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How to Determine Deposit Insurance Premium: A Book Value Approach

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ABSTRACT

The **purpose** of the study is to propose a new model for determining insurance premiums on deposits. As of today, there are two **models**: the first is theoretical, using market value (option theory), and the second is practical, using book value and, as a rule, a fixed rate. Market value cannot be applied as it does not reflect banking risk, while the use of book value is considered mandatory without any theoretical justification.This paper proposes a new model, namely the Asnawi Model with three advantages, namely: (1) based on book value, (2) considering the bank's risk-return (fair premium); and (3) considering incentive-compatible plans. The model formation is based on the main variables that influence banking performance, namely (1) asset-to-deposit ratio (2) lending-borrowing rate ratio, (3) and non-performing loans.The results of this research are: first, the formation of four Asnawi Groups which indicate the amount of premium that must be paid by the bank (group 4 is the one with the lowest premium); second, the Asnawi Score, as a reference value for banks to get/not get incentives; third, the results of simulations on Indonesian banking showed variations in premium groups, and in the fourth, regression of the three variables above on ROE, the results were found to be in line with predictions. This model for determining insurance premiums can be a reference/alternative for determining premiums in worldwide banks.

Keywords: deposit insurance; premium; put-option; Credit Default Swap; Non-Performing Loan; Book Value Approach; Asnawi Group; Indonesia; Deposit Insurer Corporation

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ОРИГИНАЛЬНАЯ СТАТЬЯ

Как определить премию по страхованию вкладов: подход на основе балансовой стоимости

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АННОТАЦИЯ

Цель исследования — предложить новую модель определения страховых премий по депозитам. На сегодняшний день существует две модели: первая — теоретическая, использующая рыночную стоимость (теория опционов), и вторая — практическая, использующая балансовую стоимость и, как правило, фиксированную ставку. Рыночная стоимость не может применяться, так как не отражает банковский риск, в то время как использование балансовой стоимости считается обязательным без какого-либо теоретического обоснования. В данной статье предлагается новая модель Аснави, обладающая тремя преимуществами, а именно: (1) основанная на балансовой стоимости, (2) учитывающая риск и доходность банка (справедливая премия) и (3) учитывающая планы, соответствующие стимулам. В основе построения модели лежат основные переменные, влияющие на эффективность банковской деятельности, а именно: (1) соотношение активов и депозитов, (2) соотношение кредитных и заемных ставок, (3) невозвратные кредиты. Результаты данного исследования: во-первых, формирование четырех групп Asnawi по размеру премии, которую должен заплатить банк (группа 4 — с самой низкой премией); во-вторых, Asnawi Score как эталонное значение для банков, чтобы получить/не получить стимулы; в-третьих, результаты моделирования на примере индонезийских банков показали изменения в группах премий; и в-четвертых, регрессия трех вышеуказанных переменных на ROE, результаты оказались в соответствии с прогнозами. Данная модель определения страховых премий может стать образцом/альтернативой для определения премий в крупнейших банках мира.

Ключевые слова: страхование депозитов; премия; пут-опцион; кредитный дефолтный своп; невозвратный кредит; подход на основе балансовой стоимости; группа Аснави; Индонезия; Корпорация страховщиков депозитов

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INTRODUCTION

The purpose of Deposit Insurance (DI) is to provide "cash assistance" as a preventive measure, not to compensate in the event of bankruptcy. In the DI scheme, two important factors need to be objectively determined which are the amount of coverage and premium. The coverage is standardized and determined by the institution. Meanwhile, the Deposit Insurance Corporation (DIC) determines the premium and is a concern in this study. Almost all theoretical determinations are based on adaptations of the put-option model Merton [1]. This model cannot be applied because it is based on market prices, which tend to be biased, fluctuate-subjective, and contain many expectations. For example, the rumor-shares of Jago Bank (ARTO) have increased up to 8.500% Asnawi et.al. [2]. Thus, the determination of the deposit insurance premium should use book value instead of market value.

The main activities of the bank are saving (Debt, *D*) and lending (Assets, *A*). Thus the *A/D* ratio becomes the main ratio, as has been considered in the option model (1). In further development of the option model, Deposit Insurance premium is based on the volatility of Credit Default Swap (CDS) Chen [3]. Furthermore, Chiang & Tsai [4] estimated insurance premiums through lending-borrowing and the risk of early bankruptcy. These two things are considered to affect the value of bank assets. Yoshino et al. [5] showed fair premiums are based on insurance coverage, operational costs from the operator, and the Non-Performing Loan (*NPL*) ratio. *NPL* can measure the bank risk, according to Bahri & Hamza [6], Abbas et al. [7], Hunjra et al. [8]. An alternative for *NPL* can use Z-score Zhang & Hu [9], Trinugroho et al. [10], Martinez & Baselga [11].

Research on deposit insurance in Indonesia, including Sahadewo et al. [12], Nizar & Mansur [13], Trinugroho et al. [10], Ahmad et al. [14]. Sahadewo et al. [12] examined the impact of DI using the laboratory experiment method. Nizar & Mansur [13] determine deposit insurance premiums based on risk by PCA ANOVA analysis model. The method is not practical. Trinugroho et al. [10] show the effect of risk (Z-score) and Bank stability index on deposit growth, whereas Ahmad et al. [14] showed that small bank-guarantee depositors made them less sensitive to risk. In this case, the depositor considers the interest rate as an indicator of saving.

Various risk-based premium implementations around the world tend to group based on certain variables (DICGC),[1] IADI.[2] The USA uses two variables, capital (3 groups) and supervisory (3 groups), where the bank divides into four groups. The difference is that the risk category is based on predicting risk in the future. In Canada, premium is based on a combination of quantitative and qualitative aspects. The premium is divided into four categories. In Columbia, premium is based on the CAMEL component (score 1 to 5). A high rating will get a refund of up to 50% of the premium paid last year, while a low rating is asked to add a premium of up to 50% of the previous rating. Rewards and punishments apply. In Malaysia, premium is also based on a combination of quantitative aspects (60%) and qualitative aspects (40%), where the premium category is divided into four groups. In Taiwan, based on two variables, CAR and Composite score of the risk based premium rating system (CSRPRS), premiums are divided into five categories. From the description above, efforts to get a fair premium vary widely from simple methods (Colombia) to complex ones (USA). In Indonesia, the deposit insurance premium is a flat rate. Banks pay about 0.1% of the average monthly savings, with around IDR 2 billion coverage, equivalent to $ 136,054. There is no theoretical basis for why the premium is 0.1%.

In practice, more than 50% of Deposit Insurance premiums in the world use a flat rate, where the flat rate premium does not reflect risk. There is a premium subsidy from low-risk banks to high-risk banks. In countries that apply risk-based Deposit Insurance premiums, the determination of premiums varies widely. Conceptually, the determination of the risk premium was based on: (1) the structural model (option) initiated by Merton; (2) expected loss models based on the probability of default, exposure of default, and loss given default; (3) bucketing based on assets and examiner classification and fund size calculation, which consists of two components, namely the average premium and the difference from the average premium.

This research proposed a new model, the Asnawi model, which is a novelty in this study. Asnawi's model can be categorized as a bucketing model. Asnawi's model is based on the *A/D* ratio and considers risk-return through the lending rate-borrowing rate, as well as Non-Performing Loans (*NPL*). Each bank, based on these three variables, will get one score. The insurer can make categories (groups) and premiums. Incentive (discount) premiums are given to banks with lower risks. Thus, the premium is determined based on risk and has considered the Incentive Compatible Plan.

The advantages of this model are: first, it is completely based on the book value, which is more accurate than the market value. Second, it is easy to implement, so it can be applied in general, like the

[1] DICGC: Risk Based Premium-Cross Country Practices and Experience: 7–21; DICGC. URL: https://www.dicgc.org.in/pdf/Chapter2.pdf (accessed on 14.02.2023).

[2] IADI: Evaluation of Differential Premium Systems for Deposit Insurance. URL: https://www.iadi.org/uploads/DPS_Paper_final_16June2020_Final.pdf (accessed on 14.02.2023).

bank health measurement model (CAMEL). Third, it involves two essential components: risk-return, which is reflected through three variables (*A/D*); lending-borrowing rate; and NPLs. Fourth, this model will enrich the existing model (IADI 2020) but with a more concise variable category. Fifth, this model provides premium discounts for banks that have a low-risk category. This is in line with the concept of an incentive-compatible plan (Prescott [15], Asnawi [16]).

Several other things are ignored in the premium determination model here. First, deposit insurance premiums are affected by the Systematic Risk premium (SRP), where SRP has a positive trend toward expected default loss (Jokivuolle & Pennacchi [17]. Second, this study ignores the existence of a target fund level; for example, in Europe, it is around 8% of the average funds, according to Schoenmaker [18], Cerrone [19]. Third, the determination of the premium is related to the institutional quality of the insurer, but it is ignored in this study by Anginer & Bertay [20]. Fourth, the determination of the premium ignores the operator's operating costs, according to Yoshino et al. [5].

I proposed a new model of deposit insurance premiums based on book value. A premium based on book value has considerable potential to be implemented and will significantly impact market players. Its method will provide additional alternatives to determine the fair premium. For Deposit Insurance Corporation (DIC), a fair premium will encourage a new balance, where risk-return can be estimated more precisely. With this new method, the premium paid reflects the risk (fair premium) for banks. It will affect bank performance in the form of increased profitability and the potential to pay lower premiums (discount premiums). It can encourage the competitiveness of banks so that banks can provide better services for depositors.

This study contains the following: part two is a review of the literature concerning deposit insurance premiums, particularly concerning the selected variables. Part three, as an essential part of this research, is establishing a model for determining deposit insurance premiums. Part four is a simulation regarding the premium determination model, using limited data, namely banking in Indonesia (2019–2021). This limited use of data is due to simulation purposes. I also did a robustness test. The final section consists of suggestions, conclusions, and limitations.

LITERATUR REVIEW. HOW TO DETERMINE DEPOSIT INSURANCE PREMIUM

Deposit insurance premiums were initiated by Merton [1] using the put-option theory, where Deposit Book Value (B) is the exercise price and Asset (A) is Stock Price. The guaranteed deposit (D) amount is Bexp(−rT), where r is the risk-free rate. Also, the premium amount depends on the *A/D* ratio, which is a prerequisite for the amount determination. This *A/D* value is measurable, but when the audit is randomly conducted, the potential for finding the right number will be biased. This criticism of Merton can be seen by Ronn & Verma [21], who stated that the considered assets should be ex-ante, not ex-post. The important point to note is that the Bexp(−rT) value is discounting the deposit value to the depositor's detriment. In practice, the guarantee is not only B but also the interest income attached, hence Bexp(rT) is more appropriate.

Recent research has not shown significant changes. Change et al. [22] showed the results of mispricing premiums, especially for large banks. The option model states that all debts have the same priority (liquidation). Also, Chang et al. conveyed the idea regarding reverse convertible bonds (RCB), which would reduce risk, and premiums could be lower. The existence of RCB will reduce the potential for bankruptcy. Chiang & Tsai [4] determined the Deposit Insurance premium based on the specific official default rate (p). Chiang and Tsai considered capital requirements and good supervision as a way to reduce asset risk. This is shown through the efficient frontier between asset value and risk. Chiang & Tsai [4] criticized the use of market equity value as a risk measure. Based on the Merton model, when there is (p), then the bank is asked to reduce asset risk and/or increase equity. According to Chiang and Tsai, premiums should be lower when the bank complies with all regulatory rules. When the bank is not met, then it is subject to a penalty.

Chen [3] used the option model, predicting the Deposit Insurance premium based on several banks' volatility of Credit Default Swap (CDS). Furthermore, Chiang & Tsai [6] estimated insurance premiums through lending-borrowing and the risk of early bankruptcy. These two things are considered to affect the value of bank assets. Chiang & Tsai proved that the higher the spread, the lower the premium. Liu et al. [23] on the other hand, explained the opposite, namely the impact of Deposit Insurance on Credit Default Swap (CDS). It was found that the negative impact of Deposit Insurance is the increase in CDS spread, which indicates the moral hazard behavior of banks. Calomiris & Chen [24] confirmed that DI will increase asset risk in the banking system. This risk is measured by the loan-to-assets ratio, lending to households, and the proportion of lending to mortgages. Additionally, the presence of Deposit Insurance increases *D/A*, but not significantly.

Table 1

The Relation between Asset and Deposit

Time 0	Time 1
A_0	A_1 ; where $A_1 = A_0 + A = A_0 + D_0 * r_l$
D_0	D_1 ; $D_1 = D_0(1 + r) \wedge t = D_0 e^{rt} = D_0 + D_0 * r_b$

Source: Researcher model.

Bank Risk-Return

Barkauskaite et al. [25] showed Deposit Insurance organizers need to consider the individual bank and the accompanying systematic risks, which are closely related to size. This systematic risk comes from various factors, such as liquidity, assets, capital, as well as business management, and the magnitude of its influence is within a certain range. The magnitude of this range is no theory or judgment. Roy [26] showed the determination of the optimal DI premium based on relative risk, which compared "j" and bank risks. The risk of each bank is based on the score from the Insurer (0–100) and adjusted to the Cycle Index. The average bank sector score becomes the average for the Insurer, and is compared with each score. When 'j' < than the average, then the bank is declared riskier. According to Roy, this approach will simultaneously show two things, namely fairness and stability. O'Keefe & Ufier [27] made a simulation regarding the target funds the insurer needs to own. The target of this fund is determined based on (1) default odds, (2) loss rate per default, and (3) the exposure to be covered. These three things depend on various conditions. Also, the probability of default is influenced by credit, liquidity, and systematic risk. The loss rate per default is determined by the Insurer's success in managing the assets of the default bank. O'Keefe & Ufier simulation explained the required funds range from 3 to 7%, which is very different from the results of FDIC.

Bahri & Hamza [6] show that the existence of deposit insurance causes banks to carry out moral hazard, taking risks if the level of competition is higher. One of the bank's risk levels is measured by Non-Performing Loans (NPL). Measurement of risk through NPL is also shown by Bahri & Hamza [6], Abbas et al. [7], Hunjra et al. [8] and alternative measurements using the Z-score Zhang & Xu [28], Trinugroho et al. [10], Martinez & Baselga [11], Hunjra et al. [8]. Altavila et al. [29] state that banks with high NPLs and low capital ratios show that the pass-through monetary policy on lending rates (real activity) is not going well. Altavila et al. [30] show that uncertainty over interbank rates can increase lending rates, reaching around 1% of peak times. The effect of this interbank rate varies depending on credit risk factors, capital ratios, and also access to the central bank.

From the above description, it can be summarized as follows: (1) premium determination model, which is based on option theory Merton [1] and its development, (2) use of market prices, with limitations in terms of data accuracy, (3) recent studies showed: (a) the importance of the CDS, (b) Non-Performing Loan as one of the criteria for determining the premium. In this study, a new deposit insurance premium design was submitted. Asnawi's Model uses risk-return based on book value variables and finds a new formula to determine the Deposit Insurance premium. Its formula can be the basis for further research with various adjustments.

DEPOSIT INSURANCE MODEL

Deposit insurance premium-Asnawi Model based on book value, taking into account 3 variables namely: A_0 / D_0, lending-borrowing rate, and NPL. The model can be stated as follows: *At* time t_0, there is an asset of A_0 and a guaranteed deposit of D_0, with an initial balance sheet value of $A_0 = D_0 + E_0$. Based on Merton [1] the premium is based on the Assets/Deposits ratio, and the allowed situation is $A_0 / D_0 \geq 1$. A_t T_1, both assets and deposits grow. The assets grew by ΔA, which is assumed to be obtained from loan income (rate of loan, r_l) or by $L * r_l$. Meanwhile, the deposits grew by the amount of interest to be paid (rate of borrowing; r_b, or by $D_0 * r_b$. Therefore, it is assumed that the loan amount is the same as the deposit D_0, where *A* is equivalent to $D_0 * r_l$, which can be stated as follows (*Table 1*).

Equity value (E_1) can be expressed as the Bank-Charter Value (*V*) equal to the difference between A_1 and D_1 or $A_1 - D_1$. This *V* is referred to as the Bank Stability. The more stable the bank, the lower the chance of bankruptcy, and the lower the insurance premiums. Hence, at T_1, it can be stated that:

$$V = A_1 - D_1 = A0 + A - Do - D > 0, \quad (1)$$
$$: D_0$$

$$V = \left(\frac{Ao}{Do}\right) + (rl - rb - 1), \quad (2)$$

Table 2

Proposed Bank Groups Based on Asset to Deposit Ratio (ADR)

$(A_0 / D_0 - 1)$ (%)	Index	Group	Premium
8.7–9.57	100–110	1	Based premium
9.58–11.31	110.–130	2	Lower premium
11.32–13.92	130.–160	3	Even Lower premium
> 13.92	> 160	4	Lowest premium

Source: Researcher — proposed bank groups.

Table 3

Proposal of Deposit Insurance Premium Based on Lending-Deposit Rate Ratio (LDR)

r_l / r_b	Index	Grup	Premium
2.00–2.20	100–110	1	Based premium
2.21–2.60	110–130	2	Lower premium
2.61–3.20	130–160	3	Even Lower premium
>3.20	>160	4	Lowest premium

Source: Researcher model.

$$V = \left(\frac{A0}{Do} - 1\right) + (rl - rb), \qquad (3)$$

where (A_0 / D_0) = Asset Deposit Ratio.

Assumptions (A_0 / D_0):

1. I proposed 4 groups, where (i) group 1, with index 100–110 (+10 points), (ii) group 2, with an index of 111–130 (+ a maximum of 20 points), (iii) 3, with index 131–160 (+ maximum 30 points), and (*iv*) 4, with index > 160.

2. Group 1, lowest ranking and get the highest premium. Groups 2, 3, 4 get a premium discount.

The Asset Deposit Ratio

The Bank's Charter Value (V) is determined by two factors, namely (i) (A_0 / D_0) ratio and (ii) the difference between loan and deposit interests $(r_l - r_b)$. Banks can join the deposit insurance program when the ratio of $(A_0 / D_0 > 1)$. The minimum Capital Adequate Ratio (CAR) is 8% (prerequisite), with the assumption of all risk-weighted assets, hence the ratio $(A_0 / D_0 - 1)$ is 100/92 = 8.7%. This amount can be stated as the default index (100), and it will only change when the CAR prerequisite changes. An index above 100 indicates resilience for these banks. The proposal is presented in *Table 2*.

Lending-Deposit Rate Ratio

The second factor $(r_l - r_b)$ shows the banking-net margin (BNM) simultaneously indicates two things, namely profit and risk. Profit can be expressed as an index, dividing the net margin by the borrowing interest $(r_l - r_b) / r_b$. This is in accordance with (3), hence when $r_l < r_b$, a negative index will be obtained, and the bank will deteriorate. When the r_b is higher, the index will be lower, and the investment risk will increase. Furthermore, when the banking-operating costs and other (BOC) are considered and equalized to r_b, then there will be an additional r_b. It is assumed that the BOC is r_b, $r_l = 2r_b$, and the second factor $(r_l - r_b) / r_b$ will be 100%. This value can be used as a benchmark that the bank's lending rate is at least twice the interest on borrowings. The outcome is seen in *Table 3*.

Non-Performing Loan

Fundamental factors influence the lending rate, and loan risk is reflected in Non-Performing Loans (NPL). The fundamental factors are stochastic and they affect the quality of banking loans. Hence, the risk factor can be measured through NPL and expressed as a deduction. The government determines the *NPL* at 5%, which is a default (100), where the lower the *NPL*, the lesser the credit risk. With the four above groups, the Deposit Insurance premium proposal is as follows (*Table 4*).

The direct influence of fundamental factors cannot be traced to the financial statements, but will indirectly affect bank profits. Hence, profits are influenced by the fundamental factors, as well as the A/D and $(r_l - r_b)$. This study did not consider bank profitability.

Table 4

Proposed DI Premium Based On Non-Performing Loans (NPL)

NPL (%)	Index	Group	Premium
4.50–5.00	90–100	1	Based premium
3.50–4.49	70–89	2	Lower premium
2.00–3.49	40–69	3	Even Lower premium
< 2.00	⩽ 40	4	Lowest premium

Source: researcher model.

Premium Determination Proposal

Determination of deposit insurance premiums can be done in two ways. First, each bank gets an Asnawi Score, and is grouped into 4 groups (Asnawi Group). Group I, is the highest premium, and group 4 is the lowest premium. Group I is the standard premium, which applies today. Groups 2, 3, 4 will get a premium discount; this research proposes this premium discount by following the Taylor series, so that the discount gets bigger but with a smaller rate. Second, the Insurer, Deposit Insurer Corporation (DIC), makes a reference value (DIC-Asnawi Score), where each bank is required to meet (exceed) the value. The value obtained by each bank will be grouped into 4 groups, and group 4 will receive the lowest premium.

Asnawi Score-Group

Based on *Tables 2–4* above, the lowest potential score is 1 (1*1*1; highest premium), and the highest is 64 (4*4*4, lowest premium). It was proposed that a bank gets Groups 1, 2, 3, and 4 based on the following scores.

The determination of the Deposit Insurance premium is de-facto and without a theory. This is proposed in Group 1 as "based premium" because all those participating in deposit insurance have met the requirements, namely $A_0 > D_0$. Therefore, groups 2, 3, and 4 pay lower premiums but with a decreasing discount rate. This pattern is solved from the Taylor series as follows:

$$P = p0,$$

$$P = Po - \left(1/1!!+ \ldots.. + \frac{1}{n!}\right) * discount\ rate.$$

When assumed that group 1 is the current Indonesian Deposit Insurance Corporation (IDIC) premium, which is 0.1%, the discount rate is 0.01%, and the amount of premium to be paid is:

$$Group\,1 = 0.1\%,$$

$$Group\,2 = 0.1\% - \left(\frac{1}{1!} * discount\ rate\right); (i = 1) = 0.095\%,$$

$$Group\,3 = 0.1\% - \left(\frac{1}{1!} * discount\ rate + \left(\frac{1}{i!}\right) discount\ rate\right); (i = 2) = 0.0933\%,$$

$$Group\,4 = 0.1\% - \left(\frac{1}{1!} * discount\ rate + \left(\frac{1}{i!}\right) discount\ rate\right); (i = 3) = 0.0929\%.$$

The above method can be generalized for basic premium and scoring determinations (*Table 5*).

Insurance Deposit Corporation-Asnawi Score (IDC-AS)

The second way is for IDC to determine the Insurance Deposit Corporation-Asnawi Score (IDC-AS). The score of each bank is compared with IDC-AS, grouped as 1, 2, 3, 4 and declared the Asnawi Group (AG). Based on equation (2), the prevailing assumption is *CAR* = 8%, where the first term is at least 8.7%, and *rl* = 2*rb*. The IDC determines the maximum default rate of borrowing and is expressed as the Insurer-Deposit Rate (IDR). Hence, equation (3) is IDC-AS. For example, for the Indonesian Deposit Insurance Corporation (IDIC), Insurer-Deposit Rate is set at 3.5%, then IDIC-Asnawi Score is 15.7%.

Table 5

Bank Group-Premium Scenario

Score	Teoritical Probability	Asnawi Group	Estimate Premium (%)	Premium
1–9	29/64 = 45.3%	1	0.1000	Based premium
12–24	24/64 = 37.5%	2	0.0950	Lower premium
27–36	7/64 = 10.94%	3	0.0933	Even lower premium
48–64	4/64 = 6.25%	4	0.0929	Lowest premium

Source: Researcher model.

$$V_{IDR} = 8,7\% + 2 * IDR\,. \qquad (4)$$

When a bank obtains a V_{bank} higher than the Asnawi Score, then it gets incentives in the form of premium discounts. Four groups were proposed, where group 1 is the basic premium because in equation (4.a), the components of measurable risk have been considered. Banks have met the requirements; hence, a healthier bank should get a lower premium. The distribution of groups and premiums is shown in *Table 6*.

Risk Adjusting Factor: Non-Performing Loan (NPL)

Banking regulations indicate a maximum NPL value of 5%. A high NPL contains a large credit risk even for the Insurer. Therefore, the amount of NPL can be used as an Incentive Compatible Plan. Banking with an *NPL* of 5% is a high risk, and the chance of being uncollected (p) is high. This will naturally reduce *V*, and banks with lower NPLs will have a lesser risk. There will be a progressive decrease in risk following the decline in the *NPL* category; hence, the adjusted-NPL (*NPL**) value arises. With the assumption of using 4 groups, the probability (p) of being uncollected is 100%, 80%, 50%, or 10%. The NPL* is as presented in *Table 7*. This *NPL* will reduce the bank value, and equation (3) can be defined as follows:

$$V_{bank} = \left(\frac{A_0}{D_0} - 1\right) + rl - NPL* \qquad (5)$$

$$V_{bank} > IDC - Asnawi\,Score\left(V_{IDR}\right). \qquad (5a)$$

SIMULATION

Data

The purpose of the study is to provide a new model to deposit insurance premiums, so that the simulation can be used as a complement to research. Thus, the use of data is only from Indonesia and limited years, namely 2018–2021. It is hoped that the results of this simulation can be considered for application in other countries, with various adjustments. All Financial Report data obtained from Indonesia Stock Exchange (IDX); www.idx.co.id.

There are 46 banks, of which 3 are Islamic. The sample was 19 banks, consisting of 5 large ones with over IDR 1000 trillion, 6 medium-scale with about IDR 100 trillion, 5 small-scale banks with around IDR 10 trillion, and 3 registered Islamic Banking. The data used include Assets, Deposits, interest receipts, interest costs, total comprehensive income (for Islamic banking, revenue from fund management as mudharib; third parties share on return of temporary syirkah funds), and the amount of own capital. All of the data are available in their financial statements. Also, Non-Performing Loans (*NPL*) were proxied by adding all allowance for impairment losses and dividing by the amount of investment that causes the losses. The lending and borrowing rates are obtained by dividing interest income or cost by the total deposit.

RESULT AND DISCUSSION

Market Statistics

The Indonesian banking data are exciting. First, there are only about 5.5% Conventional Commercial Banks that have a value of around 93%. Second, most bank ownership is domestic; only around 2.9% is foreign. Third, for four years, the number of rural banks has decreased by an average of 2.6%, indicating the number of liquidations of rural banks. Fourth, the type of deposits, around 97.5%, are savings accounts. In 2021, the number of accounts was 386.3 million, and the number of accounts with a value of < 2 billion was 99.9%. specifically, the number of accounts less than (<) 100 million is around 98.4%. Thus, most of the accounts are under full guarantee. Fifth, regarding value/nominal savings, around 50.7% is not guaranteed where the savings are greater than IDR 5 billion. A contradiction between the fourth and fifth. Fourth shows that most depositors save low nominal savings; fifth, some have enormous

Table 6

Estimated Deposit Insurance Premium Based on Asnawi Score

Group	Indeks	Vbank	Premium-Taylor rate	Premium (%)
1	100–110	15,7–17,42	po	0.1000*
2	111–130	17,43–20,56	$P = Po - (1/1!) * discount\ rate$	0.0950
3	131–160	20,57–25,26	$P = Po - \left(1/1!!+.....+\frac{1}{n!}\right) * discount\ rate$	0.0933
4	>160	>25,26	$P = Po - \left(1/1!!+.....+\frac{1}{n!}\right) * discount\ rate$	0.0929

Source: Researcher model.

Note: * = basic premium.

Table 7

Estimated NPL, the chance of not being collected, and Adjusted NPL

Non Performing Loan (NPL)	Probability default	Adjusted NPL (NPL*)
4.5–5%	100	4.5–5%
3.5–4.4	80	2.8–3.52
2.1–3.4	50	1.05–1.7
⩽ 2.	10	0.2

Source: Researcher model.

savings. The existence of IDIC has played a perfect role in protecting the bank's depositors. Sixth, IDIC has an increase in premium revenue due to the rise in nominal savings. Most of the premium revenue comes from commercial banks, but rural banks have gone bankrupt. Rural banks can apply higher interest rates on savings, so rural banks are riskier than conventional commercial banks (*Table 8*).

Table 9 shows estimates for Asset Deposit Ratio (*ADR*), Loan-deposit rate ratio (*LDR*), Non-Performing Loan (*NPL*), lending rate (r_l), borrowing rate (r_b), and adjusted *NPL* (*NPL*)* as referenced in *Table 7*. The Asnawi's score is based on *Table 5*, V_{bank} is based on equation (5), and the Score is based on *Table 6*. Some of the results that can be discussed are as follows:

Firstly, the fundamentals of each bank can be seen in columns 3, 4, 5 to get the Asnawi Group 1. The banks already have good ADR, except for BBTN, and there was a spike in ADR in ARTO and BSWD. However, this high spike did not change the group because in the previous ratio, it had entered the high group. Secondly, LDRs are very important, but there are banks with *LDR* < 1. Based on the above criteria, *LDR* = 100%, when *rl* = 2*rb*. In this case, the *LDR* shows the lending rate is less than 2 times the borrowing rate, which is not good. *LDR* < 1 is found on all scales, including large, medium, and small, including Islamic Sharia banks. Thirdly, the estimated *NPL* is that there are banks that exceed BI rules with a maximum of 5%. These banks should be penalized, but in this calculation, they are ignored. In general, the banks' fundamentals are quite good.

The fourth is the fundamentals of every bank to get Asnawi Group II. The estimated rate of lending and *NPL** are shown in columns 6 and 8. Furthermore, the Asnawi Score and Group values are shown in columns 13 and 14. The bank lending rates are good, but BTPS (Islamic-Sharia Bank) has a very high value. Some banks have high *NPL** (> 5%), which should be a concern. The value of the V-bank is quite high, but there are 2 large banks (BBNI and BBTN) with a value of < 15.7. This is because they both have high *NPL**, which can be the focus of future improvements.

Fifth, when the groups of each bank are compared (columns 12 and 14), there will be a different outcome. The groups mean were 1.86 and 3.01, which were statistically different at α = 1%. Therefore, the measurements of these two methods are substitutional, not complementary. In the first method, DIC created a

Table 8

Indonesian Banking Market Statistic

Variable	2021	2020	2019	2018
Total Banks	1739	1778	1814	1869
Conventional Commercial Bank	95	95	96	101
Sharia Commercial Bank	12	14	14	14
Rural Banks	1468	1506	1541	1587
Sharia People's Financing Bank	164	163	163	167
Nominal Amount (IDR Trillion)	7546	6737	6196	5810
Conventional Banks	7005	6267	6077	5704
Rural Banks	541	470	119	106
Bank Ownership (Persentage of IDR Deposit)				
Foreign (%)	2.9	2.9	na	na
Mixture	2.6	2.7	na	na
Regional Development Bank (RDB)	9.2	8.9	na	na
State Ownership	42.1	42.7	na	na
National Private	43.2	42.7	na	na
Covered of Guarantor				
Full Guaranteed (%)	40.80	43.6	na	na
Partially guaranteed (%)	8.50	8.9	na	na
Not Guaranteed (%)	50.70	47.5	na	na
Premium Income (IDR Trillion)	14.38	13.09	11.93	11.22
Commercial Banks	14.12	12.85	11.71	11.02
Rural Banks	0.26	0.24	0.22	0.20

Sources: Indonesian Deposit Insurance Corporation (IDIC). URL: https://lps.go.id (accessed on 14.02.2023).

group for the three components of *ADR, LDR*, and *NPL*, then merged and became the Asnawi Group. In the second method, DIC calculated the three components above and got a V Bank Score. The Asnawi group was created based on the DIC-AS score criteria. The second method seems more practical and has a better Asnawi Group.

Sixth, BBCA Bank is the best of the two calculation models. The BBCA, which is the third-largest bank, has assets of IDR 1228 trillion (2021), and is very popular with a good reputation in Indonesia. Meanwhile, BBTN, which is the 5th largest bank, has assets of IDR. 379 trillion (2021), and is the worst out of the 2 calculations, where it obtained a score of 1. The significant difference in this score in the same bank group shows a real difference in banking operations, which can be a concern for stakeholders. This figure will change when the assumptions used in this study also change (*Table 9*).

Robustness Test

Two robustness tests were proposed, where the first is Another *NPL** proposal. The second is whether the Asnawi Group factors influence ROE. However, only the first Asnawi Group was tested.

Another NPL*

Adjusted *NPL* (*NPL**) can also be estimated, where the amount follows the Taylor series pattern (*Table 10*). Group 1, with an *NPL* of 4.5–5% did not get an adjustment, hence the *NPL** is the true *NPL*. When a 1% discount rate is assumed as a benchmark, groups

Table 9

Bank-Asnawi Score Estimation

Bank Tick	Year	Bank Performance (%)						Asnawi Score (AS)				Bank Value (*V*)	
		ADR	*LDR*	*NPL*	*RI*	*Rb*	*NPL**	*ADR*	*LDRR*	*NPL*	*AS*	*V*	*AS*
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Large Banks													
BBRI	2018	16.67	2.29	3.03	10.04	3.05	1.51	4	2	3	2	25.19	3
	2019	17.28	2.04	3.02	10.08	0.03	1.51	4	1	3	2	25.85	4
	2020	16.62	2.22	4.82	9.83	0.03	4.82	4	2	1	1	21.64	3
	2021	21.05	3.88	5.67	10.35	0.02	5.67	4	4	1	2	25.73	4
BMRI	2018	18.18	2.07	3.54	7.96	2.59	2.84	4	1	2	1	23.31	3
	2019	18.85	1.85	2.98	8.25	2.89	1.49	4	1	3	2	25.61	4
	2020	15.31	1.89	5.35	7.15	2.47	5.35	4	1	1	1	17.10	1
	2021	14.77	2.96	5.50	6.50	1.64	5.50	4	3	1	2	15.77	2
BBCA	2018	22.55	3.95	2.29	8.43	1.71	1.14	4	4	3	4	29.84	4
	2019	23.38	3.78	2.32	8.57	1.79	1.16	4	4	3	4	30.79	4
	2020	20.73	4.82	3.48	7.34	1.26	1.74	4	4	3	4	26.34	4
	2021	19.78	5.91	3.74	6.40	0.93	3.00	4	4	2	3	23.19	3
BBNI	2018	15.81	1.86	2.44	7.24	2.53	1.22	4	1	3	2	21.83	3
	2019	17.35	1.67	2.61	8.12	3.04	1.30	4	1	3	2	24.17	3
	2020	14.50	1.95	6.16	7.22	2.44	6.16	4	1	1	1	15.55	1
	2021	15.09	3.25	6.62	5.97	1.41	6.62	4	4	1	2	14.43	1
BBTN	2018	8.44	0.77	1.22	7.35	4.16	0.12	1	1	4	1	15.67	1
	2019	8.28	0.52	2.21	8.08	5.33	1.10	1	1	3	1	15.26	1
	2020	5.86	0.54	4.54	6.73	4.35	4.54	1	1	1	1	8.04	1
	2021	6.11	0.97	4.69	6.68	3.39	4.69	1	1	1	1	8.10	1
Medium Banks													
BBKP	2018	9.87	0.48	2.76	9.17	6.19	1.38	2	1	3	1	17.66	2
	2019	9.75	0.35	2.17	8.50	6.29	1.08	2	1	3	1	17.16	1
	2020	11.85	0.13	6.85	7.43	6.60	6.85	3	1	1	1	12.43	1
	2021	17.37	0.24	6.42	5.55	4.46	6.42	4	1	1	1	16.51	1
BJBR	2018	10.36	1.20	0.77	10.94	4.97	0.08	2	1	4	1	21.23	3
	2019	10.80	1.01	0.77	10.84	5.39	0.08	2	1	4	1	21.57	3
	2020	9.31	1.06	1.56	9.79	4.75	0.16	1	1	4	1	18.95	2
	2021	9.01	1.49	1.42	9.10	3.66	0.14	1	1	4	1	17.96	2
BNII	2018	16.46	1.21	1.56	9.70	4.39	0.16	4	1	4	2	26.01	4
	2019	18.74	1.12	1.84	10.87	5.13	0.18	4	1	4	2	29.43	4
	2020	18.65	1.30	2.34	8.79	3.81	1.17	4	1	3	2	26.26	4
	2021	20.51	1.97	2.55	7.66	2.58	1.28	4	1	3	2	26.90	4
BNLI	2018	17.21	0.95	6.54	8.49	4.36	6.54	4	1	1	1	19.16	2
	2019	17.49	0.95	3.04	8.55	4.38	1.52	4	1	3	2	24.52	3
	2020	21.56	1.22	4.79	7.33	3.31	4.79	4	1	1	1	24.10	3
	2021	18.51	1.80	4.93	6.01	2.15	4.93	4	1	1	1	19.60	2

Table 9 (continued)

Bank Tick	Year	Bank Performance (%)						Asnawi Score (AS)				Bank Value (*V*)	
		ADR	*LDR*	*NPL*	*Rl*	*Rb*	*NPL**	*ADR*	*LDRR*	*NPL*	*AS*	*V*	*AS*
1	2	3	4	5	6	7	8	9	10	11	12	13	14
MAYA	2018	14.16	0.59	2.60	10.49	6.60	1.30	4	1	3	2	23.36	3
	2019	15.22	0.49	3.27	11.03	7.42	1.63	4	1	3	2	24.62	3
	2020	16.22	0.03	3.72	6.53	6.31	2.97	4	1	2	1	19.78	2
	2021	13.30	0.07	1.51	6.03	5.64	0.15	3	1	4	2	19.17	2
MEGA	2018	19.70	1.08	0.71	9.68	4.66	0.07	4	1	4	2	29.30	4
	2019	18.23	0.93	0.42	8.74	4.54	0.04	4	1	4	2	26.93	4
	2020	19.37	0.95	0.63	8.56	4.40	0.06	4	1	4	2	27.87	4
	2021	16.83	1.48	0.55	7.13	2.87	0.06	4	1	4	2	23.91	3
Small Banks													
BBHI	2018	17.46	0.84	1.58	11.53	6.26	0.16	4	1	4	2	28.83	4
	2019	13.46	0.64	4.93	9.98	6.10	4.93	3	1	1	1	18.51	2
	2020	15.50	0.42	2.14	7.24	5.11	1.07	4	1	3	2	21.66	3
	2021	38.95	1.24	1.11	10.56	4.72	0.11	4	1	4	2	49.39	4
BSWD	2018	40.85	0.78	3.39	11.38	6.38	1.70	4	1	3	2	50.54	4
	2019	40.89	0.98	4.98	10.12	5.12	4.98	4	1	1	1	46.03	4
	2020	39.71	0.62	5.08	8.65	5.35	5.08	4	1	1	1	43.28	4
	2021	90.25	1.07	5.41	7.96	3.84	5.41	4	1	1	1	92.81	4
BGTG	2018	33.41	1.17	2.67	11.46	5.27	1.33	4	1	3	2	43.53	4
	2019	31.06	0.86	1.39	10.91	5.86	0.14	4	1	4	2	41.83	4
	2020	26.95	0.86	1.46	8.40	4.53	0.15	4	1	4	2	35.20	4
	2021	33.44	1.17	1.44	4.94	2.27	0.14	4	1	4	2	38.23	4
ARTO	2018	21.04	0.69	1.85	12.28	7.28	0.18	4	1	4	2	33.14	4
	2019	106.45	0.28	2.80	8.22	6.42	1.40	4	1	3	2	113.28	4
	2020	130.06	2.54	4.87	9.51	2.68	4.87	4	2	1	1	134.69	4
	2021	203.04	9.41	1.14	16.06	1.54	0.11	4	4	4	4	218.98	4
BABP	2018	15.17	0.68	2.48	10.19	6.08	1.24	4	1	3	2	24.12	3
	2019	17.23	0.60	2.31	11.84	7.38	1.15	4	1	3	2	27.92	4
	2020	15.36	0.61	2.24	9.60	5.95	1.12	4	1	3	2	23.84	3
	2021	20.30	0.71	1.78	8.41	4.91	0.18	4	1	4	2	28.54	4
Islamic Banks													
BRIS	2018	15.31	1.37	1.65	9.50	4.01	0.16	4	1	4	2	24.64	3
	2019	13.38	1.55	1.88	8.87	3.47	0.19	3	1	4	2	22.06	3
	2020	9.98	2.38	2.68	7.77	2.30	1.34	2	2	3	2	16.41	1
	2021	10.41	3.07	3.02	7.41	1.82	1.51	2	3	3	2	16.31	1
BTPS	2018	49.70	8.38	1.99	42.86	4.57	0.20	4	4	4	4	92.36	4
	2019	53.99	7.51	2.12	44.62	5.24	1.06	4	4	3	4	97.55	4
	2020	55.69	7.12	5.68	38.25	4.71	5.68	4	4	1	2	88.26	4
	2021	61.97	10.84	4.10	40.82	3.45	3.28	4	4	2	3	99.52	4
PNBS	2018	23.49	0.52	3.45	8.43	5.54	1.73	4	1	3	2	30.20	4
	2019	17.95	0.27	2.69	7.02	5.53	1.35	4	1	3	2	23.62	3
	2020	38.06	0.21	2.56	8.73	7.22	1.28	4	1	3	2	45.51	4
	2021	18.99	1.08	1.02	6.02	2.89	0.10	4	1	4	2	24.91	3

Source: Researcher result.

Table 10

NPL Estimation, Dan Adjusted NPL (NPL*) Taylor Series

Group	*NPL* (%)	Taylor rate	Discount (%)	*NPL** (%)
1	4.5–5	po	0	4.5–5
2	3.5–4.4	$P = Po - (1/1!) * discount\ rate$	1	2.5–3.4
3	2.1–3.4	$P = Po - \left(1/1!!+\ldots..+\frac{1}{n!}\right) * discount\ rate$	1.5	0.6–1.9
4	⩽2.	$P = Po - \left(1/1!!+\ldots..+\frac{1}{n!}\right) * discount\ rate$	1.67	< 0.33

Source: Researcher model.

2, 3, and 4 will obtain 1%, 1.5%, and 1.67% adjusters respectively. The group with lower *NPL* obtained a larger adjuster but with a decreasing pattern. When compared to *Table 6*, there is a difference in the estimated *NPL**, except for group 1, because it is calculated as 100%.

Regression Test of the Relationship Between Factors to ROE

Does the variable used to measure the score of this bank affect ROE? This becomes necessary because the variable is very important for banking. Three regression tests were carried out, namely the values of *ADR*, *LDR*, and *NPL* as presented in *Table 3* in columns 3, 4, 5. The test results showed the *LDR*, *NPL*, and Asnawi Group match the predictions and are significant as shown in *Table 11*. However, only ADR did not match the predictions. When the ADR data have outliers, it is possible that the regression results are not satisfactory. These results generally indicate that the selected variable can be used to predict earnings. *Table 11.b* shows the regression between (ADR, LDR, NPL)-group score on ROE, while *Table 11.c* is the Asnawi Group regression on ROE. *Table 11.b* gets equivalent results with *11.a*. *Table 11.c* shows a positive coefficient (as a prediction), where a high score (lowest risk) has a positive effect on firm profits.

CONCLUSIONS, LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

This paper provides a guide on determining deposit insurance premiums using book values, which accurately reflect the bank's profile. This paper determined the premium using three important indicators, namely the *A/D* ratio, lending-borrowing rate, and Non-Performing Loans. With these three indicators, a bank will be included in the Asnawi Groups. The DIC can also create a benchmark (DIC-AS), with which the score of each bank is compared. Both the Asnawi Score and DIC-AS can be easily determined. Stock market prices fluctuate, and banking is a regulated industry; measuring bank risk would be more appropriate if using book values. The proper formulation (risk-return) means that deposit insurance premiums can be determined fairly. This research can be used as a reference to find the best fair premium.

Regarding the use of assumptions for the model, the above description states that all lending is borrowing funds, which in practice is lending<borrowing. This causes the estimate of r_l to be undervalued. When this is considered, the results will improve the score. Also, *ADR*, *LDR*, and *NPL* have the same weight, and DIC can have different perceptions. The assumption of banking operational costs is the rate of borrowing,

Table 11

The ROE Regression Results

a): The impact value of ADR, LDR, NPL on ROE						
Variabel	Coefficients			t-value	Sign	Model
	Predicted	Unstandardized	Standardizes			
(Constant)		0.078		2.955	.002	R^2 = .38 F = 14.75*
ADR	+	–.000	–.441	–4.171	.000*	
LDR	+	0.039	.660	6.222	.000*	
NPL	–	–0.017	–.224	–2.410	.009*	
b): The impact of Group Score of ADR, LDRR, NPL on ROE						
Variabel	Coefficients			t-value	Sign	Model
	Predicted	Unstandardized	Standardizes			
(Constant)		–.005		–.075	.457	R^2 = .17 F = 5.13*
SADR	+	–0.018	–.137	–1.263	.107	
SLDR	+	0.050	.405	3.710	.000*	
SNPL	+	0.017	.154	1.424	.077***	
c): The impact of Asnawi Score on ROE						
Variabel	Coefficients			t-value	sign	Model
	Predicted	Unstandardized	Standardizes			
(Constant)		–0.037		–1.052	.149	R^2 = 0.089 F = 7.21*
Asnawi	+	0.047	.298	2.685	.005*	

Source: Researcher result.

Notes: * = significant at α = 1%; ** = significant at α = 5%; significant at α = 10%.

and the use of group 1 as a based premium can be changed to group 2. In this case, group 1 will receive a penalty.

Future research needs to pay attention to Yoshino et al. assertions. When the cost of DIC is considered, then DIC-AS may increase. The formulation of the DIC can be part of the research, as well as the potential for bankruptcy as part of DIC-AG's consideration. In V_{Bank}, the *NPL** has been adjusted, but the risk value has decreased. The potential for bankruptcy can be stochastic and it will impair DIC's funding capacity. In general, when this risk occurs, it is exposed to the DIC and the banking ecosystem. Therefore, how to formulate this risk is an aspect that needs to be studied. Not all deposits have the same risk, and not all risk assets are the same; hence, when it is accurately defined, a fairer premium will be obtained.

DIC can generally consider this premium design compared to the prevailing (flat premium). The determination of premiums is based on important indicators, is risk-based, and refers to the Incentive Compatible Plan. This is easy to implement and can be evaluated following economic-business developments.

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