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تأثير القيمة المضافة الزراعية والانفتاح التجاري والتضخم على الاستثمار الأجنبي المباشر: باستخدام تحليل السلاسل الزمنيه عن المملكة العربية السعودية

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المستخلص

استهدف البحث دراسة العوامل المحددة للاستثمار، وخاصة في سياق الاقتصادات الناشئة، محدودة. لهذا تهدف هذه الورقة إلى التحقيق في تأثير المتغيرات الاقتصادية الكلية المختلفة (على سبيل المثال، القيمة المضافة الزراعية، والتضخم، والانفتاح التجاري) على الاستثمار الأجنبي المباشر في المملكة العربية السعودية من عام 2005 إلى عام 2020. تستخدم هذه الدراسة بيانات السلاسل الزمنية حول الاستثمار الأجنبي المباشر، والانفتاح التجاري، والقيمة المضافة الزراعية، والتضخم في المملكة العربية السعودية تم اجراء هذي الدارسة باستخدام بيانات على أساس سنوي وتم الحصول عليها من مؤشرات البنك الدولي للفترة 2005-2020. وأيضا استخدمت الورقة نموذج الانحدار التلقائي المتجهي واختبار السببية لتحديد النتائج حيث تشير النتائج إلى أن الفترة الزمنية الأولى للاستثمار الأجنبي المباشر، والقيمة المضافة الزراعية، والانفتاح التجاري لها تأثير كبير إحصائيًا على الاستثمار الأجنبي المباشر. من ناحية أخرى، فإن الفترة الزمنية الأولى للتضخم ليس لها تأثير على الاستثمار الأجنبي المباشر. وتظهر نتائج اختبار السببية لجرانجر أن الاستثمار الأجنبي المباشر لجرانجر يسبب القيمة المضافة الزراعية والعكس صحيح، والاستثمار الأجنبي المباشر لجرانجر يسبب الانفتاح التجاري والعكس صحيح، ولكن التضخم لا يسبب الاستثمار الأجنبي المباشر. وتشير نتائج الدراسة إلى وجود علاقة سببية ثنائية الاتجاه بين القيمة المضافة الزراعية والانفتاح التجاري مع الاستثمار الأجنبي المباشر، لذلك يجب على حكومات البلدان النامية التركيز على خلق بيئة صديقة للتجارة. تساهم الورقة على تسليط الضوء على التأثير الكبير للقيمة المضافة الزراعية والانفتاح التجاري على الاستثمار الأجنبي المباشر، والتأكيد على أهمية تعزيز بيئة صديقة للتجارة لجذب الاستثمار الأجنبي المباشر في الاقتصادات الناشئة.

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The Impact of Agricultural Value Added, Trade Openness and Inflation on FDI: A Time Series Analysis from Saudi Arabia

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ABSTRACT

The purpose of this paper is to investigate the impact of various macroeconomic variables (for example, agricultural added value, inflation, and trade openness) on FDI in Saudi Arabia from 2005 to 2020.This study uses time-series data on FDI, trade openness, agricultural added value, and inflation in Saudi Arabia. The data are on an annual basis and were obtained from the World Bank Indicators for the period 2005–2020.The paper used Vector Autoregression Model and Granger Causality Test to determine the results. The empirical finding indicates that the first lag of FDI, agricultural added value, and trade openness have a statistically significant effect on FDI. The first lag for inflation, on the other hand, has no impact on FDI. The Granger causality test findings show that FDI Granger-causes agricultural added value and vice-versa, FDI Granger-causes trade openness and vice-versa, but inflation does not Granger-cause FDI.The results of the study suggest that there is a two-way causal relationship between agricultural added value and trade openness with FDI, so governments of developing countries should focus on creating a trade-friendly environment.The paper contributes to the literature by providing empirical evidence on the determinants of FDI in Saudi Arabia, highlighting the significant impact of agricultural added value and trade openness on FDI, and emphasizing the importance of fostering a trade-friendly environment for attracting FDI in emerging economies.
Keywords: *FDI, trade openness, agricultural added value, inflation, Saudi Arabia, granger causality*

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1. Introduction

Foreign direct investment (FDI) has increased significantly in recent decades, rising from roughly $205 billion in 1990 to $1,540 trillion in 2019 worldwide (UNCTAD, 2020). This trend is likely to continue, as FDI is one of the most effective instruments for developing the economies of host countries by drawing foreign firms. In the neoclassical model of economic growth, capital stock and labor force increase as production increases. Researchers have shown that FDI can help to decrease unemployment, raise the overall standard of living, and support the host country by providing direct capital financing (Blomström et al., 2003). FDI can also transfer technology and build strong relationships between local and international firms (Mattoo et al., 2004). It can also raise productivity, increase exports, and boost capital financing in the host country (Kurtishi-Kastrati, 2013). For all of these reasons, most countries around the world have started to attract international companies in order to boost their economies.

Saudi Arabia is believed to be one of the most attractive countries for investors in the Middle East. It has attracted a high level of FDI compared to other Gulf countries, which has allowed it to adopt more advanced technologies and benefit from higher growth (Dkhili and Dhiab, 2018) and has an FDI stock of $236 billion, which is significantly higher than any other Gulf country. According to UNCTAD's 2020 World Investment Report, Saudi Arabia ranked 62nd out of 190 countries in the 2020 Ease of Doing Business rankings (UNCTAD, 2020). In the same report, Saudi Arabia achieved a high ranking as the top improver among many developed countries, resulting in significant progress in attracting FDI. Recently, according to the Saudi Arabian General Investment Authority, there was an increase of 1,131 international companies setting up offices in 2019 compared to 2018.

In this paper, we use a vector autoregressive model (VAR) to test the impact of agricultural added value, inflation, and trade openness on FDI in Saudi Arabia. There are a few studies in this context in Saudi Arabia. However, they either examine the determinants of FDI (see Abdulrahim, 2015), the impact of FDI on the Saudi manufacturing sector (see Bardesi, 2016), or the three-way relationship between domestic capital investment, FDI, and economic growth (see Belloumi and Alshehry, 2018). However, none of them take a comprehensive look at the bidirectional impact of FDI on the various major macroeconomic variables in Saudi

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Arabia. Therefore, the study addresses a key research gap in estimating the bidirectional impact of FDI on macroeconomic variables.

2. Literature Review

2.1 FDI and Economic Growth

Foreign direct investment (FDI) has a number of effects on economic conditions. In recent years, there have been a number of studies conducted to investigate the relationship between FDI and economic indices in various countries or regions. Kravis and Lipsey (1980) and Wheeler and Mody (1989) argue that investors use a number of indicators to determine whether to invest in a country, such as location, market size, trade openness, tax, labor cost, and productivity. Chowdhury and Mavrotas (2003) test the relationship between FDI and economic growth using time series data for Malaysia, Chile, and Thailand from 1969 to 2000. They found that there is strong evidence of a bidirectional relationship between FDI and economic growth in the case of Malaysia and Thailand, but only a one-way relationship from FDI to economic growth in the case of Chile. Sukar, Ahmed, and Hassan (2007) also examined the effect of FDI on economic growth in Sub-Saharan African countries. Using panel data from 1975 to 1999, they found that FDI has a marginally significant positive effect on economic growth.

Dritsaki, Melina, and Adamopoulos (2004) investigated the relationship between trade, FDI, and economic growth for Greece from 1960-2002. They found that there is a long-run relationship between FDI and growth. They also used the Granger causality test, and the result showed that there is a two-way causal relationship between these variables. Feridun (2004) for Cyprus used the same methodology as Dritsaki, Melina, and Adamopoulos (2004) and found a similar result. Ang (2008) investigated the relationship between FDI and level of financial development, infrastructure development, and trade openness using annual time series data for the period 1960–2005 in Malaysia. He found that as a level of financial development, infrastructure development, and trade openness increases, FDI will follow. This means that FDI is attracted to countries with strong financial systems, good infrastructure, and open markets.

2.1 FDI and Inflation

The impact of FDI on inflation has been the subject of much debate in recent years. Some studies have found that FDI can help to mitigate the detrimental effects of inflation, while others have found that it can actually lead to higher inflation. Sayek

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(2009) investigated the impact of FDI on inflation and how global multinational corporations influence inflation in host and home countries. They found that FDI can help reduce inflation in host countries by increasing competition and efficiency. However, they also found that FDI can lead to higher inflation in home countries, as multinational corporations may repatriate profits back to their home countries, where they can contribute to inflation.

Alshamsi, bin Hussin, and Azam (2015) studied the impact of inflation on FDI using time series data from 1980 to 2013 in the case of the United Arab Emirates. They found that inflation has no significant influence on FDI. This they attributed to United Arab Emirates being a relatively open economy, so foreign investors are not likely to be deterred by inflation. Mohammed and Mansur (2014) used annual data from 1970 to 2012 to investigate the relationship between the inflation and FDI in South Africa. They found that the degree of inflation and FDI have a long-run inverse relationship. This means that in the long run, higher inflation is associated with lower FDI. This is likely because high inflation can make it more difficult for foreign investors to make profits in a country.

Okafor (2016) and Mustafa (2019) both investigated the effect of FDI on inflation rates in Nigeria and Sri Lanka, respectively. They both employed Granger causality and ordinary least squares regression for time series results. Mustafa (2019) discovered an inverse relationship between FDI and inflation, with a one-way casual direct influence from FDI to inflation. This means that FDI can help to reduce inflation in the short run. However, Okafor (2016) found FDI has a non-significant impact on the inflation rate. Vasileva (2018) examined the association between FDI and inflation, as well as how inflation influences FDI, using panel evidence from 71 countries from 1985 to 2013. The findings show that there is a positive relationship between FDI and inflation. This means that higher FDI is associated with higher inflation. This is likely because FDI can lead to increased demand for goods and services, which can put upward pressure on prices.

2.3 FDI and Trade

Hailu (2010) examined the relationship between FDI and trade balance in African countries from 1980 to 2007. He found a major positive relationship between FDI and trade balance. This means that FDI can help to increase exports and reduce imports, which can lead to a positive trade balance. In contrast, Duong, Anh, and Phuong (2012) found that there is not any linkage between FDI and trade in Vietnam.

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This may be because Vietnam is a relatively closed economy, and foreign investors are not able to easily export their goods and services. Mukhtarov, Alalawneh, Ibadov, and Huseynli (2019) investigated the impact of FDI on exports for Jordan. They employed Autoregressive Distributed Lag (ARDL) Bounds Testing and cointegration approach for ranged data from 1980 to 2018. Their results reveal that there is a statistically significant impact of FDI on the volume of exports. This is consistent with the findings of other studies, which have shown that FDI can help to increase exports.

2.4 FDI and Unemployment

There is a fairly large body of literature on the relationship between FDI and the unemployment rate. Some studies have found that FDI can lead to a decrease in the unemployment rate, while others have found that there is no relationship between the two. Stra, Davidescu and Paul (2014) and Grahovac and Softić (2017) found that there is no relationship between FDI and the unemployment rate. They argue that this is because FDI does not create as many jobs as it is often thought to do. Instead, FDI often displaces domestic jobs, as foreign companies bring in their own workers from abroad. Irpan, Saad, Md Noor, and Ibrahim (2016) found that FDI can lead to a decrease in the unemployment rate in the case of Malaysia. They argue that this is because FDI can lead to an increase in economic growth, which can create more jobs.

2.5 FDI and Industrial Development

FDI can be one of the most important factors in enhancing the growth of the industrial sector in the host countries by transferring technical innovations and new equipment with advanced raw materials. Samantha and Haiyun (2018) investigated the impact of FDI on the industrial sector growth by using data from 1980-2016 with the ARDL Model. Their conclusion reveals that FDI can have a significant effect on industrial sector growth in both the long and short term. Akpan and Eweke (2017) used annual time series data for the period 1981-2015 in the case of Nigeria to examine the relationship between FDI and the industrial sector development in the long term. The results showed there is a bidirectional relationship between FDI and the industrial sector development.

In summary, a fairly large body of literature investigate the relationship of FDI with inflation, employment, GDP, trade, technology transfer, and industrial growth. Although most see a positive relation between FDI and employment, GDP, trade,

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technology transfer, industrial growth, and a negative relation with inflation, there were a few papers that found the opposite result. However, there are no contemporary, comprehensive such studies in Saudi Arabia even though FDI is clearly an important issue in Saudi Arabia, especially in light of the *Vision 2030* which aims to achieve the goal of increased diversification economically, socially and culturally. The main objective of this study is to thus address this research gap by investigating the impact of trade openness, agricultural added value, inflation, and trade openness in Saudi Arabia using a vector autoregression (VAR) approach.

3. Data

This study uses time-series data on foreign direct investment (FDI), trade openness (export and import as a percentage of GDP), agricultural added value, and inflation in Saudi Arabia. The data are on an annual basis and were obtained from the World Bank Indicators for the period 2005–2020 (World Bank, 2023). More details about the data follow:

***Foreign Direct Investment (FDI)* (billion USD):** Foreign Direct Investment (FDI) refers to equity sources of direct investment in the reporting economy. That is the amount of equity capital, earnings reinvestment, and other capital.

***Inflation (INF)* (%):** Inflation (INF) is the annual growth rate of the GDP implicit deflator, which shows the rate of price change in the economy as a whole.

***Trade Openness (TR)* (% of GDP):** Trade Openness (TROP) is computed by dividing the sum of a country's imports and exports by its total GDP.

***Agricultural added value (AV)* (% of GDP):** Agricultural added value (AV) includes forestry, hunting, fishing, agricultural agriculture, and cattle rearing.

The descriptive statistics for FDI, inflation, trade openness, and agricultural added value are presented in Table 1. The results show that the mean of the variables is $14.778 billion, 3.356%, 77.435%, and 2.506% for FDI, inflation, trade openness, and agricultural added value, respectively. The standard deviation of FDI is 11.740, inflation is 2.340, trade openness is 13.013, and agricultural added value is 0.338.

Table 1. Summary Statistics of Variables Used in the Estimation

	FDI (billion USD)	Inflation (%)	Trade Openness (% of GDP)	Agricultural Value Added (% of GDP)
Mean	14.778	3.356	77.435	2.506
S.D.	11.740	2.340	13.013	0.338
Minimum	1.418	0.479	52.076	2.079
Maximum	39.455	9.870	96.102	3.221
Observations	16	16	16	16

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Figure 1 shows a bar chart of FDI in Saudi Arabia from 2005 to 2020. The figure shows that FDI in Saudi Arabia peaked in 2008 at $39.46 billion. However, it declined rapidly until 2017, when it reached a low of $14.42 billion. It has since picked up gradually but has hovered around $4-5 billion annually. There are a number of factors that may have contributed to the decline in FDI in Saudi Arabia in the years following 2008 including the global financial crisis, the Arab Spring, and the COVID-19 pandemic. However, the recent rise in FDI is encouraging, given ambitious long term plans such as the *Vision 2030*.

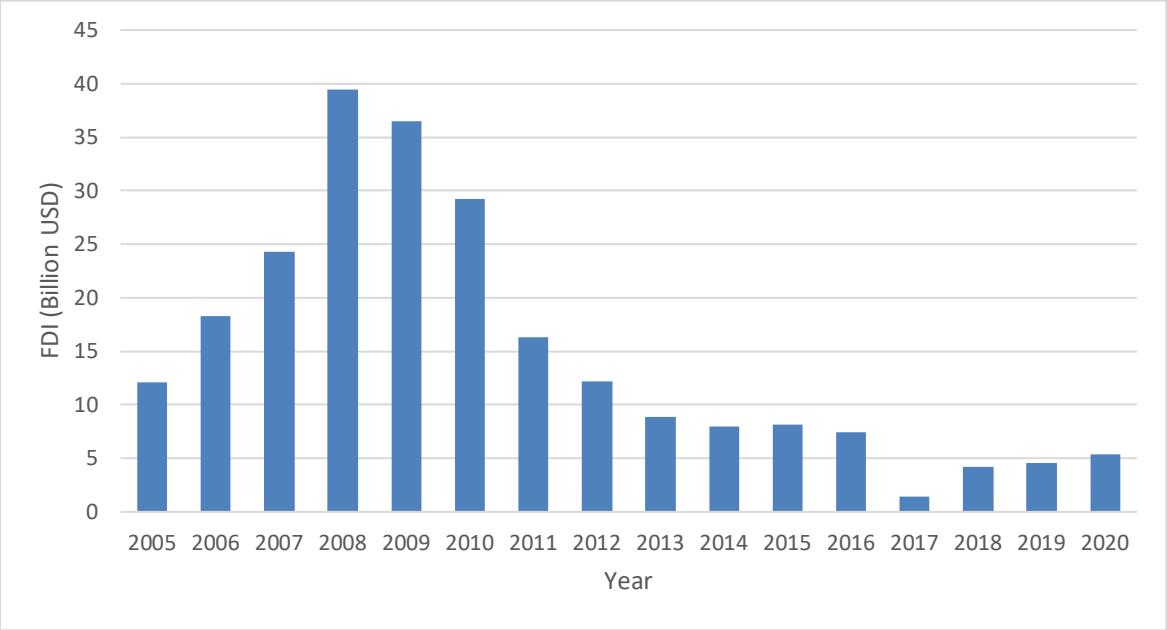

Figure 1. Foreign Direct Investment from 2005-2020

4. Methodology and Materials

The main objective of this study is to investigate the impact of trade openness, agricultural added value, inflation, and trade openness in Saudi Arabia using a vector autoregression (VAR) approach. In the process, we will also test for unit root and Granger causality tests. More details about the methodology follow in the next section.

4.1Vector Autoregression (VAR) Model

Vector autoregression (VAR) is a statistical model that is used to analyze the relationship between multiple time series variables. In a VAR model, all variables are treated as endogenous, meaning that they are all affected by each other. Each variable is modeled as a linear function of its own lagged values and the lagged values of the other variables.

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VAR models are often used to study the short-run dynamics of economic systems. They can also be used to identify the causal relationships between variables, to forecast future values of variables, and to assess the impact of shocks to the system. (Besley and Kontoghiorghes, 2009). The vector autoregressive model is shown below:

$$y_t = B_0 + B_1 X_{t-1} + B_2 Z_{t-1} + B_3 T_{t-1} + B_4 f_{t-1} + \varepsilon_t \quad (1)$$

where $\boldsymbol{y_t}$ is the endogenous dependent variable measuring FDI, $\boldsymbol{X_{t-1}}$ is the lagged Agricultural Value Added, $\boldsymbol{Z_{t-1}}$ is the lagged Inflation , $\boldsymbol{T_{t-1}}$ is the lagged Trade Openness, $\boldsymbol{f_{t-1}}$ is the lagged FDI, $\boldsymbol{B_0}$ is the intercept, and $\boldsymbol{B_1, B_2, B_3,}$ and $\boldsymbol{B_4}$ are the coefficients of the Agricultural Value Added, Inflation and Trade Openness, and lagged FDI respectively. More specifically, the model is:

$$FDI_t = B_0 + B_1 AV_{t-1} + B_2 Inf_{t-1} + B_3 TO_{t-1} + B_4 f_{t-1} + \varepsilon_t \quad (2)$$

4.2 Unit Root Test of Stationarity

The VAR model assumes that the variables in the model are stationary. This means that the mean, variance, and autocovariances of the variables are constant over time. If the variables in the VAR model are not stationary, then the model will be biased and inconsistent and the estimates of the model will not be accurate and the forecasts from the model will not be reliable. Therefore, it is important to test for stationarity using unit roots before fitting a VAR model.

A unit root test is a statistical test that is used to determine whether a time series is stationary. The Augmented Dickey-Fuller (ADF) test is a popular unit root test and tests the null hypothesis that a time series has a unit root against the alternative hypothesis that the time series is stationary. It is conducted by regressing the time series on its own lagged values and a constant term. The ADF test statistic is then calculated and compared to critical values from a t-distribution.

If the ADF test statistic is greater than the critical value, then the null hypothesis of a unit root is rejected and the alternative hypothesis of stationarity is accepted meaning that the time series is stationary.

4.3Granger Causality Test

Granger causality is a statistical concept that is used to measure the causal relationship between two time series variables. Granger causality is a popular tool for studying the causal relationships between economic, financial, and other time series variables. It is a relatively simple and straightforward method that can be used

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to identify causal relationships even in the presence of other factors that may be affecting the variables.

The idea behind Granger causality is that if one variable can help to predict another variable, then it is said to "Granger-cause" that variable. Formally, Granger causality is defined as follows: if the variance of the residual error of a time series regression model is reduced by including the lagged values of another variable, then the first variable is said to Granger-cause the second variable. Conversely, if the variance of the residual error of a time series regression model is not reduced by including the lagged values of another variable, then the first variable does not Granger-cause the second variable.

The Granger causality model is a linear regression model as follows:

$$X_1(t) = \sum_{j=1}^{p} A_{11j} X_1(t-j) + \sum_{j=1}^{p} A_{12j} X_2(t-j) + e_1(t) \quad (3)$$

$$X_2(t) = \sum_{j=1}^{p} A_{21j} X_1(t-j) + \sum_{j=1}^{p} A_{22j} X_2(t-j) + e_2(t) \quad (4)$$

where:

- $\boldsymbol{X_1(t)}$ and $\boldsymbol{X_2(t)}$ are the two time series variables
- $\boldsymbol{A_{11j}}$ and $\boldsymbol{A_{12j}}$ are the coefficients on the lagged values of $\boldsymbol{X_1(t)}$ in the first equation
- $\boldsymbol{A_{21j}}$ and $\boldsymbol{A_{22j}}$ are the coefficients on the lagged values of $\boldsymbol{X_2(t)}$ in the second equation
- $\boldsymbol{e_1(t)}$ and $\boldsymbol{e_2(t)}$ are the residual errors

The Granger causality test is conducted by comparing the variance of the residual errors of the two equations. If the variance of $\boldsymbol{e_1(t)}$ is reduced by including the lagged values of $\boldsymbol{X_2(t)}$ in the first equation, then $\boldsymbol{X_2(t)}$ is said to Granger-cause $\boldsymbol{X_1(t)}$. Conversely, if the variance of $\boldsymbol{e_2(t)}$ is not reduced by including the lagged values of $\boldsymbol{X_1(t)}$ in the second equation, then $\boldsymbol{X_1(t)}$ does not Granger-cause $\boldsymbol{X_2(t)}$.

4.4Jarque–Bera Test in Regression Analysis

The Jarque–Bera test is a statistical test that is used to test the normality assumption in regression analysis. It is a two-tailed test, which means that it can be used to test for both the null hypothesis that the data is normally distributed and the alternative hypothesis that the data is not normally distributed. The test is based on the skewness and kurtosis of the data. Skewness measures the asymmetry of the distribution, while

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kurtosis measures the peakedness of the distribution. The test calculates two test statistics, one for skewness and one for kurtosis. If the test statistics are significant, then the null hypothesis of normality is rejected. Formally, the test statistic is:

$$JB = \frac{n-k}{6}(s^2 + \frac{1}{4}(k-3)^2) \quad (5)$$

where *n* is the number of observations and *k* is the number of regressors. The test statistic has a chi-squared distribution with 2 degrees of freedom. If the null hypothesis of normality is true, the Jarque–Bera test statistic will have a p-value that is greater than 0.05. In other words, there is not enough evidence to reject the null hypothesis of normality. However, if the p-value is less than 0.05, then we can reject the null hypothesis and conclude that the data is not normally distributed.

5 Results and Discussion

5.1 Unit Root Test on FDI, Agricultural Added Value, Trade Openness and Inflation

The ADF test results for the FDI, inflation, trade openness, and agricultural added value series presented in Table 2 show that the null hypothesis of unit roots fails to reject for FDI, agricultural added value, and trade openness. This means that these variables are non-stationary. However, the ADF test results for inflation fail to reject the null hypothesis for inflation because the P-value is less than 5% and we conclude inflation is stationary. The Dickey-Fuller for the first differences (DF.FD) test results for the FDI, inflation, trade openness, and agricultural added value series presented in Table 2 show that the null hypothesis of unit roots is rejected for all variables. This means that these variables are stationary.

In terms of unit root tests, the first difference (DF.FD) is preferable to (ADF) for this data since all variables are stationary at the DF.FD. So, we prefer to use the first different results for the same variables in the vector autoregressive (VAR) model.

Table 2. Unit Root Test Results

	FDI				
	Z-stat	1% level	5% C level	10% C level	P-Value
ADF[1]	-1.139	-3.750	-3.000	-2.630	0.699
FD.DF	-4.339	-3.750	-3.000	-2.630	0.0004
	Trade Openness				
	Z-stat	1% level	5% C level	10% C level	P-Value
ADF	0.673	-3.750	-3.000	-2.630	0.9893
FD.DF	-2.790	-3.750	-3.000	-2.630	0.0597

[1] ADF: Augmented Dickey-Fuller test for unit root, FD.DF: the first different of Dickey Fuller test.

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	Inflation				
	Z-stat	1% level	5% C level	10% C level	P-Value
ADF	-3.112	-3.750	-3.000	-2.630	0.0256
FD.DF	-4.825	-3.750	-3.000	-2.630	0.0000
	Agricultural Value Added				
	Z-stat	1% level	5% C level	10% C level	P-Value
ADF	-2.689	-3.750	-3.000	-2.630	0.0759
FD.DF	-3.279	-3.750	-3.000	-2.630	0.0159

The empirical conclusions drawn from the formal tests are further reinforced by graphical representations. Panels A-D in Figure 2 presents plots of the FDI, inflation, trade openness, and agricultural added value series by using the Augmented Dickey-Fuller (ADF) test and show that the FDI, inflation, trade openness, and agricultural added value series are all non-stationary as they display very obvious trends. This means that the mean, variance, and autocovariances of these variables are not constant over time.

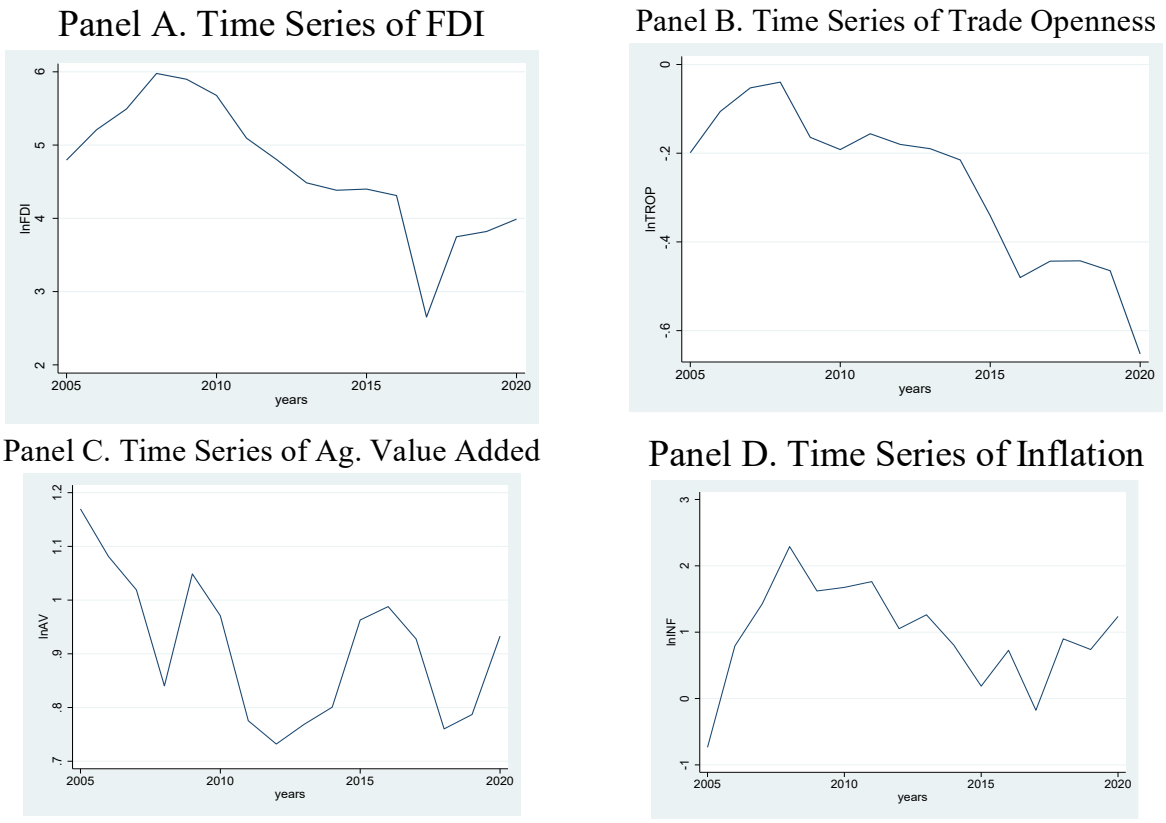

Figure 2. Time Series of FDI, Trade Openness, Ag. Value Added and Inflation

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Panels A-D in Figure 3 presents plots of the FDI, inflation, trade openness, and agricultural added value series after taking the first difference. The first difference of a time series variable is the difference between the current value of the variable and the value of the variable one period ago. The plots in Figure 3 show that the FDI, inflation, trade openness, and agricultural added value series are all stationary after taking the first difference, indicated by the absence of any clear trend in the plot. Based on the results of the unit root tests from Table 2 and the plots, we prefer to use the first difference of the FDI, inflation, trade openness, and agricultural added value series to estimate the VAR model.

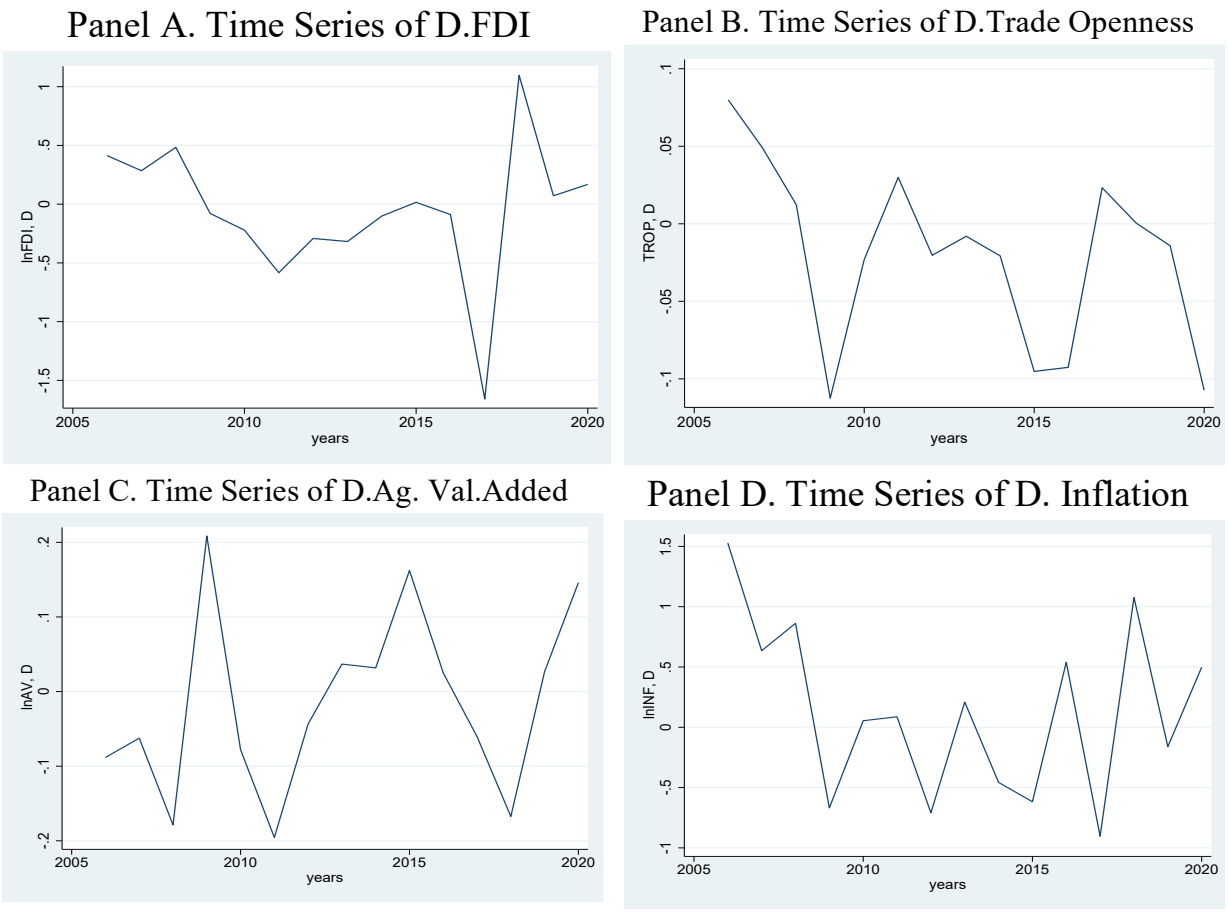

Figure 3. Lagged Time Series of FDI, Trade Openness, Ag. Value Added and Inflation

We use the Akaike's Information Criterion (AIC) to select the optimal lag length for the VAR model. The AIC is a statistical criterion that is used to select the model that minimizes the information loss, and the results suggest that the optimal lag length for the VAR model is 1 (see detailed results in Table 3). In sum, our preliminary

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analysis suggest FDI, inflation, trade openness, and agricultural added value series are all stationary after taking the first difference. We also find that the first lagged is the optimal lag for the VAR model to estimate the impact of FDI on agricultural value added, inflation, and trade openness, meaning that the first lagged values of FDI are the most important predictors of the current values of agricultural value added, inflation, and trade openness.

5.2Vector Autoregression (VAR) Model

Table 4 presents the estimated coefficients, standard errors, and p-values for each equation in the VAR model. For the FDI equation, the p-values for the first lags of FDI, agricultural added value, and trade openness are all less than 0.05, so all these variables have a statistically significant impact on FDI. However, the first lag of inflation does not have a statistically significant impact on FDI. For the agricultural added value equation, the p-values for the first lag of FDI, inflation, and trade openness are all larger than 0.05, so these variables do not have a statistically significant impact on agricultural added value. For the trade openness equation, the first lag of FDI, agricultural added value, and inflation are all greater than 0.05. Finally, for the inflation equation, the first lag of FDI, agricultural added value, and trade openness have statistically significant impacts on inflation.

Table 3. Lag-Order Selection Criteria

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-14.961	-	-	-	0.837	2.660	2.645	2.701
1	-9.388	11.145*	1.000	0.001	0.392*	1.898*	1.868*	1.979*
2	-9.115	0.548	1.000	0.459	0.446	2.019	1.974	2.140
3	-9.113	0.003	1.000	0.960	0.535	2.186	2.126	2.347
4	-9.104	0.019	1.000	0.889	0.648	2.351	2.276	2.553

Table 4. Estimation of VAR Model

Dependent variable	FDI	Trade Openness	Ag. Value Added	Inflation
FDI	**0.617**	**-0.067**	**0.058**	**0.923**
S.E.	*0.247*	*0.080*	*0.117*	*0.394*
P-Value	*0.012*	*0.401*	*0.621*	*0.019*
Trade Openness	**10.920**	**0.716**	**-0.065**	**9.077**
S.E.	*1.101*	*0.355*	*0.520*	*1.755*
P-Value	*0.000*	*0.044*	*0.900*	*0.000*

Ag. Value Added	**4.874**	**-0.047**	**0.456**	**4.040**
S.E.	*0.928*	*0.300*	*0.438*	*1.480*
P-Value	*0.000*	*0.874*	*0.298*	*0.006*
Inflation	**-0.062**	**0.037**	**-0.001**	**-0.222**
S.E.	*0.242*	*0.078*	*0.114*	*0.386*
P-Value	*0.799*	*0.639*	*0.992*	*0.566*
Intercept	**2.302**	**-0.236**	**0.874**	**-4.223**
S.D.	*1.008*	*0.325*	*0.476*	*1.608*
P-Value	*0.022*	*0.469*	*0.066*	*0.009*

(*): significance level at 1%, (**): significance level at 5%, and (***): significance level at 10%.

Jarque-Bera Test for Normality

The Jarque-Bera test is used to test the normality assumption in the VAR model and the results are presented in Table 5. The p-value for the Jarque-Bera test is greater than 0.05 for all of the variables meaning that all the variables have a normal distribution. The results of this study suggest that FDI has a statistically significant impact on agricultural added value, inflation, and trade openness. However, agricultural added value, inflation, and trade openness do not have a statistically significant impact on FDI.

Table 5. Jarque-Bera test for Normality

Equation	Chi-sq.	Prob.
FDI	0.215	0.898
Trade Openness	0.637	0.727
Agricultural Value Added	1.160	0.559
Inflation	0.689	0.708
ALL	**2.701**	**0.951**

5.3Granger Causality Wald Test

The results of the Granger causality test for FDI are presented in Table 6. In this case, we are testing whether agricultural added value, trade openness, and inflation can help predict FDI. The p-values for the Granger causality tests for agricultural added value and trade openness are both less than 0.05 suggesting that agricultural added value and trade openness can help predict FDI. This also means that past values of agricultural added value and trade openness can be used to improve the

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forecasts of FDI. However, the p-value for the Granger causality test for inflation is greater than 0.10 meaning that inflation cannot Granger-cause FDI.

Table 6. Granger Causality Test: FDI

Dependent Variable: FDI	Chi-sq.	Prob.
Trade Openness	98.39	0.000
Agricultural Value Added	27.57	0.000
Inflation	0.06	0.799

The results of the Granger causality test for trade openness are presented in Table 7. The p-values for the Granger causality tests for FDI, inflation, and agricultural added value are all less than 0.05 meaning that FDI, inflation, and agricultural added value can Granger-cause and help predict trade openness.

Table 7. Granger Causality Test: Trade Openness

Dependent Variable: Trade Openness	Chi-sq.	Prob.
FDI	0.71	0.400
Agricultural Value Added	0.03	0.874
Inflation	0.22	0.638

The results of the Granger causality test for agricultural added value are presented in Table 8. The results of the Granger causality test suggest that FDI, inflation, and trade openness cannot help predict agricultural added value. This means that past values of FDI, inflation, and trade openness cannot be used to improve the forecasts of agricultural added value.

Table 8. Granger Causality Tests: Agricultural Value Added

Dependent Variable: Ag. Value Added	Chi-sq.	Prob.
FDI	0.25	0.620
Inflation	0.00	0.992
Trade Openness	0.02	0.900

Finally, the results of the Granger causality test for inflation are presented in Table 9. Again, the p-values for the Granger causality tests for FDI, agricultural added value, and trade openness are all greater than 0.05 meaning FDI, agricultural added value, and trade openness cannot Granger-cause inflation.

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Table 9. Granger Causality Test: Inflation

Dependent variable: Inflation	Chi-sq.	Prob.
FDI	5.50	0.019
Agricultural Value Added	7.45	0.006
Trade Openness	26.74	0.000

6. Conclusion

Foreign direct investment (FDI) is a significant driver of economic growth and development. It can help create jobs, transfer technology, and improve productivity. In this paper, we a use a vector autoregressive (VAR) model to investigate the impact of various macroeconomic variables on FDI in Saudi Arabia from 2005 to 2020.

The results of the VAR model suggest that the first lag of FDI, agricultural added value, and trade openness have a statistically significant effect on FDI. The first lag for inflation, on the other hand, has no impact on FDI. The Granger causality test findings show that FDI Granger-causes agricultural added value and vice-versa, FDI Granger-causes trade openness and vice-versa, but inflation does not Granger-cause FDI. This suggests that FDI has a two-way causal relationship with agricultural added value and trade openness.

The results of this study have important implications for the government of Saudi Arabia. The government should continue to focus on creating a conducive business-friendly environment that attracts FDI. This will help to create jobs, transfer technology, and improve productivity. The government should also invest in infrastructure and education to improve the quality of the workforce. By taking these steps, the government can help to make Saudi Arabia a more attractive destination for FDI and promote economic growth and development. In addition to the above, the results of this study also suggest that the government of Saudi Arabia should focus on promoting trade openness and reducing barriers to investment. This will help to attract FDI from foreign companies that are looking to expand into the Saudi Arabian market.

Ethical consideration: N/A

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