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Future scenarios for the Indicator of selling foreign currency in Iraq for the period (2020q1-2025q4)

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Abstract
The foreign currency selling has become the appropriate land in determining the exchange rate that the monetary policy which aims to and adopts, establishing a nominal anchor or of monetary policy in order to achieve its ultimate goal represented by stabilizing the general level of prices and reducing inflationary. As the foreign currency sale window contributed to achieving a balance between the local currency supply (demand for foreign currency) and the local currency demand (foreign currency supply), which led to improvement and stability of the dollar / dinar exchange rate The Central Bank of Iraq started executing the outside money deal window on 4/10/2003 and it has proceeded until presently, as the Central Bank of Iraq has gotten to be a central showcase for remote money, and the Central Bank of Iraq has received the overseen coasting strategy of the Iraqi dinar trade rate. The objective of the window is to diminish variances within the esteem of the Iraqi dinar against the US dollar, and to surmised the genuine trade rate from its ostensible level after the Iraqi dinar endured from a assortment in its exchange rates some time recently 2003, because it come to (13) the trade rate of the Iraqi dinar, and the Central Bank was able Iraqi has built outside cash saves that surpassed the IMF's desires of around (10) billion dollars in arrange to guarantee the state of monetary solidness. From this point of view, the investigate centered on the window for offering the outside money in arrange to confirm the impact that the window influenced on the components of budgetary solidness, both for the banking sector and non-financial institutions. The research reached a set of conclusions and recommendations.

Keywords: Selling foreign currency, time series, scenarios

Introduction
The time series analysis method is one of the statistical methods worthy of attention, which has developed a lot and can be used for the purpose of future forecasting of macroeconomic variables. It appeared in the time series and on the pattern of growth in values. It is distinguished over the traditional method, which calculates the value difference between only two times of the series and builds the future forecast on its basis without taking into account the general pattern of the series or the rise or fall that occurs to the values of the series, meaning that the past and present are read and analyzed to elicit the future, and draw a vision for fiscal and monetary policies on their impact. Predicting monetary variables contributes in one way or another to understanding the behavior of economic variables in the future and then knowing their trends, whether they are increasing or decreasing, and this will contribute to developing economic policies that address the expected imbalances through the use of financial and monetary policy tools and other policies that can employ To address the disturbances in the macroeconomic variables, because in fact, real economic stability cannot be achieved if there is no harmony or harmony between the monetary side with the real side, as any imbalance in the monetary side will be reflected in one way or another in the real side of the economy, so it is inevitable to make predictions that appear The future behavior of economic variables by employing time series methods to understand the behavior of economic phenomena for which limited data or few observations are available, as in the case of the Iraqi economy, as most of the data available for forecasting start from 2004 due to the initiation after this year to adopt economic policies and procedures that work in The framework of the capitalist economy, including the Central Bank of Iraq Law No. 56 of 2004 and other laws that changed the tracks of the index The main economic tools in Iraq (Norwegian Central Bank, 2003: 1) [3].

There has been a noticeable increase in the demand for the dollar, as the total sales at the beginning of the window's work in 2003 reached approximately (17.8) million dollars, and it has continued to rise, which has generated an obsession for dollar dealers (represented by the intervention of the Central Bank of Iraq in the money market. It is a method that has not been used before during the past years. And as a result of the window's continuing to carry out its business on a regular basis, this contributed to creating a state of openness in the local currency market, thus allowing traders to freely deal in foreign currency in order to finance their imports. This resulted in an increase in the commodity supply in a manner that covered the demand for local needs that was suppressed for a long time which contributed to achieving the state of stability in the local market, and based on the above, the most prominent objectives of the window for selling foreign currency are (Abd al-Nabi, 2015: 5-7) [15].

1. A direct intervention tool to achieve stability in the value of the Iraqi dinar by defending a balanced exchange rate, which reflects positively on the general level of prices, especially the final imported goods and production inputs, and strengthens the export base and then realizes the development of this sector.
2. A means of applying the indirect tools of monetary policy in managing the economy's liquidity and controlling its levels. It is considered a case of applying open market operations that are required on an ongoing basis in achieving balance in the monetary market and strengthening the chances of financial stability.
3. A major source in financing the private sector's trade in goods and services that the Iraqi market needs and is a major financier for it.
4. Raising the purchasing power of people with limited income through the level of improvement in the Iraqi dinar and its reflection on the real value of incomes and improving the standard of living.
5. Providing resources in foreign currency to banks for the purpose of enabling them to open documentary credits and letters of guarantee and conduct money transfers in foreign currencies.
6. Opening up investment horizons for (bank customers) for the purpose of developing their investments and developmental economic projects and providing the necessary currency for religious tourism, medical treatment, and studies outside Iraq.
7. The foreign currency sale window has greatly contributed to curbing the growth of money supply and printed currency through the central bank's purchase of foreign currency available with the Ministry of Finance and purchased by the Central Bank for the purpose of enabling the ministry to pay the operational expenses of the country's general budget in Iraqi dinars without the need to issue an additional currency that increases the size Monetary mass and contribute to raising inflation.

Research problem

After 2004, Iraq witnessed the application of economic reform measures, which consist mainly of adopting the mechanisms of market forces in managing the Iraqi economy, and this led, in one way or another, to bringing about changes in the paths of macroeconomic variables, especially monetary ones, as most of the reforms were in the monetary aspect, especially related to the liberalization of Exchange rates and interest rate liberalization. These changes highlight the importance of addressing the issue of drawing future scenarios that contribute to understanding the behavior of monetary macroeconomic variables in the future for the Iraqi economy, especially in the period after 2004.

Research objective

The research aims to predict using different time-series methods of Selling Foreign Currency in Iraq until 2025 and then choose the best method from among the different forecasting methods through predictive ability criteria, and then draw future trends for those variables.

Research Methodology

To achieve the aims of the research and its hypothesis, the quantitative statistical method was relied on by adopting different time series prediction methods, and the statistical program Statagraphics ver.17 was presented.

Time series methods

Time series is defined as a set of observations of a phenomenon that has been measured at regular times. Applied economics depends on the analysis of time series to show knowledge of the phenomenon's behavior in the past, which may help in understanding its future behavior, that is, we assume that the past will repeat itself, and that the general trend observed in the previous period It will continue in the coming period (Hassan, 2013: 104), and among the most famous methods of time series analysis that employ economic forecasting of limited data are the following (Madlul, Baker, 2020) [12]:

1. Random Behavior
2. General Trend
3. Moving Averages
4. Simple Exponential Boot
5. Brown's Exponential Smoothing Method

These results can be reviewed according to the following (Batal, Al-Obaidi, 2018: 221) [7]:
First, the random behavior method
The method of random behavior with a direction is based on the following formula:

$$Y_t = B_0 + BY_{t-1} + e_t$$

B_1: It represents a trend, and a phenomenon follows random behavior around a general trend.
Second: The general linear trend method:
The equation for this model is as follows:

$$Y_{t=} B_0 + B_1 t + e_t$$

Where Y_t is the predicted observations, B_0 represents the regression constant, B_{1t} represents the slope of the regression line, e_t is an estimate of the error, and this model is suitable for time series with a linear trend, whether the trend is increasing or decreasing.

A: Quadratic trend model:
And the equation of this form is the quadratic function:

$$Y_t = B_0 + B_1 t + B_2 (t)^2 + e_t$$

This model fits with time series with a curved trend, whether concave or convex.
B: the exponential trend model
The equation of this form is the following exponential function:

$$Y_{t=} B_0 . B_1^t + e_t$$

This model is compatible with time series that are characterized by acceleration of growth or acceleration of decay, meaning that the acceleration starts weak and then increases strongly over time, whether upward or downward.
A: The cubic function model:
The equation for this model is:

$$Y_{t=} B_0 + B_1 t + B_2 (t)^2 + B_3 (t)^3 + e_t$$

They are proportional to s-shaped double-curvature time series and plotting the series is the first step in analyzing any time series.

Third: the moving averages method
Its general form is as follows:

$$Y_t = \frac{(y_t + y_{t-1} + y_{t-2} + \cdots + y_{t-n+1})}{n}$$

Fourth: The exponential boot method
A - simple exponential preamble
Its mathematical formula is as follows:

$$Y_{t+1} = a y_t + (1 - a) y_{t-1}$$

0 < a < 1

Where Y_(t+1) is the estimated viewing value in the subsequent period.
It represents a constant that is automatically estimated at the expense of the predictive error and its value ranges between zero and one.

y_t represents the value of the phenomenon in the current period.

y_{t-1} The value of the phenomenon in the previous period.
Prediction model accuracy tests

There are several tests that depend on evaluating the predicted models, including: (Keller and Worrack, 1997:923, Anderson et al, 2001:173, Harnett and Horriel, 1998:368) [9, 8, 10].
a- Mean absolute error
It can be found in the following form:

$$MAE = \sum |et|/n$$

$$e_t = y_t - F_t$$

Where: e_t represents the error or residuals

y_t represents the real values of the variable

F_t represents the predicted values of the variable y_t

a. The absolute squared error
It is calculated as follows:

$$RMSE = \sqrt{\sum |et2|/n}$$

This formula is used to compare several predictive models and is a percentage.
b- Akaile information criteria
It is calculated as follows:

$$AIC(m) = logde_t \left(\sum_k^{\sim} (m) + (\frac{2}{r}) \right) mk^2$$

The concept of scenario also refers to the image placed that expresses a phenomenon, a sequence of events, or a situation, based on some assumptions and factors (variables) chosen by the creator, and used in estimating the potential effects of a variable or group of variables, and it is an integral part of situation analysis and long planning. Term (Business Dictionary nd), as the concept of the scenario refers to a possible, possible or hypothetical future situation, with clarification of the paths leading to it based on the current situation or from an assumed initial situation, and although the scenarios have a specific method of construction, they are in the same Time can be built in other ways based on science fiction and the futuristic vision of events with an indication of their expected results (Al-Azim 2018, 183). Hence, the final purpose of the scenarios lies in the formation of a set of expected future cases that have an equal possibility of occurrence and answer the following questions: What will happen in the future? How does it happen? What are the factors causing this to happen? So, "The scenario plays a key role in strategic planning, setting future plans, directing plans and programs, and foreseeing the future reality. On the future paths of the studied variables, which will be positively reflected in the development of plans and policy formulation. Scenarios can be divided into two parts: the reconnaissance scenario and the targeting scenario. When we study a possible or likely future situation, the scenario is exploratory. We start from the facts and general trends that already exist, and try to explore what events or possible actions may lead to in future developments. Without committing to a predetermined picture or set goals, which allows for many possibilities and raises discussions and controversy. As for the other scenario, the targeted scenario represents the desired scenarios and the starting point is specific goals set that should be achieved in the future and translated into a consistent future image.
The process of describing the general trends of the main variables and analyzing the path of future variables is one of the most important steps adopted in drawing and analyzing scenarios, as well as choosing the best paths that reflect the actual reality and drawing conclusions for them (Baker, Madlul, 2021) [13].

Analyzing forecast results and drawing future scenarios for the variable of the Indicator of Selling Foreign Currency in Iraq
Table (1, a,b) shows the different models that were

estimated to predict variable of the Indicator of Selling Foreign Currency in Iraq. until the first quarter of 2025, and the results show that the model that was chosen is the one that achieved the best criteria for predictive ability, as this model showed the lowest values.

Table 1a: Results of the predictive ability measures of the foreign exchange sale index in Iraq for the period (2021q1-2025q4)

Model	RMSE	MAE	MAPE	ME	MPE	AIC
(A)	621.524	408.374	16.2253	54.8407	1.68056	12.8644
(B)	1356.71	1121.01	100.357	-5.61747	-73.4817	14.455
(C)	834.419	688.701	42.0855	4.54747	-24.1697	13.5123
(D)	611.728	439.793	21.6774	1.24387	-0.936818	12.9208
(E)	1201.94	987.705	42.6885	93.5738	-12.4309	14.2422
(G)	623.845	406.737	16.0115	100.097	3.21808	12.9012
(H)	621.512	402.363	15.9867	54.0396	1.65603	12.8937
(I)	959.591	608.235	23.7196	0.436928	-0.112595	13.7624
(J)	633.219	403.52	15.6404	-13.3926	-1.84176	12.9605
(K)	613.505	405.811	17.7815	-11.0614	0.860913	12.8678
(M)	554.382	374.003	15.6571	99.8918	4.16349	12.7239
(N)	548.629	343.565	14.2555	1.32216	-0.523789	12.7325
(O)	539.685	350.188	18.0867	39.7893	-5.39845	12.7584
(P)	548.875	364.887	14.9258	89.0112	3.7943	12.7628
(Q)	565.45	365.946	15.134	4.73317	-0.109051	12.7635

Source: Program Output Statgraphics Ver.17

Table 1b: Results of the predictive ability measures of the foreign exchange sale index in Iraq for the period (2021q1-2025q4)

Statistic	Estimation Period	Validation Period
RMSE	554.382	
MAE	374.003	
MAPE	15.6571	
ME	99.8918	
MPE	4.16349	

Table 2: Results of estimating forecast models for different the Indicator of Selling Foreign Currency in Iraq for the period (2021q1-2025q4)

Models
(A) Random walk
(B) Constant mean = 2911.92
(C) Linear trend = -10701.7 + 54.3457 t
(D) Quadratic trend = -112810. + 874.614 t + -1.63726 t^2
(E) Exponential trend = exp (0.631538 + 0.0285816 t)
(G) Simple moving average of 3 terms
(H) Simple exponential smoothing with alpha = 0.9999
(I) Brown's linear exp. smoothing with alpha = 0.9998
(J) Holt's linear exp. smoothing with alpha = 0.9999 and beta = 0.0326
(K) Brown's quadratic exp. smoothing with alpha = 0.1673
(M) ARIMA (2,1,1)
(N) ARIMA (2,1,1) with constant
(O) ARIMA (3,0,2) with constant
(P) ARIMA (3,1,2)
(Q) ARIMA (2,2,1)

Source: Program Output Statgraphics Ver.17

The table (2) shows the different models that were estimated to predict the foreign currency selling window variable until 2025, and the results show that the chosen model was the one that achieved the best criteria for predictive ability, as this model showed the lowest values as in the table (1).
The table (3) also shows the results of the parameters of the selected model ARIMA (2,1,1), and as it is clear that this model includes a moving average of rank (2) and an autoregression of rank (2), taking the first difference for the series (1).

Table 3: Results of Estimation ARIMA (2,1,1) Model

Parameter	Estimate	Stnd. Error	T	P-value
AR(1)	-0.0639511	0.250339	-0.255458	0.799188
AR(2)	-0.416051	0.144611	-2.87704	0.005448
MA(1)	0.272765	0.274978	0.991953	0.324956

Source: Program Output Statgraphics Ver.17

Table 4: Shows the results of the future forecast for the Selling Foreign Currency in Iraq for the period (2021q1-2025q4)

Period	Forecast	Lower 90.0% Limit	Upper 90.0% Limit
Q1/21	3375.85	2450.15	4301.56
Q2/21	3451.21	2340.39	4562.04
Q3/21	3647.96	2509.62	4786.31
Q4/21	3604.03	2396.84	4811.21
Q1/22	3524.98	2200.88	4849.08
Q2/22	3548.31	2142.86	4953.77
Q3/22	3579.71	2113.77	5045.64
Q4/22	3567.99	2034.4	5101.59
Q1/23	3555.68	1951.38	5159.98
Q2/23	3561.34	1893.59	5229.09
Q3/23	3566.1	1839.2	5293.0
Q4/23	3563.44	1777.61	5349.27
Q1/24	3561.63	1718.09	5405.17
Q2/24	3562.85	1664.08	5461.63
Q3/24	3563.53	1611.3	5515.76
Q4/24	3562.98	1558.42	5567.54
Q1/25	3562.73	1507.11	5618.36
Q2/25	3562.98	1457.65	5668.31
Q3/25	3563.06	1409.2	5716.93
Q4/25	3562.96	1361.57	5764.34

Source: Program Output Statgraphics Ver.17

Depending on the forecast results shown in table (4), three future scenarios can be developed for the Selling Foreign Currency in Iraq, which are:
Base scenario: Selling Foreign Currency, according to the base scenario, will reach 3562 dinars in the fourth quarter of 2025.

The first optimistic scenario: It is noted that the Selling Foreign Currency will also rise from 3860 dinars in the fourth quarter of the year 2020 to 5764 dinars in the fourth quarter of 2025.

The second pessimistic scenario: It is noted that the Selling Foreign Currency will decrease to 1361 dinars in the fourth quarter of year 2025.
The following figure shows the three scenarios of the Selling Foreign Currency:

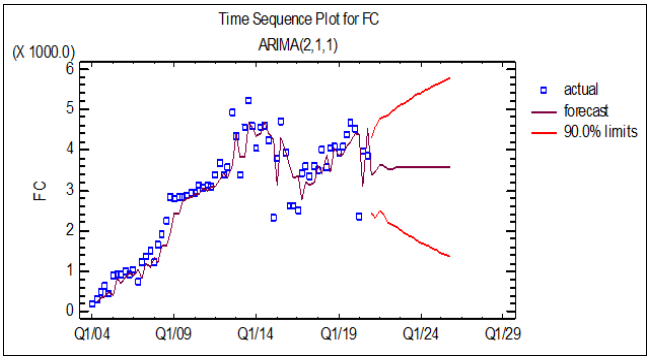

Fig 1: Scenarios for the foreign currency sale window until 2025

Conclusion

The results indicated that the best model that can be employed to predict the variable of Selling Foreign Currency in Iraq is the ARIMA (2,1,1), model according to the predictive ability tests of the different models, and based on the prediction results, it is possible to add three future scenarios can be developed for the Selling Foreign Currency in Iraq, which are: Base scenario: Selling Foreign Currency, according to the base scenario, will reach 3562 dinars in the fourth quarter of 2025. The first optimistic scenario: It is noted that the Selling Foreign Currency will also rise from 3860 dinars in the fourth quarter of the year 2020 to 5764 dinars in the fourth quarter of 2025. The second pessimistic scenario: It is noted that the Selling Foreign Currency will decrease to 1361 dinars in the fourth quarter of year 2025.

Recommendations

1. Must to support the window for selling foreign currency with monetary and financial instruments that would support financial stability in the Iraqi economy, The monetary policy cooperation with the fiscal policy would stimulate the financial environment and support the components of financial stability and it need to educate individuals about the importance of monetary policy measures and the main aim of the foreign currency sale window, in order to avoid speculations that push the economy on its proper course.
2. The research recommends the need to take advantage of the results of forecasting to develop monetary policy that are compatible with future trends in order to achieve financial and economic stability in Iraq. The research also recommends conducting other studies in the field of forecasting monetary policy variables and their impact on the value of Selling Foreign Currency in Iraq.

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Appendix 1: The value of selling foreign currency in Iraq for the period (2004q1-2020q4) dinars

Year	FC	Year	FC	Year	FC	Year	FC
2004 Q1	186	2008Q2	1906.33	2012Q3	4933.33	2016Q4	3407.66
2004Q2	321.66	2008Q3	2233.33	2012Q4	4327.33	2017Q1	3619.66
2004Q3	504.33	2008Q4	2835.66	2013Q1	3383.66	2017Q2	3346.33
2004Q4	648.33	2009Q1	2785.33	2013Q2	4539.33	2017Q3	3614.33
2005Q1	442.33	2009Q2	2825.33	2013Q3	5220.33	2017Q4	3486.66
2005Q2	901.33	2009Q3	2836.66	2103Q4	4599.66	2018Q1	4008.66
2005Q3	949.33	2009Q4	2883.66	2014Q1	4042.66	2018Q2	3578.66
2005Q4	923.33	2010Q1	2955.66	2014Q2	4555	2018Q3	4058.66
2006Q1	1004	2010Q2	2947.33	2014Q3	4581.66	2018Q4	4065
2006Q2	923.33	2010Q3	3111.33	2014Q4	4212	2019Q1	3925.66
2006Q3	1037	2010Q4	3042	2015Q1	2335.66	2019Q2	4082
2006Q4	760.66	2011Q1	3113.66	2015Q2	3800	2019Q3	4363.33
2007Q1	1231	2011Q2	3107.33	2015Q3	4706.33	2019Q4	4670.66
2007Q2	1355.66	2011Q3	3376.66	2015Q4	3926	2020Q1	4519.66
2007Q3	1503.33	2011Q4	3668	2016Q1	2629	2020Q2	2346.33
2007Q4	1236.66	2012Q1	3383	2016Q2	2625.33	2020Q3	3967
2008Q1	1647.66	2012Q2	3572.66	2016Q3	2512.66	2020Q4	3860.33

Source: https://cbi.iq/currency_auction/all