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Optimal Composition of the Indonesian Listed Banks' Earning Assets and the Effects on Their Market Capitalization: Does It Matter?

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Abstract

Even though it is beneficial for banks to generate the highest net interest margin at the lowest risk for optimality sake, in reality bankers and finance professionals have varied in their management style for earning assets. The general aim of the banking sectors is to generate the best net interest margins that lead to a satisfactory market capitalization level, particularly in compliance with the risk mitigation instructions issued by Bank Indonesia. Non-parametric statistical analysis was applied to secondary data obtained from the Financial Services Authority and Bank Indonesia (2012–2014). It was concluded that the loan-to-deposit ratio was not dependent on the optimal earning assets composition, even though the latter correlated with the listed Indonesian banks' market capitalization. Market capitalization is the ultimate achievement goal for all listed banks. As a result of this study, it is recommended that the Financial Service Authority and Bank Indonesia should further regulate optimal earning assets composition, in addition to prudent management of the banking system's assets and liabilities.

Keywords: *Bank Indonesia, Bank of International Settlement, Indonesian Stock Exchange, earning assets, market capitalization, net interest margin, loan-to-deposit ratio*

Introduction

In general, earning assets (EA) management by commercial banks has given rise to the use of arbitrage pricing, capital asset pricing, efficient market hypothesis generation, and modern portfolio theory. The best understanding of bank EA is to comprehend how the loan portfolio and securities investment generate the needed bottom line, giving rise to higher Price-to-Earnings Ratio (P/E) and market capitalization. During the past decade, studies have been conducted on Indonesian banks' EA portfolio and their impact on asset growth, market capitalization value, and the P/E multiple. The studies particularly focused on the efficient composition of these EAs: i.e. 18% and 82% for securities investment and the listed bank loan portfolio, respectively. One cannot know whether the 18%–82% composition belongs to an efficient EA structure according to modern portfolio theory (Table 1).

Turcas, Dumiter, Brezeanu, Farcas and Coroiu (2019) argued that it is necessary to pay more attention to the construction of an optimal EA portfolio, in spite of the pessimistic findings in the early 2010s (Choueifaty, 2010; Norges Bank Investment Management, 2012). These contributors argued that market capitalization-based EA were no more efficient than some weight-based methods. The Norges group even specified equal weight EA, equal risk contribution, and the most diversified portfolio methods as more desirable.

The correlation of portfolio composition with market capitalization or return on equity (ROE) has been an attractive line of investigation by some entities. For example, Savitri (2018) indicated that PT Bank Negara Indonesia (Persero) Tbk had successfully designed its EA portfolio composition to maximize the quality of its assets. In this case, EA portfolios were linked with related yields. This is in harmony with Hagstrom's (2014, pp. 20–21) comments, "… few assets, and not too many assets, must comprise the investment portfolio in a bank," which he saw as a Keynesian way of economic strategic thinking.

Trinugroho, Agusman and Tarazi (2012) investigated the impact of Indonesian bank portfolio composition on their net interest margins. Saksonova (2014) suggested that good practice was to avoid Net Interest Margin (NIM) volatility, as it triggered a negative signal to a bank's profitability,

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stability, and efficiency. The challenge is whether the EA composition of loans and investments in securities is reasonably optimal from the point of view of minimizing risk and increasing NIM.

This study focused on evaluating the actual financial position of the 36 listed Indonesian banks in terms of the optimality in their EAs, or efficient composition of loan portfolio and securities investments.

Table 1. Overview of 36 Indonesian Listed Banks in 2014 (Otoritas Jasa Keuangan, 2014)

Description	US$ Billions as of 2014	Average NIM (%)	Amount – Billion Rupiahs / Billion US$†		
			< 200 Billion < (US $16 B)	200-500 Billion (US$ 16–40 B)	> 500 Billion > (US$ 40 B)
By Total Assets	414.1	6.5	32	2	2
By Market Capitalization	912.4	6.7	33	1	2
By Earning Assets‡					
• Loan portfolio	185.0 (82%)	5.3			
• Securities	39.6 (18%)	11.3			
Total EA	224.6 (100%)				
Net Interest Margin (%)	6.4		n/a	n/a	n/a
Loan-Deposit Ratio (%)	88.0		n/a	n/a	n/a
By Price/Earnings range	5 to 15	5.9	n/a	n/a	n/a

† Indonesian listed banks classified by size in billions (B) of Rupiahs (Rp) and USD; USD 1 = Rp 12,400 as of 31/12/2014;

‡ Loans portfolio growth of 17% p.a., which was much higher than the third party deposit funds growth (2.0% p.a. for private banks, and 5.6% for state-owned banks).

Research Objective, Problem and Questions

Based on the fragmented manner in which the Indonesian banking system's EA portfolios are generally managed, the study sought to recommend a strategy by which banks will be capable of formulating and using an efficient EA scheme for their loan portfolio and securities investment. The optimality of EA composition was measured by the capacity of Indonesian banks to generate the highest NIM return with the lowest standard deviation of those margins. In addition to the effort of maximizing bank shareholder wealth and minimizing risk for generating NIMs, this study also endeavored to add to the risk mitigation process contained in Bank Indonesia's (2011) recommendations. Their purpose was to provide a management system that gives a more efficient EA portfolio.

Our main focus was on optimizing performance of the listed banks' EAs. The aim of the study was to find the optimal weight composition of the two EAs. The study specifically sought to answer the following research questions:

1. How do listed Indonesian banks' Net Interest Margins differ according to the key financial indicators below:
   - Total Earning Assets,
   - Total third party deposit funds,
   - Market capitalization, and
   - Price/Earnings ratios?
2. What is the correlation between Loan Deposit Ratios and the actual weight composition between loans and securities investments for listed Indonesian banks as of 2014?
3. How does the optimal composition of listed Indonesian banks' Earning Assets correlate with their market capitalization?

Underlying Theoretical and Conceptual Framework

The study was based primarily on the thoughts of four economic theorists—John M. Keynes, Harry M. Markowitz, Jack Treynor, and William F. Sharpe—who all developed the building blocks of an efficient portfolio that would achieve a comfortable market capitalization value. Barth, Beaver, and Wolfson (1990) reinforced the market capitalization notion by arguing that a bank's stock price, as a function of earnings, was linked to an earnings multiplier. The conceptual framework of their study is presented in Figure 1.

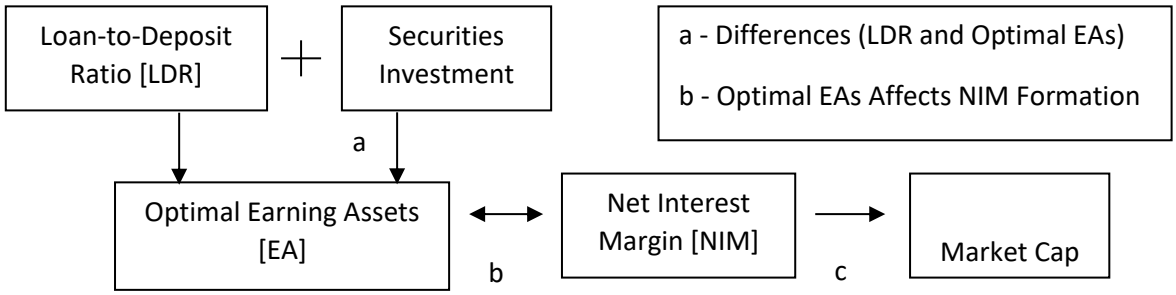

Figure 1. Conceptual Framework of the Study

Based on the above framework and research questions, the following hypotheses were tested:

H_{10}: The listed Indonesian banks' Net Interest Margins does not differ according to total assets, total third party deposit funds, market capitalization, and Price/Earnings ratios.

H_{20}: The listed Indonesian banks' Loan Deposit Ratios do not significantly correlate with their actual weight composition between loans and securities investment as of 2014.

H_{30}: The optimal composition of listed Indonesian banks' earning assets does not correlate with their market capitalization.

The linkage between the theoretical and conceptual framework is illustrated in Table 2.

Table 2. Underlying Theories of the Study

Theory	Year	Economist	Linkage with the Concept
Key Theories			
Keynesian Economic	1952	John M. Keynes	Demand of IS ≠ *f* (Liquidity/Money)
Modern Portfolio	1936	Harry M. Markowitz	Optimality at high return and low risk
Supporting Theories			
Capital Assets Pricing	1961	Jack Treynor	Return for a diversified portfolio
Capital Market Pricing	1963	William F. Sharpe	Market equilibrium under risk

The synchronization of the conceptual and theoretical frameworks is presented in Figure 1, and is best understood by moving from the left to the right-hand side of the diagram.

First, the effect of the Loan Deposit Ratio on Earning Asset optimality is demonstrated by liquidity preferences and the effect of the optimal EAs on interest rates. Pop, Cepoi, and Anghel, (2018) linked the quality of investment – in this case in the bank's EAs – through the bank's preference for liquidity and money supply. A higher demand for money will fundamentally drive a higher Net Interest Margin that affects the efficiency of the EA portfolio composition. Brady (2018) similarly reinforced the concept that this preference for liquidity determines the level of interest rates that form the structure of the optimal EAs. This will lead further to the size of a bank's NIM in the next linkage (Figure 2). In explanation, when demand increases from Y1 to Y2, the curve moves to the right causing an increase in NIM from i1 to i2.

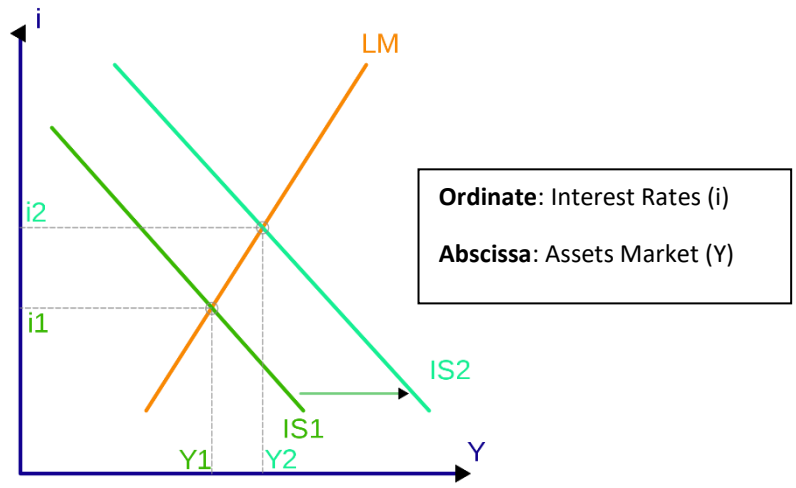

Figure 2. Interaction between Keynes' Investment-Savings (IS), Liquidity-Money model (LM), and EA Optimality ("IS-LM Model," 2019)

In line with Keynesian economic thought on LDR, Posnaya, Kaznova, Shapiro, and Vorobyova (2018) reaffirmed the importance of determining the strengths and weaknesses of a bank's capital estimation. They further mentioned that NIM must be the center of a special SWOT analysis. Still, with regard to this LDR, Memmel and Schertler (2013) further strengthened its importance by requiring banks to decompose their NIM by liquidity, creditors and borrowers, and different maturities, rather than using the banks' balance sheet decomposition.

Second, the effects of the optimal EAs, by virtue of Markowitz's Modern Portfolio Theory, would further contribute to optimalization. The idea is that having a diversity of financial assets leads to less risky operations. The risk to the overall portfolio was considered rather than focusing on individual asset risk contributions. Indonesian banks have structured their portfolios to deliver maximum net interest margins while keeping risk levels to a minimum.

Wagner (2009, p. 473) mentioned from his experience, "EAs are all that matters in a bank. It is comprised of credits, inter-bank placements, securities investment for dealing, third parties receivables, contracts and contingencies that must be optimally managed." The Markowitz efficient frontier, according to Pasaribu and Kowanda (2013), has been designed as a portfolio of risky and riskless assets, allowing the NIMs of the loan and securities investment to be optimally managed as well. Corielli and Meucci (2003) believed that optimality in portfolio composition must be diversified in terms of sub-optimality. Further, Koster and Zimmermann (2017) have even recommended an alternative accounting and market-based valuation technique in order to arrive at banks' EA optimality as conceptualized by Markowitz. Ma, Xiandong and Xi (2011) have suggested, from the Chinese banks perspective, that NIM must be managed in the minimum range of 2–3% from the total EAs. They even presented a comparison with those of the original five ASEAN countries' NIMs, which varied, i.e., Singapore (1–2%), Malaysia (2–3%), Thailand (3–3.5%), Philippines (3–4%), and Indonesia, of 4% to 5%. As Diether (2012) has said, the EA of any bank may consist of more than two risky portfolios. He further identified the mean-variance efficient frontiers, which was defined as "the efficient areas above the inefficient ones with the highest mean return and lowest variance." In that study, Diether referred to the highest NIM at the lowest risk.

Third, of the supporting theories, capital assets pricing and capital market pricing by Treynor and Sharpe (1964), respectively, also gave strong significance to the study. Both economists fundamentally theorized similar concerns regarding EA efficiency. One emphasized diversification of the EAs, and the other on market equilibrium of the EAs as evaluated by Guerard (2017). He further stressed concerns from the risk point of view. Loan and securities investment portfolios have an associated risk in NIM generation in Treynor's theory, as well as the risky and riskless investment in

Sharpe's theory. In response to EA efficiency, Rengasamy (2014) commented that in compliance with the Basel III regulation liquidity, banks must be managed close to 100%.

Using Spearman non-parametric rank correlation, this study aimed on finding out that degree of dependency. Naturally, the closer the coefficient of correlation is to 1.0, the stronger the degree of dependency will be to its EA portfolio.

Research Methodology

In the framework of answering the research questions posed for the study, the methods of research and procedures employed focused on a survey of the listed Indonesian banks' EA composition. Particular attention was devoted to observing their efficient frontier profiles and portfolio strategic weights, and correlating them with the listed banks' market capitalization.

Secondary data were used to delimit the effects of listed Indonesian banking developments on the optimal composition of their earning assets (January 1, 2012 to December 31, 2014). The time segment chosen coincided with period when the Rupiah exchange rate to the USD was not abruptly affected by fluctuations above Rp 12,400/US$1.

Out of 120 commercial banks currently operating in Indonesia, some 36 of these were listed on the Indonesia Stock Exchange. These banks represent the largest such enterprises in Indonesia. As of December 31, 2014, the average assets of state-owned and private banks were US$ 90.6 Billion and US$ 201.4 Billion, respectively. By market capitalization estimates, both types shared equally from the total US$ 73.5 Billion value as of the end of 2014 (Table 3).

Table 3. Financial Profile of Listed Indonesian Banks, December 31, 2014 (Otoritas Jasa Keuangan, 2014)

Financial Indicator	Amount(Trillion Rp)	(Billion US$)	Percentage (%)
Total Assets			
Type of Bank			
State-owned	1,124.3	90.6	31.0
Private	2,497.3	201.4	69.0
Total	3,621.6	292.0	100.0
Asset Ranges			
Up to 300 T Rp	1,518.9	122.5	42.0
Rp 300-500	829.6	66.9	22.9
Above 500 T Rp	1,273.1	102.6	35.1
Total	3,621.6	292.0	100.0
Market Capitalization			
Type of Bank			
State-owned	455.9	36.7	50.0
Private	456.5	36.8	50.0
Total	912.4	73.5	100.0
Market Cap Ranges			
Up to 200 T Rp	813.5	65.6	78.1
Above 200 T Rp	228.3	18.4	21.9
Total	912.4	84.0	100.0

Due to the significant number of sampled banks, the study employed non-parametric statistics. Data were gathered from selected secondary sources, mainly from the Financial Services Authority (Otoritas Jasa Keuangan) and the Indonesia Stock Exchange. These secondary sources were reinforced by interviews with some executives from the top 10 listed commercial banks like Bank Mandiri, Bank Central Asia (BCA), Bank Negara Indonesia (BNI), Bank Rakyat Indonesia (BRI), Bank Danamon Indonesia, Bank Internasional Indonesia (BII), Bank CIMB Niaga, Panin Bank, Permata Bank, and Citibank. Table 4 presents how the research questions were addressed.

Table 4. Data Analysis of the Research Questions

Research Question	Hypothesis (H0)	Data Analysis
First: Difference in Banks' NIM	Banks' NIM did not differ	Kruskal-Wallis
Second: Correlation of Banks' LDR with EA Composition	Banks' LDR was not correlated with EA composition	Spearman Rank Correlation
Third: Correlation of EA Composition with Market Capitalization	EA composition was not correlated with market capitalization	Spearman Rank Correlation

The Markowitz part of the efficient portfolio formula is given to explain how the frontiers were manually computed and evaluated, using Excel Microsoft Office to answer the second and third questions. SPSS and non-parametric calculators also were used to test the dependency between the efficient composition and market capitalization. The following formulas were used when working with Excel.

First formula: $E(r_p) = \sum_{i=1}^{n} w_i\ (r_i)$, where
$\sum_{i=1}^{n} w_i\ (r_i) = 1$
n = Number of sampled listed Indonesian banks
w_i = Weight of each EA (loans and securities), the sum of which = 1.0
ρ_{ip} = Coefficient of correlation
E = Expectation of the most optimal composition

Second formula: $var(r_p) = \sigma_p^2 \quad \sum_i^n \sum_{i=1}^n w_i\, w_i\, Cov(r_i, r_j)$

Third formula: $Cov(r_i, r_j) = \rho_{ij}\sigma_i\sigma_j$ where ρ_{ij}= coefficient of correlation between the loan component for i (r_i) and the securities investment component for j (r_j), and the σ_i for r_i and σ_j for r_j. The resulting variance is expressed as follows:

Fourth formula: $var(r_p) = \sigma_p^2 \quad \sum_i^n \sum_{i=1}^n w_i\, w_i\, \rho_{ij}\sigma_i\sigma_j$

The expected mean NIM should be the average value, while the expected variance should be the average value of the squared deviation, as well as the expected covariance as the cross-product of the deviations.

Results and Discussion

In the study, three main points were considered – namely NIM differences, listed banks' correlation of EA with LDR, and correlation of the optimal EA composition with market capitalization.

Net Interest Margin Differences (First H_0)

When referring to the Indonesian banking system's NIM generation capacity, its fragmentation was seen by the significant differences ($p < 0.05$, 2-tailed) of the selected indicators in terms of total assets, market capitalization, and third party funds accumulation. The Chi-square (χ^2) values of the NIM generated by total EAs, market capitalization, and third party deposit accumulation differed noticeably – 2-tailed tests were significant at the 0.05 level ($p = 0.025$, $p = 0.030$, and $p = 0.024$, respectively). What does this imply? The χ2 test seemed to indicate that at a *df* = 35, the NIMs of the listed Indonesian banks by EA, market capitalization, and third party deposits showed a certain degree of fragmentation as their probabilities were less than 5%. However, in terms of Price/Earnings levels in the secondary stock market, this NIM generation capacity did not show significant differences as of 2014 ($p = 0.410$ at a critical $\chi^2 = 49.8$; Table 5).

Listed Banks' Correlation of Optimal EAs Composition with Loan Deposit Ratios (Second H_0)

The proper utilization of third party deposit funds handled by the Indonesian banking system in the mobilization of credits and management of marketable securities investment is a concern. Utilization is reflected in the size of their LDR as per the Bank of International Settlement (BIS) direction. Riyadi (2006) mirrored this thought by mentioning the complexity of rate-sensitive assets and liabilities in gap management. In compliance with BIS directives, Bank Indonesia (1998), by virtue of SK Direksi Bank Indonesia No. 30/277/KEP/DIR, has stipulated the importance of liquidity through the LDR indicator.

In general, listed banks' LDRs were relatively stable, being in the range of 80–90%, except for a few private banks where the values were at a very low rate of 45% and 57%. State-owned banks ranged more stably from 83–100%. Table 5 shows the results of our analysis, which indicated that at p = 0.146, LDR did not seem to correlate with the actual composition of the listed banks' EAs. Nevertheless, it does imply that banks wishing to manage their EAs optimality at a constant level might follow the practice of the stable listed Indonesian banks. These kept their LDR level at 80%-90%.

Listed Banks' Correlation of Market Cap with Optimal EAs Composition (third H_0)

The correlation between optimal weight composition of the listed banks' EAs with their market capitalization is shown in Table 5. At p = 0.037, the listed Indonesian banks' optimal EA composition would have a strong influence on how their market capitalizations react. Optimal composition means a high average NIM at their lowest standard deviation. At least 28 out of 36 listed Indonesian banks (78%) indicated that they adopted the efficient composition of (W_i, W_j), namely, the (100,0), (90,10), and (80,20) options. Two implications flow from this finding. First, the majority of listed Indonesian banks had invested in loan portfolios with less securities investment, which was still within the BIS directive. Second, these compositions corresponded with the average level of 80–90% LDR. The logic of optimally maintaining more loans with high NIM seemed to comply with the BIS directives.

In spite of the good effects of EA composition on a bank's market capitalization, the US experience on EA management is worth noting. The US Federal Reserve Bank has noted a couple of experiences when the banking system became overconfident because of favorable protective regulations. This over-confident market capitalization may lead to too much risk taking with the bank EAs. An EA composition with too much risk is normally reflected in the declining value of its market capitalization. Fisher and Rosenblum (2013) showed that too much risk taking – because of overconfidence of the Fed's protection to the US banking system – had a severe impact on US listed banks' market capitalization value. This occurred particularly before the 2008 US financial crisis took effect. Gong, Huizinga and Laeven (2018) have also given another effect of too much risk taking on a bank's EAs, particularly by its holding company, that caused lower market capitalization values in the US banking system.

The third research question was answered, too, and it transpired that there was a dependency (correlation) between good management of EAs with the banks' market capitalization. This agrees with the previous works of Treynor (1961), Sharpe (1964), and Wagner (2009).

Three implications flow from this finding. First, the majority of listed Indonesian banks had invested in loan portfolios with less dependency on securities investment. Second, these compositions corresponded with the average level of 80–90% LDR. The logic of optimally maintaining more loans with high NIM seemed to comply with the BIS directives. Third, these EAs composition seemed to be the prerequisite for an improved market capitalization of all listed banks in general. Hence, optimal EA composition essentially does matter!

Table 5. Net Interest Margin Differences and Optimality (Otoritas Jasa Keuangan, 2014)

Description	*n*	Average P/E (x)	Market Cap (US$ B)	LDR (%)	*p* value	χ^2 (*df* = 35)[+]	*R*
NIM Differences by							
Earning Assets					0.025	49.8	
Market Capitalization					0.030	49.8	
Third Party Deposits					0.024	49.8	
Price/Earnings Multiples					0.410	49.8	
Loan-Deposit Ratio= *f*(EA)					0.146		0.468
EA = *f*(Market Cap)					0.037		0.117
Optimal EA (W_i, W_j)[++]							
(100,0)	20	51	12.3	87.8			
(90, 10)	5	86	22.6	75.2			
(80, 20)	2	22	15.4	75.6			
(70, 30)	6	11	17.7	77.9			
(0, 100)	2	8	7.7	106.7			
Total banks	36						

[+] Based on critical χ^2 values or H-values at a df = 35 (36 rows, 2 columns).

[++] Details of the listed banks' EAs are presented in the Recommendations section.

Summary of Findings, Conclusion, and Recommendations

Based on the analysis of the research questions, the findings of the study were broken down into general and major components.

General Findings

The listed Indonesian banks recorded an impressive 17% growth rate of their loans from December 31, 2012 to June 30, 2014, compared to the relatively unimpressive growth of their third party deposit funds (g = 2.0% p.a. for the private banks, and g = 5.6% for the state-owned banks). This mismatch in the Indonesian banking system surely demands adjustments and urgent remedial action.

Major Findings

The fragmentation of the Indonesian banking system was seen among others by the significant differences (0.05 = 2-tailed) of the NIM generation in terms of their total EAs (p = 0.025), market capitalization (p = 0.030), and third party deposit funds accumulation (p = 0.024). Loan NIMs seemed to be generated more stably, while securities investment NIMs were very volatile.

At a p = 0.146, LDR did not lead to an indication that it was significantly correlated with the actual composition of the listed banks' EAs. At a p = 0.037, and thus a level of significance better than 5%, the listed Indonesian banks' optimal EA composition would have a strong influence on how their market capitalization reacted.

Conclusion

Based on the above findings, commercial banks should comply with the BIS requirement in order to manage the optimal composition of the EAs that would lead to improved market capitalization. Such a result was shown from the observation made on the 36 listed Indonesian banks during the period from January 1, 2012 to December 31, 2014.

Recommendations

Learning from the experience of the listed Indonesian banks, and based on the conclusion of this study, it is recommended that the Indonesian banking system:

First, adopt an integrated scheme to maintain the optimality of the listed Indonesian banks' EAs. The steps in the integrated scheme that are needed to implement this EA optimality might be as follows:

1. Optimal EAs management
    i. NIM means and variances of the EA composition.
    ii. Constant regular review of W_i and W_j (Wloan and Wsecurities investment)
2. Subsequent to the optimal EA review, an optimal EA profile may take the following pattern:
    a. If W_i = 100,0:
        i. Optimal loan portfolio by industry.
        ii. Placement with Bank Indonesia (checking deposits and Sertifikat Bank Indonesia or SBI).
        iii. No additional short-term investments (not from the third party deposits).
    b. If W_i = <100, >0.
        i. Optimal loan portfolio by industry.
        ii. Placement with Bank Indonesia (checking deposits and SBI) of additional short-term investments (not from the third party deposits), i.e., investment grade money market securities and Secondary government securities trading.
        iii. Long-term securities investment (investment grade corporate bonds, mutual funds and blue chip stocks) via shelf underwriting facility (stand-by underwriting).
3. Gap management through a regular duration evaluation on rate-sensitive EAs and liabilities.
4. Risk hedging for possible investment losses by shorting a foreign bond or US Treasury futures from the futures option market, i.e., Chicago Board of Option, Philadelphia, and others (Indonesian futures market has not listed these yet).

Second, it is recommended that listed Indonesian commercial banks have the following optimal Wi, Wj composition for their EAs:

(100, 0) = CIMB Niaga, Danamon, Permata, Internasional Indonesia, Tabungan Negara, Tabungan Pensiun, Bukopin, Ekonomi Rah., Artha Graha, Mutiara, ONB Kesawan, Nusantara Parahiyangan, Pundi Indonesia, International Commercial Bank, Bumiputra, Windu Kentjana, Mestika Dharma, BRI Agroniaga, Maspion Indonesia, Bumi Arta, and India Indonesia.

(90, 10) = Central Asia, Jabar Regional Development, Mayapada Internasional, Sinarmas, and Nationalnobu.

(80, 20) = Rakyat Indonesia, OCBC, and Mitraniaga.

(70, 30) = Mandiri, Panin, Mega, Victoria International, and Himpunan Sdr.

A recommended optimality of 0, 100 was not given in this section, because it does not comply with the Indonesian Banking Act. Any commercial bank must always invest its third party deposit funds in a loan portfolio and not in securities investments only.

Third, future research is recommended on how non-listed Indonesian banks might accomplish EA optimality and correlation to their book value build-up. This recommendation will include how the non-listed banks perform in general when compared to the listed banks. Such a comparison should be sought to generate more traits and managerial patterns on how EAs might be optimally managed.

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