Forecasting the Incurred Loss Ratio

IN THE LIFE AND NON-LIFE INSURANCE SECTORS IN THAILAND.

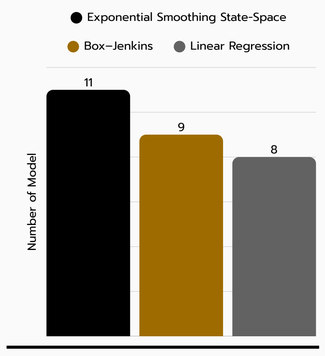
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Abstract

This study aims to forecast the Incurred Loss Ratio (ILR) of life and non-life insurance businesses in Thailand. Earned premiums and incurred claims were modeled separately using quarterly data from 2016 to 2025, comprising a total of 28 datasets. Model performance was evaluated using the Root Mean Square Error (RMSE), together with diagnostic checking of model assumptions. The models considered in this study include Box–Jenkins models, Exponential Smoothing State Space (ETS) models, and Linear Regression models.

The results indicate that the ETS model provides the best performance (11 out of 28 datasets), followed by the Box–Jenkins model (9 out of 28 datasets) and the Linear Regression model (8 out of 28 datasets).



Overall, the forecasted ILR for the period from Q3 2025 to Q4 2026 shows a relatively stable trend. Personal accident life insurance exhibits the highest ILR, whereas group life insurance remains at a comparatively lower level. These findings provide an early warning signal that can support pricing strategies, risk management, and insurance planning decisions.

Introduction

The insurance industry plays a vital role in promoting financial stability and providing protection to individuals and businesses in Thailand by serving as a mechanism for risk distribution. This study aims to forecast the Incurred Loss Ratio (ILR) of various insurance products in the future by separately forecasting two key components: earned premiums and incurred claims. The results are then combined to calculate quarterly ILR projections for the period 2025–2026. The forecasting outcomes reflect the overall trends of each product and can serve as supporting information for risk management and financial planning within the insurance industry.

Objective

1. To evaluate and compare the performance of time series forecasting models in predicting incurred claims and net earned premiums of insurance businesses.

2. To identify the most appropriate forecasting model for estimating incurred claims and net earned premiums, and to use the results to compute and forecast the Incurred Loss Ratio (ILR).

Variables

Incurred Loss Ratio (ILR)

$$\text{INCURRED LOSS RATIO} = \frac{\text{INCURRED CLAIM}}{\text{EARNED PREMIUM}}$$

Life Insurance

- Ordinary
- Industrial
- Group
- Annuity
- Unit-Linked
- Universal
- Personal Accident

Non-Life Insurance

- Fire
- Marine and Cargo
- Motor
- Personal Accident
- Health
- Industrial All Risks
- Other

Model

ARIMA >>

$$\left(1-\sum_{i=1}^{p}\phi_i B^i\right)(1-B)^d Y_t = \left(1+\sum_{j=1}^{q}\theta_j B^j\right)\varepsilon_t$$

SARIMA >>

$$\left(1-\sum_{i=1}^{p}\phi_i B^i\right)\left(1-\sum_{k=1}^{P}\Phi_k B^{ks}\right)(1-B^s)^D Y_t = \left(1+\sum_{j=1}^{q}\theta_j B^j\right)\left(1+\sum_{l=1}^{Q}\Theta_l B^{ls}\right)\varepsilon_t$$

Exponential Smoothing State Space (ETS) >>

$$Y_t = \ell_{t-1} + b_{t-1} + s_{t-m} + \varepsilon_t$$

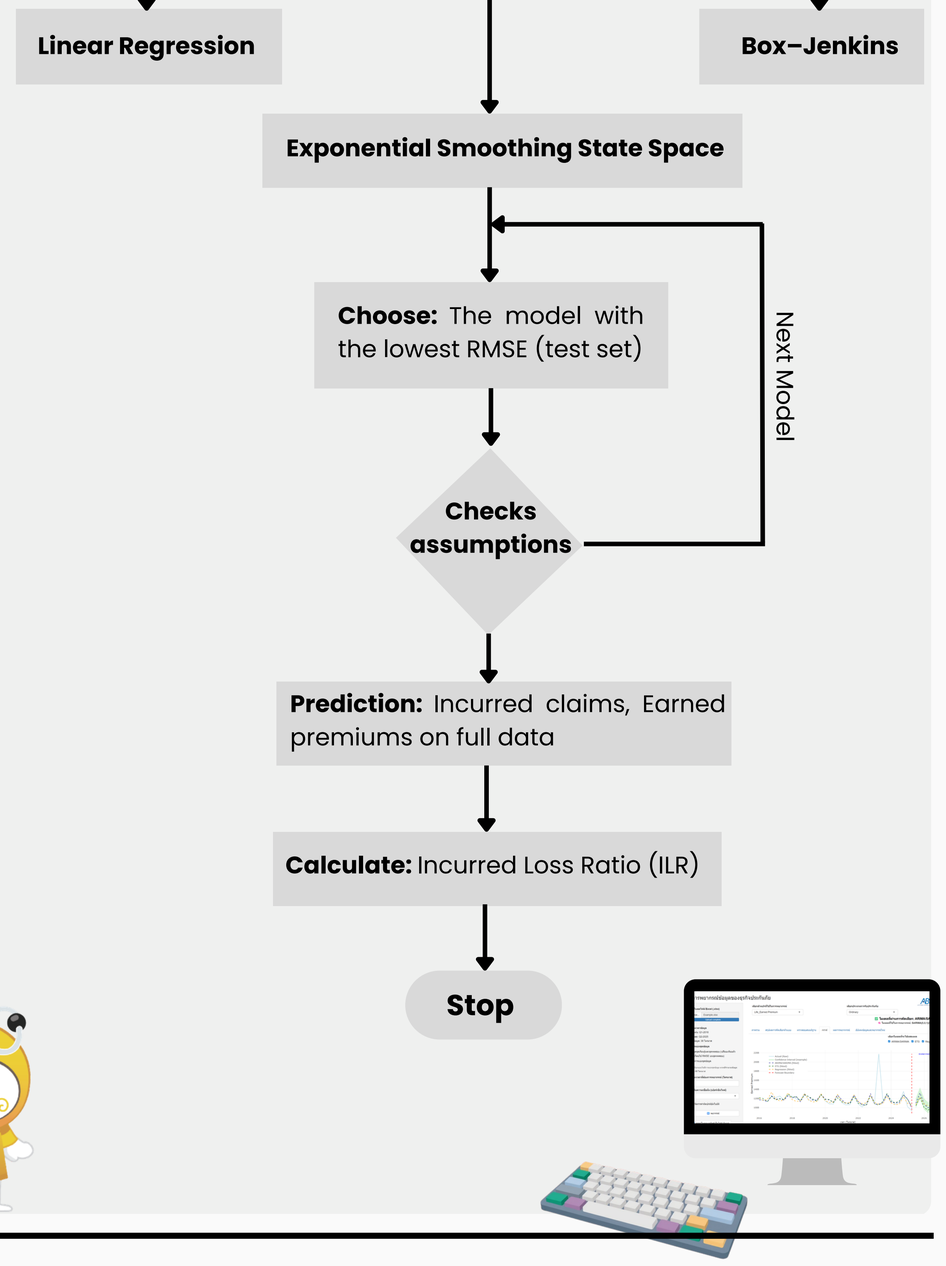
Linear Regression >>

$$Y_t = \beta_0 + \beta_1 t + \sum_{k=1}^{m-1}\gamma_k D_{k,t} + u_t$$

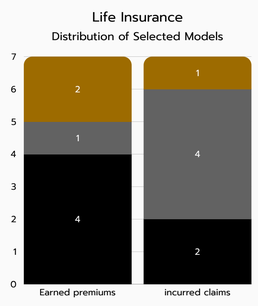
Evaluation Criteria

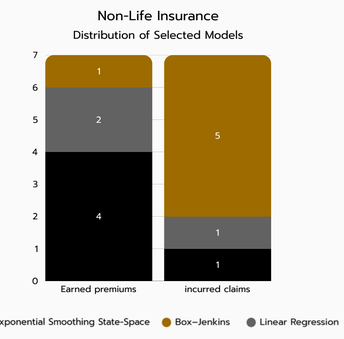
$$RMSE = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(Y_t - \hat{Y}_t)^2}$$

Process



Result





Calculate: Incurred Loss Ratio (Life Insurance)

Line of Business	Quarter					
	3/25	4/25	1/26	2/26	3/26	4/26
Ordinary	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029
Industrial	0.0039	0.0039	0.0039	0.0039	0.0039	0.0039
Group	0.1151	0.1151	0.1151	0.1151	0.1151	0.1151
Annuity	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002
Unit-Linked	0.0019	0.0019	0.0019	0.0018	0.0018	0.0018
Universal	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
Personal	0.6000	0.6001	0.6001	0.6002	0.6002	0.6003

Calculate: Incurred Loss Ratio (Non-Life Insurance)

Line of Business	Quarter					
	3/25	4/25	1/26	2/26	3/26	4/26
Fire	0.3040	0.3040	0.3040	0.3040	0.3039	0.3039
Marine/Cargo	0.1549	0.1549	0.1549	0.1549	0.1549	0.1549
Mortor	0.3931	0.3931	0.3931	0.3930	0.3930	0.3930
Personal	0.2963	0.2964	0.2964	0.2964	0.2965	0.2965
Health	0.4398	0.4398	0.4398	0.4399	0.4399	0.4399
Industrial All	0.1879	0.1879	0.1880	0.1880	0.1881	0.1881
Other	0.2789	0.2790	0.2790	0.2790	0.2790	0.2790

Conclusion

The results from 28 datasets indicate that the most appropriate model varies according to the time-series characteristics. The Box–Jenkins approach was selected for 9 datasets, the Exponential Smoothing State Space model for 11 datasets, and the Linear Regression model for 8 datasets. This finding suggests that no single model is universally suitable for all types of insurance underwriting.

The projected Incurred Loss Ratio (ILR) for the period from Q3/2025 (B.E. 2568) to Q4/2026 (B.E. 2569) shows a generally stable trend. Personal accident life insurance products exhibit the highest ILR (approximately 0.60), while health insurance remains at a relatively high level (approximately 0.44). Motor and fire insurance demonstrate moderate and stable ILR levels. Other life insurance products show relatively low ILR values with only slight changes, reflecting overall stability during the forecast period.

Benefits



Reliable ILR forecasts for strategic decision-making



Supports the design of insurance products



Supports internal risk management planning

[1] Forecasting with Exponential Smoothing: The State Space Approach – Hyndman et al. (2008)
[2] Time Series Analysis: Forecasting and Control – Box, Jenkins, Reinsel & Ljung (2015)\
[3] Early Warning Signal Model for Non-Life Insurance Business in Thailand – Saisuk & Peeracheir (2023)