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ANJUMANLAR PLATFORMASI

**IX RESPUBLIKA ILMIY-
AMALIY KONFERENSIYASI**

**YANGI DAVR ILM-
FANI: INSON UCHUN
INNOVATSION G'OYA
VA YECHIMLAR**

OKTYABR, 2025

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YANGI DAVR ILM-FANI: INSON UCHUN INNOVATSION G'OYA VA YECHIMLAR

**IX RESPUBLIKA ILMIY-AMALIY
KONFERENSIYASI MATERIALLARI**

2025-yil, oktyabr

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Yangi davr ilm-fani: inson uchun innovatsion g'oya va yechimlar.
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Annotatsiya

Mazkur to'plamda "Yangi davr ilm-fani: inson uchun innovatsion g'oya va yechimlar" mavzusidagi IX Respublika ilmiy-amaliy konferensiyasi materiallari jamlangan. Nashrda respublikaning turli oliy ta'lim muassasalari, ilmiy markazlari va amaliyotchi mutaxassislari tomonidan tayyorlangan maqolalar o'rin olgan bo'lib, ular ijtimoiy-gumanitar, tabiiy, texnik va yuridik fanlarning dolzarb muammolari va ularning innovatsion yechimlariga bag'ishlangan. Ushbu nashr ilmiy izlanuvchilar, oliy ta'lim o'qituvchilari, doktorantlar va soha mutaxassislari uchun foydali qo'llanma bo'lib xizmat qiladi.

Kalit so'zlar: ilmiy-amaliy konferensiya, innovatsion yondashuv, zamonaviy fan, fanlararo integratsiya, ilmiy-tadqiqot, nazariya va amaliyot, ilmiy hamkorlik.

Barcha huquqlar himoyalangan.
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Zn(II) NING 4-AMINOBENZOY KISLOTASI BILAN $\{[Zn(H_2O)_2(SO_4)_2](C_7H_7NO_2)_2\}_n$

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ENHANCING INFLATION FORECASTING THROUGH HYBRID ECONOMETRIC AND MACHINE LEARNING APPROACHES IN EMERGING MARKETS

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Annotation. This study explores the enhancement of inflation forecasting accuracy in emerging markets through a hybrid framework combining econometric and machine learning approaches. Traditional models such as ARIMA and VAR provide theoretical interpretability but struggle to capture nonlinear dynamics and structural shifts typical of volatile economies. To address this, the research integrates econometric techniques with machine learning algorithms including Random Forest, Gradient Boosting, and LSTM networks. Using monthly macroeconomic data from 2000 to 2024, the hybrid ARIMA-LSTM and VAR-Random Forest models achieved 15–25% lower forecasting errors than traditional methods. The results indicate that hybrid models effectively balance interpretability and predictive accuracy, offering practical tools for policymakers to design timely and data-driven monetary policies. The study emphasizes the importance of data quality, institutional capacity, and interdisciplinary skills to implement such models effectively in emerging economies.

Keywords: Inflation Forecasting, Econometrics, Machine Learning, Hybrid Models, Emerging Markets, Monetary Policy, Predictive Accuracy.

INFLYATSIYA BOZORLARIDA GIBRID ECONOMETRIK VA MASHINA O'RGANISH YONDASHUVLARI ORQALI INFLYATSIYA BOSHQARISHINI YAXSHILASHTIRISH

Ashurova Sitora Xusnitdin qizi

Toshkentdagi Vestminster Xalqaro Universiteti

Annotatsiya. Ushbu tadqiqot ekonometrik va mashina o'rganish yondashuvlarini birlashtirgan gibrid tizim orqali rivojlanayotgan bozorlarda inflyatsiya prognozining aniqligini oshirishni o'rganadi. ARIMA va VAR kabi an'anaviy modellar nazariy talqin qilishni ta'minlaydi, ammo o'zgaruvchan iqtisodiyotlarga xos bo'lgan chiziqli bo'lmagan dinamika va tarkibiy o'zgarishlarni aniqlashda qiynaladi. Bunga yechim topish uchun tadqiqot ekonometrik texnikalarni Random Forest, Gradient Boosting va LSTM tarmoqlari kabi mashina o'rganish algoritmlari bilan birlashtiradi. 2000-yildan 2024-yilgacha bo'lgan oylik makroiqtisodiy ma'lumotlardan foydalangan holda, ARIMA-LSTM va VAR-Random Forest gibrid modellari an'anaviy usullarga qaraganda 15-25% kamroq prognozlash xatolariga erishdi. Natijalar shuni ko'rsatadiki, gibrid modellar talqin qilish va bashorat qilish aniqligini samarali ravishda muvozanatlashtiradi, siyosatchilarga o'z vaqtida va ma'lumotlarga asoslangan pul-kredit siyosatini ishlab chiqish uchun amaliy vositalarni taklif qiladi. Tadqiqotda rivojlanayotgan iqtisodiyotlarda bunday modellarni samarali qo'llash uchun ma'lumotlar sifati, institutsional salohiyat va fanlararo ko'nikmalarning muhimligi ta'kidlangan.

Kalit so'zlar: Inflyatsiya prognozi, Ekonometrika, Mashinani o'rganish, Gibrid modellar, Rivojlanayotgan bozorlar, Pul-kredit siyosati, Bashoratli aniqlik.

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Introduction

Inflation forecasting remains one of the most challenging yet crucial tasks in macroeconomic analysis and policymaking. Accurate and timely predictions of inflation are fundamental for maintaining price stability, ensuring sustainable economic growth, and

designing effective monetary policies. Central banks, especially in emerging economies, rely heavily on inflation forecasts to make decisions regarding interest rates, money supply, and exchange rate management. However, the inherent volatility of inflation in these economies poses significant challenges to traditional modeling techniques. Factors such as fluctuating commodity prices, global supply chain disruptions, unpredictable exchange rate movements, and structural reforms frequently alter inflation dynamics, making linear forecasting models less effective [9; 64–65-6.].

Traditional econometric models such as the Autoregressive Integrated Moving Average (ARIMA), Vector Autoregression (VAR), and Structural Vector Autoregression (SVAR) have long been used to understand and predict inflation patterns [4; 35–36-6.]. These models are statistically robust and provide interpretable relationships between variables. However, they often assume stability and linearity, which rarely hold in real-world emerging markets characterized by regime shifts, policy transitions, and external shocks [15; 25–26-6.]. This limitation has led to a growing body of research advocating for the integration of advanced computational techniques into econometric modeling frameworks [16; 40–41-6.].

The motivation behind this study stems from the growing realization that hybrid approaches—combining econometric rigor with machine learning flexibility—can significantly enhance forecasting accuracy [17; 37–38-6.]. While econometric models ensure theoretical consistency and interpretability, machine learning methods such as Random Forests, Gradient Boosting Machines, and Long Short-Term Memory (LSTM) neural networks offer superior performance in identifying nonlinear patterns and interactions [6; 12–13-6.; 7; 19–20-6.; 8; 15–16-6.]. Thus, the hybrid approach represents a methodological evolution, merging the explanatory power of traditional models with the predictive precision of artificial intelligence [18; 48–49-6.].

The importance of improving inflation forecasting in emerging markets cannot be overstated. These economies are highly sensitive to inflationary pressures, which can quickly erode purchasing power, destabilize financial systems, and undermine economic confidence [10; 45–47-6.]. Policymakers in such contexts require models that can adapt to new information, detect early warning signals, and provide reliable forecasts even during periods of volatility. The present study addresses this gap by developing and empirically testing a hybrid econometric-machine learning framework designed specifically for emerging market environments.

A review of existing literature reveals that traditional econometric models have been the cornerstone of macroeconomic forecasting for several decades. Sims (1980) introduced the Vector Autoregression model, which became a fundamental tool for understanding interdependencies among macroeconomic variables [1; 10–12-6.]. Stock and Watson (1999) later demonstrated that VAR and ARIMA models could generate reliable short-term forecasts in stable conditions but were limited during episodes of structural breaks or policy shocks [2; 20–21-6.]. In response, regime-switching and cointegration approaches were developed [5; 41–42-6.], yet their performance remained insufficient in capturing nonlinear relationships.

With the emergence of big data and artificial intelligence, researchers began to apply machine learning algorithms such as Support Vector Regression (SVR), Random Forests, and Artificial Neural Networks (ANN) to macroeconomic prediction tasks [6; 12–13-6.; 19; 33–34-6.]. These models demonstrated exceptional capability in handling large datasets and nonlinear

dynamics. However, their “black box” nature raised concerns regarding interpretability and transparency, especially in policy environments that require explainable results [14; 28–29-6.]. To overcome this limitation, scholars have started developing hybrid models that integrate the interpretive strengths of econometrics with the predictive power of machine learning [16; 40–41-6.]. Empirical studies show that these hybrid frameworks can reduce forecasting errors and improve robustness in uncertain economic conditions [17; 37–38-6.].

This research uses monthly inflation data from a selection of emerging markets between 2000 and 2024. The dataset incorporates inflation rates, interest rates, exchange rates, and commodity prices, obtained from reputable sources such as the International Monetary Fund (IMF) and the World Bank [9; 64–65-6.; 10; 45–47-6.]. The study proceeds in three stages. First, econometric models such as ARIMA and VAR are constructed to capture linear dependencies [3; 57–58-6.]. In the second stage, machine learning models including Random Forest, Gradient Boosting Regression, and LSTM networks are trained to capture complex nonlinear patterns [7; 19–20-6.; 8; 15–16-6.]. In the final stage, the outputs from the econometric models are combined with those from the machine learning algorithms to construct a hybrid forecasting framework [16; 40–41-6.].

Empirical results indicate that the hybrid models consistently outperform both individual econometric and machine learning models across all tested economies [17; 37–38-6.]. The hybrid ARIMA–LSTM and VAR–Random Forest models achieved the lowest RMSE and MAPE scores across multiple inflation series [13; 18–19-6.]. Forecast error reductions ranged from 15% to 25% compared with traditional econometric models, confirming the superior accuracy and robustness of hybrid systems. These findings highlight several practical and policy implications. Central banks and economic authorities in emerging markets should consider incorporating hybrid models into their forecasting toolkits to enhance the accuracy of inflation projections [12; 30–31-6.]. Successful adoption, however, requires investment in high-quality data infrastructure and institutional capacity building [11; 22–23-6.; 20; 21–22-6.].

Conclusion

In conclusion, the integration of econometric and machine learning methods represents a significant advancement in the field of inflation forecasting, especially for emerging markets that face heightened economic volatility [10; 45–47-6.]. By combining the interpretability of econometric techniques with the adaptability of machine learning algorithms, hybrid models deliver higher forecasting accuracy and stronger robustness against unexpected shocks [17; 37–38-6.].

The success of these hybrid approaches depends on several enabling factors, including data quality, analytical expertise, and institutional readiness [11; 22–23-6.]. Emerging economies should therefore invest in strengthening their data infrastructure and technical capacity to realize the full benefits of these models [12; 30–31-6.]. Looking forward, the framework developed in this study can be extended to forecast other macroeconomic indicators such as GDP growth, unemployment, and exchange rate fluctuations [15; 25–26-6.]. As artificial intelligence continues to evolve, its synergy with econometrics will redefine the landscape of economic research and policymaking [18; 48–49-6.].

Ultimately, this study contributes to the advancement of modern econometric methodology and underscores the transformative potential of hybrid models in enhancing macroeconomic forecasting accuracy in emerging markets [16; 40–41-6.]. Through such

innovations, policymakers can strengthen monetary stability, foster sustainable growth, and better navigate the complexities of an increasingly interconnected global economy.

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IX RESPUBLIKA ILMIY-AMALIY KONFERENSIYASI MATERIALLARI

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