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Forecasting Future Sequences of Inflation and the Investor Sentiment Index Using Artificial Intelligence

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ABSTRACT

This study aims to forecast future sequences of inflation and the investor sentiment index using artificial intelligence in Iran and Iraq. In terms of purpose, the research is applied, and in terms of nature and method, it is descriptive-analytical, conducted through a hybrid approach combining artificial intelligence and econometrics. The statistical population comprises monthly data on inflation and the investor sentiment index in Iran and Iraq, with the statistical sample including all available observations over the 10-year period ending in October 2025. Data were collected using a documentary method from official statistical sources and reputable databases. In the first stage, a Long Short-Term Memory (LSTM) recurrent neural network was employed to forecast future sequences of both variables; 80% of the data were allocated for training and 20% for testing, with forecasts evaluated across seven future sequences. The results indicated that the model demonstrated more stable and reliable performance in forecasting the investor sentiment index in Iran, whereas in Iraq, prediction errors gradually increased as the forecast horizon extended. Furthermore, the findings from the Error Correction Model revealed that a long-run equilibrium relationship exists between the variables in both countries, and the system returns to its equilibrium path at an appropriate speed. Overall, the findings suggest that integrating artificial intelligence and econometric methods can provide a suitable tool for inflation forecasting, with results applicable to economic policymakers and capital market participants.

KEYWORDS: Inflation, Investor Sentiment Index, Long Short-Term Memory, Artificial Intelligence

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1. Introduction

Inflation, as an economic phenomenon, gives rise to multiple negative social and cultural consequences, including poverty, inequitable income distribution, and the proliferation of financial corruption, each of which imposes significant costs on the economy (Akbarifard et al., 2018).

While inflation is observed to varying degrees across most countries worldwide, its rate differs across nations and time periods. In recent decades, this economic phenomenon has caused fewer disruptions in developed countries, as they are generally not afflicted by severe or chronic inflation. Conversely, developing countries frequently confront high inflation rates that generate numerous adverse effects, such as heightened income inequality, reduced savings and investment, increased consumption, misallocation of resources toward non-essential goods and services, diminished economic growth, and the spread of various forms of financial and administrative corruption. Consequently, estimating and forecasting the future trajectory of this indicator has gained substantial importance (Clements & Reade, 2020).

Evidently, accurately understanding the future behavior of macroeconomic indicators such as inflation, particularly in developing economies, requires a thorough comprehension of the impact of its underlying components. In this context, the capital market can be identified as one of these critical factors, functioning as a vital artery and the pulsing heartbeat of a nation's economy.

The capital market is a constituent component of the financial market and, in fact, serves as one of the primary channels for financing in an economy. The influence of the capital market on liquidity flow and its contribution to economic growth and development constitutes a significant issue that has recently garnered attention, particularly given the increasingly favorable outlook toward Iran's capital market. Should a logical relationship between the financial market and other economic sectors be absent, the likelihood of disruptions and deficiencies within the economic mechanism increases. Owing to its fundamental role in mobilizing resources through savings, optimizing the circulation of financial resources, and directing them toward investment needs in productive economic sectors, the capital market plays a substantial role in fostering economic growth across nations. Indeed, some economists contend that the distinction between developed and underdeveloped economies lies not in advanced technology, but rather in the presence of an integrated, active, and extensive capital market (Farmanara et al., 2019).

In this context, decision-making regarding investment is critically important for capital market investors, as it can lead to substantial gains or losses. Therefore, investors must possess adequate analytical and interpretive capabilities to make informed decisions about stock market investments. However, most capital market participants and investors lack the capacity to conduct technical and scientific analyses of financial statements, price trend movements, risk, and returns. Consequently, psychological factors and conformity with prominent or herd behaviors exert a significant influence on individuals' financial decision-making. This is because individuals tend to form preferences based on likes or dislikes. As a result, the investment behavior of ordinary, and predominantly retail, investors stems more from their emotions than from scientific analyses (Afaf & Sarvar, 2016).

In summary, inflation and capital market performance constitute two critical components that play significant roles in the economic vitality of any nation. Given the importance of these two indicators, researchers have consistently sought to examine their nature and behavior from multiple perspectives. Accordingly, with the passage of time and the emergence of modern analytical techniques, the quality of such analyses has also improved. However, due to their complex behavior and highly volatile nature, forecasting the trajectory of these two indicators remains a crucial, vital, and challenging task. This is particularly the case when the objective is short-term forecasting. Therefore, in this research, which is being conducted for the first time, an attempt is made to estimate the seven future sequences of these two indicators (on a monthly basis) utilizing long-term data. Concurrently, with the advancement of analytical sciences, advanced and novel methods for forecasting various phenomena have been proposed, seriously challenging past achievements. In this regard, the application of artificial intelligence tools undoubtedly constitutes one of the most powerful analytical approaches available, capable of overcoming the shortcomings of traditional models. Accordingly, the core research question addressed in this study is: What is the predictive power and accuracy regarding the seven future sequences of the inflation and investor sentiment indicators in the capital markets of Iran and Iraq?
Accordingly, considering the main research problem, the objectives are formulated as follows:

1. Forecasting the seven future sequences of the inflation rate using artificial intelligence in the capital markets of Iran and Iraq
2. Forecasting the seven future sequences of the investor sentiment index using artificial intelligence in the capital markets of Iran and Iraq

2. Theoretical Foundations and Literature Review

Inflation

Various definitions of inflation have been proposed in the literature, nearly all of which converge on a common underlying concept. Inflation refers to a sustained increase in the general price level. The inflation rate represents the rate of change in the general price level and, for year *t*, is measured as the difference between the general price level in year *t* and year *t-1*, divided by the general price level in year *t-1* (Phillip et al., 2025).
In a study conducted by Fama, stock returns exhibited a simple negative correlation with both expected and unexpected inflation. Nevertheless, in a multivariate regression of stock returns on real variables and inflation measures, an anomalous relationship between returns and inflation emerges—one that is typically latent between historical stock returns and expected future inflation within the monetary sector of the economy (i.e., the integration of money demand theory with considerations of the money supply process). This framework suggests that the relationship between inflation and the normal growth rate of real economic activities is negative. Within the real sector, most fundamental stock market activities necessitate forecasting the values of real variables that also determine stock prices (Phillip et al., 2025).
Therefore, the real sector of the economy indicates that the derived relationship between stock returns and real economic activities (originating from the real sector) combines with the negative

relationship between inflation and real activity (originating from the monetary sector) to account for the spurious negative relationship between stock returns and inflation (Brewer & Gibson, 2016).

Among the most prominent theories addressing inflation is the monetary theory. In brief, the monetary perspective on inflation can be summarized in the following distinct propositions:

a) Inflation is a monetary phenomenon in the long run. This implies that a high and sustained growth rate of the money supply generates inflation, whereas a low growth rate of the money supply ultimately reduces the inflation rate.

b) The relationship between the price level and the money supply is proportional in the long run. This means that a ten percent increase in the money supply leads to a ten percent increase in the general price level. c) The causal relationship runs from money to prices. In other words, changes in the money supply cause changes in prices, rather than being a consequence of them. d) The nominal money stock is exogenous and controllable, determined by monetary authorities (i.e., the money supply is not endogenously determined by economic activities and macroeconomic variables) (Barley & Klein, 2016).

Investor Sentiment and Inflation

In developing economies, investor sentiment plays a crucial role in shaping economic trajectories. Such sentiment, encompassing confidence, fear, optimism, and uncertainty, can significantly influence investment decisions. When investors hold optimistic expectations regarding a country's economic future, they exhibit a greater propensity to invest. This increase in investment can stimulate production, employment, and ultimately aggregate demand. If such demand is not matched by a commensurate supply response, inflationary pressures may arise. Conversely, feelings of uncertainty or fear among investors can trigger capital outflows. In developing countries, which often rely heavily on foreign investment, such capital flight can lead to a depreciation of the national currency. This depreciation, in turn, raises the prices of imported goods and consequently contributes to higher inflation. Thus, negative investor sentiment can indirectly exacerbate inflationary trends (Eugster & Uhl, 2024). In developing nations, economic and political structures are typically more fragile. This fragility renders investors highly sensitive to even minor changes in economic policies or political developments. For instance, adjustments in interest rates or fiscal policies can induce fluctuations in investor sentiment. Such emotional volatility, particularly when negative, may result in reduced investment and heightened economic uncertainty, which themselves serve as drivers of inflation (Chiang, 2024). Investor sentiment can also influence inflation expectations.

If investors anticipate that inflation will rise in the future, they may seek to acquire assets that preserve their value against inflation, such as gold or foreign currencies. This behavior can increase demand for these assets and depreciate the national currency. Such depreciation, in turn, fuels further inflation, even if underlying real economic factors remain unchanged (Zhang, 2019). In developing countries, financial markets typically exhibit lower depth and transparency. This condition amplifies the influence of investor sentiment on market volatility. For instance, a rumor

or unofficial news report can trigger a rush among investors to sell off assets. Such emotional or herd behaviors can induce sharp price fluctuations, which may ultimately lead to economic instability and heightened inflation (Afaf & Sarvar, 2016). Investor sentiment can also affect governmental economic policymaking. In efforts to attract investment, governments may adopt expansionary policies, such as lowering interest rates or increasing public expenditure. If implemented without due consideration of the economy's productive capacity, such policies can boost aggregate demand and consequently contribute to inflation. Therefore, governmental responses to investor sentiment can constitute a significant factor in the formation of inflationary pressures. In some instances, however, positive investor sentiment may help mitigate inflation. For example, if investors possess confidence in a country's economic future, they are more likely to undertake long-term investments, which can enhance the economy's productive capacity.

An increase in the supply of goods and services can alleviate inflationary pressures. Therefore, investor sentiment can not only contribute to rising inflation but, under appropriate conditions, also aid in its control (Mahdif & Enke, 2024).

Ultimately, it is essential to recognize that investor sentiment is a psychological factor that operates in interaction with real economic fundamentals. Such sentiment can either amplify or dampen economic trends. In developing countries, where economic structures are still evolving, managing investor sentiment through information transparency, political stability, and rational policymaking can play a pivotal role in inflation control. Accordingly, to achieve a more comprehensive understanding of inflation in developing economies, attention should not be limited to traditional factors such as supply and demand or monetary policies. Rather, the role of investor sentiment must also be considered as a significant and influential determinant. This sentiment can affect inflation both directly and indirectly and, if managed appropriately, can contribute to economic stability (Eugster & Uhl, 2024).

Analytical Review of Domestic and Foreign Literature

The significance of inflation and its relationship with the capital market has prompted researchers over successive years to conduct numerous and diverse studies in this field, each examining the topic from a distinct perspective.

A review of prior studies indicates that, fundamentally, the literature acknowledges the influence of investor sentiment on the capital market and its performance. In this regard, Ateeq (2022) conducted a study examining the impact of investor sentiment on capital market performance and cash flow volume. This research focused on Pakistan over the period from 2008 to 2019. The results of this correlation-based analysis revealed that investor sentiment significantly affects both market performance indicators and trading volume, as well as cash flows.

Lou et al. (2021) conducted a study titled "Predicting Stock Market Crises Using Market Indicators and Investor Sentiment." This research employed a correlational approach over a 10-year period, focusing on organizations affected by financial crises. The empirical findings demonstrated that investor sentiment can enhance early-warning capabilities in forecasting stock market crises, and

that the Artificial Neural Network (ANN) model exhibits superior performance compared to other methods, including Support Vector Machines, Decision Trees, and Random Forests.

Ni et al. (2017) examined the nonlinear effect of investor sentiment on monthly stock returns in the Chinese market. Their findings indicate that the influence of investor sentiment remains significant over horizons ranging from one to 24 months. Furthermore, the results revealed that the impact of sentiment is positive in the short term for high-return stocks, whereas it is negative for low-return stocks. This inverse effect corroborates the presence of strong extreme behavior in the Chinese stock market. Additionally, they found that Chinese investors exhibit notable cognitive biases and a pronounced tendency toward speculation.

Dalika and Seetharam (2015) also investigated the relationship between investor sentiment and stock returns in the South African stock market over the period from 1999 to 2009. The results indicated that investor sentiment exerts a substantial influence on stock returns. Specifically, when sentiment is low, returns are relatively high, volatility is elevated, and stock growth is pronounced.

Several studies have also been conducted in Iran in this field. For instance, Dadgar et al. (2023) sought to analyze the role of investor sentiment in capital market volatility in their research. To this end, emphasizing a behavioral economics and finance approach and employing econometric models, they examined the critical trends in the stock market during the Iranian year 1399 (2020–2021). The required data were collected on a daily basis from 30 large companies listed on the Tehran Stock Exchange. The results confirmed the significant effect of investor sentiment on one hand, and the influence of government performance on investor behavior on the other, on the net inflow of funds from individual investors into the stock market.

Hajian-Nejad et al. (2022) also investigated the impact of investor sentiment on reactions to earnings news among companies listed on the Tehran Stock Exchange. In this regard, a sample comprising 125 companies listed on the Tehran Stock Exchange during the years 2015–2020 was selected, and a multivariate regression model using panel data was employed to test the hypotheses. The findings revealed that in companies with high sentiment, return sensitivity to positive earnings news was greater, whereas in companies with low sentiment, return sensitivity to negative earnings news was more pronounced. Furthermore, the results indicated that earnings news possesses informational content.

Babaji (2012) conducted a study titled "Investigating the Effects of Macroeconomic Variables (Inflation Rate, Exchange Rate, Liquidity Growth Rate) on the Return Index of the Automotive Industry in Companies Listed on the Tehran Stock Exchange." The results indicated that, during the period from 2006 to 2010 and at a 95% confidence level, the inflation rate and liquidity growth rate exerted a positive influence, whereas the exchange rate had a negative impact. Furthermore, when examined separately for each year within the 2006–2010 period, the macroeconomic variables (inflation rate and liquidity growth rate), where a relationship existed, demonstrated either positive or negative effects; however, the exchange rate consistently exhibited a negative influence whenever a significant relationship was observed. Concurrently, a review of prior studies reveals another category of research that posits the influence of capital market performance on macroeconomic indicators, including inflation. Studies in this category either assert the impact of

capital market performance on the macroeconomy and its indicators or advocate for a bidirectional relationship between these two factors. In this context, the study by Khadri-Gharibvand and Sinaei (2023) can be cited, which examined the responsiveness of investor sentiment to economic variables using an investor sentiment behavior index in the Tehran Stock Exchange. This index was measured on a monthly basis from 2014 to 2020. In their study, the influence of the aforementioned index by four economic variables was also investigated using regression analysis within an Autoregressive Distributed Lag (ARDL) framework. The results demonstrated a negative effect of liquidity volume (with a coefficient of -0.000045), operational and capital balance (with a coefficient of -0.00085), and interest rate (with a coefficient of -0.02828) on investor sentiment behavior, while the risk-free interest rate was found to have no significant impact on investor sentiment behavior in the Tehran Stock Exchange.

Furthermore, Moghaddam and Rafiei (2021) conducted a study examining the relationship between capital market development and economic growth. The required data were analyzed and tested on a quarterly basis over the period from 2003 to 2012. The research findings indicate that, given the underdeveloped state of the Tehran Stock Exchange, the effect of capital market development on economic growth is minimal. Additionally, based on the conducted tests, the impact of economic growth on capital market development was also found to be negligible.

Finally, reference can be made to the study by Abunouri et al. (2013), which investigated the relationship between the inflation rate and the stock return index on the Tehran Stock Exchange using the CECM model and based on monthly time-series data from March 2004 to September 2011. The results obtained from their research confirmed the existence of an asymmetric relationship between the aforementioned variables, such that only the negative components (shocks) of the stock index and inflation exhibited a long-run relationship with each other, whereas their positive components showed no significant association.

Eugster and Uhl (2024) conducted research on forecasting inflation based on a sentiment index. These researchers constructed an index using algorithmically scored sentiment from approximately 730,000 news articles published between the first quarter of 2003 and the fourth quarter of 2021, and analyzed its predictive power for United States inflation up to eight quarters ahead. The results demonstrate that sentiment can forecast inflation with greater accuracy than simple classical techniques, achieving a root mean square error that is approximately 30 percent lower, depending on the forecast horizon. Compared to other frequently employed measures, forecasting models utilizing the sentiment index exhibit superior predictive accuracy for shorter forecast horizons relative to models based on macroeconomic variables and the Michigan Survey of Consumers.

3. Research Methodology

From the perspective of purpose, this research is applied, as it addresses the analysis of investor sentiment and inflation, and in this regard, its findings can be utilized by various individuals and institutions. Furthermore, in terms of implementation approach, the research method is descriptive-correlational, employing statistical and econometric techniques to forecast future investor sentiment and the inflation index. Concurrently, regarding the data collection procedure, the study

is classified as library-based. In terms of data type, the research utilizes time-series data, for which both descriptive and inferential statistical methods have been employed to analyze and interpret the findings. To address the research objectives, a deep learning technique—a prominent branch of artificial intelligence—will be implemented within the Python software environment.

The statistical population of this study comprises the countries of Iran and Iraq (for the inflation variable) and their respective capital markets (for the investor sentiment index). The time period employed in this research spans a 10-year horizon on a monthly basis, determined according to data adequacy and availability.

In fact, in the present study, the method for collecting information related to the research literature is library-based, encompassing books, various articles, and domestic and foreign journals. Similarly, the methods for gathering information required for hypothesis testing and analyzing relationships are also library-based and documentary.

The information and data required for this research will be collected in two sections and through two approaches:

a) To gather the necessary information for completing the theoretical framework and research literature, credible domestic and foreign books, articles, dissertations, and theses will be utilized. In this section, efforts will be made to employ up-to-date sources to develop the research literature and enhance the scholarly depth of the work.

b) Furthermore, in the second section, two primary tools will be employed to complete the information required for statistical analyses and elucidating the research hypotheses. In this regard, it is noteworthy that the variables used in this study are twofold: the investor sentiment index of the capital market and inflation. These two variables will be extracted on a monthly basis, covering the most recent 10-year period ending in 2025. The source of primary data for calculating the investor sentiment index is the Stock Exchange. The inflation rate will also be extracted from reputable global databases such as the World Bank or Trading Economics.

To conduct statistical analyses for elucidating the research objectives, two categories of statistical techniques will be employed. In the first section, which encompasses forecasting the future sequences of the inflation and investor sentiment indices, artificial intelligence—specifically, the deep learning technique—will be utilized. This technique is based on training an intelligent analytical model that, upon detecting logical behavioral patterns, will estimate future sequences. The Python software environment will be employed for this section.

Deep learning employs artificial neural networks to perform complex computations on large volumes of data. Deep learning is a subset of machine learning that operates based on the structure and functioning of the human brain.

A neural network, structured analogously to the human brain, consists of artificial neurons, also referred to as "nodes." These nodes are arranged across three distinct layers:

• Input Layer • Hidden Layer(s) • Output Layer

Data provide information to each node in the form of inputs. Each node multiplies the inputs by random weights, computes the sum, and adds a bias term. Finally, nonlinear functions, referred to as "activation functions," are applied to determine which neuron should be activated.

While deep learning algorithms possess self-supervised representation capabilities, they rely on artificial neural networks that mirror the manner in which the brain processes information. During the training process, these algorithms utilize unknown elements within the input distribution to extract features, group objects, and discover useful data patterns. Similar to training machines for self-learning, this process occurs at multiple levels through the application of algorithms to construct models.

Deep learning models employ various algorithms. Although no single network architecture can be considered universally optimal, certain algorithms are better suited for specific tasks. In this research, aligned with the stated objective, Long Short-Term Memory (LSTM) networks will be utilized.

Long Short-Term Memory networks, abbreviated as LSTMs, are a type of Recurrent Neural Network (RNN) capable of learning and retaining long-term dependencies. Recalling information from the past over extended sequential periods constitutes their default behavior.

These networks retain information over time and are particularly useful in time series forecasting, as they preserve previous inputs. LSTMs feature a chain-like architecture in which four layers interact with one another, communicating in a distinctive manner.

The operational steps of this function are as follows:

First, they discard the irrelevant components of the previous state. Then, they selectively update the cell state values. Finally, they output specific portions of the cell state, with the seven future sequences being the focal point of this research. Figure 1 below illustrates the operational mechanism of LSTMs:

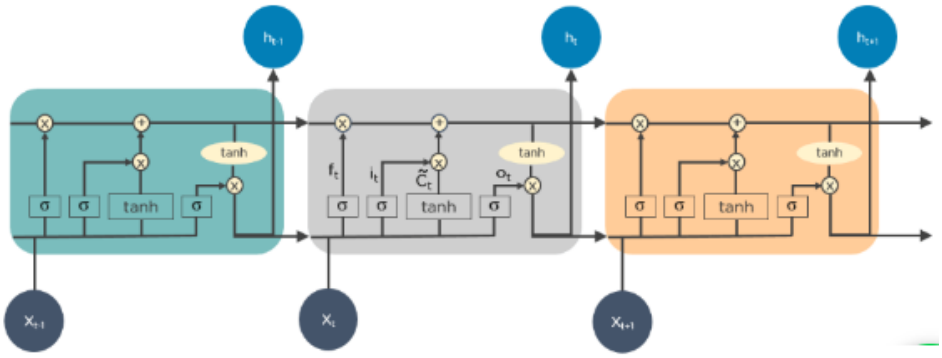

Figure 1. The Operational Function Employed in the Study

In this regard, it is noteworthy that the variables employed in this study are twofold: the investor sentiment index of the capital market and inflation. These two variables will be extracted on a monthly basis, covering the most recent 10-year period ending in 2024. The source of primary data for calculating the investor sentiment index is the Iraq Stock Exchange. The inflation rate will also be extracted from reputable global databases such as the World Bank or Trading Economics.

Furthermore, to elucidate the pattern of influence exerted by the investor sentiment index in the capital market on the inflation phenomenon, the Autoregressive Distributed Lag (ARDL)

econometric technique will be employed. This technique will also be implemented using the EViews software environment.

Given the utilization of the ARDL technique, the initial model employed to examine the impact of investor sentiment on inflation is specified as follows:

$$\pi_{i,t+h} = \alpha + \sum_{K=0}^{q} \beta_k Sent_{t-k} + \sum_{j=1}^{p} y_j \pi_{t-j,t-j+1} + \varepsilon_{t+h}$$

where π denotes inflation and Sent represents investor sentiment.

4. Research Findings

Code Execution and Results Analysis

Iran's Inflation Index

The data for this section pertain to the monthly inflation index over the most recent 10-year period ending in October 2025, as illustrated in the figure below. The objective is to forecast this index for the next seven months

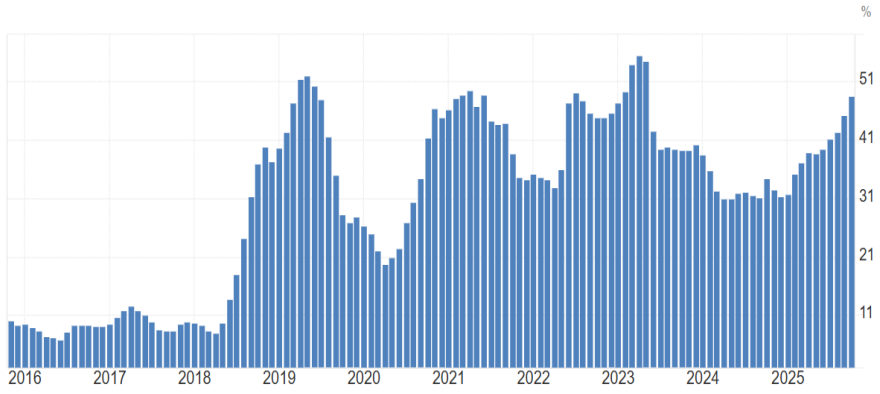

Figure 2. Iran's Inflation Index

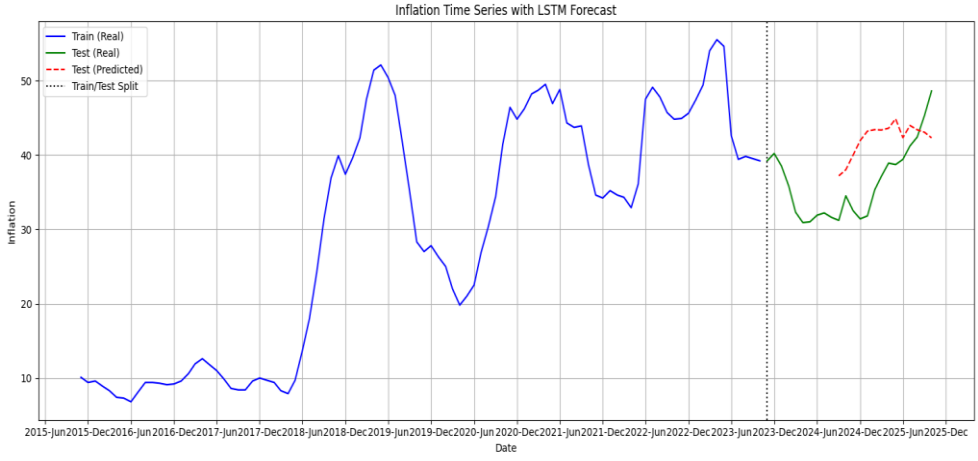

Figure 3. Comparison of Actual Data and Predicted Test Data for Iran's Inflation Index

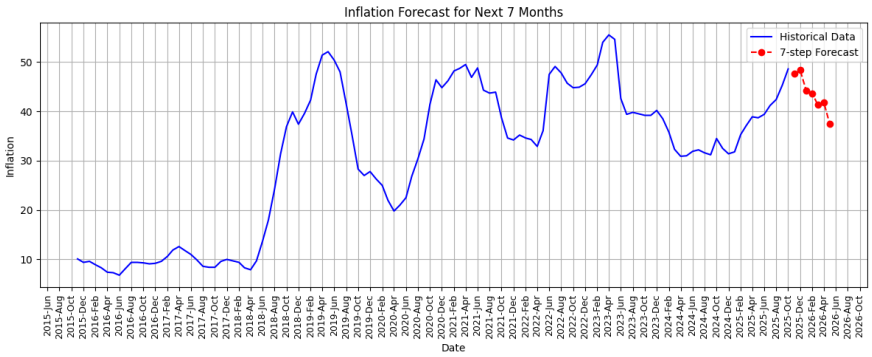

Figure 4. Forecast of Iran's Inflation Index for the Next Seven Months

Table 1. Forecast of Iran's Inflation Index for the Seven Future Sequences

Sequence	Estimated Index	Actual Index	Incremental Estimation Error	Cumulative Incremental Estimation Error
First	47.6	38.9	8.7	8.7
Second	48.3	38.7	9.6	18.3
Third	44.2	39.4	4.8	23.1
Fourth	43.7	41.2	2.5	25.6
Fifth	41.3	42.4	-1.1	24.5
Sixth	41.8	45.3	-3.5	21.0
Seventh	37.4	48.6	-11.2	9.8

Table 2. Model Accuracy in Forecasting the Sequences

Step	MAE	RMSE	MSE
1	7.242074	7.676762	58.932673
2	7.693592	8.022515	64.360748
3	4.874018	5.109958	26.111666
4	5.562762	5.745061	33.005731
5	4.259734	4.668442	21.794349
6	3.151733	3.441775	11.845815
7	3.145331	3.572175	12.760436

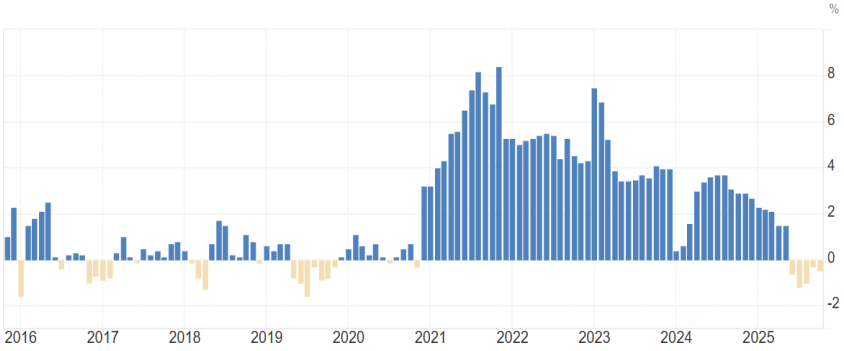

Figure 5. Iraq's Inflation Index

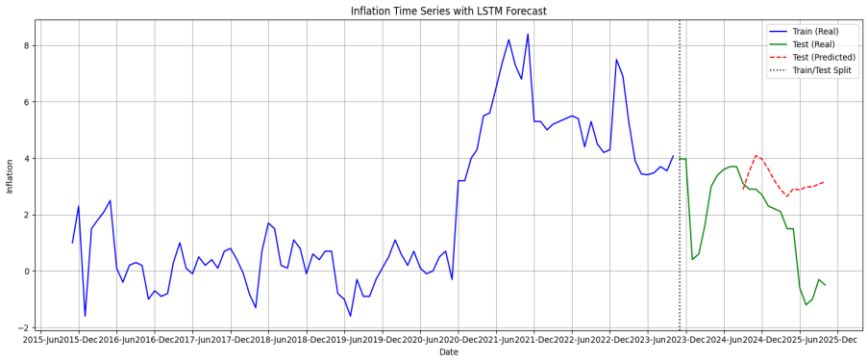

Figure 6. Comparison of Actual Data and Predicted Test Data for Iraq's Inflation Index

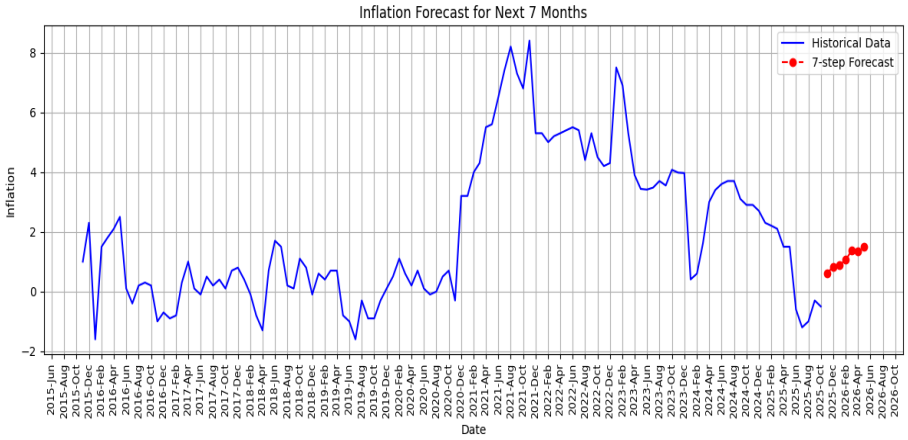

Figure 7. Forecast of Iraq's Inflation Index for the Next Seven Months

Table 3. Forecast of Iraq's Inflation Index for the Seven Future Sequences

Sequence	Estimated Index	Actual Index	Incremental Estimation Error	Cumulative Incremental Estimation Error
First	-0.053	1.55	-1.50	-1.55
Second	0.23	1.50	-1.27	-2.82
Third	0.30	-0.60	0.90	-1.92
Fourth	0.50	-1.20	1.70	-0.22
Fifth	0.85	-1.00	1.85	1.62
Sixth	0.93	-0.30	1.23	2.85
Seventh	1.20	-0.50	1.70	4.55

Table 4. Model Accuracy in Forecasting the Sequences

Step	MAE	RMSE	MSE
1	0.939065	1.002857	1.005722
2	1.340976	1.433593	2.055189
3	1.720507	1.921621	3.692626
4	2.306553	2.559482	6.550946
5	2.608104	2.893757	8.373831
6	3.029091	3.283686	10.782592
7	3.356697	3.586424	12.862438

Iran's Investor Sentiment Index

Similar to the preceding section, the data for this part pertain to the investor sentiment index over a monthly timeframe comprising 120 months ending in October 2025, as illustrated in the figure below. The objective is to forecast this index across the seven future sequences.

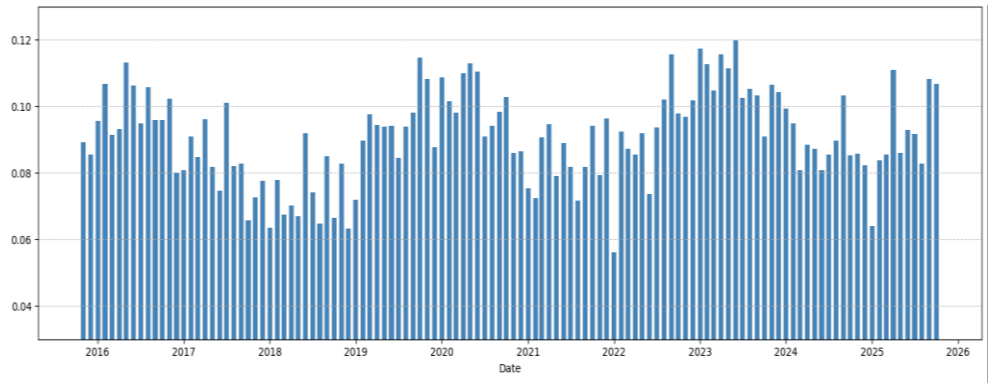

Figure 8. Iran's Investor Sentiment Index

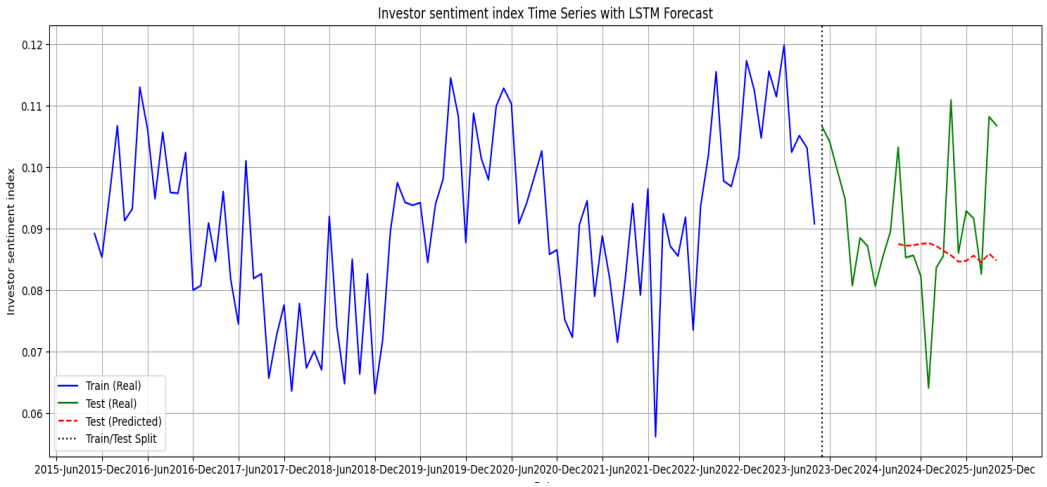

Figure 9. Comparison of Actual Data and Predicted Test Data for Iran's Investor Sentiment Index

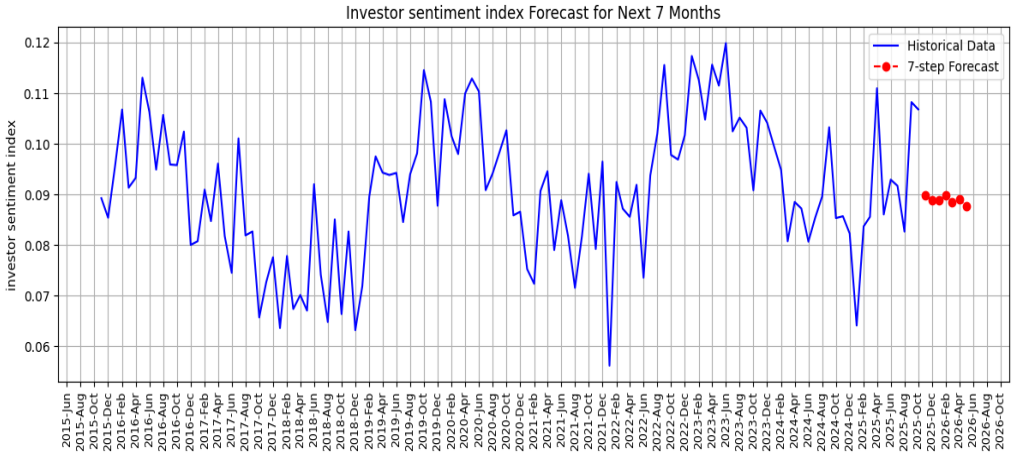

Figure 10. Forecast of Iran's Investor Sentiment Index for the Next Seven Months

Table 5. Forecast of Iran's Investor Sentiment Index for the Seven Future Sequences

Sequence	Estimated Index	Actual Index	Incremental Estimation Error	Cumulative Incremental Estimation Error
First	0.089	0.111	-0.022	-0.022
Second	0.088	0.086	0.002	-0.020
Third	0.088	0.093	-0.005	-0.025
Fourth	0.089	0.092	-0.003	-0.028
Fifth	0.088	0.083	0.005	-0.023
Sixth	0.089	0.108	-0.019	-0.042
Seventh	0.087	0.107	-0.020	-0.062

Table 6. Model Accuracy in Forecasting the Sequences

Step	MAE	RMSE	MSE
1	0.009723	0.013638	0.000186
2	0.007295	0.012123	0.000147
3	0.007937	0.012052	0.000145
4	0.007958	0.011550	0.000133
5	0.007529	0.011362	0.000129
6	0.008210	0.012288	0.000151
7	0.012177	0.015784	0.000249

Iraq's Investor Sentiment Index

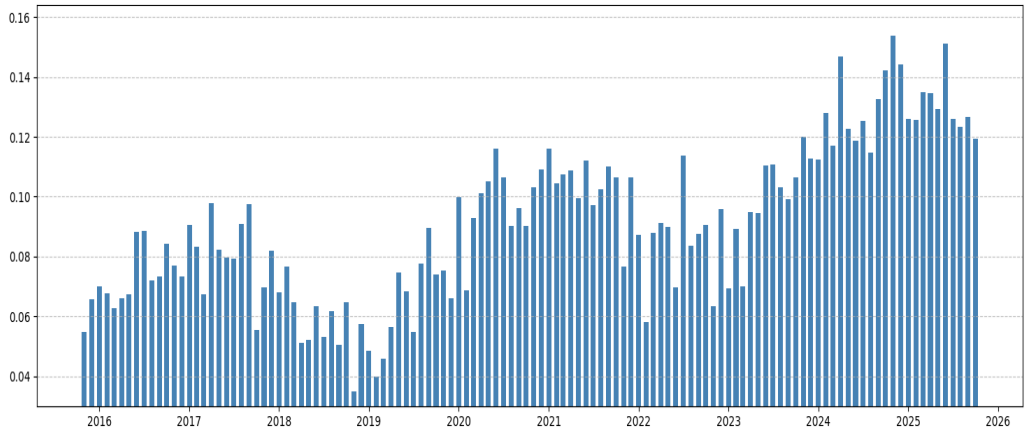

Figure 11. Iraq's Investor Sentiment Index

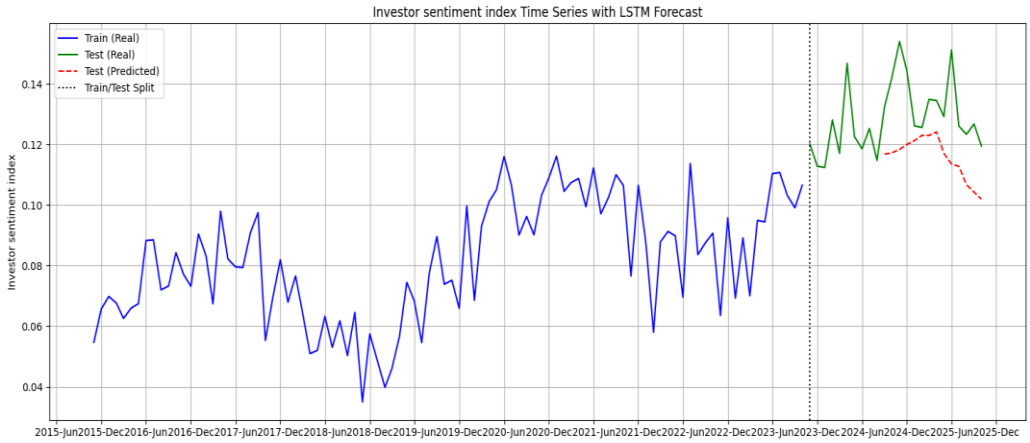

Figure 12. Comparison of Actual Data and Predicted Test Data for Iraq's Investor Sentiment Index

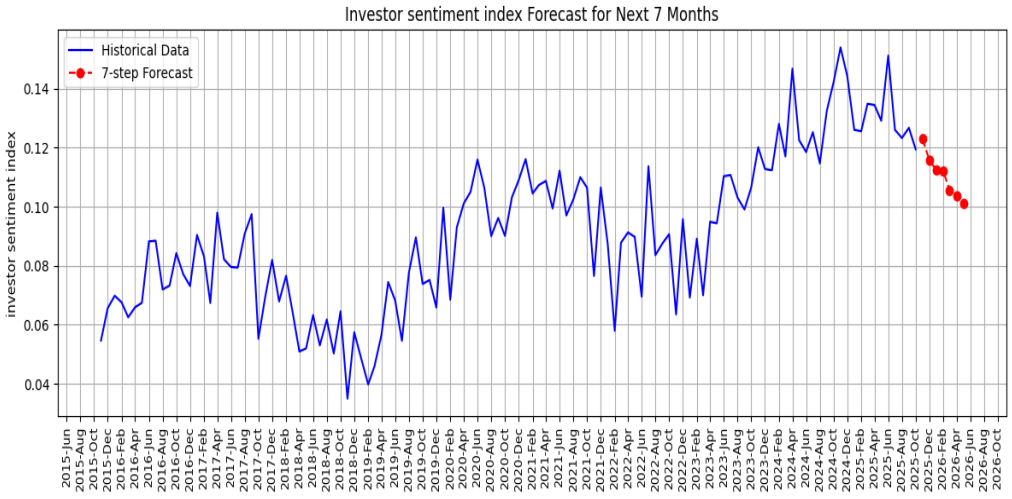

Figure 13. Forecast of Iraq's Investor Sentiment Index for the Next Seven Months

Table 7. Forecast of Iraq's Investor Sentiment Index for the Seven Future Sequences

Sequence	Estimated Index	Actual Index	Incremental Estimation Error	Cumulative Incremental Estimation Error
First	0.123	0.134	-0.011	-0.011
Second	0.115	0.129	-0.014	-0.025
Third	0.112	0.151	-0.039	-0.064
Fourth	0.112	0.126	-0.014	-0.078
Fifth	0.106	0.123	-0.017	-0.095
Sixth	0.103	0.126	-0.023	-0.118
Seventh	0.101	0.119	-0.018	-0.136

Table 8. Model Accuracy in Forecasting the Sequences

Step	MAE	RMSE	MSE
1	0.016288	0.019392	0.000376
2	0.022444	0.024975	0.000624
3	0.026803	0.028924	0.000837
4	0.023712	0.025334	0.000642
5	0.026739	0.028010	0.000785
6	0.028877	0.030166	0.000910
7	0.030304	0.031869	0.001016

Analysis of Model Performance in Forecasting the Inflation Index

The results indicate that the model exhibits differing performance in forecasting the inflation index for Iran and Iraq. For Iran, the model initially overestimated the inflation index relative to actual values and subsequently shifted to underestimation in later sequences. This pattern suggests relative weaknesses in the model's capacity to track the upward trajectory of inflation, reflecting its sensitivity to the inherent volatility of the series.

In contrast, the model's performance for Iraq has been more stable, with a narrower and more controlled range of forecasting errors. Although some initial errors are observed in certain sequences, the model has demonstrated a relatively higher degree of accuracy in following the overall trend of the index.

Overall, the results demonstrate that the model performs less effectively under conditions of high inflation and rapid index growth, whereas its forecasts prove more reliable in environments characterized by lower volatility. These findings underscore the necessity of optimizing the model in accordance with the specific economic characteristics of each country.

Furthermore, a comparison of model accuracy across the seven forecast sequences reveals differing performance in predicting the inflation index for Iran and Iraq. For Iran, the model initially encountered relatively high errors; however, as the forecasting horizon progressed through subsequent steps, its accuracy improved and the error magnitude decreased.

Conversely, for Iraq, the model exhibited higher initial accuracy, but with the extension of forecast steps, error accumulation led to a gradual increase in prediction errors.

In summary, under conditions of severe inflation and rapid index fluctuations, such as those observed in Iran, the model requires initial refinement and enhancement. In contrast, in settings with lower volatility, such as Iraq, the model's forecasts are more stable but remain sensitive to the length of the forecast horizon.

Analysis of Model Performance in Forecasting the Investor Sentiment Index

The results indicate that the model exhibits differing performance in forecasting the investor sentiment index for Iran and Iraq. In Iran, the model predicted the actual index slightly below its true value; however, the error remained small and stable, reflecting a relatively high degree of model accuracy. In Iraq, the model also underestimated the actual index, but the magnitude and accumulation of errors were greater, suggesting that the model requires further calibration and refinement to better accommodate Iraq's economic conditions.

Overall, the model demonstrated stable and reliable performance in Iran, whereas in Iraq, prediction errors increased as the forecast sequences progressed. These findings emphasize the importance of tailoring the model to the specific economic characteristics of each country.

Furthermore, comparing model accuracy across the seven forecast sequences reveals divergent performance in predicting the investor sentiment index for Iran and Iraq. In Iran, the model forecasted the index with high and consistent accuracy, and the associated errors were minimal, indicating a high level of reliability in the predictions.

In Iraq, the model initially demonstrated relatively good accuracy; however, as the forecasting steps progressed, errors gradually increased. This indicates that longer forecast horizons lead to error accumulation and a reduction in relative predictive accuracy.

Overall, the model exhibited stable and reliable performance in Iran, whereas in Iraq, further calibration and optimization are required to accommodate the country's specific economic conditions.

5. Conclusion and Recommendations

This research aimed to forecast future sequences of inflation and the investor sentiment index, as well as to analyze the relationships between these two variables, by employing a combination of novel artificial intelligence methods based on Long Short-Term Memory (LSTM) networks and econometric models grounded in the Autoregressive Distributed Lag (ARDL) approach for Iran and Iraq. The findings of the study revealed that the simultaneous utilization of deep learning models and traditional econometric frameworks can provide a more comprehensive depiction of economic and behavioral dynamics, thereby fostering a deeper understanding of the interaction between investor sentiment and inflation.

The results obtained from LSTM-based forecasts indicate that model performance is largely contingent upon the structural and behavioral characteristics of the markets under study. In Iran, the model was able to predict the investor sentiment index with high accuracy and stable error, a

finding that suggests the presence of more regular and learnable temporal patterns within this index. In contrast, in Iraq, due to lower market depth, more intense behavioral volatility, and greater sensitivity of the sentiment index to external shocks, the model encountered error accumulation over longer forecast horizons.

A similar pattern was observed in inflation forecasting: Iranian inflation data, characterized by sharper fluctuations and greater complexity, led to errors in the initial forecasting stages, whereas the more moderate trends in Iraq created more favorable conditions for short-term predictions. Nevertheless, the phenomenon of error accumulation reemerged in longer-term sequences.

The analysis of the relationships between investor sentiment and inflation using the ARDL model also revealed fundamental differences between the two countries. In Iran, the investor sentiment index exhibited a negative and statistically significant effect on inflation in both the short run and the long run. This implies that an improvement in sentiment and an increase in investor optimism contribute to mitigating inflationary pressures. This finding suggests that in the Iranian economy, the "expectations channel" plays a pivotal role, and shifts in the psychological atmosphere of the market can rapidly assist in controlling inflation.

In contrast, in Iraq, investor sentiment was found to be insignificant in the short run but exerted a positive and statistically significant effect on inflation in the long run. In other words, investor optimism over the long-term horizon leads to higher inflation through pathways such as increased economic activity, rising aggregate demand, and heightened price pressures.

In summary, the findings indicate that:

• The use of LSTM models for forecasting economic time series, particularly for behavioral indices, can serve as a powerful tool; however, their accuracy is contingent upon the quality and stability of the underlying data.

• Integrating artificial intelligence with econometric frameworks such as ARDL can facilitate a deeper understanding of behavioral–economic relationships.

• The influence of investor sentiment on inflation follows distinct pathways across different countries; these differences stem from market structures, the role of expectations, the depth of capital markets, and institutional characteristics.

• In economies such as Iran, where expectations play a central role in inflation dynamics, sentiment indices can serve as appropriate instruments for forecasting and managing inflation.

• Conversely, in economies with oil-dependent structures and heightened sensitivity to external shocks, such as Iraq, the impact of sentiment may manifest primarily over the long-term horizon and through the demand-pressure channel.

Accordingly, this research demonstrates that employing hybrid approaches combining artificial intelligence and econometrics can provide a novel and efficient framework for analyzing economic behaviors, offering policymakers, market participants, and analysts an effective tool to forecast future trends with greater accuracy and better manage the effects of investor behaviors.

In light of the achievements and analytical results of this study, the following recommendations are proposed:

Given the statistically significant effect of sentiment on inflation (particularly in Iran), it is recommended that the Central Bank and policymaking institutions incorporate the investor sentiment index alongside variables such as exchange rates and liquidity as a leading indicator for monitoring inflationary changes.

Given that the LSTM model has demonstrated the capacity to forecast the future trajectory of inflation and sentiment (albeit with differences between the two countries), it is recommended that statistical organizations and central banks establish specialized units dedicated to developing deep learning models. This would enable economic forecasts to move beyond traditional approaches and achieve greater precision.

The results indicated that the model's performance was relatively weaker in Iran—due to high inflation and elevated volatility—and more stable in Iraq. Therefore, it is recommended that in more unstable economies such as Iran, hybrid models or the incorporation of auxiliary variables such as exchange rates, liquidity, and oil prices be employed to enhance forecasting accuracy.

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ETHICAL CONSIDERATION

Authenticity of the texts, honesty and fidelity has been observed.

CONFLICT OF INTEREST

Author/s confirmed no conflict of interest.