International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2024, 14(4), 66-80.

An Applied Study of the Symmetric and Asymmetric Impact of Oil Prices and International Financial Markets on Economic Growth in Iraq

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Received: 09 February 2024 **Accepted:** 12 May 2024 **DOI:** https://doi.org/10.32479/ijeep.16123

ABSTRACT

Iraq, one of the main oil-exporting nations, is extremely susceptible to changes in the price of oil. This article attempts to investigate how the price of oil affects the way the Iraqi economy performs, as indicated by several factors (economic growth and international financial markets). We will apply econometric techniques in both linear and non-linear frameworks to accomplish this goal. To represent NARDL non-linearities in the relationship between the aforementioned economic variables, we will first look for linear cointegrating correlations and/or estimate ARDL models. If necessary, we will next use threshold cointegration. Thus, we demonstrate that independent of the regime we are in, the asymmetry associated with the shock's sign is confirmed from January 2006 to December 2021. Regarding the asymmetry associated with the shock's magnitude, it is only confirmed under the "below oil price threshold regime." In the "above oil price threshold regime," yields respond in a way that is proportionate to the shock's magnitude. Additionally, we demonstrate that the asymmetry associated with the shock's sign is confirmed during times of negative industrial output growth, while the influence of shocks looks symmetrical during times of positive industrial production variation.

Keywords: Oil Prices, Economic Growth, International Financial Markets, Autoregressive Distributed Lag, Nonlinear Autoregressive Distributed Lag, Iraq
Classification JEL: C32, E32, F42, F43

1. INTRODUCTION

Due to its crucial role in directing national savings into investment avenues that support the country's economy and raise member welfare rates, as well as serving as a reflection of the state's overall economic circumstances, the international stock market is a fundamental component of modern economic systems' financing systems. Because of the intimate connections between the economy and the stock market, stock market performance indicators are helpful tools for identifying trends in economic activity. Stock market stability is regarded as a gauge of the effectiveness of the state's general economic policies, including the accomplishment of the nation's economic development.

Many nations experienced economic stagflation throughout that decade as a result of the oil crises of 1973 and 1979 (Rafiq et al., 2016). Abrupt increases in oil prices negatively impacted the ability of the international economy to grow (Hamilton, 1983; Hamilton, 1996). International oil prices have been rising and fluctuating significantly since the start of the twenty-first century, which has had an impact on the macroeconomic growth of many industrialized and oil-exporting economies. Two spikes in oil prices occurred in the past 10 years: The first occurred in 2008 and was associated with the financial crisis, and the second spike started barely 3 years later, placing pressure on producers (Liu et al., 2020). In the global economic system, oil holds a significant and strategic position, particularly for the sustainable development of industry. As such, the trajectory of global oil prices has a significant impact on the economic prospects of individual countries (Gisser and Goodwin, 1986; Mork et al., 1994; Lardic and Mignon, 2006).

By 2020, oil will have contributed an additional 35% to global energy consumption, which currently stands at approximately 40%. As there are no viable alternatives for some demands, it is the most important energy source in the world and particularly important for transportation. Two-thirds of the oil reserves are found in the Middle East, and about one-third are found in the eleven OPEC countries. Iraq ranks as the second-largest country worldwide regarding oil reserves, comprising 10.6% of the total. However, its contribution to global oil production stands at <4%, with exports making up slightly over 5%. In contrast, Saudi Arabia holds a significant portion of the world's proven reserves, totaling 25%, and produces 12% of global oil output, contributing nearly 17% to global exports. In terms of import destinations, the United States and the European Union are key players, collectively accounting for 52.4% of global oil trade. On the other hand, the Middle East serves as the primary export hub, facilitating over 44% of global oil transportation.

But other nations—most notably, Russia and the littoral states around the Caspian Sea—are expected to become more significant players in the global oil and gas market. The military conflict in Iraq closely links the region's oil interests. Undoubtedly, the United States cannot overlook Russia's aspirations in this field, and the ongoing "arm wrestling" match between the two countries seems to have an impact on American tactics in Iraq. One can view the effects of the recent war in Iraq on the oil market in two ways: Either as an attempt by the United States to restore political stability in a major source of future oil supplies, or in the context of the rivalry and cooperation between Russia and the United States in a region that is crucial to both nations.

Because of the structural excess supply in the oil market, the war in Iraq has not resulted in a substantial and long-lasting increase in oil prices. Prices won't likely decrease either after the fighting ends and peace returns because the rest of OPEC will likely control Iraq's growing market share, and quota discipline may be beneficial. However, a worsening of the military situation would cause instability in the area and might jeopardize US efforts to ensure political stability in a region that is essential to OECD countries' oil supplies through a "domino effect."

Others have argued that the Iraqi state exhibited the traits of a failed state before the outbreak. Undoubtedly, Iraq is facing significant challenges for which it is ill-prepared. A September 2020 World Bank report asserts that Iraq, nearly two decades after the Iraq War, is on the brink of disaster due to escalating political instability and division. The vulnerability of Iraq's healthcare system to the COVID-19 outbreak highlights the country's extreme vulnerability. The COVID-19 pandemic has also resulted in a rise in unemployment and price increases, which have increased the country's poverty rate. The COVID-19 pandemic disproportionately impacted three vulnerable groups: women, children, and those forced to evacuate.

In light of our research, it is reasonable to ask ourselves the following question after all of this analysis: What effects is the progressive increase in the price of oil on global financial markets having on Iraq's economic development?

Therefore, the purpose of this study is to examine how the widespread involvement of financial investors in the oil derivatives market, within the framework of the financialization of economies and markets, may account for the spread of volatility shocks between the financial and oil markets. Thus, the purpose of this essay is to examine the nature of the relationship that exists between the world market stock, the price of oil, and the growth of the Iraqi economy. Our goals are to: (1) identify the various relationships between the oil price, the stock market index, and economic growth; and (2) use a linear model (ARDL) and a non-linear model (NARDL) to study the symmetrical and asymmetrical effects of the oil price and the stock market index on Iraqi economic growth to propose an answer to this question.

The remainder of the paper is organized as follows to fulfil our article's objectives: The theoretical and empirical literature, or background, on the relationship between oil prices, the global market, and economic growth, is reviewed in Section 2. Section 3 presents the data and preliminary tests on the used variables, along with the methodology. We examine the study's findings in Section 4. As previously said, we conclude this essay in Section 5 with the key findings and suggestions for economic policy.

2. LITERATURE REVIEW

A sudden shift in an external factor that impacts endogenous economic variables is known as an external shock. Businesses that rely on international markets and resources are consequently more vulnerable to outside shocks than other types of economies. It is a prevalent practice among policymakers to impute external shocks to the economic fluctuations of emerging nations. Even though the significance of external shocks is understandable given several prominent structural features, they do not entirely cause volatility.

2.1. Theoretical Framework

The question of whether stabilization policies are required to increase the stability of macroeconomic performance is one that economists disagree on. Non-monetarists argue that an economy experiences instability requiring proactive stabilization measures, while monetarists maintain that an economy is inherently stable and thus does not require interventionist stabilization policies (Modigliani, 1988).

According to the neoclassical growth model, nations that have similar population growth, depreciation rates, savings rates, and production functions will typically develop at the same steady-state rate over time, resulting in long-term convergence (Solow, 1956). The observation that developing nations with lower starting incomes grow faster than developed nations supports this claim. As production functions differ throughout nations, convergence theory does not always hold in practice. The factors that commonly influence variations in production functions encompass technological progress, human capital development, and the quality of public and social infrastructure, which encompasses institutions and the rule of law.

Nonetheless, endogenous growth theory contends that, rather than being the product of outside influences, economic growth is an inherent byproduct of an economic system (Romer, 1994). As a result, numerous scholars contend that strengthening political and economic institutions is essential to enhancing developing nations' macroeconomic performance (Burda and Wyplosz, 2009; Hall and Jones, 1999; North and Wallis, 1994; Tornell and Velasco, 1992). Franko (2007) supports this claim, arguing that institutional quality is the primary driver of growth because it stimulates investment in technology and, consequently, advocates for its advancement in emerging nations.

Neoclassical and Keynesian economic theories have not satisfactorily explained the inadequate performance of macroeconomic variables in developing nations. These emerging nations have implemented massive changes, but they have not taken the required actions to synchronize the market economy for the best results.

In general, stabilizing external shocks in an economy makes sense from an economic standpoint, but it does not ensure a large decrease in macroeconomic volatility. Because emerging nations depend on developed nations, it is critical to evaluate external shocks. On how these developing countries' economies are affected by external shocks, there is still disagreement in the research.

2.2. Empirical Framework

Over the past 20 years, a substantial body of empirical research has emerged that examines the relationships between global oil prices and stock markets. Numerous empirical studies (Jones and Kaul, 1996; Faff et al., 2008; Miller and Ratti, 2009; Chen and Borges, 2009) show a negative correlation between oil prices and stock market returns. However, other studies have shown that the nation's net position on the global oil market has a significant impact on how the stock market reacts to oil shocks. Indeed, according to these studies, nations that export oil get positive effects from the relationship between oil and stock market returns, whereas those that import oil see negative effects (Bashar et al., 2006; Mohanty et al., 2011; Wang et al., 2013).

Because of its limited correlation with conventional asset classes and its role in hedging against inflationary pressures, various scholars have shown that many financial institutions and investors perceive the oil market as a lucrative substitute for stock market assets (Kat and Oomen, 2007; Silvennoinen and Thorp, 2013). However, some academics who contest this notion have illustrated that the increasing financialization of the oil market, driven by the rising participation of speculative hedge funds, has led to a growing correlation between the oil and stock markets (Büyüksahin et al., 2009; Silvennoinen and Thorp, 2013; Tang and Xiong, 2012; Buyuksahin and Robe, 2011; Hamilton and Wu, 2012; Sadorsky, 2014).

The literature has not said much about the connection between the volatility of the stock and oil markets, despite the growing interest in the relationship between the two. Ross (1989) demonstrated that market volatilities might affect one another and that asset price volatility carried significant information. Bloom (2009) and Baum et al. (2010) argue that uncertainty in the oil market delays investment decisions, potentially exacerbating stock market volatility.

A substantial body of empirical research (Jones and Kaul, 1996; Ciner, 2001; Ciner et al., 2013; Papapetrou, 2001; Driesprong et al., 2008; Chen and Borges, 2009; Miller and Ratti, 2009) has confirmed these negative effects of fluctuations in oil prices on stock markets. Nonetheless, some scholars back up the claim that this effect only applies to nations that import oil; in contrast, stock markets in nations that export oil benefit from rising oil prices (Sadorsky, 2001; El-Sharif et al., 2005; Bashar et al., 2006; Boyer and Filion, 2007; O'Neill et al., 2008; Mohanty et al., 2011; Mohanty et al., 2011; Arouri and Rault, 2012; Filis et al., 2013; Wang et al., 2013; Elgayar et al., 2024; Mpofu, 2024).

We must stress, though, that depending on the shocks' nature, fluctuations in oil prices may have varying consequences for stock markets. According to Hamilton (2009), developments on the supply and demand sides can both affect oil prices. He clarifies that OPEC decisions to reduce or increase oil production, or disruptions in the oil supply due to inclement weather, cause supply-side oil shocks, while changes in global demand (such as China's industrial growth and worldwide recessions) produce demand-side oil shocks. Based on available data, demand-side shocks appear to have a more favorable impact on economic activity than supply-side shocks. Furthermore, by separating the precautionary demand shock—which reflects worry about future oil availability—from the demand shock, which is comparable to Hamilton's demand shock, Kilian (2009) discovered a third kind of oil shock. Events like terrorist attacks or wars in the Middle East might set off this kind of shock. Ultimately, it is evident that significant geopolitical and economic developments are closely associated with each of the three oil shocks.

As we previously discussed, the impact of swings in oil prices might vary based on a nation's import or export status. An increase in oil prices causes production costs to rise, which in turn raises the rate of inflation for nations that import oil (the opposite impact is observed in the case of a fall in oil prices). Increased inflation affects the real economy and financial markets, which in turn affects economic growth.

Kaplan (2015) investigated the linear cointegration and structural breakdowns between the price of oil and the debris. He discovered that there is a linearly cointegrating link between the variables, despite the structural breakdowns. Take note that the time-invariant cointegrating vector will no longer hold if a break alters the long-term link between the 2-time series of oil and rubble. This fact motivates us to use non-linear models, like threshold models, to review Kaplan's work.

A 2016 study by Polbin and Skrobotov examined structural flaws in the Russian economy. The empirical findings demonstrate that the long-term growth rate of the Russian economy has two structural breakdowns, from 1998-Q3 to 2007-Q3. This finding suggests that fundamental issues in the Russian economy predate the 2008-2009 financial crisis and that an abrupt and remarkable spike in oil prices starting in 2003 caused the rapid economic expansion of the 2000s.

The research by Charfeddine et al. (2018) adds to the ongoing discussion over how fluctuations in oil prices affect the expansion of the US GDP. The relationship between oil prices and real GDP is shown to be unstable due to the dissipative effect of the proposed oil price measures, according to the researchers. They reexamine the matter and demonstrate that drops in oil prices have a more pronounced impact on GDP growth.

Pakistan's trade balance and economic growth were studied by Chaudhry et al. (2021) about changes in oil prices. The model employed by the authors for the years 1970-2018 was a linear autoregressive distributed lag (ARDL). The outcomes demonstrated that while other control variables like governmental spending, financial development, and gross capital creation were positively impacted, oil prices had a detrimental impact on Pakistan's economic growth.

The literature provides an examination of how oil prices affect several macroeconomic and financial variables. We discover that growing oil prices benefit exporting nations while having a negative effect on importing nations. Production and transportation expenses go up when the price of oil rises in importing nations, but exporting nations' wealth levels grow as a result of foreign exchange inflows.

Our investigation will center on the theory that the stock market affects Iraq's oil prices. Relationships can have a positive or negative quality. When there is a positive correlation, there is a complementary relationship since the two economic variables vary in the same direction. When there is a negative relationship between the two economic variables, there is a substitution link since the two variables vary oppositely.

3. EMPIRICAL METHODOLOGY

3.1. Presentation of the Model and Variables

The idea that the price of oil alone affects economic growth is inapplicable to our study since it obscures the true impact. We have expanded the model to incorporate other variables to better align it with theory and the actual data for the period spanning from January 2006 to December 2021. Additional variables have an impact on growth.

Concerning Olamide et al. (2022) and Adigun and Ogunleye (2021), the data availability and the features of the Iraqi economy lead to the following logarithmic formulation for the growth model:

$$lnGDPC_t = \beta_0 + \beta_1\, lnOP_t + \beta_2\, lnSMI_t + \varepsilon_t \qquad (1)$$

By the same token, economic growth (GDPC) (an endogenous variable) will be close to the price of oil (OP) and the stock of international market indices (SMI). "ε_t" is the assumption error term that satisfies the Gauss-Markov hypotheses. We summarize all the variables in Table 1.

3.2. ARDL Model

The most popular technique for assessing variables in panel data environmental analysis is ARDL modeling. The order in which variables are integrated does not impact it. The Johansen (1991) method, employing a co-integration model on time series data, deviates from the conventional mean. It mandates the inclusion of every variable in the first order. On one side, focusing on the rationale of a traditional association evaluating both short- and long-term dynamics concurrently the ARDL model presents a precise method for addressing long-term relationships. Additionally, it allows us to work with variables other than just I (1), such as I (0) and I (1), which may have different orders of integration. This need is not met by the ARDL model. According to Pesaran et al. (1999), the ARDL approach determines that all of the variables are endogenous. As a result, the general formula for these models (Eq. 1) is:

$$y_t = \alpha_0 + \alpha_1 t + \sum\nolimits_{j=1}^{p} \lambda_j y_{t-j} + \sum\nolimits_{m=0}^{q} \delta_k{}' x_{t-m} + u_t \qquad (2)$$

Here, x_t denotes the set of regressors, presumed to have no correlation with the residual term x_t. A comparable specification is frequently encountered:

$$\Delta y_t = \alpha_0 + \alpha_1 t + \varphi y_{t-1} + \beta' x_t + \sum\nolimits_{j=1}^{p-1} \lambda_j{}^{*} \Delta y_{t-j} +$$
$$\sum\nolimits_{m=0}^{q-1} \delta_m{}^{*'} x_{t-m} + \varphi_t \qquad (3)$$

By isolating the equation for y_t from the equations (Eq. 2 and 3) of the remaining elements in x_t and incorporating the respective matrix divisions, the following equation can be formulated as an Error Correction Model (ECM) response model:

$$\Delta y_t = \alpha_0 + \alpha_1 t + \pi_{yy} y_{t-1} + \pi_{yx} x_{t-1} + \sum\nolimits_{j=1}^{p-1} \Gamma_j \Delta Z_{t-j} + \varepsilon_{y_t} \qquad (4)$$

Where $\Pi = \begin{pmatrix} |\pi_{yy} & \pi_{yx} \\ |\pi_{xy} & \Pi_{xx} \end{pmatrix}$ the variance-covariance matrix of $\varepsilon_t = \left(\varepsilon_{y_t}\ \varepsilon_{x_t}{}'\right)$ and $Z_t = \left(y_t\ x_t{}'\right)$.

Table 1: Variable definitions and data sources

Variables	Symbol	Definition	Source
Economic growth	GDPC	GDP per capita at constant US dollar prices.	WDI
Oil prices	OP	The oil price represents the fluctuation in the cost of oil, serving as the fundamental metric within the oil market.	https://oilprice.com/
Stock of international market indices	SMI	A capitalization-weighted index is calculated based on the most liquid share prices of the largest Iraqi issuers listed on the stock exchange.	https://cbiraq.org/

If $\varphi = \pi_{yy}$ and $\beta = \pi_{yx.x}$, after redefining the polynomial delay in Z_t to obtain the contemporary value of x in the equal part, from which the ARDL approach's Pesaran et al. (2001) equation (Eq. 4) is derived:

$$\Delta y_t = \alpha_0 + \alpha_1 t + \pi_{yy} y_{t-1} + \pi_{yx.x} x_{t-1} + \sum_{j=1}^{p-1} \tilde{\psi}_j' \Delta Z_{t-j}$$
$$+\omega' \Delta x_t + \varepsilon_{y_t} \tag{5}$$

Where $\pi_{yx.x} = \pi_{yx} - \omega' \Pi_{xx}$ (matrix 1xk)., $\omega = \Omega_{xx}{}^{-1} \omega_{xy}$, $\Omega = \begin{pmatrix} \left| \omega_{yy} \; \omega_{yx} \right. \\ \left| \omega_{xy} \; \Omega_{xx} \right. \end{pmatrix}$ the variance-covariance matrix of ε_t and $u_t = \varepsilon_{y_t} - \omega_{yx} \Omega_{xx}{}^{-1} \varepsilon_{x_t}$. It is noteworthy to mention that the ARDL model has been employed to verify that all components of the supply-demand relationship considered from Z_t adhere to the I (1) criteria as required by VECM specifications.

More specifically, we put each period t's background Eq. 5 as follows:

$$\Delta y_t = \alpha_0 + \alpha_1 t + \varphi y_{t-1} + \beta' x_t + \sum_{j=1}^{p-1} \lambda_{ij}{}^{*} \Delta y_{t-j} +$$
$$\sum_{i=0}^{q-1} \delta_i^{*'} x_{t-i} + u_t \tag{6}$$

Pesaran et al. (1999) propose that u_t residuals are assumed to be independent across individuals and x_t regressions, and for each individual *i*. So, the long-term relationship is given by (Eq. 7):

$$y_t = \theta_0 + \theta_1 t - \frac{\beta_i'}{\varphi_i} x_t + v_t \tag{7}$$

First, we go over the ARDL cointegration method in brief and outline the two procedures that must be followed for the cointegration process to be successful using this method. Currently, we must determine if these variables have a real long-term link. Following that, the null hypothesis posits that there is no integration or long-run relationship among the variables H_0: $\varphi_i = \beta_i = 0$ is tested against the alternative hypothesis H_1: $\varphi_i \neq 0$; $\beta_i \neq 0$.

Fisher's "F" statistic serves as the foundation for the "*Bounds test*" process. The process employs a non-standard distribution for the statistic since the system variables are I (0) or I (1). As a result, at a certain significance level, Pesaran et al. (2001) computed two sets of critical values. Whereas the second set assumes that all variables are I (1), the first set assumes that all variables are I (0). H_0 is rejected when the "F" statistic's computed value exceeds the crucial value.

If a long-term relationship is established by the end of the second step, the initial short-term equation can be used to get the long-term error correction model (ECM) estimations of the ARDL model. The first step in estimating the ARDL model is figuring out how much delay needs to be added. The use of the Schwartz criteria (SBC) and Akaike information criteria (AIC) is common. The following (Eq. 8) is the general expression formula for the error correction model (ECM) of the first short-term equation:

$$\Delta y_t = \alpha_0 + \alpha_1 t + \delta EC_{t-1} + \sum_{i=1}^{p} \lambda_i \Delta y_{t-i} +$$
$$\sum_{k=1}^{K} \sum_{j=0}^{q_k} \delta_j \, \Delta x_{ki,t-j} + \zeta_t \tag{8}$$

Here, δ represents the parameter denoting the speed of adjustment, and EC refers to the residuals derived from estimating the cointegration model of the initial short-run equation. As we utilize annual estimates, we conduct tests incorporating up to "p" lags on the first-order difference of each variable. We then employ the F-statistic to assess the collective significance of variable lags in the initial short-run equation.

The long-term condition model can be derived from the simplified form of the initial short-term solution, expressed as follows (Eq. 9):

$$y_t = \theta_0 + \sum_{k=1}^{K} \theta_k x_{kt} + \mu_t \tag{9}$$

With $\theta_0 = -\alpha_0/\delta_0$ and $\theta_k = -\beta_k/\delta_0$.

Two procedures are required to implement the Pesaran et al. (2001) cointegration test: (i) use the AIC and SIC criteria to determine the optimal delay; (ii) validate the subsequent hypotheses (Eq. 10) using Fisher's test of relationship (Eq. 6):

$$\begin{cases} \left| H_0 : \varphi = \beta' = 0 : Absenceofacointegrationrelationship \right. \\ \left| H_1 : \varphi \neq 0; \beta' \neq 0 : Existenceofacointegrationrelationship \right. \end{cases} \tag{10}$$

The information criterion can also be used to determine the ideal delay numbers, p* and q*, much like in the dynamic approach. A delay is considered optimal when the model under evaluation suggests the least amount for any of the previously mentioned factors. The Akaike (AIC) and Schwarz (SIC) information criteria are the most widely utilized ones. We assess their formulations in the following manner (Eq. 11):

$$AIC(p) = log\left|\hat{\Sigma}\right| + \frac{2}{T} n^2 p \text{ and } SIC(p) = log\left|\hat{\Sigma}\right| + \frac{logT}{T} n^2 p \tag{11}$$

With $\hat{\Sigma}$ representing the variance-covariance matrix of the estimated residuals, T denoting the number of observations, p indicating the lag of the estimated model, and n representing the number of regressors.

Post-estimation statistical tests have become nearly indispensable in scientific research. Among these, the most familiar are the student's t-test and the X^2 test. A statistical hypothesis test serves as a mechanism for making decisions between two hypotheses. It facilitates an inference: Based on the outcome of an experiment conducted on a finite sample of observations (the source population), we aim to infer a truth applicable to our target population—the population to which we intend to apply the findings of our study.

To ensure methodological rigor before commencing model estimation, we will conduct a series of tests. These include the

Ljung-Box serial correlation test of order 1 (Ljung and Box, 1979, LB) and Breusch-Godfrey test (Breusch and Godfrey, 1978) for serial correlation, the ARCH test for heteroskedasticity of order 1 (McLeod and Li, 1983), the Jarque-Bera test (Jarque and Bera, 1987, JB) for assessing the normality of residuals, the Durbin-Watson test (Durbin and Watson, 1950) for detecting autocorrelation, and the Ramsey RESET test (Ramsey, 1969) for evaluating the functional form of the model.

3.3. NARDL Model

Shin et al. (2014) propose the nonlinear autoregressive distributed lag (NARDL) model to examine the strength of inflation and unemployment transmission in the short and long term. By modeling both cointegration dynamics and asymmetries at the same time, this method has big advantages over other modeling approaches like the error correction model (ECM), threshold ECM, Markov switching ECM, and smooth transition ECM. In contrast to the ECM model, which imposes restrictions in this regard, the NARDL model offers greater flexibility and simplicity in estimation. It relaxes the assumption that time series must integrate in the same order, allowing for more accurate differentiation between no cointegration, linear cointegration, and non-linear cointegration (Katrakilidis and Trachanas, 2012). Additionally, it performs better for cointegration testing in small samples (Romilly et al., 2001). Granger (1981), Engle and Granger (1987), and Johansen (1988) widely acknowledge that the linear ECM can capture short-term deviations of first-order integrated variables from their long-term joint equilibrium. The linear ECM is typically represented as follows:

$$\Delta y_t = \mu + \rho_y y_{t-1} + \rho_x x_{t-1} + \sum_{i=1}^{p=1} \alpha_i \Delta y_{i-1} + \sum_{i=0}^{q=1} \beta_i \Delta x_{t-1} + \varepsilon_t \qquad (12)$$

Where y_t represents the endogenous variable and x_t denotes the explanatory variable. The symbol Δ denotes the first difference. This model (Eq. 12) facilitates the analysis of both short- and long-term relationships between variables, particularly when these relationships are linear and symmetrical. However, its specification tends to be poor in cases of non-linearity and/or asymmetry. In this regard, Granger and Yoon (2002) introduce the concept of hidden cointegration, where 2 time series may not be cointegrated in the classical sense, but their positive and negative sums exhibit cointegration. The NARDL model proposed by Shin et al. (2014) enables the simultaneous examination of the short- and long-term response of inflation to unemployment and the detection of hidden cointegration. This methodology involves decomposing the exogenous variable x into its positive and negative partial sums, denoted as x_t^+ and x_t^-, respectively, representing increases and decreases, as follows:

$$x_t^+ = \sum_{j=1}^{t} \Delta x_j^+ = \sum_{j=1}^{t} \max(\Delta x_j, 0) \quad \text{and}$$

$$x_t^- = \sum_{j=1}^{t} \Delta x_j^- = \sum_{j=1}^{t} \min(\Delta x_j, 0) \qquad (13)$$

Considering both short- and long-term asymmetries within the framework of the linear ECM model as outlined in Eq. 12, Shin et al. (2014) expand this model into the comprehensive NARDL model, articulated as follows:

$$\Delta y_t = \mu + \rho y_{t-1} + \theta^+ x_{t-1}^+ + \theta^- x_{t-1}^- + \sum_{i=1}^{p-1} \alpha_i y_{t-i} + \sum_{i=0}^{q-1} (\omega_i^+ \Delta x_{t-1}^+ + \omega_i^- x_{t-1}^-) + \varepsilon_t \qquad (14)$$

In Eq. 13, the superscripts (+) and (−) signify the decomposition into positive and negative partial sums, as previously defined. The symbols p and q represent the respective shift orders of the dependent variable and the exogenous variable in the distributed-shift component. In particular, long-run symmetry can be tested using a Wald test for the dependent variable using a Wald test of the null hypothesis $\theta^+ = \theta^-$. We can then calculate the positive and negative long-run coefficients as follows: $L_{x^+} = -\theta^+ / \rho_x$ and $L_{x^-} = -\theta^- / \rho_x$. The short-run adjustments to positive and negative shocks affecting inflation and unemployment are captured by the parameters ω_t^+ and ω_t^- respectively. Short-term symmetry can also be tested using a standard Wald test of the null hypothesis such that $\omega_t^+ = \omega_t^- \text{for} i = 0, \ldots, q-1$. Eq. 14 simplifies to the conventional (linear) ECM when both null hypotheses of short-term and long-term symmetry remain unchallenged. If either the null hypothesis of long-term symmetry or short-term symmetry cannot be rejected, it leads to NARDL with short-term asymmetry (Eq. 15) and with long-term asymmetry (Eq. 16), respectively:

$$\Delta y_t = \mu + \rho y_{t-1} + \rho_t x_{t-1} + \sum_{i=1}^{p-1} \alpha_i y_{t-i} + \sum_{i=0}^{q-1} (\omega_i^+ \Delta x_{t-1}^+ + \omega_i^- x_{t-1}^-) + \varepsilon_t \qquad (15)$$

$$\Delta y_t = \mu + \rho y_{t-1} + \rho_y^+ x_{t-1}^+ + \rho_y^- x_{t-1}^- + \sum_{i=1}^{p-1} \alpha_i y_{t-i} + \sum_{i=0}^{q-1} \omega_t \Delta x_{t-1} + \varepsilon_t \qquad (16)$$

Asymmetric responses to positive and negative shocks of one unit of x are taken into account in the short-term, in the long-term, or both. The asymmetric responses to positive and negative (i.e., increases or decreases) in y_t are, respectively x_t^+ and x_t^- :

$$m_h^+ = \sum_{j=0}^{h} \frac{\partial y_{t+j}}{\partial x_t^+} \quad \text{and} \quad m_h^- = \sum_{j=0}^{h} \frac{\partial y_{t+j}}{\partial x_t^-} \quad \text{with } h = 0, 1, 2, \ldots \qquad (17)$$

Where $h \to \infty, m_h^+ \to Lx^+$ and $m_h^- \to Lx^-$, with Lx^+ and Lx^- are the long-run asymmetric positive and negative coefficients, respectively. The nonlinear dynamic adjustments of the two variables from their initial equilibrium to their new equilibrium state over time, subsequent to a shock affecting the cointegrating system, can be discerned through the predicted multipliers. Overall, the NARDL model uses a single common cointegrating vector to account for long-term dynamics and a distribution to account for short-term dynamics. Asymmetry is acceptable in both sections. Furthermore, by employing a boundary-testing process to check for the existence of the equilibrium vector, the NARDL model allows for combinations of I (1) and I (0) variables. Consequently, the conventional requirement in cointegration models, where all variables must be I (1), does not apply in this context.

4. EMPIRICAL RESULTS

Given the several key indicators seen in the region, our goal is to determine if, between January 2006 and December 2021, the increase in oil prices will have a major effect on Iraq's economic growth. We must treat the price of oil, economic growth, and the stock of market indices as interactive variables as we concentrate on macroeconomic relationships. Furthermore, it is critical to employ a framework that permits a more thorough dynamic analysis, considering the forward-looking nature of economic decisions. The goal of this section is to examine every variable—that is, T = 192 observations—that relates the price of oil to economic growth between January 2006 and December 2021. We will first display the model and all its component variables, along with the specifics of its graphical, descriptive, and integrated analyses.

4.1. Graphical and Descriptive Analysis of Variables in the Sample

Table 2, the first panel, presents a descriptive statistical analysis of the various model variables. Trend shifts and histograms for every variable have been included to further enhance our analysis. To verify the results of the autocorrelation and normality tests, we have also included the statistics and probability from Jarque and Berra (1987) and Ljung and Box (1978).

First, we start with economic growth (lnGDPC) for the descriptive analysis. According to Figure 1, this variable is slowly heterogeneous (CV = 0.012) with a worldwide mean of 8.388 and a standard deviation of 0.105. With higher concentrations close to 8.409, the set of 192 observations spans from 8.187 to 8.556. The lnGDPC sample distribution is leptokurtic (kurtosis = 1.997) and exhibits an asymmetric extension to the left (skewness = −0.362). We reject the null hypothesis of normalcy based on the likelihood of the Jarque-Bera normalcy test. Regarding the Ljung-Box probability, we acknowledge that this series has a significant level of autocorrelation.

The market index stock variable (lnSMI) is characterized by an upward and downward trend throughout the study period, as seen in Figure 2. This variable is generally less diverse (CV = 0.214), with an overall mean of 5.228 and a standard deviation of 1.122. Their values have a high concentration of about 4.885 and range from 3.217 to 6.908. The distribution is leptokurtic (kurtosis = 1.773) and strongly skewed to the left (skewness = −0.269). Using the likelihood of the Jarque-Bera normality test, we reject the null hypothesis of normality, and using the probability of the Ljung-Box probability, we acknowledge the existence of strong autocorrelation.

Table 2: Overall description of variables

Designation	lnGDPC	lnSMI	lnOP
Mean	8.388	5.228	4.211
Standard deviation	0.105	1.122	0.335
Minimum	8.187	3.217	2.929
p25	8.305	4.543	3.971
p50	8.409	4.885	4.227
p75	8.474	6.329	4.511
Maximum	8.556	6.908	4.942
Skewness statistic	−0.362	−0.269	−0.564
Kurtosis statistic	1.997	1.773	3.689
Coefficient of variation	0.012	0.214	0.079
Jarque-Bera (JB) statistic	12.24	14.37	14.01
JB P value	0.002	0.001	0.000
Ljung-Box (LB) statistic	378.07	362.86	310.06
LB P value	0.000	0.000	0.000
Correlation (probability)	***lnGDPC***	***lnSMI***	***lnOP***
lnGDPC	1.000		
lnSMI	0.743 (0.000)	1.000	
lnOP	−0.197 (0.006)	−0.564 (0.000)	1.000

Figure 3 illustrates how the oscillatory evolution throughout the study period determines the last variable, the oil price (lnOP). This variable is strongly homogenous (CV = 0.079), with a global mean of 4.211 and a weak standard deviation of 0.335. Their readings are all in the range of 2.929-4.949, with a high concentration of approximately 4.227. The lnOP sample distribution has a significant peak state (kurtosis = 3.689) and extends asymmetrically to the left (skewness = −0.564). Using the likelihood of the Jarque-Bera normality test, we reject the null hypothesis of normality, and using the probability of the Ljung-Box probability, we acknowledge the existence of strong autocorrelation.

We can discuss the numerous correlations in more detail below, but we cannot consider the test of simple correlation coefficients for the second panel of Table 2 as definitive for the study of multicollinearity. Economic growth (lnGDPC) and the stock of market indices (lnSMI) have a positive and significant link, according to the basic correlation coefficients presented in this table. Nonetheless, there is a considerable negative correlation (lnGDPC) between the price of oil (lnOP) and economic growth.

4.2. Breaking Unit Root Tests

We adjust for the existence of the unit root in the chosen variables to establish the sequences' order and for purely empirical logic. The econometric model must be satisfied, and this procedure is crucial. Therefore, a variety of stationarity tests are employed to explain the series' stationarity; however, certain traditional tests, such as the Dickey and Fuller (1981) or Phillips and Perron (1988) tests, do not incorporate structural changes. In contrast, tests like those of Zivot and Andrew (1992) and Perron (1997), which consider the null hypothesis of series unit roots in the presence of structural breaks, hold particular significance for the systematic approach to unit root testing in the presence of shocks.

The Zivot and Andrew (1992) test findings for the various transformed series of our two models in level and first difference are shown in this portion of Table 3. The bulk of variables do not exhibit a fixed level, as evidenced by the notable deviations observed in 2014, 2015, and 2019.

For instance, the variable lnGDPC is shown to be non-stationary in level, with large breaks present for the three models A, B, and C, per Zivot and Andrew (1992). For Models A, B, and C, the break is important in September 2018, November 2014, and May 2015, respectively. They are all stationary by looking at the stationarity

Figure 1: Trend evolution and histogram of GDPC in logarithm

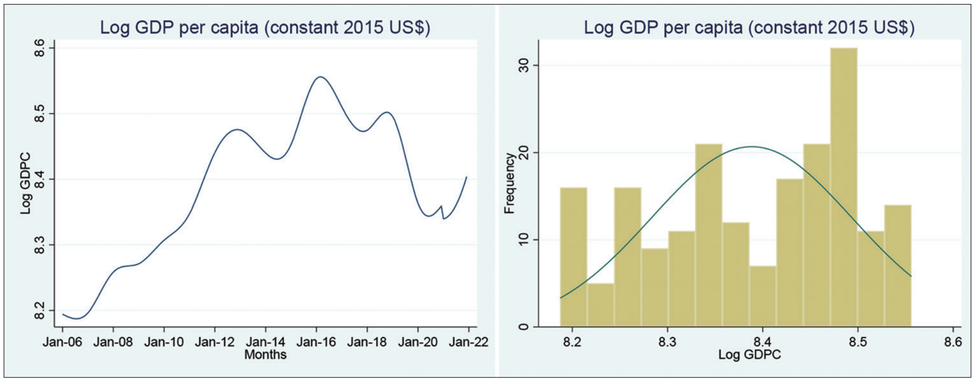


Figure 2: Trend evolution and histogram of stock of market indices in logarithm

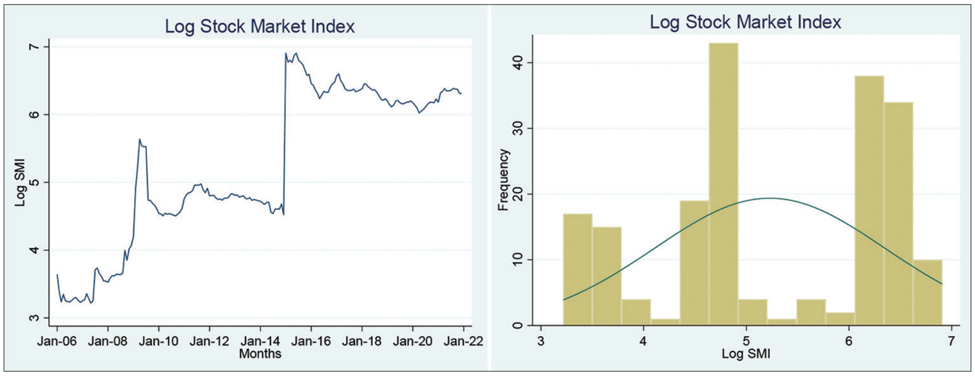
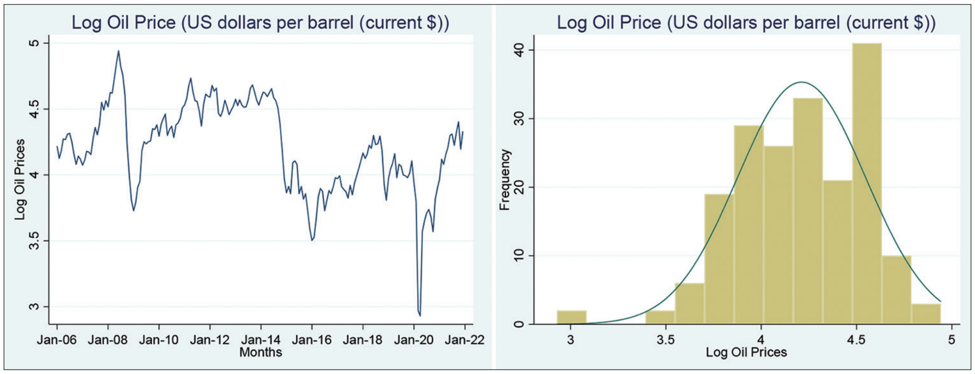


Figure 3: Trend evolution and histogram of OP in logarithm



of the same series in the first difference. Thus, they are integrated into order 1 (I[1]), as we can see.

Perron explained in 1997 that the variable must be one unit without altering the cut-off point at 0. With a break added from "endogenous" to an omitted date, the alternative theory nevertheless concurs with the stability of the value. According to Perron, there is no change in the impact of unit radicals on the theoretical H0 level. However, according to the first hypothesis, the series is stationary, and for the unidentified date, the influence is increased endogenously.

Table 4 demonstrates the existence of substantial breaks and the non-stationarity of all the series examined in the Perron and ADF models at the 5% level. The findings demonstrate that all three chains were non-stationary, with fractures connected to different shocks, the consequences of which were evident in the financial crisis of 2007 and the war in 1991. But as the first difference shows, they are all stationary, as demonstrated by the second panel of the top panel of the unit. Therefore, they can be regarded as integrated of order 1 (I[1]).

We detected the number of breaks associated with different shocks using the Ditzen et al. (2021) test. Indeed, regarding Table 5, the majority of variables admit the presence of five significant break dates in 2009, 2011, 2013, 2017, and 2019.

4.3. Cointegration Analysis with Breaks and Independence Test

Since every variable has been integrated into order 1, we will run a cointegration test to determine whether these variables have a long-term relationship. For each variable in our model, the results displayed in Table 6 demonstrate that at least one long-term cointegration relationship exists in the presence of a significant structural break, as indicated by the critical values of Gregory and Hansen (1996) being lower than the calculated statistics results of the 5% critical threshold.

Table 3: Unit root test by Zivot and Andrew (1992)

Variables		lnGDPC	lnSMI	lnOP
Model	**Designation**		**In level**	
A	Break date	2018 m^{9}	2015 m^{1}	2014 m^{10}
	t-statistic	−2.687	−3.326	−5.197
B	Break date	2015 m^{5}	2016 m^{11}	2011 m^{2}
	t-statistic	−2.456	−3.390	−3.675
C	Break date	2014 m^{11}	2015 m^{1}	2014 m^{10}
	t-statistic	−2.458	−3.320	−5.047
Decision		**Non-stationary**	**Non-stationary**	**Non-stationary**
Model	**Designation**		**In first difference**	
A	Break date	2015 m^{12}	2015 m^{7}	2016 m^{2}
	t-statistic	−5.658**	−14.481**	−7.882*
B	Break date	2019 m^{7}	2016 m^{11}	2019 m7
	t-statistic	−5.889	−5.390	−7.843
C	Break date	2019 m^{1}	2009 m^{5}	2018 m^{10}
	t-statistic	−5.733	−14.860	−7.931
Decision		Stationary	Stationary	Stationary

The critical values at 1% and 5%, respectively, for model A are (−5.34) and (−4.80), for model B (−4.93) and (−4.42) and for model C (−5.57) and (−5.08)

Table 4: Perron (1997) unit root test

Variable		lnGDPC	lnSMI	lnOP
Model	**Designation**		**In level**	
ADF	MacKinnonZ (T)	−2.817*	−1.473	−2.510
PP	MacKinnonZ (T)	−1.905	−1.506	−2.776*
Decision		**Non-stationary**	**Non-stationary**	**Non-stationary**
Model	**Designation**		**In first difference**	
ADF	MacKinnonZ (T)	−2.925**	−14.310***	−11.206***
PP	MacKinnonZ (T)	−15.476***	−14.297***	−11.053***
Decision		Stationary	Stationary	Stationary

*, **, and *** represent the significance at 10%, 5% and 1%, respectively

Table 5: Unit root test with breakdown by Ditzen et al. (2021)

Designation	Test statistic	Break date
F (1/0)	51.93	2009 m^{1}
F (2/1)	169.18	2011 m^{5}
F (3/2)	22.31	2013 m^{9}
F (4/3)	26.29	2017 m^{3}
F (5/4)	29.48	2019 m^{7}

More precisely, regardless of the model, all t-statistic ADF* values are well above the different critical levels at the model level. The stated break years are excessively crucial, revealing information about the crises that occurred in 2011, 2018, and 2019.

The Brock-Dechert-Scheinkman (BDS) test can identify non-linear dependence in time series. Even though it was not intended to be a leading signal, it can assist in preventing incorrect, crucial transition identification because of model misspecification. Rejecting the i.i.d. null hypothesis is likely to result in residual structure in the time series, potentially due to poor model fitting, hidden non-stationarity, or hidden non-linearity. Table 7 includes BDS statistics for each variable in the model. It turns out that all of the series (with standard errors of p = 1 or p = 1.5 and multiple inclusion dimensions of m = 2., 5) strongly suggest that the series is not normal or linear, and they all reject the null hypothesis at a significance level of 1%.

4.4. Symmetrical and Asymmetrical Estimation of the effect of Oil Prices and the Financial Stock Market on Economic Growth

Between 2006 and 2021, there is a mixed association between these factors, with some periods showing a negative relationship and others showing a positive relationship. This implies that there is no stability and that a mixed relationship is likely, which supports the idea that a non-linear relationship would endure. However, let's begin by encouraging the development of a linear relationship, as explained below.

Table 8 displays the short-term estimates, the ECM model's recall power, and several diagnostics about the reliability of the initial growth models created with the ARDL method. The growth model is validated using a 1-lag ARDL. The boundaries test's F-statistic, which displays a value of 7.139 with a significance equal to −3.038, is significantly lower than the 3.61 5% critical value of Pesaran et al. (2001). As a result, the null hypothesis that there is no cointegration is rejected.

The final short-term estimate of the growth model, derived from an ARDL (1,0,0)-type model, demonstrates global significance, with the probability of the final Fisher statistic (7.139) being <5%. Additionally, it shows average quality, as indicated by the R2 statistic, which typically hovers around 0.5 (0.502), suggesting moderate adjustment. Various model validation tests, including the Ramsey (RESET) functional form validation test, the 1-order ARCH heteroscedasticity test, and the 10-order Breusch-Godfrey (LM) serial autocorrelation test, affirm the normal distribution of residuals and the absence of both serial autocorrelation and heteroscedasticity.

We find that the lnGDPC delayed variable has a weak but negative short-term effect (−0.017). Therefore, we can confirm that the

Table 6: Co-integration test with rupture

Models	Model 2: Change in level	Model 3: Change in level and trend	Model 4: Change in regime	Model 5: Change in regime and trend
t-statistic *ADF**	−5.30	−5.02	−5.65	−56.02
Break date	2019 m^{7}	2011 m^{9}	2018 m^{7}	2013 m^{12}

Critical values of ADF* t-statistic at 5%: Change in level (−4.92); change in level and trend (−5.83); change in regime (−5.50); change in regime and trend (−5.96) model's dynamic relationship between economic development and the prices of equities on the global financial market and oil is true. Specifically, we document the noteworthy influence of two factors.

Long-term evidence for the existence of an error correction process comes from the oil price model and the global financial market on an approximated "lnGDPC." As a result, a mechanism of convergence towards the long-term goal continues to exist. Furthermore, stability tests conducted on the CUSUM and CUSUM squared (CUSUMQ) statistics reveal that the predicted coefficients maintain consistency in both mean and variance over the research period. This suggests that the chosen specification functional form is accurate (Figure 4).

Moreover, the calculated error correction component has a coefficient of −0.07. The results suggest that there is a long-term relationship between the variables because the error correction term is large and negative. As a result, the error correction term shows that the monthly correction to the long-term economic development path deviation caused by a specific shock is 7%. Stated differently, this coefficient, along with the recall force, leads us to the conclusion that the feedback effect corrects 7% of the mismatch between the desired and actual levels of economic development, meaning that oil price shocks in Iraq are mitigated by 7%. As a result, we may find that the average latency is equivalent to 14.29 ($|1/0.070|$). This indicates that it takes 1 year, 2 months, and 9 days for an economic growth shock to be fully absorbed.

The ARDL technique calculates the long-term association in the second panel of Table 8, indicating that 95% of the factors in our study had significant and positive effects. Oil prices and equities on international financial markets positively impact economic growth. All other things being equal, the larger the sector, the higher the oil price and the stock of the global financial market, the greater the economic growth.

Based on the aforementioned empirical investigations, we have shown that there are mixed links, for example, between oil prices, international financial market stocks, and economic growth. As such, we decided to re-estimate our model utilizing an asymmetric effects-aware methodology, such as NARDL.

To determine the link between these three variables, we proceed to the NARDL non-linear estimate for the two variables, lnOP and lnGDPC on the one hand, and lnSMI and lnGDPC on the other.

Using the lnOP variable as a starting point, we divided it into two variables to test the asymmetry of the oil price on economic growth: $lnOP^{+}$, which indicates positive variations ($lnOP^{+} = lnOP$ if $\Delta lnOP > 0$ and 0 otherwise), and $lnOP^{-}$, which indicates negative variations ($lnOP^{-} = lnOP$ if $\Delta lnOP < 0$ and 0 otherwise), where Δ stands for the first variation. Second, by splitting the lnSMI variable into two other variables—$lnSMI^{+}$, which indicates positive variations ($lnSMI^{+} = lnSMI$ if $\Delta lnSMI > 0$ and 0 otherwise) and $lnSMI^{-}$, which indicates negative variations ($lnSMI^{-} = lnSMI$ if $\Delta lnSMI < 0$ and 0 otherwise)—we tested the asymmetry of the international financial market stock on economic growth. The first variation is represented by Δ.

Table 9 presents significant and negative effects ($P < 0.05$) for sub-variable lnOP- and substantial positive effects ($P < 0.05$) for sub-variable $lnOP^{+}$ on the independent variable lnGDPC. When the two coefficients are tested for equality using the Fisher method, the result is F (1; 186) = 29.30, with a probability of 0.000. This indicates that the impact of the oil price on Iraq's economic growth is asymmetrical. Furthermore, the findings presented in Table 9 reveal that the sub-variable $lnSMI^{-}$ exhibits a negative and non-significant effect at the 5% level, whereas both $lnSMI^{+}$ and the independent variable lnGDPC demonstrate a positive and significant effect at the same significance level. Moreover, the Fisher test for the equivalence of the two coefficients yields a value of F(1; 186) = 108.18 with a probability of 0.000.

Table 7: BDS test for independence

m	lnGDPC		lnSMI		lnOP	
	p=1	p=1.5	p=1	p=1.5	p=1	p=1.5
2	130.1298	64.5849	181.4487	59.1403	69.2277	37.4975
3	171.1165	70.8313	262.7895	62.4925	83.3921	38.9592
4	233.3950	78.7365	399.8408	66.5571	102.7656	40.6788
5	333.5952	89.9943	644.9101	72.4649	133.2620	43.4760
P-value	0.000	0.000	0.000	0.000	0.000	0.000

"P" is the multiple of the standard error (or sample size) to be used for the proximity threshold; "m" is the integration dimension

Figure 4: Evolution of CUSUM and CUSUMQ statistics of autoregressive distributed lag model

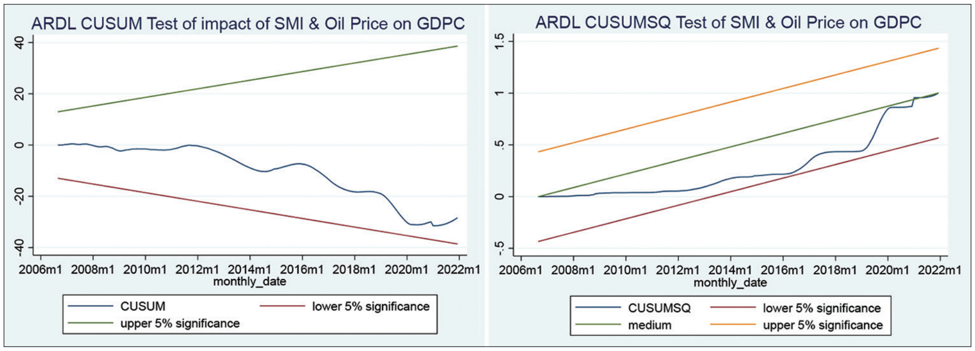


Table 8: Short-term ARDL estimate

Short-term	ARDL (1,0,0)		Maximum number of lags	1
Endogenous variable: $\Delta lnGDPC_t$	**Coefficient**	**Standard deviation**	**t-statistic**	**Probability**
Constant	0.117	0.043	2.70	0.008
$lnGDPC_{t-1}$	−0.017	0.005	−3.04	0.003
$lnOP_{t-1}$	0.005	0.001	3.60	0.000
$lnSMI_{t-1}$	0.001	0.001	2.11	0.036
ECT_{t-1}	−0.070	0.023	−3.04	0.003
R^2	0.502			
Adjusted R^2	0.488			
F Statistics (*bounds test*)	7.139		Critical value at 5% (k=5): 3.038	
Durbin-Watson	2.231			
Test LM (10)	1.236			0.266
Test McLeod-Li ARCH (p = 1)	2.436			0.118
Test white	8.491			0.485
Test RESET de ramsey	1.662			0.176
Long-term				
$lnSMI_t$	0.077	0.023	3.30	0.001
$lnOP_t$	0.302	0.102	2.94	0.004

The LM test refers to the Lagrange Multiplier test (Breusch-Godfrey serial correlation). ARCH refers to the Autoregressive Conditional Heteroscedasticity test. RESET refers to Ramsey Regression Equation Specification Error Test. *k* is the number of explanatory variables in the boundary test. ARDL: Autoregressive distributed lag

Table 9: Linear asymmetry test

lnGDPC	Coefficient	Standard deviation	t-statistic	P-value	(95% conf. interval)	
Constant	8.197	0.010	764.11	0.000	8.175	8.218
$lnOP^-_t$	−0.155	0.013	−11.16	0.000	−0.183	−0.128
$lnOP^+_t$	0.233	0.105	2.22	0.028	0.028	0.439
$lnSMI^-_t$	−0.029	0.021	−1.38	0.168	−0.072	0.012
$lnSMI^+_t$	0.066	0.007	8.77	0.000	0.051	0.081
Trend	0.003	0.001	4.77	0.000	0.002	0.005
R^2			0.792			
F-statistic lnOP	F (1, 186) = 29.30		F-statistic lnSMI		F (1, 186) = 108.18	
Probability F-statistic lnOP	0.000		Probability F-statistic lnSMI		0.000	

Furthermore, this finding indicates that the impact of equities on the global financial markets on Iraq's economic growth is unequal.

Therefore, we must reject the null hypothesis of equality and adopt the hypothesis that the two variables—the oil price and the stock of international market indices—have an unequal impact on Iraq's economic growth. We will use the NARDL method to support this.

Based on the final Fisher statistic having a chance of <5% (Fc = 4.066), the model's short-term estimate shown in Table 10 is globally significant. The final NARDL (3,0,0,1,3) model demonstrates this. As a result, the null hypothesis that there is no cointegration is rejected.

More precisely, the NARDL model's short-term estimations demonstrate a considerable influence on the fluctuation of lnGDPC, with varying signs at 5% of the lagged $lnOP^-$ and $lnOP^+$ variables. This validates earlier research showing a conflicting impact of changes in oil prices on economic expansion. Similar to this, we find that the short-term fluctuation of lnGDPC is subject to the mixed effects of lagged $lnSMI^-$ and $lnSMI^+$. This validates earlier research showing that the global financial stock market has a conflicting impact on economic expansion.

Additionally, the projected error correction term's coefficient is −0.011. The results suggest that there is a long-term relationship between the variables because the error correction term is large and negative. The error correction term thus shows that the monthly correction to the long-term economic development path deviation caused by a specific shock is 1.1%. Stated differently, this coefficient, along with the recall force, leads us to the conclusion that 1.1% of the imbalance between the desired and actual levels of Iraqi growth is adjusted by the feedback effect, thereby mitigating shocks to the country's economic growth. This means that we may determine an average lag of $|1/0.081| = 12.35$. This indicates that an average shock to Iraq's economic development takes a year and 11 days to fully absorb.

In general, any short-term rise in the positive price of oil and the positive stock price of the worldwide financial market causes economic growth to accelerate.

Likewise, the results of various model validation tests, including the functional form validation test (RESET), the ARCH test for heteroskedasticity of order 1, Breusch-Godfrey's (LM) test for 5-order serial autocorrelation, Jarque-Bera's test for residual normality, McLeod's test for serial autocorrelation, and the functional form validation test (RESET), collectively confirm the validity of the model. These tests indicate the absence of both serial autocorrelation and heteroskedasticity. However, it is worth noting that there was no confirmation of the hypothesis regarding the normal distribution of residuals.

Similarly, it is valuable to explore the cointegration of the variables, as without a cointegrating relationship, the coefficients may be misleading. Shin et al. (2014) proposed employing the joint null hypothesis of level (undifferenced) variables and comparing the critical values of the tests outlined in Pesaran et al. (2001) to examine cointegration within a NARDL model. There is proof of cointegration if the computed F value is higher than the crucial value. If not, there is no proof of cointegration.

In the long run, the results presented in Table 11 reinforce previous observations regarding the notable asymmetry. Both the student (t_BDM) and Fisher (F_PSS) statistics, exceeding the critical values established by Pesaran et al. (2001), corroborate the presence of a cointegrating relationship. Additionally, despite the non-normality of residuals, diagnostic tests affirm the validity of the model, particularly when the probability of the Ramsey test exceeds 5%.

The NARDL model's long-term results (3; 0; 0; 1; 3) show that $\ln SMI^-$ has a negative and significant effect, estimated at -0.089, whereas $\ln SMI^+$ has an insignificant influence. This demonstrates how the global financial stock market has an uneven impact on economic growth. In a similar vein, we find that $\ln OP^-$ assessed at −0.131 has a weakly significant negative effect, while $\ln OP^+$ evaluated at 0.135 has a significantly positive effect. Consequently, between 2006 and 2021, the NARDL model has been successful in demonstrating a mixed, asymmetrical long-term effect connecting the price of oil and the price of stocks on the international financial market in Iraq.

Table 10: Short-term NARDL estimate

ΔlnGDPC	Coefficient	Standard deviation	t-statistics	P-value
$\ln GDPC_{t-1}$	−0.011	0.003	−3.40	0.001
$\ln GDPC_{t-2}$	0.584	0.069	8.43	0.000
$\ln GDPC_{t-3}$	0.332	0.070	4.73	0.000
$\ln SMI^-_t$	0.139	0.107	1.30	0.197
$\ln SMI^+_t$	0.100	0.035	2.79	0.006
$\ln OP^-_t$	0.116	0.061	1.90	0.059
$\ln OP^-_{t-1}$	−0.002	0.002	−0.93	0.355
$\ln OP^-_t$	0.136	0.069	1.95	0.052
$\ln OP^+_{t-1}$	−0.001	0.002	−0.17	0.867
$\ln OP^+_{t-2}$	−0.001	0.002	−0.52	0.605
$\ln OP^+_{t-3}$	−0.007	0.002	−2.81	0.006
Constant	0.091	0.026	3.46	0.001
ECT_{t-1}	−0.081	0.026	−3.17	0.001

NARDL: Nonlinear autoregressive distributed lag

Furthermore, stability tests on the CUSUM and CUSUMQ statistics show a steady mean and variance of the predicted coefficients throughout the research period, suggesting the accuracy of the selected specification functional form (Figure 5).

The current study aims to demonstrate that dysfunction and defects in the international financial and oil markets exist in Iraq. This analytical choice prompts us to focus on policies related to the oil market that have the potential to improve the efficiency of the market's functioning. This indicates that institutional inefficiencies in the oil market itself may make initiatives meant to boost economic growth and oil consumption less effective.

Over the past 20 years, there has been a significant fluctuation in the correlation's sign and intensity between the returns of the oil and equity markets. Futures oil markets have seen a rise in trade activity throughout this time. This is the rationale behind our investigation of the effects of financialization and macroeconomic fundamentals on the co-movement of the Iraqi financial and oil markets in this chapter. More specifically, with an emphasis on the 2008 financial crisis, we have attempted to determine which explanations best account for the occurrence of excessive co-movements and the contagion effect between the two markets.

First, the ARDL and NARDL approaches show that the link between the oil market and international financial markets is due to speculative activity, not just the economic and physical fundamentals of the market (Sekali and Bouzahzah, 2021). This is especially true after the crisis and in the long term. Secondly, in the short term and even after the crisis, the speculation index exerts a positive and significant effect on the correlation of emerging countries, indicating that investor behavior explains a significant portion of the correlation between the oil market and these financial markets. Based on these findings, we conclude that the Iraqi economy is financially stable. Lastly, we confirm that other abnormal channels appear to explain the co-occurrence of the oil market and these financial markets during times of crisis (Shahsavar et al., 2022).

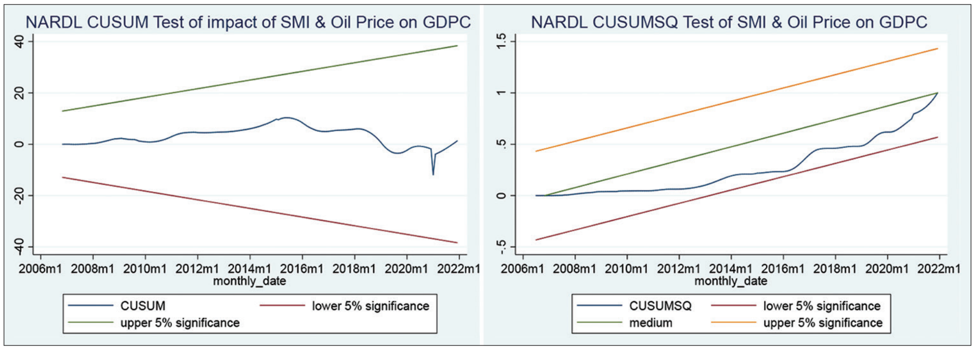
As far as we are aware, few studies have been done to explain the variables impacting the relationship between the financial and oil markets (Silvennoinen and Thorp, 2013; Büyükşahin and Robe, 2014). Our study's contribution is to present the concepts

Table 11: Long-term NARDL estimate

Variables	Positive long-term effect			Long-term negative effect		
	Coefficient	F-statistic	P-value	Coefficient	F-statistic	P-value
lnSMI	0.086	4.145	0.043	−0.089	0.617	0.433
lnOP	0.135	2.96	0.087	−0.131	3.289	0.072
	Long-term asymmetry			Short-term asymmetry		
lnSMI		4.016	0.009		0.014	0.904
lnOP		5.005	0.002		0.340	0.561
Cointegration test		t_BDM			F_PSS	
		−4.164			6.176	
Diagnostic	Statistic		Probability	Diagnostic	Statistic	Probability
Jarque-Bera test	420.24		0.000	Portmanteau test	13.58	1.000
Ramsey test	2.265		0.134	Breusch/Pagan heteroskedasticity	2.507	0.113

NARDL: Nonlinear autoregressive distributed lag

Figure 5: Evolution of CUSUM and CUSUMQ statistics of nonlinear autoregressive distributed lag model



of psychological contagion, fundamental contagion, and the excessive co-movement impact between a sample of financial markets and the oil market in the context of financialization. To achieve this, we used country-specific macroeconomic variables along with other common ones, adhering to Büyükşahin and Robe's (2014) methodology and applying it to the US market. We also attempted to explain the dynamic conditional correlation (DCC) between the oil market and a set of developed and emerging stock markets, taking into account the financialization of oil future markets and the effects of the 2008 financial crisis.

The impact of financial investors' large engagement on the co-movement of the stock and barrel markets is still up for debate, though. We have conducted three studies as a result, and they have yielded some results. Researching the dynamic relationship between the financial and oil markets might yield valuable insights into risk mitigation and portfolio diversification. It also demonstrates that, especially in times of financial crisis, oil is no longer a haven for Iraqi investors. Therefore, amid a financial crisis, it can no longer be the best option for diversifying their portfolios. Le Pen and Sévi (2018) demonstrate that investor psychology, specifically sheep-like behavior, and expectations, explain the extreme co-movement phenomena and the effect of pure contagion between the financial and oil markets.

Since this study has demonstrated that gas is a safe-haven asset for financial investors, more research should be done to investigate the phenomenon of excessive co-movement between financial markets and other energy markets (apart from oil and, in particular, natural gas).

5. CONCLUSION AND POLICY IMPLICATIONS

Oil-related factors account for a substantial portion of the US engagement in Iraq. Controlling Iraqi oil is only one issue; there is also a broader one involving the Near East and the Caspian. A major entity is also involved in the strategic stakes in the area.

The United States is prioritizing the restoration of political stability in Iraq when deciding how big of an impact to make in the area. Even though Russia's official positions appear to be the opposite, the country's objectives are very different from the United States, and their exit would strengthen their position. However, Saudi Arabia would become unstable, and the global oil market's equilibrium would be disturbed by a rise in political unrest in the area.

The international price of oil has a significant impact on the performance of the Iraqi stock market in the financial domain. Every nation in the world, including Iraq, is seeing a rise in the importance of financial markets in their economies. Any stock market index's increase in value is a direct result of the nation's economy's growth performance as well as the profitability of the companies that make up the index. Businesses with increasing stock values will have easier access to the capital they require for expansion and investment. Then, these businesses will have more capacity to hire more, produce more, and, as a result, make more money and pay out more dividends. The nation's economic growth will be largely fueled by this upward spiral.

Other than this, the production and export of Iraqi oil will have a negligible effect on the equilibrium price; in either case, OPEC will modify its limits. More importantly, though, is the rivalry between the United States and Russia, the result of which is partially dependent on how well the US does in its war with Iraq. Our findings demonstrate that most financial markets are susceptible to both short- and long-term volatility shocks, both before and after the crisis. We also note that, especially in the aftermath of a crisis, long-term shocks have greater persistence than short-term shocks.

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