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Analysis of Bank Failure Using Published Financial Statements: The Case of Indonesia (Part 1)

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Abstract: Published financial statement is the only publicly available report on financial condition of a bank operating in Indonesia. It contains limited information, but we want to exploit it to discriminate between normal, problem, and liquidated banks and to find factors underlying these conditions.

We observed 213 banks and analyzed 32 initial variables representing earning and profitability, productivity and efficiency, quality of assets, capital adequacy, growth and aggressiveness, credibility, size, income and source of fund diversification, liquidity, and dependence on affiliates.

In the classification we used ranks of each variable rather than its numerical value as such. After making necessary transformations, creating new variables and deleting unnecessary variables, we found that the ranks of 12 variables out of initial 32 could discriminate three groups of banks significantly two years before failure while the ranks of just two variables could discriminate significantly one year before failure.

In this first paper we outline our approach and consider variables describing earning and profitability, productivity and efficiency and quality of assets. In the second paper we continue the analysis of other variables. Then we show that, for good discrimination, it is sufficient to select seven basic aspects of financial structure and performance of a bank, which can be efficiently and consistently measured by the variables of simple and clear intuitive meaning (see the

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list of abbreviations below in the text). These are: efficiency in productivity and earning (ranks of EBT/SE, PM, ROE and ROEA), capital adequacy (ranks of E/EA and E/L), interest gap (ranks of IM and NII/L), credibility (ranks of ARCF), liquidity (ranks of LA/D), dependence on affiliates (ranks of NFA/L), and security of earning assets (ranks of PLL/L).

Key words: Bank failure, ranks.

1. Introduction. Data, initial variables, and method

1.1 Historical background

One of important factors caused the difficulties of Indonesian economy just few years ago was the collapse of Indonesian banking sector. It began with the taking over of 5 private banks forcefully in the middle of 1997 and then the liquidation of 16 private banks on 1 November 1997. The liquidation process had taken a long time to complete for the expense of the depositors of liquidated banks because their deposits could not be repaid promptly and they might not be repaid in full due to the bad quality of the bank assets. This caused many of depositors no longer trust to Indonesian-owned banks, and then they withdrew their deposits. This worsened the situation and made many illiquid Indonesian banks became insolvent.

On 8 April 1998, there were 7 more banks that had to be liquidated and there were 7 banks that had to be taken over by IBRA (Indonesian Banking Restructuring Agency). Also, since then there have been another 40 banks which have to operate under strict supervision of IBRA.

Most of depositors do not recognize the soundness of a bank because the central Bank of Indonesia (BI) has never disclosed any detailed statement on that matter. The only information publicly available is the annual published financial statement of a bank. It consists of very brief and aggregative balance sheet, profit and loss statement, and contingency statement.

Therefore the question arises whether the depositor can exploit such limited information from a published financial statements in order to get

the similar conclusion on the soundness of a bank as achieved by BI using the complete and detailed financial statements.

1.2 Objective

In this paper we wanted to find variables related to the financial structure and performance of a bank which could separate out ailing banks prior to the failure. These variables, then, can be used to make an early warning model of a bank failure.

1.3 Data

Data used in this project are derived from the published financial statements of 213 banks operating in Indonesia as of 31 December 1994, 31 December 1995, and 31 December 1996. As of 31 December 1996 there were 242 banks operating in Indonesia. There are 29 banks whose financial statements either are not available or contain some incomplete or missing accounts, or are contradictory hence they are deleted from observation.

Banks are grouped by their status of operation. The first group contains banks which were ceased to be exist either by being merged forcefully by another bank, or by being liquidated, or by being taken-over forcefully by IBRA. The second group contains banks which were to operate under strict supervision by IBRA. The third group contains the other banks. The first group is called Liquidated Banks (L), the second one is called Problem Banks (P), and the third one is called Normal Banks (N). Each group consists of 25, 33, and 155 banks respectively (see Appendix A and B for complete lists).

1.4 Initial variables

There are some basic financial performance and structural characteristics to evaluate a bank, namely profitability, efficiency or productivity, quality of assets, growth and aggressiveness, liquidity, size, capital adequacy, income diversification, and dependence on affiliates.

There is, certainly, no single variable which could measure and represent each characteristic perfectly. There are, typically, several variables that

proximate to a characteristic of interest.

Based on literature review on banking and financial institutions and initial judgment, we chose the following variables to represent each characteristics as listed below.

Earning and profitability:
Return on Assets (ROA) = Net Income / Assets (NI/A)
Return on Equity (ROE) = Net Income / Equity (NI/E)
Return on Earning Assets (ROEA) = Net Income / Earning Assets (NI/EA)
Return on Loans (ROL) = Interest Income / Loans (II/L)
Interest Income / Earning Assets (II/EA)
Net Interest Income / Earning Assets (NII/EA)
Interest Margin (IM) = Return on Fund - Cost of Fund (IM)

Productivity and efficiency:
Operating Expense / Operating Income (OE/OI)
Profit Margin (PM) = Earning Before Taxes / Operating Income (EBT/OI)
Staff Expense / Assets (SE/A)
Non-interest Expense / Assets (NonIE/A)

Quality of assets:
Write-offs / Loans (W/L)
Provision for Loan Losses / Loans (PLL/L)
Provision for Loan Losses / Equity (PLL/E)

Capital adequacy:
Equity / Assets (E/A)
Equity / Earning Assets (E/EA)
Equity / Loans (E/L)

Growth and aggressiveness:
Loans Growth Rate (LGR)
Loans-Market-Share Increment (LMSI)
Deposit Growth Rate (DGR)
Deposit-Market-Share Increment (DMSI)

Equity Growth Rate (EGR)
Loans to Deposit Ratio = Loans / Deposit (L/D)

Credibility or cost of fund:
Interest Expense / Deposit (IE/D)
Interest Expense / Third Party Fund (IE/TPF)

Size:
ln (Assets) (lnA)

Income and sources of fund diversification :
Non-interest Income / Operating Income (NonII/OI)
Deposit / Third Party Fund (D/TPF)

Liquidity:
Liquid Assets / Deposit (LA/D)

Dependence on affiliates:
Loans to Affiliate / Loans (LtA/L)
Deposits from Affiliate / Deposit (DfA/D)
Funds from Affiliate / Third Party Fund (FfA/TPF)

The nature of the above variables and their discriminating power will be investigated and described in Section 2.

1.5 Method

There are some problems we have to encounter in the data set: sparseness on high dimensional space, heterogeneity in the range and distribution of variables, non-normality behavior of observations in most of variables, and correlation among variables.

Initially, there are 32 variables to form a 32-dimensional space. There are, however, only 213 banks to form vectors of observations, hence these observations will be far too sparse to fill such a high dimensional space:

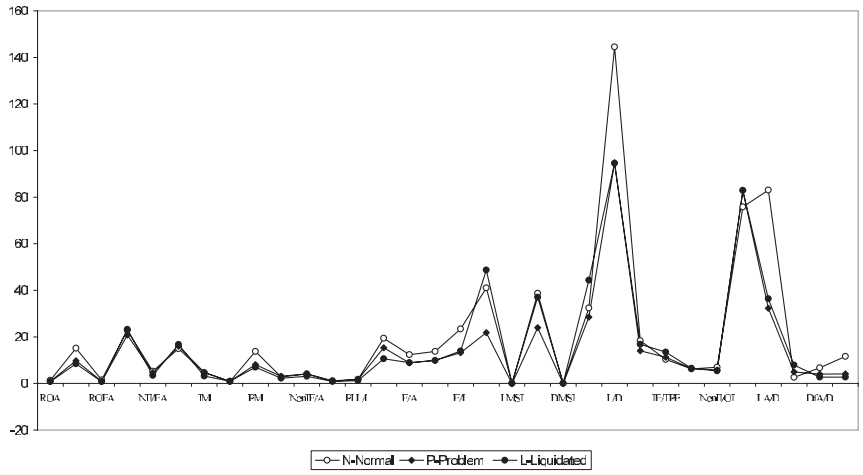

Figure 1. Average values of each variable for each of 3 groups of banks in 1996

if we round up values of each variable only to two possible l levels, that is, if we partition its range into only two groups we will obtain 2^{32} possible subgroups for a 32-dimensional vector – a number uncomparably bigger than 213. It is possible, however, to study marginal (one-dimensional) distribution of each variable having 213 observations. Hence, if we could select or construct a smaller number of parameters which will behave as independent random variables – a task common to all problems of multivariate analysis – we will be able to make reasonable inference about their joint behavior.

Each of our initial variables has, most likely, its own distribution. Even ranges of different variables show considerable difference: for "rates" the range is typically between 0 and 100 (%), but for differences of rates the range must include negative numbers, while for other variables as ratios the range is basically unbounded (see Figure 1). This creates an inconvenient heterogeneity in the analysis as we would then need to analyze many marginal distribution of quite different shape and nature. We believe, however, that the values of the variables themselves are not that important and

the relative order of the values of each variable contains the most of useful information. The ranking is not only more meaningful, as merely figures of financial performances of a bank, in most cases, have no much meaning unless they are compared to those of its peers but also, the ranking is robust against the changing of general economic and banking business environment which influences financial performance in absolute values over all banks.

For a sequence $\{X_i\}_1^n$ of random variables define the rank R_{X_i} of a random variable X_i among all $X_1, \ldots, X_n$ as follows:

$$R_{X_i} = \sum_{j=1}^{n} I_{\{X_j \leq X_i\}}$$

where $I_{\{X_j \leq X_i\}} = 1$ or $= 0$ according to whether the inequality in the brackets is satisfied or not. As we have 213 banks to analyze, in general, R_{X_i} can take any integer value between 1 and 213. In our study we mostly consider and analyze the ranks of values for each variable. It would be appropriate in any analysis, but it is especially natural for rank statistics, to select variables which are of "the higher the better" or "the lower the better" nature. The better banks would tend to have higher (correspondingly, lower) ranks of such variables, which can be naturally detected by rank statistics. Therefore in (Judijanto and Khmaladze 1998) for each variable, based on its economical content and empirical evidence, we discuss whether it is of the higher the better or the lower the better nature or not. Below we present the most essential part of it.

The basic reason for us to consider all 32 variables one-by-one from economical rather than purely statistical point of view lies in the following: in place of some rather formal aggregation of variables with rather formally obtained weights, which may result from, for example, a naive factor analysis, we would much prefer to obtain economically justified variables with intuitively clear meaning and interpretation. However, as one can see in the Section 3 below, the variables we have eventually selected behave as independent "factors" with quite high discriminatory power.

2. The nature of separate variables

2.1 Groups of HB and LB variables

We prefer to represent and to visualize a set of values of all 32 initial variables as a function. Though we listed variables in a natural order within logically justified groups, the functions we get show rather chaotic, irregular behavior. Hence it will be more convenient if we rearrange our variables at least in the following three groups: the higher the better (HB) variables, the lower the better (LB) variables, and others (O).

Apriori variables of the HB group comprises of variables related to earning and profitability (ROA, ROE, ROEA, II/L, IM, II/EA, NII/EA, PM), and to capital adequacy and capital growth (E/A, E/EA, E/L, EGR).

The LB variables group consists of variables related to expenses (OE/OI, SE/A, NoIE/A), indicators for bad quality of assets (W/L, PLL/L, PLL/E), cost of fund (IE/D, IE/TPF), and business dependence on affiliates (LtA/L, DfA/D, FfA/TPF).

The other variables related to growth and aggressiveness (LMSI, LGR, DMSI, DGR, L/D) and size (lnA) for a time being can be joined in the group O because apriori it does not look clear whether they belong to HB or LB groups.

It would be reasonable to expect that the order of our three group of banks will be $N \succ P \succ L$ for HB variables and $L \succ P \succ N$ for LB variables. As it is shown in Figure 2, this, however, is not always the case: not all of the variables behave as they are expected to in the theory and imperfection of data damages and corrupts discrimination power of some of them. In our search for variables with clear characteristics we, therefore, will need to make *re-grouping, deletion, modification,* and *replacement of variables.*

At last we may leave some variables still undecided as we have no more information available at time being to revise or to change them completely using other possible variables. These will be left for further research as there should be more information available in the future.

2.2 Earning and profitability variables

Return on assets (ROA) and return on earning assets (ROEA)

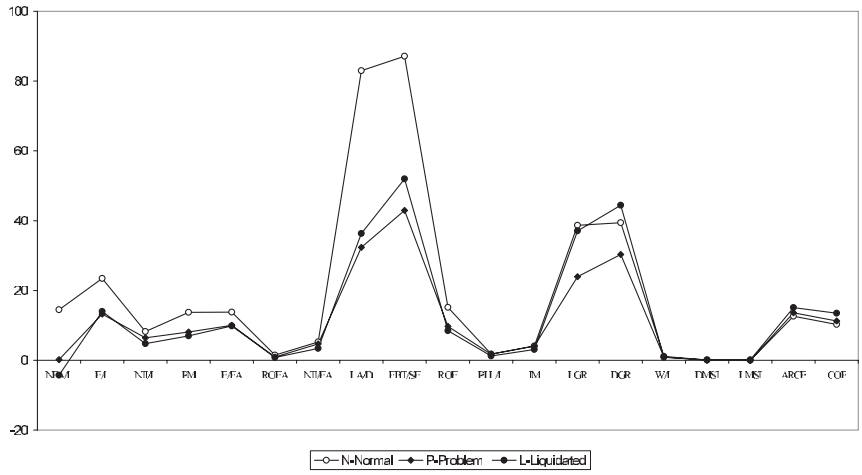

Figure 2. Average ranks of each variable for each of 3 groups of banks in 1996

Both of these variables are HB variables. This prior understanding is well supported by the empirical evidence (see Table 1). On the other hand both variables are very much correlated ($\rho_{1995} = 0.9970$ and $\rho_{1996} = 0.9930$) and it looks clear that to keep only one of them should be sufficient for discrimination purposes.

We think that the choice of ROEA is a bit more logical since it should reflect the management and quality of earning assets a bit more sharply as earning assets (EA) do not comprise of assets that do not directly generate income, like cash in vault, obligatory current account at BI, and properties.

Hence eventually we remove ROA for subsequent analysis and keep only ROEA.

Remark that the range of values of ROEA is about 1%-2% while for some other variables like LA/D it is about 80%. These far apart ranges make the plot of actual values less convenient for visualization and comprehension. On the other hand the ranks of these variables have the same range and are much more convenient for comprehension.

Table 1: Average values and ranks of ROA, ROEA and ROE

Return on assets

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	1.47 (0.14)	1.33 (0.08)	116.24	117.26
Problem	0.94 (0.10)	0.83 (0.11)	84.32	82.17
Liquidated	0.87 (0.65)	0.74 (0.10)	79.66	76.18

Return on earning assets

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	2.06 (0.59)	1.47 (0.10)	115.95	116.99
Problem	1.05 (0.14)	0.94 (0.12)	85.74	83.86
Liquidated	0.94 (0.11)	0.80 (0.09)	79.54	75.62

Return on equity

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	16.17 (2.31)	15.16 (2.52)	108.99	112.38
Problem	10.69 (3.15)	9.72 (1.01)	105.05	96.86
Liquidated	9.60 (0.89)	8.48 (1.00)	97.26	87.02

Here and everywhere below we removed the p-values of tests for statistical significance of changes and such things for the sake of brevity. This information is given in (Judijanto and Khmaladze, 1998)

Return on equity (ROE) and return on earning assets (ROEA)

Both of these variables belong to HB group. This relatively clear prior idea is also well supported by our empirical data (see Table 1 and Figure 3). The banks with higher returns seem really better. At the same time both of these variables are sufficiently good classifiers as the difference in average ranks agrees with the ordering $N \succ P \succ L$.

Basically everyone may agree that if a bank A has both returns ROEA

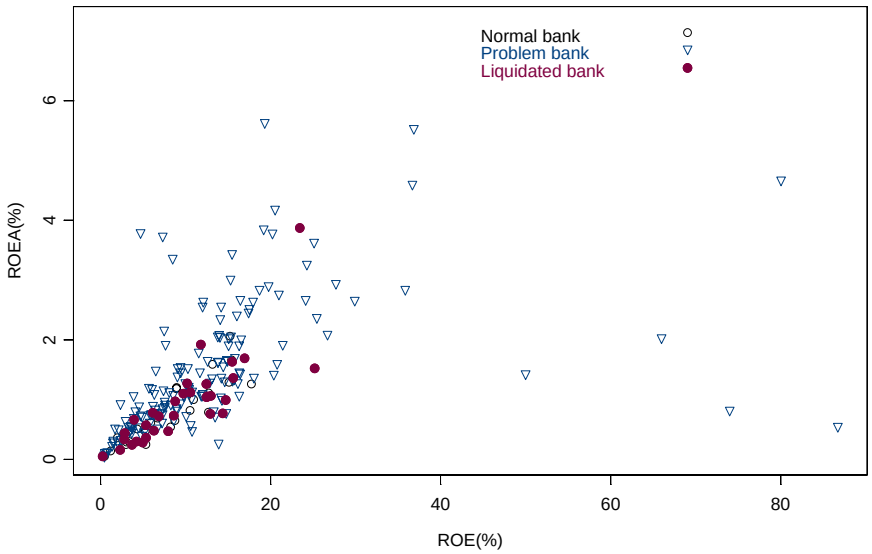

Figure 3. ROEA and ROE in 1996

and ROE higher than those of a bank B, then the bank A is preferable to the bank B. Hence, what looks more interesting is to form an opinion concerning banks A and B when A has high ROEA and low ROE while B has low ROEA and high ROE. As the Figure 3 shows, though most of the banks have typically both returns high or low simultaneously, there still are some banks following each of above mentioned two patterns.

The definition of ROEA and ROE shows that the banks with low ROEA and high ROE are simply those who have small *capital ratio,*

$$\text{Capital Ratio} = \text{Equity} \;/\; \text{Earning Assets}$$

The capital ratio is a characteristic of stability of a bank. There are even formal legal requirements associated with minimal admissible value of capital ratio (more exactly there are requirements concerning so called Capital Adequacy Ratio). Hence though we would not like to say anything specific against banks with low ROEA and high ROE, we still believe that

in between these two groups, banks with high ROEA and low ROE should be preferred since they have higher capital ratio.

Return on loans (ROL)

We recall that according to initial definition

$$\text{ROL} = \text{Interest income / Loans} = \text{II / L}$$

At the first glance one may expect that this variable belongs to the HB group. Indeed, it could be expected that ROL measures profitability of loan portfolio of a bank. For certain degree of risk, the well negotiating bank will be able to get a higher interest from its debtor. Hence it may be expected that such a bank will have higher ROL.

However the empirical evidence is quite different. As the Table 2 shows neither average values nor average ranks of ROL can distinguish between our three groups of banks!

Table 2: Average values and ranks of ROL

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	22.77 (0.76)	22.77 (0.74)	106.82	107.73
Problem	21.29 (0.87)	20.84 (0.79)	103.77	96.83
Liquidated	22.24 (1.08)	23.21 (1.34)	112.38	115.90

One reason for this situation may seem to lie in the definition of ROL. Indeed it will be more logical to use in the numerator not the total interest income (II), but only the part of it generated by loans-loans interest income. However the data on loans interest income is not available. So, alternatively, one can change the denominator and choose earning assets (EA) and not loans only because actually the interest income is generated by the whole amount of earning assets and not only by loans (see definition of EA in "Return on assets ..."). We call this new variable Return on Fund (ROF=II/EA).

The next Table 3 shows the actual situation with this new variable ROF. It is no longer indifferent to groups of banks, but turned into LB variable now.

The explanation behind this behavior of ROF is the following. We could expect that II/L or ROF are HB variables provided we assumed that all banks operating in Indonesia are facing the same risks. Actually, however, normal banks prefer to put their funds into a relatively low-risk asset, even though that kind of project would give a lower interest income. It means that they are more conservative in forming portfolio of earning assets.

Table 3: Average values and ranks of II/EA and NII/L

Interest income/earning assets

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	14.63 (0.28)	14.93 (0.30)	100.19	101.26
Problem	16.19 (0.64)	15.10 (0.55)	126.86	116.41
Liquidated	15.68 (0.61)	16.68 (0.58)	122.98	130.18

Net interest income/loans

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	7.95 (0.79)	8.25 (0.48)	114.99	118.39
Problem	7.30 (0.60)	6.41 (0.66)	106.80	89.68
Liquidated	5.31 (0.30)	4.74 (0.32)	61.66	59.22

The banks from other groups are getting higher interest income at the cost of higher risk. The problem faced by them, which affects their overall financial performance, may not be solely due to their bravety to take a higher-risk earning assets than those of the N group[2]. They may be forced

[2]It has just been revealed in the court house that most of liquidated banks did illegal *plafondering*. Instead of writing off the bad loans, they gave new loans to the bad debtors to repay that previous ones. Indeed this kind of loan arrangement incurred higher interest rate payment. Also in fact, most of bad loans were channeled to their affiliates.

to put their funds into that kind of earning assets simply because they have a relatively higher cost of fund. See more discussion on this in Sec.2.7.

There is one more alternative to ROL variable. This is

$$\text{NII / L} = \text{Net interest income / Loans}$$

The Table 3 demonstrates that this variable now is of quite reasonable performance and actually it belongs to the HB group. It shows that though normal banks deal with lower interest income loans, that kind of loans are more profitable after considering the cost of fund.

The average ranks of values of this variable within each group of banks is quite good discriminator and hence we will use NII/L in our final recommendations.

Net interest income over earning assets (NII/EA)

Similar to NII/L of previous section, this variable also belongs to HB group and allows good discrimination between groups of banks (see Table 4).

Table 4: Average values and ranks of NII/EA

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	6.87 (0.52)	5.22 (0.18)	107.99	116.12
Problem	7.89 (1.54)	4.68 (0.33)	114.35	102.50
Liquidated	5.08 (0.64)	3.42 (0.19)	91.14	56.38

One can think that these two variables, NII/L and NII/EA, may be essentially correlated, and indeed this seems to be the case in Indonesian banks (see Figure 4). We believe, however, that still both variables should be preserved in the analysis so far. It is clear that the difference between the two variables lies in denominators and can be described simply by the

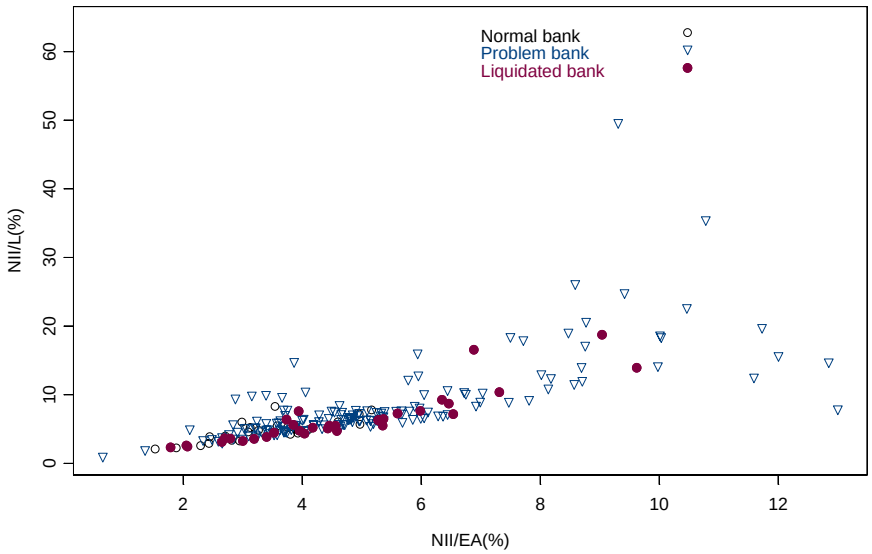

Figure 4. NII/L and NII/EA in 1996

ratio L/EA. This ratio – the share of loans among earning assets – could be quite variable within all groups of banks. Hence the two variables could have sufficient independence in them. Though it is not quite the case in Indonesia, we, on the other hand, see that there is a tendency within a group of normal banks to have smaller share of loans as compared to other banks (see Table 5 and Figure 5).

In statistical terms, for a given value of NII/EA the variable NII/L still tells us about the quality and performance of a bank, because it tends to be higher in the group of normal banks.

Interest margin (IM). Appropriate measure for return on funds (ROF) and cost of funds (COF)

The definition of the variable called interest margin is the following:

$$\mathrm{IM} = \mathrm{ROF} - \mathrm{COF}.$$

Table 5: Average values and ranks of L/EA

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	69.69 (1.39)	70.20 (1.30)	102.21	100.16
Problem	76.85 (1.84)	78.29 (2.29)	125.23	133.98
Liquidated	72.98 (3.14)	74.53 (2.51)	112.66	113.78

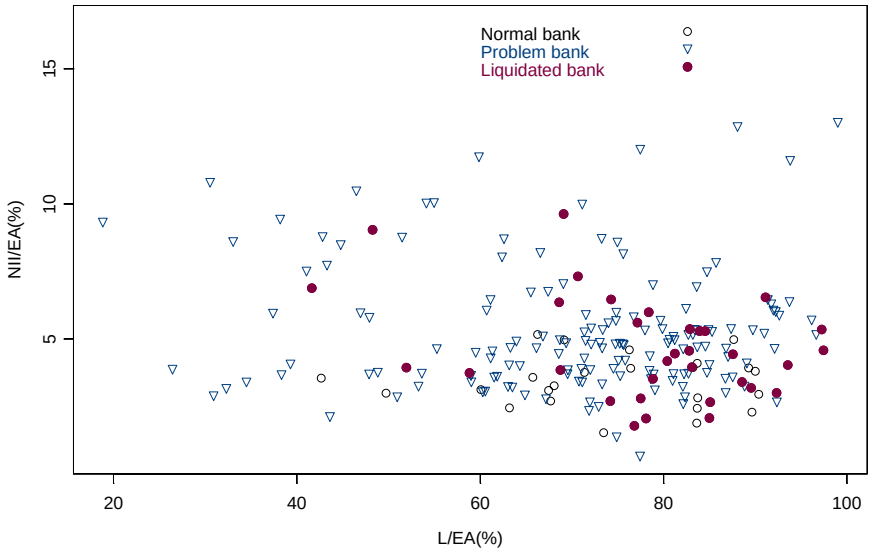

Figure 5. LE/A and NII/EA in 1996

Here ROF stands, obviously, for return on funds and COF – for cost of funds. We certainly will preserve this definition, but we need to be careful in measuring returns on funds and costs of funds adequately.

We have already shown that the definition

$$\text{ROF} = \text{II} \ / \ \text{EA}$$

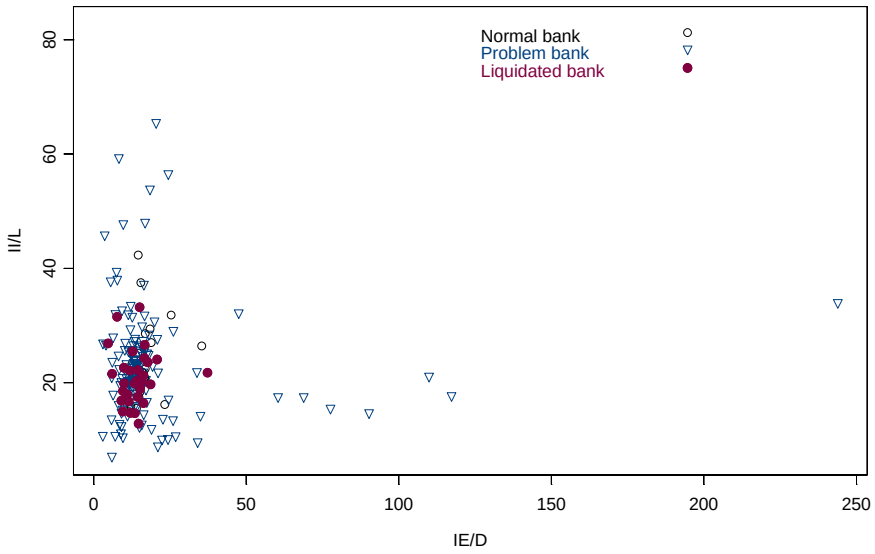

Figure 6. IE/D and IL/L in 1996

is more appropriate than the traditionally used II/L. Now concerning costs of funds we again see that the definition

$$\text{COF} = \text{IE} \ / \ \text{TPF},$$

where TPF stands for the third party fund and is defined as

$$\text{TPF} = \text{Deposits} + \text{Current accounts received} + \text{Borrowed funds}$$

will lead to more logical and proper measure of what intuitively can be understood under the "cost of fund".

Very clear illustration of our point is provided by the scatterplot where on the axes are shown more traditional values of II/L and IE/D. Nothing really can be deduced from this picture (Figure 6).

One thing became particularly clear: if we compare two banks, A and B, and both have the same IM (see Figure 7), the bank A should be preferable because it operates on lower level of returns and costs, hence, is more stable.

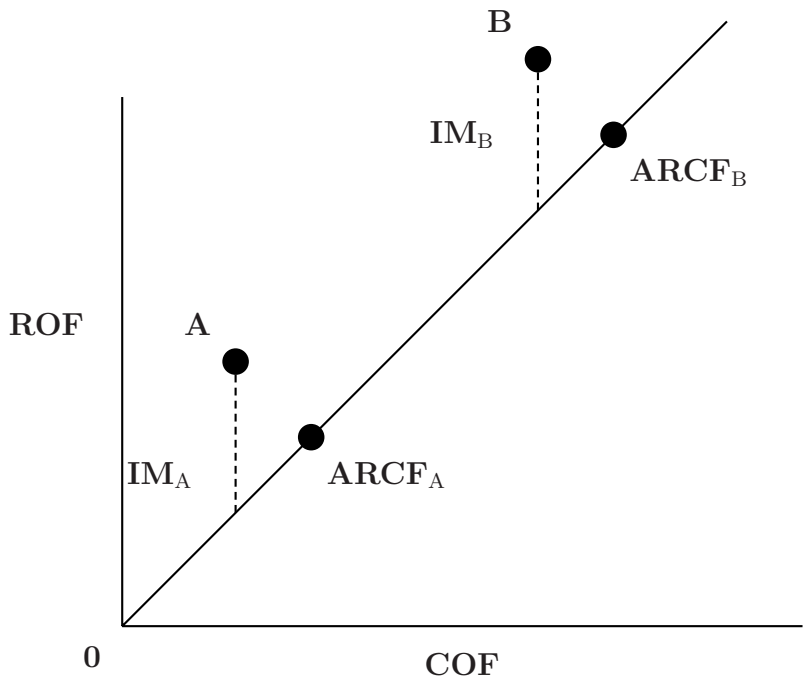

Figure 7. Comparing two banks having the same IM

From this it follows that the new variable, average return and cost of funds, defined as

$$\text{ARCF} = (\text{ROF} + \text{COF})/2$$

will reflect more fully the level of operation and will more comprehensively be used as LB variable.

Most of the normal banks operate on the lower level of ARCF and at the same time tend to have higher IM (see also Table 6). In this connection note that there is a group of some (three) problem banks which nevertheless operate on quite low ARCF and high IM. From this point of view these banks are performing quite satisfactorily.

Though it seems that the problem banks have higher IM than the normal banks do in average ranks, this difference is not statistically significant.

Table 6: Average values and ranks of IM and ARCF

Interest margin

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	4.64 (0.02)	4.08 (0.19)	08.45	110.20
Problem	5.18 (0.44)	4.08 (0.21)	125.23	119.20
Liquidated	3.46 (0.24)	3.11 (0.18)	73.98	71.06

Average return and cost of fund

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	12.31 (0.27)	12.60 (0.29)	99.34	99.33
Problem	13.60 (0.56)	13.62 (0.53)	122.95	115.68
Liquidated	13.95 (0.53)	15.09 (0.57)	133.42	143.08

There is a clear distinction between the liquidated banks and the other groups as the liquidated banks have the smallest IM and the highest ARCF among them. It means that the liquidated banks dealt with high level returns but failed to maintain sufficient interest margin enough to make them exist substantially.

We will use the variables IM and ARCF for further analysis.

2.3 Productivity and efficiency variables

Operating expenses over operating income (OE/OI)

As most of Indonesian banks' main activities are in loans and trading securities, interest income earned from loans and securities is the main source of operating income. Other sources of operating income can be generated from credit card, investment banking, retail banking, export and import, risk management products and services, and other financial intermediary services. Most of operating expenses are incurred for paying interest for de-

posits, borrowing, and issued securities. Other operating expenses include staff, administrative, public relation, telecommunication, office supplies, and research and development expenses.

Indeed, by incurring certain amount of operating expenses a well-managed bank should be able to get the highest possible income. On the other hand, by targeting certain amount of income, a well-managed and efficiently operated bank should only sacrifice the minimum amount of expenses for generating that income. It means that this ratio has the LB characteristic. In fact it is supported by our empirical data (see Table 7).

Table 7: Average values and ranks of OE/OI and PM

Operating expenses/operation income

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	0.88 (0.02)	0.86 (0.01)	96.85	95.52
Problem	0.91 (0.01)	0.92 (0.01)	132.56	136.29
Liquidated	0.93 (0.01)	0.93 (0.01)	136.18	139.50

Profit margin

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	16.13 (2.23)	13.75 (0.87)	117.50	117.78
Problem	8.75 (1.18)	8.13 (1.24)	79.41	80.98
Liquidated	8.10 (0.86)	6.10 (0.95)	78.30	74.50

Though the difference between the problem and liquidated banks is not statistically significant, at least we can say here that normal banks operate more efficiently in terms of this ratio than the other two group of banks.

Profit Margin (PM)

Bank may generate high income. However, this does not mean that this practice always be profitable as this still depends on how high are the

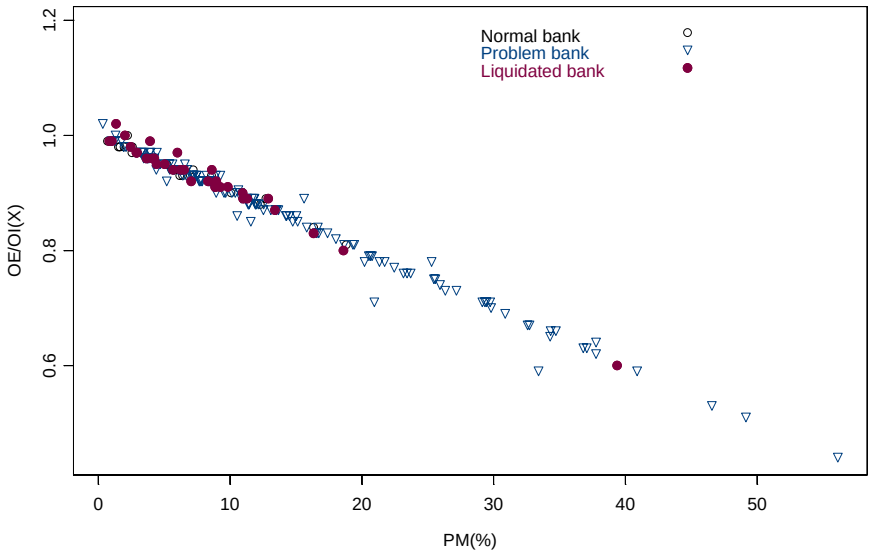

Figure 8. PM and OE/OI in 1996

expenses for generating that amount of income or, in other words, depends on its efficiency. The popular quantity for measuring this characteristic is . profit margin (PM). It is defined as

$$\text{PM} = \text{EBT} \ / \ \text{OI}$$

where EBT stands for earning before taxes (all income subtracted by all expenses) and OI stands for operating income.

Indeed a well-managed bank should earn high and make sufficient gap between income and expenses such that creating high value of profit. Therefore this ratio should belong to the HB group. Table 7 demonstrates that this is supported by empirical data.

Decomposing EBT gives

$$\text{EBT} = \text{OI} - \text{OE} + \text{NonOI} - \text{NonOE}$$

where NonOI and NonOE stand for non-operating income and non-operating expenses respectively. Since both non-operating income and non-operating

expenses are accounted only a small amount compared to operating income and operating expenses, it is clear that

$$\text{PM} = (\text{OI} - \text{OE} + \text{NoOI} - \text{NoOE})/\text{OI} \approx (1 - \text{OE/OI}).$$

It means that there is a close negative relationship between PM and OE/OI. It is exactly supported by empirical data ((1996 = −0.9933) as it is shown in Figure 8. Therefore we will preserve only one of these variables in our analysis. We choose PM as a more commonly used characteristic and, hence, drop OE/OI.

Staff expenses over assets (SE/A)

This ratio is expected to reveal how efficient a bank is in managing its assets in terms of staff expenses incurred. Staff expenses include expenses for salaries, provision for leaves and employee entitlements, and payroll tax. It should be expected that for an efficient bank, for a given amount of assets managed it would cost the least possible. Hence theoretically this ratio has the LB characteristic.

However Table 8 indicates that this ratio does not behave as it was expected. It distinguishes significantly between three groups of banks, but the order is $L \prec N \prec P$ not $N \prec P \prec L$.

It seems that employees of the liquidated banks are underpaid and those of the problem banks are overpaid compared to the normal banks for the similar amount of asset they manage. If it is the case, it means that this variable neither belongs to the HB nor the LB group as the well managed banks may lie in the middle. As we prefer to find variable that has either HB or LB characteristic, therefore we will consider other new variables: OI/SE, EBT/SE, and NI/SE to replace SE/A variable. The reason for putting earning related accounts (OI, EBT, NI) over SE is that we want to create such a variable which intuitively belongs to HB variable.

It is clearly indicated in Table 8 that OI/SE variable does not satisfy our requirement as this variable still shows that the order of group of banks is $L \succ N \succ P$ and not $N \succ P \succ L$. Hence we will no longer consider this variable as a replacement for SE/A.

Table 8: Average values and ranks of SE/A and OI/SE

Staff expenses/assets

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	2.95 (0.12)	2.81 (0.10)	106.39	107.65
Problem	3.43 (0.24)	3.10 (0.18)	131.24	126.98
Liquidated	2.38 (0.13)	2.24 (0.11)	78.78	76.62

Operating income/staff expenses

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	602.49 (23.61)	621.48 (21.19)	105.43	103.81
Problem	511.29 (28.96)	547.05 (31.77)	85.29	86.71
Liquidated	676.35 (29.07)	766.12 (35.19)	145.38	153.58

The second alternative, EBT/SE, seems to behave as HB variable as it is demonstrated in Table 8. Though average ranks of the liquidated banks seems higher than that of problem banks, this difference is not significant at $\alpha = 0.20$.

The third alternative, NI/SE, does not show any improvement over the second alternative (see Table 9). Even worse, it failed to detect difference between the three groups of banks in 1996 and hence could not be considered as the HB variable.

Because of these considerations above, we prefer to use EBT/SE instead of SE/A as a measure of productivity of bank employees for further analysis. It also seems to us more logical as it measures what staff could produce out of existing assets rather than the size of the assets as such.

Non-interest expenses over assets (NonIE/A)

Non-interest expenses are expenses incurred for activities not directly related to money collected from the third party. These include staff expenses,

Table 9: Average values and ranks of EBT/SE and NI/SE

Earning before taxes/staff expenses

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	91.43 (7.55)	87.14 (6.54)	115.49	115.61
Problem	42.87 (5.09)	42.94 (5.70)	74.35	77.32
Liquidated	55.75 (6.49)	51.99 (6.84)	97.46	92.78

Net income/staff expenses

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	63.07 (5.94)	68.25 (0.85)	115.26	107.29
Problem	30.28 (3.73)	70.50 (2.09)	76.44	116.71
Liquidated	38.69 (23.67)	65.06 (1.70)	96.10	92.36

building rent and maintenance, cost of information technology equipment used, and administrative expenses, and also non-operating expenses. These expenses are expected to be as low as possible for managing a given amount of assets. Hence apriori this ratio belongs to the LB group.

Table 10: Average values and ranks of NoIE/A

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	4.29 (0.19)	4.64 (0.19)	108.58	108.56
Problem	4.51 (0.27)	4.76 (0.34)	128.36	124.29
Liquidated	3.21 (0.19)	3.18 (0.24)	69.00	74.50

However Table 10 above indicates that this ratio does not behave as it was expected. It clearly distinguishes significantly between three groups of banks, but it does not create the order $N \prec P \prec L$.

Recall that this ratio is intended for measuring efficiency and at least more than a half of non-interest expenses is in terms of staff expenses. Hence the behavior of SE account seems to influence the behavior of NonIE. In fact, we already have obtained more meaningful and more powerful variable in discriminating between three groups of banks for similar purpose, hence we can and will no longer use this for further analysis.

2.4 Quality of Assets Variables

Write-offs over loans (W/L)

Write-off account in financial statement records amount of loans that can not be repaid by a debtor. If the amount of write-off's for a certain year is compared to the amount of previous year loans, it will indicate the quality of the loans. If this ratio is high, it would mean that previous loans approval was relatively careless as many debtor were no longer able to repay their debts. Hence this ratio should certainly belong to the LB group.

However the empirical data does not seem to support this view (see Table 11).

Table 11: Average values and ranks of W/L

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	1.43 (0.11)	1.11 (0.12)	111.41	109.25
Problem	1.26 (0.19)	0.93 (0.16)	105.08	101.68
Liquidated	0.83 (0.12)	0.85 (0.16)	82.18	100.08

It seems that W/L ratio fails to detect bad quality of loans of the problem and the liquidated banks. It is quite interesting to note that the liquidated banks have even the lowest average value and ranks of this ratio!
There are some explanations why this happens. First, the value of write-off account in profit and loss statement may be understated. Hence these figures may not give the real quality of loans. Second, it is under discretion of a bank management to state whether a loan is classified as a bad debt

or not. A bank management may decide that a bad debt should not be written-off as this practice will make its profit and loss statement look not good. Instead they may keep that loan as if it were a well-serviced loan. In this case the debtor will be forced to pay a higher interest than before. Indeed, this practice conceals the real amount of bad debts.

As we did not find any appropriate replacement for this variable, we put it to the group O (others).

Provision for loan losses over loans (PLL/L)

Provision for loan losses (PLL) is amount of money set aside for recovering possible losses due to bad loans. The riskier the loan the more PLL should be made for that loan by a prudent bank. Or for a given risk assessed, a more conservative bank may set aside more PLL. Though more PLL means more funds become idle as they can not be transformed into earning assets and hence may affect the profitability of a bank, in case of measuring quality of loans this should be considered as a good practice as this will make loans more secure against possible losses. Therefore, apriori PLL/L may be considered as the HB variable *assumed* banks have the same method in assigning PLL.

The empirical data seems to support the HB character of this variable though it is not manifested so strongly. The difference between the three groups of banks is not statistically significant, but it is still reasonable to state that there is a tendency that the order is $N \succ P \succ L$. The reason why the empirical data indicates that PLL/L did not have such a good discriminatory power is that banks seem to apply different methodology to assign PLL as this is not exactly ruled out by the central bank. The most common method for assigning PLL is by automatically giving certain percentage for a loan based on a long-term historical percentage of bad debts in that sector of business at that duration. Even if all banks had used this method, the percentage still can vary. The other method is that a bank considers a loan project case by case and then assign PLL individually and arbitrarily based on their own judgment. Both methods involve subjective bank management judgment and attitude towards risks.

Remark that though this ratio involves high subjectivity, still the liqui-

Table 12: Average values and ranks of PLL/L and PLL/E

Provision for loan losses/loans

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	1.78 (0.09)	1.77 (0.09)	112.14	110.75
Problem	1.74 (0.20)	1.72 (0.19)	106.32	107.08
Liquidated	1.19 (0.12)	1.22 (0.09)	76.06	83.66

Provision for loan losses/equity

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	24.24 (9.38)	19.37 (6.74)	102.90	102.96
Problem	16.35 (2.70)	15.30 (1.98)	129.95	125.98
Liquidated	9.75 (1.21)	10.62 (1.21)	102.10	106.98

dated banks have the smallest PLL/L.

Provision for loan losses over equity (PLL/E)

Though high level of PLL speaks about prudent and secure policy of lending, the high level of equity is no less important characteristic of stability of a bank. Therefore it is not very clear whether the ratio PLL/E should belong to HB or LB group. Still, we thought it should be attributed to the group of LB variables. It is clear, however, that this ratio can be small not because equity is high, but because PLL is low. Indeed, many of liquidated banks have the ratio PLL/E small (see Table 12).

This means that the variable PLL/E should not be considered separately, but has to be *taken jointly* with the variable PLL/L. Then it is correct to expect that for a good bank we must have PLL/L high and *at the same time* have PLL/E low. The scatterplot of these two variables (Figure 9) supports this statement.

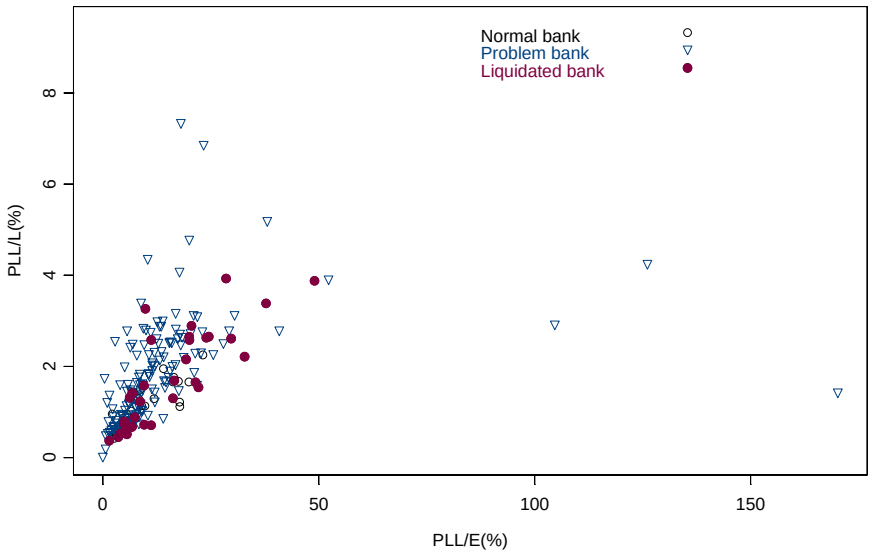

Figure 9. PLL/L and PLL/E in 1996

Equivalently one could consider the pair PLL/L and E/L. With the same logic as above, E/L must be the HB variable and the empirical data (see Table 13) supports this. Figure 10 shows the scatterplot of ratios (PLL/L, E/L). We see that the pattern again supports the expectation.

Table 13: Average values and ranks of E/L

	Average values		Average ranks	
Group	1995	1996	1995	1996
Normal	22.89 (1.38)	23.42 (2.90)	119.41	119.15
Problem	13.53 (1.11)	13.23 (1.03)	69.71	72.41
Liquidated	14.88 (1.47)	13.96 (1.38)	79.26	77.34

We remark here that having three variables PLL, L and E, if one agrees that the quality of loans in a bank A with given values (PLL, L, E) is the same as that of a bank B with values (αPLL, αL, αE) for any positive

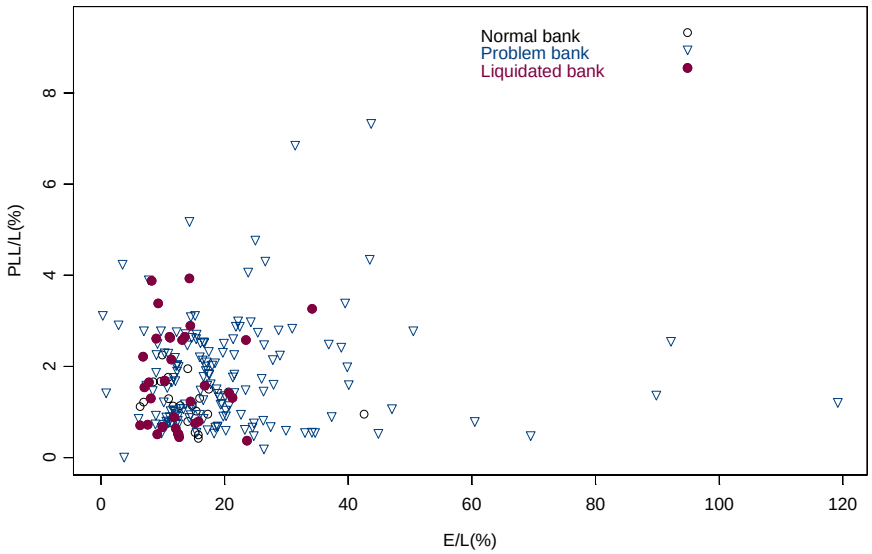

Figure 10. PLL/L and EL/L in 1996

number α, then it formally follows that the quality of loans must be described only through any two ratios: PLL/L and PLL/E, or PLL/L and E/L (or PLL/E and E/L). Which two ratios we consider in principle does not matter.

We choose the pair PLL/L and E/L simply because both variables belong to the HB group which is more convenient for presentation purposes.

Final remarks

Here ends the Part 1 of the whole paper. In Part 2, which will be published in the next issue, we continue with analysis of variables to measure the capital adequacy, the growth and aggressiveness, size of assets, sources of income and funds diversification, liquidity and, finally, dependence on affiliates. Then we show how can we further reduce the number of variables and illustrate the quality of discrimination between the three groups of banks using only 7 variables.

For data used in this paper, see
http://mpd.pagras.net/ mtchao/JDataScience/JDS-118.pdf

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Appendix: List of Abbreviations

ARCF	:Average of Return and Cost of Funds
BI	:Bank Indonesia (the Central Bank of Indonesia)
CAR	:Capital Adequacy Ratio
DfA/D	:Deposits from Affiliates to Deposits Ratio
DGR	:Deposits Growth Rate
DMSI	:Deposits Market Share Increment
D/TPF	:Deposits to Third Party Fund Ratio
E/A	:Equity to Assets Ratio
EA/A	:Earning Assets to Assets Ratio
EBT/OI	:Earning before Taxes to Operating Income Ratio
EBT/SE	:Earning before Taxes to Staff Expenses Ratio
E/EA	:Equity to Earning Assets Ratio
EGR	:Equity Growth Rate
E/L	:Equity to Loans Ratio
FfA/TPF	:Fund from Affiliates to Third Party Fund Ratio
HB	:the Higher the Better Variable
IBRA	:Indonesian Banking Restructuring Agency
IE/D	:Interest Expenses to Deposits Ratio
IE/TPF	:Interest Expenses to Third Party Fund Ratio
II/EA	:Interest Income to Earning Assets Ratio
II/L	:Interest Income to Loans Ratio
IM	:Interest Margin
LA/D	:Liquid Assets to Deposits Ratio
LB	:the Lower the Better Variable
L/D	:Loans to Deposits Ratio
L/EA	:Loans to Earning Assets Ratio
LGR	:Loans Growth Rate
LMSI	:Loans Market Share Increment
LnA	:Natural Logarithmic of Assets
LtA/L	:Loans to Affiliates to Loans Ratio
L/TPF	:Loans to Third Party Fund Ratio
NI/A	:Net Income to Assets Ratio
NI/E	:Net Income to Equity Ratio
NI/EA	:Net Income to Earning Assets Ratio
NII/EA	:Net Interest Income to Earning Assets Ratio
NII/L	:Net Interest Income to Loans Ratio
NI/SE	:Net Income to Staff Expenses Ratio

List of Abbreviations (continued)

NonIE/A	:Non-interest Expenses to Assets Ratio
NonII/OI	:Non-interest Income to Operating Income
OE/OI	:Operating Expenses to Operating Income Ratio
OI/SE	:Operating Income to Staff Expenses Ratio
PLL/E	:Provision for Loan Losses to Equity Ratio

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