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The Risk of Gold Price Fluctuations on the Balance of Assets and Liabilities: An Analysis within the Framework of Asset-Liability Management at the XYZ Church Welfare Fund

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ABSTRACT

The XYZ Church Welfare Fund (BAKES) manages benefit obligations denominated in gold grams, creating structural exposure to gold price volatility. However, its investment portfolio remains dominated by deposits with fixed returns, lacking assets that move in tandem with gold prices, thereby generating an Asset-Liability mismatch. This research aims to analyze risk fluctuations price gold to balance assets and liabilities in Management of the XYZ Church's BAKES welfare fund. Obligations benefit participant set in gram of gold so that its value very influenced by dynamics price gold in the market. Meanwhile that, portfolio asset BAKES investment is still dominated by deposit instruments with characteristics reward results still that doesn't own sensitivity mark one way with change price gold. This research used approach descriptive analytical with method studies case through secondary data analysis in the form of document policy management wealth, report portfolio investment, participant data, and price data gold 2022-2025 period. Research results This show that nominally condition BAKES solvency is still be in position safe Because mark asset bigger than obligations. However, the structure portfolio investments that have not been implement investment gold cause exposure risk to fluctuations price gold and potential cause imbalance between assets and liabilities in long term. Therefore that, is necessary strengthening management strategies asset in Asset Liability Management framework, including utilization investment gold as a protection instrument value, use guard stability finance and sustainability fulfillment welfare fund obligations.

INTRODUCTION

BAKES XYZ is the Welfare Section under XYZ Church, mandated to manage and develop the welfare funds collected from participants and institutions of XYZ Church to ensure the long-term sustainability of benefit provision. These benefits take the form of pension provisions for retired pastors and employees. Specifically, the obligation for pastors is set at a value equivalent to 10 grams of 24-carat gold per year of service, with a maximum limit of 32 years of service. For non-clerical employees, the obligation is set at 5 grams of 24-carat gold per year of service, with the same maximum limit of 32 years. Because these obligations are determined based on the price of gold, BAKES's overall liability structure is inherently tied to fluctuations in gold commodity prices, making exposure to gold price risk a significant and

structural concern (Fabozzi, 2019; Hull, 2022; OECD, 2023; World Gold Council, 2023; Bodie et al., 2021).

From an Asset-Liability Management (ALM) perspective, an obligation structure denominated in gold requires a correspondingly balanced asset composition, in which asset values move in tandem with gold price movements (Fabozzi & Konishi, 2019; CFA Institute, 2022). In BAKES's case, wealth management policy allocates 60% of funds to non-liquid instruments including gold investment and land and 40% to liquid instruments in the form of deposits. However, the gold investment component has not yet been implemented, and the majority of funds remain placed in deposits, which have fixed-return characteristics. This creates a structural mismatch between assets and liabilities, resulting in an asset-liability mismatch (Institute and Faculty of Actuaries, 2020; Bodie et al., 2021). Consequently, any increase in gold prices directly raises the value of participant benefit obligations, while deposit-based assets do not experience a corresponding adjustment in value. These dynamics widen the long-term funding gap and threaten the sufficiency of BAKES's funds in sustainably fulfilling participant entitlements (OECD, 2023; World Gold Council, 2024).

Several studies have examined the relationship between gold price fluctuations and asset-liability management across various institutional contexts. Baur (2025) investigated whether gold functions as an inflation hedge, finding that its effectiveness as a protective asset depends heavily on investment horizon and prevailing market conditions. Similarly, Binh (2024) conducted a comparative analysis of gold, art, and wheat as inflation hedges, concluding that gold remains among the most effective instruments for long-term value preservation. Ryan, Corbet, and Oxley (2024) examined gold's safe-haven properties and found that its effectiveness in this role is not constant, but varies with market conditions and geopolitical events. Collectively, these studies affirm gold's strategic value as a protective instrument, particularly amid economic uncertainty. However, they primarily treat gold as a standalone investment asset rather than examining its role as a strategic buffer for liabilities denominated in the same commodity (Fernando, 2017; Lahoti, 2025; Prengle, 2026).

Within the field of Asset-Liability Management, Di Francesco and Simonella (2023) developed a stochastic ALM model for life insurance companies, demonstrating that effective ALM requires close alignment between asset characteristics and liability profiles. Pan and Zhou (2024) examined optimal investment strategies for asset-liability management involving defaultable bonds under stochastic default intensity, underscoring the importance of matching asset sensitivity to liability sensitivity. Wijayanti *et al.* (2024) conducted a systematic literature review on robust goal programming as a novel approach to ALM modeling for non-financial companies, emphasizing the need for flexible and adaptive ALM frameworks. Nonetheless, these studies predominantly focus on financial institutions and do not address the specific challenges faced by welfare funds with commodity-linked liabilities (Animante, 2015; Lkhagvasuren, 2026).

Research specifically addressing welfare funds with gold-denominated liabilities remains scarce in the peer-reviewed literature. Most ALM studies concentrate on pension funds, insurance companies, or banking institutions with monetary liabilities. The distinctive case of welfare funds that denominate participant benefits in physical gold grams produces a unique risk profile that conventional ALM frameworks may not adequately capture. Moreover, while investment gold is widely recognized as a value-protection instrument in portfolio

management, limited research has examined its function as a strategic asset buffer for liabilities denominated in the same commodity (Rawat, 2026).

The novelty of this research lies in several aspects. First, it addresses an underexplored context by examining ALM challenges within a church-based welfare fund with gold-denominated obligations an institutional type rarely analyzed in the academic literature. Second, unlike prior studies that treat gold solely as an investment asset, this research positions gold as a strategic liability buffer within the ALM framework, emphasizing its role in risk mitigation rather than return generation alone. Third, this study provides empirical evidence of the structural mismatch between conventional fixed-income assets and commodity-linked liabilities, offering a more comprehensive understanding of ALM risk in non-financial institutions. Fourth, the research develops mitigation strategies specifically tailored to institutions with gold-based obligations, including ALM-informed commodity policies and the implementation of gold investment as a protective mechanism.

The research gap identified in this study is the absence of comprehensive analysis on the risk posed by gold price fluctuations to the balance of assets and liabilities in welfare funds with gold-denominated benefit obligations. While prior studies have examined gold as an investment asset and ALM across various institutional contexts, none has specifically addressed the structural mismatch between conventional fixed-income assets and commodity-linked liabilities within church-based welfare funds. This limited availability of empirical evidence on this specific ALM risk exposure forms the basis for the present research.

This research aims to analyze the risk posed by gold price fluctuations to the balance of assets and liabilities within the Asset-Liability Management framework at the XYZ Church Welfare Fund. Specifically, the study seeks to identify the sources of investment risk arising from the mismatch between gold-denominated liabilities and conventional assets, analyze the impact of gold price volatility on asset-liability balance from an ALM perspective, evaluate the level of risk exposure faced by BAKES, and formulate appropriate mitigation strategies to manage gold price risk and ensure the long-term sustainability of benefit fulfillment obligations.

The contributions of this research are both theoretical and practical. Theoretically, this study contributes to the development of Asset-Liability Management literature by extending ALM application to non-financial institutions with commodity-linked liabilities, and by enriching the understanding of gold's strategic function as a liability buffer rather than merely an investment asset. The findings offer a framework for analyzing structural mismatches between fixed-income assets and commodity-sensitive liabilities. Practically, this research benefits BAKES management by strengthening asset management strategies and informing gold investment policies as value-protection instruments; it also serves church institutions as a reference for reviewing welfare fund management policies, and policymakers in developing more comprehensive regulatory frameworks for welfare fund management involving commodity-based obligations.

METHOD

Types and Approach of the Study

This study employed a descriptive-analytical approach using a case study method conducted at BAKES Church XYZ. This approach was chosen to systematically describe the

current condition of fund management, the structure of gold-price-based obligations, and the risk exposure arising from the fact that gold investment has not yet been implemented. This research is also evaluative in nature, as it aims to assess the suitability of the asset structure relative to institutional obligations within the Asset-Liability Management (ALM) framework, while simultaneously formulating relevant risk mitigation recommendations.

Unit of Analysis

The object of this study is the management of welfare funds carried out by BAKES Church XYZ, with a focus on the arrangement of the investment asset portfolio as well as the structure of participant benefit obligations that must be fulfilled over the long term. The management of these funds is viewed as an integrated system of investment policy, asset characteristics, and liability profiles, making it relevant to analyze within the ALM framework. The unit of analysis in this study covers three main dimensions: first, the structure of obligations based on gold prices; second, the composition of BAKES XYZ Church's asset portfolio, including the placement of funds in deposits, land, and the planned gold investment as a value-protection instrument; and third, the risk profile of gold investment within the ALM context, which will be analyzed through the identification of price risk, liquidity risk, operational risk, and asset-liability mismatch risk, serving as the basis for evaluating the sustainability of long-term obligation fulfillment.

Data Types and Sources

This study uses secondary data as its primary source of analysis. Secondary data were selected because they provide a structured description of the current condition of BAKES Church XYZ's welfare fund management, the characteristics of gold-price-based obligations, and the composition of managed asset portfolios. The use of secondary data also enables systematic and measurable analysis without disrupting institutional operations. The research data sources include BAKES's wealth management policy documents, financial reports, and internal investment portfolio reports, as well as data on the number of active participants and the magnitude of benefit entitlements based on gold prices. In addition, this research also utilizes gold price data obtained from official publications as the basis for calculating obligation values.

Data Collection Method

Data collection in this study was conducted through documentation study techniques and the retrieval of official secondary data. This technique was chosen because the characteristics of the data analyzed are institutional, historical, and normative in nature, and can therefore only be obtained through institutional archives and official publications. Operationally, the data collection process involved tracing and classifying BAKES's wealth management policy documents, annual financial reports, and the recapitulation of participant data and gold-price-based benefit entitlements. Gold price data were then obtained from official national gold market publications as the basis for obligation calculations. These data were used as the foundation for modeling obligation values, assessing asset adequacy, and systematically identifying gold investment risk exposure within the Asset-Liability Management framework.

Data analysis

XYZ Church BAKES

a. Documentation Policy Management Kekayhaan BAKES

BAKES documentation in this article only taken in accordance with need writing and taking through book The Welfare Section Regulations that have been approved as document official Church.

BAKES: Welfare Section.

Purpose and objectives:

(1) To manage and develop funds collected from institutions and participants,

(2) provide assistance in procuring residential housing or Love for participants when they reach retirement age,

BAKES Wealth: Collected from Participant Premiums, Institutional Premiums, development proceeds, voluntary donations that do not conflict with Christian faith.

Management:

40% is placed in liquid storage services (Deposits)

60% is placed in non-liquid storage services, gold bullion investments, land investments.

Obligation Participant:

For Pastors: Every month pay premium 7.5% of Guarantee need

Main Life Pastor

For Employees: Every month pay premium 7.5% of Wages Main Point

Participant Rights:

Pastor: receives an award of 10 grams of 24 carat gold for every year of service, and the maximum service period is 32 years.

Annual Benefit Needs with Formula:

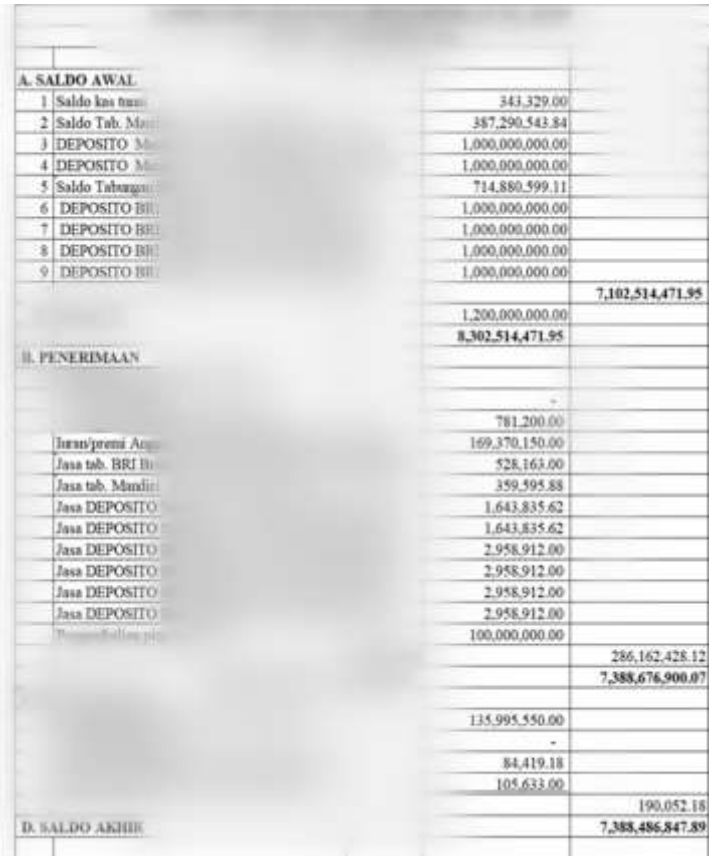
(Pastor = 10 grams x Price of 24 carat gold today x number of pastors) + (Employee = 5 grams x Price of 24 carat gold today x number of employees)

Notes:

BAKES Not yet implemented investment gold, so that exposure to asset liability risk is very high tall

b. Report BAKES Portfolio

Data used is data as of December 31, 2024 (Published in 2025)



A. SALDO AWAL			
1	Saldo kas tun	343,329.00	
2	Saldo Tab. Ma	387,290,543.84	
3	DEPOSITO M	1,000,000,000.00	
4	DEPOSITO M	1,000,000,000.00	
5	Saldo Tabungan	714,880,599.11	
6	DEPOSITO BR	1,000,000,000.00	
7	DEPOSITO BR	1,000,000,000.00	
8	DEPOSITO BR	1,000,000,000.00	
9	DEPOSITO BR	1,000,000,000.00	
			7,102,514,471.95
		1,200,000,000.00	
		8,302,514,471.95	
II. PENERIMAAN			
		-	
		781,200.00	
	Iuran/premi An	169,370,150.00	
	Jasa tab. BRI B	528,163.00	
	Jasa tab. Mandi	359,595.88	
	Jasa DEPOSITO	1,643,835.62	
	Jasa DEPOSITO	1,643,835.62	
	Jasa DEPOSITO	2,958,912.00	
	Jasa DEPOSITO	2,958,912.00	
	Jasa DEPOSITO	2,958,912.00	
	Jasa DEPOSITO	2,958,912.00	
		100,000,000.00	
			286,162,428.12
			7,388,676,900.07
		135,995,550.00	
		-	
		84,419.18	
		105,633.00	
			190,052.18
D. SALDO AKHIR			7,388,486,847.89

Figure 1. Asset-Liability Mismatch Structure at BAKES XYZ Church
Source: Author's elaboration based on BAKES financial report data (2026)

c. Quantity Data Participant Active and Amount of Benefit Rights Based on Gold Price

BAKES currently manages the benefit obligations of 232 active pastors and 15 permanent non-pastoral employees. To simulate the maximum obligation, this study assumes that four pastors and one permanent employee will retire in 2025. The obligation calculation is based on the longest period of service, 32 years, using the average gold price in 2025 as the basis for assessment. Based on this assumption, the amount of benefit obligations that BAKES must provide is calculated as an estimate of the maximum potential obligation that the institution could bear. The following is the obligation fulfillment formula:

Formula for Fulfilling BAKES Obligations with the assumption

(Pastor = 10 grams x Price of 24 carat gold today's date x Service Period x Number of Pastors) + (Employee = 5 grams x Price of 24 carat gold today's date x length of service x number of employees)

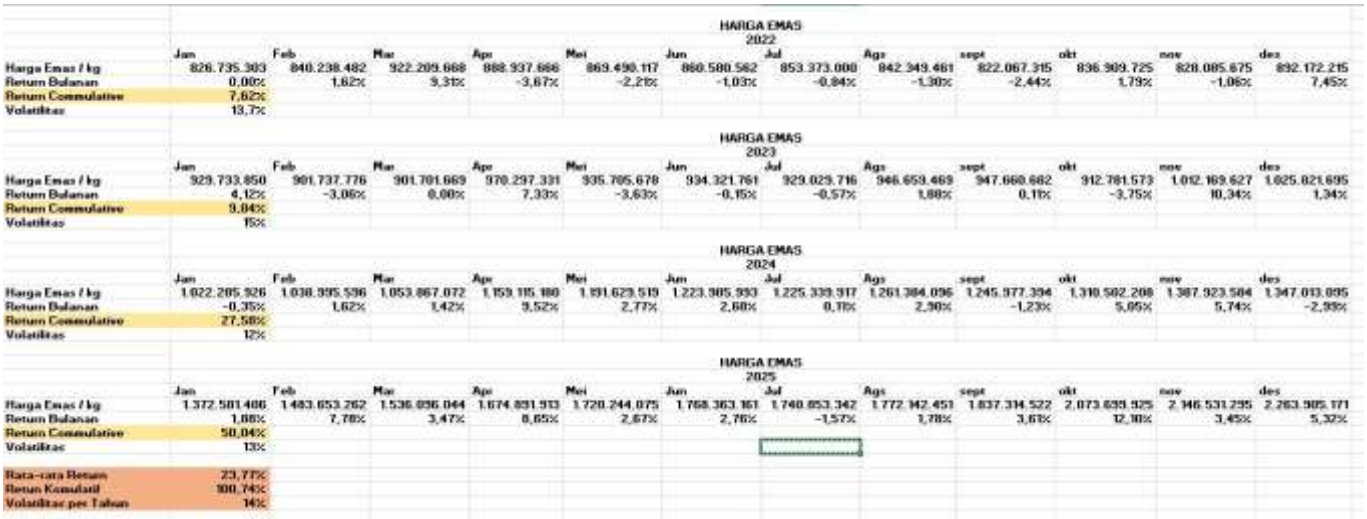
(10gram x Gold Price x 32 x 4) + (5gram x Gold Price x 32 x 1)

1280gram.HE + 160gram.HE

1440 grams.HE

Gold Price Data 2022-2025 period

Price data sources gold taken from https://goldprice.org/gold - price - indonesia.html?utm_source



HARGA EMAS 2022

	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Ags	sept	okt	nov	des
Harga Emas / kg	826.735.303	840.238.482	922.209.668	888.937.666	869.498.117	860.580.562	853.373.000	842.349.461	822.067.315	836.909.725	828.085.675	892.172.215
Return Bulanan	0,00%	1,62%	9,31%	-3,67%	-2,21%	-1,03%	-0,84%	-1,30%	-2,44%	1,79%	-1,06%	7,45%
Return Commulative	7,62%											
Volatilitas	13,7%											

HARGA EMAS 2023

	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Ags	sept	okt	nov	des
Harga Emas / kg	929.733.850	901.737.776	901.701.669	970.297.331	935.705.678	934.321.761	929.029.716	946.659.469	947.660.682	912.781.573	1.012.169.627	1.025.821.695
Return Bulanan	4,12%	-3,06%	0,00%	7,33%	-3,63%	-0,15%	-0,57%	1,88%	0,11%	-3,75%	10,34%	1,34%
Return Commulative	9,84%											
Volatilitas	15%											

HARGA EMAS 2024

	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Ags	sept	okt	nov	des
Harga Emas / kg	1.022.285.926	1.038.395.536	1.053.867.072	1.159.115.180	1.191.623.519	1.223.305.993	1.225.339.917	1.261.384.096	1.245.977.394	1.319.502.208	1.387.923.584	1.347.013.095
Return Bulanan	-0,35%	1,62%	1,42%	9,52%	2,77%	2,68%	0,17%	2,90%	-1,23%	5,85%	5,74%	-2,99%
Return Commulative	27,58%											
Volatilitas	12%											

HARGA EMAS 2025

	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Ags	sept	okt	nov	des
Harga Emas / kg	1.372.581.486	1.483.653.262	1.536.096.044	1.674.831.913	1.720.244.075	1.768.363.161	1.740.853.342	1.772.142.451	1.837.314.522	2.073.639.925	2.146.531.295	2.263.905.171
Return Bulanan	1,66%	7,78%	3,47%	8,65%	2,67%	2,76%	-1,57%	1,78%	3,61%	12,38%	3,45%	5,32%
Return Commulative	50,04%											
Volatilitas	13%											

Rata-rata Return	23,77%
Return Komulatif	100,74%
Volatilitas per Tahun	14%

Figure 2. Gold Price Fluctuation Trends 2022–2025

Source: Adapted from https://goldprice.org (2026)

Asset Liability Management Analysis

ALM analysis is used as framework strategic for evaluate level harmony between structure portfolio asset BAKES investment and liabilities benefit price - based participants gold. approach This directed for identify potential occurrence *Asset Liability mismatch* originating from difference characteristics value, liquidity, and sensitivity price between assets owned and liabilities to be paid fulfilled. In addition, ALM analysis also works for measure ability BAKES portfolio in maintain adequacy funding when happen fluctuations price significant gold.

Based on report BAKES's financial statements as of December 31, 2024, recorded total assets amounting to Rp. 7,388,486,847. on the other side obligations, amount benefits that must be paid in 2025 is calculated based on a total of 1,440 grams of gold multiplied with price average gold in 2025 with mark amounting to Rp. 1,782,523 per gram. With thus mark obligations that must be fulfilled filled with BAKES to recipient benefits in 2025 reach value of Rp. 2,566,833,120.

Referring to the ALM principle which places condition solvency in position When the value now asset bigger or the same with mark now obligation, then nominally BAKES will be in a solvent condition in 2025, namely with mark assets ≥ value obligation amounting to Rp. 7,388,486,847 ≥ Rp. 2,566,833,120. However, in perspective term length, condition This contain Level relatively high risk if no balanced with implementation investment gold in a way real. Dependence on non- gold assets for fulfil full obligation based price gold potential enlarge exposure risk fluctuations price and enlarge gap between future assets and liabilities.

RESULTS AND DISCUSSION

Risk Identification: BAKES Church XYZ Investment

Within the risk management framework, the risk identification stage focuses on recognizing potential sources of uncertainty that hinder BAKES's ability to fulfill participant benefit obligations, which are explicitly denominated in gold prices. This obligation structure makes the price of gold a key variable that directly determines the magnitude of liabilities, meaning that gold investment risk cannot be separated from BAKES's obligation structure.

The primary risk identified is gold price risk. This risk relates to increases in the price of gold, which directly raise the value of BAKES's obligations. Every increase in the gold price proportionally increases the value of benefit obligations, while BAKES's asset portfolio which does not yet include gold investment does not experience a corresponding increase in value. This condition creates a one-sided (unilateral) risk exposure to gold prices, whereby the risk of price increases is fully absorbed by BAKES without an adequate value-protection mechanism.

The second risk is the absence of a gold-based asset buffer. This risk arises as a consequence of the fact that the planned gold investment policy within BAKES's wealth management has not yet been implemented. Gold is currently used only as a basis for determining obligation values, rather than as an investment instrument that supports and offsets those obligation values. The absence of this asset buffer weakens the effectiveness of risk management and increases the portfolio's long-term vulnerability to gold price dynamics.

The third risk is asset-liability mismatch risk. This risk is reflected in the difference in characteristics and value sensitivity between assets and liabilities. Investment assets are dominated by deposits with fixed nominal returns, while liabilities have high sensitivity to changes in gold prices. This mismatch amplifies the risk of asset-liability imbalance from an ALM perspective and could erode funding capacity should a sustained upward trend in gold prices occur. Thus, the risk identification process shows that the investment risks faced by BAKES are structural and interrelated, encompassing gold price risk, the absence of a gold-based asset buffer, and asset-liability mismatch. These findings confirm the need for integrated investment risk management within a combined risk management and ALM framework to ensure that participant benefit obligations can be fulfilled sustainably and in a controlled manner.

Risk Analysis

Analysis of gold price risk shows that BAKES's benefit obligations have a direct and proportional sensitivity to movements in gold prices. Given that liabilities are calculated based on grams of gold multiplied by the prevailing gold price at the time of payment, every increase in the gold price linearly increases the value of obligations. Conversely, investment assets dominated by deposits with fixed returns do not experience a corresponding adjustment in value relative to the obligations, thereby widening the potential funding gap.

Further analysis was conducted on the risk arising from the absence of a gold-based asset buffer. The lack of gold investment within the portfolio means that BAKES has no instrument capable of functioning as a value-protection mechanism against gold-based obligations. Under these conditions, gold price risk is not only fluctuating in nature but also cumulative over the long term. A sustained upward trend in gold prices has the potential to significantly increase obligations, while asset values remain relatively stagnant, thereby increasing pressure on reserve funds.

The asset-liability mismatch further reveals a significant difference in characteristics between assets and liabilities. Assets placed in deposits have high liquidity but low risk, with fixed returns, while liabilities are inherently uncertain in value, as they depend on gold prices. This value-sensitivity mismatch amplifies the risk of deep structural imbalance within the portfolio, particularly under a scenario of sharp or prolonged gold price increases. Thus, the results of the risk analysis show that BAKES's current investment structure remains significantly exposed to gold price fluctuations and asset-liability mismatch. These risks are not only short-term in nature but also have the potential to accumulate over the long term. Therefore, this risk analysis confirms the urgency of formulating appropriate mitigation strategies aligned with BAKES's fund management objectives.

Risk Evaluation

Based on the results of the analysis, gold price risk and asset-liability mismatch risk are categorized as primary risks, given their high impact level and significant probability, as they directly influence the magnitude of obligations and the sustainability of funding. The risk arising from the absence of a gold-based asset buffer is assessed as a strategic risk that heightens exposure to gold price fluctuations and has the potential to widen the funding gap over the medium to long term. Thus, the risk evaluation indicates that BAKES's current investment structure exhibits a relatively high level of risk exposure to gold-price-based obligations, necessitating priority mitigation measures integrated within the investment risk management and ALM framework.

Risk Mitigation

The most fundamental mitigation strategy is the implementation of gold investment as a liability buffer, so that a portion of the portfolio has value sensitivity that moves in the same direction as changes in gold prices. This measure functions as a value-protection mechanism against the risk of rising gold prices and helps reduce the asset-liability imbalance. The next mitigation step involves establishing an ALM-based commodity policy that integrates gold characteristics into asset allocation planning, obligation projections, and risk control. This policy should cover the determination of the strategic proportion of gold investment, the investment horizon, and risk tolerance limits aligned with the objective of participant welfare. However, if the implementation of gold investment as a liability buffer is assessed to introduce new risks particularly those related to total asset value exceeding the institution's tolerance limits then the related gold investment policy should be re-evaluated.

CONCLUSION

BAKES obligations stipulated in price gold create exposure structural risks to fluctuations price gold. absence infestation gold in portfolio asset cause mismatch between assets and liabilities, so that improvement mark obligation No offset by growth mark assets that are in the same direction and have potential widen gap funding term long. That thing makes BAKES face risk mismatch assets-liabilities as risk with exposure highest. In the context of that, the recommended mitigation strategies cover investment gold as asset buffer obligation, determination ALM based policy commodities gold, and diversification form investment gold. implementation of the strategy expected capable lower exposure risk, guard sufficient funds, and support sustainability management of BAKES welfare funds. Based on these findings, several recommendations are proposed. For BAKES management, it is recommended to

immediately implement gold investment as a strategic asset buffer and formulate commodity-based ALM policies with clear allocation proportions, investment horizons, and risk tolerance limits. For the XYZ Church institution, it is necessary to review and strengthen wealth management policies to ensure alignment between asset allocation and liability characteristics, as well as to provide support for the implementation of gold investment instruments. For future researchers, further studies are needed to examine the long-term impact of gold investment implementation on asset-liability balance, develop more comprehensive ALM models specifically for commodity-linked liabilities, and explore the effectiveness of various hedging instruments in managing gold price risk in non-financial institutions.

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