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Analysis of JIBOR Discontinuity: Comparison of Spread Adjustment for Several Alternative Reference Rates for 1-Month JIBOR

Zulfikar, H.[1*], Taufiq, A. A.[1], Giyatno A.[1]

[1]*Product Development Division, PT Asuransi Jiwa IFG, Jakarta, Indonesia*

*Corresponding email: harly@ifg-life.id

Abstract
The planned discontinuation of the Jakarta Interbank Offered Rate (JIBOR) publication by Bank Indonesia, effective January 1, 2026, has significant implications for the financial industry, particularly for life insurance contracts that reference JIBOR. Therefore, a credible and economically equivalent Alternative Reference Rate is needed. This paper addresses the discontinuity from two perspectives, forecasting methods for accurately predicting JIBOR post-discontinuation and analyzing the transition to four Alternative Reference Rates: Indonesia Overnight Index Average (IndONIA), BI Rate, LPS Rate, and the average deposit rate of state-owned banks (Bank Himbara). The methodology involves historical data analysis over the past five years, following the National Working Group on Benchmark Reform (NWGBR) recommendations. Findings show that for forecasting, the Autoregressive Model with Box-Cox transformation has the smallest error compared to actual JIBOR. Among Alternative Reference Rates, IndONIA has the smallest error compared to actual JIBOR. This paper is expected to provide insights for financial industry stakeholders affected by the JIBOR discontinuity, including insurance products using JIBOR as a Reference Rate in cash value calculations.

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1. INTRODUCTION

The termination of the Jakarta Interbank Offered Rate (JIBOR) publication, scheduled to be effective on January 1, 2026, marks a new chapter in Indonesia's interest rate benchmark reform. This step aligns with the global reform agenda aimed at strengthening interest rate benchmarks and ensuring the stability and integrity of the domestic financial market. The National Working Group on Benchmark Reform (NWGBR), consisting of the Ministry of Finance (Kemenkeu), Bank Indonesia (BI), the Financial Services Authority (OJK), and the Indonesian Foreign Exchange and Money Market Traders Association (APUVINDO), has issued a transition guide to assist market participants in adapting to this change [1]. The guide adopts the "Summary of the ARRC's Fallback Recommendation" issued by the Alternative Reference Rates Committee (ARRC) [2], also referenced by various countries during their benchmark rate transition processes.

One of NWGBR's main recommendations is the adoption of the Indonesia Overnight Index Average (IndONIA) as the replacement for JIBOR. IndONIA, based on actual money market transactions, is expected to enhance transparency and accuracy in setting benchmark interest rates. This transition requires adjustments to various financial instruments and contracts (legacy contracts) that previously referenced JIBOR, particularly those maturing after JIBOR's discontinuation. One practical example is an endowment policy that offers a guaranteed maturity benefit with interest rates directly/indirectly dependent on JIBOR. The discontinuation of JIBOR publication creates a disruption in the mechanism for determining interest rates, and if not properly managed, may lead to contractual ambiguities, legal disputes, and adverse policyholder behavior. Company may encounter increased reserving pressure due to the recalibration of actuarial assumptions, heightened liquidity risk from potential surrender waves, and operational complexities in adjusting administrative systems.

The absence of a smooth and transparent transition framework could expose the company to significant reputational and financial risks. Without clear internal guidelines and proactive communication to policyholders, the replacement reference rate may be perceived as less favorable, triggering a loss of customer trust. This loss of confidence may lead to an increase in early surrenders or withdrawals, thereby pressuring the company's liquidity position. Furthermore, negative sentiment surrounding the transition could impair the company's ability to acquire new business, resulting in a decline in premium income. From a regulatory perspective, failure to demonstrate prudent transition planning and to safeguard policyholder interests may subject the company to increased supervisory attention, reputational sanctions, or administrative penalties. Internally, an unstructured transition process may also disrupt actuarial modeling and financial reporting systems, increasing operational risk and potentially causing misalignment between asset returns and liability projections. Therefore, a replacement reference rate that maintains economic equivalence with JIBOR and ensures a timely transition process is necessary.

Several approaches can be used to analyze this JIBOR discontinuity, the first approach is using time series forecasting methods to predict future JIBOR values after its publication ends. However, this is only accurate for early periods and lacks legal authority for replacing JIBOR in financial contracts. The second approach is to identify publicly available Alternative Reference Rates. However, different Reference Rates have distinct characteristics due to their underlying factors. Therefore, the Spread Adjustment becomes a crucial component to bridge the differences between JIBOR and Alternative Reference Rates. The Spread Adjustment compensates for characteristic disparities between JIBOR and the new Reference Rates.

Several methodologies can be used to calculate the Spread Adjustment. The International Swaps and Derivatives Association (ISDA), in "Summary of Responses to the ISDA Consultation on Final Parameters for the Spread and Term Adjustments" [3], proposed calculating Spread Adjustment using 5-year lookback median, or 10-year trimmed mean method. Most banks, broker-dealers, and insurance companies prefer 5-year median method. Furthermore, in "ARRC Consultation on Spread Adjustment Methodologies for Fallbacks in Cash Products Referencing USD LIBOR" [4], Spread Adjustment is calculated both statically (using 5-Year Median Spread to SOFR In Advance) and dynamically (using 1-Month Financial CP Series). NWGBR recommends calculating Spread Adjustment based on 5-year median difference between JIBOR and Compounded IndONIA rates prior to JIBOR cessation [5]. This approach is expected to better reflect market conditions, ensuring a smooth and fair transition to the new Reference Rates for all parties.

In this paper several Alternative Reference Rates that could be considered to replace JIBOR will be discussed, namely IndONIA, BI Rate, LPS Rate, and the Deposit Rate of the State-Owned Banks Association (Bank Himbara). For each Alternative Reference Rate, a Spread Adjustment will be calculated based on the methodology recommended by NWGBR. A comparative analysis of the Spread Adjustments for each Reference Rate becomes important to understand the financial and operational implications of each option.

2. METHOD

2.1 Data

This paper discusses various Reference Rates that could potentially replace JIBOR. Therefore, the data used includes JIBOR [6], Compounded IndONIA [7], BI Rate [8], and the Deposit Rate of Bank Himbara [9] released by Bank Indonesia, as well as the LPS Rate [10] issued by the Deposit Insurance Corporation (LPS). Following the recommendations of the NWGBR regarding the calculation of Spread Adjustment [11], this paper utilizes data from the five-year period preceding the cessation trigger date (September 27, 2024). To account for differences in publication schedules across datasets, monthly average values are used for each Reference Rate, resulting in a dataset spanning from September 2019 to September 2024. In addition, the period from October 2024 to January 2025 is included to assess the performance and accuracy of the forecasting models and the Alternative Reference Rates considered.

Since JIBOR, IndONIA, and the Deposit Rate of Bank Himbara have data with different tenors, the focus will be narrowed to the 1-Month/30-Days tenor to match the tenor of the BI Rate and LPS Rate. After all the data is collected and processed, the resulting dataset will be as follows:

Table 1. Historical Data of JIBOR and Alternative Reference Rates (September 2019 – January 2025)

Period	JIBOR 1M	Compounded IndONIA 30D	Deposit Rate Bank Himbara 1M	BI Rate	LPS Rate
Jan 2025	6.39%	6.05%	-	5.75%	4.25%
Dec 2024	6.63%	6.11%	4.40%	6.00%	4.25%
Nov 2024	6.63%	6.13%	4.37%	6.00%	4.25%
Oct 2024	6.64%	6.22%	4.30%	6.00%	4.25%
Sep 2024	6.80%	6.34%	4.31%	6.00%	4.25%
Aug 2024	6.90%	6.25%	4.36%	6.25%	4.25%
⋮	⋮	⋮	⋮	⋮	⋮
Feb 2020	4.21%	4.81%	5.90%	4.75%	6.00%
Jan 2020	4.40%	4.83%	5.92%	5.00%	6.25%
Dec 2019	4.13%	4.84%	6.05%	5.00%	6.25%
Nov 2019	4.29%	4.93%	5.97%	5.00%	6.50%
Oct 2019	4.72%	5.14%	6.09%	5.00%	6.50%
Sep 2019	4.89%	5.39%	6.29%	5.25%	6.75%

If presented in graphical form, it would result:

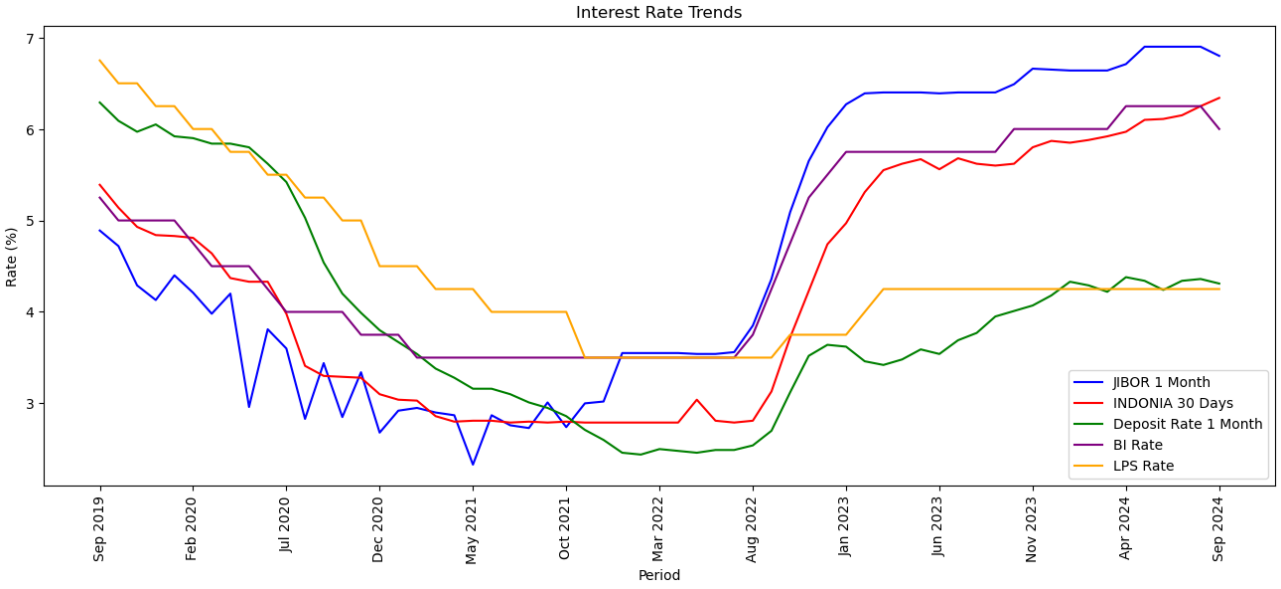

Figure 1. Movement Trend of JIBOR and Alternative Reference Rates. Overall, the Alternative Reference Rates exhibit trends that closely resemble JIBOR, indicating that they are suitable candidates for replacing JIBOR.

2.2 Methodology

2.2.1 Forecasting Methods

In this paper, Forecasting was carried out using various statistical and econometric techniques to identify which model provides the most accurate results in modeling JIBOR data. These models are used to capture trends, seasonality, and fluctuations in the data. The following approaches were used in this paper:

1. *Autoregressive Model with Box-Cox Transformation*, used to handle scale variability and improve data linearity.
2. *Linear Regression Model with seasonal and trend features along with Box-Cox Transformation*, allowing the model to more effectively capture seasonal and trend patterns.
3. *Holt-Winters Model with additive seasonal component and logarithmic transformation*, used for handling data with a fixed seasonal pattern.
4. *Holt-Winters Model with multiplicative seasonal component and logarithmic transformation*, used for data where the seasonal pattern changes proportionally to the data level.
5. *Seasonal Autoregressive Integrated Moving Average (SARIMA) Model*, used to accommodate trends and seasonal patterns in the data using an autoregressive and moving average-based approach.
6. *Seasonal Autoregressive Integrated Moving Average Model with Box-Cox Transformation*, used to improves data distribution to enhance parameter estimation efficiency in the SARIMA model.
7. *Exponential Smoothing State Space Model (ETS) with automatic selection of error, seasonal, and trend components using Box-Cox Transformation*, allowing the model to choose the best combination of available components.
8. *Exponential Smoothing State Space Model with Box-Cox Transformation, ARMA errors, and trend and seasonal components*, used to capture more complex instability patterns in the data.

2.2.2 Spread Adjustment

Based on the previous study, NWGBR recommends calculating Spread Adjustment using the median of the differences between JIBOR and Adjusted Reference Rate IndONIA in Arrears for each tenor. Accordingly, the same method will be applied to other Alternative Reference Rate to calculate their Spread Adjustments. The formula for calculating the Spread Adjustment is as follows [11]:

$$SA_{f,t} = Median\left(\{u \in MP_{f,t} | L_{f,u} - ARR_{f,u}\}\right) \quad (1)$$

Where:

$SA_{f,t}$: Spread adjustment for specific tenor (1, 3, 6, 12 Month)
$MP_{f,t}$: Data points (tenor 1, 3, 6, or 12 months)
u : Median period
$L_{f,u}$: JIBOR for specific tenor (1, 3, 6, or 12 months) in media period
$ARR_{f,u}$: Adjusted Reference Rate compounded with a specific tenor (1, 3, 6, or 12 months), during the median period prior to the Tenor Cessation Trigger Date.

In this paper, the median period used is five years. The use of this method is based on the consideration that the five-year median reflects market condition movements over a sufficiently long period, thus it can be regarded as a fair and reasonable representation of the historical differences between JIBOR and Alternative Reference Rate. Furthermore, the calculation uses historical data over the past five years (from the cessation

trigger date). The tenor analyzed is limited to 1 month to match Alternative Reference Rates, which do not offer tenors of 3, 6, or 12 months.

The above calculation method is also recommended by the International Swaps and Derivatives Association (ISDA) in "Summary of the ARRC's Fallback Recommendation" [2], which has been adopted by various countries in their benchmark interest rate transition processes. Therefore, the use of this method can be considered a commonly recognized industry standard and regarded as best practice during benchmark interest rate transitions.

2.2.3 Root Mean Square Error (RMSE)

RMSE is a metric used to measure the performance of a model. The smaller the RMSE value, the more accurate the model is. RMSE reflects the degree of deviation between actual JIBOR and those predicted by the model. Its sensitivity to outliers makes it particularly useful for identifying models that perform poorly at specific data points. The formula used to calculate RMSE is as follows [12]:

$$RMSE = \sqrt{\frac{1}{n}\sum_{j=1}^{n}\left(x_j - \hat{x}_{i,j}\right)^2} \tag{2}$$

where $n =$ number of data points, x_j = actual JIBOR at period j, and $\hat{x}_{i,j}$ = Alternative Reference Rate i at period j.

2.2.4 Mean Absolute Percentage Error (MAPE)

MAPE is a metric that quantifies relative forecasting error by representing it as a percentage of the actual values over a given time period, allowing for assessment of whether the error magnitude is high or low. By expressing the error as a percentage, MAPE offers a proportional perspective on forecasting accuracy, which is especially useful for understanding the scale of the error in relation to actual outcomes. In this study, MAPE is also utilized as a key criterion for evaluating and selecting the most suitable Alternative Reference Rate in comparison to actual JIBOR values. The formula used to compute MAPE is as follows [12]:

$$MAPE = \frac{1}{n}\sum_{j=1}^{n}\left|\frac{x_j - \hat{x}_{i,j}}{x_j}\right| \tag{3}$$

where $n =$ number of data points, x_j = actual JIBOR at period j, and $\hat{x}_{i,j}$ = Alternative Reference Rate i at period j.

3. RESULTS

3.1 Forecasting JIBOR

In this section, forecasting of JIBOR will be conducted using the eight methods previously described in the forecasting methodology section. For each method, the necessary assumptions have been verified. Based on the calculation results, the forecasted values for the next four periods (October 2024 – January 2025) are as follows:

Table 2. JIBOR Forecast Results Using Various Forecasting Methods (October 2024 – January 2025)

Model	October 24	November 24	December 24	January 25
JIBOR Aktual	6.64%	6.63%	6.63%	6.51%

Model	October 24	November 24	December 24	January 25
Autoregressive Model with Box-Cox Transformation	6.76%	6.67%	6.58%	6.51%
Linear Regression Model with seasonal and trend features along with Box-Cox Transformation	6.93%	7.14%	7.05%	7.30%
Holt-Winters Model with additive seasonal component and logarithmic transformation	7.02%	7.46%	7.20%	7.74%
Holt-Winters Model with multiplicative seasonal component and logarithmic transformation	7.20%	7.73%	7.51%	8.13%
Seasonal Autoregressive Integrated Moving Average (SARIMA)	6.87%	7.01%	6.98%	6.96%
Seasonal Autoregressive Integrated Moving Average Model with Box-Cox Transformation	6.91%	7.07%	7.06%	7.05%
Exponential Smoothing State Space Model (ETS) with automatic selection of error, seasonal, and trend components using Box-Cox Transformation	6.90%	6.92%	6.94%	6.97%
Exponential Smoothing State Space Model with Box-Cox Transformation, ARMA errors, and trend and seasonal components	7.16%	7.49%	7.27%	7.81%

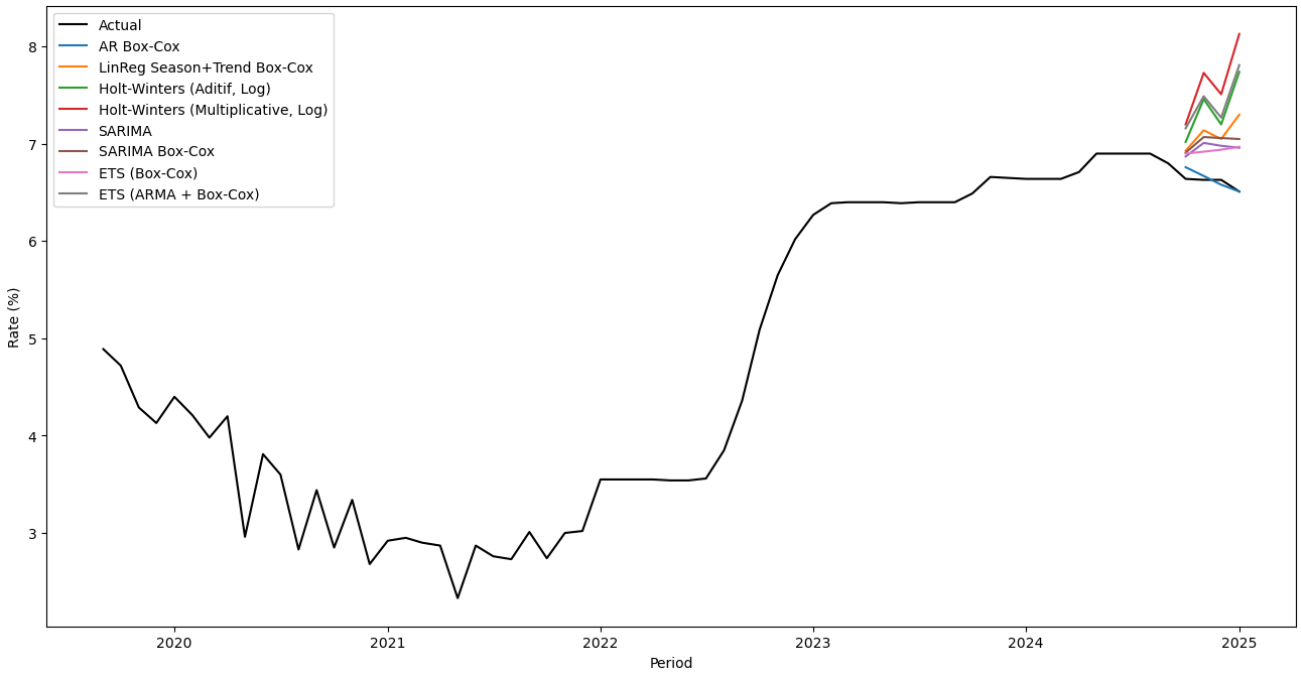

Figure 2. Comparison of actual 1-Month JIBOR values with forecasted values using various methods

Based on Table 2, only Autoregressive Model with Box-Cox Transformation exhibits a movement pattern similar to actual JIBOR. Among the other models, SARIMA model, both with and without Box-Cox transformation, comes closest. However, in SARIMA model, there is an upward movement in November 2024

compared to the previous month. Therefore, as an initial assumption, these three methods are considered the ones that most closely approximate the actual JIBOR.

To determine the best model, the RMSE and MAPE of each forecasting method will be evaluated. These values can be found in Table 3.

Table 3. RMSE and MAPE Values of Various Forecasting Methods Compared to Actual JIBOR

Model	RMSE	MAPE
Autoregressive Model with Box-Cox Transformation	0.0009	1.23%
Linear Regression Model with seasonal and trend features along with Box-Cox Transformation	0.0058	8.14%
Holt-Winters Model with additive seasonal component and logarithmic transformation	0.0087	12.03%
Holt-Winters Model with multiplicative seasonal component and logarithmic transformation	0.0116	16.41%
Seasonal Autoregressive Integrated Moving Average (SARIMA)	0.0040	5.87%
Seasonal Autoregressive Integrated Moving Average Model with Box-Cox Transformation	0.0047	6.87%
Exponential Smoothing State Space Model (ETS) with automatic selection of error, seasonal, and trend components using Box-Cox Transformation	0.0038	5.52%
Exponential Smoothing State Space Model with Box-Cox Transformation, ARMA errors, and trend and seasonal components	0.0093	13.19%

Based on Table 3, all the models used exhibit fairly accurate performance, as their forecasting MAPE are below 20%. The Autoregressive Model with Box-Cox Transformation has the smallest RMSE and MAPE, making it the best model for forecasting JIBOR. Other models that are still considered accurate (with MAPE values below 10%) include Linear Regression Model with seasonal and trend features and Box-Cox transformation, SARIMA model, SARIMA model with Box-Cox transformation, and ETS model with automatic selection of error, seasonal, and trend components using Box-Cox transformation.

3.2 Spread Adjustment for Alternative Reference Rates

In accordance with NWGBR's recommendation regarding Spread Adjustment calculation method, this section calculates the median of the differences between JIBOR and each Alternative Reference Rate. As a result, the following Spread Adjustment values are obtained:

Table 4. *Spread Adjustment for Each Alternative Reference Rate*

Alternative Reference Rate	Spread Adjustment
IndONIA 30 Days	0.65%
Deposit Rate 1 Month	1.07%
BI Rate	0.05%
LPS Rate	0.05%

Based on these results, a comparison will be made between the actual value of Alternative Reference Rate + Spread Adjustment with the actual JIBOR.

Table 5. Forecasting Results and Accuracy for Each Alternative Reference Rate

Reference Rate	October 24	November 24	December 24	January 25	RMSE	MAPE
Actual JIBOR	6.64%	6.63%	6.63%	6.51%		
IndONIA 30 Days + Spread Adjustment	6.88%	6.78%	6.76%	6.70%	0.0018	2.69%
Deposit Rate 1 Month + Spread Adjustment	5.37%	5.44%	5.47%	-	0.0121	18.18%
BI Rate + Spread Adjustment	6.05%	6.05%	6.05%	5.80%	0.0062	9.32%
LPS Rate + Spread Adjustment	4.30%	4.30%	4.30%	4.30%	0.0230	34.87%

Based on Table 5, Alternative Reference Rate that most closely matches is the 30-days Compounded IndONIA, as it produces the lowest RMSE (0.0018) and MAPE (2.69%) among all alternatives, indicating the highest level of accuracy in replicating JIBOR movements. This is consistent with the recommendation issued by NWGBR. An alternative replacement Reference Rate, besides the 30-days Compounded IndONIA, is the BI Rate, with an RMSE of 0.0062 and a MAPE of 9.32%.

4. DISCUSSION

The results demonstrate that while the Autoregressive Model with Box-Cox Transformation yields the most accurate short-term JIBOR forecasts, its application is inherently limited. Forecasting models, although statistically robust, are not legally recognized as substitutes in financial contracts. Moreover, their reliability diminishes over longer periods, particularly as market conditions change. This makes them unsuitable as a long-term basis for interest rate replacement in legacy contracts.

In contrast, the 30-days Compounded IndONIA + Spread Adjustment not only approximates 1-month JIBOR closely, but also fulfills legal, regulatory, and operational criteria. It is publicly available, endorsed by NWGBR, and aligned with international transition practices, making it a reliable reference that can be formally incorporated into insurance policy contracts. From an insurance industry standpoint, adopting Compounded IndONIA + Spread Adjustment is a more prudent move, ensuring continuity, transparency, and protection of policyholder interests in cash value-linked products.

The superior performance of IndONIA as a replacement reference rate may also be attributed to its market-based nature and responsiveness to actual overnight funding conditions, making it structurally more aligned with JIBOR's original purpose. While forecasting can support internal projections and reserve modeling, relying on it as a substitute for contractual benchmarks poses significant legal and reputational risks.

For future research, it would be valuable to explore adaptive Spread Adjustment mechanisms that can reflect changing liquidity premiums or interest rate cycles over time. Additionally, empirical studies examining how different replacement Reference Rates affect policyholder behavior, such as surrender rates or lapse

patterns, would help insurers anticipate and mitigate potential business disruptions during the benchmark transition.

5. LIMITATIONS

Several limitations identified in this paper:

1. Historical Data Limitations
   The use of data from the past five years (five-year lookback) may not fully capture entire economic cycles or long-term structural shifts. Differences in publication times and data availability across reference rates necessitate the use of monthly averages, which may obscure relevant daily or weekly fluctuations.
2. Tenor Limitations
   Since JIBOR, Compounded IndONIA, and the Bank Himbara Deposit Rate have different tenors, the paper focuses only on the 1-Month/30-Day tenor. This limits the generalization of the spread adjustment and forecasting results for other tenors, which may exhibit different dynamics.
3. Forecasting Model Assumptions and Limitations
   Various forecasting models (such as Autoregressive with Box-Cox Transformation, Linear Regression with seasonal and trend features, Holt-Winters, SARIMA, ETS, etc.) each have underlying assumptions, such as stationarity, residual normality, and homoscedasticity. Violations of these assumptions can reduce projection accuracy. Furthermore, forecasting for only four future periods may not adequately reflect long-term uncertainties or sudden market condition changes.
4. Spread Adjustment Methodology
   While the use of the median method with a five-year lookback to calculate spread adjustment is recommended by NWGBR, it may not capture future dynamic market changes. This method assumes that historical differences between JIBOR and the replacement reference rates will remain relevant, even though market conditions could change significantly.
5. Legal and Implementation Limitations
   Although the forecasting approach provides a technical view of the reference rate transition, the forecasting methods themselves may not have legal authority to replace JIBOR in legacy financial contracts. Establishing spread adjustments and selecting replacement reference rates requires further regulatory and operational evaluation.
6. Dependence on External Assumptions
   This paper does not incorporate external variables such as global economic conditions, monetary policies, or systemic risk factors that could influence interest rates. This could limit the model's ability to fully capture all dynamics occurring in financial markets.

6. CONCLUSIONS

The discontinuation of JIBOR publication will generally impact financial contracts that use JIBOR as a reference rate. In the insurance industry specifically, JIBOR discontinuity will affect insurance products that incorporate JIBOR as a component in determining their cash value. In insurance products, the use of JIBOR is considered important to minimize the potential gap between the market rate and the reference rate used, as JIBOR is depicted as fluctuating to reflect market movements. Going forward, the impact of JIBOR discontinuity is expected to be mitigated by forecasting data trends based on JIBOR historical data or by

applying a Spread Adjustment to one of the Alternative Reference Rates, such as INDONIA, BI Rate, LPS Rate, or the average deposit rate of Himbara banks.

From a modeling perspective, the forecasting results indicate that Autoregressive approach with Box-Cox Transformation achieves the highest accuracy in reflecting JIBOR dynamics, as evidenced by the lowest RMSE and MAPE values. Other models, such as SARIMA and Exponential Smoothing (ETS), show adequate performance but do not surpass the precision of the Autoregressive model. In the context of insurance, choosing an accurate forecasting model is crucial, as interest rate predictions directly affect actuarial liability assessments, technical reserve calculations, and premium pricing that reliably reflect risk exposure.

Furthermore, the Spread Adjustment analysis shows that the 30-days Compounded IndONIA is the closest alternative to JIBOR when a spread of 0.65% is added. This finding reinforces NWGBR's recommendation, identifying IndONIA as possessing market characteristics that more accurately reflect current conditions. Although the BI Rate and other alternatives could be considered, the disparity in the comparison results suggests that selecting a new benchmark rate must involve careful evaluation to ensure continuity for financial contracts relying on JIBOR, including insurance policies and related derivative instruments. Thus, this paper provides an empirical foundation that can serve as a reference for actuaries and stakeholders in the insurance industry in adapting reliable benchmark rate-setting methods that meet sound risk management practices.

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