

The Effect of Oil Price Fluctuations on the Economic Growth of Major Exporting and Importing Countries

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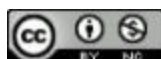
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Résumé

Cette étude évalue l'influence des fluctuations des prix du pétrole brut sur la croissance économique des pays du G20, en distinguant les pays importateurs des pays exportateurs. Les données annuelles couvrant la période 2004-2022 sont utilisées. Pour l'analyse, un cadre économétrique en données de panel est appliqué, mobilisant à la fois des modèles à effets fixes et à effets aléatoires. Le modèle intègre les principaux indicateurs macroéconomiques, notamment les taux de change, le niveau des prix, l'Indice de développement humain, la stabilité politique et les rendements boursiers.

Les résultats montrent qu'une hausse des prix du pétrole est positivement associée à la croissance économique dans les pays exportateurs, tandis qu'une relation inverse est observée dans les pays importateurs. En outre, l'étude met en évidence que le développement des marchés financiers et l'amélioration du capital humain contribuent positivement à la croissance, alors que l'inflation, en particulier dans les pays exportateurs de pétrole, freine la croissance économique. Ces résultats comportent plusieurs implications en matière de politiques économiques et suggèrent notamment la nécessité de stratégies différenciées en fonction du profil énergétique des pays.

Mots-clés : prix du pétrole, croissance économique, pays exportateurs de pétrole, pays importateurs de pétrole, données de panel, G20.

Abstract

The study evaluates how fluctuations in crude oil prices influence the economic growth of G20 countries, distinguishing between importing and exporting states. Annual data from 2004 to 2022 were used. For analysis, a panel data econometric framework was applied with both fixed and random-effects models. The model considered major macroeconomic indicators such as exchange rates, price levels, Human Development Index, political stability, and stock market returns. The findings show that rise in oil prices is positively linked to economic growth in exporting countries; however, the reverse is found to be true in importing countries. On top of this, the study also finds that the development of financial markets and improvement in human capital furnish positive growth returns while inflation, especially in oil-exporting countries, puts the brakes on growth. These findings carry several policy implications and, among others, suggest the need for differentiated economic strategies based on countries' energy profiles.

Keywords: oil prices, economic growth, oil-exporting countries, oil-importing countries, panel data, G20

1. Introduction

Oil ranks as one of the most essential facets of the worldwide economy. It has a central role in countries whose economic performances are majorly dependent on oil revenues—the so-called 'black gold' nations. The dependency itself explains the strong correlation between oil prices and economic fortunes of such countries. Oil as a production factor is special because it aids economic growth, both positively and negatively, with its price fluctuations affecting the upside or downside changes in the countries' economic outlook. Macroeconomic volatility means that some shocks have their incidences heightened as

shifts take place in key macroeconomic indicators. Variables such as GDP, inflation, currency values, and interest rates are inherently unstable and subject to aberrant exogenous shocks. Hence some of the researchers have typically tried to analyze the effects that changes in oil prices have on macroeconomic performances.

While it is generally agreed that oil prices are closely related to macroeconomic conditions, some studies, however, have suggested that such fluctuations in oil prices may not have a significant bearing on overall economic growth or production development (Ewing & Malik, (2017); Taiwo, Abayomi & Damilare, (2012)). Changes in the oil price parameters may or may not have an effect on the economic fundamentals. As the oil-exporting nations usually appreciate higher oil prices for their macroeconomic development, lower oil prices tend to work adversely.

Increases in oil prices seem to elicit a greater reaction from financial markets than do declines (Jacobs, Kuper, & Van Soest, (2009)). According to studies of Hamilton (1983), Abdullah (2015), and Musa (2017), crude oil price moves positively with economic growth. Actual and theoretical articles have shown incidences where higher oil prices seemed to hinder the macroeconomic growth of oil-importing countries by raising inflation and unemployment, hence lowering household purchasing power, while simultaneously lowering the value of financial and other assets. The example is represented well by the commodity crash of 2014, where oil was selling just a little above \$50 per barrel after a decade above \$100 the previous year. The sudden slide in prices brought the ramifications of resource revenue dependence into the everyday lives of common citizens, thereby demonstrating the manner in which economic annihilation can sprout from volatile oil markets.

Elmi and Jahadi (2011), using a Vector Auto Regression (VAR) model of a few OPEC and OECD countries from 1970 to 2008, found that oil shocks had varying effects on these economies. Similarly, Omojolaibi and Egwaikhide (2013), using a panel VAR model, found as a conclusion that oil price volatility has a significant effect on crude oil prices than fiscal deficits, real GDP, or money supply. Eyden et al. (2019) also proved that volatility in oil prices negatively and significantly affects GDP growth in their panel VAR analysis.

2. Literature review

2.1. Main theoretical mechanisms

A vast literature focuses on the relationship between resource availability and economic activity (Frankel, (2012)). Through a simple economic impulse that indicates that the increase in natural resources would potentially play a benefit in promoting economic development due to their transformation into capital to support capital needs (Rodriguez and Sachs, (1999)).

Theoretically, the availability of excess resources can stimulate the economy through higher investments in health, education, public infrastructure and renovation of communication systems and therefore the entire economy benefits from this windfall (Limi, (2007)). However, the results obtained in recent decades reveal that natural resources serve to reduce costs and stimulate economic growth instead of promoting it. The biggest intervention was that of Sachs and Warner (1995), they conducted a multitude of studies arguing that there is a negative association between the abundance of natural

resources and economic growth. As a result, the literature focuses on the unfavorable economic performance of resource-rich countries and, consequently, the phenomenon of the resource curse and, as a result, begins to penetrate the literature (Limi, (2007)).

Most of the literature highlights a number of channels through which natural resources influence development. These channels are known as elimination channels through which its natural resources suppress other sources of capital required for development and thus slow economic growth (Gylfason, (2001)). Similarly, (Warner & Sachs, 2001) stipulate that natural resources cannot directly put a negative stigma on income but instead tend to increasingly negatively affect many activities favorable to income, such as physical capital, human capital and institutional capital, which, due to their purpose, drive growth. There is no shared hypothesis approved in such literature on the natural resources curse, but only possible explanations of the latter according to the logic of destruction by Sachs and Warner (2001). The design of contemporary models discovers that excessive availability of natural resources affects certain variables or parameters that constitute their empirical and theoretical investigations of this sector and to identify the mechanisms and variables that are responsible for an adverse effect on economic profitability (Gylfason, (2001)).

All studies refer to various avenues through which natural resources impact development. These avenues are referred to as elimination channels in which its natural resources keep others forms of capital required for development in check and thus slow down economic growth (Gylfason, (2001)). Similarly, natural resources, according to (Warner & Sachs, (2001)), do not necessarily directly impact income with a negative stigma but more so negatively affect many activities conducive to income, such as physical capital, human capital and institutional capital, which due to their purpose, result in growth. There is no general hypothesis legitimated within this literature for the curse of natural resources, but only plausible interpretations of the latter by means of Sachs and Warner's logic of destruction (2001). The design of existing models indicates that the abundance of natural resources affects certain variables or parameters constituting their empirical and theoretical investigations of this sector and to identify the variables and mechanisms that account for a detrimental impact on economic profitability (Gylfason, (2001)).

Thus, the first channel established is the Dutch disease, which creates a negative dependency by the presence of natural resources and economic growth: nations with an abundance of resources grow less than others (Sachs & Warner, (1995)). Furthermore, oil product export causes an appreciation of the exchange rate, leading to a decline in the commercial sector (Masan, (2016)). Thus, this phenomenon, which is proven by the exploitation of a natural resource that brings profits to the sector dealing with this fortune, would negatively impact economic growth (Aggab & Ait Elhadj, (2015)). That is, the boom of the natural windfall, for countries that practice poor resource management, creates the partial collapse of the economy, which triggers the reinforcement of the hydrocarbon sector which will absorb more and more factors of production, in particular capital and labor, hence crowding out other activities intended for export (Haoua, (2012)). The second channel is the education and human capital channel. For this purpose, and as seen through history, it is quite clear that natural resources do not necessarily result in human development in a country: resource-abundant developing countries usually have higher average life expectancy and lower infant and maternal mortality rates than other countries that are not resource-abundant (Bill & Melinda Gates, (2015)). Under these

circumstances, natural resources reduce investment and the quality of education (Papyrakis & Gerlagh, 2006). In addition, increasing the production level in the sector of the latter, i.e., employing a skilled workforce with highly high remuneration, leads to more remunerations in other sectors (e.g., textiles), hence the fate of workers. This is owing to the fact that the manufacturing sector finds itself in a disadvantaged location and therefore needs production (Gingras, (1997)). Additionally, Gylfason (2001) approximated a sequence of two equations, he found that natural resources overshadow human capital, and it smothers the economic performance of countries that possess them on the economic results of developing countries between 1989 and 1999. He found that primary education is often overlooked in poor countries. The above findings support the human capital interpretation of the natural resource curse.

The third channel is investment and physical capital, wherein the plenty of natural resources reduces incentives to save and thereby retards economic growth (Gylfason, (2001)). Various mechanisms are likely to be responsible for this investment decline, taking the case of natural resources when it is a source of wealth, which demands a reduction in public savings for the next term which binds the demand for savings and investment (Gylfason & Zoega, (2001)). In fact, the developing countries which are rich in resources, they spend them in preference to public consumption against more productive to economic growth public investments (Alkinson & Hamilton, (2003)). In the same regard, Gylfason (2001) states that a 25% increase in natural resources is consistent with a 5% decrease in the ratio of investment which, in turn, results in a 1% decrease in economic growth.

The fourth channel is the political economy channel and is based on the poor reputation of governance and public institutions owing to profit-driven actions as a result of the vast richness of natural resources. Some studies have confirmed the positive relationship between institutional quality and economic returns, while others confirm a negative relationship.

The fifth channel is the volatility of oil prices and its effects on public spending. Also, the flexibility of crude oil prices is also viewed as a major issue for oil exporting nations. Yet again, an upheaval in oil prices will affect export revenues and hence public spending and investment, which again have a vital role in economic growth.

Hence, the effect of oil prices does not manifest itself in a similar manner in all countries; it varies depending on the country's institutional arrangement, sectoral structure and phase of economic development (Ahmad & Masan, (2015)). Similarly, previous research studies on the relationship between black gold price volatility and macroeconomic indicators present the impact of such shocks on producing and consuming countries, but the intensity of these effects differs from one country to another and according to the periods. The most important among them are Hamilton (1983); Darby (1982); Burbdge and Harrison (1984) observed statistical significance in the performance of the oil price and macroeconomic variables in developed countries. More recently, various empirical investigations have been conducted and disseminated based on developing and oil-producing countries' data. As Mehrara (2008) explains, peak oil would eliminate pressures on the exchange rate and thus energize economic performance on the supply and demand side for oil-exporting countries. More precisely, when prices of crude oil fall, governments are unable to directly manage their fiscal policy, which will lead to fiscal imbalances that are a key challenge for the majority of developing countries (Farzanegan, (2011)).

The sixth channel is the long-run trend in primary goods prices. Paul Prebisch (1950) and Hans Singer (1950) assumed that the prices of raw materials and farm resources in the long run fall relative to processed goods prices. This follows from the inelasticity of demand for raw materials with respect to income. Engel's Law is the hypothesis: as wealth rises, one decreases the proportion of spending on food. Therefore, this proportion of food spending can be treated as an indirect measure of well-being.

Consequently, Van Eyden and others (2019) in their research discovered that oil price volatility has a negative impact on growth within the Organization for Economic Co-operation and Development. Kirca and others established a permanent relationship between gas and oil prices in Turkey spanning five years in 2020. Subsequently, in 2018, Guan and others used the same frequency domain approach to investigate the effect of gold and oil price volatilities on growth of resource economies. In a recent work, Magazzino and others in 2021 noted that energy consumption corresponds to faster rates of growth lower frequency bands. Accordingly, in Italy, energy consumption corresponds to more intensive and frequent economic growth.

2.2.Key insights from empirical work

There is so much empirical evidence that has challenged the issue of oil prices and their effects on consumption and economic growth in the developed world and developing countries, bearing in mind that crude oil is a natural product (Eden and Hang, (1984); Stern and Cleveland, (2004)). Rotemberg and Woodford's (1991) analysis indicates that neoclassical growth models can account for the fall in output and real wages following the rise in crude oil prices. Furthermore, Brown and Yucel (2002) argue that oil price shocks affect economic performance in addition to dictating the energy policy employed to counteract oil shocks. Similarly, Mukhtarov (2020) examines how oil price volatility affects the exchange rate, inflation, exports, and economic growth in Austria. Subsequently, he demonstrated that the oil price is statistically significant and has a positive impact on all variables except the exchange rate in which the effect was negative. Punzi (2019) anchored his research on a dynamic stochastic general equilibrium (DSGE) model and analyzed the macroeconomic effects of oil price volatility in an open economy. Therefore, there is high macroeconomic exposure in the economic cycle due to the heterogeneity of uncertainties and crude oil prices. The second work analyzed by Xu and Wang (2022) is regarding the effects of fluctuations in the price of oil worldwide on the Chinese economy and states that if the oil price risk is very high, then precautionary household action is preventing the functioning of the real sphere. Hence, policymakers encourage investments in renewable power and energy management so that industries and residences become less sensitive to fluctuations in the energy market.

3. Emphasizing the impact of crude oil price fluctuation on economic growth in a few G20 nations

Our empirical study includes the growth rate of the countries in question and crude oil prices. The aim of this study is to provide an insight into the contribution of crude oil price volatility to economic growth. Our model demonstrates the relationship between oil prices and economic growth in the presence of different variables such as the return of the stock index, the exchange rate, the inflation rate, the political stability index, and the human development index.

3.1. Development of hypotheses

Oil has been a traditional barometer of economic stability in modern times due to the high dependence of the world on petroleum products. Moreover, oil is the most widely traded commodity in the world, both in volume and in value. Furthermore, the prices of energy-intensive goods and services are linked to energy prices, of which oil constitutes the largest share.

Because the global economy depends so much on petroleum products, the connection between oil prices and economic growth has been a subject of great interest to economists for a while. There is also a vast technical literature that covers many aspects of the topic. On the contrary, rising national income in Saudi Arabia, due to the direct effect of rising oil prices, leads to increased demand for Chinese products (increased imports from China), which has an indirect positive effect on China's economic growth. Yet, a big oil price increase can harm Saudi Arabia indirectly (trade shock); as increased energy prices raise the production costs of Chinese goods, resulting in a contractionary supply shock, which decreases China's demand for Saudi oil (one of Saudi Arabia's most profitable exports).

Mehrara (2008) studied the relationship between oil price and economic growth for oil-exporting countries. Empirical evidence confirms the reality of the nonlinear and asymmetric relationship between oil price and GDP. For example, Farzanegan and Markwardt (2009) studied the relationship between oil price and macroeconomic indicators for Iran. Their results confirm the reality that a positive shock in oil price has a positive and significant impact on GDP. On the other hand, negative oil price shocks positively and significantly impact industrial production. Similarly, Ozlale and Pekurnaz (2010) analyzed the relationships among oil price and macroeconomic variables for the Turkish economy. They employed a structural vector autoregressive (SVAR) model and confirmed that oil price leads to a current account deficit, and that leads to a decline in economic growth.

For China, Tang et al. (2010) revealed that oil price shocks have a negative effect on investment and economic growth. Using the G7 economies, OPEC economies, Russia, India, and China data, Ghalayini (2011) retested the hypothesis that economic growth is affected by oil price shocks and found that oil price is negatively (positively) related to economic growth in oil-importing (exporting) countries. Besides, Timilsina (2015) studied 25 economies to examine the empirical relationship between GDP and oil price. The results for developing nations indicate a negative and significant impact of oil price on GDP. The dependence of industries on oil is the major explanation behind this inverse relationship.

H1.1: The price of oil has a strong positive effect on the economic development of the exporting countries

H1.2: There exists a significant negative effect of oil price on the growth of importing country

3.1.1. The effect of inflation on economic growth

In the literature, investigation of the nexus between inflation and economic growth is still topical and has given rise to different schools of thought. In Latin America, Manoel (2010)

examines the influence of the inflation rate on the nation's economy by using data sets spanning the years 1970-2007 for four Latin American countries. The study uses the real GDP growth rate as a function of inflation, government contribution to GDP, openness to trade, investment rate, structural development index, cash to GDP ratio, and political regime. The results show that there is a significant negative relationship between inflation and economic growth.

In this regard, Mkhathshwa et al. (2015) analyze the effect of the inflation rate on agricultural and economic growth in Swaziland during the period 1980-2013. The ARDL (Autoregressive Distributed Lag) analysis result indicates that inflation has a negative relationship, while agricultural growth has a positive relationship on economic growth. Moreover, Kasidi and Mwakanemela (2015) in their article analyzed the effect of inflation on economic growth between 1990-2011 in Tanzania using correlation and cointegration techniques and maintain there is no strong relationship between the inflation rate and economic growth. Using panel analysis, Ndoricimpa (2017) investigates the threshold inflation on economic growth in some selected African countries. The result unveils the nonlinear relationship between the two variables and that low inflation supports economic growth in middle-income countries, with no effect on the entire sample. The result also shows that inflation above the threshold negatively affects the economy in all countries. In a similar study, Idris and Suleiman (2019) analyze the impact of inflation on Nigeria's economic growth spanning the period 1980-2017. The research uses the vector error correction mechanism on the selected variables such as gross domestic product, inflation rate, interest rate, and exchange rate in the country. The results indicate a long-run relationship between the variables and that inflation rate and interest rate play an important role in Nigeria's economic growth during 1980-2017.

H2: Economic growth is negatively affected by inflation

3.1.2. The effect of human development on economic growth

In the study conducted by George and Ogunyomi (2019) in Nigeria, also concluded that human capital has a positive relationship with economic growth. The study found that human capital development, curriculum development, inflation rate and GINI index were the missing variables in achieving long-term economic growth between 1985 and 2016 in Nigeria. Presence of bidirectional causality between human capital formation and economic growth was also established by the study using the income measurement framework. The problem was also corroborated by Howitt and Aghion (1998), who further stated that an increase in research and development (which is brought about by human capital formation) enhances long-term chances for economic growth.

Considering the research of Base and Guariglia (2007) where they checked for the association between human capital inequality, foreign direct investment (FDI) and economic growth relying on panel data of 119 developing nations from 1970-1999. The findings of the study confirm that FDI is positively and significantly influencing human capital inequality and economic growth in developing economies.

H3: Human Development Index is also considered as one of the indicators of economic growth

3.1.3. The effect of financial market development on economic growth

The literature also indicates that stock market development has favorable economic effects. For example, liquid and internationally connected stock markets can spur productivity growth (Levine, (1991), Devereux and Smith, (1994), Obstfeld, (1994)). However, previous studies for developed economies mainly support the favorable relationship between stock market development and economic growth. In addition, Beck and Levine (2004) find that stock markets and banks are beneficial for economic growth for 1976-1998 in some countries. In their view, Boubakari and Jin (2010) find a positive relationship between economic growth and the stock market in countries with a highly liquid, highly active stock market. With a focus on 146 countries over the period 1991–2011, Seven and Yetkiner (2016) observe a positive and statistically significant relationship between economic growth and stock market development for middle- and high-income countries.

Also including the mean trading volume in the bill and bond market as a variable, Soytaş and Küçükkaya (2011) fail to establish long-run causality between financial development and economic growth between the third quarter of 1991 and the fourth quarter of 2005 for Turkey. Also using the BIST total volume/GDP ratio, as an index for the evolution of capital markets and several other markers for the banking system, the results of Araç and Özcan (2014) support the supply and demand hypotheses. The authors conclude that while the evolution of the economy fosters the development of finance by increasing banks' long-term assets in Turkey. With the fixed effect panel regression model and Dimutrescu-Hurlin test, Karabıyık and Taşkın (2016) conclude that there is no linear or causal relationship between economic growth and stock market development in Turkey.

H4: Financial market development enhances the economy of the country 3-1-4. Political stability and economic growth

Effects of political instability on economic growth are the concern of most literature since political instability implies future risk, which scares away investment and consequently impacts the growth of an economy both in the present and in the future. Second, the politically unstable economy will have the tendency to encourage corruption and other distortive inclinations. Political instability will therefore have the tendency to impact economic growth negatively. Several empirical studies have found that political instability adversely impacts key macroeconomic variables, such as GDP, inflation, and private investment. For example, Jong- A-Pin (2009) examined the causal impact of political instability on economic growth using a dynamic panel system and a generalized method of moments (GMM) estimator and concluded that political regime instability significantly impacts economic growth in a negative manner. In a more recent contribution, Aisen and Veiga (2013) empirically tested the problem using the System-GMM estimator of linear dynamic panel data models for 169 countries between 1960 and 2004. Their contribution confirmed previous evidence that political instability adversely affects economic growth through a reduction in physical and human capital accumulation and further found that political instability reduces productivity growth rates more.

Existing literature therefore seems to agree that political stability must be there for economic growth. Political stability is assumed to be responsible for the desirable framework, attracting private financiers and multilateral companies capable of creating the setting in which growth occurs, and will also lead to the creation of best

macroeconomic policies in the long term. This means less frequent economic policy changes, which are more likely to introduce additional volatility that harms the macroeconomic performance of a country, will be observed.

H5: The greater the political stability, the greater the economic growth.

3.1.4. Currency appreciation and economic growth

Indeed, the literature has also explored the interface between exchange rate volatility and economic growth, but theoretical literature is still an issue of much debate among economists. Theoretically, while on one hand some research works (see Obstfeld & Rogoff, (1998)) argue that large changes in the exchange rate are costly for the home economy, as per other research works such as Devereux and Engel (2003) the effect of exchange rate volatility depends upon the price setting mechanism.

In general, the causes of exchange rate volatility fall under domestic real shocks on supply, domestic real shocks on demand, external real shocks, and nominal shocks caused by shifts in the supply of money. Using the structural vector error correction model, Gauthier and Tessier (2002) estimate the effect of a supply shock on the dynamics of the Canadian real exchange rate. They discovered that the exchange rate appreciated following a positive supply shock. Hausmann, Panizza, and Rigobon (2006) find that the real exchange rate of developing countries is more volatile than that of developed nations because they have a high exposure to shocks (real and nominal) via variations in the sensitivity of the real exchange rate to shocks. Kandil (2004) examines the effects of exchange rate volatility on real output growth and price inflation across 22 developing countries. The authors argue that, depending on the openness level, exchange rate volatility and depreciation, respectively, have adverse impacts on economic performance by reducing output growth and inflation. Long-term expected exchange rate volatility significantly increases and decreases inflation and output growth. Holland et al. (2013) examine the impact of real exchange rate volatility on long-term economic growth of advanced and emerging economies between 1970 and 2009 and assert that high (low) exchange rate volatility positively (negatively) influences the real GDP growth rate.

But, when control for the volatility of the exchange rate is added in a model with both exchange rate levels and exchange rate misalignment, the variables become insignificant, suggesting that exchange rate volatility does not matter, suggesting that exchange rate stability matters more in long-run growth than exchange rate misalignment.

H6: Currency appreciation promotes economic growth

4. Data and Methodology

4.1. Model estimates

Panel data econometrics is a very active field. The increasing availability of data observed on cross-sections of units (households, firms, countries, etc.) and over time has created a sequence of estimation techniques exploiting this double dimensionality to tackle some of the typical problems associated with economic data, first and foremost the existence of unobserved heterogeneity. Longitudinal observation of data from multiple observation units has been standard practice in other statistical disciplines (where they are often

referred to as longitudinal data) for many years. In the field of panel data as in others, the econometric approach is nonetheless distinctive compared to experimental settings, as it emphasizes model specification and testing and addresses a sequence of issues arising from the particular statistical challenges caused by economic data Croissant and Millo (2014).

The literature on statistical models for panel data has grown exponentially in the past twenty years with several recent textbooks focusing on this subfield of econometrics; see Arellano (2005), Hsiao (2003), Halaby (2004), Baltagi (2005), Cameron and Trivedi (2005), Wooldridge (2010). The growth is preoccupied mainly with the development of estimation procedures that are asymptotically valid under probability assumptions for the error terms that allow for some heterogeneity and dependence. Since the data are in panel, the study used ordinary least squares (OLS), random effects (RE) and fixed effects (FE) panel data estimation techniques depending on which was most appropriate. This test of estimation is appropriate as it controls for both time series and cross-sectional observations (Chen, 2008). To determine the determinants of the effect of IFRS adoption on the cost of equity in African countries, we used panel data as an econometric analysis technique. Indeed, Greene, 2003, averred that panel data is a technique which makes use of time domain cross-sectional data in predicting economic relations.

Similarly, Wooldridge (2002) shows that the panel uses the effects of sections. Thus, the analysis uses data, which both possess time and number of links. One of the reasons for selecting this method instead of others is that technology allows us to deal with the hidden effects that might be linked with the model parameters. In addition, we expect that the financial data modeling is defined in a way that it has both the time dimension and the number of bonds dimension, which will lead us to more accurate results. Indeed, the use of panel data is more preferable than the use of time series and cross-sectional data. Firstly, in panel data analysis, we do not have the problem of non-conformity as we do in most time series and analysis chapters.

Also, the Hausman specification test was used to choose between the analysis methods or the fixed effects model or the random effects model. In accordance with this hypothesis, H0 indicates that "random effects exist" and hypothesis H1 indicates that "random effects do not exist."

H0: Absence of fixed effects: if probability is more than 5%.

H1: Presence of fixed effects: if probability is less than 5%. That is, if probability is less than 5%, we use the fixed effect, and if it's more, the random effect is released.

4.2. Data

This study is focused on a sample of 19 nations, eight oil-exporting nations and eleven oil- importing nations for 19 years between 2004 and 2022. In fact, our entire sample consists of 361 observations. The data are taken from multiple sources The Global Economy and the World Bank.

Model:

$$EG_{it} = \beta_0 + \beta_1 WTI_{it} + \beta_2 SMI_{it} + \beta_3 EXR_{it} + \beta_4 INF_{it} + \beta_5 PS_{it} + \beta_6 HDIN_{it} + \varepsilon_{it}$$

EG_{it} : Represents the rate of economic growth of country *i* during year *t*

WTI_{it} : Represents the price of oil in country *i* during year *t*

SMI_{it} : Represents the return of the stock index of country *i* during year *t*

EXR_{it} : Represents the exchange rate of the currency of country *i* during year *t* against the Dollar

INF_{it} : Represents the inflation rate of country *i* during year *t*.

PS_{it} : Represents the index of political stability of country *i* during year *t*

HDIN_{it} : Represents the human development index in country *i* during year *t*

Table 1: Presentation and measurement of variables

Variable name	Description	Source
Economic growth (EG)	Logarithm of real gross domestic product	TheGlobalEconomy.com
The price of oil (WTI)	Logarithm of the average annual oil price	TheGlobalEconomy.com
The stock market index (SMI)	The performance of stock indices	TheGlobalEconomy.com
The exchange rate (EXR)	Logarithm of the exchange rate (USD)	World Bank
Inflation (INF)	Logarithm of consumer price index inflation	World Bank
Political stability	Political Stability Index	TheGlobalEconomy.com
Human development	Human Development Index	TheGlobalEconomy.com

4.3.Descriptive statistics

Table 2: Descriptive statistics

VARIABLES	Exporting Countries				Importing Countries			
	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
EG	2.978045	2.849081	-7.8	10	3.362578	3.79007	-5.92	14.23
WTI	67.76545	19.73651	39.23	99.57	67.49625	19.96101	39.23	99.57
SMI	11.01478	21,401	-38.39	111.88	13.86741	26.80224	-28.6	159.99
EXR	10.12274	0.79318	8.022667	11.04341	10.14036	0.5827604	8.47995	10.89004
INF	3.69	2.956842	-2.1	15.5	3.128099	3.353387	-1.4	16.3
PS	25.4253	39.5425	20.13	26.42	30.1708	42.9943	38.49	97.71
HDIN	0.8084409	0.1070049	0.53	0.944	.8188623	.0929054	0.618	0.947

The descriptive statistics for the variables in question are given in Table 2. Log transformation of all variables is done mostly because of two reasons. The first reason is that log transformation of the variables allows the estimated coefficients to be interpreted as elasticities and therefore a meaningful interpretation can be noted. Second, the conversion of the variables to logarithm reduces unnecessary fluctuations and variability of the variables and smooths the data series. Table 2 gives the descriptive statistics of all the variables indicating the mean, standard deviation, and minimum and maximum for export and import countries.

According to the standard deviation of the summary statistics, all variables are less spread from their mean values, with the exception of the log of stock indices and political stability and the log of oil price, whose standard deviations are a little greater than the remaining variables.

4.4. Correlation matrix

Table 3: Correlation matrix of exporting countries

	WTI	SMI	EXR	INF	PS	HDIN
WTI	1.0000					
SMI	-0.2484	1.0000				
EXR	0.0213	-0.2220	1.0000			
INF	0.0962	0.0511	-0.5801	1.0000		
PS	0.0011	0.1196	-0.8156	0.3839	1.0000	
HDIN	0.0241	-0.2747	0.9539	-0.6067	-0.7412	1.0000

Table 4: Correlation matrix of importing countries

	WTI	SMI	EXR	INF	PS	HDIN
WTI	1.0000					
SMI	-0.1236	1.0000				
EXR	-0.0613	-0.0559	1.0000			
INF	0.2499	0.0343	0.0890	1.0000		
PS	-0.0190	0.0467	-0.3066	-0.0130	1.0000	
HDIN	0.0158	-0.1168	-0.0609	-0.5074	-0.4918	1.0000

Tables 3 and 4 are the correlation matrices between all independent variables. This is important for spotting multicollinearity problems between the independent variables within the regression. Indeed, there is a chance that the inclusion of highly correlated variables in the same model will distort the results provided.

Referring to the study of Kennedy (1985) and Nor et al. (2010), for the relationship between two variables to be considered significant, the correlation coefficient must be 0.7 or higher in both exporting and importing countries. In our case, the correlation matrix indicates that all of the coefficients are less than this need, and that none of the correlations are significant. We can therefore conclude that there is no problem of multi-collinearity between the explanatory variables, and that it is not necessary to exclude certain variables.

4.5. VIF Test

A variance inflation factor or VIF is a measure of the magnitude of multicollinearity in regression analysis. Multicollinearity arises when there is correlation between multiple independent variables in a multiple regression model. This is negatively affecting regression outcomes. Thus, the variance inflation factor can determine the amount of variance of a regression coefficient that is being inflated with multicollinearity.

To again verify the absence of multicollinearity between variables, we conducted the VIF (Variance Inflation Factor) test. VIF measures how much each explanatory variable can be explained by other explanatory variables. Thus, when VIF is less than 10, then collinearity is no longer present (Chavent et al. 2006).

Table 5: VIF test

Exporting Countries			Importing Countries		
Variables	LIVEL Y	1/VIF	VARIABLES	LIVEL Y	1/VIF
HDIN	4.68	0.213601	HDIN	2.26	0.443079
PS	2.67	0.374026	PS	1.78	0.560304
INF	1.93	0.516871	INF	1.71	0.585040
EXR	1.39	0.717600	EXR	1.20	0.833711
SMI	1.23	0.813541	WTI	1.13	0.885064
WTI	1.10	0.910349	SMI	1.04	0.964527
Mean VIF	2.17		Mean VIF	1.52	

Variance inflation factor (VIF) is used to check multicollinearity between the independent variables. If a VIF value is more than 10, then it generally indicates severe multicollinearity problems (Chavent et al., 2006).

In this, all the VIF values are below the threshold value of 10 for export countries as well as import countries, which indicates that there is no serious problem of multicollinearity. The average VIF is 2.17 for export countries and 1.52 for import countries. These findings suggest that the explanatory variables of the regression model are sufficiently independent and no variable should be removed due to multicollinearity issues.

5. Results and discussions

Table 6: Result of the effect of oil price on economic growth: a comparative analysis between exporting and importing countries

EG	EXPORTERS			IMPORTERS		
	Coefficient	t	P> t	Coefficient	t	P> t
WTI	0.02542	2.46	0.016**	-0.4470916	-3.80	0.000***
SMI	0.0671465	6.13	0.000***	0.042501	4.95	0.000***
EXR	18.63756	3.20	0.002***	11.68503	2.16	0.034**
INF	-1.06707	-2.41	0.017**	-0.0434008	-0.32	0.748
PS	0.0005374	0.03	0.973	0.0002659	0.13	0.900
HDIN	7.07606	1.69	0.094*	7.08681	2.37	0.018**
R2		0.3619			0.4222	
FISHER		282.44			6.94	
		0.000***			0.000***	

The table 6 above shows the results of the influence of oil price on economic growth in the presence of other macroeconomic variables, financial variables and political variables. The results show a comparison between exporting countries and importing countries.

The relationship between oil prices and economic activity has attracted many researchers after the seminal work of Hamilton (1983), who believed that there is a negative effect of oil prices on real output. It is asserted here that oil price volatility has a significant effect on the well-being of individuals throughout the world.

Indeed, the results show that oil price has a positive and significant effect at the 5% level on economic growth in exporting countries, which allows us to validate our hypothesis. This allows us to state that, for exporting countries, increases in oil price led to an increase in the level of revenues and that, consequently, investment and consumption revenues increase, which leads to higher levels of GDP growth. As a matter of fact, higher oil prices lead to higher incomes, which mean higher incomes in oil exporting countries. Our results are consistent with the works of (Akpan, (2009); Foudeh, (2017); Jahangir and Dural, (2018); Dabachi et al., (2020)).

For importing countries, the results show that oil price has a negative and significant effect on economic growth at the 1% level, thus allowing us to validate our second hypothesis. In this regard, we can contend that an increase in the global prices of oil reduces the revenue of oil-

importing countries. In this regard, this loss in revenue depends on the extent of elasticity of the oil price as well as the long-run change in the oil price.

However, our results agree with some empirical studies that concluded that the volatility of oil prices negatively affects GDP growth, especially in the case of countries that import oil since the price of oil is among the most critical production factors (Arouri and Nguyen, (2011); Filis et al., (2011); Murshed and Tanha, (2020); Rahman and Majumder, (2020)).

The table of results indicates that economic factors such as the market index and the exchange rate have a positive and significant impact at the 1% and 5% level on economic growth of importing and exporting countries respectively. Actually, the favorable contribution of the market index to economic growth is supported by many reasons having an influence on financial markets' increasing importance in most countries of the globe, such as the expanded private sector's contribution to the economy, highly developed technological advancements, and the unprecedented velocity of access to financial information.

In addition to this, there have been advances in communication technology and the provision of new, efficient financial instruments and new legislation to facilitate free trade and the movement of capital. These all serve to emphasize the importance of stock markets, offering new sources for expansion. Our evidence concurs with Lebdaoui et al. (2021) and Nyanaro and Elly (2017), who had determined that the growth of financial markets creates economic growth. For the exchange rate, the evidence reveals that a rise in the exchange rate is good for economic growth, while the rise in the exchange rate leads to a fall in the economy, as per the structuralist. There are various empirical studies which have examined the relationship between the level of the exchange rate and economic growth (Setiawanta et al., (2020)). Most of such empirical research have found a strong causal relationship between the exchange rate and growth. This supports our findings.

Our evidence shows that inflation is negative and significant at the 5% level to economic growth in countries that export but negative but not significant to countries that import. Our evidence allows us to conclude that inflation is a signal to shatter economic growth. The high inflation rate will weaken the economy of a region, as Fitri, (2022), propounds. Due to the continuous rise in prices, the purchasing power of people decreases. This will force the company to decrease the level of production in such a scenario will force investors to harvest their investment, thereby decreasing economic growth. Similarly, Utama & Wardana (2018) also

elaborate that inflation is a condition resulting from a discrepancy in demand and supply of raw materials, i.e., demand outpacing supply, and the wider the difference between the two, the greater the danger to the well-being of an economy. This allows us to confirm our results.

The following table shows that political stability positively but insignificantly affects both exporting and importing nations. Similarly, our results show that the human development index positively but significantly affects economic growth at the 10% and 5% levels for exporting and importing nations respectively. The above indicates that the present research supports

previous studies as studied by Iskandar (2017), Nazamuddin (2013); Dewi and Sutrisna (2014) and Brata (2002) who claimed that the human development index which includes life expectancy, old school expectation, average years of schooling and per capita spending or one of them possesses a positive trend, will lead to economic growth.

6. Conclusion

The study provides a comprehensive empirical and theoretical examination of crude oil price volatility and economic growth interaction for a group of 19 G20 countries that both include oil-exporting and oil-importing nations over the period of 2004–2022. Using panel data econometric models like fixed effects and random effects, we identify the growth trend between oil importers and exporters in response to movements in crude oil prices. The findings reveal a high and statistically significant positive relationship between oil prices and economic growth for exporting countries, yet a high and statistically significant negative relationship for importers.

From a macroeconomic perspective, the findings reveal that higher oil prices act as a positive revenue shock to exporting nations, inducing higher government revenues, increased investment, and stronger aggregate demand, all of which contribute to shooting economic growth. Alternatively, in oil-importing countries, higher oil prices are observed to accompany higher-cost production, reduced household purchasing power, inflationary pressure, and a decrease in output ultimately contributing to weaker economic performance. Such asymmetric impacts identify the central role that energy dependence occupies in determining national economic trajectories.

The paper makes various contributions to the literature on the macroeconomic effects of oil shocks. First, it contributes to empirical research by presenting comparative panel-based results for the G20, which is one of the most economically and geopolitically significant sets of nations. Second, by incorporating a broad array of macroeconomic controls stretching from inflation and exchange rates to political stability, human development, and financial market variables it facilitates a more nuanced appreciation of how variations in oil prices interact with various facets of the economy.

Beyond its empirical contribution, the study has significant policy implications. To oil-exporting countries, the findings draw attention to the necessity of optimizing windfall oil revenues to achieve sustained economic growth through investment in human capital, diversification of the economy, and institution building. To oil-importing economies, the findings draw attention to the imperative of reducing dependence on foreign energy shocks at once through promoting energy efficiency, investment in renewable energy, and hedging mechanisms to cushion against price volatility in commodities.

However, the present study has its boundaries. It is focused narrowly on economic growth impacts, and therefore it leaves intact other relevant transmission channels of how oil prices may have an effect, for instance, on public health, environmental degradation, energy poverty, or geopolitical stability. A future research agenda needs to be multidisciplinary in scope, integrating economic, environmental, and social indicators in order to paint a more complete

image of the consequences of oil price volatility. In addition, the time horizon of future research can be lengthened in order to yield more detailed, high-frequency data to enable an analysis of short-term volatility alongside long-term trends. Also, the application of advanced econometric specifications such as time-varying parameter models, non-linear causality tests, or machine learning algorithms could even enhance predictive power and uncover higher-order dependencies. It would also be of interest to split the effect of changes in oil prices into supply-driven and demand-driven shocks to further understand the underlying transmission channels. In conclusion, this study reaffirms the significant role that energy prices, particularly crude oil, in determining the economic fortunes of exporting and importing countries alike. As the global economy is transitioning towards decarbonization and sustainability, the insights into macroeconomic implications of energy market volatility remain relevant and timely. The double imperative of energy security and economic growth requires flexible, forward-looking policies calibrated to the structural characteristics of the energy mix of each country.

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