



PROCEEDINGS OF THE INTERNATIONAL CONFERENCE 2025 ON ECONOMIC AND BUSINESS DEVELOPMENT IN THE NEW ERA

University of Economics, Hue University, June, 2025



HUE UNIVERSITY PUBLISHING HOUSE



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BOARD TRAITS AND FIRMS' COST OF DEBT IN VIETNAM	271
<i>Phuoc Vu Ha</i> <i>University of Economics, The University of Danang, Vietnam</i>	
TRANSPARENT AND AUTOMATED VEHICLE INSURANCE PROCESS USING BLOCKCHAIN TECHNOLOGY	280
<i>Minh Duc Nguyen</i> <i>University of Economics, Hue University, Vietnam</i>	
APPLICATION OF MACHINE LEARNING AND DEEP LEARNING TO PORTFOLIO OPTIMIZATION UNDER FORECAST ERROR IN THE VIETNAMESE STOCK MARKET	287
<i>Minh Duc Nguyen, Quoc Khang Pham</i> <i>University of Economics, Hue University, Vietnam</i>	
HOW DOES CREDIT USAGE IMPACT HOUSEHOLD WELFARE?	302
<i>Nguyen Thai Phan</i> <i>University of Economics, Hue University, Vietnam</i>	
THE OPTIMAL HYBRID GARCH- GRADIENT BOOSTING REGRESSOR MODEL FORECASTS THE VOLATILITY OF LAFOOCO (LAF.VN) STOCK IN THE CONTEXT OF THE U.S. RECIPROCAL TARIFF SUSPENSION	310
<i>Tran Ba Thuan</i> <i>University of Economics, Hue University, Vietnam</i>	
THE EFFECT OF BOARD SIZE ON FIRM PERFORMANCE: EVIDENCE FROM VIETNAM	323
<i>Nguyen Thi Thanh Binh¹, Ha Phuoc Vu²</i> <i>¹University of Economics, Hue University, Vietnam</i> <i>²University of Economics, The University of Danang Vietnam</i>	
DO THE LARGEST VIETNAMESE CORPORATE INCOME TAXPAYERS AVOID TAXES?	339
<i>Pham Thi Hong Quyen</i> <i>University of Economics, Hue University, Vietnam</i>	
UNDERSTANDING CONSUMER INITIAL TRUST IN AI-POWERED SERVICE CHATBOT: THE CASE STUDY IN ONLINE RETAIL BANKING IN HUE CITY	353
<i>Bui Thi Thanh Nga, Nguyen Thi Thuy Dat</i> <i>University of Economics, Hue University, Vietnam</i>	
EVALUATE THE EFFECTIVENESS OF PRICE PREDICTION MODELS AND DEVELOP DECISION SUPPORT SYSTEMS FOR TRADER ON BINANCE	370
<i>Truong An Binh¹, Nguyen Thanh Tuan²</i> <i>¹IRTECH JSC; ²University of Economic, Hue University, Vietnam</i>	
HOW TO MEASURE THE IMPACT OF CLIMATE RISK ON BANK PROFITABILITY IN MALAYSIA AND INDONESIA	390
<i>Ilinka ANTOVA, Marcellin YOVOGAN</i> <i>Sofia University Saint Kliment Ohridski, Bulgaria</i>	

APPLICATION OF MACHINE LEARNING AND DEEP LEARNING TO PORTFOLIO OPTIMIZATION UNDER FORECAST ERROR IN THE VIETNAMESE STOCK MARKET

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ABSTRACT

This study proposes a methodological framework that integrates machine learning and deep learning models with portfolio optimization strategies, taking forecast errors into account, to enhance investment performance in the Vietnamese stock market. Specifically, four predictive models including Support Vector Regression (SVR), Random Forest (RF), Long Short-Term Memory (LSTM), and One-dimensional Convolutional Neural Network (1D-CNN) are implemented to forecast stock returns. These forecasts are then incorporated into two portfolio optimization models: the traditional Mean-Variance Portfolio (MVP) and the Mean-Variance with Forecasting (MVF) model. The empirical dataset comprises daily closing prices of stocks in the VN30 index over the period 2019-2023. The models are evaluated based on both forecasting accuracy and portfolio performance. The results indicate that strategies utilizing the MVF model outperform the MVP in terms of both average and cumulative returns, while maintaining low volatility. In particular, LSTM-MVF and SVR-MVF emerge as the most effective strategies, demonstrating strong adaptability under volatile market conditions. This study contributes to improving investment efficiency in emerging markets by combining advanced forecasting techniques with optimal asset allocation strategies, while highlighting the importance of forecast error as a critical factor in investment decision-making.

Keywords: Portfolio Optimization; VN30; Support Vector Regression (SVR); Random Forest (RF); Long Short-Term Memory (LSTM); One-Dimensional Convolutional Neural Network (1D-CNN)

JEL codes: C61, G11, G17

1. INTRODUCTION

Portfolio optimization plays a fundamental role in financial decision-making, aiming to achieve the best trade-off between expected return and risk. Since the pioneering work of Markowitz (1959), the Mean-Variance Portfolio (MVP) framework has been the dominant paradigm in this field, providing a mathematical basis for efficient diversification. However, the effectiveness of this approach is critically dependent on the accuracy of return forecasts, which remain a persistent

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