

International Stock Return Prediction Methods & Formulation of Optimal Portfolios

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Abstract

This paper investigates advanced predictive methods for international equity returns and evaluates their structural and financial utility in constructing optimal portfolios. The empirical analysis comprehensively examines ten highly diversified equity UCITS ETFs traded on European markets over the 1995–2025 period, capturing distinct geographic exposures (US, Europe, and emerging markets), thematic sectors (technology), investment styles (value, quality), and ESG-driven strategies.

Methodologically, the study transitions from traditional asset pricing models to contrast classical linear frameworks (Pooled OLS and Fixed Effects) against a flexible, non-linear machine learning algorithm via Random Forest. The predictive matrices incorporate lagged return metrics, rolling risk variables (historical volatility and beta), macroeconomic proxies (the CBOE Volatility Index and term spread), and fund-specific characteristics including the Total Expense Ratio (TER) and Assets Under Management (AUM). The empirical evaluation shifts from pure statistical out-of-sample accuracy indicators—such as Root Mean Squared Error (RMSE) and Mean Absolute Error (MAE)—to a rigorous economic simulation across five distinct portfolio allocation strategies: Equal Weight (EW), Mean-Variance OLS, Mean-Variance Random Forest (MV-RF), Top-3 Random Forest (TOP3-RF), and an active Long-Short framework. Every strategy is assessed using risk-adjusted metrics like the Sharpe, Sortino, and Information ratios under realistic transaction cost penalties.

The out-of-sample results reveal that the Random Forest algorithm vastly outperforms linear models. Feature importance mapping identifies 12-month volatility, 12-month momentum, and the VIX as the primary predictive drivers. Economically, these predictive signals translate directly into enhanced financial gains. The TOP3-RF and MV-RF allocations dramatically outpace the passive EW benchmark, generating impressive annualized returns of 15.92% and 13.84% respectively, coupled with significantly minimized maximum drawdowns. Ultimately, this research bridges quantitative finance theory and modern asset management, demonstrating that data-driven algorithmic models substantially optimize global asset allocation within the transparent UCITS regulatory setting.

Keywords: Exchange-Traded Funds (ETFs); UCITS; Portfolio Optimization; Return Predictability; Machine Learning; Random Forest; Factor Investing.

Declarations: This work has been partly supported by the University of Piraeus Research Center.