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Modeling and Estimating the size of Foreign Direct Investment in Saudi Arabia ARIMA Model Approach

Dr. Walaa Magdy Rezk

Assistant Professor of Economics, Financial Sciences Department, The Applied College, Imam Abdulrahman Bin Faisal University, Saudi Arabia.
E-mails: Wmrezk@iau.edu.sa
ORCID-ID: 0000-0002-6968-977X

Dr. Mona Aboul Atta Halim

Assistant Professor of Economics, Financial Sciences Department, The Applied College, Imam Abdulrahman Bin Faisal University, Saudi Arabia.
E-mails: mahalim@iau.edu.sa
ORCID-ID: 0000-0001-9075-2801

Keywords:
Foreign Investment, Investment Climate, Saudi Economy, Economic Growth, Investment Future Planning

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Dr. Mona Halim
Assistant Professor of Economics, Financial Sciences Department, The Applied College, Imam Abdulrahman Bin Faisal University, Saudi Arabia.
E-mails: mahalim@iau.edu.sa
ORCID-ID: 0000-0001-9075-2801

Abstract:

The Kingdom has put foreign investment in its priorities, and investment has become a major hub not only to enhance its vision, but also be an effective tool in the economic transformation process that is mainly based on attracting more foreign investment.

This paper examined econometric modeling foreign direct investment inflows in Saudi Arabia during the period 1990-2019 and forecasting using Box-Jenkins ARIMA model approach. The study shows that the net foreign direct investment inflow in Saudi Arabia is integrated of the first order. Based on the number of significant coefficients.

The result of the study shows that net foreign direct investment inflows in Saudi Arabia are likely for exhibit upward trend in the next decade which is not significantly different from values of FDI inflows in Saudi Arabia in the recent years.

The study also provides policies recommendations to assist policy makers and the Saudi Arabia government on better ways to accelerate and maintain higher level of net foreign direct investment inflows in Saudi Arabia.

Keywords: Foreign Direct Investment, Investment Climate, Saudi Economy, Economic Growth, Investment Future Planning.

الملخص:

وضعت المملكة العربية السعودية الاستثمار الأجنبي المباشر على قمة أولوياتها حيث اصبح الاستثمار مركزًا رئيسيًا ليس فقط لتعزيز رؤيتها الطموحة ولكن أيضًا ليكون أداة فعالة في عملية التحول الاقتصادي التي تقوم بشكل أساسي على جذب المزيد من الاستثمارات الأجنبية المباشرة.

وقد تناولت هذه الورقة القيام بنمذجة لتدفقات الاستثمار الأجنبي المباشر في المملكة العربية السعودية خلال الفترة 1990-2019 والتنبؤ بالاستثمارات القادمة وذلك باستخدام نهج نموذج .Box- Jenkins ARIMA وقد اتضح من النموذج أن تدفق الاستثمار الأجنبي المباشر الصافي في المملكة العربية السعودية متكامل من الدرجة الأولى. استنادًا إلى عدد المعاملات الهامة. واظهرت نتيجة الدراسة أن صافي تدفقات الاستثمار الأجنبي المباشر الوافدة إلى المملكة العربية السعودية من المرجح أن تظهر اتجاهاً صعوديا في العقد المقبل ولكن لا يختلف كثيراً عن قيم تدفقات الاستثمار الأجنبي المباشر الوافدة في المملكة العربية السعودية في السنوات الأخيرة.

كما تقدم الدراسة توصيات بشأن السياسات المالية لمساعدة صانعي السياسات وحكومة المملكة العربية السعودية على افضل الطرق والوسائل لتسريع والحفاظ على مستوى أعلى من صافي تدفقات الاستثمار الأجنبي المباشر الواردة إلى المملكة العربية السعودية.

الكلمات المفتاحية: الاستثمار الأجنبي المباشر، مناخ الاستثمار، الاقتصاد السعودي، النمو الاقتصادي، التخطيط المستقبلي للاستثمار

1. Introduction:

As the world's economies become more interdependent and interconnected, various nations and regions are looking for ways to take advantage of opportunities that may exist in other nations by using a variety of methods, tactics, and strategies. One of these tactics, methods, or strategies is foreign direct investment. Foreign direct investment is a concept or idea that deals with the business operations of multinational companies or multinational enterprises outside of their home country with the intention of capturing the market and also maintaining competitiveness in the sector at which the enterprise or company is present. As stated by (Caves, 2007), Multinational organizations or firms are businesses that govern and run a production facility with locations in several different nations. According to (Adamu, 2018), control in this situation means different things in different nations. As stated by (IMF, 2009), For a foreign investment to be regarded as a foreign direct investment, the foreign investor must own more than 9% of the equity in the foreign subsidiary. It is undeniable that flows brought about by multinational corporations or enterprises help both developing and developed countries (Narula and Marin, 2003). Because it involves the transfer of financial resources, innovation, and new technology, which helps to create more employment opportunities and in turn improve aggregate demand or gross domestic product, foreign direct investment is important for development. As stated by (Olayiwola and Okodua, 2013) By expanding the possibility of joining the global capital and financial market, increasing exports, employment, and the generation of technological efficiency and capacity flows to local firms, foreign direct investment can stimulate economic growth and development in an economy. It also results in the arrangement of investments that favorably affect the economies of the host countries. As stated by (Ghebrihiwet and Motchenkova, 2017), Due to poor standards in technological resources and a lack of financial resources, practically all developing nations depend on foreign direct investment to be able to harvest and sell natural resources. because developing nations have discovered that FDI promotes growth and development, as well as the creation of jobs and revenue. As a result, the majority of developing nations have pushed for the liberalization of their investment laws and other sorts of policies that draw in international capital or foreign direct investment. Therefore, the goal of this study is to model and predict foreign direct investment in Saudi Arabia over the coming ten years to determine whether it is sustainable. This study will also help academic studies and policy makers comprehend what will happen

to future foreign direct investment inflows, the trajectory of such inflows to Saudi Arabia, and their effects on GDP.

2. Study Problem:

The Kingdom of Saudi Arabia aims to strengthen the national economy and diversify its revenue sources through its Vision 2030 plan. to generate new employment possibilities and move the economic growth in the direction of diversification, the Kingdom introduced several economic reform packages. It entails offering and developing investment prospects as well as luring foreign investors with help and incentive schemes. Saudi Arabia's recent foreign direct investment inflows have fluctuated over time, and it is necessary for foreign direct investment to have a significant impact on an economy by favorably affecting some important macroeconomic fundamentals that it be sustained over time or possibly even exhibit an increasing trend.

3. Study Objectives:

The goal of this study is to estimate and predict the foreign direct investment inflows from foreign investors to Saudi Arabia over the next ten years to determine whether or not they are sustainable. This research will also help academics and policymakers comprehend Saudi Arabia's future trend in foreign direct investment inflows as well as what will happen to such inflows in the future. to be able to formulate appropriate economic policies that follow the trend. Based on the available data, this study uses the ARIMA Model technique to forecast the future value of foreign direct investment inflows.

There aren't many studies on the topic of modeling and forecasting foreign direct investment inflows. By predicting the inflows of foreign direct investment into Saudi Arabia over the next ten years, this study aims to both fill a gap in the literature and add to it.

4. Litretrature Review

This section reviews several theories, research, points of view, and empirical discussions related to forecasting foreign direct investment inflows.

As suggested by **(Lagrendijk and Hendrikx, 2009)**, foreign direct investment has a favorable direct or indirect impact on the local or host country. The host economy is impacted by foreign direct investment in a variety of ways, including asset, capital, and technology inflows as well as the development of employment opportunities. The indirect effect pertains to a rise in secondary good and service demand that aids in opening an economy for additional financial and technological resources as well as the need for more labor. If the host country does not make strategic policy preparations, the advantages of foreign direct investment might not likely materialize. Foreign direct investment inflows can play a significant role in fostering international trade by joining the global economy, promoting modern technology transfer, reducing poverty, and increasing growth and development if the host nation creates a favorable business environment for the foreign investment**.**

(Dupasquier and Osakwe, 2006; Gui-Diby and Renerd, 2015) Review of the Theoretical Literature the Hecksher-Ohlin model and the product life cycle theory are taken into consideration in this study since they are theories that can be used to explain the existence of foreign direct investment. According to the Hecksher-Ohlin model, nations will import goods that use up their scarce resources and export goods that use up their surplus resources or production inputs. According to the Product Life-Cycle, a product goes through the following four developmental stages: I. The stage of innovation. II. The launch phase. 3. The maturation stage; and 4. The decline stage.

(Biwas, 2015) Using the ARIMA model method, net foreign direct investment was examined. India from 1992 to 2014 is the study's time of focus. The study's main objective was to forecast net foreign direct investment in India through the year 2034. According to the report, from 2015 to 2034, foreign direct investment in India would show an upward or increasing trend.

(Jere et al, 2017) Zambia's net foreign direct investment inflows were projected and modelled. Zambia from 1974 to 2014 is included in the study's time frame. Box Jenkins ARIMA modeling was the method employed in the study. According to the analysis, Zambia's annual net inflow of foreign direct investment will steadily rise by roughly 44.4% by 2024. The company will start producing goods for the domestic or local market in the take off stage, the innovation stage, and the decline stage. In the maturity stage, as the firm's product tends to expand, the firm will start exporting the product to foreign markets or starting exports to other

countries. In the decline stage, which is the final stage, some rival firms start producing the product and then start exporting and selling to other countries as well as to the innovative firms already present in the domestic country.

This model illustrates how foreign direct investment travels back and forth between developed and developing nations.

(Empirical Literature Review Adamu, 2018) Net foreign direct investment inflow was used as a variable to project United States (USA) foreign direct investment inflows to Nigeria over a ten-year period using data from 1982 to 2017. The Exponential Smoothing (EST) algorithm is the forecasting method employed in the study. The analysis finds that over the projected years, there would be a moderate but positive increase in the amount of foreign direct investment coming into Nigeria from the United States, with a growth rate ranging from 2.1% to 3.0%.

(Nyoni, 2018) observed the modeling and projection of FDI inflows in Zimbabwe over the period of observation, which runs from 1980 to 2017. The ARIMA model technique was used to make the forecast. The study's findings indicate that Zimbabwe's net inflow of foreign direct investment will expand at a slow and depressing rate.

(Thabani and Wallingon, 2019) Using annual time series data for net foreign direct investment from 1960 to 2017, it was possible to anticipate the net foreign direct investment in Nigeria. The study used the Box-Jenkins ARIMA model approach to carry out the prediction. The study's findings indicate that over the following ten years, net foreign direct investment in Nigeria is projected to decrease.

Studies about modelling and forecasting the foreign direct investment inflows are relatively low. This study therefore seeks to fill the gap in literature by forecasting foreign direct investment inflows in Saudi Arabia over the next decade and contribute to the existing literature in this regard.

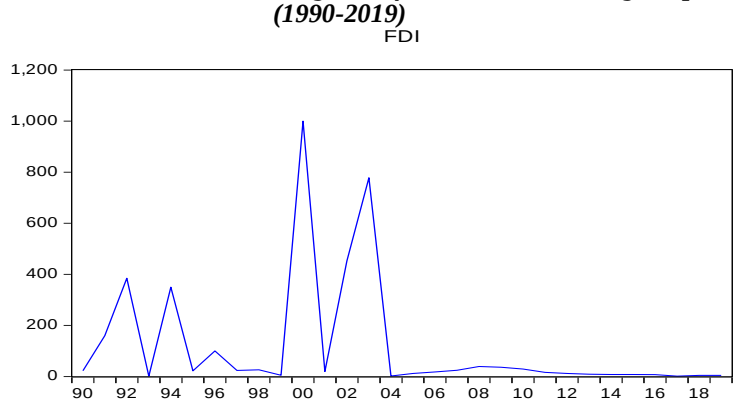
5. The Study Data:

This variable used in this paper for its forecast is net foreign direct investment inflows based on the quarter data of each of direct investment and GDP growth, in Saudi Arabia during the period 1990-2019 in Saudi Arabia. the data is measured in current prices. The data source is World Bank database.

5.1 FDI

The data was generated from the second degree, because the graph of the unemployment rate takes a second-degree curve, as shown in the following figure.

Figure (1)
foreign direct investment in the Kingdom of Saudi Arabia during the period (1990-2019)

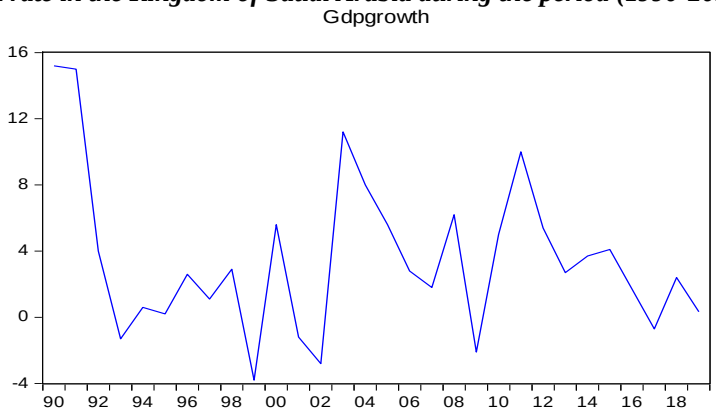


Source: by researchers based on E-views output

5.2 GDP growth rate.

The data was generated from the second degree, because the graph of the unemployment rate takes a second degree curve, as shown in the following figure.

Figure (2)
The growth rate in the Kingdom of Saudi Arabia during the period (1990-2019)



Source: by researchers based on E-views output

Descriptive statistics

In this part, descriptive statistics of the variables under study will be presented after converting them to quarterly variables.

Table (1): Descriptive statistics of variables

	GDPGROWTH	FDI
Mean	3.636872	122.0717
Median	2.665625	25.07000
Maximum	16.81250	1000.000
Minimum	-4.637500	1.369000
Std. Dev.	4.776266	201.0855
Jarque-Bera	15.89223	198.5185
Probability	0.000354	0.000000
Observations	120	120

Source: by researchers based on E-views output

6. Methodology:

To accomplish the study's goal, the section looks at issues relating to the kind, sources, measures, and characteristics of the historical data used in the forecast. The purpose of the study is to use the ARIMA Model technique to model and predict the inflows of foreign direct investment into Saudi Arabia during the next ten years.

Box-Jenkins Method

George Box and Gwilym Jenkins introduced the Box-Jenkins approach in their influential 1970 book Time Series Analysis: Forecasting and Control. The method begins with the presumption that the time series' generation process can be roughly modeled using either an ARMA model or an ARIMA model, depending on whether it is stationary or non-stationary. Testing stationarity for the variables is hence the first step.

iterative strategy that includes the following 3 steps:

1. **Identification**. Select a subclass of model using the data and all relevant facts to help determine how well it will represent the data.
2. **Estimation**. Train the model's parameters using the data (i.e. the coefficients).
3. **Diagnostic Checking**. Examine the fitted model in light of the supplied data to identify any potential areas for improvement.

1. Identification

Identifying a time series involves determining whether it is stationary and, if not, how many variations must exist for it to become stationary. Additionally, determine the ARMA model's parameters using the given data.

Stationarity is checking by using Augmented dickey fuller test. While the **p** and **q** parameters of the ARMA or ARIMA are determined using ACF, and PACF.

a) **Autocorrelation Function (ACF)**. The plot summarizes the correlation of an observation with lag values. The x-axis shows the lag and the y-axis shows the correlation coefficient between -1 and 1 for negative and positive correlation.

b) **Partial Autocorrelation Function (PACF)**. The plot summarizes the correlations for an observation with lag values that is not accounted for by prior lagged observations.

Some useful patterns you may observe on these plots are:

a) The model is AR if the ACF decays and there is cut-off in the PACF after a lag. This lag is taken as the value for **p**.

b) The model is MA if the PACF decays and there is a hard cut-off in the ACF after the lag. This lag value is taken as the value for **q**.

c) The model is a mix of AR and MA if both the ACF and PACF are decay.

7.Results

Throughout this section the results for Box-Jenkins model for the three variables are presented. But firstly, the augmented dickey fuller test is discussed.

Table (2) displays the results of ADF test. From the results it can be concluded that FDI is stationary at the level, while GDP growth are stationary after taking first difference, this with confident 95%, as p-value for them at their level less than 5%. So, ARMA model is used for FDI, and Education payment, while ARIMA model is used for GDP growth.

Table (2): Augmented Dickey-Fuller (ADF) test for unit root variable

Variables	ADF	p-value
FDI	-2.2643	0.1854
GDP growth	-3.54056***	0.0086
$\Delta GDP\ growth$	0.68869	0.5181

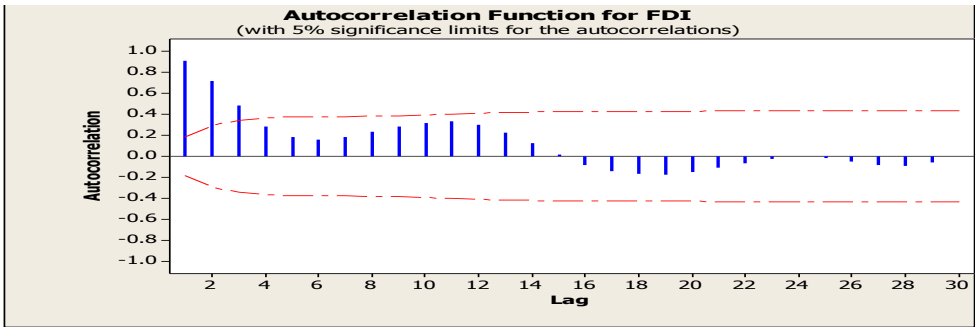
*10%, **5%, ***1% significance. ADF t-statistic reported.
Source: by researchers based on E-views output

Note: The ADF tests include an intercept. The appropriate lag lengths were selected according to the Schwartz Bayesian criterion, also p-value are calculated using MacKinnon (1996) one-sided p-values.

7.1. FDI

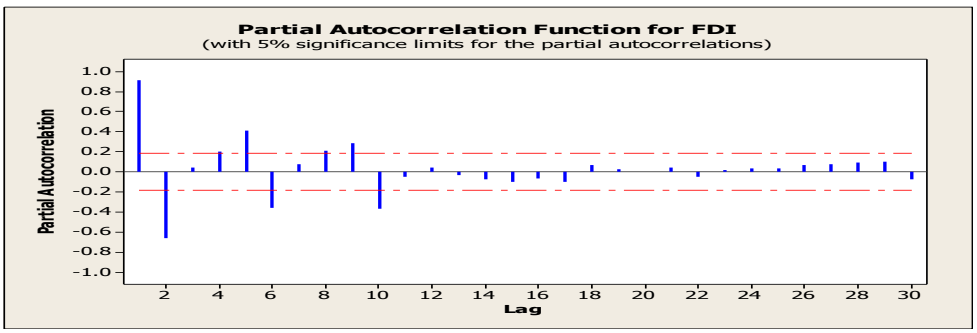
From the following graph it is clear that autocorrelation function is decayed, while partial autocorrelation function cuts off after 2 lags, then the appropriate model is AR(2), it is well mentioning that it is adjusted for seasonal effect for 3 periods

Figure (3)



Source: by researchers based on E-views output

Figure (4)



Source: by researchers based on E-views output

The estimated model:

Final Estimates of Parameters

Type		Coef	SE Coef	T	P
AR	1	0.9389	0.0935	10.04	0.000
AR	2	-0.0625	0.0941	-0.66	0.508

According to the above table, it is clear that the coefficient of AR(2) is not significant, so it is excluded and then the final model is AR(1) as its clear from the following table

Type		Coef	SE Coef	T	P
AR	1	0.8843	0.0452	19.56	0.000

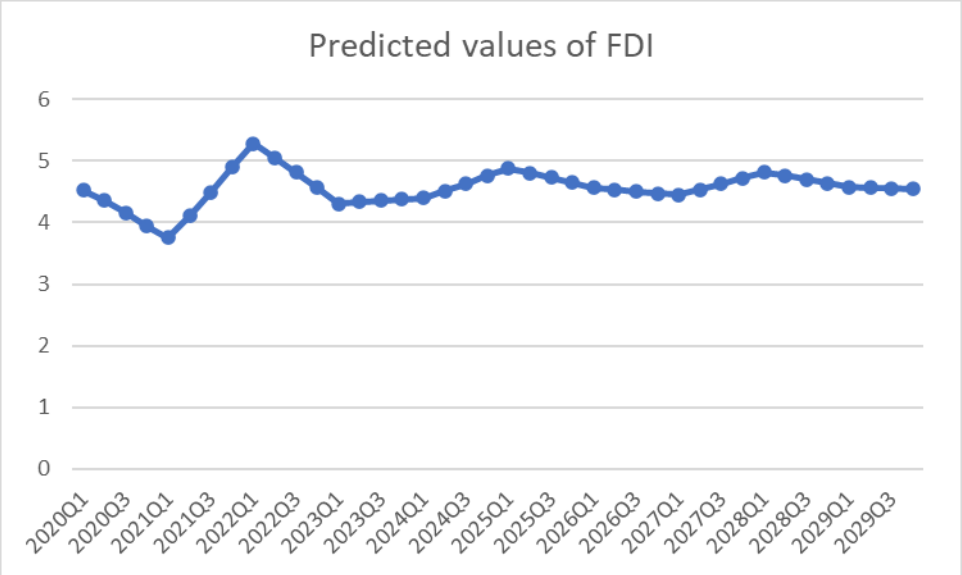
Then according to the above the predicted values for 10 years are represented in the following table :

2020Q1	4.526471
2020Q2	4.358596
2020Q3	4.162938
2020Q4	3.942713
2021Q1	3.752739
2021Q2	4.110334
2021Q3	4.491584
2021Q4	4.893752
2022Q1	5.28155
2022Q2	5.052162
2022Q3	4.811536
2022Q4	4.560973
2023Q1	4.30226
2023Q2	4.332448
2023Q3	4.356262
2023Q4	4.37444
2024Q1	4.403665
2024Q2	4.513715
2024Q3	4.632403
2024Q4	4.75873
2025Q1	4.882115
2025Q2	4.80636
2025Q3	4.728306
2025Q4	4.648218
2026Q1	4.560756

2026Q2	4.537071
2026Q3	4.507621
2026Q4	4.473072
2027Q1	4.446865
2027Q2	4.532587
2027Q3	4.624833
2027Q4	4.722846
2028Q1	4.818221
2028Q2	4.759771
2028Q3	4.699258
2028Q4	4.63692
2029Q1	4.571141
2029Q2	4.565832
2029Q3	4.557833
2029Q4	4.547454

Source: by researchers based on E-views output

Figure (5)



Source: by researchers based on E-views output

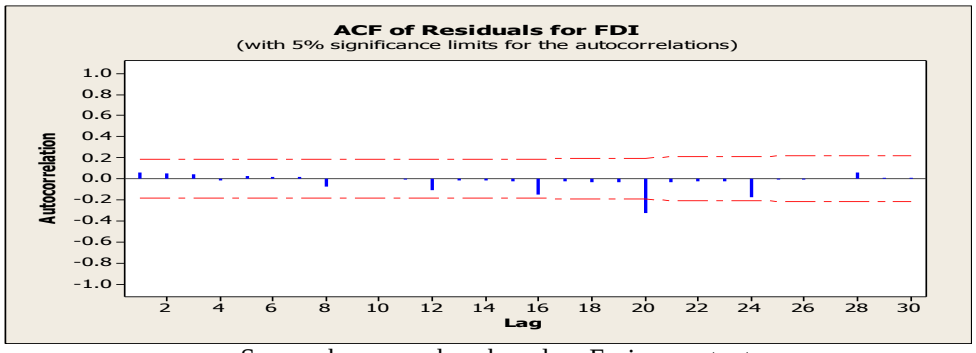
Goodness of fit of the Model:

From the following tables and graph, it clear that, the model is good fit as the p-value associated with modified BOX-pierce test greater than 5% for all lags which support that the residuals are white noise, Also this is supported from the ACF, and, PACF of the residuals.

Modified Box-Pierce (Ljung-Box) Chi-Square statistic

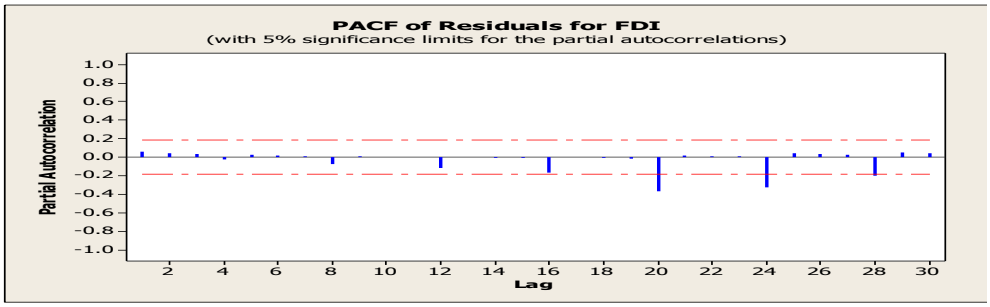
Lag	12	24	36	48
Chi-Square	3.4	27.3	44.7	46.5
DF	8	20	32	44
P-Value	0.910	0.127	0.067	0.370

Figure (6)



Source: by researchers based on E-views output

Figure (7)



Source: by researchers based on E-views output

7.2. GDP growth

Using the above predicted values of FDI, we predict GDP growth for the same time period, Using ARDL model. The following is the result of ARDL model:

The estimated model is:

Dependent Variable: GDPGROWTH
Method: ARDL
Date: 01/03/21 Time: 15:05
Sample (adjusted): 1990Q4 2019Q4
Included observations: 117 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): FDI

2020Q1	-2.159
2020Q2	-2.337
2020Q3	-2.077
2020Q4	-1.545
2021Q1	-0.843
2021Q2	-0.075
2021Q3	0.672
2021Q4	1.334
2022Q1	1.871
2022Q2	2.256
2022Q3	2.492
2022Q4	2.592
2023Q1	2.577
2023Q2	2.479
2023Q3	2.326
2023Q4	2.145
2024Q1	1.960
2024Q2	1.790
2024Q3	1.646
2024Q4	1.537
2025Q1	1.464
2025Q2	1.424
2025Q3	1.413
2025Q4	1.425
2026Q1	1.453
2026Q2	1.492

2026Q3	1.535
2026Q4	1.577
2027Q1	1.614
2027Q2	1.645
2027Q3	1.669
2027Q4	1.685
2028Q1	1.694
2028Q2	1.694
2028Q3	1.690
2028Q4	1.681
2029Q1	1.670
2029Q2	1.658
2029Q3	1.648
2029Q4	1.639

Fixed regressors: C

Number of models evalulated: 20

Selected Model: ARDL(3, 1)

Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDPGROWTH(-1)	1.334603	0.089115	14.97625	0.0000
GDPGROWTH(-2)	-0.202482	0.136863	-1.479450	0.1419
GDPGROWTH(-3)	-0.256102	0.084089	-3.045599	0.0029
FDI	0.008550	0.001787	4.785780	0.0000
FDI(-1)	-0.007194	0.001855	-3.877212	0.0002
C	0.196827	0.198760	0.990276	0.3242

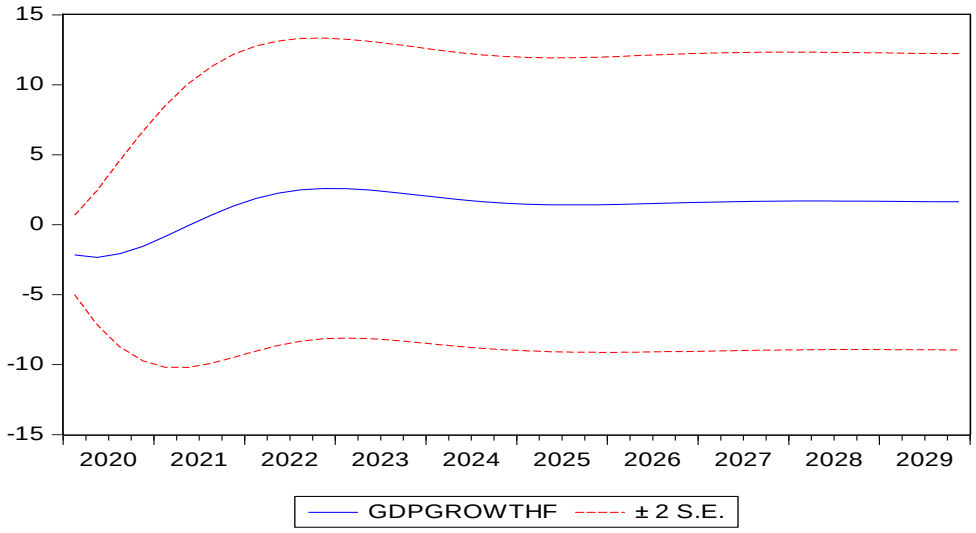
R-squared	0.905952	Mean dependent var	3.255833
Adjusted R-squared	0.901716	S.D. dependent var	4.459401
S.E. of regression	1.398034	Akaike info criterion	3.557931
Sum squared resid	216.9493	Schwarz criterion	3.699581
Log likelihood	-202.1390	Hannan-Quinn criter.	3.615439
F-statistic	213.8509	Durbin-Watson stat	2.010709
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Source: by researchers based on E-views output

According to the above table, it is clear that all coefficients are significant which mean that the model is correctly specified. And the values that are predicted

Figure (8)



Source: by researchers based on E-views output

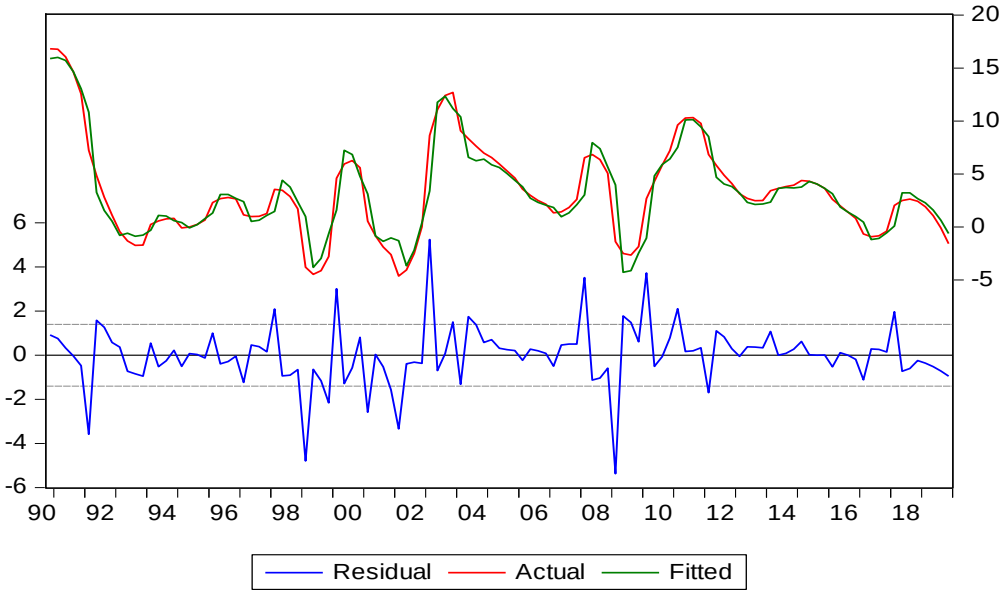
The prediction graph for inflows of foreign direct investment is shown in fig. 8 and it is within the 95% confidence interval or 2 standard error. Plotting the forecast graph versus the real graph will show you how well the series has been forecasted and how near the forecast is to the actual values.

However, to know how accurate the forecast is, the forecast graph will therefore be plotted against the actual FDI values.

Goodness of fit of the Model:

By the following graph, it is clear that the residuals is scattered randomly, in addition the fitted value are almost the same as the actual values

Figure (9)



Source: by researchers based on E-views output

The graph in Figure (9) depicts the trend in foreign direct investment (FDI) inflows into Saudi Arabia from 2021 to 2030. It may be concluded that, while the future years are practically exact, there is a significant difference between the actual and predicted FDI. As a result, the prediction is generally favorable. Additionally, the best model, the ARIMA model, forecasts that Saudi Arabia's foreign direct investment inflows are expected to stagnate or settle between 4.50 billion and 5.05 billion over the next ten years, barring any changes to certain government policies, particularly those that pertain to improving the country's investment climate. It is crucial to understand that the goal of ARIMA modelling is just to estimate future values, therefore researchers might not be able to provide an exact forecast.

8- Conclusion and Recommendations

This study demonstrates that the best model to achieve the goal of modeling and forecasting FDI in Saudi Arabia is the ARIMA model. However, this analysis also demonstrates that if nothing is done to enhance and ameliorate the investment climate in the economy, foreign direct investment inflows to Saudi Arabia are predicted to slightly drop and hover around recent years' levels.

Therefore, a significant increase in foreign direct investment is required in Saudi Arabia to promote growth, generate employment opportunities, and achieve future development levels.

Since it is evident from the forecast that what is likely to happen to FDI inflows in Saudi Arabia is like the current rising issue or situation of FDI inflows in recent times, there is a need for strong policies that need proper and adequate follow up in Saudi Arabia. FDI inflows in Nigeria have been forecasted to be around 4.80 billion USD, which is not significantly different from around the FDI inflows recorded since 2020.

Due to its significance in boosting the economic performance of the Kingdom by increasing production, diversifying sources of income, transferring advanced and technical methods and localizing them, and creating job opportunities, there is a need for policies that are purpose driven with defined objectives and goals. Foreign direct investment attraction strategies should be developed by creating an attractive environment for foreign investment in the Kingdom and removing any barriers to its flow.

Recommendations:

- Encouraging foreign direct investment in various sectors, especially in sectors with interconnected relationships with other sectors, to maximize the returns from these investments, and activities with high export capabilities to reduce dependence on oil revenues.
- Studying the obstacles that reduce the flow of foreign direct investment, whether from the economic, administrative, or legal aspects, and working to solve them quickly.
- Disseminating and clarifying investment opportunities in the Kingdom through international conferences, seminars, commercial offices of the Kingdom in countries around the world, embassies and consulates, and establishing branches of the General Investment Authority in countries with international companies with the Kingdom.

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