# “Dynamics of oil price shocks in Latin American stock markets during global turbulence: A nonlinear autoregressive distributed lag analysis”


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# DYNAMICS OF OIL PRICE SHOCKS IN LATIN AMERICAN STOCK MARKETS DURING GLOBAL TURBULENCE: A NONLINEAR AUTOREGRESSIVE DISTRIBUTED LAG ANALYSIS

## Abstract

This paper investigates the impacts of oil price shocks on the stock markets of six Latin American countries – Argentina, Brazil, Chile, Colombia, Mexico, and Peru – by employing a Nonlinear Autoregressive Distributed Lag (NARDL) approach. This is during periods of global turbulence triggered by the COVID-19 pandemic and Russia's war in Ukraine. The study used data gathered from January 2020 to July 2023, daily stock prices of the six countries, and West Texas Intermediate (WTI) as a proxy of the oil price index. The analysis revealed that the complex relationship between oil price shocks and stock markets in Latin America has changed significantly since the start of the pandemic and the Russian-Ukrainian War. The findings indicate that the relationship between oil price changes and stock markets is not a straightforward linear correlation, but rather is more complex, with non-linear and counteracting effects, likely due to the uncertainty created by the pandemic and the Russian-Ukrainian War, which has caused investors to be more cautious when responding to oil price shocks.

**Keywords** stock markets, oil price shocks, NARDL approach, COVID-19 pandemic, Russian-Ukrainian war, Latin American

**JEL Classification** N26, C33, Q42

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## INTRODUCTION

In recent years, the global economy has been subjected to various episodes of turbulence, with significant implications for financial markets worldwide. Among the numerous factors that contribute to these turbulent periods, oil price shocks have emerged as a critical driver of economic instability. Oil price shocks have long been recognized as influential events that can severely impact economies around the world. Latin American countries, being major oil producers and exporters, are particularly susceptible to these shocks. The volatility and unpredictability of oil prices can create substantial challenges for their stock markets, leading to significant fluctuations in stock prices, exchange rates, and overall economic performance. To understand the relationship between oil price shocks and Latin American stock markets during global turbulence, a nonlinear autoregressive distributed lag (NARDL) analysis is employed. The NARDL approach allows for the examination of both short- and long-run effects of oil price shocks on stock market behavior, considering the presence of asymmetry in the impact of positive and negative shocks.

Recently, Latin American stock markets have been severely impacted by a confluence of factors, namely the Russian-Ukrainian War and



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the COVID-19 pandemic. The root cause of this monetary downturn can be attributed to the oil price shocks that have been triggered by reduced demand and investment in the oil sector. As a result, the region's stock markets have experienced substantial declines, leading to economic instability that has had far-reaching repercussions on businesses throughout Latin America. However, the negative effects have also permeated into GDP growth, which could result in long-term economic damage. Beyond the monetary ramifications, the hardship has also resulted in social and political unrest in the region, as citizens struggle to cope with the ongoing crisis.

The nexus among time financial markets, mainly stock markets, and oil price changes has been widely covered by research scholars. Analyzing the type and magnitude of stock markets reaction to energy price changes has become a major concern of policy makers and investors alike, where the changes in oil price affect stock markets through multiple indirect channels, for instance, changing the investors' attitude and sentiment, or influencing the government revenues generated from oil exports, which will in turn change or alter the monetary and fiscal stances in addition to government spending (Kilian & Park, 2009). The stock markets in Latin America are described as emerging markets based on their size, liquidity, and their phase of development and financial infrastructure. These markets have been generally claimed to be affected by vulnerability in international energy prices, given that Argentina, Brazil, Colombia, Mexico, and Venezuela are oil exporting countries, and they are relatively dependent on oil export incomes to manage their national expenditure (Kilian & Park, 2009).

## 1. LITERATURE REVIEW

Oil is a crucial source of revenue for many countries, as it is one of the most valuable commodities in the world. Oil exports generate a large portion of a country's income and can be used to fund infrastructure and other development projects. Additionally, oil can be used to generate electricity, providing a dependable source of energy for the country. This makes oil a fundamental resource for countries to ensure their economic stability and growth. Oil also serves as a form of foreign currency and can be used to purchase goods and services from other countries.

Latin America is especially dependent on oil exports, as the region is home to some of the world's largest producers of oil, and they are one of the world's top oil producers, and the country's oil exports make up many of its exports. This makes oil a crucial source of revenue for many Latin American countries, as it is one of the most valuable commodities in the world. Oil exports generate a large portion of a country's income and can be used to fund infrastructure and other development projects. As such, Latin American countries are heavily reliant on the production and exportation of oil. This has made them vulnerable to the fluctuations of global oil prices and other geopolitical forces. To protect themselves from the volatility of the oil markets, Latin American countries have chosen to diversify their energy sources. This includes investing in renewable energy sources, such as solar and wind. Additionally, they are also looking to maximize the efficiency of oil production, while minimizing the environmental impact of oil extraction, to preserve the natural resources of the planet (Vasquez, 2019). In 2022, Latin America's oil consumption reached 6.2 million barrels per day. This is a reduction of 4% from the previous year, and a sign that they are making progress towards their goal of energy diversification. To further reduce their dependence on oil, they have set a goal to increase the share of renewable energy sources in their energy mix to 40% by 2030. They are also investing in new technologies to reduce their carbon footprint and increase the sustainability of their energy sources (Vasquez, 2019).

The economy is a complex system that is affected by various factors, with the return of the market and prices of oil being two of the most significant ones. Production costs and transportation of goods and services are heavily influenced by oil prices, which are in turn influenced by economic activity. When economic activity is high, oil demand increases, and so does its price. Conversely, economic downturns can decrease oil demand, leading to lower oil prices. The relationship be-

tween the economy and oil prices has been the subject of numerous studies. These studies have consistently shown that there is a significant correlation between economic performance and energy sources, such as oil. For example, Angeliki and Ozturk (2016) have found that changes in oil prices can have a strong influence on economic growth; Solarin et al. (2016) found that oil price fluctuations can lead to large fluctuations in economic output; Cuñado and Pérez de Gracia (2000) showed that oil prices can have a significant effect on the rate of economic growth; Hamilton (2003) demonstrated that oil price shocks can have considerable impacts on macroeconomic activity; and Kilian and Park (2009) concluded that oil price shocks can have a large and lasting effect on economic growth.

Many factors can affect the stock market, and one of them is oil prices. When oil prices change, it can influence how well companies perform and ultimately impact stock market returns. Furthermore, sudden hikes in oil prices can cause inflation and result in changes in monetary policy. Ozturk and Feridun (2010) indicated that oil prices and stock market performance exhibit a strong and statistically significant correlation. Similarly, Dotsey and Reid (1992) showed that oil prices have a significant effect on stock market returns. Friedman (2005) also concluded that a positive relationship exists between oil prices and stock market performance. Finally, Filis et al. (2011) determined that oil prices influence stock market performance. These studies have found that oil prices can have a significant effect on the stock market, and investors should take this into consideration when making decisions. It is also important to consider the long-term effects of oil price changes on the stock market.

There have been numerous studies conducted to explore the connection between oil prices and the stock market, but the results have been inconsistent. While some studies have found a positive correlation between the two, others have found a negative correlation, and still others suggest that there may not be a significant relationship at all. For example, Serkan et al. (2013) found a statistically significant positive correlation, while Acaravcı et al. (2012) and Kilian and Park (2009) found a statistically significant negative correlation. On the other hand, Gencer and Demiralay (2014) found no significant correlation. Ultimately, the relationship between the economy, oil prices, and stock market returns is complex and interconnected, requiring further research to fully understand. Changes in one of these factors can have a significant impact on the others. Therefore, it is essential to understand the relationship between these factors to make informed decisions and predictions about the economy's future.

The past couple of decades have seen Latin America's stock market and investors suffer because of multiple significant financial crises, including the Asian crisis (1997–1998), the global financial crisis (2007–2008) and the Chinese Stock Market Crash (2015–2016). These events have had a long-lasting effect on the economic and financial stability of the region, as highlighted by Gillespie (2015) and Xiao et al. (2018).

For more than three decades now, researchers have been investigating the potential link between the prices change of oil and the stock market. While previous investigation has explored the overall impact of oil price fluctuations on the economy, recent global trends have seen the effect of oil price shocks on the stock market emerge as a more significant area of academic interest. Notable studies in this field include those by renowned scholars such as Kilian (2009), who conducted a notable study in this field, and Papapetrou (2001), who also provided valuable insights. Jones and Kaul (1996) and Huang et al. (1994) unearthed complex relationships between oil prices and the stock market through their rigorous research, helping to inform policy decisions and guide investors.

Since many public corporations in Latin America import and/or export oil, the stock market is highly sensitive to fluctuations in oil prices. Brazil is an example of a country that has a significant domestic oil production but does not produce enough exports to maintain a balanced oil current account. Consequently, any significant changes in the price of oil in these countries can have a great impact on the economy as well as on the stock markets of these countries, thereby contributing to economic instability and in some cases even recessions in these countries (Santillán-Salgado et al., 2017).


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It has been observed that emerging economies' oil export revenues and taxes are closely linked to oil prices. As a result, shifts in crude oil prices can have a tremendous impact on their economies. Rising prices tend to benefit these countries, whereas sudden drops can cause a negative effect. The trade balance of net importers of oil also tends to worsen during times of high oil prices but improves during times of low oil prices. As a result, the stock markets of emerging economies are highly susceptible to changes in crude oil prices (Valdés et al., 2012; Hernández-Gamarra et al., 2015; Santillán-Salgado et al., 2017). Latin America is particularly well-positioned for economic development due to its abundance of natural resources, the large size of its population, and the potential for natural resource extraction.

This sensitivity of the Latin American stock market to fluctuations in oil prices can be seen in some studies. Valdés et al. (2012) found that the Mexican Stock Market returns were significantly influenced by changes in oil prices, and the leverage effect parameter was positive. Similarly, Hernández-Gamarra et al. (2015) found that there was a causal relationship between oil prices, copper prices, and the returns of the stocks that make up the MILA index. As oil prices continue to fluctuate, the Latin American stock market remains vulnerable to their effects. Santillán-Salgado et al. (2017) determined that there is an association between the price of oil and the returns of stocks in Latin America. This is regardless of whether a country exports or imports oil. This suggests that higher oil prices lead to increased profitability for oil-related industries, which in turn leads to higher stock returns across the region. Countries such as Brazil, Mexico, Venezuela, Colombia, and Argentina, all exporters of oil, and Peru and Chile, which are importers of oil, have all experienced a positive effect on their stock markets due to increased oil prices.

It has been widely discussed in the literature that there is a correlation between the movement of oil prices and that of the stock markets. Yet the results of many studies are inconclusive. According to several studies, a negative relationship was found between the two, while other studies found a positive relationship, and still other studies found no significant correlation at all. Overall, the nature of the relationship between oil price movements and stock markets is complex and varied. The results from different studies also suggest that the direction of the relationship can differ across countries and over time. Therefore, further research is needed to gain a better understanding of the relationship (Van Eyden et al., 2019).

There have been very few and limited studies done in Latin America, especially when it comes to the most recent data, and none of these studies were conducted during the COVID-19 and the Russian-Ukrainian War. This paper seeks to add to the existing literature by analyzing the relationship between oil price movements and Latin American stock markets during COVID-19 and Russian-Ukrainian War. To this end, the paper examines the effects of both positive and negative oil price shocks on Latin American stock markets, providing empirical evidence to understand the dynamics of oil prices and the impact of shocks on stock markets.

The following hypotheses were framed in general for all the variables taken into consideration country-wise:

*H1: The price of oil has a significant impact on the stock markets of Latin American countries during the COVID-19 pandemic.*

*H2: The price of oil has a significant impact on the stock markets of Latin American countries during the Russian-Ukrainian War.*

*H3: The impact of oil prices on the stock markets of Latin American countries is different during the COVID-19 pandemic compared to the Russian-Ukrainian War.*

*H4: The impact of oil prices on the stock markets of Latin American countries is nonlinear, meaning that short and long-term movements, as well as unexpected shocks, in oil prices, have a varying effect on stock market performance.*

## 2. DATA AND METHOD

This study seeks to investigate how the price of oil affects Latin American stock markets differently during the two periods of the COVID-19 pandemic and the Russian-Ukrainian War. This paper examines the daily stock prices of various countries in Latin America, including Argentina,

Brazil, Chile, Colombia, Mexico, and Peru, and employs the West Texas Intermediate (WTI) index as a proxy of the oil price index, from January 2020 to July 2023. This study employs the novel approach of Shin et al. (2014) of nonlinear autoregressive distributed lag approach for testing the nonlinear reaction of dependent variable to short and long-term movements, as well as unexpected shocks, in variables and regressors independent to the system. The key advantage of this model over linear ones is it allows for asymmetric observations in both negative and positive reactions to vary over short and long periods of time. Moreover, it divides up the sharp variations in dependent variable into two different sums, negative and positive. The change in dependent variable's reaction to shocks with different signs reflects the asymmetric reaction in terms of the nature of shock (Shin et al., 2016). However, the difference in the reaction in terms of time demonstrates the asymmetric and nonlinear time path reaction. Hence, the NARDL model is considered as superior to other linear methods usually used for depicting the nexus and interactions variables within a time series. The NARDL model is based basically on the ARDL methodology introduced by Pesaran et al. (2001), the framework of the augmented ARDL model is presented as:

$$\alpha(L,p)x_t = a_0 + \\ +\sum_{i=1}^{k}\beta_i(L,q_i)y_{it} + \lambda' w_t + \varepsilon_t, \quad (1)$$

$$\beta_i(L,q_i) = \beta_{i0} + \beta_{i1}L + \beta_{i2}L^2 + \ldots + \beta_{iq_i}L^{q_i}, \quad (2)$$

where $x_t$ is the vector of dependent variables, $a_0$ is constant, and $w_t$ is $s \times 1$ is a vector of deterministic regressors such as trend and intercept. $y_{it}$ represents $i$ independent variables, where $i = 1, 2, ..., k$. The ARDL is shown using equation (3):

$$\Delta x_t = \Delta a_0 - \alpha(1,\hat{p})EC_{t-1} + \sum_{i=1}^{k}\beta_{i0}\Delta y_{it} + \\ +\lambda' w_t - \sum_{j=1}^{\hat{p}-1}\alpha^* j\Delta x_{t-j} - \\ -\sum_{i=1}^{k}\sum_{j=0}^{\hat{q}_i-1}\beta_{ij}\Delta y_{i,t-j} + \varepsilon_t. \quad (3)$$

The error correction mechanism ECM is:

$$ECM_t = x - \hat{a} - \sum_{i=1}^{k}\hat{\beta}_i y_{it} - \lambda' w_t, \quad (4)$$

where $\beta_{ij}$ and $\lambda'$ represent short-term dynamics of the model, and $\Delta$ is the first difference of the regressors, the independent variable is the oil price, while the dependent variables are the stock markets in Latin America.

The oil price shock is decomposed into two partial sums, negative and positive, as shown in equation (5):

$$OilSh_t = OilSh_0 + OilSh_t^+ + OilSh_t^-. \quad (5)$$

The partial sums anticipated to capture negative and positive oil price shocks are ($OilSh_t^+$) and ($OilSh_t^-$). They can be presented individually by equation (6) and (7):

$$OilSh_t^+ = \sum_{i\bar{\tau}1}^{t}\Delta OilSh_t^+ = \sum_{i\bar{\tau}1}^{t}\max(\Delta OilSh_i 0), \quad (6)$$

$$OilSh_t^- = \sum_{i=1}^{t}\Delta OilSh_t^- = \sum_{i=1}^{t}\min(\Delta OilSh_i 0). \quad (7)$$

NARDL can be expressed in the following way (equation 8) using positive and negative shocks in the dependent variable:

$$\Delta SM = \sum_{i=1}^{n1}\partial_{1i}\Delta SM_{t-i} + \sum_{i=0}^{n2}\partial_{2i}\Delta OilSh_{t-i}^+ + \\ +\sum_{i=0}^{n2}\Delta OilSh_{t-i}^- + \upsilon_1 SM_{t-1} + \upsilon_2 OilSh_{t-i}^+ + \\ +\upsilon_3 OilSh_{t-i}^- + \varepsilon_t, \quad (8)$$

The nonlinear short-run asymmetric impact is indicated for by testing the null $\partial_{2i} = \partial_{3i}$. Whereas, the long-term repercussions of fluctuations in oil prices on Latin American stock markets are evaluated by the null of $\upsilon_2 = \upsilon_3$, $SM$ represents Latin American stock markets individually. Additionally, the NARDL allows for testing the cointegration variables in the system by bound test with the null ($\upsilon_1 = \upsilon_{2=}\upsilon_3 = 0$) of no cointegration.

## 3. EMPIRICAL RESULTS AND DISCUSSION

Prior to the investigation of stock market's reaction to shock in oil prices, this paper applies the Augmented Dicky-Fuller and Phillip-Perron tests for unit root. The time series variables are generally known by their non-stationary behavior when they presented in first differences, however they tend to exhibit stationary trajectory in their first difference (Almohamad et al., 2022). The applica-


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tion of most time series models, such as the Engle and Garnger (1982) test or the Johansen-Juselius (1991) test, should be applied to the series in the same order in which they are integrated, as those integrated at levels I(0) or first order I(1).

The results in Table 1 deconstrue the outcomes of unit root tests for Latin American stock markets and the oil price index. The result indicate that variables have different orders of integration, where Chile and Colombia are stationary at their levels; however, the oil price and other stock markets become stationary after taking first differences. Hence, with such a mixed order of integration, the use of traditional time series models becomes inaccurate and misleading, the NARDL methodology provides a significant advantage over the traditional time series testing, where the test can be applied for mixed order of integration without losing its power (Sraieb et al., 2022).

**Table 1.** ADF and PP unit root tests

| Variables | Augmented Dickey-Fuller | Phillips-Perron |
|---|---|---|
| | t-statistics | t-statistics |
| **Panel A: Variables at levels** | | |
| Argentina | –1.669 | –1.855 |
| Brazil | 3.12 | 3.19* |
| Chile | 3.25* | 3.42** |
| Colombia | 3.42** | 3.35* |
| Mexico | 2.91 | 2.87 |
| Peru | 2.96 | 2.92 |
| Oil Price | 2.33 | 1.95 |
| **Panel B: Variables at first difference** | | |
| Argentina | 29.09*** | 29.10*** |
| Brazil | 31.75*** | 31.71*** |
| Chile | 28.12*** | 28.09*** |
| Colombia | 17.06*** | 26.83*** |
| Mexico | 26.70*** | 26.67*** |
| Peru | 18.97*** | 30.84*** |
| Oil Price | 24.39*** | 33.42*** |

*Note*: Significance levels of 1%, 5%, and 10% are indicated by *, **, and ***, respectively.

Table 2 displays the outcomes of the NARDL for asymmetric reaction of Latin American stock indices to different shocks in oil price index. Table 2 encompasses three different panels; Panel A reports the short-run effects of oil price shock, in its both positive and negative signs on aforementioned markets, panel B demonstrates the long-term effect, whereas panel C depicts the existence of short or long-run nonlinearity in markets' response to changes in oil prices. Starting with panel A, the results indicate that in general, the shock in oil price leads to significant short-run response of Latin American stock markets almost with no exceptions, and these outcomes are in line with Salgado et al. (2017). It can be also noticed that both negative and positive shocks in oil index have significant effects on these stock markets, with Argentina and Mexico scoring the highest significance coefficients to negative oil shock, that a -1% change in oil prices leads to 5.49% and 6.75% declines in the two markets, respectively. Similarly, all stock markets under consideration seem to respond positively to an increase in oil prices. The results of this study are in line with Sohag et al. (2023), who studied the effect of oil market shocks on financial stress levels in Russia from 2012 to 2022. Their findings revealed that rising oil prices due to supply and demand shocks lead to an increase in financial stress levels in the short term, but negative oil price shocks reduce financial stress in the long term. The Russia-Ukraine conflict had a smaller effect on financial stress than the US shale boom. Another study conducted by Si Mohammed et al. (2023) investigates the relationship between oil prices and stock markets in the G5+ countries. They used Parkinson's proximal realized volatility, asymmetric aggregate static spillovers, and a Quantile VAR to analyze the dynamic nature of this relationship. The study found that the impact of the Russian-Ukrainian conflict on the energy crisis was greater than that of the COVID-19 pandemic. However, the latter had a higher persistence of negative spillovers. The research also revealed that oil price shocks are associated with stock exchange uncertainty in low and middle quantiles, indicating that investors rely heavily on this commodity.

Mroua and Bouattour's (2023) study delves into the effects of the COVID-19 pandemic and the Russo-Ukrainian conflict of 2022 on traditional stock markets and commodities, such as oil, precious metals, and renewable energy. Interestingly, their findings show that the United States and renewable energy markets were the primary sources of shocks throughout the global period, not just during the two crisis sub-periods. Additionally, the oil market experienced both shock emission and reception, likely due to price fluctuations during the same sub-periods. Okhrin et al. (2023) conducted an insightful study examining the correlation between financial and commodity markets during

the COVID-19 pandemic and the Russia-Ukraine conflict. By analyzing high-frequency intraday data, the researchers discovered that the markets exhibited greater interconnectivity during times of extreme market conditions, with stronger tail dependence in the lower tail highlighting an unequal connectedness among the assets.

Panel B reports the long-run response and reaction of Latin American indices to shocks in oil index. One can notice that the number of markets exhibiting changes due to oil shock has generally decreased compared to panel A, where stock markets in Brazil and Chile seem to be unaffected in the long term by oil shocks, and this appears to be somewhat favorable as it affirms the agility and resilience of these markets to unexpected vulnerability in global energy market. On the other hand, the effect of shock in long-run horizon seems to have a very disturbing effect on Argentina, Colombia, and Mexico, where the 1% increase in oil price generates a long-lived response in these markets by 13.72%, 2.65%, and 3.46%, respectively. These outcomes might be explained by the fact that Argentina, Mexico, and Colombia are the oil exporting Latin American countries, where the rise in oil price initiates to boost the national income, and this, in turn, is reflected in high government spending and positive investment sentiment.

Panel B also demonstrates that a 1% decrease in oil price exhibits a partial effect on these markets, with the highest value recorded for Argentina. It is also somewhat noticeable that the stock market in Peru, which is considered as the main oil importer in Latin America, exhibits positive reaction to a decrease in oil prices, where the country can experience a significant reduction in its oil and energy bills following declines in oil price, where a 1% decline in oil price leads to a 3.46% increase in the market index of Peru (it is worth mentioning that the negative sign of Peru's coefficient indicates for movement of the stock market in the opposite direction to an oil price decrease, which means an increase in the Peru market index).

So far, the results in Table 2 have shed light on the responsiveness of Latin American stock markets to negative and positive shocks in oil prices. Nevertheless, the outcomes in panel B do not indicate any long-term effect of oil shocks on the Brazilian stock market, which is somewhat implausible, considering that Brazil is the eighth largest oil consumer and 10th largest oil exporter (Almohamad et al., 2020). Therefore, the shocks in the oil price are expected to cause a notable influence, or even a structural break, in the Bovespa index. This lack of any long-term effects from oil shocks in panel B could be because Brazilian investors may have already priced in the effects of oil shocks, making it less of a shock to the market. Additionally, one must consider that Brazil is both an oil consumer and oil exporter, meaning that the Bovespa's response to oil shocks index may be more nuanced than just the direct effects of a shock to oil prices.

**Table 2.** NARDL test

| Regressors (left side of NARDL Equation) | Stock Markets in GCC Countries – Dependent Variables | | | | | |
|---|---|---|---|---|---|---|
| | ΔArgentina | ΔBrazil | ΔChile | ΔColombia | ΔMexico | ΔPeru |
| **Panel A: Short Run** | | | | | | |
| Δ(*Dep*(–1)) | – | –0.075* | 0.055* | 0.080* | 0.097* | –0.037 |
| Δ(*Oil*$^{-}$) | 5.499*** | 3.810*** | 2.101*** | 1.255** | 6.757*** | 3.344*** |
| Δ(*Oil*$^{-}$(–1)) | – | 1.328* | 0.859* | 0.658** | 2.681** | 1.329** |
| Δ(*Oil*$^{+}$) | 3.186*** | 4.144*** | 1.563** | 0.999** | 4.746*** | 3.623*** |
| Δ(*Oil*$^{+}$(–1)) | – | – | – | – | – | – |
| **Panel B: Long Run** | | | | | | |
| *Dep*(–1) | – | – | – | 0.131** | – | 0.112* |
| *Oil*$^{-}$(–1) | 19.555*** | 2.409 | 1.826 | 2.965** | –1.545 | –3.465*** |
| *Oil*$^{+}$(–1) | 13.725*** | 2.351 | 1.904 | 2.654** | 3.461** | –0.024 |
| **Panel C** | | | | | | |
| Short-term asymmetry | 21.147*** | 21.016*** | 12.838*** | 5.370*** | 6.850*** | 9.446*** |
| Long-term asymmetry | 5.172*** | 3.124** | 1.153 | 2.081 | 2.577* | 2.427* |

*Note*: Significance levels of 1%, 5%, and 10% are indicated by *, **, and ***, respectively.


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Panel C in Table 2 supports the establishment of a more comprehensive view of nexus among these markets and energy prices through measuring if the reaction to oil shocks follows linear trajectory over the long and short-run horizon. Panel C demonstrates that in the long term, none of Latin American markets follow a fixed manner of reaction to different positive or negative oil shocks. In other words, it appears that the response to shocks in the oil price in both time horizons exhibits nonlinear nature, which indicates that there is no one single or linear relationship that can identify and govern the responsiveness of these stock markets to unexpected shocks or changes in the oil price index. This in turn confirms the outcomes add novelty to previous literature by affirming that in the wake of the COVID-19 pandemic and Russian-Ukrainian War, the oil price vulnerability affects stock markets in Latin America differently, with one common factor, i.e. nonlinearity.

## CONCLUSIONS

This study investigates the impact of oil price fluctuations and sudden shifts on Latin American stock markets. To conduct this investigation, data were collected from six prominent stock markets in Latin America, and West Texas Intermediate (WTI) oil prices were used. The data analysis encompassed the period from January 2020 to July 2023. Through this comprehensive examination, valuable insights were gained into the relationship between oil prices and Latin American stock markets. This study contributes to our understanding of the intricate dynamics between oil prices and stock market fluctuations, providing valuable information for investors and policymakers.

To accomplish this, a sophisticated Autoregressive Distributed Lag Model (NARDL) in its nonlinear version was employed to assess the market's response to oil shocks. The research findings reveal that the conventional linear model does not fully capture the complex relationship between stock market behavior and oil price shocks. This relationship is further complicated by the COVID-19 pandemic uncertainties and the Russian-Ukrainian War. The study found that oil shocks tend to have a significant short-term impact on stock markets in Latin America, with adverse long-term consequences, particularly for countries like Argentina, Colombia, and Mexico. Consequently, the study concludes that a single or linear model is inadequate to adequately account for the stock market's sensitivity to unforeseen changes in the oil price index.

## AUTHOR CONTRIBUTIONS

Conceptualization: Ammar Jreisat.
Data curation: Ammar Jreisat.
Formal analysis: Ammar Jreisat.
Funding acquisition: Ammar Jreisat.
Investigation: Ammar Jreisat.
Methodology: Ammar Jreisat.
Project administration: Ammar Jreisat.
Resources: Ammar Jreisat.
Software: Ammar Jreisat.
Supervision: Ammar Jreisat.
Validation: Ammar Jreisat.
Visualization: Ammar Jreisat.
Writing – original draft: Ammar Jreisat.
Writing – review & editing: Ammar Jreisat.

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