A REGIME-AWARE MIXTURE OF EXPERTS FRAMEWORK FOR U.S. HEADLINE INFLATION FORECASTING UNDER STRUCTURAL INSTABILITY: A COMPARATIVE EVALUATION

R. A. V. S. Ranathunga[1]*, Chandima N. P. G. Arachchige[1]

[1]Department of Statistics, University of Colombo, Colombo, Sri Lanka

*Corresponding author: 2021s18952@stu.cmb.ac.lk

Abstract

Accurate inflation forecasting is essential for monetary policy, yet structural breaks, regime shifts and time-varying transmission lags reduce the accuracy of standard models. Most hybrid models add a single nonlinear residual correction that is applied the same way under all economic conditions. This study proposes a regime-aware Mixture of Experts (MoE) framework in which the combination itself changes with the regime. Filtered probabilities of four latent volatility states from a Markov-Switching Multifractal (MSM) model gate specialized linear experts built on a SARIMAX forecast, with expert coefficients estimated by Ridge (L2) regression to limit overfitting. The novelty lies in using regime probabilities to switch between interpretable linear experts rather than adding one black-box correction. Using monthly U.S. data from January 1986 to June 2025 (462 year-over-year observations) on CPI inflation, the Effective Federal Funds Rate (EFFR) and WTI crude oil prices, the MoE was compared with a naïve model, ARIMAX, SARIMAX with split-specific lags, and an LSTM network. Three expanding training samples ending in 2014, 2017 and 2020 covered the Zero Lower Bound (ZLB) and post-pandemic periods. The MoE achieved the lowest test RMSE in all splits, reducing it by **6.99%, 7.28%** and **7.15%** relative to SARIMAX, while the LSTM overfitted. Oil price pass-through remained stable at 11 months, whereas EFFR transmission shortened from 11 months in conventional periods to 3 months during the ZLB. Ljung-Box tests indicated no remaining residual autocorrelation ($p > 0.05$). Regime-aware gating of econometric baselines can therefore improve U.S. inflation forecasts under structural instability while keeping the model interpretable.

Keywords: Inflation forecasting, Markov Switching, Mixture of Experts Gates, Deep learning, Hybrid modeling