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Evaluating the Effectiveness of the Impact of Interest Rate Changes on Foreign Direct Investment on the Iraqi Economy for the Period (2004-2023)

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Abstract. *The interest rate in the Iraqi economy represents an active and important element in the management of monetary policy in the Iraqi economy, as it is used by the monetary authority represented by the Central Bank of Iraq to influence the money supply, as well as the impact of this also by allocating the available resources for savings among foreign investments to achieve the central goal of the monetary authority of achieving stability in prices such as the interest rate and various prices and values of investments together and thus achieve balance at the economic and financial levels. This research analyzes the relationship between interest rate changes (IRC) and foreign direct investment (FDI) in the Iraqi economy during the period from (2004-2023). Multiple analytical tools were used, including descriptive statistics, correlation analysis, time series analysis, and prediction models using ARIMA and Prophet. The results showed an association between the two variables under consideration, with the ability of the ARIMA and Prophet models to provide accurate forecasts of future FDI trends. A quantitative methodology that includes descriptive statistics, correlation analysis, time series models, and forecasting tools has been adopted to clarify the relationship between the two variables and draw conclusions that support economic decision-making.*

Keywords: *Interest Rate, Investment, Forecasting, Economy*

1. INTRODUCTION

Determining the relationship between interest rate changes and the foreign direct investment environment varies according to the nature of the economy of the country concerned and its repercussions on attracting foreign direct investment and maximizing the benefits achieved. When the state's policy is clear, flexible, effective, efficient, and keeps pace with economic transformations and changes at the macroeconomic level, it is effective in attracting foreign investments. On the contrary, whenever monetary policy expands in granting credit by reducing interest rates in a certain way, it leads to an increase in the supply of money in circulation. Whenever this is a catalyst for investment and its increase, developed countries and a number of developing countries have used the interest rate in addition to the exchange rate to attract investments as a very important monetary and economic indicator with a direct and legal impact in attracting investment flows, especially foreign direct investment in light of capital movements at the international level, the Iraqi economy has witnessed significant changes in interest rates and their potential effects on the flow of foreign direct investment. The relationship between them is of particular importance in light of the volatile economic conditions experienced by the Iraqi economy and this research aims to provide a comprehensive analysis to identify and evaluate the

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impact of interest rate changes on foreign direct investment, using data covering the period (2004-2023).

Importance of research

The research derives its importance from the importance of the role played by the interest rate as a basic monetary tool that attracts investments, especially foreign direct investment, through its direct or indirect effects on the decisions taken by investors, as it affects many important aspects of its changes, including reducing financing costs, market attractiveness and international competitiveness, and thus affecting economic stability in the country concerned.

Search problem

The research problem revolves around trying to enable countries in how to maintain a delicate balance between how to attract short-term capital and stimulate long-term investment by following sustainable economic policies, as the interest rate and the changes that occur to it is one of the pivotal factors to determine investment flows, especially direct ones, as maintaining a moderate interest rate enhances the attractiveness of these flows and prevents the flight of short-term capital and thus reduce dependence on the flow of volatile capital.

2. RESEARCH HYPOTHESES

Positive interest rates play a prominent and very important role in increasing investment and savings, on the contrary, in exchange for negative interest rates that raise the exchange rate by transferring a large part of the savings to foreign deposits as well as the flight of domestic capital.

The existence of a negative relationship between the interest rate and foreign direct investment, suggesting that higher interest rates may discourage the flow of foreign investment.

Research Objectives

a. Clarify the importance of the interest rate and its role in attracting investment flows, especially foreign direct investment.
b. Evaluate the effectiveness of changes in the interest rate and clarify their effects on foreign direct investment in the Iraqi economy.
c. Clarify how to predict future investment trends and follow a planned and deliberate monetary policy to ensure the stability of interest rates, taking into account what factors can stimulate the flow of foreign investment.

d. Provide a comprehensive analysis to identify and evaluate the impact of interest rate changes on FDI, using data covering the period (2004-2023).

Data sources

The data was obtained from the Central Bank of Iraq and the World Bank, and includes annual data on interest rate and foreign direct investment for the period studied.

Data Analysis Tools

a. Descriptive statistics to determine the basic properties of data.
b. Correlation analysis to measure the strength of the relationship between the two variables.
c. Time Series Analysis and Models ARIMA and Prophet to predict future investment trends.

The first topic

Theoretical review of interest rate changes and their relationship to foreign direct investment

First: The theoretical basics of interest rate and investment

a. Interest rate changes and their effects on economic activity and attracting investments

Interest rates are one of the important monetary tools of monetary policy, as they directly affect economic activity by minimizing borrowing costs and savings returns, and interest rates are determined by the monetary authority represented by the Central Bank to work to achieve stability in prices, promote growth as well as maintain stable operating levels, and interest rate changes are represented by decreasing once and rising again, increasing the interest rate works to raise the cost of borrowing, so spending decreases both consumer and investment, and this is what reduces growth On the contrary, when the interest rate is reduced, the cost of borrowing decreases, and this is what encourages and stimulates the increase in spending, both consumer and investment, so economic growth is enhanced, as well as the Central Bank resorts to work to reduce the interest rate to stimulate economic establishments, businessmen and investors to borrow to carry out their investments in many areas, as well as encouraging individuals to scale savings and work to increase spending, especially on durable goods (1).

b. Interest rate changes and their relationship to investment flows

The interest rate greatly affects the movement of economic activity in the macroeconomy, as the interest rate is used as an economic-monetary tool to analyze

macroeconomic trends through the monetary policy of the Central Bank, and according to economic theory, the interest rate affects both consumption and savings, as well as its impact on the investment decisions of investors in businesses and economic establishments that use their financial resources to make investments or provide them in the bank, as the interest rate is associated with an inverse relationship with investment, as it represents the cost of obtaining According to the Keynesian analysis, any investment increases lead to an increase in income and use in the event that the economy does not reach full operation, when the central bank pursues and follows an expansionary monetary policy by buying bonds in the open market, this leads to an increase in the money supply and an increase in the monetary reserve, which enables commercial banks to expand by granting credit and vice versa by following a restrictive monetary policy by the central bank as a monetary authority [(2)].

c. The importance of interest rate changes as an influential monetary variable in making and approving investment decisions

The importance of the interest rate is embodied as an important and influential economic monetary variable in investment decisions, since investment represents that part that has been deducted from the income used in the production process in order to form capital, as the demand for investment is determined through three important pivotal pillars: expected profits "marginal capital adequacy", interest rates and investment opportunities, as investors must compare profits and costs, when profits exceed costs, the continuous investments and expand them when establishing any economic projects [(3)] The interest rate determined by the central bank called the policy rate is one of the main policies used by the monetary authorities as a very important weapon affecting economic activity for the following reasons [(4):]

1) Lowering the interest rate will increase the volume of securities offered by commercial banks to work in rediscounting them at the Central Bank, which contributes to providing the necessary liquidity for commercial banks to expand the volume of credit.
2) The importance of the relationship between the interest rate determined by the Central Bank and the interest rate determined by commercial banks is evident, as the interest rate here is a cost rate for commercial banks on loans provided by the Central Bank, when the interest rate set by the Central Bank rises, this leads to an increase in the interest rate on loans granted by commercial banks to individual customers.

3) The interest rate is a monetary instrument that enables commercial banks to collect the money they need from time to time.
4) The interest rate is the bank rate as an important means used by the bank to influence the money supply.

Second: Foreign Direct Investment (Theoretical Introduction)

a. Definition of FDI according to the perspective of international economic organizations

Foreign direct investment is defined according to what the World Trade Organization considers as representing the ownership of a stable investor in a particular country of an asset located in a second country (5), so he uses his assets in other countries that are the host countries to manage it (6), as well as foreign direct investment is defined according to the perspective of the United Nations Trade and Development UNCTAD as a long-term investment that reflects the benefits and permanent control of the foreign investor or the parent company in a foreign branch located in the host country other than Belonging to its nationality, provided that the ownership of shares is (10%) or more (7) Foreign direct investment is also defined according to the Organization for Economic Cooperation and Development (OCDE) is the most comprehensive definition among the definitions as an investment in which the investor owns a share of not less than (10%) of the total capital or of the number of votes in the investment project (8)It can be defined according to the Investment Law No. (13) on (12/9/2006) as the sum of the benefits resulting from the investment of capital when establishing any economic project at the level of the national economy (9), so foreign direct investment is the investment owned and managed by the foreign investor as a result of owning all or part of the share in the investment project to ensure his right to manage it completely and multiple investment may be free, joint or aggregated. As for the investment environment and its investment climate, it is embodied in the conditions Economic, legal, social and political that constitute the overall investment environment on the basis of which important investment decisions are made (10).

b. The theoretical relationship between interest rate changes and foreign direct investment

Interest rate changes significantly affect investment decisions at many levels at the level of individuals and at the level of institutions, whether economic or financial institutions in general, as they affect the decisions of commercial investors and the impact of the interest rate on foreign direct investment, in the case of marginal capital

adequacy is greater than the interest rate [11], according to Keynes's theory, the size of investment is determined on the basis of the relationship between the prevailing interest rate in the market between it and the marginal adequacy of capital [12] This means the continuous pursuit by the investor to reach the maximum possible profit, as an investor, he does not invest in new financial assets except when the marginal adequacy of capital exceeds the interest rate, it is obvious that he stops investing in those assets, as the marginal adequacy of capital is equal to the interest rate [13], and the high interest rate in the country of origin attracts foreign capital in the form of foreign direct investment and thus increases the money supply of foreign currencies on the other hand. If the interest rate is high in other countries, FDI will be left because of the low supply of foreign currencies, which leads to a lower exchange rate[14].

The second topic

Analytical aspect and evaluation of the results obtained

First: Evaluating the impact of interest rate changes on foreign direct investmentin the Iraqi economy using data covering the period (2004-2023).

a. Measuring and analyzing the impact of interest rate changes on foreign direct investmentin the Iraqi economy over the period (2004-2023), including the use of the following in the analysis:

1) Descriptive statistics:

The data were analyzed using descriptive statistics that showed a clear fluctuation in FDI during the research period. The interest rate has been relatively stable with some periods marked by a sudden rise.

Table 1. Descriptive statistics for variables and data

Variable	Average	Standard deviation	The bare minimum	The maximum
IRC	6.85	4.67	4.00	20.00
FDI	-1.67	4.99	-10.18	3.40

Source: Prepared by the researcher based on the data of Appendix (1)

2) Correlation analysis and the relationship between study variables

The Pearson correlation coefficient was used to measure the relationship between the two variables. The results showed a negative moderate-strength correlation between interest rate and FDI, indicating the impact of monetary policies on investment flows.As shown in table 2.

Table 2. Correlation analysis between variables

Correlation coefficient	IRC Interest Rate Changes	
Foreign Direct Investment FDI	Correlation coefficient	P value
	-0.53	0.015

Source: Prepared by the researcher based on the data of Appendix (1)

Figure 1 shows the relationship between the interest rate (IRC) as a percentage and foreign direct investment (FDI) in billions of dollars during the period (2004-2023) as the blue dots represent the actual data, while the red line expresses the general trend using linear regression. The negative tilt of the line indicates an inverse relationship between the two variables, as higher interest rates are associated with lower FDI.Statistical analysisis illustrated by the red line, which means that there is a weak linear relationship between the interest rate and FDI, noting a clear dispersion of data, which may indicate the impact of additional factors other than the interest rate affecting the flow of foreign investment. The confidence interval surrounding the red line shows uncertainty in the outlook, as the region's supply increases as interest rates rise, reflecting a higher degree of uncertainty in outliers. The data highlights that most of the points cluster at low interest rates (between 4% and 7%), indicating the concentration of foreign direct investment during this period of time in contrast. Outliers appear at high interest rates (16%-20%) low or negative investments, which may reflect economic instability during that period of time.

The results show that the relationship between interest rate and FDI appears to be weak, which calls for studying the impact of additional factors that may affect investment flows. The broad confidence zone indicates the need for more complex analytical models to improve the accuracy of forecasts. It is recommended to introduce additional variables, such as inflation, political stability, and infrastructure, to study the combined effects. Furthermore, advanced time models, such as ARIMA or Prophet, can be adopted., to analyze seasonal and cyclical trends. Improving the current model and analyzing the impact of long-term monetary policies are necessary steps to enhance understanding of the considered relationship and support economic decision-making.

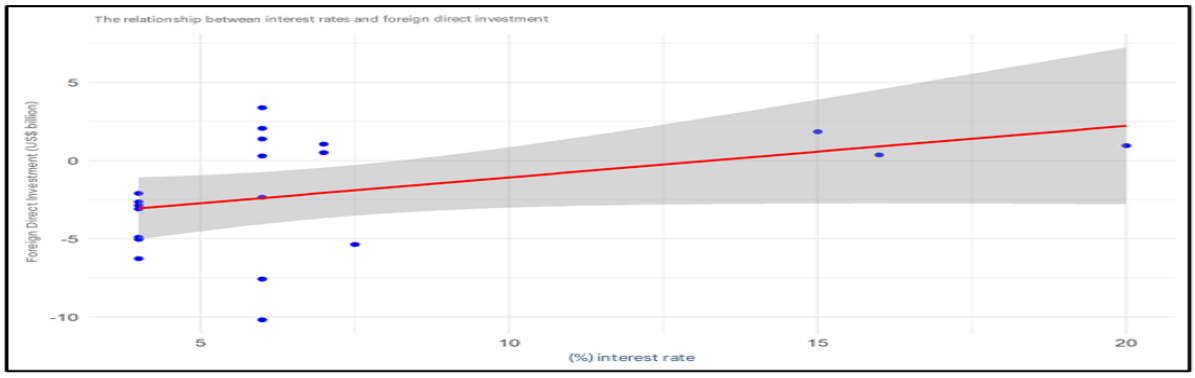

Figure 1. The relationship between the interest rate (IRC) as a percentage and foreign direct investment (FDI) In the Iraqi economy during the period (2004-2023)
Source: Prepared by the researcher

b. Analysis and evaluation of the relationship between the interest rate (IRC) as a percentage and foreign direct investment (FDI) in the Iraqi economy during the period (2004-2023).

1) Interest rate analysis (IRC): Interest rates rose sharply from 6% in 2004 to a peak of 20% in 2007, then gradually declined and stabilized at 6% between 2010 and 2015.The decline continued to 4% from 2016 to 2022, before rising again to 7.5% in 2023. These moves reflect monetary policy efforts to try to control inflation or support the economy for a certain period.
2) Foreign Direct Investment (FDI) Analysis: Foreign direct investment (FDI) showed a positive trend during the period (2004-2012) rising to a high of $3.4 billion in 2012. From 2013 onwards, investment witnessed a sharp decline, reaching (-10.18) billion dollars in 2014, indicating negative capital flows. Negative flows continued until 2023, with some slight improvement in recent years, but the overall trend remained negative.
3) Interpretation and evaluation of the relationship between the two variables: There is a clear inverse relationship between interest rates and foreign direct investment, as interest rates have risen significantly in years that have seen a significant decline in foreign investment. This pattern indicates a negative impact of higher interest rates on Iraq's ability to attract FDI, which is consistent with the economic theory that high interest rates lead to a higher cost of borrowing, reducing investment incentives.
    a) Thoughtful interest rate cuts can improve FDI flows.
    b) Work to stabilize the economic and political environment to attract long-term foreign investments.

c) Implement fiscal and monetary policies that support interest rate stability and encourage investment.

Overall, Figure 2 highlights the critical role of monetary policies and their direct impact on foreign capital flows. Policymakers canuse these analyses to guide future economic reforms.The trends of both the interest rate (IRC) and foreign direct investment (FDI) in the Iraqi economy during the period (2004-2023) show where solid lines (in blue) represent interest rates, while the dashed lines (in red) represent foreign direct investment. The actual values for each year were displayed alongside their points, providing accurate details of trends.

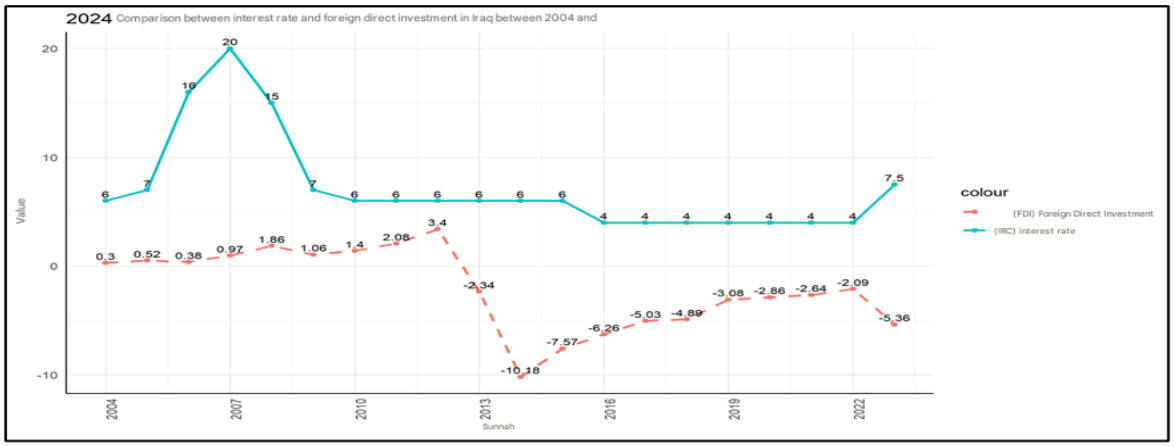

Figure 2. Trends in the interest rate (IRC) and foreign direct investment (FDI) in the Iraqi economy during the period (2004-2023)
Source: Prepared by the researcher based on the data of Appendix (1)

c. Analysis of time series and trends :

The ARIMA model was used to analyze time trends. The results showed that the model is suitable for analyzing the time series and predicting future changes. Seasonal components were also analyzed using the STL method, providing a deeper understanding of seasonal fluctuations.Briefly Figure 2 shows the components of the FDI time series:

1) The top shows the general trend, which shows a continued decline in FDI.
2) The middle part shows seasonality, which reflects cyclical patterns in the data.
3) The bottom shows random variations that are not easily predictable.

In general, Figure (3) can be explained as follows:

Top - Standardized Residuals: This drawing shows the standard remainders of the model used. The random distribution of the residuals is evaluated to determine if there are any patterns or deviations that could indicate the inappropriateness of the model.

We note that the standard values are within the expected limits, indicating that there are no outliers or clear patterns that indicate poor model performance.

ACF of Residuals: This graph shows the Autocorrelation function of model remainders across different lags. It is used to verify the independence of the remainders. The values lie within random boundaries (defined by blue dashed lines), indicating that the remainders are not self-correlated, and this supports the validity of the model assumptions.

Bottom - P values for the Ljung-Box test: The Ljung-Box test checks whether the residuals are independent (not chronologically correlated). P-values are displayed for each delay period. All p-values are greater than (0.05), indicating that there is no significant self-correlation in the remainders, and therefore the model is statistically appropriate.

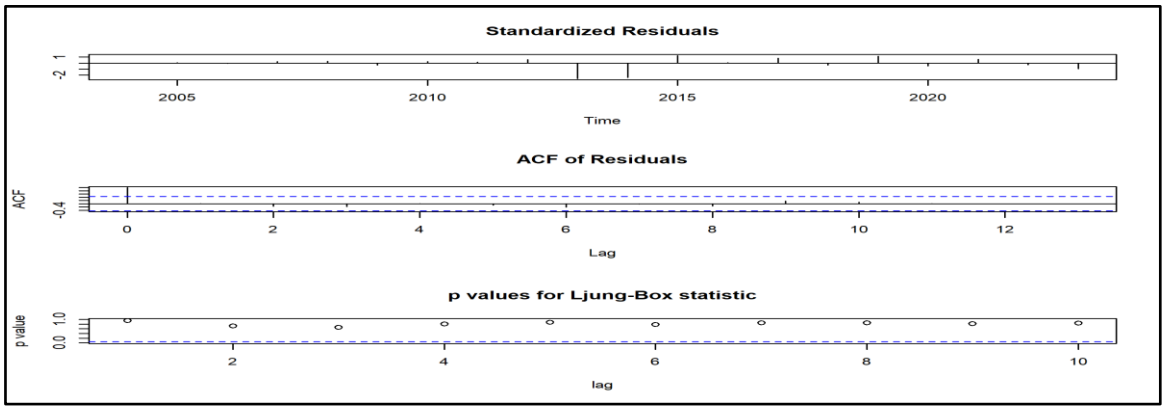

Figure 3. Seasonal analysis of data Duration studied
Source: Prepared by the author

In general, the three graphs indicate that the ARIMA model used is well suited to the available data. The remainders are randomly dispersed, and there is no evidence of autocorrelation, which reinforces the credibility of the predictions extracted from the model.

Analysis of diagnostic drawings:

a. Residuals vs Fitted:

Figure 4 shows the relationship between residues and expected values. Randomization around zero indicates the consistency of variance (Homoscedasticity) and overall model suitability, noting that there are some extreme points that require further examination.

b. Q-Q (Normal Q-Q Plot) chart:

This drawing compares the distribution of the residues with the normal distribution. Dots on the diagonal line show compatibility with natural assumptions, except for some outliers that may require additional processing.

c. Square root of standard residuals vs. expected values (Scale-Location):

This graph shows how constant the variance is with the expected values. The blue line shows a steady trend without a clear pattern, reinforcing the hypothesis of equal variance, with anomalous points requiring attention.

d. Residuals vs Leverage:

This drawing identifies high-leverage points that may significantly affect the model. No points appear outside the critical boundary, supporting the stability of the model.

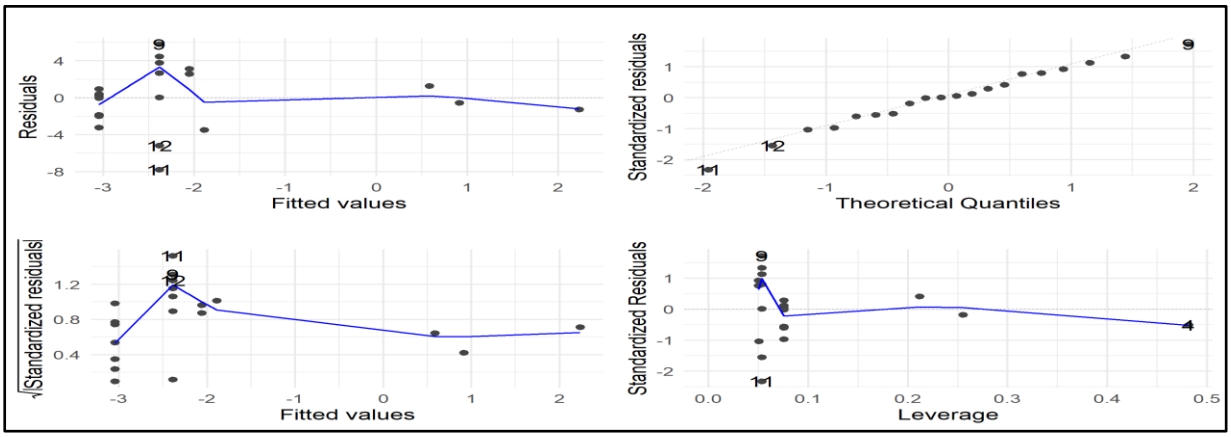

Figure 4. Statistical Diagnostic Analysis of the Linear Regression Model of FDI
Source: Prepared by the author

Statistically , the results indicate that the linear model is generally adequate, meeting the assumptions of normal residual distribution and variance stability. However, some outliers require additional examination to ensure the accuracy of the results. Additional tests and model refinement are recommended when needed to avoid the negative impact of outliers.

Figure 5 shows the future forecasts of foreign direct investment (FDI) in Iraq using the ARIMA model, with confidence intervals displayed at multiple levels. The blue line shows the expected future trend based on historical data, while the shaded areas (blue and gray) represent confidence limits at different levels.

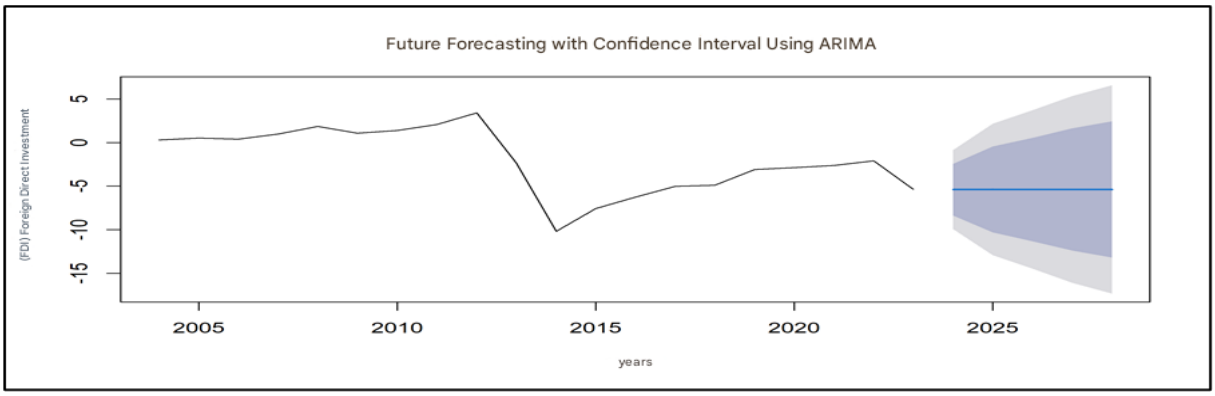

Figure 5. Future predictions with confidence interval using ARIMA
Source: Prepared by the author

Analyze future forecasts for foreign direct investment (FDI) using the Prophet model

The figure shows future forecasts for foreign direct investment (FDI) using the Prophet model.The blue line shows the expected trend based on historical data, while the shaded area (light blue) represents confidence intervals (95%). Black dots indicate the actual values of the data.

Interpretation of statistical analysis:

Actual vs. Forecast: Black dots show actual values for the period (2004-2023), while the blue line highlights the general trend expected to gradually decline.

Confidence intervals: Shaded areas indicate the level of uncertainty, as they gradually widen with time progress, reflecting greater variation in future expectations.

The model shows a long decline in foreign direct investment, with a marked decline after 2013, which calls for an examination of the economic and political causes affecting.

The Prophet model is an effective tool for forecasting foreign direct investment, highlighting the need for sustainable economic strategies to improve investment performance in Iraq.

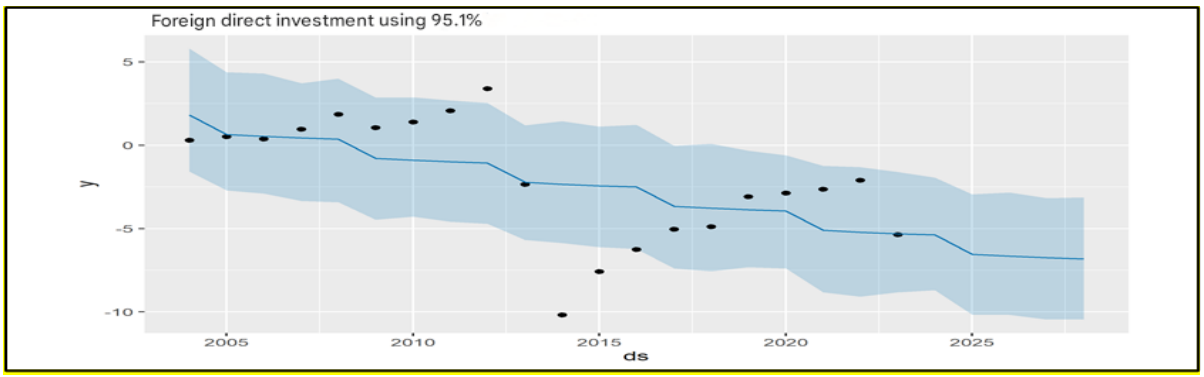

Figure 6. Future predictions with confidence interval with Prophet
Source: Prepared by the author

3. CONCLUSIONS AND RECOMMENDATIONS

First: Conclusions

a. The results confirm a negative correlation between the interest rate and FDI, suggesting that higher interest rates may discourage the flow of foreign investment.
b. Positive interest rates play a prominent and very important role in increasing investment and savings, on the contrary, in contrast to negative interest rates that raise the exchange rate by converting a large part of savings to foreign deposits as well as the flight of domestic capital.
c. 3. ARIMA and Prophet models provide powerful tools for analyzing and predicting time trends.
d. The findings point to the need for a more detailed analysis of other factors affecting FDI.

Second: Recommendations

a. Enhancing economic and political stability to support foreign investment flows and working to develop fiscal and monetary policies that encourage investment and reduce risks.
b. The need to exercise caution when adjusting interest rates to avoid negative effects on foreign investment.
c. Use advanced forecasting models as a support tool for decision makers.
d. Expanding future studies to include additional factors such as inflation and political stability.

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