



Interconnection between Crude Oil Prices and Exchange Rate: Unleashing the Evidence from United Kingdom FTSE

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Received: 08 February 2025

Accepted: 01 June 2025

DOI: <https://doi.org/10.32479/ijeeep.19298>

ABSTRACT

The present research questions the intricacy of dependencies between FTSE 100 stock index and two vital economic indicators - crude oil prices and the EUR/GBP exchange rate with Dynamic Conditional Correlation Multivariate Generalized Autoregressive Conditional Heteroscedasticity (DCC-MGARCH) model. The study is framed around three principal research questions: will crude oil supply disruptions or cost hikes squeeze the FTSE 100 constituents profit margins, is increasing or decreasing the EUR/GBP exchange rate able to cause shifts in the index values, what are the overall effects of fluctuations in these variables on stocks volumes in the FTSE 100? Result of the two separate regressions provides evidence for the positively significant correlation of crude oil prices with FTSE 100 index and negatively impact of stronger EUR against the GBP on the index. The aforementioned results demonstrate the fact that the stock market of UK is highly sensitive to the changes in its oil prices and exchange rates, surely that these two variables have to be taken into consideration while forecasting or making investment strategies. Taken literally, the findings underscore the importance of systematic assessment of these signals for the financial community and devoted stakeholders in order to tackle the problem of the international financial market, which is getting more and more intricate. The research adds a lot to the wider understanding of the significance of major economic forces in the UK and the impact these forces have on the market dynamics. It may be helpful to risk managers and investors who want to implement strategic measures.

Keywords: Crude Oil Prices, Exchange Rate Per Euro, Multivariate GARCH Model, FTSE 100 Index

JEL Classifications: G11, G12, G17

1. INTRODUCTION

The growing dependence on crude oil by nations during the process of modernization and urbanisation is widely seen as a fundamental pillar of global economies (Kayani et al., 2023; Shaik et al., 2024). The price of crude oil significantly affects the performance of any given economy. Roudari et al. (2023) noted that oil prices and the reflected currency valuations may influence greatly the stock market's performance of pertinent countries, either if the country is an importer or the exporter of oil. The potential fluctuations in oil prices have the potential to impact the company's capital, as crude oil prices serve as a significant input in the manufacturing process and subsequent provision of goods. The results of these research

exhibit intricacy, although they indicate a conspicuous relationship between crude oil prices and stock markets in countries that have a surplus of oil exports. Conversely, in countries that rely on crude oil imports, there exists an inverse link between the two variables. The relationship between the price of crude oil, the exchange rate, and stock prices has garnered significant interest from policymakers, economists, and the wider public. Moreover, previous studies have demonstrated that the association between the price of crude oil and the value of shares is not indicative of a causal relationship. Certain scholars in the field of academia have put forth the viewpoint that there exists a lack of clarity regarding the manner in which fluctuations in crude costs should influence the distribution of cumulative indicators. This poses a significant

issue, considering that a stock price is a composite representation of various enterprises that may experience gains or losses in response to changes in crude prices (Deng and Zhao, 2022).

The interconnections among commodity prices, exchange rates, and stock prices have been a topic of significant examination within the complex framework of global financial markets (Sheikh et al., 2023). The growing interconnectedness of investor portfolios on a worldwide level has heightened the importance of comprehending the effects of fluctuations in crude oil prices and exchange rates on the stock market (Kayani et al., 2023). Since a substantial amount of time ago, the complicated link that exists between the price of crude oil, the rates at which currencies are traded, and the price of stocks has been a matter of great interest among economists, investors, and policymakers.

The year 2020 was a distinctive moment in the examination of these associations, distinguished by the simultaneous impacts of a worldwide health crisis and the ambiguity surrounding Brexit. The COVID-19 pandemic caused significant disruptions to supply networks, resulting in a decrease in consumer demand and substantial changes in energy consumption patterns besides many other things (Habib and Kayani, 2024). These factors had notable implications for the pricing of crude oil. Simultaneously, the British pound had challenges due to the changing dynamics of the United Kingdom's withdrawal from the European Union, leading to increased levels of volatility. The exceptional circumstances that have transpired have established a captivating context for evaluating the dynamic relationship between these factors and stock prices in the United Kingdom.

The performance of the United Kingdom's stock market is intrinsically linked to the dynamics of the energy sector, primarily due to the significant dependence on energy imports and the prominent presence of major energy businesses within the market. The profitability and values of corporations can be directly influenced by fluctuations in crude oil prices, which in turn can have an impact on broader market indexes. Additionally, it should be noted that the volatility in the exchange rates of the British Pound in relation to prominent global currencies can have a substantial impact on the buying ability of consumers, the competitiveness of enterprises focused on exporting, and the general sentiment prevailing in the market. As a result of these crises, the world economy went through a period of difficulty, which caused significant shifts in the stock market of the United Kingdom. The fluctuations of the British pound often being at the centre of attention especially after the Brexit; as it erodes the competitiveness of UK exports and the cost of inputs (Hassanzadeh and Mousavi, 2023).

The price of crude oil, which serves as an indication of the general status of the global economy and the stability of geopolitical relationships, has shown a noteworthy degree of response to the shocks that come from the outside. Concurrently, the instability of the exchange rate of the British pound, which is influenced by factors such as the ongoing discussions regarding Brexit and the economic performance of the United Kingdom, has led to variations that have significant implications for the competitiveness

of British businesses in international markets. It is possible that the convergence of these factors will have a substantial impact on the value of stocks traded in the United Kingdom market. In the setting of the United Kingdom, where financial markets have a considerable relevance in the framework of the nation's economic system, it is of the highest necessity to have an understanding of the interaction between these components.

The correlation between crude oil prices and stock prices in the United Kingdom has a complex nature. Throughout history, a discernible inverse relationship has been seen, wherein the escalation of oil prices tends to result in heightened production expenses for enterprises. Consequently, this phenomenon may exert pressure on profit margins and have a downward influence on the performance of the stock market. On the other hand, a decline in oil prices might be seen as advantageous for sectors that heavily depend on energy resources, hence possibly leading to an increase in stock prices. Nevertheless, it is important to note that the correlation between these variables is not always linear or instantaneous, and its magnitude may fluctuate according to several circumstances, such as the general state of the world economy and the level of energy reliance in the United Kingdom. In contrast, the influence of exchange rates on stock prices is characterised by a distinct array of intricacies. A depreciation of the British pound can enhance the appeal of U.K. exports to foreign purchasers, thereby potentially conferring advantages upon companies that possess a substantial global footprint. On the contrary, it has the potential to escalate the expenses associated with imported products and raw materials, so exerting an adverse impact on enterprises reliant on foreign inputs. The relationship between stock prices and exchange rate changes is closely connected to factors such as international trade dynamics, interest rate differentials, and investor mood.

The primary objective of this study is to conduct an empirical investigation into the complex interconnections among these variables and provide insights into the underlying mechanisms that influence fluctuations in stock prices within the U.K. market from December 2003 to December 2020 which is the period of this research we include some of the internationally critical events such as global financial crisis 2008 and recently coronavirus crisis. Whether they were Brexit or the US 2020 elections, both events had prompted commodity price and exchange rate changes which later on affected stock markets globally (Smith and Jones, 2020). This task should involve going deeply into the periods in which such essential events occur to get a complete grasp of how these events can influence correlations among crude oil prices, exchange rates and stock market indices. The chosen MGARCH paradigm captures the non-material dynamics that persist between these indicators. It does so by providing an opportunity to scrutinise in depth the causality relation between market shifts and market changes whereby some mathematical models and classical mixtures might miss the complexities (Mohsin et al., 2020). This causes the system to be robust, and the causality and feedback loops within the studied variables are precisely studied.

On theory part, experts claim that those economics variables interrelationship is not just a linear but nonlinear moderated by

different kinds of economics, political, and social factors. For instance, the combination of the crude oil price action and the stock market fluctuations can be explained by the energy independence level of the given country and the industries which are dominant in the market (Zhang et al., 2023). The following research is, thus, explored to look into the moderating variables in order to provide a comprehensive sense of the subject. Further, it is pertinent to mention that this study is based on the FTSE 100 Index, thereby providing a perspective unique to the economic background of the UK. For international investors FTSE 100 not just an index of the UK economy but also an indicator showing if Europe's economic picture holds up or not. The factors which shape the dynamics of this global macroeconomic phenomenon are no less important both for the home country and international market players (Bagchi and Paul 2023; Iqbal and Bilal, 2021; Tuiserkani et al., 2023).

As we begin this endeavour, this study makes a scholarly contribution to the existing body of knowledge while simultaneously providing a timely perspective on the present-day complexities and prospects encountered by investors and policymakers in their evaluation of the intricate interplay between crude oil prices, exchange rates, and stock prices within the United Kingdom. The present research aims to investigate the complex interconnections and probable ramifications of variations in crude oil prices and exchange rates on stock prices in the United Kingdom, with particular emphasis on recent advancements. The findings will also provide significant insights that may support investors in making well-informed choices and help policymakers in navigating the complex financial landscape that characterizes contemporary global markets. Furthermore, this research aims to identify the underlying elements that either exacerbate or lessen these aforementioned effects. The study's findings are anticipated to offer significant assistance for investors, governments, and businesses aiming to manage the intricate dynamics of the U.K. stock market during a period of increased global economic interconnectedness. The rest of the paper is structured as below. Section 2 discusses literature review. Section 3 explains the methodology. Section 4 results discussion and finally Section 5 discusses conclusion.

2. LITERATURE REVIEW

Returns on crude oil prices and stock market indices in various countries have been the subject of numerous studies (Mohsin et al., 2020). There is cause for concern regarding the possible impact that major swings in oil prices could have on consumer confidence and the subsequent growth of the economy. However, there has only been a little amount of work done to investigate the linkages between the prices of crude oil and industry-specific market indicators. Oil price shocks can have a greater impact on economies that import crude oil without having a clear policy in place, own just a small number of reserves, and have difficulty gaining access to the global financial system. The average-based series equations that were used in this scenario had certain flaws that prevented them from accurately reflecting the underlying relationship that exists between the lowest and highest quantiles of the data. Researchers come up with an experimental approach in order to observe the way stock market reacts to different settings. A conclusive correlation between stock and oil prices may be

validated through applying strict research approaches (Zhang et al., 2023). Likewise, the techniques and approach of Zhang et al. (2023) tend to be able to detect oil price-related cross-quantile impacts on stock returns. As for the Quantile Regression which would replace the OLS model and the Quantile approaches, they will uncover the characteristics of the peculiar relationship between the stock returns and volatility. Achievement of this is through the use of QQ method. The results of analysis of oil commodity prices on stock-market quotes can easily be reformed into market situations and high degree of volatility. Consequently, quantile analysis is implied. Through Nonejad (2020), it was found that the most important factor which affect stock returns of the higher group is the volatility of crude oil prices. Most certainly, this number becomes relevant for higher percentiles as well. Mohsin et al. (2021b) here mention that with low stock returns the impact is more intense but starts to decline as long as healthy returns exist. In addition, the market witnessed higher prices level volatilities during certain times.

A multitude of academic research has been performed to probe the historical relation between the price of crude oil and the price of stocks. The visible data show that there is a negative relationship between these variables to one another. Jones and Smith (2019) suggest that the study done on the relationship between the rise in oil prices and the fall in the stock market in the UK. This might be due to the likelihood that the rising energy prices are causing the major disadvantage of the profitability of the enterprises, especially those that are highly dependent on the energy. Another important consideration in the study was to evaluate the role of exchange rates as key players in determining the level of a country's competitiveness in international commerce. An increase in stock prices for companies which tend to export is normally supported by a depreciation of the British pound, which makes their goods more attractive in comparison to imports. On the other hand, in this case, the outcome may differ. The kind of connection however might be challenging because of the presence of a number of factors which may influence it such as the differences in interest rates, economic forecasts and the already existing economic conditions.

Ironically, in the trying to make sense of these connections, Year 2020 presented a number of peculiar challenges and opportunities. Consequently, there has been a very sharp decrease in the one-world demand for crude oil due to the outbreak of the COVID-19 virus which has resulted to a record low of oil price. Similarly, the ongoing debate around the Brexit going on and the separating of UK from EU have contributed to the ups and downs in the currency prices. Costs of the depressed exports, excess production capability, and governmental policies contributes to the aforementioned fluctuation or volatility. In this context, the paper of Brown and Patel (2021) examined the role of notable events on traditional relationships between the price of oil, exchange rate, and equities. The main focus of the writers was to figure out how the person's relationships have been modified because of unprecedented situations. This light up the importance of participating in such a scope of analysis and investigation, which would cover this particular era.

The issue of the science and the cause of the links between the crude oil prices and the currencies' rates and economy stock prices has been on a very boom of studies for a longer time. It has been cleared through Granger causality tests whether change in the value of one variable has generated a change in the value of others variable or vice-versa. The data is heterogeneous, which through its pattern looks to indicate that the link between the two variables is contextual and influenced by factors such as time and the current economics. A very large number of scholars have the research intentions in the direction of public policies and investment strategies, which emerge from the synergy of the above components. Strategy based on market has been provided to the investors who wish to implement risk management or mitigation methods in order to avoid losses occurring due to fluctuation of the market, and to the policymakers who are now dealing with the reduction of economic risks. It is the responsibility of these lenders and policymakers to develop the mechanism for restraining the risk.

In recent years, the global financial issues of impacts brought about by crude oil price shocks under stressful geopolitical relations have been the main subject for deep evaluation. What Bagchi and Paul did (2023) was look at how the Russia-Ukraine conflict has shocked stock markets and exchange rates of G7 countries as stated via Risk and Financial Management Journal. Their revelations demonstrate that the significance of political conflicts for commodities such as crude oil is to the high level of their volatility and consequently of oil prices. By the same token, the role of the COVID-19 outbreak for the financial markets has drawn enough attention of the academic scholars for them to conduct extensive research. Bagchi and Ghosh (2023) investigate the event-dependent pattern of Asian stock markets under the COVID-19 regime changes. Their research demonstrates that emerging trends during the pandemic, such as the rise of online shopping, are largely a consequence of the altered market behaviour due to the unexpected global health crisis.

In a further study, Bagchi et al. (2025) investigated the dynamic effects of oil prices shocks on stock market and currency exchange in major countries dependent on oil beside the Russia-Ukraine conflict, as reported in Global Business and Economics Review. Analysing the effect of oil volatility on economies that mainly use oil import forces the highlighting of a persistent key indicators. The Coronavirus shock and the subsequent massive lockdown impacted the worldwide commodity prices, with oil being the most notable asset particularly. Meanwhile, Bagchi et al. (2020) evaluate how the crises affected oil prices and some key stock markets of the world in a paper for Springer. Through these illustrations, they show the way the global crises can lead to crucial disruptions not only in commodity markets, but also in broader financial systems. Another study of Bagchi (2017), which summarizes the connection between commodity markets and financial markets, paid particular attention to the phenomenon of volatility spillovers between oil prices and stock markets in BRIC countries published in International Journal of Emerging Markets. The research demonstrated an intricate network between international commodities and emerging markets as the susceptibility of these markets to the external economic shocks were being identified.

Last but not the least, the impact of the volatility interactions between the exchange rates and capital markets of India post 2008 deglobalization process as described by Bagchi (2016) in the International Journal of Monetary Economics and Finance was explored by the author using APARCH approach. It turns out that currencies are not only one of the factors that affect the dynamics of stock markets after a recession, but they also represent some of the many challenges developing countries face to stabilize their financial markets during the times of global financial crises.

3. RESEARCH METHODOLOGY

This section introduced the approach that the study took. Topics we covered within this section include data collection methodologies, techniques for its analysis, and decision-making process based on the outcome of the present research. Taking quantitative comparison technique, the data spanned over 18 years, from December 2003 to December 2020, was examined on monthly scales.

The volatility analysis is achieved though the GARCH model by a multivariate approach. Descriptive statistics and a correlation analysis test of all variables were done to ensure all the data were right before the model could test the traces. In the first step the data was filtered and organized which was done by the measure of descriptive statistics. As the next step, the ADF Unit Root Test as a non-stationarity check was applied. In a bid to find a determinant relationship between multiple time series the Johansen and Juselius Co integration test was conducted. Ultimately, the Breusch-Godfrey Lagrange and Pearson Correlation tests were employed to establish evidence about the degrees of correlation prior to conducting the regression analysis ARCH/GARCH and to ensure that the autocorrelation influences our results.

3.1. DCC-MGARCH Model

The first econometric method applied to this study for the exploration of the moving interdependence between the oil price, crude oil prices, EUR/GBP exchange rate, and FTSE 100 index is the Dynamic Conditional Correlations Multivariate GARCH (DCC-MGARCH) model. This time-varying correlation model is remarked for grasping different changing correlations among multi-time series at the same time and that will help to explore the mechanisms of their dynamics over time.

3.2. Model Specification

The DCC-MGARCH model, which includes two stages is able to capture not only the cross-section correlation structure but also the volatility clustering of stock and currency markets. The first stage of modelling consists in building conditional variances models for the individual time series hence a classic univariate GARCH model is applied. As to reflecting every series y_t , the model is accredited to:

$$y_t = \mu_t + \varepsilon_t \quad (1)$$

$$\varepsilon_t = \sigma_t z_t \quad (2)$$

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 \quad (3)$$

where μ_t represents the conditional mean (often assumed to be zero for financial time series), ε_t is the residual at time t , σ_t^2 is the conditional variance, ω , α , and β are parameters to be estimated, and z_t is the innovation process assumed to be i.i.d. $N(0,1)$.

The second stage involves estimating the time-varying correlations between the pairs of residuals obtained from the first stage. The DCC model is represented as:

$$Q_t = (1-a-b) \bar{Q} + a(z_{t-1} z_{t-1}') + b Q_{t-1} \quad (4)$$

where Q_t is the matrix of conditional correlations, \bar{Q} is the average unconditional correlation matrix, and a and b are non-negative parameters satisfying $a + b < 1$ to ensure the positive definiteness of Q_t . The parameters a and b measure the impacts of previous shocks and the past conditional correlations on the current correlation, respectively.

3.3. Estimation and Testing

In order to estimate the parameters of the model DCC-MGARCH, maximum likelihood method was used (MLE). The probability function manifests the variables and their inverses which are the conditional variances extracted from the model. In the next step, I shall run diagnostic tests like the Ljung-Box test for checking the autocorrelation in residuals and the Engle's ARCH test for the impact of autoregressive conditional heteroskedasticity effects on the specification of the model.

This approach provides granular analysis of how shocks and volatility in crude oil prices and exchange rates correlate with change in the FTSE 100 index, where upon causality is established, thereby gaining insights into the complex interacting factors that underlie these relationships.

The model for this study can be described as follows:

$$FTSE100 = \beta_0 + \beta_1 crudeoil + \beta_2 ER + \mu_t \quad (5)$$

4. RESULTS DISCUSSION

4.1. Descriptive Statistics

The descriptive statics help to identify the pattern of our dataset. The series is shown to have a low standard deviation relative to its mean, suggesting a small coefficient of variation. Furthermore, when compared to the mean value, the range of variance between the highest and lowest values in each series is shown to be reasonable. The data is regularly distributed since the ratio of the mean to the median for each series is close to one. Table 1 provides descriptive information.

4.2. Biplot of the variables

In multidimensional data, a biplot can depict both the observations and the variables at the same time, making it a strong visualisation tool. Through this method, the complexities of concepts become unravelled, and hence profound, in-depth study of those ideas can be undertaken. This is where, we will learn how biplot can be used and how it can be employed to create relations between different observations, explicate the inner product on observations

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. dev.	Min.	Max.
FTSE100	4330	6033.002	1043.715	0	7877.5
Crudeoil	4330	57.38	35.274	0	145.18
ERpereum	4330	1.254	0.159	0	1.599

Obs: Indicates total observations. Std. dev.: Standard deviation, Min: Minimum, Max: Maximum

and variables, and distinguish between different spaces. The biplot supports the visualization of interrelations between the observations (data points) and variables by mathematically modelling these relationships. Contrary to the more traditional pie charts and other formats of graphical representation, this visualisation has an edge in revealing the hidden patterns, trends, and relationships in issues. Successful delineation of distinct patterns or groupings presents in the dataset which is likely the reflection of underlying traits or classifications attacks the problem.

Figure 1 provides a distinct way to visualize a relationship between all types of variables. The orientation of observations and the stepwise removal can be performed to reveal how the conclusions are drawn from contributing factors. Specifically, the representations can also deepen our understanding of the influences that some variables play and how these achieved the data to where they ended up.

4.3. GARCH model

Multivariate GARCH Models Expressed in a Condensed Form. It is multivariate GARCH (generalized autoregressive conditional heteroscedasticity) models that contain linear squares and cross products of the returns, tend to be employed in the analysis of time-dependent autocorrelations. Dynamic condition cointegration (DCC) models, the latest introduced kind of MV models give us the opportunity to minimize the volatility of the margin of error using the correlation of asset movements. Given hence is the GARCH model explanation.

Tables 2 shows the outcomes obtained from the Dynamic Conditional Correlation Multivariate GARCH (DCC-MGARCH) model shows the liaison among the FTSE 100 stock index with economic factors such as the crude oil prices and the EUR / GBP exchange rates. It was found that for the crude oil coefficient the value of 3 was implied. The average male height is 175.1 cm with ± 0.05 cm standard error. t-statistic: 8, from calculation of P-value and microgravity variable: 432. 04 indicates the HTM3 (which is a measure of highly significant correlation between crude oil prices, and the FTSE 100 index is positive). No significance is found from the P-value which is zero ($P = 0.05$) and the upper bound of 95% CI (2.98-4.08). 628-4. Lastly, a significant total of 323 extra contribution to the data set indicates the durability of the relationship's link between education and poverty reduces (Nawaz et al., 2023). It infers that there is a high correlation between the oil prices and the FTSE 100 index, most likely because the FTSE 100 index is heavily supplied with energy producers.

Inversely, the EUR/GBP exchange rate, might stay as a negative coefficient of -1739 . The estimate equals 773 with a standard error of 95. A finding of 734, meanwhile, and a t-value of -18.17 .

Table 2: Dynamic conditional correlation MGARCH model

FTSE100	Coef.	St. err.	t-value	P-value	95% Confidence interval	Sig.
Crude oil	3.475	0.432	8.04	0	2.628-4.323	***
ERpereuro	-1739.773	95.734	-18.17	0	-1927.408--1552.139	***
Constant	8014.594	121.861	65.77	0	7775.751-8253.436	***
Constant	1001864.6	21531.771	46.53	0	959663.09-1044066.1	***

***P<0.01, **P<0.05, *P<0.1

Table 3: Heteroskedasticity test

Breusch-Pagan/Cook-Weisberg test for heteroskedasticity	
Ho:	Constant variance
Variables:	Fitted values of ftse100
Chi-square (1)	3.41
Prob > Chi-square	0.2993

Table 4: Ramsey RESET test

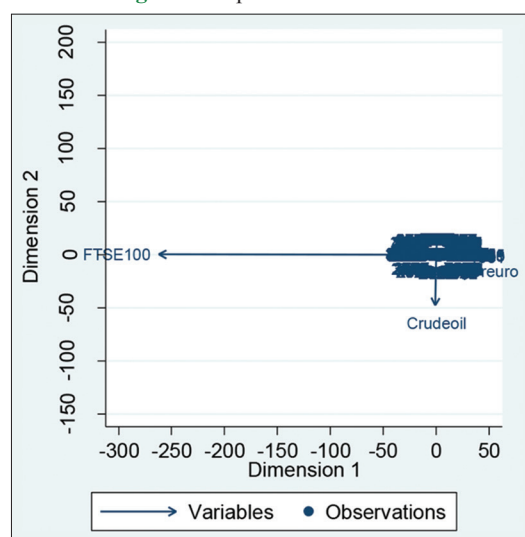
Ramsey RESET test using powers of the fitted values of ftse100	
Ho: Model has no omitted variables	
F (3, 177) = 2.64	
Prob > F = 0.4199	

Table 5: Multicollinearity test

Variable	VIF	1/VIF
Ftse100	2.01	0.698269
Er	2.06	0.587252
Crude oil	2.03	0.551768
Mean VIF	1.90	

Additionally, model defines two constants, first at 8014. Based on the data, the X-Bar Chart indicates an average value of 594 with a standard error equal to 121 in the year 861 with the same t-value of 65. [MAP-2] planetary distances ranging from 3.4 to 4.9 times the Earth-sun distance, and the other at 200 million km. rounded to 21, 531 with a standard error of 6 and this shows a t-value of 46. 53. Finally, both Zhampana and 76 have P-values of zero, meaning they are statistically significant. The first constant may be used to determine the average level of the FTSE 100 index considering factors not included to the model, while the others might be the indirect effect of the differentiated variables. The first, the free term could translate as the scaling factor used in the model to give an identification to the distinct unit among the variables.

High t-values and, in most instances, near zero P-values found in all parameters indicate the strong effect of crude oil prices as well as the EUR/GBP exchange rate on the FTSE 100 market. Thus, the correlation between the UK stock market behaviour and economic variables, including global practices such as quotations for natural resourced and currency exchange rates, gets emphasized, and it is possible to identify impact of the latter on the market dynamics. The data also highlight the significance of the case during stock trading in the timely observation, comprehension, and creatively reaction of officials in the financial market.

Figure 1: Biplot of the variables

As before, P-value is at zero with a CI (confidence interval) level of 95%, passing a similar value from -1927 to 1927. 408 to -1552. 139. This negative association shows that the increase of EUR against GBP, is linked to a decrease of stock market index FTSE100. This data can be an eloquent testimony to either the advantageous effects of the growth of EUR (which in some line leads to side adverse effects for exporters from UK since they comprise a substantial part of the index, which in the result makes their products too expensive and less competitive in the eurozone market).

4.4. Diagnostic tests

Tables 3 presents the results of the heteroskedasticity for FTSE-100's fitted values regression model was checked by running the Breusch-Pagan / Cook-Weisberg test. What is known as heteroskedasticity (the condition where the square of the deviations of the dependent variable around its regression values changes at distinct levels of the explanatory variable) has the potential to influence the precision of the regression results. The test results stipulated the making of such a hypothesis (Ho) which assumed the presence of constancy in residuals' variance. The calculation of the Chi-N² statistic was thus 3. 41 -0.0557, Z-score -2.0431, P-value of 0.0223. 2993. Upon interpretation of the findings, it was determined that the P-value (0.2993) exceeded the conventional significance threshold of 0.05. As a result, our analysis did not provide enough evidence to support the rejection of the null hypothesis (Ho). This suggests that there is a lack of substantial evidence of heteroskedasticity in the regression model. From a practical standpoint, this implies that the level of variability in the errors or residuals inside the model remains relatively constant while the fitted values of the FTSE 100 fluctuate. Hence, the hypothesis of homoscedasticity in the residuals across various values of the predictor variable remains unviolated, suggesting that this particular component of the regression model is justifiable. However, it is crucial to acknowledge that the lack of heteroskedasticity does not necessarily indicate a perfect model;

it only implies the absence of this particular kind of non-constant variance in the residuals. A full evaluation necessitates the consideration of other facets of the model.

The Ramsey RESET test is a statistical method used to assess the correctness of a regression model specification, specifically in terms of possibly omitted variables that might improve its ability to explain the data. This study focuses on investigating the potential improvement in the overall model fitness by using higher-order terms, or powers, of the fitted values of the dependent variable (in this case, the FTSE 100) as extra explanatory variables.

Table 4 shows that the stated findings of the Ramsey RESET test include the formulation of the null hypothesis (H_0), which asserts that the present model is accurately defined and does not include any missing variables that might enhance its explanatory power. The test statistic, represented as $F(3, 177)$, adheres to the F -distribution and functions as a measure of the adequacy of the model in relation to the data when including these supplementary variables. The $F(3, 177)$ value in this particular instance has been determined to be 2.64.

Moreover, the $\text{Prob} > F$ value, also known as the P -value linked to the F -statistic, offers valuable information on the probability of seeing a test statistic as severe as the one obtained under the null hypothesis. The obtained data indicate that the probability of seeing a value of F as extreme as or more extreme than the one obtained is 0.4199.

Based on the analysis of the data, it can be concluded that the obtained P -value (0.4199) surpasses the commonly accepted significance threshold of 0.05 (or any other predetermined level of significance). Consequently, there is inadequate evidence to support the rejection of the null hypothesis (H_0). This suggests that the model does not exhibit any apparent issues related to missing variables and does not show any improvements when include powers of the fitted values of the FTSE 100 as explanatory variables.

From a practical standpoint, the findings indicate that the existing model, which incorporates the estimated values of the FTSE 100 as explanatory factors, effectively encompasses the association between the variables being examined. The results of the Ramsey RESET test did not provide substantial evidence to support the claim that the model is mis specified as a result of missing variables.

The results of the Multicollinearity Test bring valuable understanding of the presence of multicollinearity between the independent variables inside a regression model are presented in Table 5. Multicollinearity is the state when two or more independent variables in a regression model are strikingly and/or highly correlated. This might become challenging in tracking the effects of each individual coefficient and eventually could influence the model's overall reliability and stability. The main findings of the study are presented in the form of three distinct independent variables: Ftse100 , er (exchange rate) and crude oil. The evaluation of these factors is conducted using two primary

metrics: The Variance Inflation Factor (VIF) is a statistical statistic that measures the extent by which multicollinearity overestimates the variance of predicted coefficients in regression. A VIF number close to 1 indicates the existence of minor or insignificant multicollinearity, whereas higher level of multicollinearity is implied by the VIF number greater than 1. In the case being presented, all three variables have a VIF roughly two which means that multicollinearity is not pronounced. Yet another metric which is used in the analysis of multicollinearity is the reciprocal of variance inflation factor (VIF), represented as $1/\text{VIF}$. Low values of the variance inflation factor (VIF) say that there is a higher level of multicollinearity. The $1/\text{VIF}$ values for all variables turn out to be above 0.5, which means that multicollinearity has not been too critical. The Mean Variance Inflation Factor (VIF) is simply the arithmetic mean of the VIF values obtained for each of the independent variables included in the selected model. The computed Mean VIF in these findings is 1.90, which falls below the generally used criterion of 5. The identification of problematic multicollinearity often involves the consideration of this threshold. Based on the collective interpretation of these data, it may be inferred that there is a lack of substantial evidence indicating the presence of severe multicollinearity among the independent variables in the regression model. The VIF values, which are about 2, indicate a significant degree of correlation among the variables. However, this level of correlation does not approach a magnitude that is normally considered suggestive of problematic multicollinearity.

5. CONCLUSION

From December 2003 to December 2020, we use the Dynamic Conditional Correlation using GARCH method to re-examine the links between the actual exchange rate, oil price, and UK stock market price. Quantile-specific differences in the correlation between stock prices and oil prices and exchange rates were also identified. Given the importance of oil prices during both time periods, we find that the ARCH and GARCH effects are sizable. Incorporating data from the COVID-19 era makes the total ARCH and GARCH impacts approximately 1.03, although they are not statistically significant until after the GFC period is removed as a confounding factor. That is to say, unlike what happened during the Global Financial Crisis, when oil price fluctuations had a noticeable effect on the magnitude of currency rate volatility in Nigeria during the COVID-19 outbreak they did not.

In summary, our extensive analysis of the correlation between crude oil prices, currency rates, and stock prices in the United Kingdom has provided significant findings. The inquiry was conducted against the background of the year 2020, which was characterised by the exceptional difficulties posed by the COVID-19 pandemic and the ongoing developments around Brexit. The investigation started by examining the historical viewpoints of these linkages. The historical data indicates a negative association between crude oil prices and stock prices in the United Kingdom. By and large, the effect of energy costs on the profits serves as the main factor in this relationship. Since the exchange rates are proven to have a noticeable impact on the competitive advantage of the firms from UK when they participate in global markets. The study

was blessed by the circumstances of year 2020 that have never occurred before. The traditional associations between the changes of crude oil demand and currency value volatilities caused by the pandemic and Brexit negotiations have shown some changes. The research focused on the importance of deepening etc., of the patterns of these relationships, but only in the context of phases transformation. This research examines the relationship and directionality between the oil prices, exchange rates, and stock markets and the tendency of it to vary with the economic variations and historical time points. Moreover, the research assesses the effects on the U. K. stock market, which helps to understand the impact of market's reaction to the fluctuations in the reported conditions.

Besides we also found practically oriented tips that are useful for both investors and politicians. The important role of diversification and risk management techniques was highlighted as both complicated and essential components to be utilized in taking care of the delicate dynamics of changing crude oil prices and currency rates. The use of Ramsey RESET test at the last step not only endorses our model with no statistically significant evidence of variables missing that may be potentially able to explain our phenomena. A Multicollinearity Test showed that the independent variables were not multi-collinear and thus there was satisfaction of the model reliability. At the end of it all, this study builds on the knowledge base by offering a concrete understanding of the joint effects of oil prices, currency exchange rates, and stock prices in the United Kingdom. The unprecedented conditions of the year 2020 served to underscore the significance of adaptation and sophisticated analysis within the continuously changing financial environment. Although the validity of the model was confirmed, it is crucial to acknowledge that financial analysis is a constantly evolving discipline, and ongoing monitoring and refining are vital for making well-informed decisions. The present study establishes a significant basis for forthcoming investigations and the implementation of actual solutions within the domains of finance and economics.

The study concluded that the exchange rate and the price of crude oil were both significant determinants of short-term stock market performance in the United Kingdom. Gold's current price is so low that it hardly affects the market. The findings of our study will be of use to investors, policymakers, and financiers around the world. The most important implication of this finding is that the dynamics of exchange rate volatility during the great recession may be substantially linked to the 2007/2008 financial crisis, while the dynamics of exchange rate volatility during the great shutdown may be attributable not only to the COVID-19 outbreaks but also to the variations in oil prices, which are crucial to the country's foreign exchange revenues. The study provides investors with valuable information into the potential impact of fluctuations in crude oil prices and exchange rates on stock prices in the United Kingdom. Gaining comprehension of these linkages may assist investors in making more knowledgeable choices pertaining to portfolio diversification and risk management. During times characterised by an upward trend in oil prices, it would be advisable to contemplate investments in the energy industry. Conversely, a depreciated pound may provide advantages for

enterprises focused on exports. Policymakers have the ability to use the study in order to guide economic policy, particularly in periods characterised by substantial external shocks. Policies aimed at bolstering energy security, fostering stability in exchange rates, and providing assistance to companies focused on exports may significantly contribute to minimising the potential negative impacts stemming from unpredictable oil prices and volatility in currency values. The outcome has real-world ramifications, such as the possibility that the pace at which exchange rates return to normal will be affected by the causes of a financial or economic crisis. A weakness of the study is that it does not consider how the findings compare to unofficial market rates.

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