007 sub-prime mortgage event made Lehman Brothers bankrupt to have influence upon world finance and economy in the UK and Spain and other European countries to create global financial crisis and

to worsen saving bank's management environment and produce red and to make saving bank bankrupt (Yang, 2011). Local saving banks that expanded investment of loan of PF (project financing) reduced their number from 147 in 2000 to 87 in 2014.

Financial institutions' insolvency is not a sudden occurrence at a particular point in time, but it has been a complex phenomenon and has been showing signs of financial mismanagement several years ago (Kim, 2017; Mohammadi & Esmailioghaz, 2017; Shirzad, Mohammadi, & Haghghi, 2015). In addition, the legal bankruptcy or inability of financial institutions to pay for creditors, shareholders, and stakeholders contributed to a balanced social destruction (Zhao, 2016)

Financial institutions expanded mutual connection at global market and innovated financial technique, and financial market can be instable to have influence upon financial market and economy in the world (Jeong & Oh, 2010). Financial institutions in Korea expanded turnover at global financial crisis to systemize to be short of risk control. Financial institutions were bankrupted to let management lose moral and to worsen local financial environment. At the

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moment, financial market should have system to keep financial stability and to get stability at the change of global financial environment.

Quantitative study on financial stability at global financial crisis can prevent bankruptcy and to forecast bankruptcy model and to lessen social expense at bankruptcy of financial institutions and to prevent bankruptcy and to improve post procedure (Jeong & Oh, 2010).

In 2000, saving bank adopted CAMEL rating to judge capital adequacy, asset quality, management, earnings and liquidity and others and to rate the bank's management by the grades of excellent, good, common, weak and risky (Park, 2009). CAMEL is needed to evaluate management of the bank and to forecast bankruptcy. Early warning system was made by using financial institution's financial statement (Stuhr & Whicklen, 1974; Korobow & Stuhr, 1975). In the case of Beaver (1966), the nonperformance forecasting model is applied to quantitative nonperformance forecasting techniques such as univariate analysis (Beaver, 1966; Kim, 2017) and multi-variate discriminant analysis (Altman, 1968; Deakin, 1972; Kassas & Soileau, 2014; Kim, 2017; Laitinen & Suvas, 2016) to improve the accuracy of the default forecast.

This study made discriminant analysis (Altman, 1968) to investigate financial institutions by variables of financial ratio of not only CAMEL rating but also precedent studies to do quantitative analysis of bankruptcy of the bank.

This study did quantitative analysis of financial ratio of bankrupt saving bank and bankruptcy model to verify financial ratio. The study gave material for better management as well as objective evidence to advance the bank and to control risks.

## 2. Methodologies

### 2.1. Materials

The subject was 30 bankrupt saving banks that suspended business from 2011 to 2015 according to financial statement from March 2008 to December 2014: The study collected material to verify variables having influence upon bankruptcy based on financial ratio index and forecast models. The study collected material of 15 bankrupt saving banks in 2011, 8 banks in 2012, 5 banks in 2013, 1 bank in 2014, and 1 bank in 2015.

11 variables of four sections excluding capital appropriateness, asset soundness, management control, profitability and liquidity and profit rate of net worth were used (Park, 2009), and profit rate of net worth and expense rate were also used. Bankruptcy models of 1 year, 2 years and 3 years before were adopted. Bankruptcy forecast model of Saemaul Bank from 2000 to 2004 was made with 17 financial rates including growth rate, liquidity rate and profitability rate of CAMEL to investigate forecast of 1 year, 2-years, 3-years and 4-years before bankruptcy model based on management rating grade (Jeong & Cho, 2008). 23

financial rates were selected according to optimum capital, asset soundness, profitability, liquidity, growth and effectiveness of CAMEL based on financial statement of 2002 to 2007 saving bank to consist of financial ratio of 1 year, 2-year and 3-year before business suspension. The subject was 30 saving banks being suspended from 2011 to 2015. The study added two of growth indexes, three of liquidity indexes and five of profitability indexes of CAMEL rating to balance sheet as well as income statement (Jeong, & Cho, 2008) to get fourteen of financial ratio indexes. The study distinguished 498 statistics by one year before suspension (D-1 year), two years before suspension (D-2 year), three years before suspension (D-3 year) and three years after suspension (D-4 year) to reorganize bankruptcy model by suspension time.

### 2.2. Variables

Gyeongbuk Nonghyup was bankrupted according to profit rate of net worth and fixed asset ratio were (Kim, 2003), and fixed asset ratio, interest of lending, and fixed asset ratio were (Jang & Kim, 2004). Bankruptcy forecast model of Saemaul Bank varied depending upon total asset increase rate, operating income increase rate, fixed asset profit rate, total capital turnover rate, turnover of net worth, sales to account receivable ratio and turnover of buying debt (Nam & Jin, 2011).

The study investigated difference between bankruptcy forecast model and financial rate of bankrupt saving banks, and two of growth indexes, three of liquidity indexes, five of profitability indexes and four of activity indexes were used to determine forecast model of bankruptcy <Table 1>.

### 2.3. Methodology

This study collected two of growth, three of liquidity, five of profitability and four of activity of not only balance sheet but also income statement of 30 saving banks from March 2008 to December 2014. ANOVA (analysis of variance) was done to select financial ratio having significant difference of D-1 year, D-2 years, D-3 years and D-4 years. The study selected financial rates having great influence upon discriminant function to investigate cross tab of forecast group by group and classification function.

The study examined difference of 14 indexes of business suspension D-1 year, D-2 years, D-3 years and D-4 years of bankrupt saving bank, and investigated relation between bankruptcy forecast model and fourteen financial ratio to get causes of bankruptcy and accuracy of forecast group. IBM SPSS VER. 21.0 was used. First, the study investigated relation and direction of total asset increase, operating income increase, fixed asset ratio, net worth ratio, liquidity, profit of net worth, operating capital profit, total asset operating profit, expense, income, total asset profit, total capital turnover, net worth turnover, sales receivable turnover, and purchase debt turnover.

**Table 1:** Selection of the variables

Index	number of index	Variables	Estimation
Growth	2	Total asset increase	$[(\text{current total asset} - \text{previous term total asset}) \div \text{previous term total asset}] \times 100$
		Operating income increase	$[(\text{current operating income} - \text{previous term operating income}) \div \text{previous term operating income}] \times 100$
Liquidity	3	Fixed asset ratio	$(\text{fixed asset} \div \text{net worth}) \times 100$
		Net worth rate	$(\text{net worth} \div \text{total asset}) \times 100$
		Liquidity	$(\text{liquid asset} \div \text{liquid debt}) \times 100$
Profitability	5	Net worth profit	$(\text{current net income} \div \text{net worth}) \times 100$
		Total asset profit	$(\text{operating income} \div \text{total asset}) \times 100$
		Expense	$[\text{expense}(\text{labor cost} + \text{expense}) \div \text{operating income}] \times 100$
		Income rate	$(\text{operating income} \div \text{operating expense}) \times 100$
		Total asset profit rate	$(\text{current net profit} \div \text{total asset}) \times 100$
Activity	4	Total capital turnover	$(\text{sales} \div \text{total asset}) \times 100$
		Net worth turnover	$(\text{sales} \div \text{net worth}) \times 100$
		Receivable turnover	$(\text{sales} \div \text{receivable}) \times 100$
		Buying debt turnover	$(\text{sales} \div \text{buying debt}) \times 100$

**Table 2:** Descriptive statistics

Section(N=498)		Min	Max	Mean	Standard error	Standard deviation
Growth	Total asset increase	-51.38	617.86	11.09	2.13	47.55
	Operating income increase	-69.75	649.76	12.13	2.59	57.77
Liquidity	Fixed asset ratio	-6207.14	10461.86	123.36	37.27	831.65
	Net worth ratio	-45.13	15.82	3.31	0.30	6.69
	Liquidity ratio	67.70	121.92	102.47	0.32	7.23
Profit	Net worth profit ratio	-11354.43	4725.19	3.70	29.54	659.20
	Total asset operating income ratio	-50.62	8.21	-1.49	0.21	4.65
	Expense rate	2.03	59.58	13.08	0.29	6.58
	Income rate	11.08	535.07	91.43	1.49	33.23
	Total asset profit rate	-49.95	8.55	-1.51	0.21	4.75
Activity	Total asset turnover	1.19	19.31	6.02	0.14	3.02
	Net worth turnover	-8097.49	12048.04	91.21	41.48	925.69
	Receivable turnover	1.85	36.66	9.24	0.24	5.28
	Purchase debt turnover	0.98	17.50	6.25	0.14	3.10

Second, the study examined financial ratio and difference of D-1 year, D-2 years, D-3 years and D-4 years of bankrupt saving bank. ANOVA was done.

Third, the study investigated effect of D-1 year, D-2 years, D-3 years and D-4 years of the bank to examine accuracy of the functions.

### 3. Empirical Analysis

#### 3.1. Descriptive analysis

The study examined standard deviation of mean and dispersion to verify financial ratio of variables of 30 banks from March 2008 to December 2014. Mean, standard deviation and mean deviation of four of activity indexes were <Table 2>.

#### 3.2. Correlation

Correlation analysis investigated relation and direction of variables of 14 financial rates of bankrupt saving banks.

Correlation results were <Table 3>. Total asset increase had positive relation with operating income increase, and fixed asset ratio had positive relation with not only net worth profit but also net worth turnover. Net worth ratio had positive relation with liquidity, total asset operating income and total asset profit. Net worth profit had negative relation with net worth turnover, and total asset operating profit had very much positive relation with total asset profit. Total asset turnover had positive relation and very much positive relation with purchase debt turnover.

#### 3.3. ANOVA

ANOVA inspected difference between financial ratio and before business suspension of bankrupt bank. Significance of Levene of net worth, liquidity, total asset operating income, income and expenditure, total asset profit and receivable was less than 0.5 and Dunnett T3 post test was done, and significance of total asset increase of Levene was larger than .05 to do Scheffe post test.

F of difference of the group was less than 0.5 and table 4 to differ depending upon business suspension time. The results of the study showed that there were 6 insignificant

results and 8 significant results. Financial ratio varied depending upon suspension time <Table 4>.

**Table 3:** Correlation Analysis

Section	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Total asset increase	1													
2. Operating income increase	.831**	1												
3. Fixed asset ratio	.011	.030	1											
4. Net worth ratio	.163**	.137**	.063	1										
5. Liquidity	.137**	.089*	.022	.829**	1									
6. Net worth profit	-.003	-.017	-.801**	-.037	-.024	1								
7. Total asset operating profit	.173**	.177**	.054	.728**	.589**	-.020	1							
8. Expense	-.048	-.074	.014	-.355**	-.465**	-.035	-.180**	1						
9. Income and expenditure	.141**	.321**	.048	.415**	.361**	.022	.597**	-.313**	1					
10. Total asset profit	.176**	.176**	.073	.728**	.577**	-.033	.980**	-.158**	.593**	1				
11. Total capital turnover	-.066	.021	-.066	-.056	-.043	.047	-.204**	-.123**	.072	-.206**	1			
12. Net worth turnover	.018	.033	.896**	.049	.033	-.897**	.045	-.001	.033	.058	-.045	1		
13. Receivable turnover	-.087	-.001	-.040	-.094*	-.088*	.027	-.202**	-.111*	-.030	-.213**	.824**	-.028	1	
14. Purchase debt turnover	-.045	.036	-.057	.078	.069	.040	-.079	-.164**	.138**	-.081	.988**	-.034	.807**	1

\* p<.05, \*\* p<.01

**Table 4:** Difference of business suspension time of bankrupt saving banks depending upon financial ratio

Section	N	mean	standard deviation	standard error	Levene (p)	F (p)	post hoc result	
Total asset increase	a) D-1year	111	-3.246	24.557	2.331	1.473 (.221)	6.055 (.000)	c>a (Scheffe)
	b) D-2year	120	12.701	25.838	2.359			
	c) D-3year	120	22.895	76.373	6.972			
	d) D-4year	147	10.956	40.869	3.371			
Operating income increase	a) D-1year	111	-1.844	42.664	4.049	1.372 (.250)	3.831 (.010)	c>a (Scheffe)
	b) D-2year	120	15.361	36.622	3.343			
	c) D-3year	120	23.161	85.943	7.845			
	d) D-4year	147	11.022	51.155	4.219			
Net worth ratio	a) D-1year	111	-1.859	8.140	0.773	11.303 (.000)	34.095 (.000)	b>a c>a d>a (Dunnett T3)
	b) D-2year	120	4.630	2.478	0.226			
	c) D-3year	120	4.759	4.027	0.368			
	d) D-4year	147	4.940	7.625	0.629			
Liquidity	a) D-1year	111	97.921	8.134	0.772	4.671 (.003)	21.639 (.000)	b>a c>a d>a (Dunnett T3)
	b) D-2year	120	103.675	5.003	0.457			
	c) D-3year	120	103.304	5.619	0.513			
	d) D-4year	147	104.242	7.823	0.645			
Total asset operating profit	a) D-1year	111	-4.255	7.264	0.689	18.748 (.000)	18.921 (.000)	b>a c>a d>a (Dunnett T3)
	b) D-2year	120	-0.643	1.649	0.151			
	c) D-3year	120	-0.472	1.984	0.181			
	d) D-4year	147	-0.930	4.550	0.375			
Income and expenditure	a) D-1year	111	75.024	53.406	5.069	6.173 (.000)	12.547 (.000)	b>a c>a d>a (Dunnett T3)
	b) D-2year	120	94.623	22.360	2.041			
	c) D-3year	120	96.888	19.539	1.784			
	d) D-4year	147	96.759	24.988	2.061			
Total asset profit	a) D-1year	111	-4.652	7.462	0.708	23.060 (.000)	23.774 (.000)	b>a c>a d>a (Dunnett T3)
	b) D-2year	120	-0.633	1.667	0.152			
	c) D-3year	120	-0.483	2.138	0.195			
	d) D-4year	147	-0.676	4.390	0.362			
Receivable turnover	a) D-1year	111	10.470	5.880	0.558	4.266 (.005)	4.766 (.000)	a>d (Dunnett T3)
	b) D-2year	120	9.542	5.521	0.504			
	c) D-3year	120	9.267	5.609	0.512			
	d) D-4year	147	8.041	3.983	0.329			

**Table 5:** Discriminant analysis on financial ratio and suspension time of bankrupt saving banks

Independent variables	Relation between discriminant function and independent variable		
	1	2	3
Net worth	.733	.362	.087
Total asset profit	.602	.395	.036
Liquidity	.591	.162	.253
Total asset operating income	.523	.445	.015
Revenue	.445	.211	-.105
Total asset turnover	-.057	-.031	-.027
Purchase debt turnover	.041	-.005	-.015
Operating income increase	.186	.350	-.311
Trade receivable turnover	-.250	.279	.131
Expense	-.123	-.234	-.180
Total asset increase	.240	.389	-.521
Fixed asset ratio	.111	.205	.482
Net worth turnover	.050	.183	.273
Net worth profit	.035	-.075	-.186
Eigen value	.367	.074	.016
Descriptive dispersion(%)	80.3	16.1	3.6
Rc(Rc2)	.518(.269)	.262(.068)	.127(.016)
Wilks lambda (p)	.670(.000)	.917(.022)	.984(.790)

©(D-3year) of total asset was larger than @ (D-1year) ( $p < .05$ ), and ©(D-3year) of operating income increase was larger than @ (D-1year). ⓑ(D-2year) of net worth was larger than that of @ (D-1year) ( $p < .05$ ), and ©(D-3year) was larger than @ (D-1year) and ⓓ(D-4year) was larger than @ (D-1year). Total asset operating income was larger than that of ⓑ(D-2year) ( $p < .05$ ), and that of ©(D-3year) was larger than that of @ (D-1year) and that of ⓓ(D-4year) was larger than that of @ (D-1year). Income ratio of ⓑ(D-2year) was larger than that of @ (D-1year) ( $p < .05$ ) and that of © (D-3year) was larger than that of @ (D-1year), and ⓓ (D-4year) had more difference than @ (D-1year). Total asset profit of ⓑ(D-2year) was larger than that of @ (D-1year) and that of ©(D-3year) was larger than that of @ (D-1year) and that of ⓓ(D-4year) was larger than that of @ (D-1year). Receivable turnover of @ (D-1year) was larger than that of @ (D-1year) ( $p < .05$ ). Receivable turnover of @ (D-1year) was larger than that of ⓓ(D-4year) ( $p < .05$ ).

**3.4. Test results**

The study investigated variables of financial ratio having influence upon group of D-1year, D-2year, D-3year and D-4years before suspension of bankrupt banks to verify accuracy of the function between groups and to do discriminant analysis. Financial ratio being independent variable was <Table 5>.

The study found out three of discriminant functions, and both first function and second function were ( $p < 0.5$ )(Table 5).

Eigenvalues were 80.3%, 16.1%, and 3.6% to explain discriminant function. Rc indicates correlation between discriminant function and group, and Rc2 does distribution between discriminant function and group, and first

discriminant has correlation of .518 and shared distribution of 26.9% to contribute the most. So, large financial ratio of first discrimination had good discrimination.

Financial ratio with high discrimination between discriminant function and independent function included net worth rate, total asset profit rate, liquidity rate, total asset operating profit rate, income rate, receivable turnover rate, total asset increase rate and operating income increase rate in order. They were important factors to distinguish effects upon D-1year, D-2year, D-3year and D-4year group of the banks.

The study investigated D-1year, D-2years, D-3years and D-4 years group by financial rate of the banks <Table 6>: The discriminant functions classified the banks into D-1year of 61.3%, D-2year of 33.3%, D-3year of 35.8% and D-4year of 53.7%.

**Table 6:** Classification of suspension time of bankrupt saving banks

(unit : bank, %)

Sections		Bankrupt saving bank forecast group				Total
		D-1year	D-2year	D-3year	D-4year	
Bankrupt saving bank groups	D-1year	68	16	15	12	111
		61.3	14.4	13.5	10.8	100.0
	D-2year	8	40	38	34	120
		6.7	33.3	31.7	28.3	100.0
	D-3year	13	21	43	43	120
		10.8	17.5	35.8	35.8	100.0
	D-4year	9	14	45	79	147
		6.1	9.5	30.6	53.7	100.0

Accuracy rate : 46.2%

## 4. Summary

### 4.1. Summary

The study did quantitative analysis on financial ratio and bankruptcy forecast models of 30 bankrupt banks from 2011 to 2015 according to financial statement from March 2008 to December 2041. The findings of bankruptcy forecast were:

First, total asset increase had positive relation with operating income increase, and fixed asset ratio had positive relation with net worth turnover. Net worth ratio had positive relation with liquidity, total asset operating profit and total asset profit. Net worth profit had negative relation with net worth turnover, and total asset operating profit had much high positive relation with total asset profit. Total capital turnover had much positive relation with receivable turnover as well as purchase debt turnover.

Second, the bank's financial ratio varied depending upon suspension time. At post-hoc test, D-3years had the largest difference with D-1year, and D-3year and D-1year of operating income increase had the largest difference.

Net worth ratio of D-2years was larger than that of D-3years and D-1year, and that of D-3years was larger than that of D-1year, and that of D-4years was larger than that of D-1year. Liquidity of D-2year was larger than that of D-1year, and liquidity of D-3year was larger than that of D-1year, and that of D-4year was larger than that of D-1year. Total asset operating income of D-2year was larger than that of D-1year, and total asset operating income of D-3year was larger than that of D-1year, and that of D-4years was larger than that of D-1year. Total asset profit of D-2year was larger than that of D-1year, and that of D-3year was larger than that of D-1year, and that of D-4year was larger than that of D-1year. Receivable turnover of D-1year was larger than that of D-4years.

Third, discrimination between discriminant function and independent variable was high in order of net worth ratio, total asset profit ratio, liquidity, total asset operating income, revenue, receivable turnover, total asset increase and operating income increase. The factors can be important to judge effect of 4 groups of 4 groups by suspension time. The study classified into D-1year of 61.3%, D-2year of 33.3%, D-3year of 35.8%, and D-4year of 53.7% to have accuracy of 46.2%.

Bankruptcy of the bank varied depending upon net worth ratio, total asset profit, liquidity, total asset operating profit, income and expenditure, receivable turnover, total asset increase and operating income increase. Net worth ratio was important at bankruptcy forecast to have bankruptcy at decrease with high debt ratio (Park & Kim, 2002). Net worth turnover was used to forecast bankruptcy of listed firms and to have no influence on bankrupt bank.

Net worth ratio, liquidity, income and expenditure were important to forecast bankruptcy (Jeong & Cho, 2008). In

this study, expenditure and total asset operating income were not important. Receivable turnover was used (Jang, 1998) and net worth was used (Jeong, 1998). Liquidity, net worth, total asset profit, income and expenditure and total asset operating income were used (Nam, 1998). In this study, fixed asset ratio was not used. Purchase debt turnover was used (Kang & Hong, 1999).

Financial institutions did not include growth at discriminant variables and bankruptcy could be judged by growth and profitability after Asian Financial Crisis (Jeong & Cho, 2008). In this study, not only total asset increase but also operating income increase of growth index, and not only net worth but also liquidity ratio of liquidity index were used. Not only total asset operating profit but also income and expenditure of income index, and receivable turnover of activity index were used. A study on bankruptcy forecast model needs to consider growth, profitability and liquidity in the future.

### 4.2. Suggestion

This study investigated 7-years financial statement in March, June, September and December from 2008 to 2014. Forecast of bankruptcy model was the highest at one year before bankruptcy, and was low 2 years and 3 years before suspension. And, it was high 3 years after suspension. At short forecast time, management environment was worsened to have bad financial ratio, and to be high 3 years after suspension. So, the bank needed supervising system to keep financial transparency and to elevate management system.

The study gave advancement and risk control of the banks:

First, financial supervising shall be developed and financial consumers shall be protected. Financial supervising system has relation with financial market and consumers to increase market risk and consumer's loss at failure of financial supervision and to develop it to get stability and soundness.

Information on financial companies shall be collected and bankrupt financial institutions shall be put in order. Information sharing of financial safety net shall increase to minimize burden of the people economy and to supervise financial institutions. Legal system shall prevent management from moral hazard.

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