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Department of Commerce

"Saudi Arabia Stock Market and Oil Market Analysis"

Submitted by

Creig Luke Picado (232626036)
Hari Shankar Arun C (232626033)

M.Sc. Business Analytics

Under the guidance of
Dr. Satyaban
Dr. Shekhar
Department of Commerce, MAHE

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Creig Luke Picardo (232626036)
Hari Shankar Arun C (232626033)

DECLARATION

We hereby declared that the matter embodied in this term paper is original and has not been submitted for the award of any other degree to any other university.

Creig Luke Picardo (232626036) [Team Lead]
Hari Shankar Arun C (232626033)

ABSTRACT

The Saudi Arabian economy has long been closely tied to oil production, with the nation emerging as a global energy powerhouse following the discovery of oil in 1938. This study explores the interplay between Saudi Arabia's stock market, the oil market, and the economic implications of dependency on oil revenues. By analyzing historical trends, stock market data, and oil prices from 2010 to 2024, this paper assesses the impact of oil price fluctuations on the Tadawul stock exchange and the broader economic landscape. The research highlights the Kingdom's efforts to reduce oil dependency through initiatives such as Vision 2030, aimed at diversifying into sectors like tourism, technology, and renewable energy. Statistical analysis, including impulse response functions, reveals the influence of oil shocks on stock market performance, underscoring the critical role of oil in shaping Saudi economic stability. The findings offer insights into the challenges and opportunities presented by the country's ambitious diversification efforts.

Keywords – Oil, Stock Market, Trends, diversifying

INTRODUCTION

Saudi Arabia's economy

Saudi Arabia's economy has undergone a significant transformation over the past century, primarily due to its rich oil reserves. Prior to the discovery of oil in 1938, the economy was largely dependent on agriculture, trade, and religious tourism centered in Mecca and Medina. However, the discovery of oil marked a new era, rapidly propelling the Kingdom to global prominence as a leading oil producer. The oil boom of the 1970s further reinforced this dependency, with oil revenues funding vast infrastructure projects, educational development, and modernization efforts.

Despite these advances, fluctuations in oil prices during the 1980s and 1990s exposed vulnerabilities in an economy heavily reliant on oil exports. Recognizing the need for diversification, Saudi Arabia launched various initiatives aimed at reducing its dependency on oil, culminating in the ambitious Vision 2030 reform plan. This strategy, introduced in 2016 by Crown Prince Mohammed bin Salman, focuses on fostering growth in non-oil sectors such as tourism, technology, and renewable energy. Additionally, the COVID-19 pandemic accelerated digital transformation efforts, further pushing the Kingdom toward economic diversification.

This study examines the historical and contemporary factors shaping Saudi Arabia's stock and oil markets, with particular emphasis on the Tadawul stock exchange. By analyzing stock market trends alongside oil price movements, this paper aims to provide insights into the economic impacts of oil dependency and the ongoing efforts to achieve a more resilient, diversified economy.

History of the Saudi Oil Market

Rise as an Oil Power

During the 1950s and 1960s, Saudi Arabia witnessed a rapid expansion in oil production, establishing Saudi Aramco as a prominent player in the global energy market. The 1973 oil crisis further strengthened Saudi Arabia's influence within OPEC and solidified its role in global energy markets. By the mid-1970s, the nationalization of Aramco granted the Saudi government full control over the company, marking a significant shift in its economic autonomy. However, the 1980s and 1990s presented new challenges as oil price fluctuations created budgetary pressures, underscoring the need for economic diversification. In the 2010s, the emergence of the U.S. shale oil industry introduced fresh competition, prompting Saudi Arabia to lead the OPEC+ alliance with Russia to help stabilize prices. The 2020 COVID-19 pandemic then brought an unprecedented drop in oil demand, leading to significant production cuts. Amid these challenges, Saudi Arabia has sought to balance oil production with investments in renewable energy as part of its Vision 2030, aiming to reduce its economic dependence on oil.

LITERATURE REVIEW

[1] "The Impact of Oil Price Fluctuations on Saudi Arabia Stock Market: A Vector Error-Correction Model Analysis"

Objective: This study aims to explore how fluctuations in oil prices affect the Saudi stock market. The analysis is conducted using a Vector Error-Correction Model (VECM), which identifies both short-term and long-term dynamics.

Author: Nouf Bin Ayaf Al-Mogren.

[2] "The Impact of Oil and Global Markets on Saudi Stock Market Predictability: A Machine Learning Approach"

Objective: The objective of this research is to analyze the predictability of the Saudi stock market based on oil price changes and global market trends, utilizing advanced machine learning techniques.

Authors: Abdou, Hussein A., Elamer, Ahmed A., Abedin, Mohammad Zoynul, and Ibrahim, Bassam A.

[3] "COVID-19 Pandemic, Oil Prices and Saudi Stock Market: Empirical Evidence from ARDL Modeling and Bayer–Hanck Cointegration Approach"

Objective: This study assesses the impact of the COVID-19 pandemic and oil price changes on the Saudi stock market. It uses ARDL and cointegration models to evaluate the stability of the stock market during the crisis.

Authors: Jamel Boukhatem and Ali M. Alhazmi.

[4] "Macro Economy, Stock Market and Oil Prices: Do Meaningful Relationships Exist Among Their Cyclical Fluctuations?"

Objective: The research investigates the cyclical relationships between the macro economy, stock market, and oil prices. It focuses on analyzing whether these factors move in sync or have independent fluctuations.

Author: George Filis.

NEED OF STUDY

This study is essential to understand the extent of Saudi Arabia's dependency on oil and to assess the effectiveness of diversification strategies, especially under Vision 2030. By analyzing the relationship between oil prices and stock market performance, this research aims to provide insights into economic resilience and the potential for growth in non-oil sectors. This is crucial for guiding future policies and investments that support a more sustainable economic model for Saudi Arabia.

OBJECTIVE

1. To analyze the impact of oil price fluctuations on the performance of the Saudi stock market.

2. To assess the effectiveness of Saudi Arabia's diversification efforts under Vision 2030.

4. To evaluate the challenges and opportunities in reducing Saudi Arabia's economic dependency on oil.

LIMITATIONS OF THE STUDY

This study is limited by its reliance on historical data, which may not fully capture future economic shifts or unforeseen global events. Additionally, the analysis focuses primarily on the Saudi stock and oil markets, which may limit the generalizability of findings to other sectors or economies. The study also assumes the accuracy of available data, which could be affected by reporting inconsistencies or market volatility. Finally, the evolving nature of Vision 2030 means that some long-term impacts of diversification efforts remain uncertain.

RESEARCH METHODOLOGY

DATA COLLECTION

Saudi Stock Market:

Tadawul All-Share Index (TASI) is an index of all traded stocks in Saudi Arabia.

Data range: Jan 2010 to Sep 2024

Frequency: Daily

Source: trandingeconomics.com.

OPEC Basket:

OPEC Basket value gives the Weighted average of prices of blends of petroleum produced by the Organization of Petroleum Exporting countries (OPEC).

Data range: Jan 2003 to Sep 2024

Frequency: Daily

Source: opec.org

TYPE OF DATA

Daily data, excluding weekends and holidays.

ANALYSIS OF DATA

The analysis focuses on examining the impact of oil price fluctuations on the Saudi stock market by using statistical tools and time-series methods. Augmented Dickey-Fuller (ADF) tests were conducted to check for stationarity in the data, ensuring reliable results in the time-series analysis. An Impulse Response Function (IRF) was applied to measure how shocks in oil prices affect stock market returns over specific time lags, showing the immediate and gradual effects on market performance. Also Transfer Function Models were used to compare the change of stock when the OPEC Basket price changes over time.

Additionally, descriptive statistics, such as mean and median, were calculated to summarize key price trends and volatility in both the stock and oil markets. These methods reveal the strength of the relationship between oil price movements and stock market performance, offering insights into the economic implications of Saudi Arabia's oil dependency and diversification efforts.

Summary Statistics:

Price:
Min. : 5323 (2nd March 2011)
Max. :13820 (8th May 2022)
Median : 7915
Mean : 8489

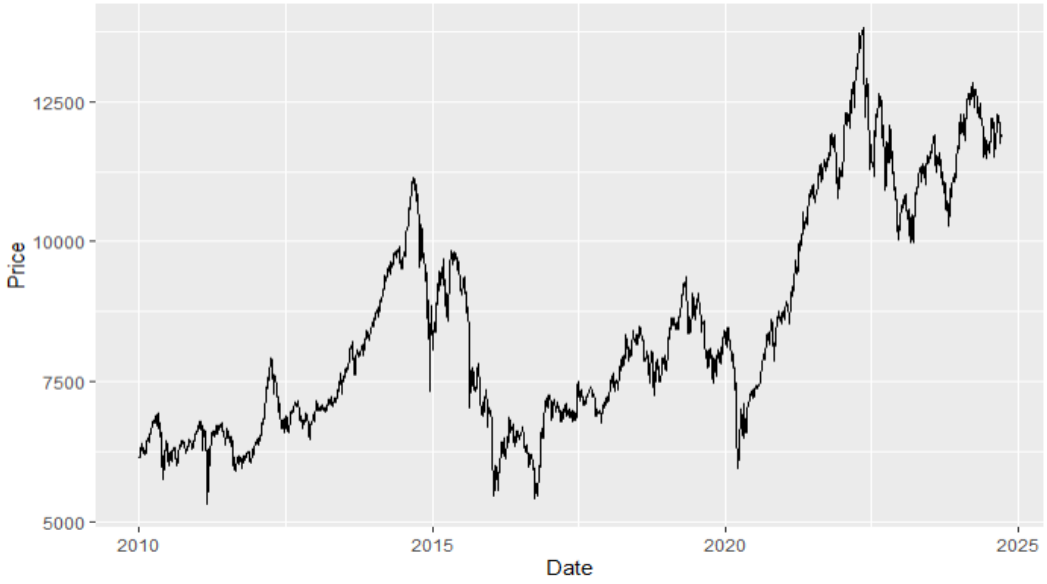
High:
Min. : 5472 (3rd October 2016)
Max. :13949 (9th May 2022)
Median : 7966
Mean : 8532

Change (%):
Min. : -0.0832000 (8th March 2020)
Max. :0.0892000 (18th December 2014)

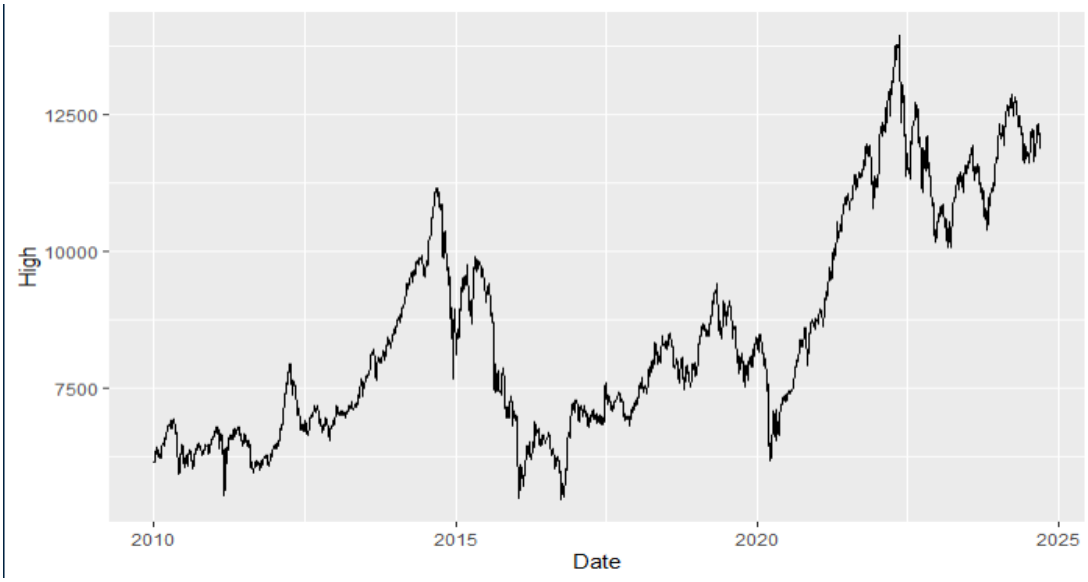
Value:
Min. : 12.22 (22nd April 2020)
Max. :140.73 (3rd July 2008)
Median : 67.92
Mean : 70.30

Time Series Plots:

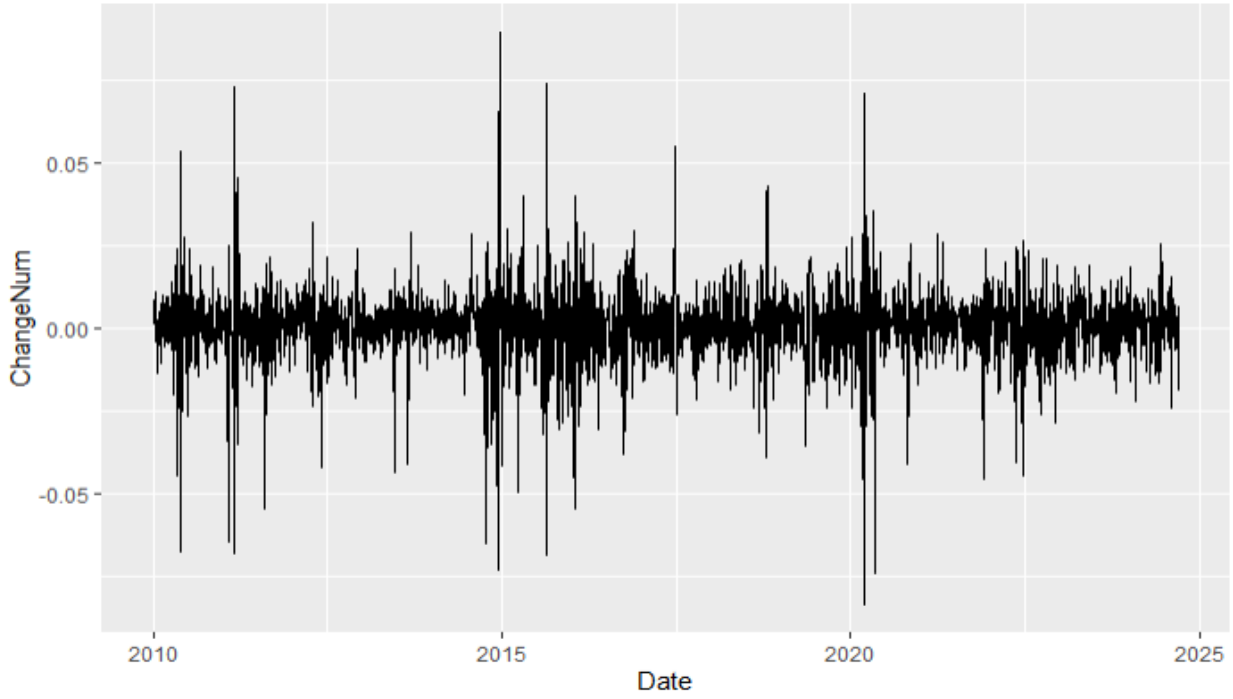
Plot for the closing price of Tadawul All-Share Index (TASI) with respect to time.



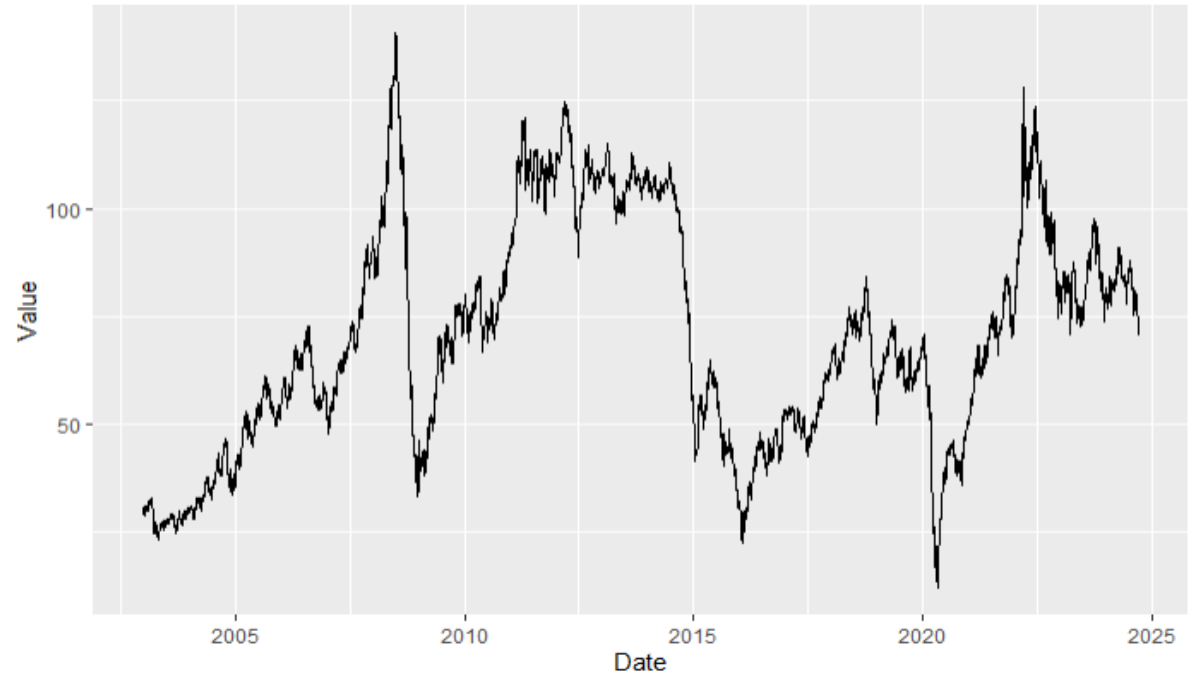
Plot for the highest price of TASI Index for the day with respect to time.



Percentage change of stock price (close) over a day, with respect to time



Percentage change of stock price (close) over a day, with respect to time



Preliminary Tests:

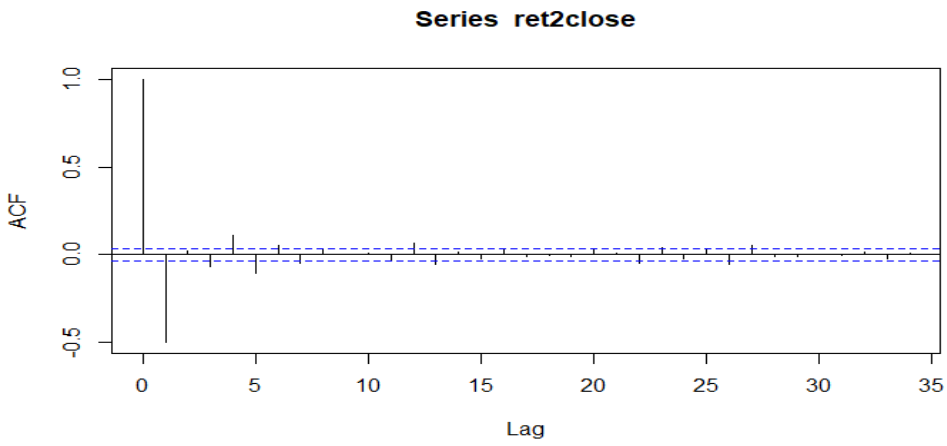
TASI Index:

Augmented Dickey Fuller (ADF Test)

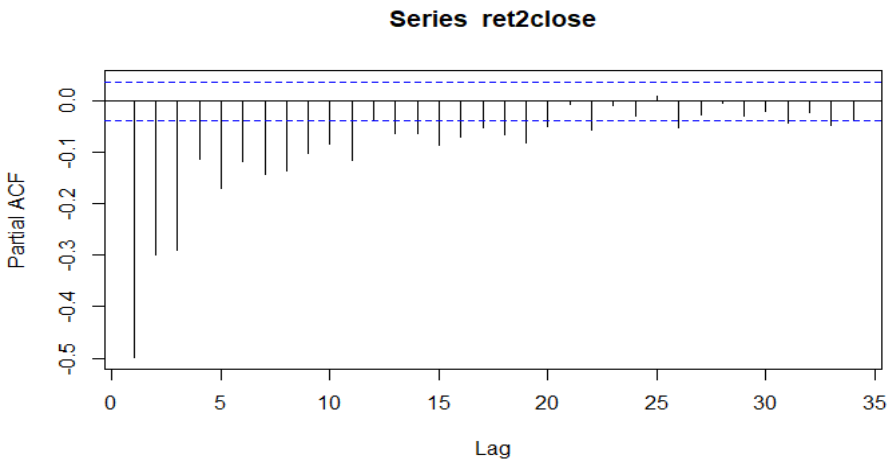
```
        Augmented Dickey-Fuller Test

data:  ret2close
Dickey-Fuller = -23.662, Lag order = 13, p-value = 0.01
alternative hypothesis: stationary
```

Auto-Correlation Factor (ACF) Plot



Partial Auto-Correlation Factor (PACF) Plot



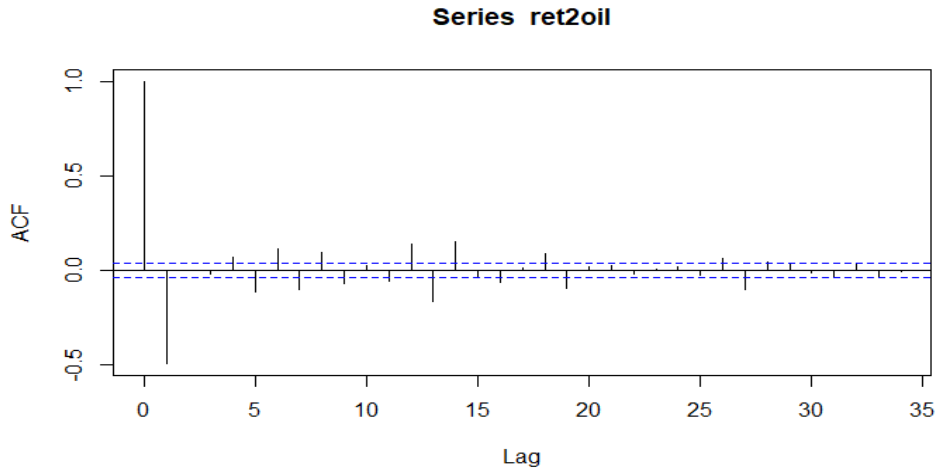
OPEC Basket:

Augmented Dickey Fuller (ADF Test)

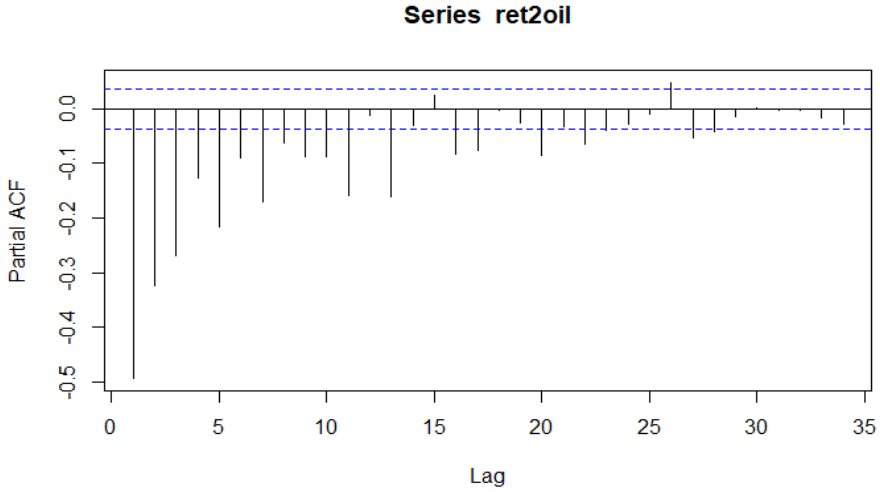
```
        Augmented Dickey-Fuller Test

data:  ret2oil
Dickey-Fuller = -24.648, Lag order = 13, p-value = 0.01
alternative hypothesis: stationary
```

Auto-Correlation Factor (ACF) Plot



Partial Auto-Correlation Factor (PACF) Plot



VAR ANALYSIS

```
VAR Estimation Results:
=========================
Endogenous variables: retoil, retclose
Deterministic variables: const
Sample size: 2737
Log Likelihood: 14328.814
Roots of the characteristic polynomial:
0.05547 0.04052
Call:
VAR(y = vardata, p = lag_selection2$selection[1], type = "const")


Estimation results for equation retoil:
=======================================
retoil = retoil.l1 + retclose.l1 + const

              Estimate  Std. Error t value Pr(>|t|)
retoil.l1    0.05433672  0.02031618   2.675  0.00753 **
retclose.l1 -0.01339676  0.04150291  -0.323  0.74688
const        0.00003136  0.00049784   0.063  0.94978
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1


Residual standard error: 0.02604 on 2734 degrees of freedom
Multiple R-Squared: 0.002753,   Adjusted R-squared: 0.002023
F-statistic: 3.774 on 2 and 2734 DF,  p-value: 0.02309
```

```
Estimation results for equation retclose:
=========================================
retclose = retoil.l1 + retclose.l1 + const

              Estimate Std. Error t value Pr(>|t|)
retoil.l1   -0.0011665  0.0099513  -0.117   0.9067
retclose.l1  0.0416468  0.0203290   2.049   0.0406 *
const       -0.0002242  0.0002439  -0.919   0.3580
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1


Residual standard error: 0.01275 on 2734 degrees of freedom
Multiple R-Squared: 0.001672,   Adjusted R-squared: 0.0009421
F-statistic:  2.29 on 2 and 2734 DF,  p-value: 0.1015



Covariance matrix of residuals:
            retoil  retclose
retoil   0.0006781 0.0001134
retclose 0.0001134 0.0001627

Correlation matrix of residuals:
         retoil retclose
retoil   1.0000   0.3416
retclose 0.3416   1.0000
```

Equation 1: retoil

Dependent Variable: retoil

Independent Variables: retoil.l1 (lagged value of retoil), retclose.l1 (lagged value of retclose), and a constant term.

- The coefficient of retoil.l1 is significant (p-value = 0.00753), suggesting that past values of retoil have a statistically significant effect on the current value of retoil.
- The coefficient for retclose.l1 is not significant (p-value = 0.74688), indicating that the lagged return of closing prices does not have a statistically significant impact on the return of oil prices.
- The constant term is not statistically significant, implying that there is no substantial baseline effect.

Model Fit:

R-squared: 0.002753, indicating that only a very small proportion of the variance in retoil is explained by the model.

F-statistic: Significant with a p-value of 0.02309, indicating that the overall model has some explanatory power, but it is weak.

Equation 2: retclose

Dependent Variable: retclose

Independent Variables: retoil.l1, retclose.l1, and a constant term.

- The coefficient of retclose.l1 is significant (p-value = 0.0406), indicating that past values of retclose have a statistically significant impact on the current value of retclose.
- The coefficient of retoil.l1 is not significant (p-value = 0.9067), meaning that past values of retoil do not have a significant effect on retclose.
- The constant term is again not significant.

Model Fit:

R-squared: 0.001672, showing that this model also explains a very small fraction of the variation in retclose.

F-statistic: Not significant (p-value = 0.1015), indicating a weak overall model fit.

Covariance and Correlation Matrices of Residuals

Covariance Matrix: Shows the variability of residuals and their covariances:

retoil: Variance is 0.0006781.

retclose: Variance is 0.0001627.

- The covariance between retoil and retclose is 0.0001134, suggesting a weak linear relationship.

Correlation Matrix: Shows the strength of the linear relationship between residuals.

- The correlation between retoil and retclose residuals is 0.3416, which indicates a moderate positive relationship.

Overall Interpretation

Significance: The model suggests that:

- retoil is influenced by its own past values, while retclose does not significantly affect it.
- retclose is also primarily influenced by its own past values, with no significant impact from retoil.

Predictive Power: Both equations have low R-squared values, implying limited predictive power.

Implication: The weak cross-dependency between retoil and retclose indicates that past oil returns and closing prices in this model do not significantly predict each other in a substantial way. The analysis implies that these time series may be driven more by their own past values than by each other.

TRANSFER FUNCTION MODEL:

For transfer function analysis, we use **two subsets of data**: one subset contain the **latest data** for OPEC basket and Tadawul Index (400 datapoints), and the other subset contains the **older data** for OPEC Basket and Tadawul Index (400 datapoints).

This can help us compare, and contrast the relation between oil price and stock price.

New data subset:

```
```{r}
newret2oil  <-head(ret2oil,400)
newret2close<-head(ret2close,400)

tf_model_new <- Arima(newret2close, xreg = newret2oil)
summary(tf_model_new)

```
```

```
Series: newret2close
Regression with ARIMA(0,0,0) errors

Coefficients:
      intercept    xreg
         0.0000  0.1514
s.e.     0.0006  0.0225

sigma^2 = 0.0001619:  log likelihood = 1179.18
AIC=-2352.35   AICc=-2352.29   BIC=-2340.38

Training set error measures:
                                      ME       RMSE         MAE      MPE     MAPE      MASE
Training set 0.00000000000000001482232 0.01269081 0.009279973 109.5085 152.1072 0.5631001
                    ACF1
Training set -0.4904572
```

- Intercept: The intercept is 0.0000 with a standard error of 0.0006, suggesting it is not statistically different from zero. This means that in the absence of a change in roil value, the baseline effect on close price is essentially zero.
- xreg (ret2oil): The coefficient for ret2oil is 0.1514, with a standard error of 0.0225. This coefficient represents the direct effect of oil on price close. A one-unit change in ret2oil is associated with a 0.1514 unit change in newret2close.
- The low standard error relative to the coefficient suggests this is a statistically significant relationship.
- Since the coefficient is positive, this means an increase in ret2oil generally results in an increase in newret2close.

Old Data subset:

```r
oldret2oil  <-tail(ret2oil,400)
oldret2close<-tail(ret2close,400)

tf_model_old <- Arima(oldret2close, xreg = oldret2oil)
summary(tf_model_old)
```

```
Series: oldret2close
Regression with ARIMA(0,0,0) errors

Coefficients:
      intercept    xreg
         0.0000  0.2853
s.e.     0.0009  0.0326

sigma^2 = 0.0003002:  log likelihood = 1055.63
AIC=-2105.26   AICc=-2105.19   BIC=-2093.28

Training set error measures:
                                      ME       RMSE        MAE     MPE     MAPE      MASE
Training set 0.000000000000000000005864274 0.01728342 0.01104913 74.7371 195.4172 0.5270668
                    ACF1
Training set -0.3766316
```

- Intercept: The intercept value is 0.0000 with a standard error of 0.0009. This essentially means that in the absence of any change in oldret2oil, there is no baseline change in oldret2close. Given the standard error, this intercept is not statistically different from zero.
- xreg (oldret2oil): The coefficient for oldret2oil is 0.2853 with a standard error of 0.0326. This positive coefficient suggests that a one-unit increase in oldret2oil is associated with a 0.2853 unit increase in oldret2close.
- The standard error is relatively small, which makes this estimate statistically significant, indicating that oldret2oil has a meaningful and direct effect on oldret2close.

Overall:

- The coefficient of the ‘reg’ for the transfer function of newer data points (newret2oil) is 0.1514 which is lesser than that of the older data points(oldret2oil).
- The lowering of coefficient shows that Saudi Arabia’s reliance on oil has reduced over the years.
- With plans such as Vision 2030 and bid to host FIFA world cup in future, Saudi Arabia plans to diversify to other industries such as communication, sports and tourism.

CONCLUSION

- **Stock-Oil Relationship:** The analysis indicates a strong correlation between Saudi Arabia’s stock market performance and fluctuations in global oil prices, highlighting the country's economic dependence on the oil sector.
- **Trend Analysis:** Visualizations show that significant drops in oil prices often correspond with downward movements in stock prices.
- **Reducing dependency on oil:** As an objective of Vision 2030 set by Mohammed bin Salman, Crown Prince of Saudi Arabia, Saudi aims to reduce dependency on oil and plans to diversify to other sectors such as Tourism, Finance and Sports.

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