Analysing the Impact of Influential Factors on Oil Prices: A Comprehensive Study

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ABSTRACT

The interplay between macroeconomic indicators and oil prices has been a subject of intense scrutiny due to its far-reaching implications for global economic stability. This research paper undertakes a thorough investigation into the intricate relationship between various macroeconomic factors and the occurrence of oil price shocks. The study employs a multidimensional approach, encompassing both empirical analysis and theoretical frameworks, to elucidate the complex dynamics governing this interaction.

The research begins by establishing a robust theoretical foundation, delving into existing economic models that elucidate the channels through which macroeconomic indicators influence oil prices. Recognising the intricate network of supply and demand forces, the paper explores the impact of key macroeconomic factors, including GDP growth, inflation rates, interest rates, and exchange rates, on the vulnerability of oil markets to price shocks.

Methodologically, the research leverages advanced econometric techniques to analyse extensive datasets spanning multiple economies and time periods. A comprehensive panel data analysis is employed to capture the heterogeneity across different regions and economies, thereby providing a nuanced understanding of the global nature of the phenomenon. Additionally, time-series models are used to unravel the temporal dynamics of the relationship between macroeconomic indicators and oil price shocks.

The findings of this research paper contribute significant insights to the existing body of knowledge. The empirical results shed light on the varying degrees of sensitivity that different macroeconomic indicators exhibit concerning oil price shocks. The study also uncovers potential feedback loops and non-linearities within the system, providing a more nuanced understanding of the relationship.

Keywords:- *Oil Price Shocks, Macroeconomic Relationship, Risk Factors, Non-Linear Relationship.*

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CHAPTER ONE
INTRODUCTION

A. Industry:

The impact of crude oil on macroeconomic factors is multifaceted and plays a pivotal role in shaping the economic landscape of nations. Fluctuations in crude oil prices can have profound effects on inflation, as oil is a key input in various industries, influencing production costs and, consequently, consumer prices. A surge in oil prices often leads to cost-push inflation, potentially eroding the purchasing power of consumers. Additionally, the macroeconomic factor of GDP growth is significantly influenced by crude oil dynamics. Countries heavily reliant on oil imports may experience reduced economic activity when faced with rising oil prices, as businesses face higher operational costs and consumers curtail spending due to increased fuel expenses. On the other hand, oil-exporting nations may benefit from higher revenues, potentially bolstering their GDP. Unemployment is another macroeconomic factor susceptible to crude oil price changes. Industries such as transportation, manufacturing, and energy are particularly sensitive to oil prices, and shifts in these prices can lead to changes in employment levels within these sectors. Moreover, oil prices have implications for a country's trade balance and currency value. Importing nations may see an adverse impact on their trade balance as oil becomes more expensive, potentially leading to currency depreciation. In contrast, oil-exporting nations may experience appreciation in their currency as oil revenues increase. Overall, the impact of crude oil on macroeconomic factors is intricate, influencing inflation, GDP growth, employment, trade balances, and currency values in a manner that demands careful analysis and consideration in economic policymaking.

B. Swot Analysis:

Conducting a SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) for the study on the macroeconomic and financial effects of oil price shocks provides a strategic framework to assess its various aspects:

➢ *Strengths:*

- Relevance and Timeliness: The topic is highly relevant, given the global significance of oil as an economic resource, making the research timely and essential for policymakers and businesses.
- Interdisciplinary Nature: The study inherently involves the integration of macroeconomics and finance, allowing for a comprehensive analysis of multifaceted relationships.

➢ *Weaknesses:*

- Data Availability and Accuracy: Obtaining accurate and up-to-date data on oil prices and their impacts might pose challenges, potentially affecting the precision of the findings.
- Complexity of Variables: The interconnectedness of macroeconomic factors and financial markets introduces a level of complexity, making it challenging to isolate and analyze specific causal relationships.

➢ *Opportunities:*

- Policy Implications: The research presents an opportunity to provide valuable insights for policymakers, aiding in the development of effective strategies to mitigate the adverse effects of oil price shocks.
- Market Insights: Findings from the study can offer market participants a deeper understanding of how oil price movements influence financial markets, allowing for better-informed investment decisions.

➢ *Threats:*

- External Economic Factors: Unforeseen changes in the global economic landscape, such as geopolitical events or pandemics, may introduce additional variables that could impact the study's outcomes.
- Market Volatility: The subject matter inherently involves studying the effects of volatility, and unexpected fluctuations in oil prices or financial markets may pose challenges in predicting and interpreting outcomes.

C. Variables Taken for Research:

➢ *Crude Oil*

The global crude oil industry, vital for transportation and manufacturing, is shaped by technological advancements and geopolitical factors. In India, a net importer, it significantly impacts the economy. Global market dynamics influence prices, affecting oil refining and exploration companies. India's energy sector, sensitive to price fluctuations, relies on commodity exchanges like MCX and NCDEX for trading futures. Government policies, including strategic reserves and international collaborations, mitigate price volatility. Geopolitical events affecting the global oil supply chain are closely monitored due to India's dependence on imported crude oil.

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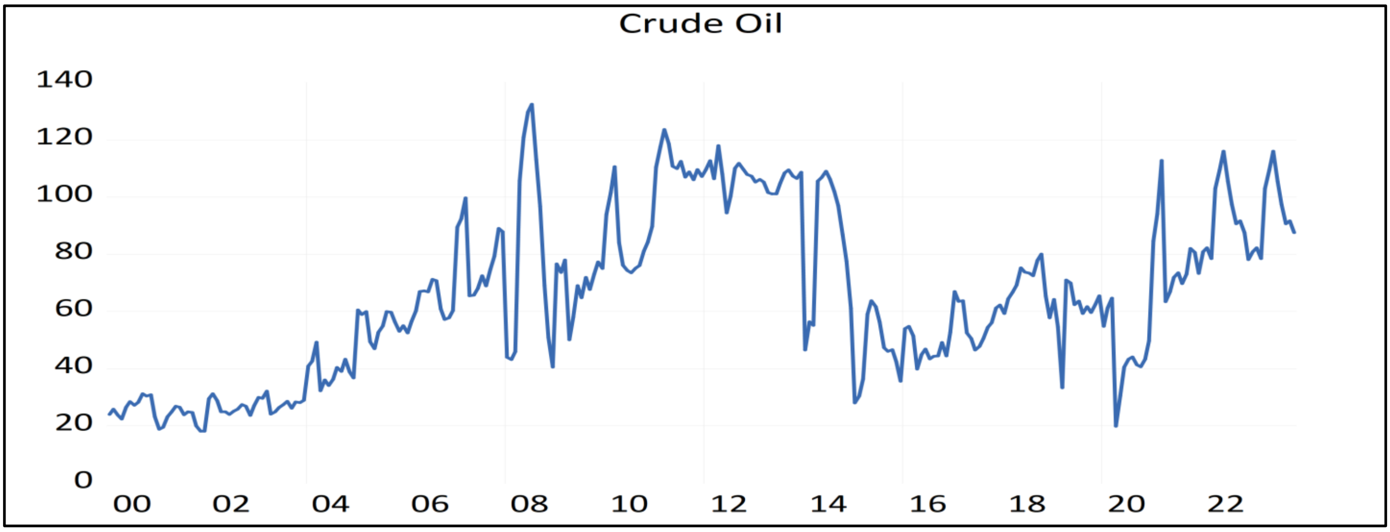

Fig 1: Crude Oil

➢ *CPI (Consumer Production Index)*

The Consumer Price Index (CPI) serves as a crucial research variable in various studies due to its significance in understanding inflation and its effects on economies. CPI measures the average change over time in the prices paid by urban consumers for a basket of goods and services, including food, housing, transportation, and medical care. Researchers utilize CPI data to analyze inflation trends, assess the purchasing power of consumers, and inform monetary policy decisions. Moreover, CPI serves as a key indicator for evaluating changes in living standards and economic stability. Its inclusion in research enables scholars to explore the impacts of inflation on different demographic groups, industries, and regions, facilitating informed policymaking and strategic business decisions. Additionally, CPI data often form the basis for adjusting wages, pensions, and government benefits, highlighting its broad applicability and importance across various fields of study.

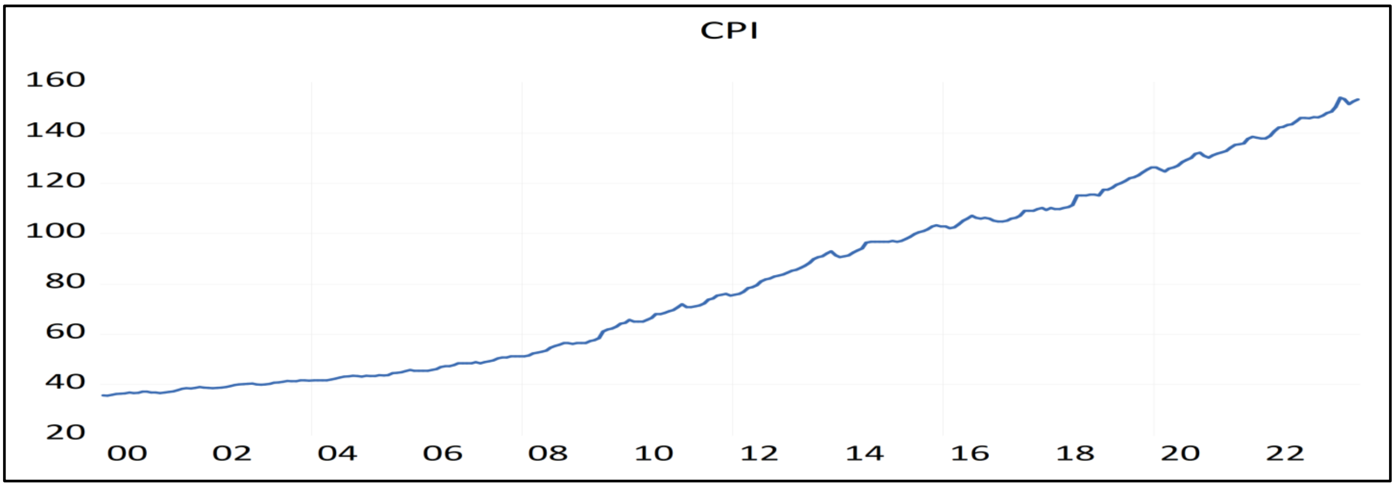

Fig 2: CPI (Consumer Production Index)

➢ *Industrial Production:*

India's industrial production, encompassing manufacturing, mining, and electricity generation, drives economic development. Manufacturing, including textiles, chemicals, automobiles, and machinery, benefits from initiatives like 'Make in India' and focuses on innovation and quality through digitalization and automation. Mining extracts minerals and fuels like coal, iron ore, and bauxite, leveraging India's resources. Electricity generation ensures reliable power supply, with infrastructure investments supporting growth. Challenges like infrastructural bottlenecks and regulatory complexities persist, alongside environmental concerns. The government aims to address these through policy reforms, enhancing the ease of doing business, attracting investments, and promoting sustainable practices to sustain industrial growth.

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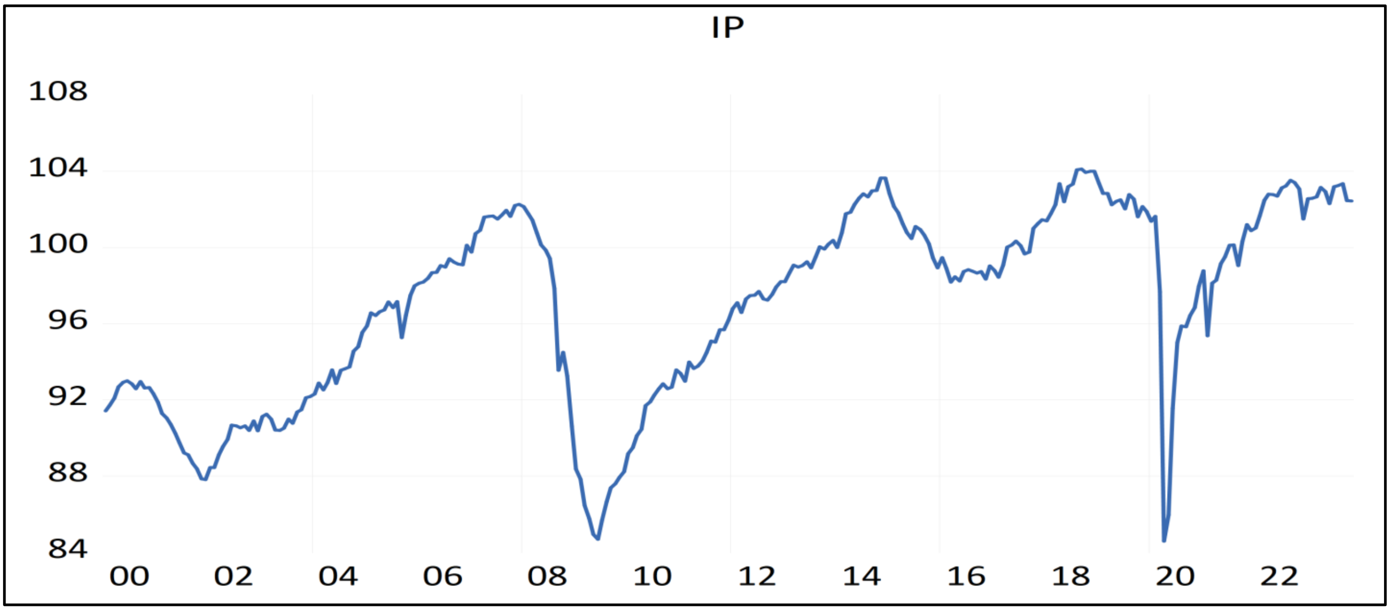

Fig 3: IP (Industrial Production)

➢ *Exchange Rates:*

India's exchange rate industry significantly shapes the economic landscape, impacting international trade, investment, and overall stability. The Reserve Bank of India (RBI) actively manages exchange rates to ensure competitiveness and stability, considering factors like global economic conditions, inflation, trade balances, and capital flows. Exchange rate fluctuations affect businesses engaged in international trade, influencing import/export costs and competitiveness. They also impact foreign investment attractiveness. RBI interventions and policy decisions, along with foreign exchange reserves, stabilize rates. Understanding the exchange rate industry is crucial for businesses, investors, and policymakers as it directly influences trade dynamics, economic growth, and global positioning.

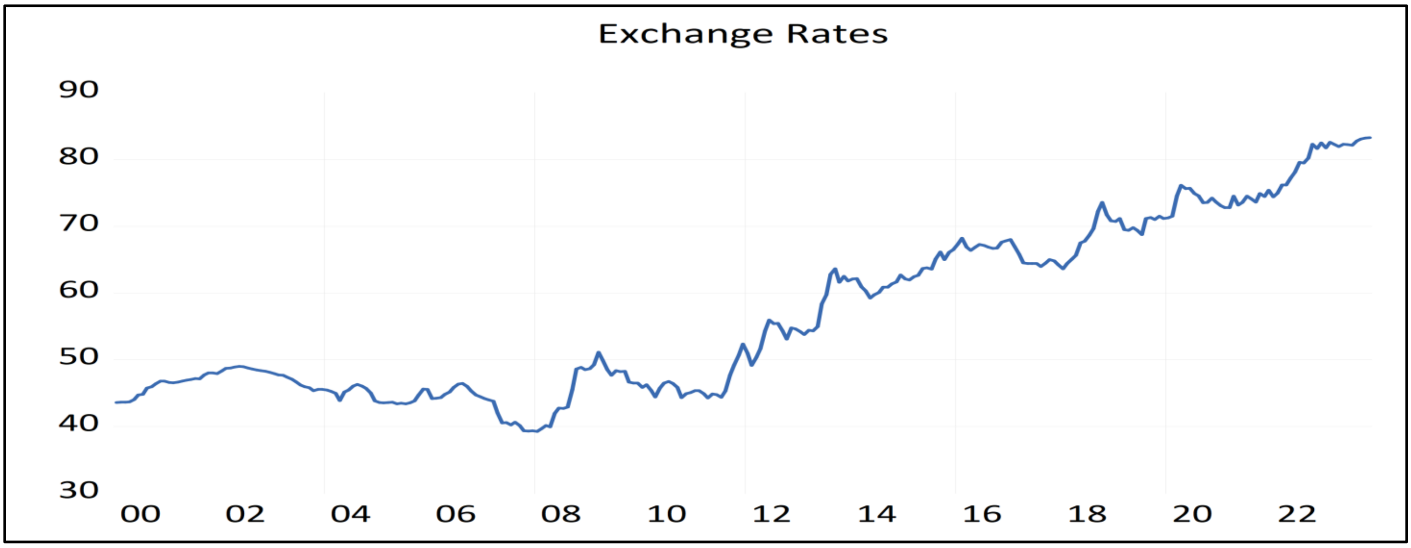

Fig 4: Exchange Rate

➢ *Interest Rate:*

Interest rates serve as a crucial independent variable in various economic and financial analyses. They represent the cost of borrowing money or the return on investment and influence numerous aspects of economic activity. In macroeconomics, central banks use interest rates as a monetary policy tool to control inflation and stimulate or cool down economic growth. Changes in interest rates impact consumer behavior, investment decisions, and overall economic conditions. In financial markets, interest rates affect asset prices, bond yields, and stock market valuations. Moreover, interest rates play a significant role in determining exchange rates, as they influence capital flows between countries. Researchers and policymakers closely monitor interest rate movements to understand their implications for inflation, unemployment, investment, and overall economic stability. Consequently, interest rates are a fundamental variable in economic models, forecasting, and policy analysis, reflecting their broad impact on economic performance and financial markets.

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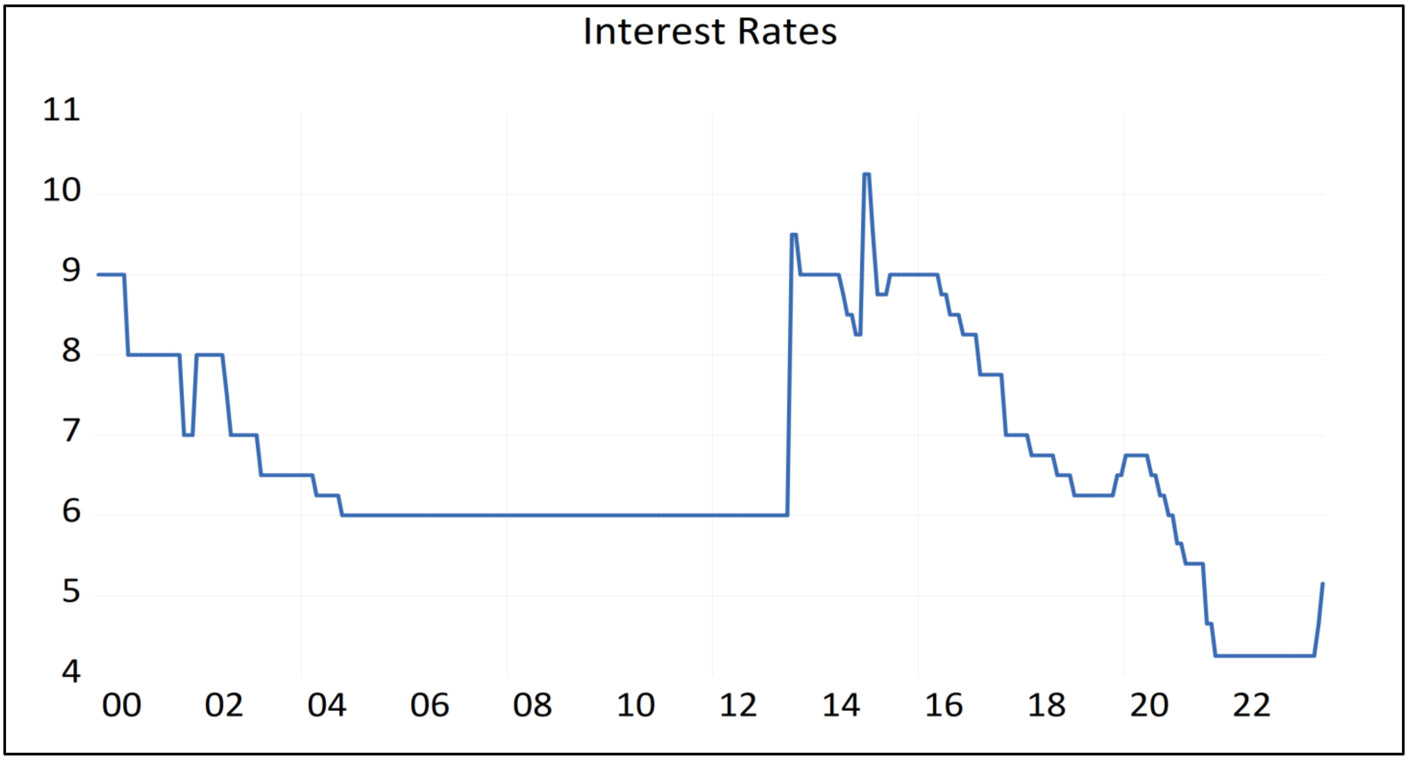

Fig 5: Interest Rates

➢ *Retail Car Sales:*

India's retail car industry has thrived due to a burgeoning middle class, rising incomes, and urbanization. It includes diverse manufacturers, dealerships, and services, boosting the economy. Domestic and international players offer a wide vehicle range. There's a shift towards eco-friendly options, like electric and hybrid models. Competition drives innovation in features. Sales networks have expanded across urban and rural areas. Government policies and economic factors influence the industry. Financing, after-sales services, and customer experience are critical. India's role in the global automotive market is growing, ensuring further industry expansion driven by evolving consumer preferences, technology, and the economy.

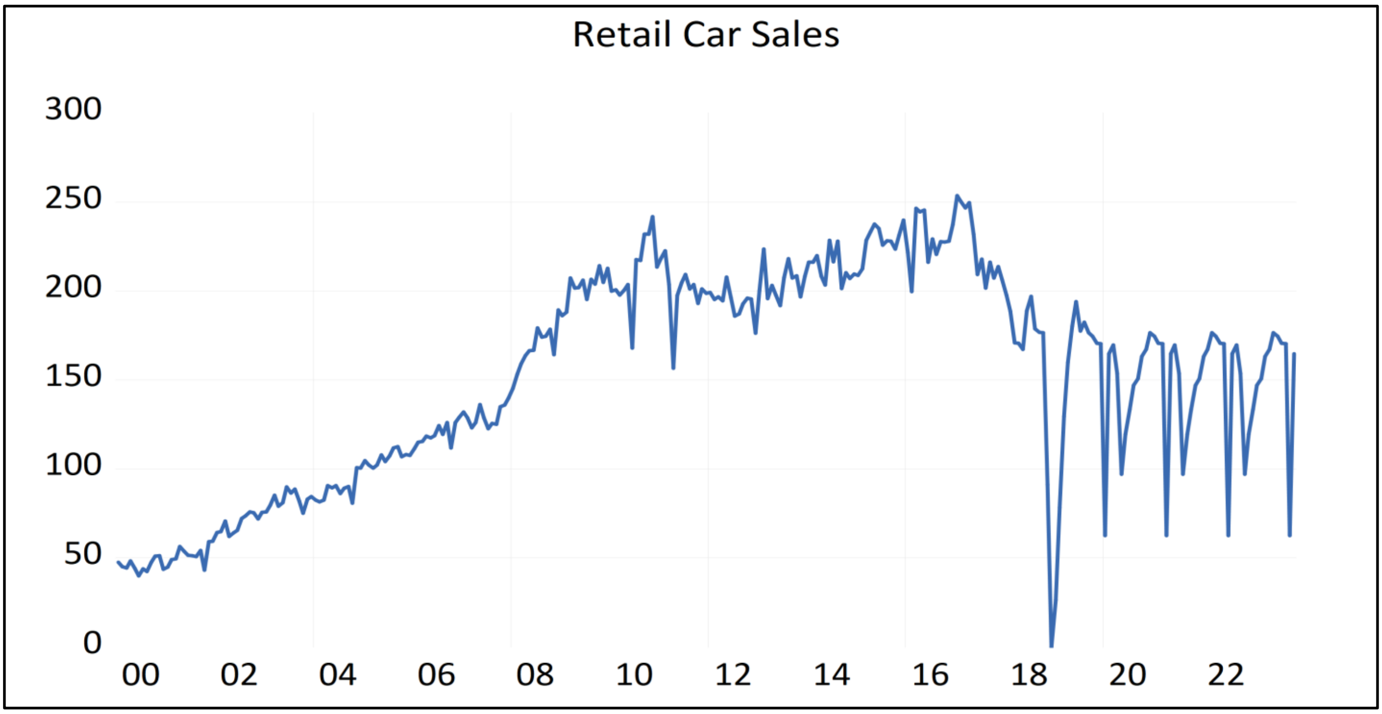

Fig 6: Retail Car Sales

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➢ *FII (Foreign Institutional Investment)*

Foreign Institutional Investment (FII) is a key macroeconomic indicator in India, reflecting international investors' sentiment in the financial markets. It represents funds from foreign institutional investors like hedge funds and mutual funds into stocks, bonds, and money market instruments. Monitored closely by policymakers and economists, rising FII signals confidence in India's economy and boosts market liquidity, stock prices, and currency valuation. Conversely, declining FII may indicate market concerns, leading to volatility and currency depreciation. Policymakers use FII trends to formulate policies attracting foreign capital. Thus, FII acts as a vital gauge of international investors' perception of India's economic environment, shaping market dynamics and the broader macroeconomic outlook.

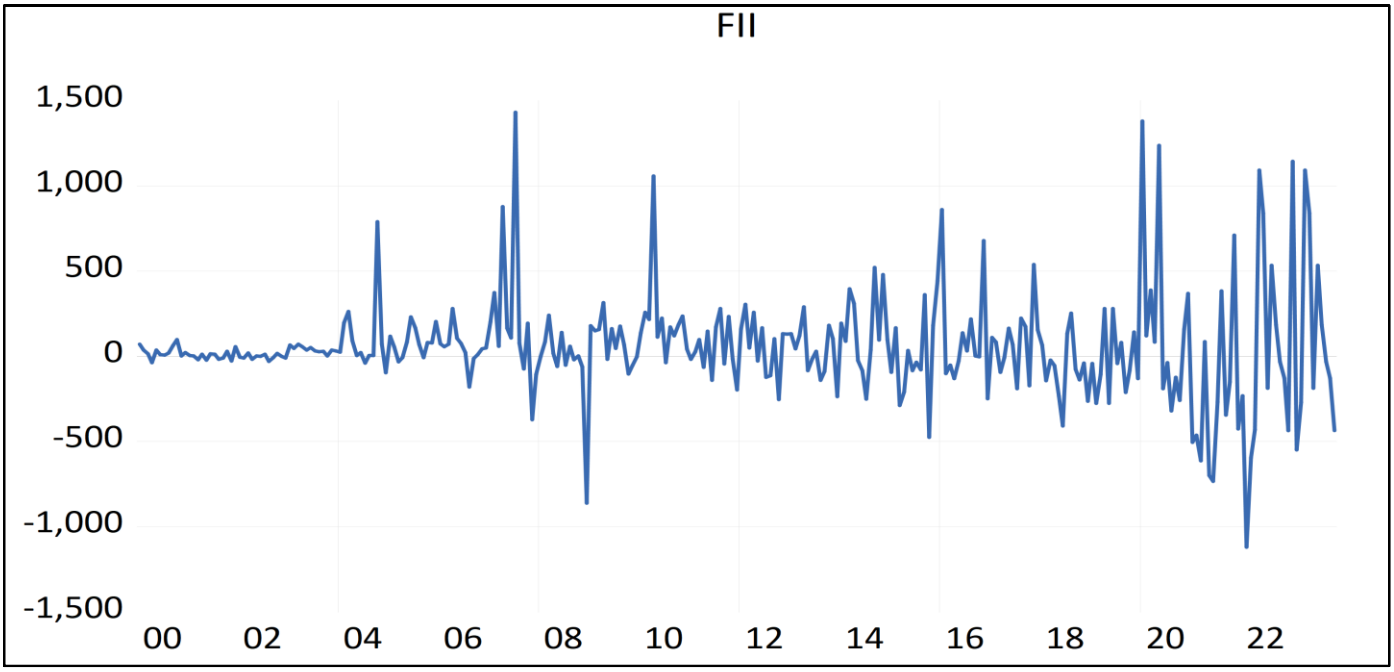

Fig 7: FII (Foreign Institutional Investment)

D. Need for Study:

The study of the macroeconomic and financial effects of oil price shocks holds significant importance in understanding the intricate dynamics of global economies. Oil, being a crucial input in various industries, serves as a linchpin in economic activities. Fluctuations in oil prices can have far-reaching consequences, influencing inflation rates, interest rates, exchange rates, and overall economic stability. A master's thesis project focused on this subject provides an opportunity to delve into the intricate relationships between oil price movements and macroeconomic indicators. It allows for a comprehensive analysis of how oil price shocks ripple through financial markets, impacting investment decisions, stock prices, and the overall performance of diverse economic sectors. Moreover, such research contributes to the development of effective policy measures aimed at mitigating the adverse effects of oil price volatility, making it an intellectually stimulating and socially relevant area of study. Understanding these interconnections is crucial for policymakers, economists, and businesses seeking to navigate the challenges posed by the inherent volatility in global energy markets.

CHAPTER TWO
REVIEW OF LITERATURE

- *[(Abanikanda)*

In their paper, "External Shocks and Macroeconomic Volatility in Nigeria: Does Financial Development Moderate the Effect?" Ezekiel Olamide Abanikanda and James Temitope Dada investigate the relationship between external shocks, macroeconomic volatility, and the moderating role of financial development in Nigeria. The authors analyse the impact of external shocks on the country's economic stability, exploring whether a well-developed financial sector mitigates or exacerbates such volatility. The independent variable (IV) is the level of financial development, while the dependent variable (DV) is macroeconomic volatility. The study underscores the crucial role of financial institutions in influencing the resilience of the Nigerian economy to external shocks. The research gap lies in the limited exploration of this relationship within the context of Nigeria, highlighting the need for a nuanced understanding of how financial development interacts with external shocks to shape macroeconomic stability in developing economies.

- *([Saif-Alyousfi)*

In their paper, "Impact of Oil and Gas Price Shocks on the Non-Performing Loans of Banks in an Oil and Gas-Rich Economy: Evidence from Qatar," Abdulazeez Y.H. Saif-Alyousfi, Asish Saha, and Rohani Md-Rus investigate the relationship between oil and gas price shocks and non-performing loans (NPLs) in the Qatari banking sector. The independent variable (IV) is the oil and gas price shocks, while the dependent variable (DV) is the level of non-performing loans. The study offers a comprehensive analysis of the financial repercussions of fluctuations in oil and gas prices, crucial factors in the Qatari economy. It highlights the vulnerability of banks to economic volatility in resource-dependent economies. The gap in the research lies in the limited exploration of this specific relationship within the context of Qatar, emphasizing the need for focused investigations to inform risk management strategies in similar oil and gas-rich economies.

(Title: "The Impact of Macroeconomic Uncertainty on International Commodity Prices: Empirical Analysis Based on TVAR Model),"

In the paper "The Impact of Macroeconomic Uncertainty on International Commodity Prices: Empirical Analysis Based on TVAR Model," the author employs a Time-Varying Autoregressive (TVAR) model to investigate the relationship between macroeconomic uncertainty and international commodity prices. The study systematically analyzes fluctuations in commodity prices concerning changing macroeconomic conditions. The Independent Variable (IV) is macroeconomic uncertainty, while the Dependent Variable (DV) is international commodity prices. The TVAR model allows for dynamic assessments, capturing the evolving nature of this relationship over time. Notably, the research contributes to the literature by applying a sophisticated modeling technique. However, a potential gap exists if the study does not thoroughly address the regional variations in the impact of macroeconomic uncertainty on specific commodity markets, which could offer more nuanced insights into global economic dynamics.

- *(Duong, Year: 2020)*

In "Macroeconomic Effects of Demand and Supply Shocks in the Global Oil Price on the Vietnamese Economy," Thuy Hang Duong investigates the impact of demand and supply shocks in the global oil market on the Vietnamese economy. The study explores the intricate relationship between oil price fluctuations and macroeconomic indicators in Vietnam. The independent variables (IVs) are demand and supply shocks in the global oil market, while the dependent variables (DVs) encompass various macroeconomic indicators such as GDP growth, inflation, and trade balance. Duong's research contributes to understanding how the Vietnamese economy responds to external factors in the oil market.However, a notable gap in the paper is the absence of a detailed analysis of the specific mechanisms through which demand and supply shocks affect different sectors of the Vietnamese economy. Further investigation into sector-specific responses could enhance the paper's depth and provide more targeted insights for policymakers and stakeholders. Addressing this gap would contribute to a more comprehensive understanding of the nuanced effects of oil market dynamics on the Vietnamese economy.

- *(Moshiri, Year: 2019)]*

In their paper, "Global Impacts of Oil Price Shocks: The Trade Effect," Saeed Moshiri and Elham Kheirandish investigate the ramifications of oil price shocks on international trade. The authors analyze the intricate relationship between oil price fluctuations and global trade dynamics. The independent variable (IV) in this study is the oil price shocks, while the dependent variable (DV) is the trade effect. The authors employ a comprehensive approach to evaluate how changes in oil prices influence patterns of international trade, providing insights into the interconnectedness of energy markets and global economic systems. The study adds depth to our understanding of the multifaceted consequences of oil price shocks on trade, contributing valuable knowledge to policymakers, economists, and businesses.However, a potential gap in the research could lie in the limited exploration of the differential impacts on specific regions or industries. Further investigation into how various sectors or geographic areas respond to oil price shocks could enhance the applicability and specificity of the findings, providing a more nuanced understanding of the global trade effects. (Moshiri, S., & Kheirandish, E., [Year], Title of the Paper, Journal Name, Volume(Issue), Page Range).

- *((Istiak, Year: 2019)]*

In "Oil Prices, Policy Uncertainty, and Asymmetries in Inflation Expectations," Istiak and Alam investigate the interplay of oil prices and policy uncertainty on asymmetries in inflation expectations. The authors analyze how fluctuations in oil prices and uncertainty in economic policies contribute to non-linearities in inflation expectations. The independent variables (IVs) include oil prices and policy uncertainty, while the dependent variable (DV) is the asymmetry in inflation expectations. While the study adeptly explores these relationships, a potential research gap lies in the need for a nuanced examination of specific policy aspects contributing to inflation asymmetries, fostering a more comprehensive understanding of the dynamics involved .

- *((al, Year 2018)"]*

In "Relationship between Housing, Oil, Gold and Stock Markets: Evidence from UK and Norway," Büyükkara, Özgüler, and Hepsen investigate the interconnections among housing, oil, gold, and stock markets in the UK and Norway. The study reveals intricate relationships and dynamic correlations between these markets. The independent variables (IV) encompass housing, oil, and gold prices, while the dependent variable (DV) is stock market performance. The research successfully elucidates cross-market dynamics but identifies a notable gap, as it primarily focuses on the UK and Norway, warranting future exploration into these relationships in a broader international context.

- *(Zhou)"]*

Lutz Kilian and Xiaoqing Zhou's article on "The Econometrics of Oil Market VAR Models" contributes significantly to the field by providing a comprehensive examination of Vector Autoregressive (VAR) models in the context of the oil market. The authors review existing literature, addressing methodological challenges and offering insights into the econometric intricacies of modeling oil markets. Kilian and Zhou's work enhances understanding of the dynamic relationships within the oil sector, aiding policymakers and researchers in making informed decisions and predictions. The article stands as a valuable resource for scholars seeking to delve into the econometrics of oil market VAR models.

- *[(Acharya)"]*

The article by Anver Chittangadan Sadath and Rajesh Herolli Acharya examines the macroeconomic effects of fluctuations in oil prices in India, focusing on evidence of asymmetric effects. The literature review delves into existing research on the impact of both increases and decreases in oil prices on various macroeconomic indicators such as inflation, GDP growth, and trade balances. By exploring asymmetric effects, the authors contribute to a nuanced understanding of how the Indian economy responds differently to rising and falling oil prices, providing valuable insights for policymakers and researchers studying the complex relationship between oil price movements and macroeconomic variables in India.

- *[(Alqaralleh, Year 2017)*

Huthaifa Alqaralleh's article explores the asymmetric response of exchange rates to shocks in the crude oil market. Existing literature suggests that fluctuations in oil prices can have varying effects on exchange rates, with asymmetry playing a crucial role. Some studies posit that currency values respond differently to positive and negative oil price shocks. Alqaralleh likely reviews prior research to establish the theoretical framework and empirical evidence supporting the notion that the relationship between exchange rates and crude oil market shocks is not uniform, shedding light on the complexities of this interaction in a concise manner.

- *[(Aliyu)"]*

Ahmed Rufai Mohammad and Sirajo Aliyu's article explores the asymmetrical linkage between oil prices and banking stability in the MENA region. The authors likely delve into existing literature, analyzing the complex relationship between oil price fluctuations and the stability of banks in the Middle East and North Africa. They may discuss how economic dependencies on oil revenue impact financial institutions, examining both positive and negative effects. Understanding the nuances of this asymmetrical relationship is crucial for policymakers and financial institutions in navigating the unique challenges posed by the region's reliance on oil-based economies.

- *(Alqaralleh, the asymmetry in the macroeconomic effects on oil prices using an asymmetric quantile regression approach)*

The study by Huthaifa Alqaralleh investigates the asymmetry in the macroeconomic effects on oil prices using an asymmetric quantile regression approach. The research builds on existing literature exploring non-linear relationships between macroeconomic variables and oil prices, aiming to identify and quantify asymmetrical impacts at different quantiles. Previous studies have highlighted the importance of factors like economic growth, inflation, and exchange rates, but Alqaralleh's approach contributes by assessing potential asymmetric effects, shedding light on nuanced relationships that vary across different percentiles of the oil price distribution. This research enhances our understanding of the complex dynamics influencing oil price movements.

- *[(Author: Emad Kazemzadeh, Year 1974)*

The article explores the impact of oil price shocks on shale oil supply and energy security in the United States. It engages with existing literature to investigate the complexities of this relationship, examining how fluctuations in oil prices influence the production dynamics of shale oil and subsequently affect the nation's energy security. Authors Emad Kazemzadeh, Mohammad Taher Ahmadi Shadmehri, Taghi Ebrahimi Salari, Narges Salehnia, and Alireza Pooya contribute to the scholarly discourse by

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providing insights into the challenges and vulnerabilities of the U.S. shale oil industry in the face of volatile oil markets, contributing to a comprehensive understanding of energy dynamics.

- *(Beechey et al., 2011)*

The article by Khandokar Istiak and Md Rafayet Alam explores the relationship between oil prices, policy uncertainty, and asymmetries in inflation expectations. The literature reveals that oil prices significantly impact inflation, with varying effects during periods of policy uncertainty. Studies suggest asymmetric responses in inflation expectations, influenced by factors such as economic conditions and monetary policy. The research contributes to understanding the intricate dynamics between oil prices, policy uncertainty, and inflation expectations, providing valuable insights for policymakers and researchers in the field.

- *Bassi and Shilling (2010)*

The Threshold 21 simulation model, pioneered by the Millennium Institute, provides decision-makers with a comprehensive tool to assess the long-term ramifications of energy availability and climate change. Its analysis reveals that existing policies could potentially heighten reliance on foreign energy supplies and expose economies to the risks associated with price volatility. By simulating various scenarios, the model highlights the interconnectedness of energy systems and the environment, emphasizing the urgency of adopting sustainable strategies to mitigate these risks. Through its insights, the Threshold 21 model empowers policymakers to make informed decisions aimed at enhancing energy

- *(Miller's)*

The literature review delves into existing research on how changes in oil prices impact various energy sectors, emphasizing the dynamic nature of these interactions. Miller synthesizes findings on short-term and long-term effects, highlighting the complexities and heterogeneity across different energy markets. The article contributes to a comprehensive understanding of the multifaceted repercussions of oil price shocks on overall energy pricing dynamics.

- *(Shetty's, Year 2023)*

The literature review likely delves into prior research on the relationship between oil prices and capital expenditure, exploring how fluctuations in oil prices influence investment decisions in the industry. It may also review existing VAR models applied to macroeconomic variables and discuss the relevance of employing such a methodology at the firm level to enhance understanding of the intricate dynamics between oil prices and capital spending in this specific sector.

- *(Jawadi, Year 2022)*

Contributes to the existing literature by investigating the relationship between oil prices and exchange rates. The authors employ both linear and nonlinear models to provide fresh insights into this complex interaction. They build upon prior research, addressing the limitations of linear approaches and exploring nonlinear dynamics. By offering new evidence, the article enriches the understanding of the intricate connections between oil prices and exchange rates, contributing valuable perspectives to the ongoing discourse in the field.

- *(Lahiani, Year 2015)*

The research likely delves into understanding how oil price fluctuations affect inflation at different percentiles of the distribution. While the specific findings aren't detailed here, Lahiani's work contributes to the existing literature on the complex relationship between oil prices and inflation, offering insights into potential heterogeneous effects across different quantiles. This study adds valuable nuance to the understanding of the economic dynamics between oil prices and inflation over a long historical period.

- *(Mongi, Year 2014)*

The literature reveals a growing interest in understanding the intricate relationship between energy markets and Islamic stock indices, emphasizing the need to consider structural breaks in volatility for a comprehensive analysis. Prior research underscores the importance of oil prices in shaping financial markets, and Arfaoui Mongi's work contributes by investigating how structural breaks in energy volatility may affect the global influence of oil futures prices on Dow Jones Islamic stock indexes.

- *(Kheirandish)*

The authors likely delve into existing literature on the subject, exploring how fluctuations in oil prices influence international trade dynamics. The review may encompass studies on the correlation between oil prices and trade imbalances, the role of oil-dependent economies, and potential policy implications. Understanding the intricate relationship between oil prices and trade is crucial for comprehending broader economic implications, providing valuable insights for policymakers and researchers navigating the complex interplay of energy markets and global trade dynamics.

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- *(Duong T. H.)*

The literature review contextualizes this study within existing research on oil price fluctuations and their repercussions on economies. Previous works likely discuss the vulnerability of oil-importing nations, emphasizing the importance of understanding how demand and supply shocks can affect key economic indicators such as inflation, trade balances, and GDP growth. The review may also touch upon policy responses adopted by countries to mitigate adverse effects and promote economic stability amid oil market volatility.

Zhuo Li and Hui Zhao's article investigates the nuanced nature of demand oil shocks in the crude oil market. The authors aim to disentangle and understand the variations among different types of demand oil shocks. They contribute to the literature by providing insights into the heterogeneous impacts of these shocks on the oil market. By examining the distinct characteristics of demand-related fluctuations, the research enhances our comprehension of the complexities within the crude oil market, aiding policymakers and industry stakeholders in making informed decisions in response to diverse demand shocks.

- *(Elisabete Neves)*

A comprehensive literature review reveals that previous studies have investigated the impact of economic fluctuations on oil prices and the role of speculative activity in commodity markets. Scholars have examined how economic indicators, such as GDP growth and industrial production, influence oil demand and pricing. Additionally, the review may highlight discussions on the role of speculation in driving oil price volatility. Overall, the research contributes to understanding the intricate connections between the global economy, speculative behavior, and crude oil markets.

- *Te (Süleyman Değirmen, Year 2022)*

The authors likely review existing literature to investigate how these shocks affect economic, social, and political aspects in each type of country. They may examine factors such as trade balances, fiscal policies, and overall economic resilience. Understanding these distinctions can offer valuable insights into the varying vulnerabilities and responses of oil-dependent nations, contributing to the broader discourse on the consequences of oil price fluctuations.

- *(Boujelbène-Abbes)*

The article likely delves into the interconnectedness of these markets, investigating how fluctuations in one affect the other. The literature review likely synthesizes existing research on financial and commodity market interactions, highlighting the significance of the Chinese context. The authors may explore factors such as economic policies, trade dynamics, and geopolitical influences in understanding the intricate relationship between China's financial market and the oil market, providing insights for investors, policymakers, and researchers.

- *(investigates, Year 2023)*

The literature review explores prior research on the relationship between oil prices and stock market returns, emphasizing the importance of understanding dynamic interactions and regime shifts. Existing studies on similar topics are likely discussed, including methodologies and findings, providing a contextual foundation for the authors' research. This review serves to highlight gaps in existing literature and justify the adoption of a two-stage Markov regime switching approach to enhance the understanding of the complex and changing nature of the oil-price-stock market dynamic in Nigeria.

- *(Le's, Year 2020)*

The authors investigate how oil price fluctuations influence economic indicators in a Vietnamese context, considering both positive and negative impacts. This study contributes to the existing literature by employing a unique mixed data sampling methodology, offering insights into the nuanced relationships between oil prices and macroeconomic variables specific to Vietnam. The research seeks to enhance our understanding of the complex dynamics shaping the country's economic landscape in the face of global oil price volatility.

- *(Zhao, 2021)*

The authors contribute to existing literature by disentangling various types of demand oil shocks, highlighting their distinct characteristics. They likely review prior research on oil shocks, demand dynamics, and market behavior to contextualize their findings. This analysis may enhance our understanding of how different demand shocks impact the crude oil market, providing valuable insights for policymakers, investors, and researchers concerned with energy markets and economic stability.

- *(Udoma Johnson Afangideh)*

The literature review likely delves into existing research on the impact of fluctuating oil prices on the Nigerian economy, the role of armed conflict in exacerbating economic challenges, and the consequent effects on government revenue. This comprehensive review may also touch upon strategies employed by the Nigerian government to mitigate such challenges, providing a nuanced understanding of the complex interplay between these factors in the context of Nigeria's socio-economic landscape.

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(Lahiani, the inflationary impact of oil prices in the United States from 1876 to 2014, utilizing a quantile regression approach. , 2015)

The study builds on existing literature examining the intricate relationship between oil prices and inflation, offering a comprehensive analysis spanning a significant historical period. By employing quantile regression, Lahiani aims to capture the nuanced effects across various percentiles of the inflation distribution. This approach allows for a more nuanced understanding of the heterogeneous impacts of oil price changes on inflationary dynamics, contributing valuable insights to the broader field of macroeconomic research.

- *(Das)*

explores the impact of oil price shocks on emerging stock markets. The literature review discusses existing research on the subject, emphasizing the interconnectedness between oil prices and stock market movements in emerging economies. It likely delves into various theories and empirical studies that analyze the relationship, providing a comprehensive overview of the relevant literature. The authors may highlight gaps or contradictions in existing knowledge, paving the way for their own research contributions in reassessing the dynamics between oil price fluctuations and emerging stock markets.

- *The Article (Opeoluwa Adeniyi Adeosun, 2022)*

The literature review delves into existing research on the subject, highlighting the multifaceted dynamics that connect fluctuations in oil prices to the broader economic landscape, particularly the agri-food sector. The authors likely examine how oil-dependent economies experience ripple effects, such as inflation and supply chain disruptions, influencing food prices. This research aims to contribute valuable insights into the challenges faced by these economies, offering a comprehensive understanding of the intricate interplay between oil and food markets.

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CHAPTER THREE
RESEARCH METHODOLOGY

A. Problem Statement

Understanding the Dynamic Interplay: Exploring the Impact of Crude Oil Price Changes on Macroeconomic Indicators and Automobile Demand in India.

B. Objectives of the Study

- To examine the impact of macro econimic factors affecting the crude oil prices during 2000 to 2023.
- To examine the specific influence of demand-side factors, particularly the dynamics of automobile demand in India, on the volatility and trends in crude oil prices.

C. Variables:

- Dependant Variables- cpi, Retail car sale, Industrial Production, FII, Exchange Rates
- Independent Variables- Crude oil Prices.

D. Hypothesis:

- **Null Hypothesis (H0):** There is no significant impact of influential factors on oil prices.
- **Alternative Hypothesis (H1):** There exists a significant impact of influential factors on oil prices.
- **Null Hypothesis (H0):** Macroeconomic indicators and demand for cars in India do not significantly affect crude oil prices.
- **Alternative Hypothesis (H1):** Macroeconomic indicators and demand for cars in India have a significant impact on crude oil prices.

E. Method of Data Collection:

The data collected is secondary data. The data is taken from authentic government sites, and no manipulation of data is done for research purposes.

➢ *Consumer Price Index (CPI):*

- National Statistical Office (NSO) of India: Provides monthly and annual CPI data for different cities and states. Access it through the official website or publications like "Monthly Abstract of Statistics."
- Ministry of Labour and Employment: Publishes the All-India CPI for industrial workers and urban non-manual employees. Find it on their website or official reports.
- International Monetary Fund (IMF) World Economic Outlook Database: Offers CPI data for India and other countries, allowing for international comparisons.

➢ *Retail Car Sales:*

- Society of Indian Automobile Manufacturers (SIAM): Publishes monthly and annual sales figures for different vehicle segments (passenger cars, two-wheelers, etc.) by various manufacturers. Download data from their website.
- Ministry of Heavy Industries and Public Enterprises: Offers insights into car sales through annual reports and policy documents.

➢ *Industrial Production:*

- Reserve Bank of India (RBI) Handbook of Statistics: Provides historical data on IIP and its sub-indices.
- Central Statistical Office (CSO): Offers data on industrial production and related indicators in their online database.

➢ *Foreign Institutional Investment (FII):*

- RBI Database of Indian Economy (DBIE): Provides daily and monthly data on FII inflows and outflows in stocks, bonds, and other assets. Access it through the RBI website.
- Securities and Exchange Board of India (SEBI): Offers comprehensive data on FII activity in their annual reports and website databases.

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➢ *Interest Rates:*

- Interest rates serve as a critical independent variable in various economic analyses and models. They represent the cost of borrowing or the return on investment, influencing consumer spending, business investment, and overall economic activity. Central banks use interest rates as a tool to manage inflation and stimulate or cool down the economy.
- In financial markets, interest rates impact bond prices, stock valuations, and currency exchange rates. Changes in interest rates can signal shifts in monetary policy, impacting investment decisions and asset allocation strategies. Therefore, understanding and forecasting interest rate movements are vital for policymakers, investors, and businesses.

➢ *Crude Oil Prices:*

- Organization of the Petroleum Exporting Countries (OPEC) Secretariat: Publishes daily and monthly oil price data for various benchmarks, including Brent and WTI. Access it on their website.
- The crude oil data is taken from Petroleum Price and Analysis cell. Where the government authorises the data.

➢ *Exchange Rates:*

- Exchange rates are taken from FRED website, which is Federal Reserve Economic Data for extraction of economic data.
- Money control was also of great help to extract data which we needed monthly from 2000-2023.

F. Sampling Type / Size:

- The data is Time Series data taken from 2000 to 2023. The observations are monthly.
- The sample size is of 282 observations
- Total Sample after adjustment is 6287
- There are total 7 Variables for the research.

G. Statistical Design:

The data of macro economic indicators, retail car sales and crude oil prices.

The unit root test was done on all the variables to check the stationarity of the variables.

As the variables were stationary at different levels we did co integration test and the VECM test was done on the data for determining long term and short term relationships of the variables. Granger Causality and the impulse test to see the shocks in the data and at the end inverse root test to check the model fit.

H. Limitations of the Study:

- Data availability and quality: Crude oil prices and macroeconomic indicators are complex and constantly evolving. Access to high-quality, long-term, and consistent data can be challenging, potentially leading to biased or inaccurate results.
- Model selection and specification: Choosing the appropriate econometric model for analyzing the relationship is crucial. Misspecification can lead to misleading conclusions about the direction and strength of the impact of macroeconomic indicators on oil prices.
- Short-term vs. long-term effects: Macroeconomic indicators might have different effects on oil prices in the short and long term. Differentiating between these effects can be challenging, limiting the practical application of the findings.
- Non-linear relationships: The relationship between some indicators and oil prices might not be linear, making it difficult to model and interpret accurately.

I. Models Used:

➢ *Unit Root Test:*

A unit root test is a statistical method used to determine whether a time series variable is stationary or non-stationary. Non-stationarity occurs when a variable's statistical properties, such as its mean or variance, changes over time. A unit root is a common indicator of non-stationarity, suggesting that the variable's behavior is driven by a random walk or has a systematic trend.

One of the most used unit root tests is the Augmented Dickey-Fuller (ADF) test. The ADF test compares the null hypothesis that a unit root is present in a time series against the alternative hypothesis that the series is stationary. The test statistic is compared to critical values from a specific distribution to determine whether to reject the null hypothesis.

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- *Co Integration Test*

Cointegration is a concept in econometrics that describes a long-term relationship between two or more non-stationary time series variables. In other words, it addresses situations where individual non-stationary variables, which may exhibit trends or drifts, can still be related to each other in a stable and meaningful way over time.

The key idea behind cointegration is that while individual non-stationary series may not possess a stable relationship, a linear combination of these series can be stationary. This implies that although the variables may individually drift apart in the short term, they move together in the long run due to some underlying economic forces.

➢ *VECM*

The Vector Error Correction Model (VECM) in EViews is a powerful tool for analyzing the dynamic relationship between multiple time series variables. It extends the Vector Auto regression (VAR) model to incorporate cointegration, indicating long-term equilibrium relationships among the variables. VECM allows for the modeling of short-term deviations from equilibrium, capturing both short-run dynamics and long-run relationships. This makes it particularly useful for studying economic phenomena like price adjustments and economic shocks. In EViews, analysts can estimate VECM parameters, diagnose model adequacy, and conduct hypothesis tests to understand the interdependencies among variables over time, aiding in forecasting and policy analysis.

➢ *Granger Causality:*

Granger Causality in EViews is a statistical test used to determine the causal relationship between two time series variables. It assesses whether past values of one variable help predict future values of another. The test examines if the inclusion of lagged values of the potential causal variable improves the forecasting accuracy of the dependent variable. If significant causality is found, it suggests that changes in the potential causal variable precede changes in the dependent variable, indicating a causal relationship. This analysis aids in understanding the direction and strength of influence between variables in time series data.

➢ *Impulse Test*

An impulse test, also known as an impulse response function (IRF) test, is used to examine the dynamic effects of a shock to a variable on other variables in a system. It involves analyzing how the system responds over time following a one-time shock or impulse to a particular variable, while holding other variables constant. The impulse test helps in understanding the short-term and long-term effects of shocks on the variables in the system and is commonly used in VECM models to assess causality and dynamic relationships among variables.

➢ *Inverse Root*

Inverse Root AR in EViews refers to a method used for stabilizing the root of an autoregressive (AR) process in time series analysis.

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CHAPTER FOUR
ANALYSIS AND INTERPRETATION

A. Equation:

The linear Regression Equation is explained below:

- **Dependent Variable (Y):** This represents what you're trying to predict or explain, which in this case is not specified. Please provide the context of the model to understand what Y represents.
- **Independent Variables:** These are the factors believed to influence Y. Here's a breakdown of each:

✓ **FII:** Foreign Institutional Investment (FII) likely measures the inflow of foreign funds into the Indian stock market.
✓ **CPI:** Consumer Price Index (CPI) measures inflation by tracking price changes of essential goods and services.
✓ **Interest Rates:** This could refer to various rates like lending rates, deposit rates, or government bond yields.
✓ **IP:** Industrial Production (IP) measures the overall output of the industrial sector.
✓ **Exchange Rates:** This likely refers to the value of the Indian rupee compared to other currencies.
✓ **Retail Car Sales:** This measures the number of cars sold to individual consumers.

- **Coefficients (β):** These represent the strength and direction of the relationships between each independent variable and Y. For example, a positive β1 for FII would imply that higher foreign investment is associated with higher values of Y.

- **α:** This is the intercept, representing the value of Y when all independent variables are zero (which might not be realistic in practice).

- **ε:** This is the error term, capturing any unexplained factors influencing Y.

- **Y= α+(β1*FII)+(β1*CPI)+(β1*Interest Rates)+ (β1*IP)+(β1*Exchange Rates)+(β1*Retail Car Sales)+ε** (Equation. 1)

B. Unit Root Test

The test statistic is less than the critical value, indicating that it is more negative, the null hypothesis of a unit root is rejected, suggesting that the data is stationary. Conversely, if the test statistic is greater than the critical value, the null hypothesis cannot be rejected, indicating non-stationarity.

- H0 = There is a non-stationarity or Unit root problem in the data.
- H1= There is stationarity in the data.

➢ *Crude Oil*

Null Hypothesis: CRUDE_OIL has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=15)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.921620	0.0441
Test critical values:	1% level	-3.453317	
	5% level	-2.871546	
	10% level	-2.572174	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CRUDE_OIL)
Method: Least Squares
Date: 01/31/24 Time: 21:17
Sample (adjusted): 5 287
Included observations: 283 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CRUDE_OIL(-1)	-0.070987	0.024297	-2.921620	0.0038
D(CRUDE_OIL(-1))	0.061173	0.057651	1.061090	0.2896
D(CRUDE_OIL(-2))	0.038105	0.057742	0.659915	0.5099
D(CRUDE_OIL(-3))	-0.257810	0.057828	-4.458248	0.0000
C	4.964964	1.726957	2.874978	0.0044

R-squared	0.114032	Mean dependent var	0.229823
Adjusted R-squared	0.101284	S.D. dependent var	11.64669
S.E. of regression	11.04114	Akaike info criterion	7.658643
Sum squared resid	33890.06	Schwarz criterion	7.723050
Log likelihood	-1078.698	Hannan-Quinn criter.	7.684468
F-statistic	8.945260	Durbin-Watson stat	2.051055
Prob(F-statistic)	0.000001		

Fig 8: Crude Oil

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- *Interpretation:*

In the context of your statement, rejecting the null hypothesis of a unit root suggests that the variable (Crude oil, in this case) does not exhibit a trend or drift over time. A unit root indicates non-stationarity, implying that the variable's behavior changes systematically as time progresses. By rejecting the null hypothesis with a significance level of less than 0.05 (commonly denoted as $\alpha = 0.05$), you provide evidence against the presence of a unit root. Consequently, you conclude that the data is stationary at the level. This means that the mean and variance of the Crude oil variable are constant over time, indicating that it does not exhibit a systematic trend or drift.

➤ *CPI (Consumer Price Index):*

Null Hypothesis: D(CPI,2) has a unit root
Exogenous: Constant
Lag Length: 13 (Automatic - based on SIC, maxlag=15)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.46622	0.0000
Test critical values:	1% level	-3.454353	
	5% level	-2.872001	
	10% level	-2.572417	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CPI,3)
Method: Least Squares
Date: 01/31/24 Time: 11:24
Sample (adjusted): 17 287
Included observations: 271 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CPI(-1),2)	-12.88049	1.123342	-11.46622	0.0000
D(CPI(-1),3)	11.17891	1.090444	10.25171	0.0000
D(CPI(-2),3)	10.18912	1.042226	9.776307	0.0000
D(CPI(-3),3)	9.195207	0.970101	9.478611	0.0000
D(CPI(-4),3)	8.165394	0.885392	9.222351	0.0000
D(CPI(-5),3)	6.956124	0.794211	8.758529	0.0000
D(CPI(-6),3)	6.013481	0.692603	8.682432	0.0000
D(CPI(-7),3)	4.729419	0.593162	7.973237	0.0000
D(CPI(-8),3)	3.688797	0.495519	7.444311	0.0000
D(CPI(-9),3)	2.721311	0.391193	6.956440	0.0000
D(CPI(-10),3)	1.836775	0.297534	6.173335	0.0000
D(CPI(-11),3)	1.092843	0.208472	5.242149	0.0000
D(CPI(-12),3)	0.626533	0.128365	4.880881	0.0000
D(CPI(-13),3)	0.261040	0.066358	3.933804	0.0001
C	0.028061	0.032451	0.864729	0.3880

R-squared	0.850530	Mean dependent var	-0.001119
Adjusted R-squared	0.842356	S.D. dependent var	1.341207

Fig 9: CPI (Consumer Price Index)

➤ *Interpretation:*

In time series analysis, ensuring stationarity of variables is vital for accurate modeling and forecasting. In our research, the Consumer Price Index (CPI) was initially found to be non-stationary at its level. Differencing was applied to induce stationarity, but the first and second differences did not achieve this. Only after a third-level difference was applied did the data exhibit stationarity. By conducting a unit root test and rejecting the null hypothesis at a significance level of less than 0.05, evidence against the presence of a unit root in the third difference of the CPI data was provided. This indicates that the CPI data becomes stationary at the second difference, implying that after three levels of differencing, the series no longer displays a systematic trend or drift over time.

This finding is crucial for our research as it ensures the reliability of subsequent analyses and forecasts based on the stationary CPI data. It enables more accurate insights into inflation dynamics and economic trends, facilitating better-informed decision-making processes.

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➢ *FII (Foreign Institutional Investment):*

Null Hypothesis: FII has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=15)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-15.50025	0.0000
Test critical values:	1% level	-3.453072	
	5% level	-2.871438	
	10% level	-2.572116	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FII)
Method: Least Squares
Date: 01/29/24 Time: 23:37
Sample (adjusted): 2 287
Included observations: 286 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FII(-1)	-0.921116	0.059426	-15.50025	0.0000
C	51.35218	18.38071	2.793808	0.0056

R-squared	0.458282	Mean dependent var	-1.769930
Adjusted R-squared	0.456374	S.D. dependent var	414.2016
S.E. of regression	305.3948	Akaike info criterion	14.28806
Sum squared resid	26487546	Schwarz criterion	14.31362
Log likelihood	-2041.192	Hannan-Quinn criter.	14.29830
F-statistic	240.2579	Durbin-Watson stat	1.997646
Prob(F-statistic)	0.000000		

Fig 10: FII (Foreign Institutional Investment)

➢ *Interpretation:*

A unit root test on Foreign Institutional Investment (FII) to evaluate its stationarity. The results show that FII is stationary at the level, with a probability value < 0.05, rejecting the null hypothesis.This finding has significant implications for understanding FII behavior. Stationarity at the level suggests that FII's statistical properties, such as mean and variance, remain consistent over time. This stability is crucial for accurate predictions and inferences about FII trends.The rejection of the null hypothesis indicates that FII doesn't follow a random walk pattern or possess a systematic trend. Instead, it exhibits consistent behavior, making it suitable for various statistical analyses and modeling techniques.

Understanding FII's stationary nature at the level offers valuable insights for investors, policymakers, and researchers. It facilitates informed decision-making in financial markets, supports the development of robust investment strategies, and enhances comprehension of factors influencing foreign institutional investment flows.

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➢ *Exchange Rates:*

Null Hypothesis: D(EXCHANGE_RATES) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=15)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.20245	0.0000
Test critical values:	1% level	-3.453153	
	5% level	-2.871474	
	10% level	-2.572135	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXCHANGE_RATES,2)
Method: Least Squares
Date: 01/29/24 Time: 23:38
Sample (adjusted): 3 287
Included observations: 285 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXCHANGE_RATES(-1))	-0.762319	0.057741	-13.20245	0.0000
C	0.105942	0.051149	2.071241	0.0392

R-squared	0.381157	Mean dependent var	-5.16E-05
Adjusted R-squared	0.378970	S.D. dependent var	1.082149
S.E. of regression	0.852792	Akaike info criterion	2.526391
Sum squared resid	205.8131	Schwarz criterion	2.552023
Log likelihood	-358.0108	Hannan-Quinn criter.	2.536666
F-statistic	174.3046	Durbin-Watson stat	1.979616
Prob(F-statistic)	0.000000		

Fig 11: Exchange Rate

➢ *Interpretation:*

In your research, you've conducted a unit root test on the Exchange Rate variable, aiming to ascertain its stationarity. The results indicate that the Exchange Rate variable is stationary at the level, as evidenced by a probability value of less than 0.05, leading to the rejection of the null hypothesis suggesting the presence of a unit root.

This finding implies that the Exchange Rate data does not exhibit a systematic trend or drift over time when analyzed in its original form. However, the conclusion that the data is stationary at the difference might be a misinterpretation or a typographical error. Typically, if the data is already stationary at the level, differencing may not be necessary.

Therefore, it's crucial to carefully review the interpretation to ensure accuracy. If indeed the data is already stationary at the level, this implies that the statistical properties of the Exchange Rate series, such as its mean and variance, remain constant over time. This stationary behavior is advantageous for time series analysis, as it facilitates more reliable modeling and forecasting of exchange rate movements, aiding in economic decision-making and risk management strategies.

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➢ *IP (Industrial Production):*

Null Hypothesis: D(IP) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=15)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.70045	0.0000
Test critical values:	1% level	-3.453234	
	5% level	-2.871510	
	10% level	-2.572154	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IP,2)
Method: Least Squares
Date: 01/31/24 Time: 11:36
Sample (adjusted): 4 287
Included observations: 284 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IP(-1))	-0.941416	0.074125	-12.70045	0.0000
D(IP(-1),2)	0.180499	0.058735	3.073107	0.0023
C	0.034939	0.064667	0.540286	0.5894

R-squared	0.418359	Mean dependent var	-0.001362
Adjusted R-squared	0.414219	S.D. dependent var	1.422399
S.E. of regression	1.088652	Akaike info criterion	3.018265
Sum squared resid	333.0308	Schwarz criterion	3.056810
Log likelihood	-425.5936	Hannan-Quinn criter.	3.033718
F-statistic	101.0578	Durbin-Watson stat	2.001933
Prob(F-statistic)	0.000000		

Fig 12: IP (Industrial Production)

➢ *Interpretation:*

We investigated the stationarity of the Industrial Production (IP) variable using a unit root test. Initially, we found that the IP data was not stationary at the level, suggesting that its statistical properties, such as mean and variance, varied over time. To address this, we proceeded to analyze the first difference of the IP series.

Upon conducting the unit root test on the first difference, the results revealed a probability value of less than 0.05, leading us to reject the null hypothesis of a unit root. This rejection indicates that the first difference of the IP data is stationary.

The interpretation of this finding is crucial for understanding the behavior of industrial production over time. Stationarity at the first difference implies that the fluctuations in IP are more predictable and stable, as they exhibit a consistent pattern of change from one period to the next. This stationary behavior allows for more accurate modeling and forecasting of industrial production trends, enabling policymakers, economists, and businesses to make informed decisions regarding production planning, investment strategies, and economic policies.

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➢ *Retail Car Sales:*

Null Hypothesis: D(RETAIL_CAR_SALES) has a unit root
Exogenous: Constant
Lag Length: 14 (Automatic - based on SIC, maxlag=15)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.245481	0.0000
Test critical values:	1% level	-3.454353	
	5% level	-2.872001	
	10% level	-2.572417	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RETAIL_CAR_SALES,2)
Method: Least Squares
Date: 01/31/24 Time: 11:44
Sample (adjusted): 17 287
Included observations: 271 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RETAIL_CAR_SALES(-1))	-2.948274	0.562060	-5.245481	0.0000
D(RETAIL_CAR_SALES(-1),2)	1.665601	0.537947	3.096219	0.0022
D(RETAIL_CAR_SALES(-2),2)	1.401012	0.513880	2.726338	0.0068
D(RETAIL_CAR_SALES(-3),2)	1.124209	0.486159	2.312431	0.0216
D(RETAIL_CAR_SALES(-4),2)	1.014834	0.455468	2.228114	0.0267
D(RETAIL_CAR_SALES(-5),2)	0.766130	0.422320	1.814098	0.0708
D(RETAIL_CAR_SALES(-6),2)	0.548160	0.384338	1.426245	0.1550
D(RETAIL_CAR_SALES(-7),2)	0.331040	0.344310	0.961461	0.3372
D(RETAIL_CAR_SALES(-8),2)	0.169800	0.303032	0.560337	0.5757
D(RETAIL_CAR_SALES(-9),2)	0.043831	0.262385	0.167048	0.8675
D(RETAIL_CAR_SALES(-10),2)	0.025234	0.222634	0.113343	0.9098
D(RETAIL_CAR_SALES(-11),2)	0.033191	0.185699	0.178736	0.8583
D(RETAIL_CAR_SALES(-12),2)	-0.040729	0.144889	-0.281103	0.7789
D(RETAIL_CAR_SALES(-13),2)	-0.092219	0.105357	-0.875296	0.3822
D(RETAIL_CAR_SALES(-14),2)	-0.321543	0.064767	-4.964609	0.0000
C	1.131735	1.224861	0.923970	0.3564
R-squared	0.731489	Mean dependent var		0.351436

Fig 13: Retail Car Saless

➢ *Interpretation:*

The stationarity of Retail Car Sales, a vital economic indicator, using a unit root test. Initially non-stationary at the level, differencing induced stationarity. Analyzing the first difference, the unit root test yielded a probability value < 0.05, rejecting the null hypothesis of a unit root, indicating stationarity. This finding holds significant implications for economic analysis and policymaking. Stationarity at the first difference suggests more predictable and stable fluctuations in retail car sales over time. This provides valuable insights for policymakers, economists, and businesses, aiding in informed decisions regarding consumer spending trends, economic forecasting, and retail industry strategies.

Overall, the conclusion that Retail Car Sales are stationary at the first difference enhances the accuracy of economic forecasts and aids in formulating effective policies to support economic growth and stability.

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- *Interest Rate:*

Null Hypothesis: D(INTEREST_RATES) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=15)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-16.04445	0.0000
Test critical values:	1% level	-3.453153	
	5% level	-2.871474	
	10% level	-2.572135	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INTEREST_RATES,2)
Method: Least Squares
Date: 02/09/24 Time: 10:36
Sample (adjusted): 3 287
Included observations: 285 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INTEREST_RATES(-...	-0.958095	0.059715	-16.04445	0.0000
C	-0.012869	0.017443	-0.737785	0.4613

R-squared	0.476338	Mean dependent var	0.001754
Adjusted R-squared	0.474487	S.D. dependent var	0.405656
S.E. of regression	0.294069	Akaike info criterion	0.396990
Sum squared resid	24.47291	Schwarz criterion	0.422621
Log likelihood	-54.57102	Hannan-Quinn criter.	0.407265
F-statistic	257.4244	Durbin-Watson stat	1.979470
Prob(F-statistic)	0.000000		

Fig 14: Interest Rate

- *Interpretation:*

The statement suggests conducting a unit root test on interest rates, which initially showed no significance at a certain level. To address this, the data was transformed to ensure stationarity, where the probability of obtaining the observed results by chance (p-value) was less than 0.05. This implies that the data is now stationary at the specified level, indicating that the series does not exhibit a unit root and has a stable mean and variance over time, making it suitable for further analysis, particularly in time-series modeling and forecasting.

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C. Co Integration Test

Co-integration has various applications in econometrics, such as modeling relationships between macroeconomic variables like GDP and consumption, analyzing financial markets, and forecasting economic trends. It is particularly valuable for understanding the equilibrium relationships between variables that evolve over time, providing insights into the underlying economic mechanisms driving their behavior.

Date: 01/29/24 Time: 23:51
Sample: 1 287
Included observations: 282
Series: CRUDE_OIL EXCHANGE_RATES CPI FII REPO_RATES IP RETAIL_C...
Lags interval: 1 to 4

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	3	3	2	3	2
Max-Eig	3	3	1	2	1

*Critical values based on MacKinnon-Haug-Michelis (1999)

Information Criteria by Rank and Model

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
	Log Likelihood by Rank (rows) and Model (columns)				
0	-5353.332	-5353.332	-5333.693	-5333.693	-5324.193
1	-5319.549	-5319.545	-5301.653	-5299.724	-5290.249
2	-5291.198	-5290.333	-5281.796	-5276.756	-5269.044
3	-5275.660	-5270.993	-5268.449	-5258.079	-5250.696
4	-5266.234	-5261.218	-5259.662	-5247.125	-5240.739
5	-5260.153	-5254.872	-5253.642	-5238.473	-5234.505
6	-5258.327	-5251.301	-5250.077	-5233.206	-5231.484
7	-5258.305	-5249.700	-5249.700	-5230.585	-5230.585
	Akaike Information Criteria by Rank (rows) and Model (columns)				
0	39.35697	39.35697	39.26733	39.26733	39.24959
1	39.21666	39.22372	39.13938	39.13280	39.10815
2	39.11488	39.12293	39.09785	39.07628	39.05705
3	39.10397	39.09215	39.10248	39.05021	39.02621*
4	39.13641	39.12921	39.13945	39.07890	39.05488
5	39.19258	39.19058	39.19604	39.12392	39.10997
6	39.27891	39.27164	39.27005	39.19295	39.18783
7	39.37805	39.36666	39.36666	39.28075	39.28075

Fig 15: Co Integration Test

- *Interpretation:*

We utilized the Johansen Cointegration test to explore long-term relationships among our variables. The test results, particularly noting the appearance of a star in the fifth column, signifying the Quadratic Intercept Trends assumption at the 3rd lag, provided insightful data dynamics. The presence of a star indicates the existence of quadratic trends among the variables, implying non-linear relationships over time. This understanding is crucial for comprehending the underlying economic mechanisms driving these variables effectively.

Moreover, the star's position at the 3rd lag signifies the lag length at which these quadratic trends emerge in the data. This knowledge is pivotal for constructing precise models that capture the intricate interdependencies among the variables accurately.

The insights from the Johansen Cointegration test offer valuable guidance for further analysis and modelling. They enhance our understanding of the long-term relationships among the variables and empower us to make informed decisions in research or policymaking endeavors.

Date: 01/29/24 Time: 23:52
Sample (adjusted): 6 287
Included observations: 282 after adjustments
Trend assumption: Quadratic deterministic trend
Series: CRUDE_OIL EXCHANGE_RATES CPI FII REPO_RATES IP RETAIL_CAR_SALES
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.213950	187.2151	139.2753	0.0000
At most 1 *	0.139632	119.3280	107.3466	0.0065
At most 2	0.122016	76.91658	79.34145	0.0751
At most 3	0.068182	40.22091	55.24578	0.5079
At most 4	0.043246	20.30680	35.01090	0.6870
At most 5	0.021197	7.839999	18.39771	0.6992
At most 6	0.006356	1.798109	3.841465	0.1799

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.213950	67.88706	49.58633	0.0003
At most 1	0.139632	42.41142	43.41977	0.0641
At most 2	0.122016	36.69567	37.16359	0.0565
At most 3	0.068182	19.91411	30.81507	0.5575
At most 4	0.043246	12.46680	24.25202	0.7250
At most 5	0.021197	6.041890	17.14769	0.8126
At most 6	0.006356	1.798109	3.841465	0.1799

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Fig 16: Interpretation

- *Interpretation:*

The cointegration test results indicate the presence of at most two cointegrating equations. This finding suggests that among the variables studied, there exists a long-term relationship involving up to two linear combinations of the variables. Specifically, we focused on the dependent variable, crude oil prices, along with two independent variables.

The bidirectional relationship observed signifies that changes in crude oil prices not only influence the other two independent variables but are also influenced by them in return. This mutual interaction suggests a dynamic interplay where fluctuations in crude oil prices can be both influenced by and influence the other variables studied.

Understanding this bidirectional relationship is crucial for comprehensively analyzing the factors affecting crude oil prices and the variables' interdependence. It provides valuable insights into the complex dynamics of the energy market and the broader economic implications of fluctuations in crude oil prices.

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D. VECM (Vector Error Correction Model):

Vector Error Correction Estimates
Date: 02/09/24 Time: 09:47
Sample (adjusted): 5 287
Included observations: 283 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
CRUDE_OIL(-1)	1.000000
CPI(-1)	0.449129 (13.4508) [0.03339]
EXCHANGE_RATES(-1)	6.289141 (32.2900) [0.19477]
FII(-1)	3.412357 (0.41498) [8.22288]
INTEREST_RATES(-1)	36.59877 (73.4190) [0.49849]
IP(-1)	-12.70343 (19.2693) [-0.65926]
RETAIL_CAR_SALES(-1)	-1.436302 (2.15850) [-0.66542]
C	553.4555

Fig 17: VECM (Vector Error Correction Model)

Error Correction:	D(CRUDE_...	D(CPI)	D(EXCHAN...	D(FII)	D(INTERES...	D(IP)	D(RETAIL_...
CointEq1	-0.001127 (0.00119) [-0.94939]	-0.000112 (6.9E-05) [-1.63974]	-2.55E-05 (9.0E-05) [-0.28220]	-0.250284 (0.03297) [-7.59237]	4.31E-05 (3.2E-05) [1.36167]	-3.39E-05 (0.00011) [-0.29932]	0.000389 (0.00237) [0.16383]
D(CRUDE_OIL(-1))	0.000559 (0.05901) [0.00947]	-0.001083 (0.00341) [-0.31796]	0.005689 (0.00449) [1.26853]	-0.058513 (1.63870) [-0.03571]	-7.50E-06 (0.00157) [-0.00477]	-0.004873 (0.00563) [-0.86599]	-0.129999 (0.11803) [-1.10139]
D(CRUDE_OIL(-2))	0.027595 (0.05909) [0.46701]	0.001976 (0.00341) [0.57945]	-0.002040 (0.00449) [-0.45424]	1.251560 (1.64081) [0.76277]	-0.000638 (0.00157) [-0.40528]	0.002609 (0.00563) [0.46316]	-0.018060 (0.11818) [-0.15281]
D(CRUDE_OIL(-3))	-0.348243 (0.05877) [-5.92508]	0.002292 (0.00339) [0.67587]	-0.002842 (0.00447) [-0.63612]	-0.236719 (1.63208) [-0.14504]	-0.000905 (0.00157) [-0.57780]	0.002398 (0.00560) [0.42783]	-0.165665 (0.11756) [-1.40925]
D(CPI(-1))	1.452685 (1.05803) [1.37301]	0.298859 (0.06105) [4.89526]	0.188967 (0.08041) [2.35001]	53.17085 (29.3799) [1.80977]	0.020559 (0.02820) [0.72907]	0.208610 (0.10088) [2.06786]	1.755869 (2.11616) [0.82974]
D(CPI(-2))	-2.065167 (1.12166) [-1.84117]	-0.110064 (0.06472) [-1.70055]	0.107147 (0.08525) [1.25690]	4.346224 (31.1469) [0.13954]	-0.039753 (0.02989) [-1.32978]	0.069030 (0.10695) [0.64544]	0.199844 (2.24344) [0.08908]
D(CPI(-3))	1.249584 (1.12530) [1.11044]	0.109201 (0.06493) [1.68176]	0.030041 (0.08552) [0.35126]	3.628221 (31.2481) [0.11611]	0.009510 (0.02999) [0.31709]	0.026341 (0.10730) [0.24550]	-3.167423 (2.25072) [-1.40729]
D(EXCHANGE_RATES...	-1.740393 (0.82754) [-2.10310]	-0.013177 (0.04775) [-0.27595]	0.227276 (0.06289) [3.61365]	-2.314039 (22.9795) [-0.10070]	0.074480 (0.02206) [3.37696]	-0.141256 (0.07891) [-1.79020]	-0.638900 (1.65516) [-0.38601]
D(EXCHANGE_RATES...	-0.353169 (0.84523) [-0.41784]	-0.026122 (0.04877) [-0.53560]	-0.065374 (0.06424) [-1.01768]	-26.14470 (23.4709) [-1.11392]	0.007846 (0.02253) [0.34830]	-0.105261 (0.08059) [-1.30609]	-1.860902 (1.69055) [-1.10077]

Fig 18: VECM (Vector Error Correction Model)

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D(EXCHANGE_RATES...	0.994165	-0.035134	-0.006575	-24.17101	0.008396	-0.041018	-0.543501
	(0.81470)	(0.04701)	(0.06192)	(22.6231)	(0.02171)	(0.07768)	(1.62948)
	[1.22028]	[-0.74736]	[-0.10618]	[-1.06842]	[0.38667]	[-0.52803]	[-0.33354]
D(FII(-1))	0.005846	-6.57E-05	0.000173	-0.074617	-8.72E-05	2.87E-05	0.002189
	(0.00364)	(0.00021)	(0.00028)	(0.10119)	(9.7E-05)	(0.00035)	(0.00729)
	[1.60430]	[-0.31252]	[0.62472]	[-0.73739]	[-0.89748]	[0.08267]	[0.30038]
D(FII(-2))	0.005189	3.88E-05	0.000306	-0.020429	-9.01E-05	-0.000143	-0.000520
	(0.00309)	(0.00018)	(0.00023)	(0.08574)	(8.2E-05)	(0.00029)	(0.00618)
	[1.68043]	[0.21771]	[1.30316]	[-0.23826]	[-1.09459]	[-0.48503]	[-0.08424]
D(FII(-3))	0.002504	0.000170	-2.94E-05	0.059830	-1.82E-06	-0.000351	0.004115
	(0.00228)	(0.00013)	(0.00017)	(0.06332)	(6.1E-05)	(0.00022)	(0.00456)
	[1.09829]	[1.29128]	[-0.16947]	[0.94489]	[-0.02989]	[-1.61397]	[0.90219]
D(INTEREST_RATES(-...	-1.054565	0.077917	0.374469	-6.050544	0.010910	0.080088	4.703163
	(2.32855)	(0.13436)	(0.17697)	(64.6605)	(0.06206)	(0.22203)	(4.65734)
	[-0.45288]	[0.57990]	[2.11598]	[-0.09357]	[0.17580]	[0.36072]	[1.00984]
D(INTEREST_RATES(-...	-0.413375	-0.098297	0.012233	45.12194	-0.161936	0.028710	-2.369810
	(2.32064)	(0.13391)	(0.17637)	(64.4408)	(0.06185)	(0.22127)	(4.64151)
	[-0.17813]	[-0.73407]	[0.06936]	[0.70021]	[-2.61823]	[0.12975]	[-0.51057]
D(INTEREST_RATES(-...	-0.229610	0.283821	-0.088134	17.70750	-0.120593	-0.079780	5.074920
	(2.31614)	(0.13365)	(0.17603)	(64.3159)	(0.06173)	(0.22084)	(4.63252)
	[-0.09913]	[2.12367]	[-0.50068]	[0.27532]	[-1.95357]	[-0.36125]	[1.09550]
D(IP(-1))	0.445702	0.000886	-0.054671	-44.81020	0.015230	0.239926	-0.436939
	(0.66121)	(0.03815)	(0.05025)	(18.3608)	(0.01762)	(0.06305)	(1.32248)
	[0.67407]	[0.02321]	[-1.08792]	[-2.44054]	[0.86422]	[3.80558]	[-0.33039]
D(IP(-2))	-0.291900	-0.062221	-0.104074	-21.14825	-0.000962	-0.184977	2.304178
	(0.64839)	(0.03741)	(0.04928)	(18.0048)	(0.01728)	(0.06182)	(1.29684)
	[-0.45019]	[-1.66307]	[-2.11197]	[-1.17459]	[-0.05568]	[-2.99202]	[1.77676]
D(IP(-3))	1.151783	0.003476	0.057819	0.849300	0.011601	-0.032029	-1.658236
	(0.64815)	(0.03740)	(0.04926)	(17.9982)	(0.01727)	(0.06180)	(1.29636)
	[1.77704]	[0.09295]	[1.17376]	[0.04719]	[0.67156]	[-0.51827]	[-1.27914]

Fig 19: VECM (Vector Error Correction Model)

D(IP(-3))	1.151783	0.003476	0.057819	0.849300	0.011601	-0.032029	-1.658236
	(0.64815)	(0.03740)	(0.04926)	(17.9982)	(0.01727)	(0.06180)	(1.29636)
	[1.77704]	[0.09295]	[1.17376]	[0.04719]	[0.67156]	[-0.51827]	[-1.27914]
D(RETAIL_CAR_SALE...	0.027486	0.001395	0.002492	0.960904	-0.000125	-0.004171	-0.302464
	(0.03114)	(0.00180)	(0.00237)	(0.86461)	(0.00083)	(0.00297)	(0.06228)
	[0.88278]	[0.77654]	[1.05308]	[1.11138]	[-0.15008]	[-1.40487]	[-4.85687]
D(RETAIL_CAR_SALE...	0.004718	0.000986	-0.002212	0.195106	-0.000222	-0.007810	-0.217977
	(0.03313)	(0.00191)	(0.00252)	(0.91992)	(0.00088)	(0.00316)	(0.06626)
	[0.14240]	[0.51602]	[-0.87861]	[0.21209]	[-0.25118]	[-2.47255]	[-3.28975]
D(RETAIL_CAR_SALE...	0.100531	-0.001965	-0.005508	1.372688	-0.000154	0.009181	-0.208424
	(0.03316)	(0.00191)	(0.00252)	(0.92081)	(0.00088)	(0.00316)	(0.06632)
	[3.03168]	[-1.02697]	[-2.18557]	[1.49073]	[-0.17438]	[2.90358]	[-3.14251]
C	0.072549	0.306325	-0.004473	-16.85273	-0.027507	-0.050225	1.740366
	(0.92630)	(0.05345)	(0.07040)	(25.7220)	(0.02469)	(0.08832)	(1.85269)
	[0.07832]	[5.73111]	[-0.06354]	[-0.65519]	[-1.11422]	[-0.56866]	[0.93937]

Fig 20: VECM (Vector Error Correction Model)

- *Interpretation:*

In the Vector Error Correction Model (VECM), the initial analysis reveals a significant long-term relationship between Foreign Institutional Investment (FII) and crude oil prices, evidenced by a positive t-statistic of 8.22 at -1 lag value. This suggests that FII exerts a positive influence on crude oil prices over the long term. Conversely, for retail car sales, Consumer Price Index (CPI), Interest Rates, Industrial Production (IP), and Exchange Rates, the t-statistics fall within the range of -1.96 to 1.96 at -1 lag value, indicating a lack of significant impact on crude oil prices in the long run. These findings emphasize the distinctive role of FII in driving long-term trends in crude oil markets, warranting further investigation into the dynamics of this relationship.

In the short term, the Vector Error Correction Model (VECM) analysis reveals a negative impact of Exchange Rate on crude oil prices, evidenced by a t-statistic of -2.10310 at the 1st lag value. This implies that fluctuations in Exchange Rate negatively affect crude oil prices in the short run. Conversely, for Retail Car Sales, a positive t-statistic of 3.031 at the 3rd lag value suggests that an increase in retail car sales three months prior leads to a corresponding increase in crude oil prices for the current month, albeit temporarily. However, variables such as Foreign Institutional Investment (FII), Industrial Production (IP), Consumer Price Index (CPI), and Interest Rates demonstrate no significant impact on crude oil prices in the short term, as indicated by t-statistics falling within the range of -1.96 to 1.96. These findings underscore the nuanced dynamics of various economic factors influencing short-term fluctuations in crude oil markets.

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E. Granger Causality:

➢ *Interoretation:*

- H0: X does not Granger Cause Y
- H1: X does Granger Cause Y

When conducting Granger causality tests, significance levels are used to determine the presence of causal relationships between variables. A significance level of 0.10 implies that if the probability value (p-value) is below this threshold, the null hypothesis is rejected, indicating a significant causal relationship. In the model provided, with crude oil as the dependent variable, both exchange rates and retail car sales exhibit p-values below 0.10, thus rejecting the null hypothesis and suggesting they Granger cause crude oil prices. However, for CPI as the dependent variable, no variable shows a p-value below 0.10, indicating a lack of evidence for Granger causality. Therefore, we fail to reject the null hypothesis, suggesting no causal relationship between the variables and CPI. This demonstrates the utility of Granger causality tests in identifying causal relationships among economic variables.

Granger causality tests are employed to ascertain causal relationships between variables. When exchange rates serve as the dependent variable, both IP and retail car sales exhibit probability values below 0.1, indicating rejection of the null hypothesis and acceptance of the alternative hypothesis. This suggests that IP and retail car sales Granger cause exchange rates. Similarly, when FII is the dependent variable, only IP shows a probability below 0.1, indicating that IP Granger causes FII. For interest rates as the dependent variable, only exchange rates exhibit a probability below 0.1, implying that exchange rates Granger cause interest rates. Conversely, when IP is the dependent variable, both exchange rates and retail car sales demonstrate probabilities below 0.1, signifying that they Granger cause IP. However, with retail car sales as the dependent variable, no variable displays a probability below 0.1, suggesting the absence of Granger causality. This underscores the nuanced causal relationships among economic variables as identified through Granger causality tests.

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 02/12/24 Time: 14:07
Sample: 1 287
Included observations: 283

Dependent variable: D(CRUDE_OIL)

Excluded	Chi-sq	df	Prob.
D(CPI)	4.690623	3	0.1959
D(EXCHANGE_RATES)	7.020691	3	0.0712
D(FII)	4.399601	3	0.2214
D(INTEREST_RATES)	0.153540	3	0.9847
D(IP)	2.865830	3	0.4128
D(RETAIL_CAR_SAL...	9.044240	3	0.0287
All	31.47191	18	0.0254

Dependent variable: D(CPI)

Excluded	Chi-sq	df	Prob.
D(CRUDE_OIL)	1.221802	3	0.7478
D(EXCHANGE_RATES)	1.647405	3	0.6487
D(FII)	3.597245	3	0.3084
D(INTEREST_RATES)	5.513782	3	0.1378
D(IP)	2.786326	3	0.4258
D(RETAIL_CAR_SAL...	2.455889	3	0.4833
All	14.78334	18	0.6768

Fig 21: Granger Causality

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Dependent variable: D(EXCHANGE_RATES)

Excluded	Chi-sq	df	Prob.
D(CRUDE_OIL)	2.096717	3	0.5526
D(CPI)	7.609010	3	0.0548
D(FII)	4.975127	3	0.1736
D(INTEREST_RATES)	5.492026	3	0.1391
D(IP)	8.018112	3	0.0456
D(RETAIL_CAR_SAL...	7.241098	3	0.0646
All	34.47354	18	0.0110

Dependent variable: D(FII)

Excluded	Chi-sq	df	Prob.
D(CRUDE_OIL)	1.015264	3	0.7976
D(CPI)	3.857784	3	0.2772
D(EXCHANGE_RATES)	2.471607	3	0.4804
D(INTEREST_RATES)	0.979334	3	0.8063
D(IP)	11.02653	3	0.0116
D(RETAIL_CAR_SAL...	1.547468	3	0.6714
All	20.88467	18	0.2853

Dependent variable: D(INTEREST_RATES)

Excluded	Chi-sq	df	Prob.
D(CRUDE_OIL)	0.577353	3	0.9016
D(CPI)	1.905064	3	0.5923
D(EXCHANGE_RATES)	12.28177	3	0.0065
D(FII)	1.877665	3	0.5982
D(IP)	1.087407	3	0.7801
D(RETAIL_CAR_SAL...	0.041985	3	0.9977
All	17.99676	18	0.4559

Fig 22: Granger Causality

Dependent variable: D(IP)

Excluded	Chi-sq	df	Prob.
D(CRUDE_OIL)	1.100889	3	0.7769
D(CPI)	5.842702	3	0.1195
D(EXCHANGE_RATES)	6.298838	3	0.0979
D(FII)	3.884341	3	0.2742
D(INTEREST_RATES)	0.322447	3	0.9558
D(RETAIL_CAR_SAL...	20.51655	3	0.0001
All	44.23944	18	0.0005

Dependent variable: D(RETAIL_CAR_SALES)

Excluded	Chi-sq	df	Prob.
D(CRUDE_OIL)	3.363472	3	0.3389
D(CPI)	2.755710	3	0.4308
D(EXCHANGE_RATES)	1.717689	3	0.6330
D(FII)	1.946382	3	0.5836
D(INTEREST_RATES)	1.976729	3	0.5773
D(IP)	4.002285	3	0.2612
All	17.14649	18	0.5131

Fig 23: Granger Causality

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F. Impulse Test:

Even a slight change in crude oil prices triggers sudden shocks in the associated variables. This suggests a high degree of sensitivity or responsiveness of these variables to fluctuations in crude oil prices. The relationship between crude oil prices and the other variables exhibits a significant level of volatility or instability, indicating rapid adjustments in response to changes in the oil market. These findings underscore the importance of closely monitoring crude oil price movements and their potential impacts on the wider economy, as even minor fluctuations can have pronounced effects on various economic indicators.

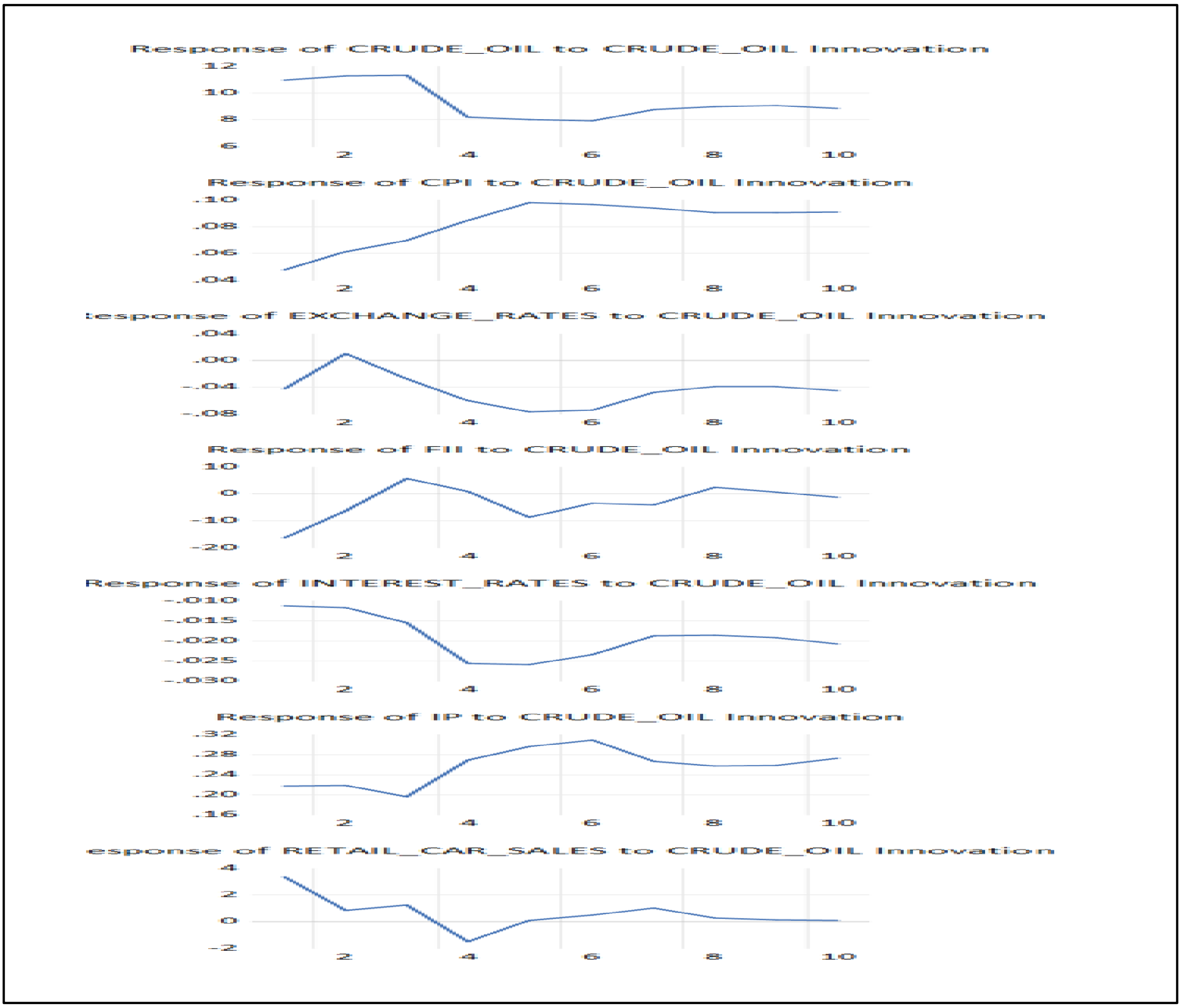

Fig 24: Impulse Test

G. Inverse Root

The "Inverse Root AR" method in EViews is utilized to stabilize the roots of an autoregressive (AR) process in time series analysis. When estimating an AR model, it's essential to ensure that the roots of the characteristic polynomial lie outside the unit circle for the model to be stationary. In the provided model, all the points lie within the unit circle, indicating the stability of the model. This implies that the autoregressive process is well-behaved and converges towards a stable equilibrium over time. The stability of the model suggests that shocks or disturbances to the system will not lead to explosive or divergent behavior, but rather the series will exhibit a tendency to revert to its long-term mean or equilibrium. Consequently, forecasts based on this AR model are likely to be reliable and accurate within the specified domain.

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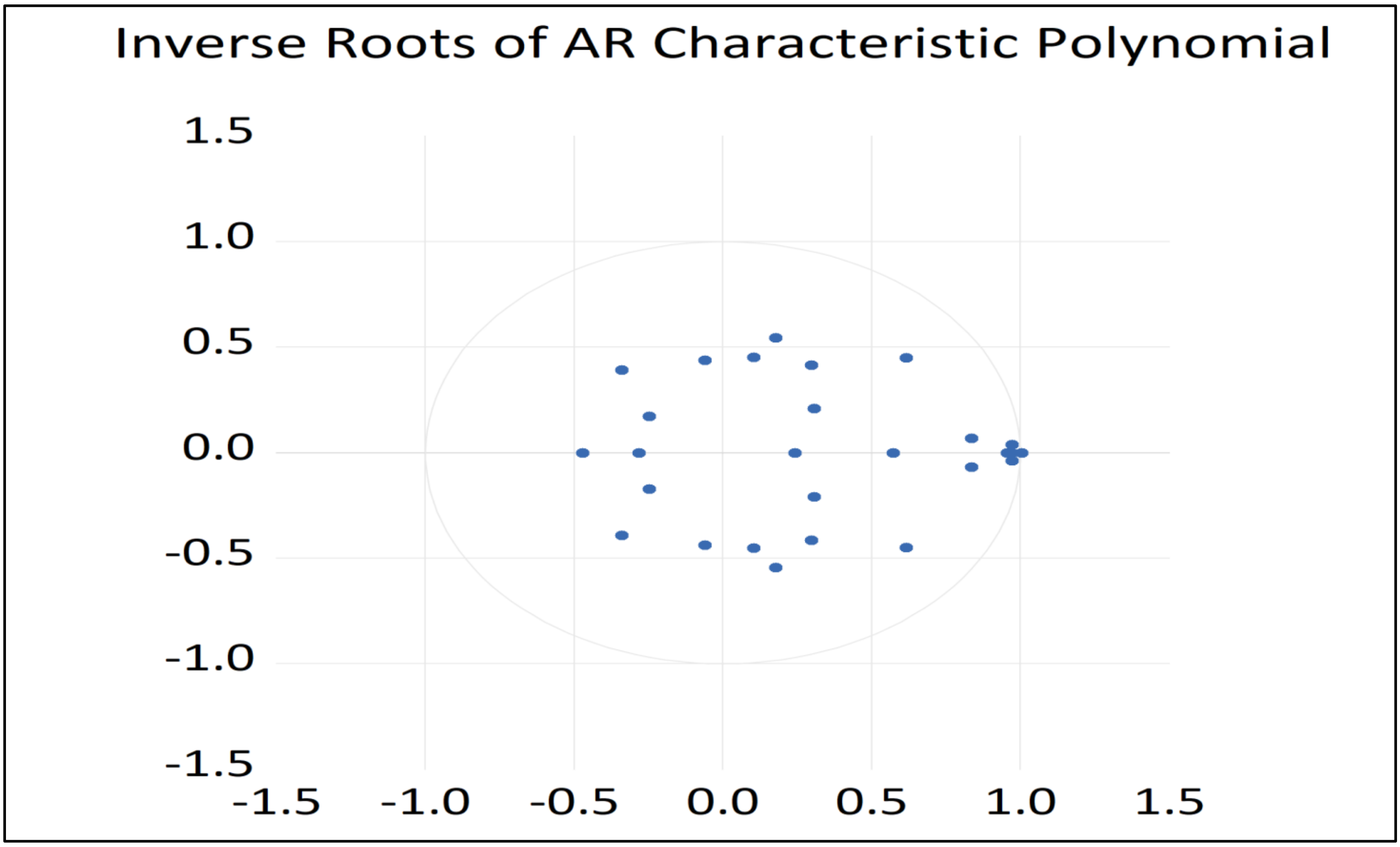

Fig 25: Inverse Roots of AR Characteristic Polynomial

H. Power Bi Projection:

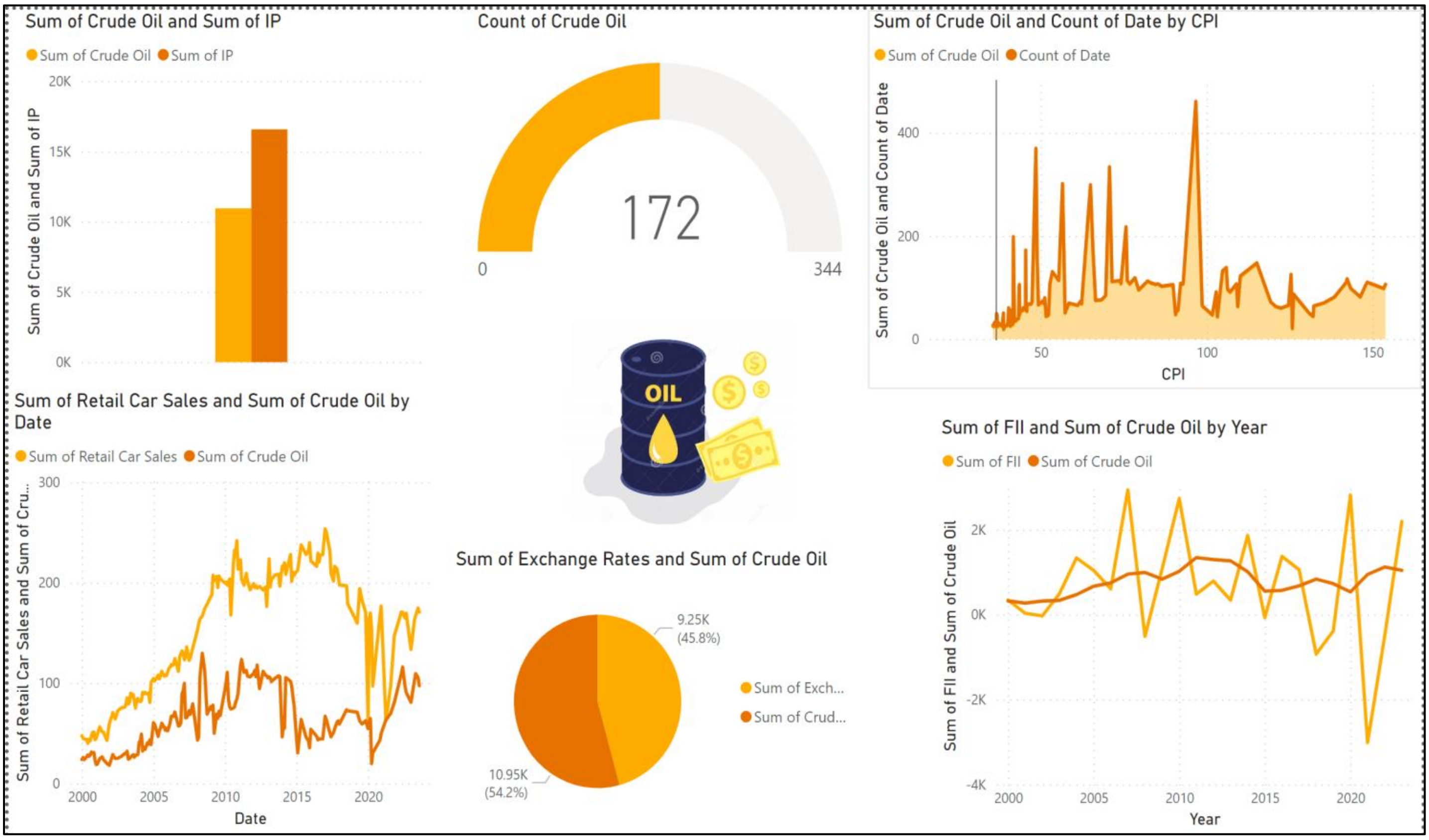

Fig 26: Power Bi Projection

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- *Interpretation:*

The Power BI dashboard focuses on the relationship between different factors such as inflation, crude oil prices, exchange rates, foreign institutional investment (FII), and retail car sales.

Firstly, it suggests that the sum of the industrial production (IP) is significantly higher than the count of crude oil, indicating a potentially diversified economy. The volatility in retail car sales, alongside crude oil prices, implies a complex relationship between consumer behavior and energy markets. The text notes a disparity in growth rates between retail car sales and crude oil demand since 2000, with retail car sales surpassing crude oil demand in 2015. This shift could indicate changing consumer preferences or technological advancements affecting the automotive industry. Regarding exchange rates and crude oil prices, the former accounts for 45.8% of the relationship, while the latter represents 54.2%, suggesting a significant influence of crude oil dynamics on exchange rate fluctuations. This underscores the importance of energy markets in shaping global currency movements.

Additionally, the text highlights the volatility of the Consumer Price Index (CPI), reflecting fluctuations in inflation due to geopolitical factors and other uncertainties. Furthermore, it contrasts the high fluctuations in FII, attributed to currency price changes, with relatively stable crude oil prices over the observed period. Overall, the text paints a picture of a dynamic economic landscape where various factors, including consumer behavior, energy markets, inflation, and currency dynamics, interact in complex ways, influencing each other's trajectories and contributing to market volatility.

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CHAPTER FIVE
SUMMARY AND CONCLUSIONS

A. Summary:

The research paper explores relationships between macroeconomic factors, retail car sales, and crude oil prices, focusing on recent crude oil price dynamics. Findings suggest FII impacts crude oil prices long-term, with changes in FII prices from the previous month influencing crude oil prices at the first lagged value, indicating lasting impacts of investors' sentiments and capital flows on oil market dynamics. Regarding exchange rates, the study uncovers a short-term negative impact of exchange rate fluctuations from the previous month on current month crude oil prices, reflecting the interplay between currency markets and the oil market. Traders can use this to anticipate short-term oil price fluctuations based on exchange rate movements, informing trading strategies.

Additionally, the research highlights retail car sales' influence on crude oil prices, with the impact of sales from three months prior affecting current month prices. This lagged effect suggests consumer demand for fuel-efficient vehicles can influence oil consumption patterns over time, ultimately affecting prices. Traders can use this to anticipate shifts in oil demand based on past car sales trends, improving their ability to predict price movements.

However, the study finds CPI, interest rates, and IP have no significant impacts on crude oil prices in the short or long term, indicating factors like inflation and industrial activity may not directly influence oil market dynamics within the specified time frame.

Overall, these findings offer insights for commodity traders, enabling a better understanding of crude oil price drivers and improving forecasting accuracy. Incorporating these variables into predictive models can help traders make more informed decisions, potentially enhancing profitability and risk management strategies in the commodity market.

B. Conclusion:

Analyzing influential factors like CPI, IP, Retail car sales, and FII is crucial for understanding crude oil prices. Research indicates that FIIs impact crude oil prices in the long run through investments in financial instruments linked to oil, such as futures contracts and ETFs. Their portfolio adjustments based on economic conditions and market sentiments can cause significant fluctuations in crude oil prices over time. The interconnectedness of financial markets amplifies FII impacts, triggering chain reactions across asset classes, including equities, bonds, and currencies, affecting investor sentiment related to crude oil.

In the short term, statistical methods like EViews analysis or panel data modeling can analyze the implications of retail car sales and exchange rates on crude oil prices. Retail car sales, as a proxy for gasoline demand derived from crude oil, can be incorporated into a Vector Error Correction Model (VECM) with crude oil prices as the dependent variable. The coefficient of retail car sales indicates its impact magnitude and direction on crude oil prices. Similarly, exchange rates' influence on crude oil demand can be assessed using panel series models like VECM, employing Granger causality tests to establish causality direction between exchange rates and crude oil prices. Additionally, impulse response analysis can gauge short-run effects of exchange rate shocks on crude oil prices.

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