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Exchange Rate Dynamics and Their Influence on International Trade: A Comprehensive Analysis

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Abstract - *This study intends to investigate the relationship between oil prices and the US dollar exchange rate, as well as the impact of inflation and GDP growth rates on global commerce. It uses secondary time series data from 2014 to 2020 and statistical tools to evaluate the variables' significance, non-stationarity, and stationarity. Trade (% of GDP) is the analysis's dependent variable, and the actual exchange rate, growth in GDP rate, along inflation rate (% of the average consumer price index) are its independent factors. The study emphasizes how minor adjustments to the independent factors have a significant impact on the dependent variable. Numerous economic techniques are included in the analysis, including the Granger causality test, OLS, ADF, ARDL, multicollinearity test, correlation test, and descriptive analysis. The research contains important results that show a long-term negative connection between trade and inflation. It is believed that inflation as a variable is important and has a big effect on trade. The analysis also shows that the economy will adjust by 69.36% in the coming years to reach equilibrium, with the variables holding steady in the short and long terms. The comprehension of the complex relationship between inflation, exchange rates, and international trade is aided by these findings.*

Key Words*: *Oil Prices, US dollar, Exchange rate, Inflation rate, Relationship, GDP growth

1. INTRODUCTION

In the past 15 years, there have been substantial changes to global trade, with a noticeable slowdown in growth following the global financial meltdown. Research has looked at the primary causes of this tendency and whether they are structural or cyclical. The research has focused mostly on two issues: the effects of exchange rates on trade and the efficiency of exchange rate regulations in controlling a nation's external position and internal economic stability.

In the modern global economy, trade regulations, tariffs, and government initiatives to encourage domestic investment and trade are just a few of the variables that affect international trade. Economic unions, like the European Union, strive to improve trade between nations by lowering barriers and tariffs and allowing capital flows. However, since it is intimately related to the stock market and can have both favorable and unfavorable consequences, the exchange rate additionally serves a big part in international trade. Maintaining international trade requires fostering an environment that encourages competition. Authorities may purposefully keep exchange rates high in order to shield their products for export or domestic industry from competition from overseas markets. Their local currency might likewise be artificially devalued by them. As a result, local goods seem cheaper in overseas markets while foreign goods get more expensive in the home market. While taxing domestic consumers, this helps domestic manufacturers. Long-term sustainability of this approach is challenging, though. Central banks have to take specific steps and may have an impact on trade imbalances and other areas of the economy in order to sustain the elevated exchange rate. Examining again how exchange rates affect trade is a useful exercise for decision-makers. Distinguishing systematic effects based on concept and empirical evidence from perspectives or biases is helpful. It is crucial to differentiate among whatever "is" and what "ought to occur," as David Hume could have put it. It is also crucial to avoid poorly thought-out policy reactions by irritated nations, like protectionism regarding trade, which may be predicated on (at least partially legitimate) claims of beggar-thy-neighbor strategy conduct by nations with whom they trade. A country's exchange rate affects many aspects of its financial system, particularly international trade, and is a good indicator of that country's financial stability. Due to rising expenses for transactions and possible trade interest reductions brought on by fluctuations in exchange rates, there is a serious risk to the mechanics of global commerce that could lead to De-internationalization. Exchange rate volatility is the result of swings in a nation's currency's value in relation to other nations. These swings can be caused by a variety of variables, including inflation, interest rate changes, political unpredictability, economic activity, and investment. In recent years, world leadership has made the problem of restructuring the global economy a top priority for policy. Since theories anticipates that real exchange rates will change, regardless through nominal rates or prices, real exchange rate modification is unquestionably a component of global equilibrium. But there is much more to this argument than just how exchange rates affect commerce. Global imbalances are mostly caused by structural and macroeconomic distortions. Therefore, considering the

intricate nature of the underlying issues, a restricted focus on commerce would have been incorrect.

The correlation between exchange rates and oil prices has been a topic of significant discourse among scholars, journalists, and policymakers in recent times. According to the opening statement of the conference "Oil Price Volatility, Economic Impacts, and Financial Management: Risk Management Experience, Best Practice, and Outlook," which took place in Washington, D.C. on March 10–11, 2008, "Oil prices aren't just rising; the volatility is also getting worse fluctuations are more pronounced than they were in the 1990s, creating unpredictable consequences." [1]

One widely held belief is that rising US dollar value causes oil prices to fall. Nevertheless, while there is indication for dual-direction causality, empirical study has not been able to establish a definite direction of causation. [2] found that certain studies show that a rise in the real price of oil leads to a genuine appreciation of the US dollar, whilst other research shows that a nominal appreciating of the US currency causes a fall in the price of oil [3].

1.1 Definitions

When analyzing the association between oil prices and currency rates, it is crucial to distinguish across real and nominal variables. As the local currency per US dollar, the nominal market exchange rate at a certain point in time (St) implies that an increase represents a nominal appreciation in the US dollar.

$s_t = \underline{domestic\ currency t}$

$US\ dollar t$

The assortment of local items that can be bought with one bucket of US goods is reflected in the actual rate of exchange (qt), which also contains price indexes for each nation. qt = st pt∗/pt, where pt and pt∗ stand for local and foreign (i.e., US) price levels, respectively, which are typically estimated using production or customer prices. Since US goods have more actual buying power, there has been a rise in the US dollar's real appreciation. In external words, this concept is equivalent to the actual exchange rate. A real depreciation is equivalent to a comparable increase in the price of traded products. This ratio, known as the terms of trade or the real exchange rate in economic terms, is taken into account in certain studies. The nominal oil price is adjusted for any variations in the US price level (which is usually based on the US consumer price index, or CPI) to determine the actual oil price. Instead of only between two countries, nominal and real exchange rates can be stated as a geometrically or arithmetic trade weighted indicator between numerous nations. These effective exchange rates show an economy's overall level of external competitiveness. Another option is to concentrate on futures market dynamics, as these also represent expectations, rather than examining recent or spot price dynamics.

The intricate correlation among energy price disruptions, currency exchange rates, and inflation over a global scale, without regional specificity. Energy price shocks, which include abrupt and notable changes in the cost of oil as well as other sources of energy, can affect inflation and exchange rates. Sharp fluctuations in energy prices can have an effect on firms' production and transportation costs, which can alter consumer pricing and cause inflation. Additionally, these variations can have an impact on exchange rates, as nations that export energy may see a gain in their currencies while those that import energy may see a devaluation due to higher import costs. The intricate interactions among these variables can impact both national and international economies, affecting investment choices, consumer purchasing power, and general economic stability.

1.2 Oil DEMAND and SUPPLY History

DEMAND: The invention of the engine's combustion process at the beginning of the 20th century created a huge need for petroleum-based goods, which have since grown to be essential to the sector. Scientists have found a vast range of oil-derived goods and industry supplies over the course of the 20th century. These products and processes have become indispensable in a variety of sectors and industries, from cars and power plants to commonplace items including pens and medication tablets. Oil and its byproducts are currently used by almost all manufacturers and industries, rendering the crude oil marketplace the biggest commodity industry in the world. The need for oil has continuously increased throughout the history of industrialization in many parts of the world, and this tendency does not appear to be slowing down. An early sign of economic expansion is frequently a sharp rise in the demand for oil, which is mostly driven by developed and developing nations like the USA, EU, Japan, China, and India. As these nations develop, industrialization, urbanization, and rising living standards lead to an increase in energy consumption, and oil is the main source of this energy. The world oil industry grew nine times between 1950 and 1973, averaging ten percent annually over two decades [4]. In that time, over 2.5 billion new motor vehicles were produced worldwide, with half of those being in the USA. The demand for oil worldwide was 11 million barrels daily every day in the 1950s, increased to 57 million tons a day in the 1970s, and is currently above 80 million barrels every day. With a daily consumption of 20.7 million barrels, the United States continues to be the greatest user, surpassing the combined consumption of the next five largest national consumers (China, Japan, Germany, Russia, and India) [5] [6]. The world's demand has increased recently at a never-before-seen pace, especially with the 10% annual growth rates in both the economies of China and India. China's oil consumption doubled between 1996 and 2006 and has increased by 8% annually since 2002. By 2020,

however, oil imports into India are predicted to more than quadruple from 2005 levels, hitting 5 million barrels for each day [7]

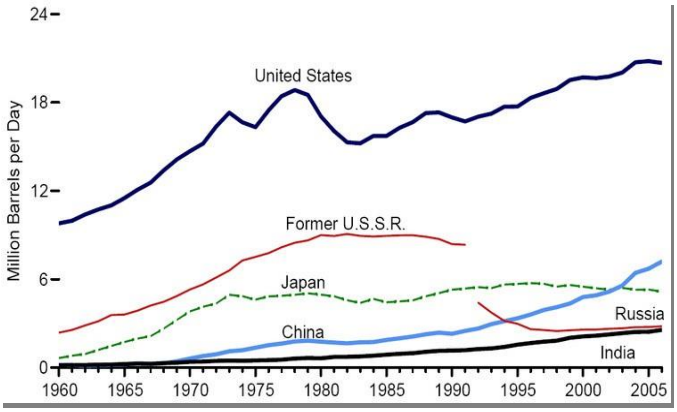

Figure-1. Demand growth for the largest consumers.

Source: Annual Energy Review 2005, US DOE, Energy Information Administration [8]

An important factor in determining a nation's susceptibility to fluctuations in oil prices and its capacity to switch to alternate fossil fuels is the composition of its oil consumption. The four primary sectors in the US that consume the most oil is logistics, manufacturing, electricity production, and residential and commercial. Nearly 70% of US oil consumption comes from the automobile sector alone, with motor fuel accounting for two-thirds of that total.

SUPPLY: The world's daily operations depend heavily on the availability of oil. The initial oil wells were drilled in Europe and the USA, which is where the petroleum industry got its start. But it wasn't until the North Sea's hydrocarbon reserves were discovered in the 1970s that European nations started to generate a sizable amount of oil. When Ford began producing vehicles in large quantities, the petroleum industry was first driven by the manufacturing of kerosene. However, as cars became more widely available, consumer demand for them increased.

The United States started to buy more oil than it exported in 1948. The United States' economic expansion, like that of other developed nations, became highly dependent on the supply of foreign oil. The United States utilizes 20.5 million barrels of oil per day, with the majority coming from imports, despite having one of the top producers at 8.5 million barrels every day [9]. There may have been three notable supply shocks in recent memory.

Initially, the Yom Kippur War and the Arab-Israeli Conflict led to the 1973 Arab oil embargo, which in turn caused political and economic upheavals. On October 16, 1973, OPEC's Arab members imposed an oil embargo on the United States in retaliation for Western support for Israel Iran's oil production, The 6 million barrels per day had been overthrown in 1979, was severely disrupted and nearly fell to zero during the revolution that saw the ascent to power of religious leader Khomeini. While they did not last as long as the preceding shocks, supply crises were also brought on by the Gulf War in 1991 and the fall of the Soviet Union [10].

In the initial portion of the 20th century, the industry and supply, that identified prices, were ruled by the so-called "Seven Sisters," but the regulation then changed to OPEC. The five strongest American companies, along with a trio of European firms, effectively created an oligopoly. Independent businesses entered the market over time, but they never matched the context of the pioneer companies. All of these supply shocks prompted significant drops in supply, which leads to significant disturbances in the market. Eventually, industrialized nations realized that cheap oil was no longer a factor. Consequently, environmental sustainability and oil supply have grown to be national security concerns.

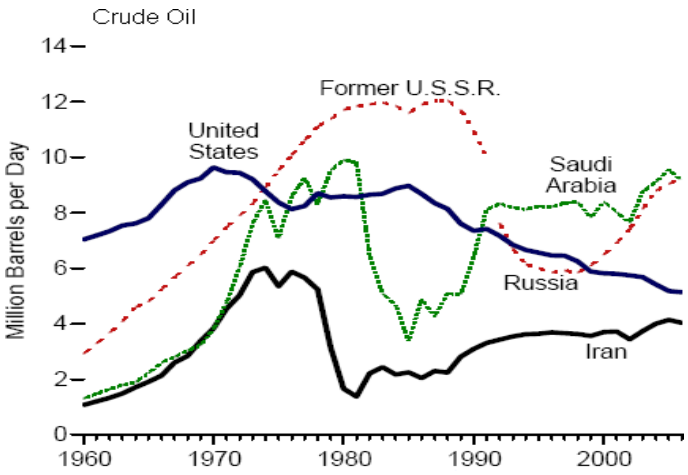

Figure-2: Major oil-producing nations from 1960 to 2006.

Source: Annual Energy Review 2006, US DOE, Energy Information Administration [11]

To extract oil and manage supply, the oligopoly built commercial and legal frameworks. This arrangement, however, was short-lived since the large revenues and the weakening of reserve-owning nations' interests resulted in popular dissatisfaction and the acceleration of nationalization. The Group of Petroleum Exporting Countries (OPEC) was established as a result of producing nations pushing forth against the oil industry as a reaction to the expanding industry and rising profits [12]. OPEC sought to move the centers of decision-making beyond the West to the regions controlled by the asset owners.

No single nation or group has the same significant impact or authority oversupply now as the "Seven Sisters" did. Before the 1970s, the supply was largely consistent, but major interruptions started in 1973 and haven't completely stopped subsequently. Although manufacturing is more

reliable than it was previously, price volatility is nevertheless present due to the emergence of several new hazards.

1.3 What elucidates oil price volatility?

Many experts think that rising crude oil trades and price volatility could be related to unforeseen economic trends. Recent instances are China's and India's surprisingly substantial energy needs and the US dollar's declining value in other commodities. The image below illustrates how the first oil shock, which marked the beginning of the price volatility that has persisted to this day, caused a slowdown in the world's economy.

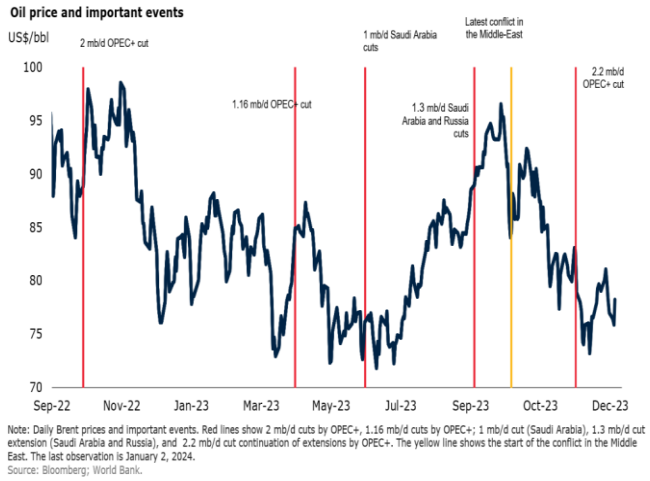

Figure-3. Crude Oil Prices and important events [13]

Price volatility has always been caused by a variety of factors, but the world has never seen the level of persistent fluctuation that has occurred lately. The reasons behind the heightened volatility in oil prices can be classified into two groups: noneconomic and socioeconomic. The underinvestment in new projects caused by resource nationalism, the recent increase in the cost of investigative technology, the aging of old oil wells, and economic growth combined with a significant increase in consumer appetite for oil in emerging economies wasn't offset by an adequate supply, and the depreciation of the dollar relative to alternative currencies constitute a few of the economic factors.

The functioning of the US economy and information on the availability of petroleum and gasoline have a significant influence on sudden, significant price fluctuations. Volatility is influenced by basic supply and demand forecasts as well as long-term global economic performance.

Political incentives drive most noneconomic factors. For example, countries with significant oil reserves conceal real oil information from investors so they can feel certain about the return on their investments. Countries manipulate oil figures to serve their political agendas and view it as a national security risk. Because of this uncertainty, most investors are reluctant to become involved in massive amounts of projects that could provide a steady supply. The nation's problem's causality is connected to the known "Peak oil" idea. The theory holds that following the ideal amount of global extraction is reached, production will gradually slow down.

In addition to other political unpredictability and noneconomic issues leading to a lack of protection for investors' rights in resource-rich nations, resource-related warfare has caused instability in oil-producing nations. Oil corporations have started to exhibit so-called "spare capacity" as a result of the political games that have been so heated over the past few decades that they have completely ignored investments in new projects that offer a consistent supply.

The European energy watchdog, the International Energy Agency, was founded to protect Western importers' interests and accuses OPEC of not producing enough oil to meet demand, which raises prices. However, the main concern raised by OPEC is the lack of refinery capacity in the world. It asserts that although it can increase production at any time, it won't reduce market volatility.

Estimates of the state of the global economy have a long-term, more than a year-long influence on prices, although there are many reasons why prices fluctuate. Recessions are associated with lower oil prices, and vice versa. Although they are still predicted to be between $90 and $100 per barrel, most publicly available oil price projections for 2023 this year have been revised lower than previous estimates. However, the industry has a terrible track record of correctly predicting oil prices, so any prediction is almost certain to be off. This is particularly true at this time due to the great amount of uncertainty surrounding fundamental factors that directly affect oil markets by acting in opposition to one another.

China, geopolitics, economic strife, and the outlook for the global economy are the main uncontrollable factors that will impact this year and the years to come.

Since low prices may make it unprofitable to invest in new oil projects since they are below the marginal cost of production, this creates additional riskier scenarios. There might once again be a lack of supply compared to demand when the world eventually emerges from its crisis, which might result in even more extreme price volatility.

1.4 The GDP and oil correlation

While petroleum has grown to be a vital asset in both the worldwide economy and daily life, oil prices are the primary means of examining the connection that exists between oil and macroeconomics. Since Hamilton's (1983) research, which showed that rises in oil prices slowed the

development of US output between 1948 and 1980 [14], the presence of a negative link among macroeconomic conditions and oil prices has come to be widely acknowledged. Numerous additional researchers have verified and expanded upon Hamilton's findings. ([15] The majority of energy economists concluded that the significant rise in oil prices was the primary cause of both the 2001 recession and the bulk of the post-World War II U.S. recessions. The traditional view is that higher production costs due to rising oil prices result in slower GDP growth. On the contrary, significant fluctuations in oil prices, whether positive or negative, can harm overall production as they can cause delays in business expenditures due to ambiguity or expensive reorganization of resources within a sector, especially moving resources from a more negatively impacted sector to a less negatively impacted one [16]

This demonstrates how rising petroleum prices have a detrimental impact on employment and production since they function as a tax on expenditure. Additionally, businesses that are suffering rising costs raise the prices of their goods, which contributes to inflation. Since job growth is typically highly contingent on production expansion, price volatility lowers employment growth and raises the unemployment rate. If output growth slows due to incertitude, it puts off making investments in capital goods.

Price volatility has a direct and indirect impact on financial markets. Currency exchange rates, equities and bond valuations, and actual as well as anticipated changes in corporate profitability, price inflation, and monetary policies in the wake of rising oil prices will all have an impact.

Therefore, understanding and analyzing the interconnectedness of energy prices, exchange rates, and inflation is crucial for policymakers, economists, and businesses to make informed decisions and anticipate potential economic impacts.

The study's objectives were to examine the intricate relationships that exist among exchange rates, inflation, and international trade as well as to assess how the exchange rate of the US dollar affects oil prices, how inflation rates affect trade, and how GDP growth rates affect trade. While a large amount of research has shown how much currency exchange levels and volatility affect commerce, some studies have produced contradictory and confusing findings. Exchange rate movements may affect other macroeconomic factors and hence have an effect on how trade is affected by exchange rates. According to research by [17] what matters is not fluctuations in exchange rates in and of itself, but rather how it increases or decreases risks for businesses or consumers. Furthermore, research using a gravity equation model by [18] and the IMF suggests that export volumes are not impacted by exchange rate volatility.

Against this background, this article investigates the relationship between oil prices and the US currency exchange rate, as well as the impact of inflation and GDP growth rates on global trade. The article examines the relationship between these variables and their noteworthy impacts on commerce (% of GDP) using statistical methodologies and additional time series information from 2014 to 2020. Numerous economic methods, including OLS, ADF, ARDL, convergence test, correlation test, Granger causality test, and descriptive analysis, are covered in the literature review. The study's conclusions provide important new light on the complex relationships between these economic variables and the state of international trade. The study also looks at other possible explanations for the declining correlation between trade and currency rates, such as shifts in the mix and structure of import products, short-term external debt exposure of nations, and global and regional value networks.

Objectives of study: The following are the study's aims.

- to look into how changes in the US dollar's exchange rate affect the price of oil.
- to investigate how the rate of inflation affects trade internationally.
- to examine how exchange rates affect global trade.
- to examine how the GDP growth rate affects trade internationally.

Section II examines the literature review; Section III presents the theoretical framework, data, and description of the empirical model; Section IV provides a conclusion.

2. LITERATURE REVIEW

Contractionary monetary policy shocks lead to significant exchange rate appreciation in Malaysia, the People's Republic of China, and the Republic of Korea. However, in India, Indonesia, the Philippines and Thailand, it is either a significant depreciation or no significant effect [19], investigates the connection between Asian nations Indonesia, Japan, Malaysia, the Philippines, Singapore, and Thailand and their trade balances. As a methodology, this study suggested an economical and explanatory model. Therefore, the nominal quantity of these countries' trade balance is impacted by actual money. This study's mathematical analysis demonstrates how real money impacts the trade balances of the Philippines, Malaysia, Singapore, and Thailand with Japan. To equalize the trade imbalance, these countries need to concentrate on using real money.

Taking into account the exchange rate, GDP, foreign direct investment (FDI), real exchange rate, employment, and trade openness as independent variables and exports and financial openness as dependent variables, [20] confirmed the impact of remittances and financial openness in Pakistan. The unit root and relationship between the variables have been

determined using the Co-integration test, the Auto-regressive Distributed Lag (ARDL), and the Augmented Dickey Fuller test. The findings showed that while foreign direct investment (FDI) has a positive but negligible link with Pakistan's GDP, remittances have an impact on human capital as well as economic stability. The contribution of competitive currencies to the economic expansion of East and Southeast Asian economies has been emphasized in a number of studies. [21] discovered a negative impact; in particular, [21] noted a negative link amongst exchange rate volatility and other economic indices. Both [22] and [23] discovered a detrimental effect; Han (2020) pointed out that foreign direct investment played a contributing factor in exacerbated this effect. Barguellil (2018) added that financial openness and exchange rate regimes have an impact on how volatile currency rates affect economic growth. Both [24] and [25] stress the value of a competitive real exchange rate in fostering economic growth, with DAI (2017) highlighting its particular relevance in less financially linked nations. This is further supported by [26], who shows how export success in these areas is impacted by exchange rate volatility and misalignment. the bilateral exports between Sri Lanka and the PRC and come to the conclusion that, although the depreciation has a negative impact on Sri Lanka's imports from the PRC, it has a major positive impact on exports from Sri Lanka to the PRC. As major trading partners in the PRC's global supply chains, [27] also use sector-level data to evaluate the effect of the Chinese renminbi on ASEAN exports. The findings indicate a significant positive impact of real exchange rate depreciation on exports of high- and medium-technology final and intermediate goods. According to [28], the devaluation of the US dollar may cause developed Asia's exchange rate appreciation to destabilize its complementing trade relationships with developing economies, particularly in the technology-intensive goods sector. [29] and used data from South Asian nations, including Bangladesh, to examine the effects of exports and foreign direct investment (FDI) on economic growth. He found that certain countries had major relationships while others had insignificant ones. The analysis found that, although it was negligible in India, FDI had a favorable and considerable impact on economic growth in Bangladesh and Pakistan. However, at the 1% significance level, this association is negative in Sri Lanka. Numerous studies have consistently shown that the ASEAN countries' exports are negatively impacted by inflation and exchange rates. Both [30] and [31] discovered that the exchange rate and inflation have a negative and considerable impact on exports; (Purusa (2018) also noted that this effect is constant across the five countries. Both [32] and [33] discovered that real exports are negatively impacted by exchange rate volatility, with Subanti (2019) speculating that increased exchange rate stability may improve real exports. [34] discovered a negative relationship between GDP and inflation. There will be an increase in GDP beyond a certain point of inflation. Using the Johansen approach to cointegration, [35] investigated the impact of long-term macroeconomic variables on economic development in Ghana from 1980 to 2010. They discovered a cointegration link between macroeconomic parameters and real GDP per capita (economic growth), and their research suggests that the government should generate more local revenue rather than relying on aid from abroad. In a study, [36] highlighted that gross fixed capital formation, foreign direct investment, and total government spending are the main factors determining Nigeria's economic output in the case of a constant inflation rate. They also proved that there is a relationship, both short- and long-term, between macroeconomic variables and economic growth; nevertheless, research on this topic is still in its early stages. [37], [38] offers a thorough examination of how the actual exchange rate level affects trade volume and prices of traded goods, as well as whether or not there has been a steady link between these variables. Its conclusions corroborate findings from past research. The findings indicate that currency depreciation causes foreigners to pay lower export prices and higher import prices, which in turn cause an increase in exports and a decrease in imports.

After controlling for price volatility, a different line of inquiry examines the connection between the level of the exchange rate and the volume of international trade. Oil prices are significantly impacted by the US dollar exchange rate, especially over the long run. [39] looked at the US dollar's value and pricing empirically. This study paper's main goal was to look at how changes in US dollar exchange rates affect the price of oil. This study explored the relationship between the exchange rate and price using both theoretical and empirical methods in order to assess this fundamental goal.

[40] used a nonlinear smooth-transition approach to study the relationship between the exchange rate of oil exporting nations and shocks to the world oil price. While [41] observed that an appreciation of the US dollar exchange rate resulted in a decrease in oil demand, [42] found that a depreciation of the US currency led to an increase in worldwide crude oil prices. [43] provided more evidence in favor of this relationship by pointing out the inverse relationship between the price of crude oil and the US dollar/euro exchange rate. Nonetheless, the US dollar exchange rate does not always have a consistent impact on oil prices, [44] noted that depending on whether changes in oil prices were caused by aggregate demand or supply, different dollar exchange rates reacted differently to shocks in the price of the commodity. This study's main goal was to explain how six significant oil exporting nations responded to changes in the nominal and real exchange rates. For this reason, the real and nominal exchange rates' symmetric smooth transition movements and logistical asymmetry were used in this analysis. Do oil shocks affect the configurations of global exchange rates examined by [45]. The actual and nominal exchange rates, oil price, foreign exchange reserves, and growth rate were the study's variables.

[46] examined the short- and long-term correlations between US dollar exchange rates and oil prices. This research sought to clarify the relationship between US dollar exchange rates and oil prices in the post-World War II era, when both were very changeable. The research approaches used in this study included the OLS, simple regression analysis, Granger causality test, and vector error model applied to daily, monthly, and annual data on oil prices and US dollars exchange rates.

3. RESEARCH METHODOLOGY

This research uses a thorough quantitative analysis to look at the connections between GDP, trade (as a percentage of GDP), inflation (INF), and exchange rates (EXR). The approach aims to clarify the short- and long-term dynamics across these variables using methods for data gathering, model formulation, and statistical analysis. The data sources, variable definitions, model design, and analytical techniques applied in the study are described in this part. The goal of the research approach is to determine whether the trade balance is impacted by exchange rates. may contribute to the calculation of the GDP growth rate.

3.1 Data Collection and Sources

The research is based on secondary time-series data that spans the years 2014 through 2020. The data for trade (percentage of GDP), GDP, inflation (measured by the consumer price index), and exchange rates were sourced from the World Bank's World Development Indicators database. This extensive dataset ensures that the analysis is based on internationally recognized and easily accessible data and offers a dependable foundation for analyzing the economic variables under investigation.

3.2 Variables

This article solely examines elements that could impact economic growth. Every variable has been selected based on previous studies conducted in this field.

Dependent Variable

The entire value of a nation's imports and exports relative to its GDP is represented by trade as a percentage of GDP (TB), the dependent variable in this study. This metric is essential for assessing a nation's level of economic integration and openness to the world economy.

trade (% of GDP): Trade (% of GDP) is the total amount of goods and services that a nation imports and exports expressed as a percentage of its GDP (gross domestic product). According to [47], [48] and Lane and [49], there is a considerable correlation between bilateral equity investment and underlying trade trends. Through trade, investors are more effectively able to obtain accounting and regulatory knowledge about overseas markets, enabling them to make investments in foreign assets. Further reduction of default risk comes from closer trade integration.

Finally, trade transactions can directly produce cross-border financial flows such as export insurance, trade credits, and payment facilitation. The trade openness information comes from the World Bank's World Development Indicators. This can shed light on the advantages and difficulties of global trade, as well as the possible impacts of trade agreements and policies on the development and expansion of a nation's economy.

Independent Variables

The influence of economic expansion on trade is assessed in this study using the GDP's annual growth rate as an independent variable.

Gross Domestic Product (GDP): One measure of economic growth is the GDP. A nation's microeconomic situation and level of progress can be inferred from its GDP [50]. There are two ways to look at GDP: the income approach and the expenditure approach. We'll start by talking about the spending strategy. It considers every good and service provided in a specific amount of time. However, the income approach takes into account the amount of worker's pay, rent, interest rates, a business's income, the tax on produced commodities, and the level of imports.

Exchange rate: This variable analyzes how changes in the value of a currency impact trade dynamics by comparing the value of the home currency to the US dollar.

Shows the Rupee's value expressed in US Dollars. The value of one currency relative to another is known as the exchange rate. Fixed exchange rates and flexible exchange rates are the two types of exchange rates. In an attempt to stabilize the monetary system, the government sets fixed exchange rates, whilst the market sets flexible exchange rates with or without its influence [51].

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Inflation (% consumer price index).: The rate at which the average level of prices for goods and services is rising is shown by the yearly percentage change in the consumer price index. [52] define inflation as a rise in general prices combined with a decline in a currency's buying power. There are a few reasons why prices for goods and services rise due to inflation: when aggregate demand grows more quickly than aggregate supply. The expansion of bank interest rates,

the government deficit, and the rise in foreign demand are all contributing factors to the mismatch between aggregate supply and demand. A few indices of inflation are the Implicit Price Index (deflator GDP), Wholesale Price Index (WPI), and Consumer Price Index (CPI) [53].

3.3 Model specification

The long-term associations and short-term dynamics among the variables are analyzed using the Error Correction Model (ECM) and Autoregressive Distributed Lag (ARDL) models, respectively.

TB = F (GDP, Exr, Inf,)
TB=α0+ β1 (GDP) +β2 (Exr) +β3 (INF) +ϵ

where GDP is the Gross Domestic Product growth rate, INF stands for inflation, EXR for exchange rate, TB is the trade balance as a percentage of GDP, 0α0 is the intercept, 1β1, 2β2, and 3β3 are the coefficients of the independent variables, and ϵt is the error term.

The ECM is included in the short-term dynamics to record the rate at which the system returns to equilibrium following a shock. To measure the adjustment process, the ARDL model's error correction term is incorporated into the ECM.

3.4 Nature of the Data

The study will make use of secondary data that is easily accessible on the official websites, and it is quantitative in nature. For the model's development, I'll use secondary time series data from 2014 to 2020.

3.5 Nature of the Data Measure

The trade (% of GDP) will be the dependent variable in this essay, and the real effective exchange rate, GDP growth rate, and inflation rate (% of consumer price index) will be the independent variables. The dependent variable changed greatly in response to any tiny change in the independent variable.

Table 1: Measurement Scales and Sources

Variables and Sources				
Initials	variables	Unit of measurement	Expected sign	sources
TB	trade (% of GDP)	Percentage	Positive (+)	WDI
GDP	Growth rate	Percentage	positive (+)	WDI
ER	Exchange rate	Percentage	positive (+)	WDI
INF	Inflation rate	Percentage	Positive (+)	WDI

3.6 Analytical Techniques

Descriptive statistics that condense the data's central tendencies and dispersion measurements are the first step in the multi-phase assessment process. The Augmented Dickey-Fuller (ADF) test is then used to verify the time series data's stationarity, which is necessary before ARDL modeling can start. The presence of long-term relationships between the variables is then determined using the ARDL bounds testing approach, and the ECM measures the rate at which the dependent variable returns to equilibrium after a disturbance. P-values are used to determine statistical significance; relationships that are statistically significant are indicated by levels below 0.05.

This research framework offers strong insights into the factors influencing trade dynamics in the context of GDP growth, inflation, and exchange rate variations, enabling a comprehensive knowledge of the economic relationships under examination.

3.7 Data Processing Tool

We used MS Word and E Views as data processing tools in this article.

3.8 Descriptive statistics

Table 2: Descriptive statistics

Variables	Mean	Maxi	Mini	Standard. Deviation	skewness	Kurtosis	JB	Prob.
TRADE	6.302069	8.300000	4.730000	0.948010	0.475171	2.459877	1.443818	0.485824
GDP	2.442378	2.955558	2.055880	0.312264	0.278456	1.457915	3.248215	0.197088
ER	12.5497	15.42000	6.990000	2.222516	-1.357218	3.914991	9.914819	0.007031
INF	10.21237	24.89115	2.463093	5.317921	1.143361	3.698373	6.904510	0.031674

The data's standard deviation is 5.317, the maximum value is 24.89, the minimum value is 2.4, and the mean value of inf is 10,2. The INF's skewed value indicates a positive skew in the data. The INF's kurtosis value is 3.6, which is higher than the 3 It indicates leptokurtosis in the INF. The INF has a JB value of 6.9, which suggests that it is regularly distributed.

3.9 CORRELATION ANALYSIS

Table-3: Correlation Analysis

Variable	TRADE	GDP	ER	INF
TRADE	1.000000			
GDP	-0.2456	1.000000		
ER	-0.6643	0.2335	1.000000	
INF	-0.5746	0.09323	0.4252	1.000000

The correlation between the variables is displayed in the table above. We have already examined the stationary variables in the ADF test, which are the combination of level and first difference. The GDP and the first variable, TRADE, now exhibit a negative correlation with a value of -0.24. The correlation coefficient of 0.66 indicates that there is less correlation between these two variables, whereas TRADE demonstrates the negative correlation between ER. The TRADE and INF connection demonstrates a negative correlation between the variables; the correlation value of -0.46 indicates a low and negative correlation between the variables.

4. ADF UNIT Root Test

Table 4: Results of ADF's Unit Root Test

Variable	Level			1st difference			conclusion
	Intercept	T&I	NONE	intercept	T&I	NONE	
TRADE	_	_	_	-7.02134* P (0.000)	-6.883932 P (0.0000)	-7.137815 P (0.001)	L (1)
GDP	-3.7491* P (0.01)	-3.6580 P (0.04)	-2.05673 P (0.04)		_	_	L (0)
ER	_	_	_	-3.97921* P (0.005)	-3.862534 P (0.027)	-4.06243 P (0.0002)	L (1)
INF	-5.3256* P (0.000)	-5.21634 P (0.001)	-0.84235 P (0.341)	_	_	_	L (0)

We learn that whereas the other variables, like the ER and TRADE, are stationary at the first difference, the GDP and the INF are stationary at the level. We verify the stationary using the probability value and the t statistics as a basis. The variable is stationary and its stationary state is proven when the probability value is less than 0.05%.

4.1. RESULTS AND DISCUSSION

With the use of the Error Correction Model (ECM) and the Autoregressive Distributed Lag (ARDL) technique, this study carefully examined the correlations between trade (% of GDP), GDP, INF, and exchange rates (EXR). A thorough explanation of the results of the ARDL model, ECM findings, and the statistical significance of the variables is given below.

4.2. ARDL Model

The following significant findings were obtained by using the ARDL model to investigate the long-term relationships between the variables:
The Effect of GDP on Trade: The ARDL model yielded a coefficient of 1.048362 for GDP, t-statistic of 2.378007, and standard error of 5.840581. At the 5% level, the GDP's effect on commerce is not statistically significant, according to the related probability value of 0.1915. This shows that although GDP growth is an important economic indicator, other aspects of the economic climate may have a moderating influence on its direct long-term impact on commerce (as a percentage of GDP).

The Effect of Inflation on commerce: The detrimental effect of inflation on commerce was found to be considerably negative, with a coefficient of -0.353796, a t-statistic of -2.197954, and a standard error of 3.345746. A strong inverse relationship between trade and inflation is demonstrated by the probability value of 0.0467, which validates the statistical significance at the 5% level. This finding emphasizes the negative impact of price increases on trade performance in a nation, implying that increased inflation can significantly lower trade as a share of GDP.

Effects of Exchange Rates: With a t-statistic of 1.115148 and a standard error of 0.333248, the exchange rate variable (ER) showed a coefficient of 0.371622. At the traditional 5% level, the exchange rate's effect on commerce is not statistically significant, as indicated by the associated probability value of 0.2850. These results cast doubt on widely held notions regarding the beneficial impacts of devaluation on trade balance and raise the possibility that other variables may be more important in determining trade outcomes.

Table-5: Results of ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	1.048362	5.840581	2.378007	0.1915
INF	-0.353796	3.345746	-2.197954	0.0467
ER	0.371622	0.333249	1.115148	0.2850
C	80.954087	34.704755	2.332651	0.0364

In a nutshell there is a long-term negative relationship between TRADE and inflation. The significance of inflation is indicated by the fact that the probability is less than 0.09 and the t-statistics value is more than 2. A one-unit shift in inflation will result in a thirty-five percent change in trade. These trade and inflation results align with Qamar's (2014) research. Furthermore, the statistical significance of the constant term (C) indicates its significance in the model.

4.3. Error correction model

The ECM was used to gauge how quickly short-term shocks were adjusted back to long-term equilibrium: The error correction term's coefficient was -0.693529, with a t-statistic of -4.789629 and a standard error of 0.233615. A robust and statistically significant adjustment mechanism is shown by the very significant probability value (0.0004), with an annual correction rate of approximately 69.36% of disequilibrium. This emphasizes how the trade balance is dynamic and that, after experiencing short-term volatility, it tends to revert to its long-term equilibrium rather rapidly.

Table-6: Result of ECM

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP)	0.814180	2.975182	0.273657	0.7886
D (GDP (-1))	4.979317	2.622670	1.898568	0.0800
D (GDP (-2))	5.958934	2.072388	2.875395	0.0130
D (GDP (-3))	1.395002	1.983395	0.703340	0.4942
D (GDP (-4))	0.774362	1.826354	0.423993	0.6785
D (GDP (-5))	-2.922831	1.395593	-2.094329	0.0564
D(INF)	-0.334897	0.471681	-0.710008	0.4902
D(INF)	0.623586	0.837290	0.744766	0.4697
D(INF)	0.904567	0.843676	1.072173	0.3031
D(INF)	1.975193	0.866737	2.278884	0.0402
D(INF)	2.438466	0.788526	3.092434	0.0086
D(INF)	1.052844	0.619852	1.698539	0.1132
D(ER)	-0.063075	1.304997	-0.048334	0.9622
D (ER (-1))	-1.260361	1.785472	-0.705898	0.4927
D (ER (-2))	3.744033	1.891513	1.979385	0.0694
D (ER (-3))	-2.870172	1.435826	-1.998969	0.0670
Cointegrating Eq (-1)	-0.693529	0.233615	-4.789629	0.0004
Cointegrating = TRADE - (-8.0484*GDP -7.3538*INF + 0.3716*ER + 80.9541)				

4.4. Bound Test

Table-7: Results of Bound Test

F STAT	3.511632	
CRITICAL BOND VALUE	LCB	UCB
10%	2.12	3.23
5%	2.45	3.61
1%	3.15	4.43

NOTE: critical value is taken from E views.

The bound test table shows a long-term connection, leading us to reject the null hypothesis and accept the alternative.

4.5. Statistical Significance and Interpretation

The statistical analyses show that trade, GDP, inflation, and exchange rates are intricately correlated. Long-term trade performance was found to be negatively impacted by inflation, a vital component that was not significantly affected by GDP or exchange rates. The ECM also emphasized the economy's ability to quickly adapt to departures from long-term patterns and the trade balances' resilience to transient shifts in the economy. Overall, these findings highlight the complex factors influencing trade dynamics and indicate that inflation plays a major influence in determining trade outcomes.

Furthermore, the results call for a reassessment of the direct effects of GDP growth and exchange rate swings on trade, arguing in favor of a more comprehensive viewpoint that takes into account the interaction of many economic factors in determining trade policies and tactics.

4.6. Model Stability

Stability tests like the CUSUM and CUSUM square tests are used to explain the stability of the long run and the short run. The CUSUM test's accuracy and stability are indicated by the blue lines, which must appear between the two red lines. Hence the results of our model are stable as the blue lines are between the two red lines.

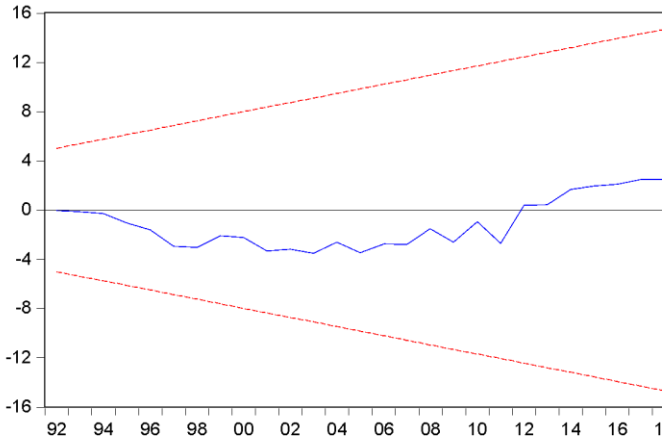

Figure. plot of CUSUM residual test

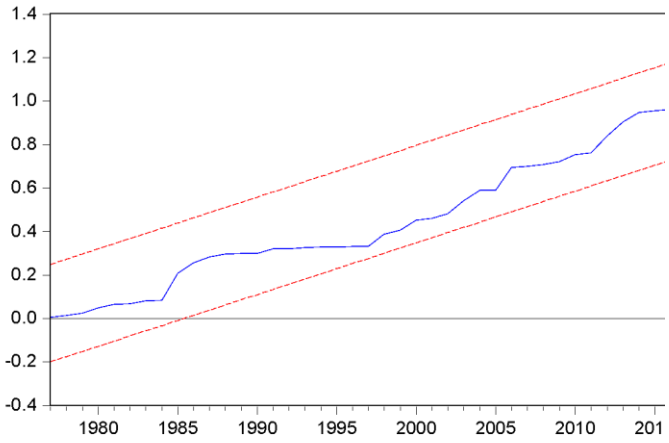

Figure. Plot of CUSUM square residual test

5. Discussion

This study adds to the body of empirical research by analyzing the complex relationships between GDP, trade (as a percentage of GDP), inflation (INF), and exchange rates (EXR). This work adds to the body of knowledge on economic policy and international commerce by revealing subtle insights into the long-term interactions between these variables through the use of an Error Correction Model (ECM) and an Autoregressive Distributed Lag (ARDL) model. Dynamics of Trade and Inflation: Our results demonstrate that inflation has a negative long-term impact on trade, which is consistent with both classical and modern economic theories that view inflation as a negative factor that undermines trade competitiveness. High rates of inflation can raise export prices, which reduces the appeal of a nation's exports abroad and raises the cost of imports, hurting the trade balance. The conclusions of this study are in line with those of Bahmani-Oskooee and Alse (1993), who discovered that inflation damages the value of native currency and has a negative impact on trade balances. But the study's findings, which show that trade (as a percentage of GDP) changes significantly for every unit increase in inflation, highlight how important it is to keep inflation under control in order to improve both the dynamics of international commerce and domestic economic stability.

GDP's Place in Trade: This analysis's non-significant findings about GDP's influence on trade run counter to the more general belief that economic growth fosters trade expansion. This discrepancy raises questions about how much GDP influences trade and raises the possibility that other variables, such the composition of the economy, trade laws, and external economic circumstances, may have a greater impact. This realization is consistent with the findings of Frankel and Romer (1999), who contended that although trade might boost economic growth, the relationship in reverse is less clear-cut. The direct effect of GDP growth on trade expansion may be lessened by the intricacy of global supply chains and the importance of services in contemporary economies, indicating a more complex relationship than previously thought.

Exchange Rates' Influence: The results contradict the widely held belief that devaluation improves trade balance by resulting in cheaper exports and more expensive imports. Instead, they show a lack of meaningful long-term link between exchange rates and trade. The J-curve effect may cause the trade balance to momentarily worsen before improving, which could be a reflection of the elasticities of demand for imports and exports. On the other hand, it might draw attention to how crucial other elements are, such how competitive products and services are, which can either lessen or magnify the consequences of fluctuations in exchange rates. This finding is intriguing, particularly in light of research such as that conducted by Bahmani-Oskooee (1985), which discovered that exchange rates had a major short-term impact on trade balances. Our results imply that a wider range of economic and policy factors may have a more complex influence on the long-term effects.

Synthesis with Previous Research: The findings of this study add to the continuing discussion over the factors that influence trade performance. For example, Rodrik (2008) highlighted the significance of trade policy and institutional quality in influencing trade results, implying that variables other than macroeconomic indicators may be crucial. In a similar vein, the study's analysis of inflation highlights the findings of Aghion et al. (2009), who connected stable inflation rates to higher productivity and, thus, improved trade competitiveness.

Economic Policy Implications: In order to improve trade competitiveness, governments should give price stability a priority, as this research has shown that inflation plays a substantial influence in determining trade outcomes. This broadens the discussion to examine how trade policy goals

can be in line with inflation targeting, moving beyond traditional monetary policy. The intricate knowledge of how GDP and exchange rates affect trade also implies that economic policies intended to boost GDP and control currency values should be integrated with more comprehensive plans that take trade laws, the structural makeup of the economy, and international economic conditions into account.

To sum up, this research not only provides empirical support for the intricate relationship between important economic indicators and trade, but it also casts doubt on some widely held beliefs and emphasizes the complexity of economic processes. The approach provides a comprehensive viewpoint that enhances the discourse on global economic interactions among academics and policymakers. The findings gleaned from this analysis shed light on the complex balance between domestic economic policies and their effects on foreign commerce.

Future Research Directions: This work provides a framework for investigating how trade and other macroeconomic factors interact in various historical and economic circumstances. Deeper understanding might be gained by looking into how trade laws, world economic situations, and sector-specific dynamics affect trade. Furthermore, comparative research among nations with different exchange rate and inflation policies may provide insightful guidance on how to manage commerce and economic expansion.

6. CONCLUSION & RECOMMENDATIONS

The study explored the complex dynamics of how oil prices are affected by the US dollar exchange rate, how inflation rates affect global trade, and how GDP growth rates affect global commerce. The research showed the large impact of tiny changes in independent factors on the dependent variable, trade (% of GDP), through the use of statistical tools and thorough examination of time series data. The results demonstrated a long-term negative association between trade and inflation, with inflation turning out to be a major and significant factor influencing commerce. Additionally, the analysis showed that the economy will adjust by 69.36% to reach equilibrium in the upcoming years, and that the variables will continue to exhibit consistent long run and short run behavior. These revelations provide significant consequences for economic policy and strategic decision-making, and they make significant advances to our understanding of the intricate interactions among exchange rates, inflation, and international trade.

Recommendations: In light of the study's conclusions, the following recommendations can be made:

Policy Implications: The long-term negative link between trade and inflation emphasizes how crucial it is to put in place efficient monetary policies to control inflation rates. Maintaining stable inflation rates is a priority for policymakers in order to promote global commerce and economic expansion.

Exchange Rate Management: It is imperative that policymakers actively monitor and control exchange rate variations because of the substantial impact that the US dollar exchange rate has on oil prices. It is important to think about ways to lessen the negative impact that exchange rate volatility has on oil prices.

Economic Forecasting: The study's finding that the economy will adjust by 69.36% over the next few years to reach equilibrium points to the necessity of precise economic forecasting. Businesses and policymakers can use this data to plan for future economic shifts and make well-informed decisions.

Trade Policy Considerations: The significance of developing trade policies that take these variables into consideration is highlighted by the study's insights into the complex relationship between inflation, exchange rates, and international commerce. The possible effects of inflation and currency rate swings on trade dynamics should be taken into account in trade agreements and negotiations.

Additional Research: The study lays the groundwork for future research in the areas of macroeconomics and international trade by utilizing a variety of statistical approaches and time series analysis. To further understand these intricate processes, future research could examine new variables and perform comparison analysis across economies.

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The authors can acknowledge any person/authorities in this section. This is not mandatory.

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