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Original Research

PRICE AND VOLUME DYNAMICS: A CORRELATION ANALYSIS OF MAJOR OIL COMPANIES

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Abstract: Understanding the relationship between trading volume and price movements is crucial for analyzing market dynamics. This study examined the correlation between monthly price changes and monthly volume changes for three major oil companies: Exxon Mobil (XOM), Chevron (CVX) and ConocoPhillips (COP). The monthly price and volume data for the period from January 2020 to May 2025 were analyzed using Pearson's correlation coefficient. The results showed a statistically significant positive correlation between price and volume changes for Exxon Mobil, suggesting that increased trading activity tends to be associated with price increases for this company. However, the correlations for Chevron and ConocoPhillips were not statistically significant during the period under review. A strong positive correlation is also found when looking at the correlation between the monthly price changes of the companies observed. On the other hand, the correlation between the volume changes of the observed companies is only strong and positive for one pair of the analyzed companies, while the other companies show a slightly negative correlation. Major oil companies may have varying short-term price-volume relationships, necessitating further research to understand these dynamics and consider other market factors.

Keywords: Price change, Volume change, Oil companies, Correlation Analysis, Stock market.

1. INTRODUCTION

The energy sector is a vital and diverse sector that forms the basis of modern society. It encompasses a wide range of industries and activities concerned with production, distribution and consumption of energy in various forms. This includes traditional sources such as fossil fuels (coal, oil and natural gas) as well as increasingly important renewable sources such as solar, wind and hydroelectric power. Its importance is visible based on its market values. According to Yahoo finance (n.d.) the energy market capitalization is determined at 2.804 trillion USD, it contains 8 industries and on this market are 257 companies present.

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The oil and gas industry remains a cornerstone of the global economy, providing energy for transportation, heating, power generation and manufacturing. That is one of the largest industries in the world, and crucial component within the overall energy sector due to its significant role in global energy supply and its far-reaching economic and geopolitical impact.

In recent years, the global oil market has been significantly impacted by COVID-19 disruptions, price wars between oil-producing nations, Russia's war in Ukraine and the conflicts in the Middle East. Despite the rise of renewables, oil and gas continue to be the engine of economic growth, employment and infrastructure development worldwide. According to the Economipedia website, oil contributes approximately 2.5% of the world's gross domestic product (GDP), and provides almost a third of the total energy used by the world's population (Innova, 2022). The global oil and gas analysis market size was estimated at USD 8.46 billion in 2024. It is projected to increase from USD 10.34 billion in 2025 to USD 63.5 billion in 2033, registering a CAGR of 22.3% during the forecast period (2025-2033) (Straits Research, 2024). Rising global energy demand is driving the industry significantly.

The first half of 2025 was characterized by geopolitical instability; tariff threats and OPEC+ production increases were among the most important trends affecting the oil and gas sector (Pistilli, 2024). Taking into consideration the importance of this sector, it is reasonable why the change of price is one of the determining factors in the financial and political power worldwide.

According to available data, the world top 5 oil producers are: USA, China, Saudi Arabia, Russia, Canada (EIA, 2024). According to Pistilli (2024), the newest available production data, the US is the largest oil-producing country in the world with 21.91 million barrels per day in 2023. As well as the producer, the USA is the biggest oil consumer in the world, too. The same author listed Saudi Arabia as second ranked by production (11.13 million barrels per day), and the Russia is on the third place with production of 10.75 million barrels per day.

As market capitalization is prone to frequent changes, it's tricky when trying to determine which are the biggest oil and gas companies worldwide. The world's largest oil and gas companies by market capitalization in March 2025, according to the report by Straits Research (2025) are listed in Table 1.

Table 1. The world's largest oil and gas companies by market capitalization in March 2025

Rank	Company	Headquarters	Market Capitalization	Primary listing*	Currency listing
1	Saudi Aramco	Dhahran, Saudi Arabia	$1.648 trillion	SSE	SAR
2	ExxonMobil	Irving, Texas, USA	$493.62 billion	NYSE	USD
3	Chevron	San Ramon, California, USA	$279.44 billion	NYSE	USD
4	Shell	London, UK	$210.03 billion	AEX	EUR
				LSE	GBP
5	PetroChina	Beijing, China	$196.17 billion	SHH	CNY
				HKG by HKEX	HKD
6	TotalEnergies	Paris, France	$139.20 billion	Euronext, Paris	EUR
7	ConocoPhillips	Houston, Texas, USA	$126.42 billion	NYSE	EUR
8	CNOOC	Beijing, China	$115.72 billion	HKG by HKEX	HKD
9	Southern Company	Atlanta, Georgia, USA	$99.30 billion	NYSE	USD
10	TAQA	Abu Dhabi, UAE	$95.82 billion	ADX	AED

* SSE – Saudi Stock Exchange, NYSE – New York Stock Exchange, AEX – Euronext Amsterdam, LSE – London Stock Exchange, SHH – Shanghai Stock Exchange, HKG by HKEX – Hong Kong Stock Exchange, ADX – Abu Dhabi Securities Exchange.

Table 1 illustrates the hierarchical structure of the largest oil and gas companies by capitalization. According to this criterion, the largest companies mainly include companies from North America and Asia, while companies from Europe are very poorly represented. It can also be observed that each company carries out its share trading primarily on the stock exchange of its country, so that we have a greater number of markets as well as different currencies in which the values of their shares are expressed on the stock exchange. It is also interesting to note that the company in first place in the ranking, measured by the value of capitalization, is many times higher than the company in next place. The United States of America also has many companies in this sector whose individual capitalization is not significant, but which together contribute to making the United States of America the largest producer and trader of oil and oil derivatives in the world. For this reason, the focus of this analysis will be on companies from the United States of America market and the analysis of their stock market transactions.

The aim of this paper is to determine the relationship between the change in share prices and trading volume for the companies observed and to determine whether there is a relationship between the change in share prices or trading volume between them. Following a brief introduction emphasizing the significance of this sector, a literature review will be conducted, succeeded by a description of the methodology employed in this research, along with a presentation and analysis of the results.

2. LITERATURE REVIEW

Based on the available literature on the stock market in the energy sector, the analyzes of numerous authors are aimed at two main directions: the prediction of the share prices of selected companies using various methods and the investigation of the relationship between the price movements between the companies or the relationship between the prices and certain factors influencing the prices.

It has already been said that the period from 2020 onwards is characterized by the crisis caused by Covid-19 and the war between Ukraine and Russia, and since these are the biggest crisis moments in the immediate past, there are many works in the literature that deal with the impact of the aforementioned factors on the energy stock market (Cardinale et al., 2024; Mao et al., 2024; Olayungbo et al., 2024; Saif-Alyousfi, 2025;). Olayungbo et al. (2024) reveals that stock price returns respond positively to oil price returns in Italy, Germany, and the US during the COVID-19 period, while only the US responds positively during the Russia-Ukraine war period. Saif-Alyousfi (2025) found that energy price shocks generally improved returns in various sectors like oil and gas. However, the EU's energy policy, influenced by domestic market competition, has made it susceptible to price and supply shocks despite external factors like Covid recovery and Ukraine war (Cardinale et al., 2024). Cui et al. (2024) in their research highlighted that geopolitical risks significantly impact total skewness spillovers during crisis periods. Implications on world market of the instabilities were noted by Shafique and Bhutta (2024) who examines the impact of the Trade War on G-7 countries' stock markets. It reveals that strong market efficiency inversely correlates with stock market volatility, but not for America, France, Japan, and the UK.

Some authors fouced on analysing the energy market for a longer period. Tiwari et al. (2025) examines the link between oil price fluctuations and stock market returns in emerging market economies, using data from 2001-2021. Xiang and Borjigin (2024) analyzes risk spillover effects between 42 global stock markets using daily data from 2004-2022, revealing heterogeneity in spillovers, with trading volume significantly influencing risk contagion. Cadena-Silva et al. (2025) using data from 2003 to 2023 reveals that oil shocks significantly impact G7 countries' stock market indices, with Canada, Japan, and the UK showing high sensitivity, highlighting the need for economic policies. Li and Shi (2024) examines the relationship between customer concentration and stock price volatility in China's A-share listed companies from 2012-2022. Results show that increased customer concentration negatively impacts stock price volatility, with state-owned companies less affected.

In the literature, there are some authors that analyzed the impact of secondary factors on the energy sector. Gao et al. (2025) in a study of 26,819 firms found a positive correlation between media coverage and investment-to-price sensitivity, suggesting optimizing media use for decision-making and supporting media development in the capital market. Gaganis et al. (2025) reveals that stock prices in secretive societies increase more due to cultural biases and less informed trading due to the enforcement of insider trading laws. Zhang and Wang (2024) examines the impact of stock market rumors on price efficiency, finding that favorable rumors positively correlate with stock price synchronicity, while unfavorable rumors negatively. Both rumors are positively correlated with mispricing levels and crash risk. Demirer et al. (2024) reveals oil price shocks significantly impact factor returns in 62 stock markets, suggesting a conditional global factor investing strategy can enhance returns. Bajzik's study (2021) examines 468 estimates from 44 studies on the correlation between trading volume and stock returns, revealing publication bias, varying predictability across markets and stock types.

Some analysis in the literature focus on certain geographic parts of the market and problems related to market volatility, stock returns, trading volume, etc. like China stock market (Fang et al., 2024; Zhang et al., 2024; Ge, 2023), Pakistan's stock market (Khan et al., 2025), African Stock Markets (Ngene & Mungai, 2022). Latim American markets (Saatcioglu & Starks, 1998), and market of EU countries (Grecu et al., 2025).

Some authors (Choi et al., 2024) focused on the long-term dependence of natural gas (NG), crude oil, and stock markets in energy-producing and consumer countries, revealing oil's more pronounced co-movements and implications for financial risk assessments and stock market stability.

Trading volume and price volatility are one of the issues discussed in literature (Bastidon & Jawadi, 2024; Fang et al., 2024; Zhang et al., 2024). Narayan et al. (2013) presents a cross-sectional model revealing that trading volume and share price volatility significantly impact asset price bubbles.

It is interesting to note that there are fewer works in the literature that analyze the topic of the relationship between price and trading volume on the market. Saatcioglu and Starks (1998) in their paper investigates the stock price-volume relationship in Latin American markets, finding a positive correlation between volume and price change. However, it does not show a strong link between stock price changes and volume, unlike developed markets. The study suggests that the differences in institutions and information flows in these emerging markets could affect equity securities valuation and warrant further analysis. Zhang et al. (2024) examines Chinese stock market volatility, trading volume, and return using Markov-switching and vector autoregressive models. Results reveal instability, asymmetric dynamics, and a positive correlation between volatility and trading volumes.

There are authors that focused on analyzing top oil and gas companies' market trends (Chrascina et al., 2024; Senteza et al., 2018; Ulusoy & Özdurak, 2018). However, the literature is more focused on top oil and gas companies' success than market trends.

Based on the given literature review, it can be stated that there are not many recent works that deal with determining the relationship between price changes and changes in trade volume, as well as determining the correlation in price changes of certain companies or changes in volumes. On this basis, the research hypotheses in this paper are as follows:

H1: There is statistically significant positive linear correlation between the monthly change in stock price and the monthly change in trading volume for at least one of the major energy companies (ExxonMobil – XOM, Chevron – CVX, and ConocoPhilips - COP) during the period of January 2020 to May 2025.

H2: There is a strong positive linear correlation between the monthly price change of each pair of the analyzed companies (XOM, CVX, COP) during the period of January 2020 to May 2025.

H3: There is a strong positive linear correlation between the monthly volume change of each pair of the analyzed companies (XOM, CVX, COP) during the period of January 2020 to May 2025.

3. DATA AND METHODOLOGY

The following methodology is used in this thesis to answer the research question and the hypotheses listed. The flowchart of the research process is shown in Figure 1.

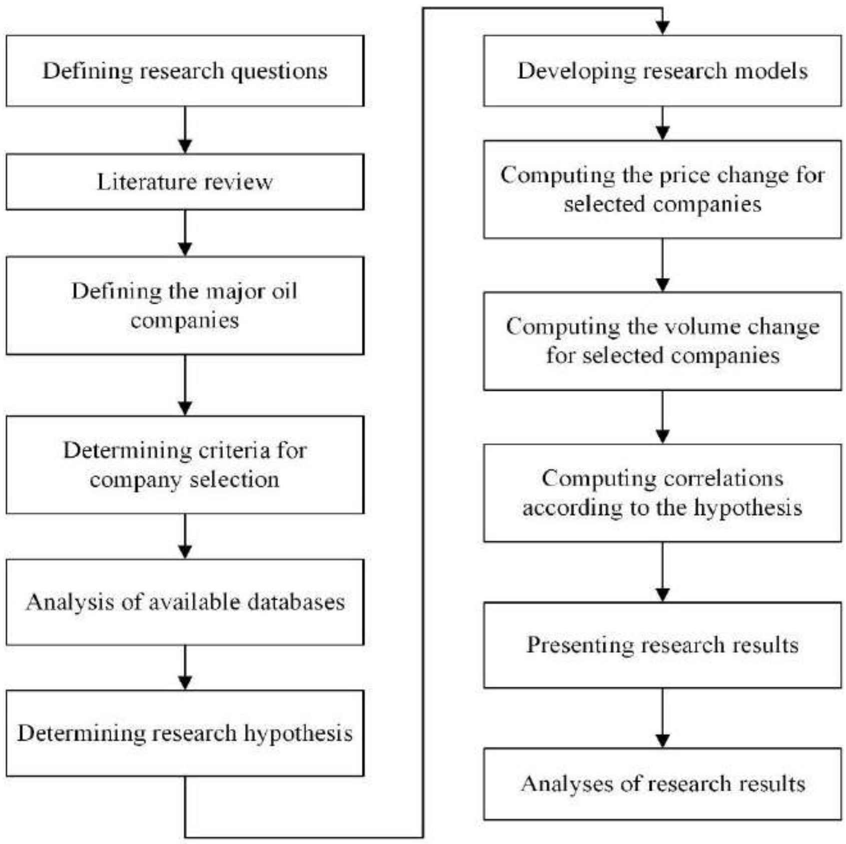

Figure 1. Research methodology flowchart

The research question corresponds to the research objective: to determine the correlation between fluctuations in share prices and trading volumes for the companies studied and to assess the relationship between changes in share prices and trading volumes. The hypotheses and the selected companies are listed based on the literature research.

The most important oil and gas companies are identified by the Straits Research report (2025) and listed in Table 1. Table 1 is supplemented with some additional data that would be helpful in determining the criteria for company selection.

Since the largest companies in terms of capital trade their shares primarily on different stock exchanges and in different currencies, and above all considering the fact that the largest producer and user in this sector is the United States of America, of the 10 companies listed, those listed primarily on the New York Stock Exchange (NYSE) were selected. These are the companies: ExxonMobil, Chevron, ConocoPhillips and Southern Company (ticker symbols: XOM, CVX, COP, SO, respectively). Of the four selected companies belonging to the energy sector, three are major oil and gas companies (XOM, CVX, COP), while Southern Company is major electricity utility company. Therefore, SO is excluded from further analysis. When analysing the currency in which it trades, COP trades in a different currency, EUR (euros), than the other two (XOM and CVX), which trade in US dollars. Since this paper analyses the percentage change in price and trading volume, this means that the influence of currency will be eliminated by calculating the percentage changes.

After the selection of potential companies, a database search was started in which it is possible to find initial data for further analysis. There are several websites that offer data on share prices and trading volumes. In this case, data was selected from the website Investing.com, which has the necessary data for all companies and is publicly accessible and downloadable. In addition to selecting the companies and the database for downloading the data, it was also necessary to determine the period for which the analysis would be carried out. The analysis was carried out for the period from January 2020 to May 2025. The data used gives monthly values, i.e. monthly share prices and monthly trading volumes on the first day of each month.

The research hypotheses were formulated following a literature review and determined criteria for analysis. Based on the research hypotheses, research models were developed for each of the hypotheses. Figures 2, 3 and 4 show research models based on specific hypotheses.

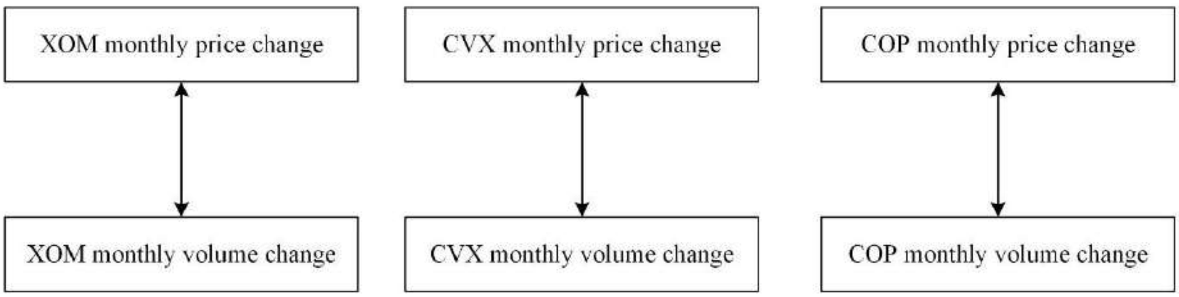

Figure 2. Research model for H1

Figure 2 shows the hypothetical relationships between the price change and the volume change of the major oil companies (XOM, CVX, COP). The model includes two key variables: Monthly Price Change (MPC), defined as the percentage change in stock price, and Monthly Volume Change (MVC), defined as the percentage change in trading volume, over the specified time period. The double arrow connecting MPC and MVC indicates an assumed correlation (r) between these two variables, suggesting a linear relationship without assuming a causal direction. The strength and direction of this relationship is quantified by Pearson's correlation coefficient.

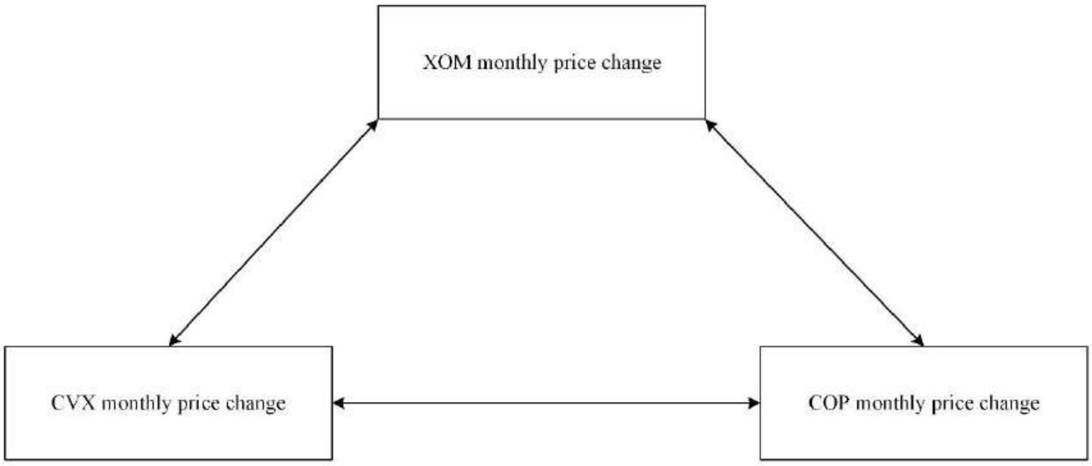

Figure 3. Research model for H2

Figure 3 shows the hypothetical relationship between the price change of the selected companies. The model includes three companies and the observed variable monthly price change, which is calculated as a percentage change in the market price. The double arrow connecting the companies indicates the expected correlation between each pair of observed variables, suggesting a linear relationship. The strength and direction of the relationship was calculated based on the Pearson correlation coefficient.

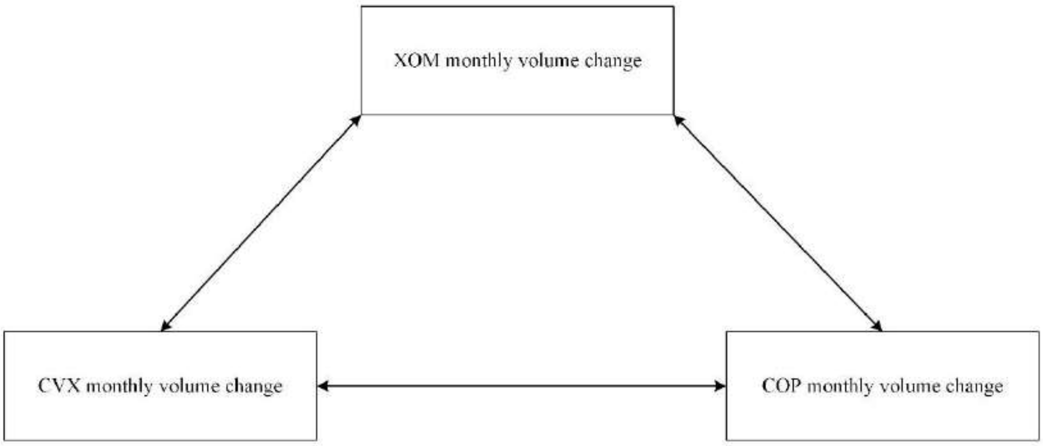

Figure 4. Research model for H3

Figure 4 shows the hypothetical relationship between the volume change of the selected companies. The model includes three companies and the observed variable monthly volume change, which is calculated as a percentage change in the trading volume. The double arrow connecting the companies indicates the expected correlation between each pair of observed variables, suggesting a linear relationship. The strength and direction of the relationship was calculated based on the Pearson correlation coefficient.

The percentage changes in price (1) and trading volume (2) were calculated using the following formulae:

$$Price\ change = \frac{(P_n - P_{n-1})}{P_{n-1}} \cdot 100 \quad (1)$$

where: P_n presents Current price, and P_{n-1} presents previous price.

$$Volume\ change = \frac{(V_n - V_{n-1})}{V_{n-1}} \cdot 100 \qquad (2)$$

where: V_n presents Current volume, and V_{n-1} presents Previous volume.

The percentage changes calculated using formulas (1) and (2) were used to calculate the Pearson correlation coefficient. The Pearson correlation coefficient (r) is a basic measure in statistics that quantifies the strength and direction of a linear relationship between two continuous variables. The Pearson correlation coefficient (r) is computed using Microsoft Excel formula "CORREL".

The value of (r) is always between -1 and +1, inclusive. Value r = +1 indicates a perfect positive linear relationship. As one variable increases, the other increases proportionally. All data points lie perfectly on a straight line with a positive slope. Value r = -1 indicates a perfect negative linear relationship. If one variable increases, the other decreases proportionally. All data points lie perfectly on a straight line with a negative slope. Value r = 0 means that there is no linear relationship between the two variables. The points on a scatter plot appear randomly distributed. Values between -1 and +1 indicate the strength of the linear relationship. The closer the absolute value of (r) is to 1, the stronger the linear relationship. The sign of the correlation coefficient indicates the direction of the relationship. A positive correlation means that as one variable increases, the other variable also tends to increase (r>o). A negative correlation means that one variable tends to increase while the other variable tends to decrease (r<0). By interpreting the obtained value of the Pearson correlation coefficient, we determine the strength of the relationship between the two observed phenomena. If the absolute value of the Pearson correlation coefficient is less than absolute 0.3, the correlation is weak. The average correlation has values from absolute 0.3 to absolute 0.5 in absolute terms. If the absolute value of the correlation coefficient is greater than absolute 0.5, we speak of a strong correlation, while values greater than absolute 0.8 indicate an extremely strong correlation.

After the calculated values of the correlation coefficients in accordance with the established hypotheses, the results and the interpretation of the obtained values are presented in the continuation of the work.

4. RESULTS AND DISCUSSION

4.1. Results of monthly price change and monthly volume change

Data from the investing.com website for three selected companies was used to conduct the analysis: XOM, CVX and COP. The analysis was conducted for the period from January 2020 to May 2025, but the data covered the period from December 2019 to May 2025 (due to the calculation of percentage changes). Share prices monthly (on this website the prices on the first day of the month) and trading volume monthly were used. Based on this data, the monthly percentage changes in prices and trading volumes were calculated, which are shown in the following Figures (5, 6, 7).

Figure 5 shows the monthly price and volume changes of XOM. While the price change shows a slight volatility, the volume change is larger. The visual assessment of the correlation is further quantified by the Pearson coefficient.

Figure 6 shows the monthly price and volume changes of CVX. In this case, both the monthly price change and the monthly volume change show a slight volatility. The visual assessment of the correlation is further quantified by the Pearson coefficient.

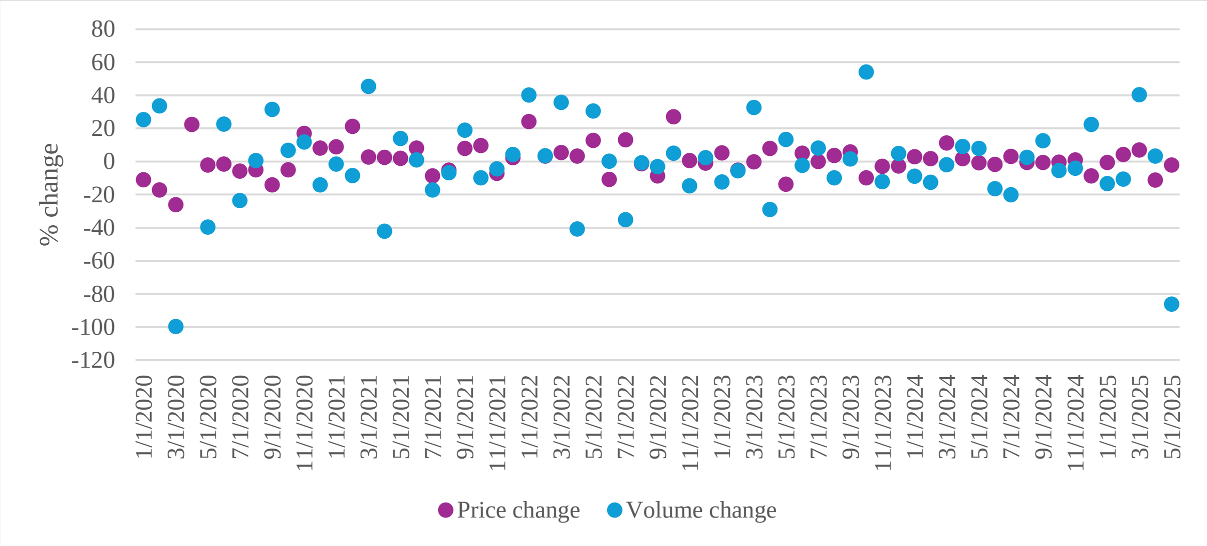

Figure 5. XOM monthly price and monthly volume for period January 2020 – May 2025

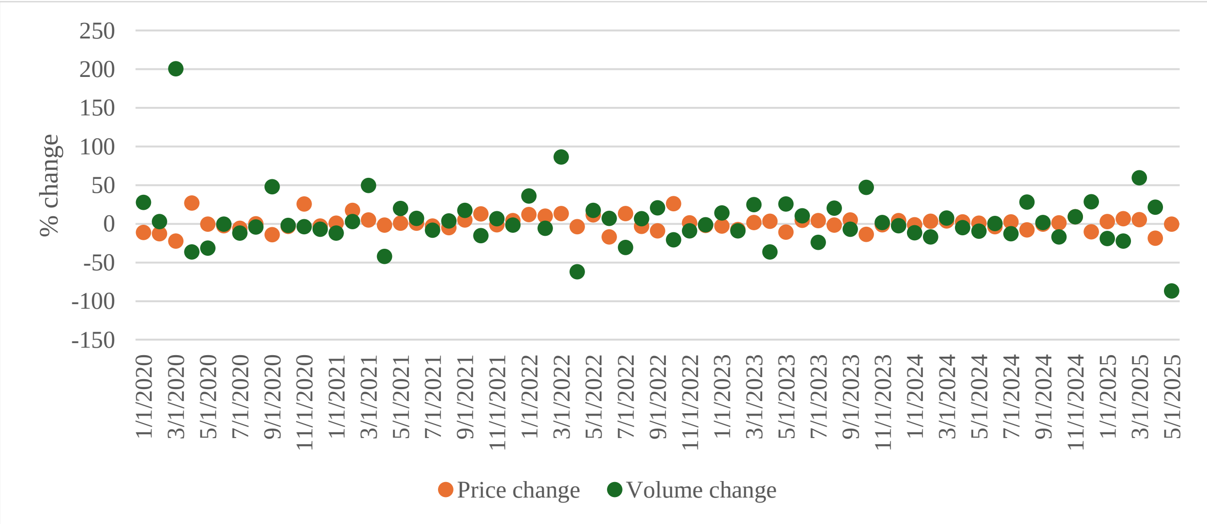

Figure 6. CVX monthly price and monthly volume for period January 2020 – May 2025

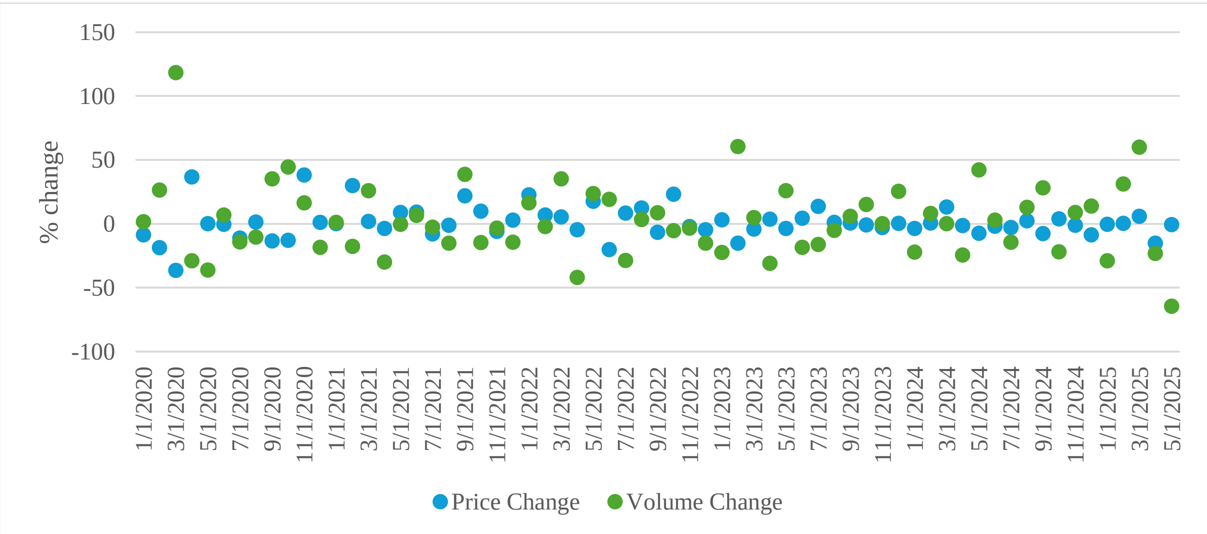

Figure 7. COP monthly price and monthly volume change for period January 2020 – May 2025

Figure 7 shows the monthly price and volume changes of COP. According to the values shown, the volatility of the change in volume is significantly greater than the change in price. The visual assessment of the correlation is further quantified by the Pearson coefficient.

4.2. Correlation analysis results and Pearson coefficient values

The first hypothesis in this paper aimed to determine the strength of the correlation between price and volume changes for the observed companies. The results of the correlation analysis are shown in the figure below.

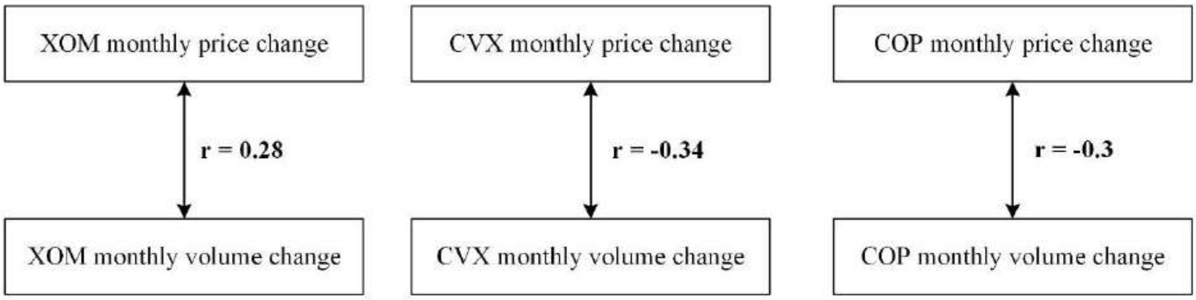

Figure 8: Pearson coefficient results for the relationships between the monthly price change and the monthly volume change of the main oil companies: XOM, CVX, COP

Figure 8 show the results of the Pearson coefficient for the relationship between the monthly price change and the monthly volume change for analysed companies. For ExxonMobil (XOM) Pearson coefficient is 0.28. This positive correlation indicates a weak positive relationship between the price change and the volume change at ExxonMobil. When the price of XOM increases, there is a slight tendency for the trading volume to increase and vice versa. However, the correlation is not very strong, indicating that other factors probably play a more important role in influencing price and volume.

For Chevron (CVX) Pearson coefficient is -0.34. This negative correlation indicates a weak negative relationship between the price change and the volume change in Chevron. When the price of CVX increases, the trading volume tends to decrease slightly and vice versa. This correlation is not very strong.

For ConocoPhillips (COP) Pearson coefficient is -0.3. Like Chevron, this negative correlation also indicates a weak negative relationship between the price change and the volume change at ConocoPhillips. Price increases are usually accompanied by a slight decrease in volume, and vice versa.

The second hypothesis was formulated on the assumption that there is a correlation between the share price changes of the companies observed. The results of the correlation analysis are shown in the following figure (Figure 9).

Figure 9 show the results of the Pearson coefficient for the relationship between the monthly price changes for analysed companies. The Pearson coefficient for the price changes of the companies XOM and CVS is 0.89. This very high positive correlation indicates that the monthly price movements of ExxonMobil and Chevron are very closely aligned. If the price of ExxonMobil rises, the price of Chevron will most likely rise as well and vice versa. This is not surprising, as both companies are major players in the same industry and are subject to many of the same market forces (oil prices, global economic conditions, etc.).

The Pearson coefficient for the price changes of the companies XOM and COP is 0.86. This also indicates a very strong positive correlation between the price movements of

ExxonMobil and ConocoPhillips. Their share prices tend to move very closely in the same direction.

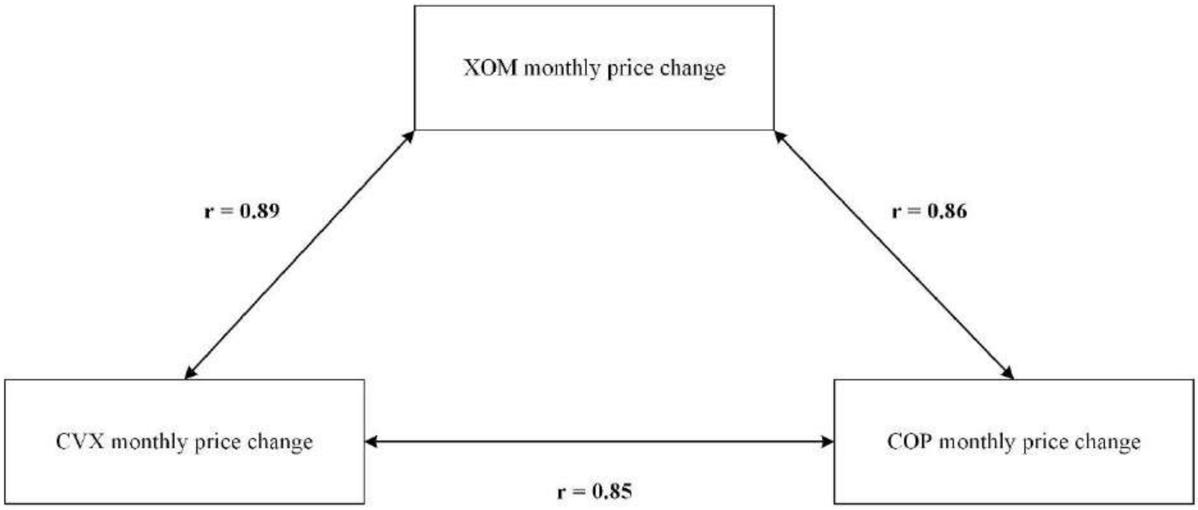

Figure 9: Pearson coefficient results for the relationships between the monthly price change of the main oil companies: XOM, CVX, COP

The Pearson coefficient for the price movements of CVX and COP is 0.85. The price movements of Chevron and ConocoPhillips also show a very strong positive correlation. It is very likely that they move in lockstep.

The high positive price correlations between these three companies suggest that their stock prices are strongly influenced by common factors affecting the oil and gas industry. They are likely to react similarly to news, oil price fluctuations and broader market trends. This could indicate a relatively high degree of systematic risk for these stocks.

The third hypothesis assumed that there is a correlation between the changes in the trading volumes of the companies observed. The results are shown in the following figure.

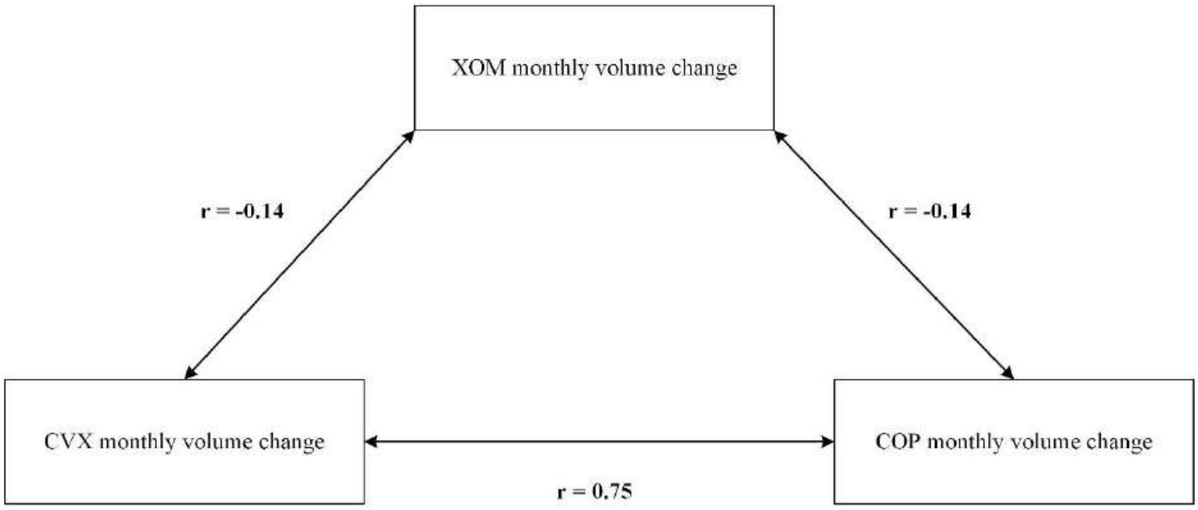

Figure 10: Pearson coefficient results for the relationships between the monthly volume change of the main oil companies: XOM, CVX, COP

Figure 10 show the results of the Pearson coefficient for the relationship between the monthly volume changes for analysed companies. The Pearson coefficient for the volume changes of the companies XOM and CVS is -0.14. This weak negative correlation indicates a slight tendency for the trading volumes of ExxonMobil and Chevron to move in opposite directions.

The Pearson coefficient for the volume changes of the companies XOM and COP is -0.14. Similarly, there is a weak negative correlation between the trading volumes of ExxonMobil and ConocoPhillips, indicating a very slight tendency for their volume changes to be inversely related.

The Pearson coefficient for the volume movements of CVX and COP is 0.75. This strong positive correlation indicates that Chevron and ConocoPhillips trading volumes tend to move in tandem. If Chevron's trading volume increases, ConocoPhillips' trading volume is likely to increase as well, and vice versa.

The volume correlations show a more differentiated picture than the price correlations. The weak negative correlations between XOM and CVX and COP suggest that trading activity in ExxonMobil is not strongly correlated with trading activity in the other two stocks. It is possible that different factors are driving investor interest and trading in XOM compared to CVX and COP monthly.

The strong positive correlation in trading volume between CVX and COP is interesting. It could indicate that market participants often trade these two stocks in similar ways, perhaps in response to the same signals or news affecting both companies.

5. CONCLUSION

The aim of this study was to investigate the relationship between monthly price changes and monthly volume changes for three major oil companies: Exxon Mobil (XOM), Chevron (CVX) and ConocoPhillips (COP). The hypothesis that there would be a statistically significant positive correlation between these two variables was supported to varying degrees by the companies.

A moderately positive correlation was found for Exxon Mobil, which is statistically significant, suggesting that higher trading volumes tend to be associated with price increases. For Chevron and ConocoPhillips, on the other hand, the correlations were negative but not statistically significant within the period analyzed. This suggests that the relationship between price and volume changes may not be the same for all major oil companies or may be influenced by other factors not considered in this study. Nevertheless, the existence of a positive correlation confirms H1.

The original assumption of H2 was that there is a positive and strong linear correlation between the price changes of the observed companies. Since the Pearson's correlation coefficient values are greater than 0.8 and positive, this proves assumption 2.

The third assumption was that there is a positive and strong correlation between the changes in the trading volume of the observed companies. This assumption (H3) is not fully confirmed when looking at the values of the Pearson correlation coefficient, which shows a positive, strong relationship between the changes in trading volume of CVX and COP. On the other hand, a weak, negative relationship was found between the changes in trading volume between the companies CVX and XOM as well as XOM and COP.

These findings suggest that while there is a discernible short-term relationship between trading activity and price movements for some companies, such as Exxon Mobil, this relationship is less pronounced or more complex for others. This could have implications for understanding market behavior and developing trading strategies, although further research is needed.

A limitation of this study is that it only focuses on three major oil companies and a specific period. Future research could extend the analysis to a wider range of companies and a longer period to assess the robustness and generalizability of these results. In addition, investigating the influence of other market factors or news events on the price-volume relationship could lead to a more comprehensive understanding.

In summary, this study provides insights into the short-term relationship between price and volume changes in the oil market and highlights possible differences between the key players. While a significant positive correlation was found for one company, the lack of consistent significant results for all three companies suggests that the dynamics between these key market indicators may be nuanced and merit further exploration.

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