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Commodities and Volatility: Sustainable Economic Development and Interplay of Oil and Gold

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Abstract

In this research, we examine the relationship between oil & gold prices, how that relationship affects the volatility in the markets, and how these changes in volatility affect the transition to renewable energy for China. Through the use of advanced econometric modeling of historical data over a defined time frame, we derive the results which demonstrate that there is a strong independent link between gold price and oil price and that they are highly influenced by the general economic environment. We conclude that the relationships between commodity prices are very sensitive to the general economic environment, so when interpreting data on commodity price relationships, it is essential to consider the context in which they are being analysed. Our findings also indicate that gold & oil prices are extremely volatile and unpredictable, as evidenced by high volatility throughout our time frame for both commodities. The strong linkage of the commodity industry to the financial industry creates an opportunity for improved information on how to develop better predictions regarding how a commodity market is developing. This insight can be used by market analysts, financial professionals, and policymakers to make better decisions in the commodities sector. The implications show that changes in oil prices will impact policies concerning commodity markets, which in turn will enforce changes in the strategies of forecasting market experts, risk managers, and policymakers.

Introduction

Due to recent volatility in the oil and gold markets, scholars and industry players are interested in their relationship (Iqbal, 2021; Rastogi et al., 2023). The dependency on crude Oil, an energy source, and Gold, a valuable commodity, has been a predictor of the global economy and financial markets for a long time. Understanding how commodities interact may help with investment, risk management, and market dynamics. According to Baloch et al. (2022), investors, decision-makers, and other stakeholders in the business world should investigate a causal connection between the volatility of oil-gold prices. High production and transportation expenses pose problems in manufacturing and transportation. However, the gold price, a haven in an uncertain economy, affects investor sentiment and mining and jewelry demand. Udeagha & Muchapondwa (2023) assert that developing nations are being given priority in the global economy because of the growing significance of these nations and the distinctive characteristics they possess.

Emerging markets differ from industrialized economies due to financial market volatility, geopolitical instability, and economic boom (Karanasos et al., 2022). Because of their quick variations and greater sensitivity to outside shocks, both markets are intriguing for establishing whether oil and gold price volatility are linked (Khan et al., 2021). Market volatility may affect a company's interdependencies and asset value (Baloch et al., 2023). Investors' emotions and risk perceptions are related to volatility, which measures price swings and market turmoil. The marketplace volatility could be a benchmark dynamic to understand the oil price relations in emerging economies (Li & Du, 2024). By considering volatility, we may better comprehend how consumer behavior and market dynamics impact commodity connections.

There are few studies in the area of research in developing nations that emphasize the need for more empirical studies to understand the dynamics and features that affect this connection. However, oil price volatility and Gold prices have been studied in well-established markets and particular seasons. However, rising economies have not gotten enough attention. Zhang et al. (2022) found that commodity prices may be impacted by market structure, political stability, and economic progress in emerging nations. Oil and Gold price volatility must be examined in developing countries to understand how these markets work. Marketplace volatility as a benchmark dynamic is crucial but understudied. Price fluctuations and market volatility affect investors' risk aversion and comfort. According to Eje et al. (2023), financial market volatility, which accounts for external variables and market conditions, may help explain the abnormal relationship between oil and gold prices. However, research on crucial commodities and developing economies seldom accounts for financial market movements.

To escape the risks of industrialized country stock markets, you may invest in commodities like Gold and Oil. Studies on volatility transmission and hedging between oil assets and stock markets recommend mixing the two to minimize portfolio risk. Several studies have shown that Oil can be a reliable hedge in the financial market. Investors purchase Gold as a means of navigating uncertainty, which in turn leads to a decrease in stock valuations. One can reasonably assume that the stock and gold markets tend to move in tandem. A convenient strategy to mitigate risk is to combine commodities from both markets. In these challenging economic times, the authors also consider purchasing Gold to safeguard against the stock market's volatility. Gold is a good investment if you're worried about stock market volatility.

In the long and short term, a non-linear influence effect has been observed in the oil and gold price relationship (Kumar, 2017). Rising gold costs benefit the markets overall but hurt stock markets. All developing stock markets are suffering from rising oil prices. Oil and gold price volatility affect the short and long-term stock markets. This study might add three new elements to knowledge. This study initially offers a novel viewpoint on past studies by focusing on oil prices in different countries rather than the global gold market. It shows that oil prices are volatile, and domestic paper money interchange rates, gold markets, and the international oil market are continually changing. Second, a rigorous econometric technique is being considered to determine the three markets' interdependencies and volatility effects. The statistical quality of this method is excellent. Another limitation is that it cannot discover mean spillovers across analyzed marketplaces. Limitations include this. Shows how trustworthy econometric approaches can predict variability more accurately than other models. The prior studies have used linear methods like VAR and ARDL to study the correlation of oil and gold prices (Rahman & Mustafa, 2018), and few have used rigorous econometric techniques to examine the exchange rate impact of Gold and oil price irregularity on the market (Singhal et al., 2019; Sujit & Kumar, 2011). Despite research on how economic indicators have affected stock markets in many South Asian countries, Bangladesh, China, Indonesia, Malaysia, Pakistan, Sri Lanka, and the US, no one has studied the Indian market or the association between commodities and stock market indexes. The economic volatility's disproportionate impact on Chinese stock indexes is neglected in the prior literature. The study aimed to investigate the three objectives. First, the study examined whether gold prices affected the Chinese market over time. The second goal is to analyze China's short- and long-term consequences from oil prices before, during, and after the economic crisis. Third, we want to investigate how fluctuations in exchange rates altered the Chinese stock market before, during, and after the financial crisis. We also aim to explore the short-term ramifications.

Literature Review

Many studies have been conducted to investigate global markets since they depend on the causal relationships and factors that impact the pricing of commodities and the dynamic interactions between commodities (Khan et al., 2020). As a result of the fact that the majority of investigations regarding this topic have focused on traditional stocks, emerging countries demand a more nuanced understanding. The findings suggest that the relationship between oil and gold prices has been irregular. The irregularity of oil and gold prices have a direct relationship. It might be because both commodities are used against inflation. The prices of Gold skyrocket whenever people are concerned about the state of the economy or the political system. It is a well-known fact that fluctuations in oil prices affect government spending and the global energy industry, and they have the potential to change investor sentiment. It was reported by (Chen et al., 2024) that other investigations found no connection. According to the findings of this research, changes in prices caused by Oil and Gold prices might be caused by the mood of the market, the dynamics of supply and demand, and certain macroeconomic variables. There is a higher connection between the irregularity of oil and gold prices in countries that are still developing. It has been reported by Munawar et al. (2023) that developing nations are experiencing rapid economic expansion and increased demand for commodities.

Further research is needed because there is a lack of research, especially in less developed countries where these commodities are being researched. Anastasiou et al. (2025) discovered that fluctuations in the financial market are closely associated with the pricing of energy commodities like Gold and Oil. Volatility in the market and price movements indicate how investors feel about risk and how they perceive it (Naqvi et al., 2019). A control variable like the financial market volatility might help us understand the oil-gold relation. It has been suggested by (N. Iqbal et al., 2020) that volatile financial markets have the potential to change the direction and co-dependencies of gold-oil prices.

It is necessary to have a complex financial structure to implement environmentally friendly economic recovery strategies to guarantee the nation's financial success. The consumption of resources, organizational structure, and the viability of financial resources were all investigated in this research. More studies are required on oil and gold prices in economically deprived countries. Further investigation is needed. Although the relationship between economic conditions and adequate resources is less or highly variable compared to pre-thought, there is still a connection (Gubareva et al., 2025). A few firms use most of China's natural resources despite the country's growing economy. More prosperous countries make greater use of the resources at their disposal. By encouraging the growth and reform of the securities industry, it may be possible to assist in revitalizing conventional businesses and free up resources for companies operating in more profitable and efficient industries. Only after considering the amount of money spent by the government did foreign direct investment lead to an improvement in resource utilization efficiency. Whether or not a corporation can use its limited resources is contingent upon the research and innovation budget allocated by its leadership. According to (Lou et al., 2024), the study disproves such a view by providing solutions for sustainable development that are supported by data.

Birnstengel and Süssmuth (2025) conducted research on the connection between (oil prices) and (gold prices), which investigated the influence that changing one component could have on another element compared to the other. It has been shown through asymmetric causation that the reasons and processes that connect commodities may change with price. Gold prices may be affected more by a surge in oil price volatility than by a rise in oil prices. The relationship between Oil and gold price instability among developing nations is no less a mystery, even though several research studies have been conducted on the subject. There is a lack of knowledge on emerging economies because most studies have focused on industrialized countries. Neither the financial market instability nor the developing nation's economy has been the subject of many studies. The current empirical study investigates the notion of asymmetric causation in developing countries by using the abnormality of financial retail as a standard dynamic.

There is a necessary compulsion to comprehend the historical background of these two commodities to understand the relationship between oil-gold prices. Since the discovery of commercial oil wells in the late 1800s, petroleum, also often referred to as crude Oil, has been used to power transportation and industry. Economies were enlarged due to the petroleum industry's ability to power equipment, automobiles, and other economic activity. The impact of oil price irregularity on power costs, economy, and inflation has been highlighted (Kazak et al., 2025). For many years, scholars have investigated the causes and impact of fluctuations in the oil price. Aurum (Gold) has served as a status symbol, a means of trade, and a wealth refuge through the ages. Older people used Gold for financial operations, such as exchange and accounting for millennia. Gold evolved into a haven for investors seeking shelter from economic and political upheaval as time passed. Both national and corporate authorities were interested in it because of its limited availability, resistance to corrosion, and long-term durability (Iqbal et al., 2021). Oil and gold prices, which originated in the 20th century, were brought to light by the oil crises that occurred in the 1970s. These crises were begun by geopolitical turmoil and supply chain disturbance.

Even though a lot of research has been done on oil and gold prices and their relationship, there are still a lot of questions there. To have a complete understanding of commodity linkages, more questions remain unanswered. The relationship between oil and gold prices, particularly in underdeveloped countries, is missing from the prior literature. Most research focuses on established markets. Thus, market change research is insufficient (Afshan et al., 2024). Emerging countries have increased commodity demand, quick economic expansion, and shifting geopolitics. This link must be investigated in developing markets to understand the dynamics (Gao & Zhang, 2023). According to other studies, the connection between oil and gold prices in developing nations uses financial marketplace irregularity as a managing tool. Financial markets vary owing to investor emotion and risk perceptions. According to (2019), financial market volatility must be incorporated when examining links to commodities. Oil and gold price control research is infrequent in underdeveloped countries. Few studies have investigated growing countries to assess whether the oil and gold prices are unequally causal. Asymmetric causation occurs when altering one variable affects the other differently.

Understanding asymmetric causation helps clarify the underlying processes and variables. While numerous research studies have examined current markets, few have examined nascent markets for asymmetric causation (Baloch et al., 2020).

Material and Method

Study Variable, Data, and Sample:

It is important to remember that because of the significant liquidity and ease of contract access, the world's more than two-thirds of crude Oil is traded below the market-priced value, encouraging an examination of the relationship between the irregularities of oil-gold prices. The study considers the stock market as a dependent variable to investigate the independent variables (gold price and oil price). A custom-built econometric model serves as the backbone of our investigation. It is based on yearly numbers taken from a database maintained by World Development Indicators (Nasir et al., 2022). This note shows The stock market as a dependent variable, whereas Gold and Oil are independent variables. On the other hand, the total number of Chinese yuan in every economy, which is equivalent to one $US, is a measure of the exchange rates. The values of Gold and oil prices are used simultaneously as natural resource proxies. In addition, Exchange Rate Fluctuations, the Consumer Price Index, and GDP Growth were added. All the study variables are hereby shown in Table 1.

Table 1: Study Variables and Symbols

Sr. No.	Symbols	Variables
1	Oilvolt	Oil Prices Volatility
2	Goldvolt	Gold Prices Volatility
3	NRS	Natural Resources
4	FMvolt	Financial Markets Fluctuations
5	EXR	Exchange Rate Fluctuations
6	CPI	Consumer Price Index
7	GDP	Gross Domestic Product Growth

Thus, macroeconomic indicators of markets, Gold and Oil, and similar factors were added to the research's data collection. As price forecasters, evidence derived from the ground up is essential, particularly on the state of variables: Oil and Gold. Technical indicators are calculated by considering the fluctuations in oil prices and the amounts of Gold.

Table 2: Descriptive Statistics

Symbols	Mean	Std. Dev.	Min.	Max.	Skewness	Kurtosis	Jarque-Bera	ARCH (1)	ARCH (2)
Oilvolt	7.95	0.45	7.1	8.8	0.25	3.1	5.6	105.25***	107.50***
Goldvolt	9.8	0.65	8.9	10.75	-0.65	2.85	19.45	140.75***	138.60***
NRS	6.5	0.48	5.75	7.35	0.15	2.75	6.3	80.65***	83.10***
FMvolt	11.25	0.98	9.85	12.95	0.55	3.25	8.75	92.30***	95.60***
EXR	6.9	0.35	6.2	7.45	-0.3	2.4	7.1	78.45***	79.90***

CPI	3.95	0.3	3.5	4.4	0.05	2.55	4.2	50.10***	52.75***
GDP	4.1	0.55	3.2	4.95	-0.1	2.65	5.05	65.80***	66.95***

Table 2 presents descriptive statistics for seven financial variables. These include measures of central tendency (mean), variability (standard deviation), distribution shape (skewness and kurtosis), and tests for normality (Jarque-Bera) and volatility (ARCH). All of the variables display a significant deviation from normal distribution, as demonstrated by the high Jarque-Bera values associated with each variable and the large range of skewness observed (both positive and negative) indicating asymmetric distributions of the data points. In addition, the results obtained from the calculation of kurtosis indicate that most of the variables are either moderately platykurtic, with slight tails; or leptokurtic, with thicker tails, suggesting non-normally distributed data. For example, Goldvolt has a negative skew and a platykurtic distribution while Oilvolt has a slightly positive skew and leptokurtic distribution.

The properties of each of these independent variables, represented by the ARCH test statistic (***) indicate that they demonstrate a clustering effect of volatility. That is, when there is a large movement in prices in one direction, it is likely there will be similar increases and decreases which occurs too often with small movements in prices from another source and is indicative of a variable showing varying degrees of volatility with time. For instance, Oilvolt has an extremely high ARCH value and Goldvolt exhibits strong volatility patterns. Consequently, the findings illustrate the necessity of using more elaborate modeling methodologies such as the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model to optimally account for the varying volatility over the course of time within the forecast and analysis processes.

Table 3: Pairwise Linear Granger Causality Test Results

Null Hypothesis	Observations	F-Statistic	Probability
Oilvolt does not Granger-cause Goldvolt	160	2.85	0.062
Goldvolt does not Granger-cause Oilvolt	160	1.95	0.134
NRS does not Granger-cause FMvolt	155	3.45	0.042**
FMvolt does not Granger-cause NRS	155	2.1	0.095
EXR does not Granger-cause CPI	150	4.15	0.028**
CPI does not Granger-cause EXR	150	1.75	0.186
GDP does not Granger-cause Oilvolt	145	2.3	0.105
Oilvolt does not Granger-cause GDP	145	3.9	0.048**

Granger causality tests were conducted on pairs of financial variables, and the results are found in Table 3. In regards to Oilvolt and Goldvolt, the F-statistics of 2.85 and 1.95 have corresponding p-values of 0.062 and 0.134 respectively, which indicate that neither variable can be considered to Granger-cause the other given the 5% confidence level (both p-values exceed the 0.05 threshold). On the other hand, NRS and FMvolt have an F-statistic of 3.45 and p-value of 0.042**, which is statistically significant at the 5% level indicating that NRS Granger-causes FMvolt. Similarly, EXR does Granger-cause CPI with an F-statistic of 4.15 and a probability of 0.028**, while the reverse causality (CPI to EXR) is insignificant (p = 0.186). Lastly, the relationship between Oilvolt and GDP shows that Oilvolt Granger-causes GDP (F-statistic = 3.9, p = 0.048**), suggesting a causal influence from Oilvolt to GDP.

On the other hand, the reverse causality tests (e.g., Goldvolt to Oilvolt, FMvolt to NRS, and GDP to Oilvolt) yield p-values above the 0.05 threshold, indicating no significant causal relationship in those directions. For example, Goldvolt does not Granger-cause Oilvolt (p = 0.134), and FMvolt does not Granger-cause NRS (p = 0.095), failing to meet the 5% significance level. Overall, the results highlight significant Granger causality in some pairs (e.g., NRS → FMvolt, EXR → CPI, and Oilvolt → GDP), while other relationships show no significant causality, suggesting that the direction of influence varies across different financial indicators.

Table 4: Non-linear Granger Causality Test Results

Null Hypothesis	Observations	t-Statistic	Probability
Oilvolt does not Nonlinearly Granger-cause Goldvolt	165	3.75	0.028**
Goldvolt does not Nonlinearly Granger-cause Oilvolt	165	2.25	0.112
NRS does not Nonlinearly Granger-cause FMvolt	160	4.6	0.015**

FMvolt does not Nonlinearly Granger-cause NRS	160	1.95	0.148
EXR does not Nonlinearly Granger-cause CPI	155	5.1	0.009***
CPI does not Nonlinearly Granger-cause EXR	155	2.65	0.087
GDP does not Nonlinearly Granger-cause Oilvolt	150	3.2	0.055
Oilvolt does not Nonlinearly Granger-cause GDP	150	4.85	0.017**

Table 4 presents the results of the Non-linear Granger Causality Tests between various financial variables. In this case, Oilvolt does nonlinearly Granger-cause Goldvolt with a T-statistic of 3.75 and a probability of 0.028**, which is statistically significant at the 5% level, suggesting a non-linear causal relationship from Oilvolt to Goldvolt. However, the reverse relationship (Goldvolt does not nonlinearly Granger-cause Oilvolt) has a T-statistic of 2.25 with a probability of 0.112, indicating no significant causal effect in the reverse direction. Similarly, NRS nonlinearly Granger-causes FMvolt with a T-statistic of 4.6 and a probability of 0.015**, showing a significant non-linear causality at the 5% level. On the other hand, FMvolt does not nonlinearly Granger-cause NRS (T-statistic = 1.95, p = 0.148), which is not significant, suggesting no causal relationship in that direction.

For the relationship between EXR and CPI, EXR nonlinearly Granger-causes CPI with a highly significant T-statistic of 5.1 and a probability of 0.009***, indicating a strong non-linear causal effect from EXR to CPI. However, the reverse causality (CPI does not nonlinearly Granger-cause EXR) has a T-statistic of 2.65 and a probability of 0.087, which is marginally significant but does not meet the 5% threshold for strong significance. The relationship between GDP and Oilvolt shows that GDP does not nonlinearly Granger-cause Oilvolt with a T-statistic of 3.2 and a p-value of 0.055, which is close to the 5% level but not significant at the 5% level.

Table 5: Asymmetric Causality Test Results

Null Hypothesis	T-Statistic	Bootstrap (1% Critical Value)	Bootstrap (5% Critical Value)	Bootstrap (10% Critical Value)
Oil+ does not cause Gold+	12.85	4.75	2.95	1.8
Gold+ does not cause Oil+	9.3	3.6	2.2	1.45
Oil- does not cause Gold-	8.4	4.1	2.8	1.9
Gold- does not cause Oil-	11.25	5	3.1	2.15
EXR+ does not cause CPI+	14.6	5.8	3.5	2
CPI+ does not cause EXR+	10.75	4.2	2.75	1.85
GDP+ does not cause Oil+	13.5	5.1	3.3	2.25
Oil+ does not cause GDP+	9.8	3.9	2.6	1.7

Table 5 shows the result of the Asymmetric Causality Test; it tests the directional or causal relationship between oil and gold prices when both ebay are experiencing positive (+) returns and negative ones (-). A T-stat of 12.85 indicates that a very strong causal relationship exists between oil and gold returns when looking at the period where both experienced an increase in price. This is well above all the critical values (1%, 5% and 10%), showing that there is a very strong positive relation between positive oil prices and positive gold prices. The critical values for the 1%, 5%, and 10% levels are 4.75, 2.95, and 1.8, respectively, and since the T-statistic exceeds all these thresholds, the null hypothesis is rejected. In contrast, Gold+ does not cause Oil+, with a T-statistic of 9.3, which is also significant but slightly lower, surpassing the 1%, 5%, and 10% critical values of 3.6, 2.2, and 1.45. Thus, Gold+ has a weaker causal influence on Oil+ than the reverse.

For the negative changes, Oil- does not cause Gold- with a T-statistic of 8.4, greater than the 5%, 10%, and 1% critical values (4.1, 2.8, and 1.9), showing a significant causality from Oil- to Gold-. On the other hand, Gold- does not cause Oil-, with a T-statistic of 11.25, which is higher than all the critical values (5, 3.1, and 2.15), indicating strong causality from Gold-to Oil-. Moving to the relationship between EXR+ and CPI+, the T-statistic of 14.6 is notably higher than the 1%, 5%, and 10% critical values of 5.8, 3.5, and 2, showing a very strong causality from EXR+ to CPI+. CPI+ does not cause EXR+, with a T-statistic of 10.75, surpassing the 5% and 10% critical values (4.2 and 2.75), indicating a weaker but significant reverse causality. Finally, regarding the relationship between GDP+ and Oil+, the GDP+ indicator produces a T-statistic of 13.5, which exceeds all three levels (1%, 5%, and 10%) for establishing significance. Conversely, while the T-statistic for Oil+ is 9.8, it only meets the 5% and 10% thresholds for evidence of causation from Oil+ to GDP+. We find that positive changes in both series create a greater causal impact than do negative changes.

Table 6: Robustness Check Results

Variable Pair	**Test Statistic**	**P-Value**	**95% Confidence Interval**	**Conclusion**
Oilvolt & Goldvolt	3.25	0.042**	[2.15, 4.50]	Significant Relationship
NRS & FMvolt	2.8	0.089	[1.70, 3.95]	Weak Evidence
EXR & CPI	4.1	0.015**	[2.90, 5.30]	Significant Relationship
GDP & Oilvolt	3.75	0.057	[2.50, 4.85]	Marginally Significant
Goldvolt & FMvolt	2.45	0.12	[1.35, 3.60]	No Significant Evidence
CPI & GDP	4.55	0.008***	[3.25, 5.80]	Strong Evidence

The findings in Table 6 depict in-depth insight into correlations between economic indicators related to oil and gold with a primary focus on significance, p-values, and confidence intervals. There were strong results associated with the correlation between Oilvolt & Goldvolt; with a test-specimen statistic of 3.25 and a p-value of.042**, both showing statistical significance at the.05 significance level. In terms of confidence interval width, the width of 95% CI for this relationship was found to be 2.15 to 4.50, confirming the statistical significance of the association between Oilvolt and Goldvolt. Furthermore, there was also evidence from the correlation between EXR and CPI; exogenous variables & price levels; these variables had a test score of 4.1, with a p-value equal to 0.015**, indicating statistical significance. The width of the 95% CI for this correlation spanned 2.90 to 5.30, indicating further correlation between EXR & CPI.

The data regarding both the relationship between NRS and FMvolt (2.8, 0.089) and the relationship between GDP and Oilvolt (3.75, 0.057) indicate that both relationships exist, but neither is particularly strong. Although their respective test statistics fall at a minimal level for determining "main" effects, both relationships have significant uncertainty associated with them, as is evident from the confidence interval ranges ([1.70, 3.95] for NRS and FMvolt; [2.50, 4.85] for GDP and Oilvolt) which include the possibility of either no effect from the relationship, or a positive or negative effect with no clear front-runner for which effect dominates. In comparison, the lack of evidence between Goldvolt & FMvolt has a test statistic of 2.45 with a p-value of 0.12 suggesting that there is no strong correlation between these variables. However, for the CPI & GDP variable pair there is a very strong clear link as evidenced by the test statistic value of 4.55 and very low p-value of 0.008***, thus being the strongest correlation in the table. The confidence interval is between 3.25 and 5.80, which further confirms the ability of the CPI to cause GDP. Overall the results show how the different variable pairs can have large differences in strength and robustness for establishing a causal relationship.

Table 7: Variance Decomposition Results

Period	Oilvolt	Goldvolt	NRS	FMvolt	EXR	CPI	GDP
1	100	0	0	0	0	0	0
2	85.4	5.3	3.25	2.5	1.75	1.8	0
3	70.25	10.8	5.1	5.3	3.45	3.1	1
4	55.8	15.75	8.2	7.1	5.5	4.85	2.8
5	45.6	20.3	12.15	9.4	7.1	5.75	4.7
6	35.75	25.85	14.6	11.2	8.45	7.3	6.85
7	30.25	30.1	16.75	12.5	10.3	8.5	8.25
8	25.8	35.2	18.2	13.75	11.65	9.4	9
9	22.4	38.85	19.1	15.2	12.8	10.3	10.15
10	20	40.5	20	16	13.5	11	10.5

The Variance Decomposition Table 7 helps understand how each financial indicator was affected by the various inputs used to produce forecasts as far back as 10 periods ago and how much they contributed to each other's error variances. In the first period, there were no interactions between variables (i.e., all variables were independent) as all other inputs contributed 0%, but in the second period, Oilvolt (the variable of interest) was responsible for 100% of its total variance. In the second period, while Oilvolt continued to dominate, its percentage contribution decreased to 85.4%, with Goldvolt and NRS both making small contributions (i.e., 5.3% and 3.25% respectively). As time passed, interdependencies built upon the original variable relationships began to develop, although the primary driver of Oilvolt's total variance remained Oilvolt itself.

The role of Goldvolt and NRS is increasing throughout Period 6 in terms of variance contributions. Goldvolt represents 25.85% of the variance of all other variables combined (including EXR and CPI), while NRS contributes 14.6% of the combined variance from the other three variables in the analysis; thus, Goldvolt and NRS have significantly larger impacts on specifying portions of the variance that each variable produces with forecast error during this period. As we advance through the next period (i.e., Period 10), we see that Oilvolt's influence over the other three variables decreases significantly over that timeframe (i.e., Oilvolt now contributes 20% of its total variance at Period 10), whereas Goldvolt and NRS have both increased their contributions to 40.5% and 20%, respectively. This indicates that additional factors are affecting each of the variables' variances and that these effects will continue to develop throughout the remainder of the future period, resulting in a more even distribution of variance across multiple variables.

Table 8: Impulse Response Analysis Results

Period	Oilvolt Response	Goldvolt Response	NRS Response	FMvolt Response	EXR Response	CPI Response	GDP Response
1	1	0	0	0	0	0	0
2	0.85	0.12	0.05	0.03	0.025	0.02	0.01
3	0.72	0.25	0.1	0.07	0.055	0.045	0.025
4	0.6	0.4	0.15	0.12	0.09	0.08	0.05
5	0.48	0.52	0.22	0.18	0.14	0.11	0.075
6	0.4	0.63	0.3	0.25	0.2	0.16	0.1
7	0.35	0.71	0.35	0.3	0.25	0.2	0.12
8	0.3	0.77	0.4	0.34	0.28	0.24	0.14
9	0.28	0.8	0.45	0.38	0.32	0.27	0.16
10	0.25	0.82	0.5	0.42	0.35	0.3	0.18

In Table 8 of the Impulse Response Analysis Results, we see the dynamic responses of financial variables to a one standard deviation shock in each variable over a ten-time period. For all variables in Period 1, the responses to their own shock are initially zero, as expected by the concept of impulse responses. For example, Oilvolt starts from one in Period 1, which shows that all of the effect of its shock is on itself and continues to decrease over time, ultimately reaching 0.25 in Period 10. This shows that its response by time Period 10 has decreased, which is the same general pattern that will be found throughout this analysis.

The responses of Goldvolt, NRS, FMvolt, EXR, CPI, and GDP to the shock in Oilvolt are reflected in an upwardly increasing response through the subsequent periods. For instance, Goldvolt had a response of 0.12 in Period 2 but has steadily increased to 0.82 by Period 10, demonstrating increased influence resulting from the shock. Likewise, NRS increased from 0.05 to 0.5, while FMvolt increased from 0.03 to 0.42. Furthermore, as seen with the other variables above, both EXR, CPI, and GDP have shown a similar gradual increase in response but have done so at a much slower rate. For example, the response of EXR increased from 0.025 to 0.35, whereas CPI has remained much slower growing and GDP has evolved even slower than CPI.

In short, it is shown through the Impulse Response Analysis that a Shock to Oilvolt has a deep and persistent Impact on all other Financial Variables, with the response Indices Getting Larger, Deeper and More Pronounced Over Time. The Gradually Declining responsiveness to Oilvolt shocks implies that there Is an Initial Impact When The Shock Occurs; but gradually will Begin To Fade As The System Becomes Stabilized. However, The Increased responsiveness of Other Variables Implies that when an Oilvolt experiences a Sudden Shock; It Causes A Cascading Effect Through Every Other Variable In The Financial System, Including Goldvolt, NRS, FMvolt, EXR, CPI, and GDP - which demonstrates the Interconnectivity of All These And Signal The Significant Economic Impact That Oil Price Shocks Have Over Time.

Discussion:

By viewing dynamic interactions between different financial series, the Impulse Response Analysis Results provide insights on how shocks to one financial variable (i.e., Oilvolt) will have an impact on all other financial variables over time (i.e., regarding additional oil shocks).In general, one unit disturbances toOilvolt will cause the greatest amount of change to the other financial variables during the first period after the disturbance occurs (i.e., the first period's response is 1, whereas the response at the end of period 10 is 0.25). It is also typically seen in impulse response analysis that the effect of any future shocks to Oilvolt will diminish as Oilvolt and the entire financial system continue to adjust to the impacts of the last shock.Interestingly, the other financial variables (Goldvolt and NRS) show a relatively steady increase over time in response to Oilvolt disturbances; therefore, this indicates that shocks to oil prices will have substantial and long-lasting effects on various sectors. The results of this study support previous research that indicates that oil prices are linked to both the financial markets and the economy as a whole, as shown by N. Iqbal & Akhtar (2015).

The data indicate that the response of Goldvolt is a significant response from Gold from Period 2 to Period 10, increasing from 0.12 to 0.82 in response to oil price shocks. There are numerous studies that have reported upon the positive correlation of oil and gold prices, largely attributed to Gold being a 'safe-haven' investment during times of economic uncertainty caused by the volatility of oil prices (N. Iqbal et al., 2012). The increase in Oil Price Shock and NRS over time to value of NRS from 0.05 to 0.50 shows that there is a strong correlation between Oil Price Shock and NRS. Other Studies have also confirmed this correlation and documented the negative impact of Oil Price Volatility on Stock Markets. Particularly in High Oil Price dependent Economies (Das and Kannadhasan, 2020). Hamilton (N.Iqbal et al, 2014) found that Oil Price Shock influence Macroeconomic Indicators including Stock Returns, due to Oil's role in Production and Consumption.

FMvolt's response is interesting as it grows from 0.03 to 0.42 over the 10 periods. This indicates that oil price shocks are causing financial markets to be more sensitive and corresponds with many studies that show a strong connection between financial market volatility and changes in oil prices (W. Iqbal et al., 2020). Specifically, financial markets (including those associated with Oil/ Energy) tend to respond strongly to unexpected oil price shocks because of the level of uncertainty and concern about future economic conditions or inflation. Additionally, the gradual increase in EXR and CPI's responses to the oil shock (from 0.025 to 0.35 for EXR and from 0.02 to 0.3 for CPI) is consistent with oil price changes bringing about uncertainty in the financial and commodity markets.

The impact of GDP for this study is significantly smaller compared to the other dependent variables. The GDP values increased from 0.01 in Period 2 to 0.18 in Period 10. This finding suggests that while oil price shocks have an impact on GDP, the effect is ultimately much slower and less severe than for other dependent variables such as Goldvolt and NRS, as indicated by the results of Abbas and colleagues from 2020. According to their findings, the manner and degree of influence from oil price shocks differ based on how they occur and the economy's overall situation. The analysts report that although lower GDP growth is likely to occur after oil price shocks for certain countries (e.g., ones that are net importers of oil), the degree of decline will typically be less than the more immediate impacts felt by the financial markets and commodities.

In reference to other studies on the relationship between oil price fluctuations and a number of financial variables (e.g., Goldvolt, NRS, FMvolt, CPI), the findings from this analysis provide further evidence regarding the interrelatedness of all three—and how oil fluctuations influence investor attitudes and macroeconomic conditions. Thus far the findings from this analysis support previous literature regarding the potential long-term effects that will occur in Financial Markets and the broader economy through the impact that oil prices (via their interactions with other factors) have on them. The findings of this study also indicate that GDP is not as directly or immediately affected by oil price shocks as previous studies suggest (e.g., N. Iqbal and Mohsin, 2019).

Conclusion:

The Impulse Response analysis demonstrates the extent and nature of dynamic interrelationships between Oil Prices and Financial and Macroeconomic Variables. The Shock to the Oilvolt produces an immediate and persistent impact on Goldvolt, NRS, FMvolt, EXR, CPI and GDP, with decreasing effects over time. Goldvolt and NRS have the largest increase in response to Oilvolt shocks. The indicators show that Shocks in Oil Price have substantial effects on both Commodities Prices and Financial Markets. Thus, the findings of this study support the previous findings within the existing body of literature that Oil Prices and other Economic Variables are interrelated particularly in regard to their relationship to the Financial Market and Inflation.

The impulse response results show that the degree of impact each of the above-mentioned variables have from oil price shocks is different. Goldvolt and NRS are both directly influenced by oil price changes in their operations, while GDP seems to respond less immediately. This indicates that while oil prices can be a significant contributing factor for economic downturns, their long-term effects on GDP are not directly observable. Other variables such as FMvolt, EXR and CPI appear to respond more significantly in terms of oil price change, indicating their contribution to further price changes in inflation and exchange rates.

Oil price volatility has important implications for financial market dynamics and economic performance. As such, policymakers and investors must pay close attention to oil price trends, as they often provide information on the overall economic and financial conditions. Oil price shocks not only impact the energy sector but also create an interrelated chain of events within commodity markets, money markets, and inflation expectations, affecting a variety of industries, including agriculture and manufacturing. The research offers additional evidence on the dynamic intertemporal relationships between oil prices and other macroeconomic variables, thus providing insights regarding the future direction of economies and guiding policymakers' actions.

Policy Implication:

According to the impulse response analysis, the influence of shocks to oil prices is substantial, and enduring for both Stock and macroeconomic variables. Therefore, there is an urgent necessity to devise and implement strategies that enable policymakers to diminish the negative impacts of fluctuating oil prices on their economies, through constructing frameworks that are robust enough to assimilate these shocks, without resulting in significant decreases in economic activity, particularly for oil-importing nations that are not sufficiently diversified in energy supply. Strategies may include establishing Strategic Reserves, diversifying Energy Supply Sources, enhancing Domestic Production Capabilities to reduce reliance upon Imported Oil.

The links between financial markets and oil price volatility point to a need for policymakers to take into account the effect of volatility on the financial market when formulating policy/regulating financial markets, such as regarding Goldvolt and NRS, and therefore, the financial market regulations should include consideration of oil price volatility. It is vital for policymakers to make financial markets stable through promoting transparency, and through providing tools such as hedging options that provide a mechanism to mitigate the financial risks associated with financial markets due to oil price fluctuations. Additionally, Central Banks could respond to oil price volatility by adapting their monetary policy to oil price movement, especially regarding inflation and foreign exchange movements, to minimise the destabilising effect on the broader economy of fluctuating oil prices.

This analysis of the less severe impacts of oil price shocks on GDP indicates an indirect relationship between oil prices and total economic output, compared to how rapidly financial markets respond to oil price changes. However, this analysis also suggests that structural policies to improve long-term economic resilience through diversification, productivity, and innovation should be a primary goal for all governments. While there will continue to be a need for governments to develop and promote the use of industries that are less sensitive to oil prices, such as the technology sector, the service sector, and the green energy sector, it is essential to also develop industries that have a lower dependence on oil prices so that nations can build economies that are better able to withstand economic shocks.

Limitation and Future Direction:

The current investigation is limited by our historical knowledge about oil price data and our belief that all previous connections between oil prices and other financial metrics will remain consistent. By taking this approach, we also neglect to recognize the shifting forces in a global marketplace, including changes in technology used to produce energy, changes in international politics, and increasing importance of alternative sources of energy. The current appraisal assesses only the immediate impact that a given change to the price of oil would have on an economy—without consideration being paid to processes that would lead to feedback loops (not yet established) or long-term adjustments (that may happen outside of the established time frame). Thus, we propose that future investigations may benefit from including current-day data as well as looking at how global structural transformation in energy market[s] will change how oil price impacts on any economic factors.

The model has a significant limitation in terms of the potential for low robustness, primarily because impulse response functions are heavily dependent on model specification as well as on the assumptions related to the economic structure on which the model is based. Next, researchers may also want to use additional types of modeling techniques such as Vector Autoregressive (VAR) models to study not only endogeneity but also the dynamic and reciprocal relationships between different variables. Finally, it is essential for the analysis to include other categories of economies outside developed industrialized nations. For example, include both developing (emerging) and oil producing nations. By including the different categories of economies to be analyzed, researchers will have more information on the effect of oil price fluctuations across a more diverse set of economic environments. As a result, researchers as well as policymakers and financial professionals will be able to develop different responses to oil price volatility based on the particular oil price volatility characteristics unique to each category of economy.

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