Exploring the sensitivity of BRICS stock markets to oil Price shocks: a quantile-on-quantile perspective

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ABSTRACT

This paper evaluates the impact of varying magnitudes of oil price shocks on the equity market returns in BRICS countries under diverse market conditions using quantile-on-quantile regression analysis. Uniquely, unlike previous studies, this paper differentiates between demand and supply oil price shocks, under the assumption of a perfectly elastic oil supply. This assumption is grounded in a structural vector autoregressive (SVAR) framework, enhancing the analysis's precision in identifying the specific nature of oil price shocks. The empirical findings reveal that the impact of demand oil price shocks on the equity markets of BRICS nations varies according to the resource endowment of each country, showing distinct effects between countries with greater and lesser resource endowments. Additionally, the influence of supply oil price shocks on equity markets differs based on the market conditions, specifically whether the countries are net oil importers or exporters. These findings offer critical insights for policymakers and investors in BRICS countries, enabling the development of economic and business strategies that are closely aligned with the unique economic conditions and characteristics of each nation.

1. INTRODUCTION

The interplay between oil prices and stock market returns holds significant importance for a diverse group of stakeholders, including policymakers, asset managers, and individual investors. This dynamic is not only pivotal for understanding market fluctuations but also for devising strategic investment decisions.

Extensive research has been dedicated to exploring this relationship. A noteworthy study by Morema and Bonga-Bonga (2020) indicates that commodities, particularly oil, can be effectively utilized as a hedging tool against equity market positions. This finding is crucial for investors seeking to mitigate risks associated with stock market volatility. In their analysis, Morema and Bonga-Bonga demonstrate that the hedging effectiveness of oil is not static; rather, it fluctuates over time. This variability is largely attributed to the asymmetric relationship between oil prices and stock market returns, suggesting that the benefits of using oil as a hedge might vary depending on prevailing market conditions.

Further emphasising the role of commodities as hedging instruments against stock market fluctuation, Basher and Sadorsky (2016) conducted a comparative study which reveals that oil outperforms gold in terms of its efficacy as a hedge against stock market exposure. This is a particularly significant finding given that gold has traditionally been viewed as a safe haven in times of financial uncertainty.

Studies indicate that oil price shocks, characterized by abrupt changes in oil prices, can significantly influence stock market returns through a variety of mechanisms. These mechanisms include fluctuations in production costs, consumer spending patterns, the wealth effect, and inflationary pressures. For example, a study by Bjørnland (2009) underlines the intricate relationship between oil prices and stock market performance, particularly highlighting the critical channels that shape this interaction, especially in oil-exporting nations. The study reveals that positive oil price shocks often lead to an uptick in stock market returns in these countries. This positive correlation is primarily due to the surge in aggregate wealth and demand that oil-exporting countries experience following favourable shifts in oil prices.

From this observation, it becomes evident that the impact of oil price shocks on stock market returns is intricately linked to the specific channels through which these shocks permeate an economy. In oil-exporting countries, the dominant channel might be the boost in wealth and demand stemming from

higher oil prices, which in turn positively impacts stock market returns. On the other hand, in economies where oil price shocks predominantly affect production costs, the impact on equity returns is likely to be adverse. This negative effect is observed in economies where escalating oil prices considerably increase production costs, leading to reduced profitability for companies and, consequently, diminished stock market performance (Cunado and de Gracia, 2014; Phan et al., 2015). Therefore, understanding the varied effects of oil price fluctuations on stock markets is essential, as these effects are closely tied to each country's unique economic characteristics and oil dependency.

Another critical facet of the interplay between oil price fluctuations and equity returns is the asymmetrical nature of this relationship. Yildrim et al. (2018) employ a Markov Switching Vector Autoregressive model to elucidate the asymmetric dynamics between BRICS equity market returns and oil prices. Their findings reveal that the reactions of equity markets to oil price changes are contingent on the prevailing market volatility conditions. Specifically, in high volatility regimes, equity market returns tend to react positively to oil price shocks, whereas in low volatility regimes, the response is generally negative. This indicates that the impact of oil price shifts on equity returns can vary significantly, depending on whether the market is experiencing bearish, balanced, or bullish conditions. Badeeb and Lean (2018) further substantiate the asymmetrical influence of oil price alterations on Islamic stocks by analyzing the stock market at a sectoral level. Their research demonstrates that, in the long term, many Islamic sectoral stocks exhibit a nonlinear response to oil price shocks. However, in the short term, these indices tend to show a linear correlation with oil price variations. This distinction between short-term and long-term responses highlights the complexity of the relationship between oil prices and equity markets and underscores the importance of considering time horizons in financial analysis.

While several studies illustrate the asymmetric relationship between oil price shocks and equity market returns (see Badeeb and Lean, 2018; Al-Fayoumi, 2023; Escribano, et al., 2023).; however, only a few looks at how the magnitude and distribution of oil price fluctuations impact stock market returns under varying stock market regimes or states (see Sim and Zhou, 2015; Joo and Park ,2021 ; Ge, , 2023). For example, Sim and Zhou (2015) assess the relationship between oil price and the US equity market by showing how the quantile of oil price shocks affect the quantile of equity returns. The authors are the first to apply the quantile on quantile regression methodogy, an approach that captures the dependence between the distribution of the different variables. Following the same methodology, Joo and Park (2021) assess the effects of oil price volatility on stock markets of ten major oil-importing

countries namely, China, France, Germany, India, Italy, Japan, Korea, the Netherlands, Spain, and the U.S. from May 2001 to December 2019. The authors find that oil price uncertainty has asymmetrical effects on stock returns; moreover, these asymmetric behaviors vary depending on not only the level of stock returns but also oil market conditions in that the increase of oil price volatility has a negative effect on stock returns when both oil price volatility and stock returns are low. However, when stock returns are high and oil price volatility is low, rising oil price volatility leads to an increase in stock returns.

In our paper, which builds on prior research by assessing the asymmetric impact of oil price shocks on stock returns when accounting for the distribution of these variables, we make two novel contributions to the literature on the oil shocks and stock returns nexus. First, unlike previous studies, our paper examines the asymmetric effects of oil price shocks on equity returns in BRICS countries, differentiating between demand and supply shocks. We propose a new identification of these shocks beyond the one currently used in many literature either based on Kilian and Park (2009) or Ready (2018). Second, rather than concentrating on a single economy, our research delves into the dynamics between oil price shocks and stock returns within an economically integrated bloc—the BRICS grouping. We aim to explore how the interconnectedness within this group, coupled with the varying levels of dependency on natural resources, particularly oil, shapes the relationship between oil shocks and equity returns.

It's crucial to recognize the diverse economic landscapes of BRICS countries, each with different degrees of reliance on natural resources. For instance, Russia, Brazil, and South Africa are endowed with rich natural resources, with Russia standing out as a major oil producer and exporter. In contrast, India and China, having limited resource endowments, are significant importers of natural resources. This diversity within the BRICS grouping offers a unique perspective on how varying economic characteristics influence the oil shocks and equity returns nexus.

Understanding the differential and distributional impacts of oil price shocks on stock returns is pivotal for policymakers and investors alike in formulating economic and business policies that are specifically tailored to the unique needs and characteristics of each country or institution. For instance, a supply shock, such as a sudden decrease in oil production due to geopolitical tensions or natural disasters, might necessitate policymakers to implement specific fiscal or monetary responses aimed at stabilizing prices and ensuring economic resilience. For investors and businesses, grasping these dynamics is crucial for better risk management. In-depth knowledge of how oil price fluctuations interact with equity markets enables investors

and businesses to anticipate potential market shifts and adjust their strategies accordingly. It allows them to make informed decisions about when to hedge against potential negative impacts of oil price fluctuations on their equity investments. For example, in a scenario where a supply shock is anticipated, investors might seek to hedge their positions by investing in assets that are likely to appreciate under such circumstances, or they may diversify their portfolios to reduce exposure to affected sectors.

The remainder of the paper is divided as follows; Section 2 discusses the methodology employed. Section 3 presents the data and discusses the results of the empirical analysis. Section 4 concludes the paper.

2. METHODOLOGY

This section outlines how the quantile-on-quantile method is used to determine the effects of oil price shocks on the returns of equity markets in BRICS countries. It is important to note that the quantile-on-quantile method is based on the combination of quantile regression and non-parametric estimation.

To understand how the quantile on quantile methodology works, we first express a model for $\theta - quantile$ of stock returns as a function of oil price shocks as:

$$r_t = \beta_0^\theta + \beta_1^\theta(oilshock_t) + \alpha^\theta r_{t-1} + v_t^\theta, \qquad (1)^1$$

Where $r_t = Q_{r_t}(\theta / oilshock_t, r_{t-1})$. r_t is the stock returns for each BRICS country, $oilshock_t$ is the oil shocks, v_t^θ is an error ter m that has a zero θ-quantile. $\beta_1^\theta(\,)$ is a link function that relates stock returns to oil price shocks at a specific quantile. Equation 1 represents a quantile regression that demonstrates how changes in oil shocks and other different regressors affect stock returns across various regimes or quantiles.

To analyse the relationship between θ-quantile of stock returns and the ω-quantile of oil price shocks, $oilshock^\omega$, we linearise Equation 1 by taking a first-order Taylor expansion of β_1^θ in the neighbourhood of $oilshock^\omega$ such as:

[1] The model is represented as ARIMA-X. we follow Bonga-Bonga and Muteba Mwamba (forthcoming) who show that stock returns in emerging markets are fitted better with an ARIMA-X .

$$\beta^{\theta}(oilshock_t) \approx \beta^{\theta}(oilshock_t^w) + \beta^{\theta\prime}(oilshock_t^w)(oilshock_t - oilshock_t^w) \quad (2)$$

As $\beta^{\theta}(oilshock_t)$ and $\beta^{\theta}(oilshock_t^w)$ are functions of θ and $oilshock_t^w$, respectively, the parameters obtained are doubly indexed in θ and w, redefined as $\beta_0(\theta, w)$ and $\beta_1(\theta, w)$. Thus, Equation 1 can be expressed in terms of $\theta - quantile$ of r_t as:

$$r_t = \beta_0(\theta, w) + \beta_1(\theta, w)(oilshock_t - oilshock^w) + \alpha(\theta) r_{t-1} + v_t^{\theta}, \quad (3)$$

Equation 3 is estimated by solving a non-parametric model based on the following minimisation problem:

$$\min_{b_0, b_1} \sum_{i=1}^{n} \rho_0\left[r_t - b_0 - b_1\left(\widehat{oilshock}_t - \widehat{oilshock}^w\right)\right] K\left(\frac{F_n\left(\widehat{oilshock}_t\right) - w}{h}\right), \quad (4)$$

where a Gaussian kernel $K\left(\frac{F_n\left(\widehat{oilshock}_t\right) - w}{h}\right)$ is used to weight the observation around $oilshock^w$.

We make use of a SVAR (structural vector autoregression) model to identify the oil shocks ($oilshock_t$), especially the demand-driven and supply-driven oil price shocks from the global oil market block. While our approach aligns with Kilian and Park (2009) regarding the selection of variables for identifying various innovations in a 3-variable SVAR system, our identification methodology diverges from that proposed by the authors in theoretical aspects. It is worth noting that Kilian and Park (2009) identified three innovations in a SVAR system such as :

$$\begin{pmatrix} e_t^{\Delta Prod} \\ e_t^{reac} \\ e_t^{repo} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix} \begin{pmatrix} \varepsilon_t^{oil\ supply\ shocks} \\ \varepsilon_t^{aggregate\ demand\ shocks} \\ \varepsilon_t^{oil\ specific-demand\ shocks} \end{pmatrix} \quad (5)$$

where ε_t denotes the vector of serially and mutually uncorrelated structural innovations and e_t represents the reduced-from errors. $\Delta prod$ is the percent change in global crude oil production, *reac* denotes the index of real economic activity, and *repo* is to the real price of oil. According to Kilian's

analysis, Equation 5 introduces contemporaneous restrictions and identifies shocks, suggesting that the short-run supply curve for crude oil is essentially vertical. This implies that crude oil supply shocks are unpredictable changes in global oil production. The rationale behind this contemporaneous restriction is that oil-producing countries are typically slow to adjust to demand shocks due to the costs and complexities involved in altering oil production, as well as the uncertainties surrounding the crude oil market. Additionally, the model posits another key restriction: increases in the real price of oil, when caused by shocks specific to the oil market, do not immediately reduce global real economic activity. Instead, there is a lag effect, with the impact becoming apparent after a delay of at least one month. Lastly, Kilian's model acknowledges that there are factors affecting the real price of oil that cannot be solely attributed to oil supply or aggregate demand shocks, suggesting a more complex interplay of market dynamics.

Our identification approach and contemporaneous restrictions differ from those proposed by Kilian and Park (2009), primarily in the ordering of variables. This alternative structure is detailed in Equation 6 below.

$$\begin{pmatrix} e_t^{repo} \\ e_t^{reac} \\ e_t^{\Delta Prod} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix} \begin{pmatrix} \varepsilon_t^{oil\ supply\ shocks} \\ \varepsilon_t^{aggregate\ demand\ shocks} \\ \varepsilon_t^{oil\ specific-demand\ shocks} \end{pmatrix} \quad (6)$$

The model we propose suggests a horizontal supply curve, indicating that real oil prices become 'trapped' or stagnant in scenarios characterized by excess supply shocks. Specifically, in such situations, real oil prices are observed to be low and relatively unresponsive to the excess supply or other related factors[2]. Consequently, in the context of excess supply shocks, it is primarily innovations in aggregate demand and shifts in oil demand that have the potential to stimulate and resurge oil production. This dynamic underpins the rationale for the ordering of variables within our model represented in Equation 6.

[2] We extend the idea of liquidity trap in the oil market.

3. DATA, ESTIMATION, RESULTS AND THEIR INTERPRETATION

3.1 Data

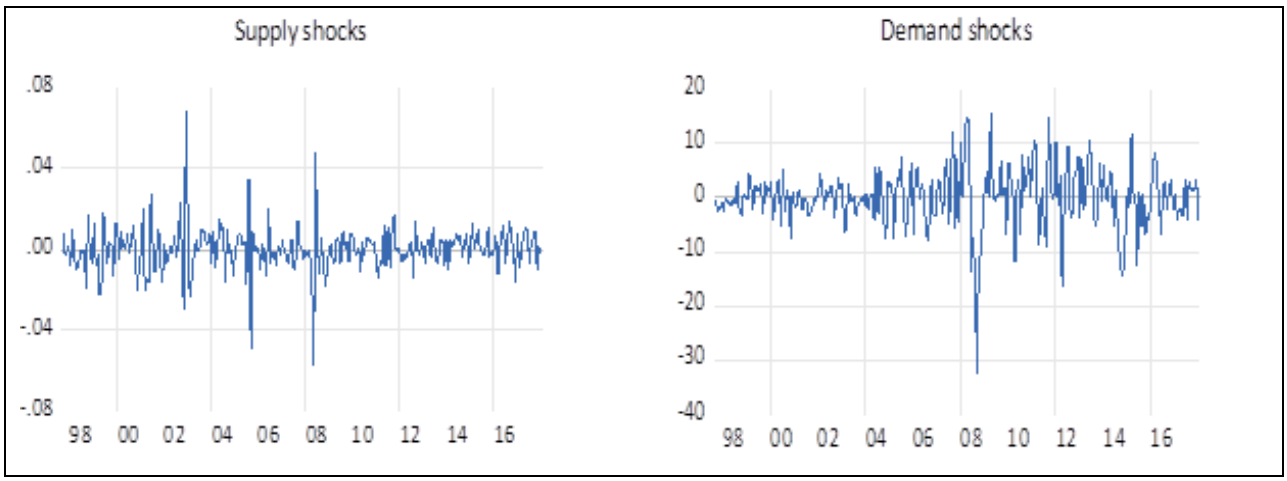
The study employs monthly data spanning from January 1998 to December 2017. The sample is chosen to cover periods of high changes to oil prices triggered either by demand and supply shocks to oil. This sample is representative enough for policy recommendations that should derive from the findings of the paper.

The data for stock indices for BRICS countries and total world oil production is obtained from Thomson Reuters. For oil prices, we use the monthly West Texas Intermediate (WTI) Spot Price free on board (dollars per barrel) obtained from the U.S. Department of Energy. The WTI is one of the major international oil price benchmarks (see Zhu et al., 2015). The index used for measuring global economic activity is from Kilian's personal website[3]. The index considers an index linked to a panel of cargo ocean shipping freight rates and reflects the aggregate global demand for industrial commodities such as oil. Moreover, the attractiveness of the index rests on the idea that it takes into consideration the effects of increased real activity in emerging markets such as India and China. Stock indices for BRICS countries, which are transformed in returns, include IBOVESPA for Brazil, JSE for South Africa, MOEX for Russia, SENEX for India and SHANGHAI for China.

Demand and supply oil shocks are obtained from the SVAR identified with contemporaneous restrictions, as explained in section 2. Figure 1 displays the supply and demand shocks to oil price obtained from this identification.

[3] See https://www.dallasfed.org/research/igrea to access the data on global economic activity.

Figure 1. Identified supply and demand shocks



High spikes in these figures indicate periods of significant fluctuations in oil prices, as illustrated by the historical oil price time series. For instance, the mid-2008 variations seen in the demand shock graph coincide with the July 2008 peak in oil prices, reaching an all-time high of $145.31 per barrel. This spike resulted from various elements, including heightened demand from emerging economies, as detailed by Baffes et al. (2015) and Soliman (2020). Following the high oil prices, negative demand shocks emerged due to the global financial crisis. Moreover, Figure 1 illustrates that oil supply shocks predominantly occurred during global and regional financial and economic crises, including the 2002 Latin American crisis, the 2006 emerging market crisis, and the 2008 global financial crisis. Due to these crises, there was a supply glut that resulted in low oil prices during these periods (Baffes et al., 2015).

The high spikes observed between 2014 and 2016 are the results of alternate supply and demand shocks. In fact, studies show that the decline in oil prices, from mid-2014 to early 2015,was mainly due to supply factors such as increased U.S. oil production, easing geopolitical tensions, and changing OPEC policies (see Stocker et al., 2018) . However, the weakening of demand prospects, spurred by a downturn in global economic activities, also significantly contributed to the decline in oil prices, particularly from mid-2015 to early 2016. This decline in global economic activities can be attributed to several factors, including reduced investments, lower consumer spending, and the slowing down of major economies. The interplay between these elements exacerbated the drop in oil demand, further

influencing the oil market. This complex dynamic sheds light on why the sharp fall in oil prices during this period did not translate into a corresponding boost in global economic activities, as one might typically expect. Such an outcome, where reduced oil prices fail to stimulate economic growth, underscores the intricate relationship between energy markets and the global economy (see Anachedo et al. 2021, Baumeister et al., 2022)

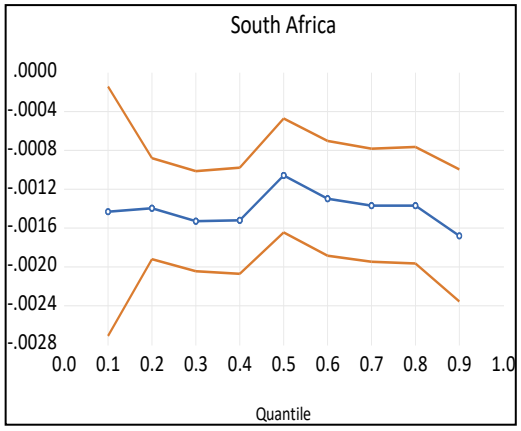
3.2 estimation, results and their interpretation

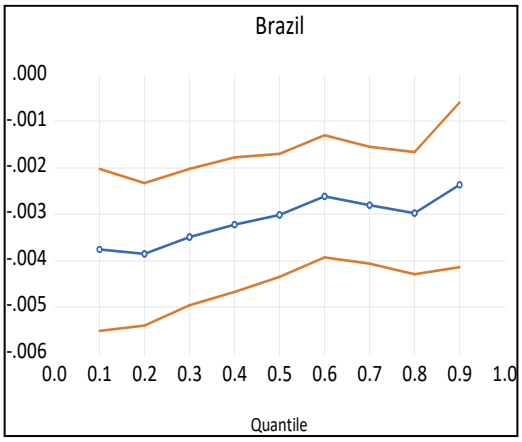
Figures 2 and 3 display the outcomes of the quantile regression analysis, specifically focusing on the estimation of the slope coefficient β_1^{θ} . This coefficient represents the relationship between stock returns and demand, as well as supply shocks in oil prices, as outlined in Equation 1.

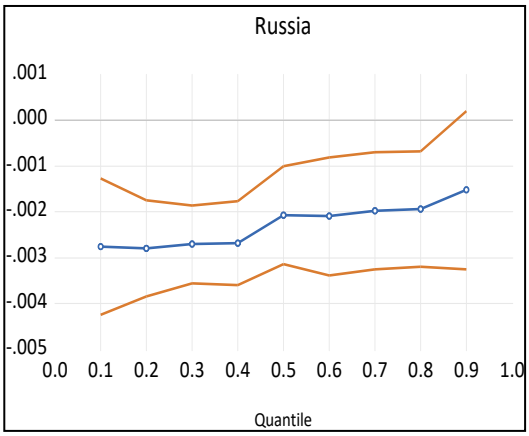
Figure 2 reveals a generally negative impact of oil demand shocks on stock market returns in BRICS countries. However, this adverse effect diminishes at higher quantiles of stock market returns, typical of a bull market. This phenomenon is attributable to the fact that rising oil prices, stemming from changes in oil demand, can escalate production costs and spur inflation. These factors, in turn, adversely affect stock market returns (Anand and Paul, 2021).

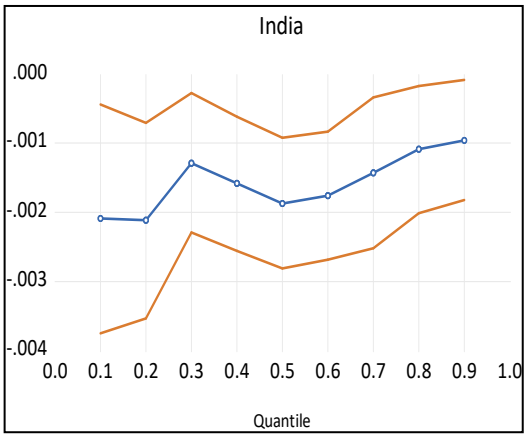
Figure 3 examines the impact of supply shocks on the stock market performance of BRICS countries. Overall, these shocks appear to have a neutral effect on the stock markets of these nations. However, an exception is observed in Russia, the most prominent oil producer among the BRICS. In Russia, supply shocks show a significant impact on stock market performance.. In Russia, supply shocks correspond to a decline in bullish stock markets. This unique response in Russia could be due to positive oil supply shocks lowering oil prices, subsequently reducing government revenue and the profits of oil-dependent firms. The overall neutral impact of oil supply shocks on BRICS markets, as shown in Figure 3, might be because these shocks often coincide with global financial and economic crises (as illustrated in Figure 1). During such crises, firms and stock markets are typically unable to capitalize on the lower oil prices resulting from positive supply shocks.

Figure 2. Time-varying coefficient in the relationship between demand oil shocks and returns









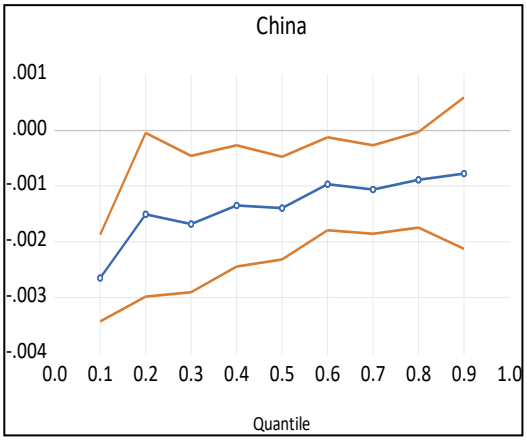
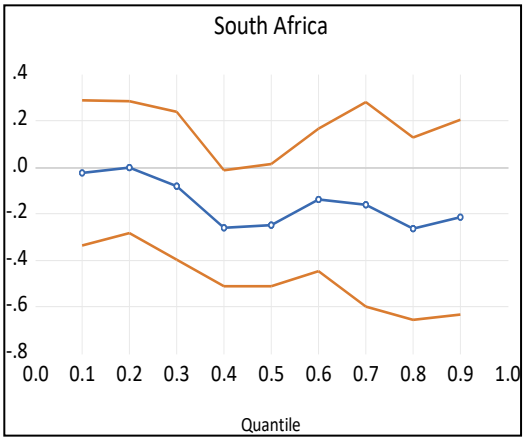
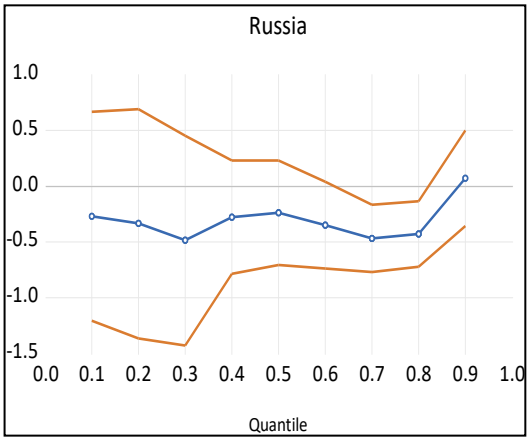
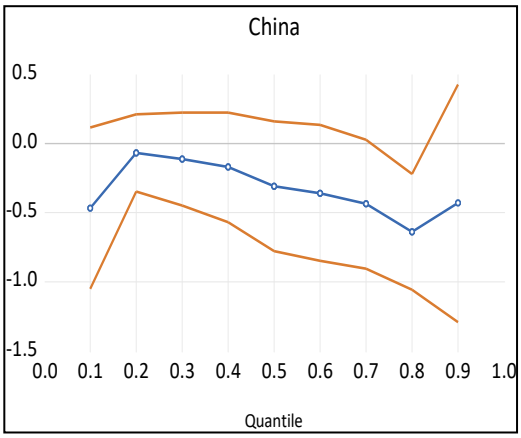
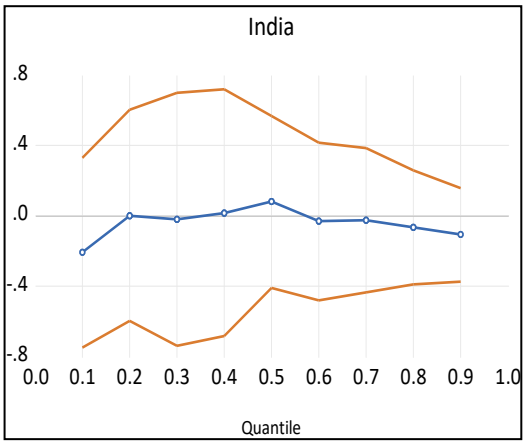


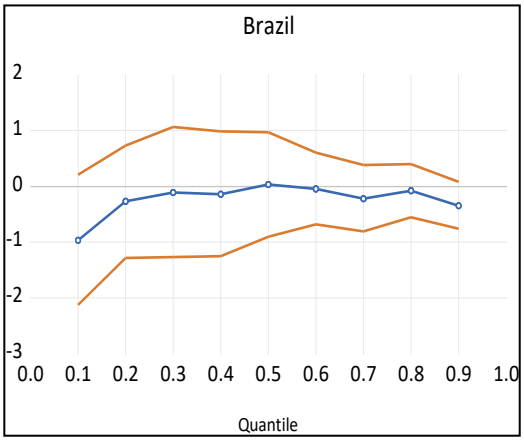
Figure 3. Time-varying coefficient in the relationship between supply oil shocks and returns











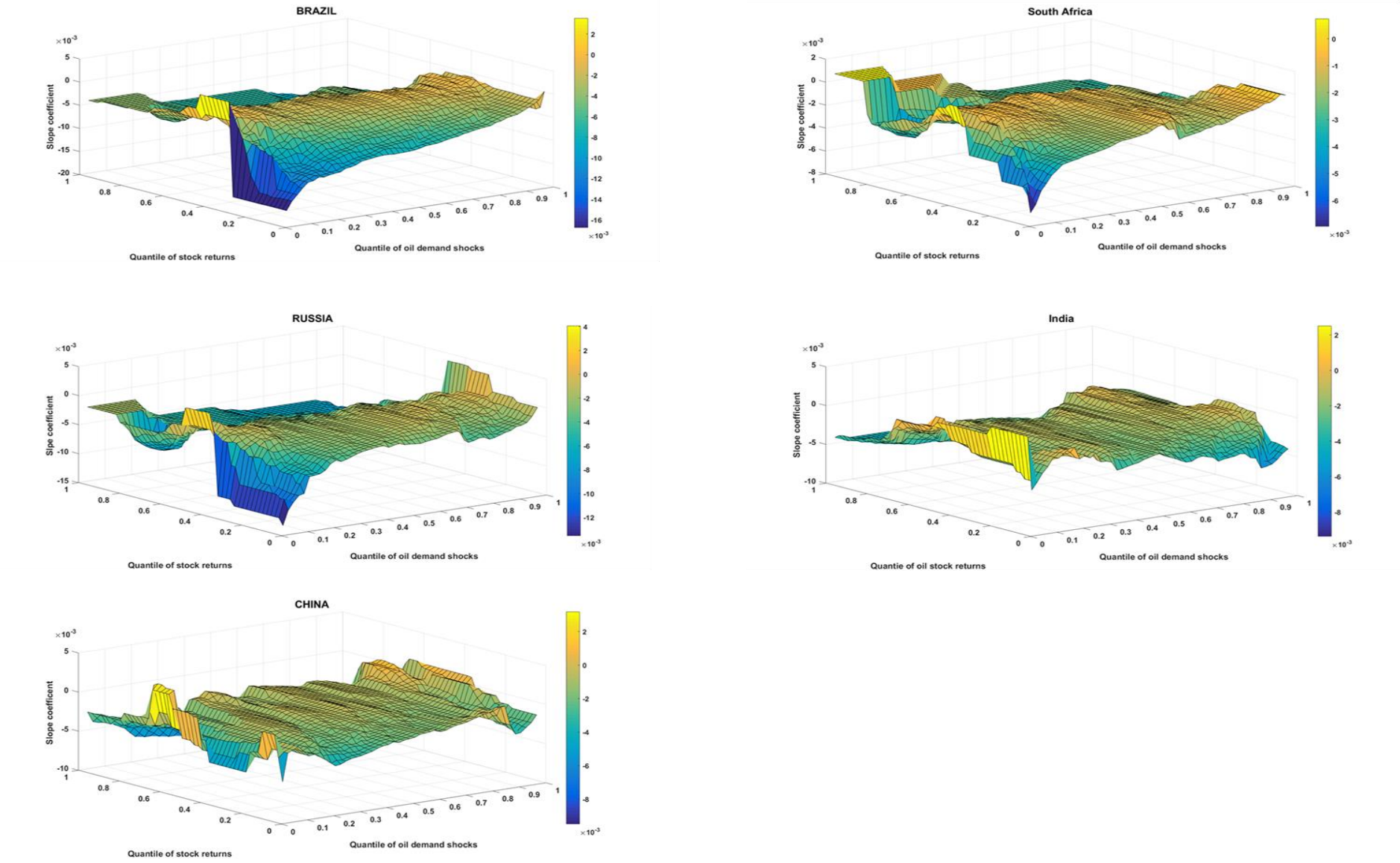
While Figures 2 and 3 highlight the effects of oil demand and supply shocks on BRICS stock market returns, they primarily show how these shocks influence stock markets in different states, such as bullish or bearish periods. However, they do not provide insights into the size or distribution of these shocks. So far, the analysis does not account for the varying impacts of these shocks based on their magnitude, which is determined by their distribution. It's important to note that firms may respond differently to minor versus significant oil demand and supply shocks, depending on their industry. Similarly, the reaction of a country's stock market to oil demand and supply shocks can vary based on the size of the shock and the country's resource endowment. To address these gaps, the forthcoming analysis will employ the quantile-on-quantile methodology, which aims to overcome the limitations observed in the quantile methodology approach previously discussed[4].

The outcomes of the quantile-on-quantile regression analysis, examining the impact of oil demand shocks on stock returns in BRICS countries in Figure 4, appear to reveal two distinct trends. The first trend pertains to resource-rich countries, specifically Brazil, South Africa, and Russia. These nations show one pattern of response to oil demand shocks. On the other hand, the second trend is observable in countries with lesser resource abundance, namely India and China, which demonstrate a different response pattern to these shocks.

In countries with abundant resources, analysis reveals that during periods of low oil demand shocks, indicating a potential decrease in oil prices, stock market returns in these nations decline when their markets are bearish, yet rise in bullish markets. Conversely, when oil demand shocks are high, indicating excessive demand, stock markets in bearish states tend to perform well. Several factors contribute to this phenomenon. Firstly, the consistent response of resource-rich countries' stock markets to oil price fluctuations is attributed to the tendency of oil demand changes to coincide with shifts in other commodity demands. High oil prices, driven by strong demand, often signal global economic expansion and increased demand for various commodities (Ji and Fan, 2012; Baffes, 2007). As global economic activities intensify, the rising consumption of oil and other raw materials drives up their prices.

[4] A notable shortcoming of the quantile approach is the unexpected decrease in stock market returns in Russia following changes in oil demand shocks. Conventionally, an increase in oil demand should benefit an oil-rich country like Russia. However, this anticipated positive impact is not observed in our results.

Figure 4. Quantile-on-quantile results of the impacts of the oil demand shocks on stock returns in BRICS



Secondly, a decrease in oil demand or negative oil demand shocks does not facilitate recovery in bearish stock markets of resource-rich countries. This is due to limited income and a scarcity of resources essential for revitalising real and financial activities. Lastly, significant increases in oil demand shocks aid the recovery of stock markets in resource-abundant nations. However, excessively large oil demand shocks may lead to the formation and subsequent bursting of market bubbles, thereby reducing stock market returns when the market is bullish. Excessive leverage and overvaluation in stock markets, often influenced by factors like a sharp rise in commodity prices, can exacerbate market downturns by creating bubbles that eventually burst due to irrational investor behavior (Dale et al., 2005; Dhesi and Ausloos, 2016; Tuyon and Ahmad, 2018).

In less resource-abundant or resource-dependent BRICS nations, exemplified by India, the dynamics of stock market reactions to oil demand shocks differ significantly. When there is a negative or lower change in oil demand shocks, stock market returns generally increase, aiding the recovery of the market in a bearish phase. This positive effect on stock markets is primarily attributed to the reduction in production costs that result from these negative oil demand shocks. Lower oil prices decrease operational expenses for businesses, particularly in sectors heavily reliant on oil for energy and production processes. This cost reduction can improve company profitability, reflecting positively in stock market performance.

Conversely, high demand shocks in oil, indicative of increased oil prices, typically lead to higher production costs. For countries like India, which are less resource-abundant and more dependent on oil imports, this increase in oil prices can have a significant adverse impact. In such scenarios, the elevated production costs strain the profitability of businesses, especially those heavily reliant on oil. This strain is often reflected in the stock market, resulting in reduced returns, particularly when the market is already in a bear state. The heightened production costs can exacerbate the challenges faced by companies in a bear market, leading to a more pronounced negative impact on stock market returns. Moreover, these dynamics also imply that stock markets in such countries are more sensitive to global oil price fluctuations. In bear markets, any increase in oil prices can intensify the negative sentiment, further dampening investor confidence and stock market performance. Conversely, in a bullish market, the effects might be less pronounced due to overall positive market sentiment and stronger economic conditions that can better absorb the impact of higher oil prices.

The findings illustrated in Figure 4 provide a nuanced understanding of how high demand shocks impact stock markets in countries with varying levels of natural resources. In high-resource countries, these shocks often trigger a 'wealth effect,' which proves to be advantageous for stock markets, particularly during periods requiring market recovery, such as when the market is in a bearish state. This wealth effect is primarily driven by increased revenues and profits from higher demand and prices for their natural resources, which in turn boosts investor confidence and stimulates stock market growth. However, this wealth effect, while beneficial in bear markets, can lead to adverse outcomes when the market is bullish. In such scenarios, the increased

optimism and influx of capital can inflate stock prices beyond sustainable levels, creating a market bubble. As this bubble grows, it becomes increasingly vulnerable to a sudden burst, especially if the high demand and accompanying high prices for resources prove to be temporary or if other economic factors shift. This bursting of the bubble can lead to rapid declines in stock values, eroding wealth and damaging investor confidence.

Conversely, in countries with less abundant resources, the scenario differs significantly. Here, high demand shocks usually translate into increased production costs, particularly due to higher prices for imported resources like oil. This increase in costs can be detrimental to stock markets, especially when they are in a bear state. In such situations, companies face squeezed profit margins, leading to lower earnings and potentially reduced dividends for shareholders. This can dampen investor sentiment and exacerbate the downturn in the stock market.

Overall, the effect of high demand shocks on stock markets significantly depends on a country's resource endowment and the current state of its stock market, either amplifying growth in bear markets or potentially causing bubbles in bull markets for resource-rich countries, and exerting downward pressure in bear markets for those with fewer resources.

Figure 5 illustrates the outcomes of a quantile-on-quantile analysis concerning the impacts of oil supply shocks on stock returns within the BRICS nations. This analysis reveals two primary observations. The first observation is the unique effects of supply shock variability on stock market returns, irrespective of the market's state or regime. This finding suggests that a specific magnitude of oil supply shocks tends to have a consistent impact on stock markets, regardless of whether they are in a bullish or bearish state. The rational of this finding should be that supply shocks primarily influence the total cost of firms in general and thus, their profit. Lower costs resulting from high oil supply shocks can be beneficial for listed firms, enhancing profitability and investor sentiment, whereas higher costs have the opposite effect, potentially harming corporate profits and investor confidence, irrespective of the market's broader state.

The second observation from Figure 5 is the divergence in responses between oil importing and exporting countries within BRICS. For net oil importers like Brazil, India, China, and South Africa, high oil supply shocks, which often lead to a decrease in the real price of oil, are beneficial. This is because lower oil prices reduce production costs, thereby potentially increasing the profitability of businesses reliant on oil as an input. This dynamic is reflected in the higher stock returns observed at higher quantiles of oil supply shocks for these countries, as shown in Figure 5.

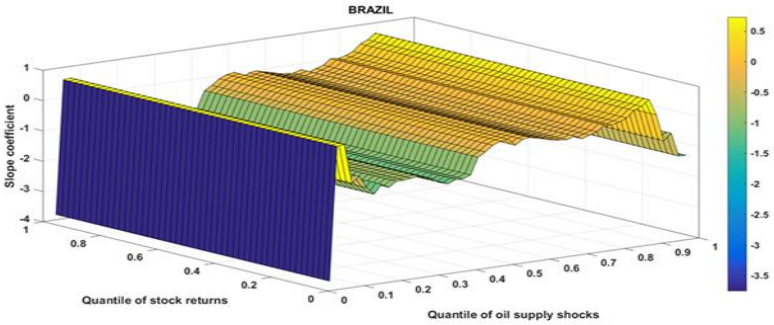
Conversely, the situation for Russia, the net oil exporter in the BRICS group, is markedly different. In Russia's case, an increase in oil supply shocks, which tends to lower oil prices and hence the revenue of oil-exporting sectors, diminishes the profit opportunities for listed firms. This adverse impact is particularly pronounced in sectors directly or indirectly reliant on oil exports. Consequently, these increased supply shocks contribute to poorer performance in the Russian stock market, as evidenced by the trends depicted in Figure 5.

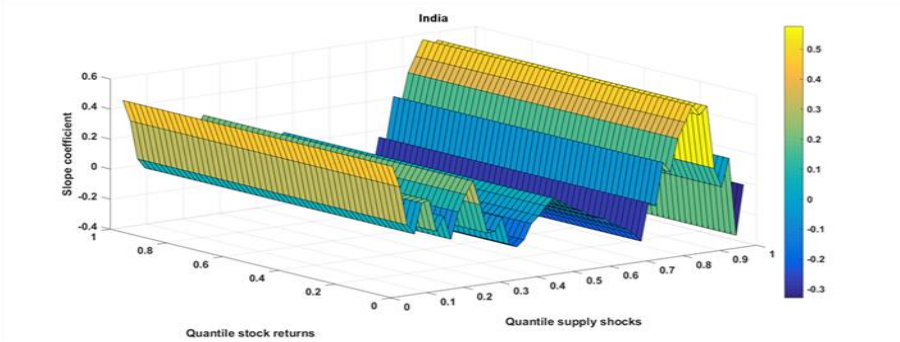
Overall, these findings underscore the complex and varied impacts of oil supply shocks on stock markets within the BRICS nations, influenced significantly by each country's status as either an oil importer or exporter.

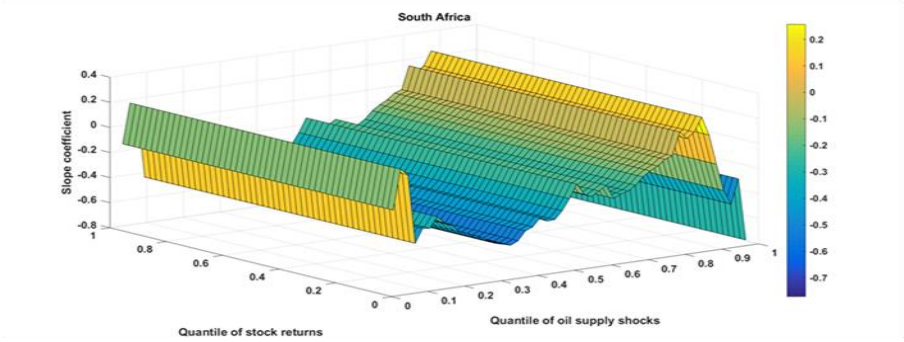
To enhance the validity of our findings, we implemented an alternative methodology for distinguishing supply and demand shocks within the oil market. This alternative approach is informed by the framework proposed by Kilian and Park (2009), which is detailed in Equation 5. By applying this revised identification strategy, we sought to verify the robustness of our initial results.

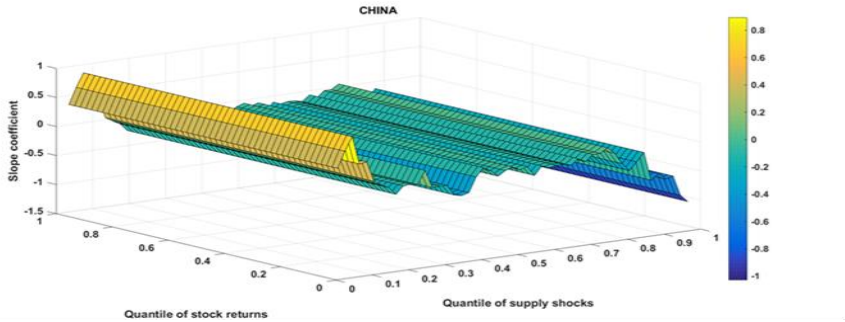
The results of this comparative analysis, depicted in Figure 6, focuses on the impact of oil demand shocks on the stock market returns across the BRICS nations (Brazil, Russia, India, China, and South Africa). This analysis echoes the insights gleaned from Figure 4, particularly highlighting the nuanced response of stock returns to oil demand shocks in resource-rich countries such as Russia, Brazil, and South Africa. Specifically, during episodes characterized by diminished oil demand shocks, these countries tend to experience a notable downturn in stock market returns. This trend is predominantly observed in bearish market conditions. Conversely, periods marked by heightened oil demand shocks, which signify surging demand levels, appear to have a positive correlation with stock market performance in these nations, especially under bearish market conditions. This counterintuitive phenomenon suggests that in times of excessive demand for oil, stock markets in countries with significant natural resources can outperform, even when the broader market sentiment may be downbeat.

Figure 5. Quantile-on-quantile results the impacts of the oil supply shocks on stock returns in BRICS









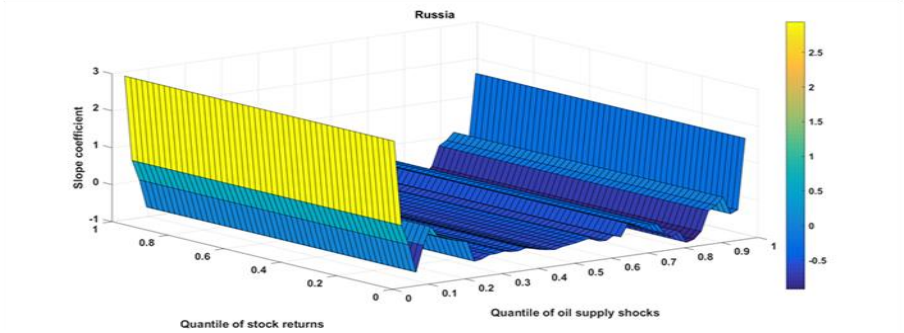
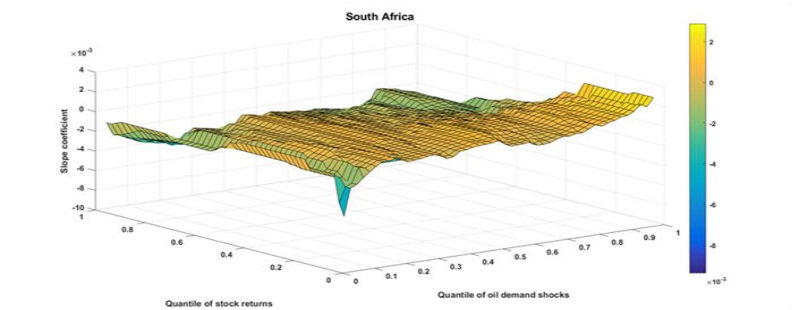
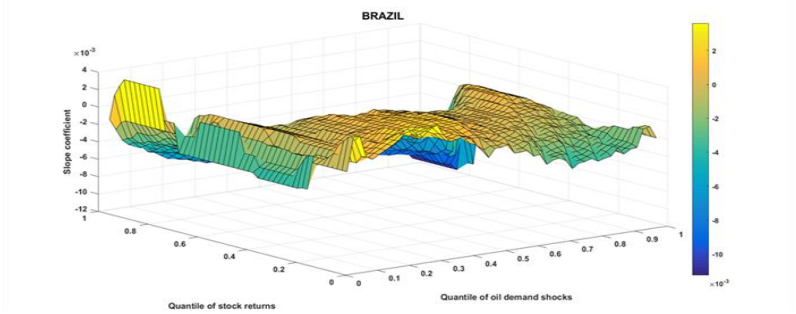
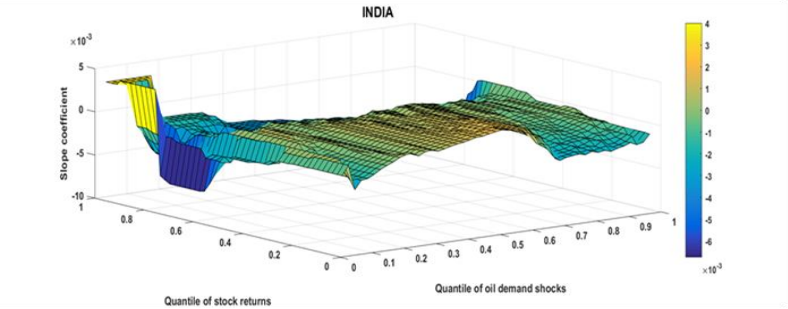
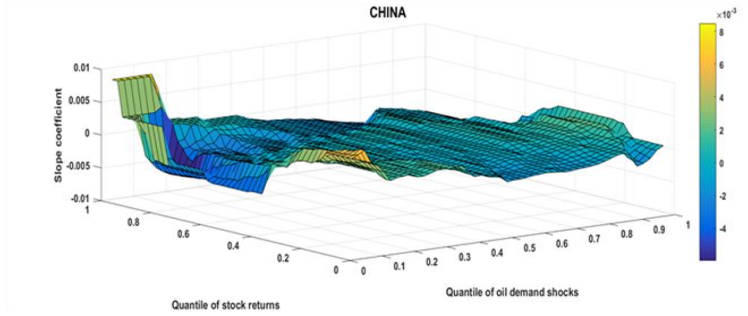


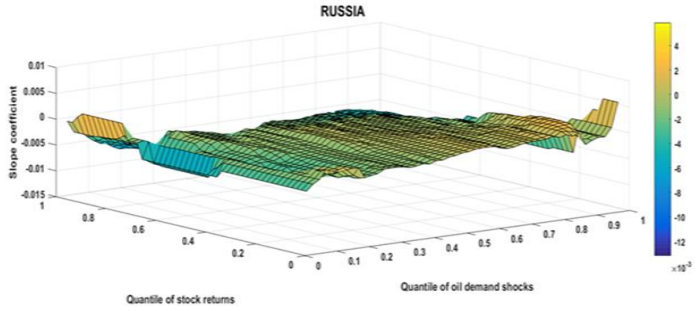
Figure 6. Quantile-on-quantile results the impacts of the oil demand shocks on stock returns in BRICS: Kilian and Park' identification











4. CONCLUSION

This paper evaluates the impact of oil price shocks on stock market returns within the BRICS nations. It employs a quantile-on-quantile regression approach to demonstrate that the relationship between these two variables is asymmetrical and varies according to the distribution of both oil price shocks and stock market returns. Furthermore, the study introduces an innovative method for categorizing oil price shocks into supply and demand shocks, based on the elasticity characteristics of oil supply curve.

The empirical analysis reveals that the impact of oil demand shocks on stock market returns in BRICS nations exhibits two distinct patterns, contingent on whether the countries are resource-rich or not. In countries with abundant resources like Brazil, South Africa, and Russia, the findings indicate that during periods of low oil demand shocks, which suggest a potential decline in oil prices, stock market returns in these nations decrease in bearish markets but increase in bullish markets. In contrast, in scenarios of high oil demand shocks, signaling excessive demand, stock markets in bearish conditions tend to perform positively in these resource-rich countries. This consistent response of stock markets in resource-rich countries to oil price changes can be attributed to several factors, including the tendency for shifts in oil demand to align with changes in demand for other commodities.

In BRICS nations with less resource abundance or dependency, such as India, the empirical analysis reveals a markedly different dynamic in stock market responses to oil demand shocks compared to their resource-rich counterparts. Specifically, when there is a decrease or negative change in oil demand shocks, stock market returns typically rise, facilitating market recovery during bearish phases in the country. This beneficial impact on stock markets is mainly due to the decreased production costs resulting from these negative oil demand shocks.

The empirical analysis concerning the distributional response of stock returns to supply shocks highlights two key observations. Firstly, the distinct impact of supply shock variability on stock market returns is evident regardless of the market's current state, whether bullish or bearish. This implies that a specific level of oil supply shocks consistently influences stock markets, independent of their prevailing trend. The rationale behind this observation is that supply shocks primarily affect the overall costs of firms, thus impacting their profits. High oil supply shocks, leading to reduced costs, can benefit listed companies by boosting profitability and investor sentiment. Conversely, increased costs due to lower supply shocks may negatively affect corporate profits and investor confidence, regardless of the broader market condition. The second observation notes a contrast in reactions between oil-

importing and exporting countries within the BRICS bloc. For net oil importers like Brazil, India, China, and South Africa, substantial oil supply shocks, typically resulting in lower real oil prices, are advantageous. In contrast, for Russia, the sole net oil exporter in the BRICS group, an increase in oil supply shocks, which generally leads to reduced oil prices and subsequently lower revenues for oil-exporting sectors, adversely affects the profit potential of listed companies.

The insights from this paper are crucial for both policymakers and investors in developing economic and business strategies, respectively, that are finely tuned to the distinct economic conditions and characteristics of each country. For example, when facing oil price shock or volatility triggered by sudden drops in oil production due to geopolitical tensions or natural disasters, it becomes essential for policymakers to discern the nature of the oil shock and devise appropriate policies that align with their country's specific attributes. This tailored approach ensures more effective management of the economic impact of oil market fluctuations.

REFERENCES

Al-Fayoumi, N., Bouri, E., & Abuzayed, B. (2023). Decomposed oil price shocks and GCC stock market sector returns and volatility. Energy Economics, 126, 106930.

Anachedo, C. K., Echekoba, F. N., Egbunike, F. C., & Ubesie, C. M. (2021). Lessons and Policy Implications of Nigeria's Economic Recession: 2016-2017. Journal of Contemporary Issues in Accounting, 2(1), 65-77.

Anand, B., & Paul, S. (2021). Oil shocks and stock market: Revisiting the dynamics. Energy Economics, 96, 105111.

Baffes, J. (2007). Oil spills on other commodities. Resources Policy, 32(3), 126-134.

Baffes, J., Kose, M. A., Ohnsorge, F., & Stocker, M. (2015). The great plunge in oil prices: Causes, consequences, and policy responses. Consequences, and Policy Responses (June 2015).

Basher, S.A. and Sadorsky, P., 2006. Oil price risk and emerging stock markets. *Global finance journal*, *17*(2), pp.224-251.

Baumeister, C., Korobilis, D., & Lee, T. K. (2022). Energy markets and global economic conditions. Review of Economics and Statistics, 104(4), 828-844.

Bjørnland, H. C. (2009). Oil price shocks and stock market booms in an oil exporting country. Scottish journal of political economy, 56(2), 232-254.

Cunado, J. and de Gracia, F.P., 2014. Oil price shocks and stock market returns: Evidence for some European countries. *Energy Economics*, *42*, pp.365-377.

Dale, R. S., Johnson, J. E., & Tang, L. (2005). Financial markets can go mad: evidence of irrational behaviour during the South Sea Bubble 1. The Economic history review, 58(2), 233-271.

Dhesi, G., & Ausloos, M. (2016). Modelling and measuring the irrational behaviour of agents in financial markets: Discovering the psychological soliton. Chaos, Solitons & Fractals, 88, 119-125.

Escribano, A., Koczar, M. W., Jareño, F., & Esparcia, C. (2023). Shock transmission between crude oil prices and stock markets. Resources Policy, 83, 103754.

Ge, Z. (2023). The asymmetric impact of oil price shocks on China stock market: Evidence from quantile-on-quantile regression. The Quarterly Review of Economics and Finance, 89, 120-125.

Ji, Q., & Fan, Y. (2012). How does oil price volatility affect non-energy commodity markets?. Applied Energy, 89(1), 273-280.

Kilian, L. and Park, C., 2009. The impact of oil price shocks on the US stock market. *International Economic Review*, *50*(4), pp.1267-1287.

Phan, D. H. B., Sharma, S. S., & Narayan, P. K. (2015). Oil price and stock returns of consumers and producers of crude oil. Journal of International Financial Markets, Institutions and Money, 34, 245-262.

Ready, R.C., 2018. Oil prices and the stock market. Review of Finance 22 (1), 155–176.

Sim, N. and Zhou, H., 2015. Oil prices, US stock return, and the dependence between their quantiles. *Journal of Banking & Finance*, *55*, pp.1-8.

Stocker, M.; Baffes, J.; Some, Y. M.; Vorisek, D.; Wheeler, C.M (2018). The 2014-16 Oil Price Collapse in Retrospect: Sources and Implications. Policy Research Working Paper;No. 8419.

Soliman, M. (2020). EGYPT'S INFORMAL ECONOMY. Journal of International Affairs, 73(2), 185-194.

Tuyon, J., & Ahmad, Z. (2018). Psychoanalysis of investor irrationality and dynamism in stock market. Journal of Interdisciplinary Economics, 30(1), 1-31.

Yıldırım, D.Ç., Erdoğan, S. and Çevik, E.İ., 2018. Regime-Dependent Effect of Crude Oil Price on BRICS Stock Markets. *Emerging Markets Finance and Trade*, *54*(8), pp.1706-1719.

Zhu, H., Guo, Y., & You, W. (2015). An empirical research of crude oil price changes and stock market in China: evidence from the structural breaks and quantile regression. Applied Economics, 47(56), 6055-6074.