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## THE IMPACT OF OIL PRICE VOLATILITY ON FINANCIAL PERFORMANCE OF SAUDI FIRMS

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**Abstract.** The research examines the effects of oil price volatility on the financial performance of oil corporations and focuses on financial metrics: Return on Assets (ROA), Net Profit Margin (NPM), and Gross Profit Margin (GPM). This work employs a panel data regression analysis from 2016 to 2023 to examine the effect of oil price fluctuations on these indicators during the pre-pandemic, pandemic, and post-pandemic phases. The research furthermore examines the impact of fluctuations in oil prices on firms within the oil and various non-oil industries. The initial research indicates a positive correlation between the increases in oil prices and the enhancements in ROA, NPM, and GPM. The declines in oil prices are inversely correlated with these numbers, especially in the short term. The pandemic period exposed peculiarities due to fluctuations in oil demand and prices, which impacted the overall financial status of enterprises throughout their respective sectors and demonstrated the efficacy of risk management methods. Firms in the oil sector demonstrated greater fluctuations in performance compared to those in other industries, attributable to changes in oil prices. The document identifies risk management issues, emphasizes optimal hedging and cost control practices, and highlights the significance of adapting to environmental and geopolitical changes for enterprises. These insights are beneficial for corporations and policymakers, as they emphasize the necessity of implementing sound financial management techniques to plan for swings in oil prices and broader economic shocks.

**Keywords:** financial performance; oil price; pandemic impact; volatility

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### 1. Introduction

Fluctuations in oil prices significantly impact both global and national economies, particularly in oil-dependent nations like Saudi Arabia, a prominent oil exporter, whose financial performance is inherently connected to global oil price trends (Elneel & AlMulhim, 2022). Price fluctuations can impact the financial stability of corporations, government income, and the overall economic landscape (Guo et al., 2024). This study aims to analyze the impacts of price fluctuations on Saudi businesses' financial activities by evaluating the 114 highest enterprises based on their market capitalization within the Saudi exchange (Tadawul). It also seeks to explore how COVID-19 has changed the effect of oil price volatility on corporate performance and whether oil-dependent firms are more affected by these fluctuations than diversified firms. Oil has also been the pillar of the economy of Saudi Arabia, responsible for the salient portion of its GDP and governmental income (Alley et al., 2014).

Fluctuations in oil prices can cause drastic fluctuations in the financial indicators of all firms in the industry, especially in oil-exporting countries (Moshiri, 2015). The impacts may vary according to a firm's exposure to

the oil market, diversification strategy, and ability to respond to changing economic circumstances. A decline in oil prices typically leads to lower revenues, reduced profitability, and an increased risk of financial distress (Shu et al., 2018). Firms with divergent investments are less likely to be affected by oil price shocks, as their revenues stream is not fully dependent on oil prices (Chen et al., 2017). The objective of this study is to explore these questions by analyzing the performance of these two types of businesses and how they respond to changes in global oil prices. The country's reliance on oil makes its financial market and businesses highly vulnerable to fluctuations in oil prices. High oil prices lead to increased government revenues for Saudi Arabia, which in turn boosts public sector spending and investment. However, in periods of falling oil prices, the economy suffers from budget deficits, reduced public spending and slowed growth (Shu et al., 2018).

Scholars have also studied the link between oil price fluctuations and financial performance in several contexts. Shu et al. (2018) studied the responsiveness of stock markets of Saudi Arabia and other oil-exporting countries in response to changes in oil prices. Their analysis reveals an inverse relation between changes in oil prices and stock-market performance in those economies. Cashin et al. (2016) used a Global Vector Auto-Regressive (GVAR) approach to demonstrate how fluctuations in oil prices affected the MENA region, with specificity for Saudi Arabia, given its reliance on oil exports. These studies underscore the sensitivity of oil-exporting economies like Saudi Arabia as they make it blameless to fluctuations in global oil prices.

Changes in oil prices also have direct impacts on enterprises and have an indirect influence on enterprises, from the adjustment of operational costs, production costs, and enterprise stability (Guo et al., 2024). In Saudi Arabia, many enterprises are dependent on oil; hence, changes in oil prices may affect oil-related as well as other sectors of the economy (Jawadi & Ftiti, 2019). For example, increased oil prices will lead to higher profitability for firms operating in the energy sector while simultaneously benefiting non-oil firms as the entire economy expands (Elneel & AlMulhim, 2022). However, in the face of dropping oil prices, firms face higher production costs, lower demand for oil products, and potential technical challenges (Kilian et al., 2009). This dynamic creates an environment where financial performances are interlocked with oil price volatility.

It led to an added layer of difficulty to the association between oil prices and business performance, complicating the relationship during the COVID-19 pandemic. Lockdowns, travel restrictions, and significantly weakened global demand led to unprecedented drops in oil prices in 2020, including a dramatic slide into negative territory for West Texas Intermediate (WTI) crude oil in April 2020 (Gharib et al., 2021). The price collapse was exacerbated by geopolitical tensions, notably the failure of discussions between Russia and OPEC. The pandemic disrupted global supply lines and resulted in a substantial decline in oil consumption, particularly affecting oil-exporting economies such as Saudi Arabia. These interruptions resulted in significant economic and financial consequences for both the public and commercial sectors (Yu et al., 2022). Nonetheless, the pandemic underscored the resilience of certain firms, especially those that had diversified their activities beyond reliance on oil.

As a significant oil exporter, Saudi Arabia and its firms' financial success is closely linked to fluctuations in international oil prices (Khamis et al., 2018). Nonetheless, the ways through which these movements affect business financial consequences and how these linkages may evolve due to recent global disruptions such as COVID-19 remain inadequately studied. While fluctuating prices have been linked to economic variations, the effect on Saudi firms remains an ambiguous subject of investigation, particularly prior to and during the coronavirus pandemic. Moreover, the effects of these volatility changes on mutually exclusive portfolios of oil-dependent and diverse enterprises have not been thoroughly analyzed, creating another substantial study gap. This study contributes to knowledge by identifying the risks facing Saudi firms owing to prospective fluctuations in global oil prices and the strategies they might implement to mitigate these risks. The study's recommendations are beneficial for investors seeking to assess the susceptibility of Saudi enterprises to volatile oil prices.

Current research seeks to substantially enhance the literature about deviations in oil prices and financial performance, particularly for Saudi Arabia. This study will enhance comprehension of the effects of oil price fluctuations on various firm types in Saudi Arabia by solving existing research gaps. The study encompasses the following objectives:

1. To examine the impact of global oil price fluctuations on the financial performance of the top 114 corporations ranked by market capitalization on the Saudi stock market.
2. To examine the fluctuations in the impact of oil price volatility on the firm's performance before and after the COVID-19 pandemic.
3. To analyze the effects of fluctuations in oil prices on oil-dependent vs diversified firms.

## 2. Literature Review

Over time, the oil industry has played a noteworthy role in the global financial boom. Scholars have been drawn to explore the implications of oil prices since they represent the most critical risk variables influencing alterations in a nation's economic framework (Gharib et al., 2021; Almasria et al., 2024). A multitude of studies have investigated the factors associated with oil charge fluctuations, which significantly influence macroeconomic indicators such as GDP growth rate, investment, stock market trends, and inflation, among others (Shu et al., 2018). The capital asset pricing model helps this phenomenon by proving a high-quality connection by establishing a robust correlation between risk, oil fluctuations, and impacts inside the financial system (Shu et al., 2018). Volatile oil prices, particularly during economic concerns, impact the firm's financial performance. Narayan and Narayan (2007) conducted an empirical investigation of the impact of oil price fluctuations on enterprises within the oil-dependent industry. It was determined that fluctuations in oil prices significantly impact firm profitability, as measured by Return on Assets (ROA) and Net Profit Margin (NPM), due to elevated and unpredictable operational costs. Zainal Abidin and Haseeb (2018) examined the adverse relationship between fluctuations and stock market returns using leveraged regression methods to illustrate the correlation.

Fluctuations in oil prices significantly affect enterprises, especially in oil-dependent countries, such as Saudi Arabia, due to their influence on production costs, operational expenses, and overall stability (Shu et al., 2018; Elneel & AlMulhim, 2022). Lee and Chang (2015) established that oil price shocks significantly impact oil-exporting nations' financial stability and profitability. In Saudi Arabia, where dependency on oil revenue is significant, fluctuations in its price affect corporate profitability. Nonetheless, volatility can generate risks that affect the overall economic landscape and market circumstances, particularly impacting enterprises in non-oil sectors (Lee & Chang, 2015). The oil-dependent economies are susceptible to external influences that impact price volatility, resulting in an uncertain business environment. Consequently, reducing dependence on oil was one of the most significant objectives of Saudi Arabia's Vision 2030.

A multitude of experts have investigated the intricate relationship between oil prices and the diverse economic factors influencing corporate operations. Ghalayini (2011) demonstrates that fluctuations in oil prices substantially impact a nation's GDP. The study's findings indicated non-linear and threshold effects of oil price fluctuations on economic growth (Elneel & AlMulhim, 2022). An increase in oil prices temporarily enhances a firm's profitability; nevertheless, the volatility of oil prices might diminish long-term profitability due to elevated operating expenses and risks. Firms reliant on oil are adversely affected by fluctuations in oil prices. Alaali (2020) suggested in his study that implementing risk management measures to mitigate or hedge against pricing risks can prevent these consequences.

The worldwide monetary disruption caused by the COVID-19 pandemic is the primary factor behind the severe impacts on oil prices and markets. Su et al. (2021) observed that the pandemic increased unemployment, a decline in stock market prices, and a significant decrease in oil prices. The volatility induced by the pandemic presented substantial challenges for policymakers and investors worldwide, impacting oil-exporting nations (Narayan, 2020; Yu et al., 2022). Yarovaya et al. (2021) have examined the relationship between oil price fluctuations and financial performance amidst the COVID-19 pandemic, focusing on the effects of market volatility on equity funds and the overall economic environment. They found a strong correlation suggesting that oil price volatility impacts macroeconomic performance through changes in production costs and subsequent consumer behaviour (Narayan, 2020).

Patel et al. (2021) highlighted the need for innovative approaches to protect vital sectors of the economy that depend on oil. COVID-19 reduced oil prices to historic lows in the oil markets. Producers had to pay buyers to

take excess oil, turning crude oil prices negative on April 21, 2020, leading to negative crude oil prices (Gharib et al., 2021). Ma et al. The collapse in negotiations between Russia and OPEC regarding the reduction of daily oil production is, indeed, an unusual and exceptional event (2021). In addition, as the pandemic caused a decline in oil consumption and its derivatives, the oil and petroleum products export-dependent Saudi economy was also affected by this business decline. On the contrary, the implications of COVID-19 highlighted the importance of corporate resilience, especially in the countries exporting oil, to adapt to unanticipated situations that might lead to economic turmoil. A study conducted by Yu, Guo and Chang (2022) showed that the pandemic increased oil price volatility and, therefore, increased financial pressure on corporations, especially those in the energy sector. Their study showed how firms with high operating risk associated with oil price uncertainty experienced serious erosion in financial performance, particularly in profitability (Yu et al., 2022). This was particularly evident in enterprises located in Saudi Arabia, as the nation depended significantly on oil sales, hence exacerbating the financial repercussions of the pandemic.

Although considerable research has examined the effects of oil price volatility on corporate performance in Saudi Arabia, several significant areas and elements remain unexplored (Shu et al. 2018; Narayan, 2020). A limited number of studies have investigated the correlation between oil price volatility and financial performance, while the bulk have focused on the relationship between oil prices and stock markets. One main reason for this is that most of the early studies did not differentiate between oil-dependent and diversified firms when discussing oil price volatility (Shu et al., 2018). Therefore, there is a great need for extensive research to study the financial performance of all firms that are affected by oil price fluctuations.

The literature review discussed this point in detail, and as a conclusion, let us summarize it by saying that higher oil prices may benefit oil-producing parties, but the volatility of oil prices constitutes major risks. The cash flow strains could increase during uncertain events such as COVID-19, subsequently affecting revenue outlooks further. Corporate financial performance is moderated by government budgeting and fiscal measures concerning oil price volatility. Recent literature suggests that economic diversity protects for the detrimental effects of oil price variation on financial performance. Thus, the dip in oil prices harms oil production firms, while the rise benefits them in the short term. However, for long-term financial stability, firms need to implement effective risk management and business diversification to maintain consistent financial stability.

### 3. Methodology

The current study investigates the financial performance of 114 leading business entities listed on the Saudi Stock Exchange (Tadawul) ranked by their market capitalization. Data as of 2016-2023 is used to evaluate financial performance across several years of different business and economic conditions, including the COVID-19 crisis. This study's secondary data is collected from several websites including the Tadawul Website, IMF, SAMA, EIA, and World Bank.

#### 3.1 Variables

A comprehensive set of variables was utilized to assess the impact of oil price deviations on Saudi Arabian firms. These variables provide a broader overview of the economy — both in terms of the macroeconomic variables as well as the variables pertaining to specific segments of the economy. Table 1 provides a general overview of each variable.

**Table 1.** Description of Variables

| Variable Names                       | Description                                                                                                              |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| ROA                                  | Profitability is assessed in relation to total assets in the dependent variable.                                         |
| NPM                                  | The dependent variable denotes the proportion of revenue that is converted into profit.                                  |
| GPM (Gross Profit Margin)            | The dependent variable represents the proportion of revenue that exceeds the cost of products sold.                      |
| OP (Oil Prices)                      | The crude oil price during the study years is represented by the independent variable.                                   |
| Volatility                           | The independent variable captures the fluctuations in crude oil prices over time.                                        |
| DV1 (Pre-, Post- or Pandemic Period) | The dummy variable represents the three COVID phases: Pre-, During, and Post-COVID.                                      |
| DV2 (Sector Type)                    | The dummy variable represents whether the firm is in the oil sector (1) or non-oil sector (0).                           |
| $OP \times DV1$                      | The interaction term quantifies the impact of fluctuations in oil prices across various stages of the COVID-19 pandemic. |
| $OP \times DV2$                      | The interaction term quantifies the impact of oil price fluctuations on sectors (oil-reliant versus non-oil).            |

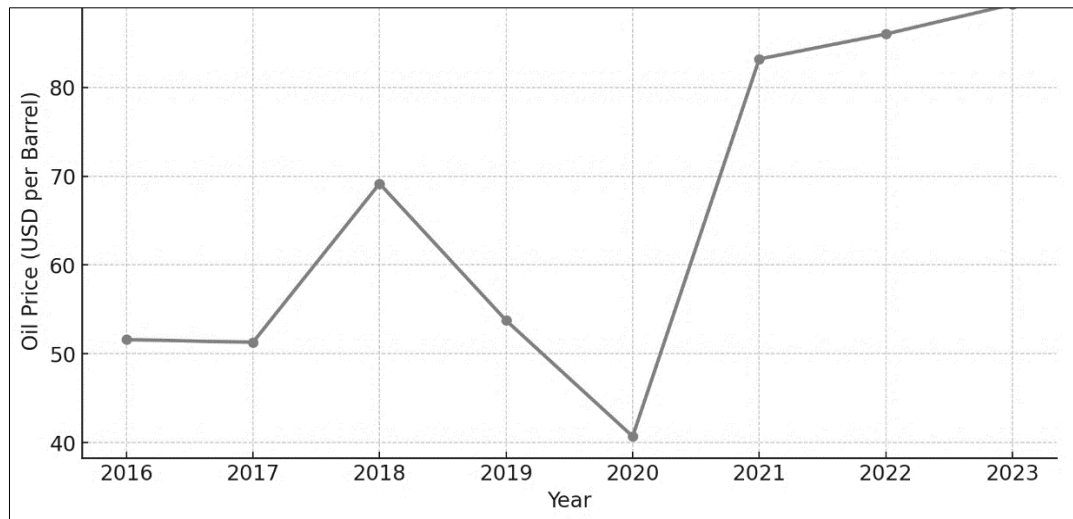
Current research includes “ROA”, “NPM”, and “GPM”, which are important measures to determine the financial performance of Saudi Arabian firms. These variables were chosen to reflect various dimensions of a firm’s profitability and productivity, which are susceptible to changes in oil prices, particularly in Saudi Arabia, which is an oil-exporting country.

ROA signifies how asset-efficiently a firm generates profit. ROA illustrates how effectively the firm uses its asset base to drive earnings. Previously, research has shown drastic changes in oil prices affecting ROA in oil-exporting countries. Ali and Shaik (2022) state that the fluctuations in ROA are relatively high in the case of firms within the Saudi oil sector, indicating how much oil price changes affect firms' profitability.

An essential financial performance measure is the Net Profit Margin (NPM), which shows relatively how much profit from sales remains after subtracting all costs. Filis (2010) elaborated on how oil price shocks can influence operating profit margins to leave high and fluctuating rates for those firms which are dependent on oil. The knowledge and understanding of how much sales change due to oil price changes affect the firms' viability, be they oil or non-oil firms in Saudi Arabia, is gained from NPM.

GPM is an important ratio that indicates, in general, the profitability of a firm and how efficiently it earns gross profit from its sales. GPM would develop valuable conclusions as to how price changes in oil can be reflected in the cost structure of production in firms. As Papapetrou (2001) states, the price of oil is a key factor that impacts the gross margin ratio of firms in oil-dependent economies, as it determines the production costs for many firms in such economies.

The current research is basically about annual average prices of "West Texas Intermediate (WTI)," considered as a global rustic structure for oil pricing. That's why changes in oil prices will reflect naturally on revenues, costs, and profits of firms, especially those falling within the oil industry itself. For a wholesome perspective regarding Saudi Arabia's economy, viewing WTI price as an independent variable is needed to understand how global oil price changes would critically affect firms in this economy. Former studies like Kilian (2009) and Ali and Shaik (2022) have arrived at similar conclusions about oil prices directly affecting firm performance, especially in oil-dependent economies. The trend of oil prices from 2016 to 2023 is illustrated in Figure 1 below. The fluctuations in oil prices across this period reflect key economic and geopolitical events.



**Figure 1.** Trend of Oil Prices from 2016 to 2023

The examination also introduces COVID-19 period dummy variable (DV1) for the assessment of a pandemic like COVID-19 towards financial performance. This variable is categorized into three stages: Pre-COVID, During COVID, and Post-COVID. The utmost importance is attached to the inclusion of this dummy variable in order to assess the impact that COVID-19 had on the oil market since it redefined oil prices as it came about by suddenly collapsing in demand and supply. Sheng et al. (2023) discussed the significance of inflation and financial distress during times of cataclysm, such as in the case of the COVID-19 pandemic, in relation to financial markets, oil, and other such sectors. It becomes necessary to include this variable as it allows the last assessment to be more sophisticated in terms of the various stages of the pandemic reflections phase-by-phase, as shown in the title of this study.

A dummy variable is used to differentiate firms based on their sector for sector-specific oil price analysis such that '0' represents the oil industry and '1' identifies the non-oil sector. The oil industry's revenue and profits are closely tied to oil prices, making it more vulnerable to price fluctuations. These price changes have asymmetric impacts on oil and non-oil sectors, indicated by the research conducted by Hamilton (2009), whereby oil-sensitive firms are more reactive relative to these changes.

The term, which comes from the multiplication of  $OP_{it}$  by DV1, assesses the impact during the COVID-19 period. It assesses whether fluctuations in oil price volatility have had more or less impact on different phases of the pandemic on firm's financial performance. To illustrate, it is likely that oil price reduction in early COVID-19 hits oil-dependent firms more than those in the non-oil sector. Conversely, during the post-COVID period, rising oil prices would probably have a lesser effect on the oil sector due to uncertainty in the economy. This term captures the phenomena of the pandemic and oil prices together, making the economy more complex during the period under investigation. The research by Filis (2010) and Kilian (2009) states that the synergy between oil price shocks and industries is important for understanding their compounded effects through the pandemic and the volatility of oil prices.

The other interaction term,  $Oil\ Prices \times DV2$ , assesses the impact of oil price fluctuations on firms in oil and non-oil industries differently. This term helps determine whether oil price variation has a relatively clearer effect on oil sector firms than on others, where effects could be more ambiguous. The literature usually states that revenue generally increases in oil firms when prices rise; for non-oil firms, revenues may decline because of higher production costs or demand for their products or services, as cited by other studies earlier.

The last volatile element is the volatility of oil prices, which is a key factor in determining market risk and uncertainty. Through oil price volatility, instability in the oil markets eventually leads to the financial instability of the organization. As studied by Chen et al. (2017), oil price volatilities impact firm financial resilience, which

finds that increased volatility escalates financial risk, especially relevant to oil-dependent economies like Saudi Arabia.

### 3.2 Pre- Diagnostic test

This is the first step used to test the panel data and determine whether they are stationary or non-stationary with unit roots. Fisher's unit root test is often employed for its ability to assess the variability within panel data. Unlike other tests that assume each panel has a single unit root, the Fisher test acknowledges that each panel may have distinct characteristics. This test incorporates the Augmented Dickey-Fuller (ADF) test. The null hypothesis of the Fisher test assumes that each panel has a unit root, implying non-stationarity. If the probability value is less than 0.05, the test rejects the null hypothesis (H0), indicating that the panel data is stationary (Maddala & Wu, 1999).

This study utilizes correlation analysis and the Variance Inflation Factor (VIF) to identify and address multicollinearity, which occurs when two or more predictors are highly correlated in a regression model. Extreme multicollinearity can obscure the ability to assess the impact of individual independent variables in the model. Typically, a VIF value greater than 10 suggests significant multicollinearity, meaning that certain variables may need to be removed or the model adjusted. VIF values range from one to higher values, with values above five indicating substantial multicollinearity. If the VIF exceeds 10, corrective measures should be taken to ensure the regression results remain meaningful (O'Brien, 2007; Kennedy, 2008).

$$VIF = \frac{1}{1 - R_i^2}$$

### 3.3 Research Design

The research uses random effects regression models to analyze the fluctuations in oil prices and their impact on Saudi Arabian firms. The study utilizes panel data from 2016 to 2023, focusing on the 114 largest firms listed on the Saudi Stock Exchange, Tadawul. Two models, consisting of three equations, represent different dimensions of financial performance: "ROA," "NPM," and "GPM." The first regression model assesses the effect of oil price volatility on the financial growth of these firms during the pre-COVID and post-COVID periods, particularly within the context of the pandemic. The second model explores the impact of the oil and non-oil sectors on firms' financial performance, providing a detailed view of how the pandemic influenced firms in both sectors. Both models incorporate random effects to capture unobserved heterogeneity among the firms, facilitating a thorough investigation of how deviations in oil prices impact the financial behaviour of firms across various sectors and time periods.

The following hypotheses have been formulated to examine the impact of oil price fluctuations on the financial stability of major firms in Saudi Arabia:

*H1: Oil price fluctuations significantly affect the financial performance of leading firms in Saudi Arabia.*

*H2: The impact of oil price fluctuations on financial performance varies significantly between the pre-COVID, COVID-19, and post-COVID-19 periods.*

*H3: The effect of oil price fluctuations on financial performance differs significantly between oil-dependent and diversified firms.*

### 3.4 Regression Model

The analysis utilizes a random effects regression model to evaluate the impact of oil price fluctuations on the performance of Saudi Arabian firms. Annual data spanning from 2016 to 2023 for 114 firms listed on the Saudi Stock Exchange is used to explore the directional and proportional effects on key financial metrics. The random effects model is well-suited for panel data analysis as it captures both the cross-sectional and temporal elements of the data while addressing unobserved variation among individual firms (Baltagi, 2008).

The model assumes that individual effects are stochastic and uncorrelated with the explanatory variables, which is critical when examining multiple firms across a series of years in a panel dataset (Wooldridge, 2010). This

approach is advantageous because it leverages both intra-firm and inter-firm variation to generate more reliable estimates. This framework is particularly valuable as it enables the researcher to control for unobservable firm-specific characteristics, such as management quality or corporate governance, that could influence financial performance. It is especially useful when assessing the financial outcomes of firms in the oil and non-oil sectors. By using the random effects model, this study provides a comprehensive analysis of the relationship between oil price volatility and financial performance, offering insight into how fluctuations in oil prices impact Saudi firms that are either dependent on or independent of oil.

The general equation for the random effects model in this study is as follows:

$$Y_{it} = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \mu_i + \varepsilon_{it}$$

Where:

- $Y_{it}$  represents the financial performance indicators (ROA, NPM, or GPM) of the firm.
- $X_1, X_2, X_3, X_4$  represents the independent variables.
- $\mu_i$  is the unobserved random effect (firm-specific component),
- $\varepsilon_{it}$  is the error term.

#### 4. Results and Discussion

The descriptive statistics provide a summarized overview of the dataset, focusing on variables such as ROA, GPM, NPM, Volatility, and OP. The average ROA is 2%, with a standard deviation of 0.07, indicating moderate variation across firms. The ROA ranges from -14% to 14%, showing a broad spectrum of performance. GPM has an average of 19.8% but a wide standard deviation of 21.98%, indicating significant variability in profitability, with some firms showing losses while others achieve up to 65.5% profitability. Similarly, Net Profit Margin (NPM) averages 4.5%, with a range from -52.8% to 44.2%, revealing substantial differences in profitability. Volatility averages 27.02%, with values ranging from 12.6% to 45.8%, reflecting notable fluctuations in performance. Operating Profit (OP) has an average of 232.17 units, with a standard deviation of 64.41, indicating significant variation, ranging from 147.41 to 354.12 units (see Table 2). Overall, the dataset highlights considerable disparities in financial performance, with notable variability in profitability, volatility, and operating profits among the firms.

**Table 2.** Results of Descriptive Statistics

| Variable   | Obs. | Mean   | Std. Dev. | Min    | Max    |
|------------|------|--------|-----------|--------|--------|
| ROA        | 919  | 0.02   | 0.07      | -0.14  | 0.14   |
| GPM        | 864  | 19.77  | 21.98     | -24.49 | 65.52  |
| NPM        | 912  | 4.47   | 21.83     | -52.81 | 44.17  |
| Volatility | 920  | 27.02  | 10.88     | 12.63  | 45.76  |
| OP         | 920  | 232.17 | 64.41     | 147.41 | 354.12 |

The unit root test results show that the data is stationary, as the p-value is below 5%, leading to the rejection of the null hypothesis. The full results of the unit root test are presented in Table 3.

**Table 3.** Unit Root Results

| Variables  | z-statistic | p-value |
|------------|-------------|---------|
| ROA        | -6.2007     | 0.000*  |
| NPM        | -5.3142     | 0.000*  |
| GPM        | -4.3506     | 0.000*  |
| OP         | -8.18       | 0.000*  |
| Volatility | -11.17      | 0.000*  |

Note: \* indicate the level of significance at a 5% confidence interval.

The correlation matrix shows the interrelationships among the financial variables, including "ROA," "NPM," "GPM," and "Oil Price." The correlation between ROA and GPM is moderate (0.5008), suggesting that firms with higher GPM tend to have better asset utilization. The correlation between ROA and NPM is stronger (0.7519), implying that firms with efficient asset utilization also exhibit higher net profit margins. The

correlation between ROA and Volatility (0.0772) is weakly positive, suggesting a slight increase in volatility as asset returns rise, though the relationship is marginal. The correlation between ROA and OP is weakly negative (-0.0568), indicating a very slight inverse relationship. GPM and NPM are strongly positively correlated (0.6753), implying that higher gross margins tend to coincide with better net margins. The correlation between Volatility and OP is moderate (0.3248), indicating a positive relationship (see Table 4). Overall, these correlations suggest moderate to weak associations among the variables, with no significant concerns regarding multicollinearity.

**Table 4.** Correlation Matrix

| Correlation Matrix | ROA     | GPM     | NPM    | Volatility | OP |
|--------------------|---------|---------|--------|------------|----|
| ROA                | 1       |         |        |            |    |
| GPM                | 0.5008* | 1       |        |            |    |
| NPM                | 0.7519* | 0.6753* | 1      |            |    |
| Volatility         | 0.0772* | -0.0562 | -0.06* | 1          |    |
| OP                 | -0.0568 | 0.0141  | -0.024 | 0.3248*    | 1  |

A VIF of 1 indicates minimal multicollinearity, and values between 1 and 5 are generally acceptable, while values exceeding 5 or 10 may indicate potential multicollinearity, especially if the VIF surpasses 10 (O'Brien, 2007). The lack of strong correlations among the independent variables is favourable for the stability and reliability of the model. The mean VIF of 1.48 suggests that the model is appropriately specified, and multicollinearity is not a significant issue (see Table 5).

**Table 5.** VIF and 1/VIF of 1

| Variable   | VIF  | 1/VIF    |
|------------|------|----------|
| NPM        | 1.84 | 0.542149 |
| GPM        | 1.84 | 0.542545 |
| Volatility | 1.12 | 0.89288  |
| OP         | 1.12 | 0.895272 |
| Mean VIF   | 1.48 |          |

In 1978, Hausman developed the Hausman specification test to distinguish between panel data models that use fixed effects and those using random effects. This test assumes there are no substantial differences between the estimators of the fixed and random-effect models. The formula for the Hausman test statistics is as follows:

$$H = (\beta_{RE} - \beta_{FE})' \sum^{-1} (\beta_{RE} - \beta_{FE}) \sim \chi^2(k)$$

The following hypotheses for this test are presented below:

H0: *The Random effect model is appropriate.*

$$Cov(\mu_i, x_{it}) = 0$$

H1: *The Fixed effect model is appropriate.*

$$Cov(\mu_i, x_{it}) \neq 0$$

H0 is rejected if the p-value is less than 0.05; otherwise, it is accepted. The random effect model is appropriate in our situation, as the "p-value" is plainly greater than 0.05, indicating that H0 is accepted.

#### 4.1 Models

In the Random Effects model, financial performance is assessed using the dependent variables "ROA," "NPM," and "GPM." The independent variables include oil price, volatility, a dummy variable (DV1) indicating the pre-pandemic, during, or post-pandemic period, a dummy variable (DV2) distinguishing between the oil and non-oil sectors, and the interaction term between oil prices and the dummy variables. A random effects regression model is applied to the panel dataset. Model 1 consists of three equations to analyze the impact of oil price fluctuations on corporate financial performance, using ROA, NPM, and GPM as the performance indicators.

The subsequent equations are employed in Model 1:

$$ROA_{it} = \alpha + \beta_1 OP + \beta_2 Volatility_{it} + \beta_3 DV1_{it} + \beta_4 DV1 * OP_{it} + \mu_i + \varepsilon_{it} \dots\dots\dots 1$$

$$NPM_{it} = \alpha + \beta_1 OP + \beta_2 Volatility_{it} + \beta_3 DV1_{it} + \beta_4 DV1 * OP_{it} + \mu_i + \varepsilon_{it} \dots\dots\dots 2$$

$$GPM_{it} = \alpha + \beta_1 OP + \beta_2 Volatility_{it} + \beta_3 DV1_{it} + \beta_4 DV1 * OP_{it} + \mu_i + \varepsilon_{it} \dots\dots\dots 3$$

The results from the random effects model equation 1, shown in Table 6 below, support Hypothesis *H1: Oil price fluctuations significantly affect the financial performance of leading firms in Saudi Arabia* and Hypothesis *H2: The impact of oil price fluctuations on financial performance varies significantly between the pre-COVID, COVID-19, and post-COVID-19 periods*. These findings align with the study by Wattanatorn and Kanchanapoom (2012), which illustrates that oil prices have a significant influence on accounting performance measures like ROA, particularly within the energy sector. The p-value of 0.001 and a coefficient of -0.0002 for oil price (OP) suggest a negative relationship between oil price and ROA. This indicates that for every unit increase in oil price, ROA decreases by 0.0002 units, highlighting the negative impact on financial performance as measured by ROA. Volatility has a coefficient of -0.0004, with a p-value of 0.023, indicating that volatility negatively affects ROA. The coefficient for the interaction term between oil price and DV1 is 0.0002, with a significant p-value of 0.00, suggesting a positive relationship between oil price fluctuations and financial performance. The model's overall significance is confirmed by a Prob>chi<sup>2</sup> value of 0.000.

**Table 6.** Random Effect Model Equation 1 Results

| ROA                   | Coef.    | Robust Std. Err. | Z     | P> z     |
|-----------------------|----------|------------------|-------|----------|
| OP                    | -0.0002  | 0.000            | -3.41 | 0.001*** |
| Volatility            | -0.0004  | 0.000            | -2.27 | 0.023*** |
| DV1                   | -0.0535  | 0.009            | -6    | 0.000*** |
| OPDV1                 | 0.0002   | 0.000            | 5.14  | 0.00***  |
| _cons                 | 0.0756   | 0.014            | 5.6   | 0.00***  |
| sigma_u               | 0.0471   |                  |       |          |
| sigma_e               | 0.0458   |                  |       |          |
| Rho                   | 0.5139   |                  |       |          |
| Wald chi <sup>2</sup> | 53.42    |                  |       |          |
| Prob>chi <sup>2</sup> | 0.000*** |                  |       |          |

Note: \*\*\* specifies a significance level at a 1% confidence interval

The Random Effects model for equation 2 uses Net Profit Margin (NPM) as the dependent variable to assess financial performance. The independent variables include oil price, volatility, a Dummy Variable (DV1) indicating the pre-pandemic, during, or post-pandemic period, and the interaction term between oil prices and the dummy variable. The regression results for Equation 2 are presented in Table 7 below. The coefficient for oil price (OP) is -0.0421 with a p-value of 0.07, suggesting a negative relationship between oil price fluctuations and NPM, though the relationship is not statistically significant at the 5% level. Volatility, with a coefficient of -0.126 and a p-value of 0.014, is statistically significant at the 5% level, indicating that volatility negatively impacts NPM. The variable DV1 has a coefficient of -13.66 with a p-value of 0.001, indicating a significant negative effect on NPM. The interaction term OPDV1 has a coefficient of 0.0471 and a p-value of 0.003, showing a significant moderating effect and a positive impact on financial performance due to the interaction between DV1 and oil price fluctuations. The overall model's statistical significance is confirmed by a Prob>chi<sup>2</sup> value of 0.000.

**Table 7.** Random Effect Model Equation 2 Results

| NPM                   | Coef.    | Robust Std. Err. | Z     | P> z     |
|-----------------------|----------|------------------|-------|----------|
| OP                    | -0.0421  | 0.023            | -1.81 | 0.07*    |
| Volatility            | -0.1260  | 0.051            | -2.45 | 0.014**  |
| DV1                   | -13.662  | 4.026            | -3.39 | 0.001*** |
| OPDV1                 | 0.0471   | 0.016            | 2.93  | 0.003*** |
| _cons                 | 18.309   | 5.270            | 3.47  | 0.001*** |
| sigma_u               | 15.480   |                  |       |          |
| sigma_e               | 14.910   |                  |       |          |
| Rho                   | 0.518    |                  |       |          |
| Wald chi <sup>2</sup> | 33.40    |                  |       |          |
| Prob>chi <sup>2</sup> | 0.000*** |                  |       |          |

Note: \*\*\*, \*\*, \* indicates a significance level at a 1%, 5% and 10% confidence interval respectively

The results for equation 3 from the random effects model are shown in Table 8 below, illustrating the relationship between oil price fluctuations and the financial performance (GPM) of major Saudi Arabian firms. The coefficient for OP is -0.029 with a p-value of 0.182, suggesting that GPM decreases by 0.029 units for each unit increase in oil price. Volatility has a negative impact on GPM, with a coefficient of -0.141 and a p-value of 0.005, both statistically significant at the 5% level. DV1 negatively impacts financial performance, with a coefficient of -9.135 and a p-value of 0.016. The coefficient for the interaction term between oil price and DV1 (OPDV1) is 0.0356 with a p-value of 0.023, indicating that oil price fluctuations positively impact GPM. The constant term (cons) is significant with a p-value of 0.000, and the overall model's statistical significance is confirmed by a Prob>chi<sup>2</sup> value of 0.000.

**Table 8.** Random Effect Model Equation 3 Results

| GPM                   | Coef.    | Robust Std. Err. | Z     | P> z     |
|-----------------------|----------|------------------|-------|----------|
| OP                    | -0.0295  | 0.0221           | -1.33 | 0.182    |
| Volatility            | -0.14198 | 0.0501           | -2.83 | 0.005*** |
| DV1                   | -9.135   | 3.7979           | -2.41 | 0.016**  |
| OPDV1                 | 0.0356   | 0.0157           | 2.27  | 0.023**  |
| _cons                 | 29.399   | 4.774            | 6.16  | 0.000*** |
| sigma_u               | 17.761   |                  |       |          |
| sigma_e               | 13.451   |                  |       |          |
| Rho                   | 0.6354   |                  |       |          |
| Wald chi <sup>2</sup> | 17.02    |                  |       |          |
| Prob>chi <sup>2</sup> | 0.000    |                  |       |          |

Note: \*\*\*, \*\*, \* indicates a significance level at a 1%, 5% and 10% confidence interval respectively

Model 2 comprises three equations to observe the impact of oil prices on financial performance. The dependent variables of the equations are ROA, NPM, and GPM, which are the performance indicators of the firms, and the independent variables are oil price, volatility, dummy variable DV2, which shows the oil and non-oil sectors, and the interaction term of OP and dummy variable. Prior studies have also elucidated that oil-reliant firms are prone to financial difficulties because of fluctuations in oil prices. For instance, Shaeri, Adaoglu, and Katircioglu (2016) explored how oil price hikes act differently for firms based on their sectors. They also found that oil-dependent firms, especially in the energy sector, are more sensitive to oil price changes, while non-oil diversified firms are less affected by these fluctuations, describing a significant difference in financial performance between the oil and non-oil sectors. This corresponds well to our hypothesis that the sensitivities of oil price fluctuations to financial performance vary dramatically across oil-dependent and diversified firms. Thus, the model viably explains the *H3: The effect of oil price fluctuations on financial performance differs significantly between oil-dependent and diversified firms.*

The following are the equations mentioned below:

$$ROA_{it} = \alpha + \beta_1 OP + \beta_2 Volatility_{it} + \beta_3 DV2_{it} + \beta_4 DV2 * OP_{it} + \mu_i + \varepsilon_{it} \dots \dots \dots 4$$

$$NPM_{it} = \alpha + \beta_1 OP + \beta_2 Volatility_{it} + \beta_3 DV2_{it} + \beta_4 DV2 * OP_{it} + \mu_i + \varepsilon_{it} \dots \dots \dots 5$$

$$GPM_{it} = \alpha + \beta_1 OP + \beta_2 Volatility_{it} + \beta_3 DV1_{it} + \beta_4 DV2 * OP_{it} + \mu_i + \varepsilon_{it} \dots \dots \dots 6$$

The random effects regression results reveal the relationships between the financial performance (ROA) and several explanatory variables, including oil prices (OP), volatility, and firm diversification (DV2), as well as their interaction (OPDV2). The coefficient for oil prices (OP) is -0.0002, and statistically meaningful at the 5% level ( $p = 0.001$ ), representing that oil price fluctuations adversely impact ROA. Similarly, volatility has a negative coefficient of -0.0003, with a p-value of 0.023, suggesting that volatility also significantly reduces ROA. The coefficient for DV2 (firm diversification) is -0.0535, with a p-value of 0.00, showing an adverse relationship with ROA. The interaction term, OPDV2, has a positive coefficient of 0.0002, and is statistically significant ( $p = 0.00$ ), suggesting that it mitigates the negative impact on ROA. The constant term ( $\_cons$ ) coefficient is 0.07564, with a p-value of 0.000, indicating statistical significance at the 1% level. The Prob>chi<sup>2</sup> is 0.000, indicating the significance of the overall model (see Table 9).

**Table 9.** Random Effect Model Equation 4 Results

| ROA                    | Coef.    | Robust Std. Err. | Z     | P> z     |
|------------------------|----------|------------------|-------|----------|
| OP                     | -0.0002  | 0.0001           | -3.41 | 0.001*** |
| Volatility             | -0.0003  | 0.0002           | -2.27 | 0.023**  |
| DV2                    | -0.0535  | 0.0089           | -6    | 0.000*** |
| OPDV2                  | 0.0001   | 0.0000           | 5.14  | 0.000*** |
| $\_cons$               | 0.0756   | 0.0135           | 5.6   | 0.000*** |
| sigma_u                | 0.0471   |                  |       |          |
| sigma_e                | 0.0458   |                  |       |          |
| Rho                    | 0.5139   |                  |       |          |
| Wald-chi <sup>2</sup>  | 20.03    |                  |       |          |
| Prob> chi <sup>2</sup> | 0.000*8* |                  |       |          |

Note: \*\*\*, \*\*, \* indicates a significance level at a 1%, 5% and 10% confidence interval respectively

Table 10 shows the relationships between various variables and their impact on Net Profit Margin (NPM), which serves as a measure of financial performance in this research. The coefficient for OP (oil price fluctuations) is 0.063, and a p-value of 0.142 suggests that oil price fluctuations have an insignificant direct relationship with NPM. Volatility, however, shows a significant negative relationship with NPM, with a coefficient of -0.137, and a p-value of 0.01, demonstrating that higher volatility is linked with a lower NPM. Similarly, the interaction term OPDV2 has a coefficient of -0.069 and a p-value of 0.113, suggesting that the combined effect of oil prices and the dummy variable on NPM is negatively insignificant. The model's constant term ( $\_cons$ ) is negative and has an insignificant p-value. The overall model's significance is evident by Prob>chi<sup>2</sup> = 0.000.

**Table 10.** Random Effect Model Equation 5 Results

| NPM                   | Coef.    | Robust Std. Err. | Z     | P> z    |
|-----------------------|----------|------------------|-------|---------|
| OP                    | 0.063    | 0.0427           | 1.47  | 0.142   |
| Volatility            | -0.137   | 0.0532           | -2.58 | 0.01*** |
| DV2                   | 10.545   | 14.321           | 0.74  | 0.462   |
| OPDV2                 | -0.069   | 0.0436           | -1.58 | 0.113   |
| $\_cons$              | -1.477   | 14.0940          | -0.1  | 0.917   |
| sigma_u               | 15.487   |                  |       |         |
| sigma_e               | 15.088   |                  |       |         |
| Rho                   | 0.513    |                  |       |         |
| Wald-chi <sup>2</sup> | 14.65    |                  |       |         |
| Prob>chi <sup>2</sup> | 0.000*** |                  |       |         |

Note: \*\*\*, \*\*, \* indicates a significance level at a 1%, 5% and 10% confidence interval respectively

Only volatility is of statistical importance in the model, according to Table 11's results. With a coefficient of -0.1251 and a p-value of 0.013, volatility and GPM have a significant negative relationship, suggesting that increased volatility in the oil price lowers GPM. With a p-value of 0.648 and a positive coefficient of 0.015, the interaction term OPDV2 suggests a negligible inverse relationship with GPM. There is statistical significance in the entire model.

**Table 11.** Random Effect Model Equation 6 Results

| GPM                   | Coef.    | Robust Std. Err. | Z     | P> z     |
|-----------------------|----------|------------------|-------|----------|
| OP                    | -0.003   | 0.0327           | -0.11 | 0.913    |
| Volatility            | -0.125   | 0.0503           | -2.48 | 0.013**  |
| DV2                   | -14.42   | 10.143           | -1.42 | 0.155    |
| OPDV2                 | 0.0153   | 0.0335           | 0.46  | 0.648    |
| _cons                 | 33.606   | 9.884            | 3.4   | 0.001*** |
| sigma_u               | 17.732   |                  |       |          |
| sigma_e               | 13.518   |                  |       |          |
| Rho                   | 0.6324   |                  |       |          |
| Wald-chi <sup>2</sup> | 10.79    |                  |       |          |
| Prob-chi <sup>2</sup> | 0.000*** |                  |       |          |

## 5. Research Limitations

Despite the durability of the analysis done for the study, there are certain limitations. First, the database is only for publicly traded firms on the Tadawul (Saudi Stock Exchange), thus neglecting the financial performance of private entities or multinational corporations operating in Saudi Arabia. Second, some external macroeconomic factors, such as inflation and interest rates, may influence financial performance, but they were not controlled for in the model. Tackling these limitations would further clarify how oil price volatility impacts financial performance in future studies.

## 6. Conclusion

Fluctuations in oil prices significantly influence financial performance, especially in oil-exporting nations like Saudi Arabia. The study indicates a strong correlation between oil price volatility and key performance metrics (ROA, NPM, and GPM), with oil-dependent firms experiencing a more apparent negative impact. Random effects models confirm that profitability diminishes with oil price fluctuations, emphasizing the sensitivity of oil-centric enterprises.

The results support Hypothesis *H1*, demonstrating a significant negative effect of oil prices on financial performance, particularly during the COVID-19 period (Hypothesis *H2*). Diversification emerges as a relieving factor, as diversified firms are better equipped to manage oil price volatility (Hypothesis *H3*). Furthermore, fluctuations in oil prices disturb investor confidence, markets stability, and negatively affect profitability.

The study contributes novel insights into the impact of oil price volatility on Saudi firms in different sectors, and analyzing the effects pre, during, and post the COVID-19 pandemic. Unlike existing literature focusing more on stock reactions to oil price changes, this study further assesses firm-level performance indicators alongside the diversified nature of operations of the firms studied. The study results corroborate those of Shu et al. (2018) and Elneel & AlMulhim (2022), which state that oil price volatility and financial performance have a strong correlation; however, this study takes it a step further and demonstrates that diversified firms tend to be more immune to oil price shocks than oil-dependent firms. These findings are especially pertinent for investors and policymakers concerned with the financial implications of oil price volatility.

Ultimately, fluctuations in oil prices should be regarded as a significant determinant for oil-dependent Saudi enterprises. The volatility in oil prices presents issues related to uncertainty and ambiguity, particularly impacting organizations that are largely dependent on oil. Consequently, understanding these dynamics is essential for firms in oil-rich nations like Saudi Arabia to endure an economy characterized by volatile oil prices, a shifting global economy, and diversification initiatives.

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