



Forecasting Rubber Prices and Their Impact on Farmers Income Using Mathematical Models

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Abstract

This study aims to develop and evaluate mathematical forecasting models for forecasting cup lump rubber prices one year in advance. The predictive performance of three models including SARIMAX, Facebook Prophet, and the Bayesian Dynamic Linear Model (BDLM) was analyzed under three temporal forecasting schemes such as Lagging, Slice, and Two-step. Additionally, independent external factors influencing cup lump rubber prices from January 1, 2014, to December 31, 2024, were investigated and compared. Feature selection was conducted using the Cross-Correlation Function (CCF), LASSO Regression, and Random Forest algorithms to identify key predictors. The results indicate that the Bayesian Dynamic Linear Model (BDLM) outperformed the other candidates. The optimal model configuration incorporated the crop price index ($r = -0.536$), STR20 rubber block export volume ($r = 0.111$), and STR rubber block export volume ($r = 0.137$) as co-exogenous variables. The forecast yielded an mean forecast error of 2.33 Baht, The standard deviation of the forecast error was approximately 3.06% of the forecast price, a Mean Absolute Percentage Error (MAPE) of 4.57%, and a coefficient of determination (R^2) of 0.6334. Furthermore, integrating these price forecasts into a Vensim-based income simulation model alongside internal farm-level variables obtained from farmer questionnaires (specifically fertilizer usage, pesticide application, and irrigation systems) demonstrated that could help farmers increase net profit by 14.7% and reduce production costs by 37.2% compared to decision-making without forecasting information.

Keywords: Rubber Price Forecasting ,Feature Selection ,Income Simulation Model ,Cup Lump Rubber, Bayesian Dynamic Linear Model (BDLM)