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Article

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International Journal of Energy Economics and Policy

Provided in Cooperation with:
International Journal of Energy Economics and Policy (IJEEP)

Reference: Loc Dong Truong/Nguyen Thi Kim Anh et. al. (2024). The asymmetric effects of oil prices on stock returns : evidence from Hanoi Stock Exchange, Vietnam. In: International Journal of Energy Economics and Policy 14 (5), S. 236 - 241.
https://www.econjournals.com/index.php/ijeep/article/download/16672/8140/38822.
doi:10.32479/ijeep.16672.

IJEEP

INTERNATIONAL JOURNAL OF ENERGY ECONOMICS AND POLICY

EJ EconJournals

ISSN: 2146-4553

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(5), 236-241.

EJ EconJournals

The Asymmetric Effects of Oil Prices on Stock Returns: Evidence from Hanoi Stock Exchange, Vietnam

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Received: 27 April 2024 **Accepted:** 24 July 2024 **DOI:** https://doi.org/10.32479/ijeep.16672

ABSTRACT

This study is devoted to investigating the asymmetric effects of oil prices on stock returns for Hanoi Stock Exchange (HNX). The data used in this study are weekly series of HNX-Index, WTI crude oil prices and geopolitical risks (GPRs) Index covering the period from January 2, 2010 to December 31, 2023. This study employed a nonlinear Autoregressive Distributed Lag (NARDL) bounds testing approach to estimate the short-term and long-term asymmetric effects of oil prices on the market returns. We found that in the short-term, oil prices have negative asymmetric effects on the market returns. Specifically, 1% increase in positive changes of oil prices immediately leads to 0.0085% decrease in the market returns. However, 1% increase in negative changes of oil prices is associated with 0.1487% decrease in the market returns. In the long-term, the estimated results confirm that both the negative and positive changes of oil prices have significantly negative effects on the market returns. Finally, the results obtained from the error correction model (ECM) indicate that 81.54% of the disequilibria from the previous week are converged and corrected back to the long-term equilibrium in the current week.

Keywords: Oil Prices, Stock Market Returns, HNX
JEL Classifications: E44, G12, G41

1. INTRODUCTION

Oil has played an important role in any economy as it is an essential input for most companies. An increase in oil prices is associated with an increase in production costs, hence it could deteriorate economic activities, especially for oil-importing countries. The impact of oil prices on stock returns have extensively investigated during the recent decades. However, the findings from these studies have not reached a consensus. Specifically, most of studies found that oil prices have a negative effect on stock returns (Jones and Kaul, 1996; Sadorsky, 1999; Kilian and Park, 2009; Chen, 2010; Filis et al., 2011; Cunado and de Gracia, 2014; Raza et al., 2016; Elian and Kisswani, 2018; de Jesus et al., 2020), while some studies provided evidence on positive impact of oil prices on stock returns (Narayan and Narayan, 2010; Arouri and Rault, 2011; Bouri, 2015; Mandal and Datta, 2024; Luo and Qin, 2017; de Jesus et al., 2020; Cevik et al., 2021). These studies focused mainly on the US and other developed countries and less on developing countries. In addition, most of these studies have assumed that the effect of oil prices on stock returns is symmetric, meaning that an increase in oil prices has the same effect on stock returns compared to a decrease in oil prices with the same magnitude. However, the effect of oil prices on stock returns could be asymmetric.

Vietnam, a transitional economy from a central planning to a market-based economy, has been deeply and widely integrated in the world economy since 1986 (Truong and Vo, 2023). Vietnam's economy has been heavily dependent on oil imports. In fact, oil imports accounted for nearly one-third of the country's consumption in 2022 (Nguyen, 2024). Therefore, oil price fluctuations could influence on stock prices in Vietnam. Although the effect of oil prices on stock returns has substantially investigated in both developed and emerging stock markets, to the best of our knowledge, no evidence on this effect has been found for Hanoi Stock Exchange (HNX). To fill the gap in the literature, this study examines the impact of oil prices on stock returns for the HNX. This research makes several contributions to the existing literature in the following aspects. First, this study provides fertile ground for investigating the effect of oil prices on stock returns due to the fact the Vietnam's economy has been in a transitional period with a growing consumption of oil and deep integration into the world economy. Therefore, it is expected that the effect of oil prices on stock returns will be more pronounced for the HNX. Second, while most of previous studies examined symmetric effects of oil prices on stock returns, this research investigated the asymmetric effects of oil prices on stock returns. The HNX is characterized by a large number of small individual investors, thus responses of investors to oil prices could be asymmetric. The rest of this paper is organized as follows. Section 2 reviews the related literature. Section 3 describes the data and the research methodology used in the study. Section 4 discusses the empirical findings. Finally, conclusions are presented in Section 5.

2. LITERATURE REVIEW

Theoretically, oil prices could have negative or positive effects on stock returns depending on the nature of shocks (Smyth and Narayan, 2018). The effect of oil prices on stock returns can be explained on the basis of cash-flow theory which states that value of stocks is equal to the present value of expected cash flows. On the one hand, there are two ways to justify the negative effect of oil prices on stock returns. First, because oil is used as a vital input for most companies, an increase in oil prices results in an increase in production costs. Second, an increase in oil prices can lead to an increase in expected inflation, hence nominal interest rates increase. It is noted that interest rates are used as discount rates to determine the value of stocks. Therefore, higher interest rates are associated with lower stock returns. On the other hand, a reason could be used to explain the positive impact of oil prices on stock returns is that investors could positively respond to increasing oil prices because higher oil prices could be associated with greater economic growth and stronger performance of firms (Kollias et al., 2013).

Empirically, the effects of oil prices on stock returns have been widely documented in the financial literature over the last few decades. Most of empirical studies in this field have foused on specific countries or groups of countries (Smyth and Narayan, 2018). However, empirical findings from these studies have not reached a consensus. One group of studies documented that oil prices have negative effects on stock returns. As a pioneer in this field, Jones and Kaul (1996) found that oil prices have a negative effect on stock returns for the United States, Canada, Japan and the United Kingdom. In addition, Sadorsky (1999), Kilian and Park (2009) and Chen (2010) found evidence in the US stock market to corroborate the finding of Jones and Kaul (1996). In addition, Filis et al. (2011) examined the relationship between oil prices and stock market returns for both oil-importing and oil-exporting countries. They found a negative relationship between oil prices and stock market prices for oil-importing countries. Besides, Cunado and de Gracia (2014) investigated the effect of oil price changes on stock returns for 12 oil-importing European countries for the period from February 1973 to December 2011. The findings derived from Vector Autoregressive (VAR) and Vector Error Correction Models (VECM) indicate that oil price changes have a significantly negative effect on stock market returns in most of the countries. In emerging markets, Raza et al. (2016) investigated effects of oil prices on stock returns for China, India, Brazil, Russia, South Africa, Mexico, Malaysia, Thailand, Chile and Indonesia during the period from January 2008 to June 2015. Using the nonlinear autoregressive distributed lag (NARDL) bounds testing approach, they found that oil prices have negative effects on stock returns for all stock markets in both the short-term and long-term. Similarly, Elian and Kisswani (2018) estimated the short-term and long-term effects of oil price on stock market returns in Kuwait for the period from January 2000 to December 2015. The results derived from the autoregressive distributed lag (ARDL) bounds testing approach indicate that oil prices have negative effects on the market returns in both the short-run and long-run. In addition, de Jesus et al. (2020) determined the effects of oil prices on stock market returns in oil-importing and oil-exporting countries. They found that oil prices have positive effects on market returns for oil-importing countries in both the short-term and long-term.

Contrary to the first category, several studies found a positive relationship between oil prices and stock returns. Specifically, Arouri and Rault (2011) investigated the effect of oil prices on stock returns for gulf cooperation council (GCC) countries. The findings of this study confirmed that oil prices have a positive effect on stock returns for all contries, except Saudi Arabia. Using VAR-GARCH (Vector Autoregressive - Generalized Autoregressive Conditional Heteroskedasticity), Bouri (2015) explored the relationship between oil prices and market returns for the Lebanese stock market during the period from January 30, 1998 to May 30, 2014. The main finding of the study confirm that there is a positive causal effect from oil price moments to the market returns for the whole studied period. In addition, Luo and Qin (2017) examined the effect of oil price changes and oil price volatility on Chinese stock market and five sector returns. The empirical findings reveal that oil price changes have a positive effect on the market returns and all sector returns. Similarly, de Jesus et al. (2020) found a positive long-term effect of oil prices on stock returns for the oil-exporting countries (Saudi Arabia, Canada, Norway and Russia). Besides, Cevik et al. (2021) examined the relationship between oil prices and stock market returns in Saudi Arabia during the period from 2001 to 2018. Based on the results derived from causality tests, they concluded that oil price changes is positively associated with stock market returns. In Vietnam, Narayan and Narayan (2010) investigated the effect of oil price on stock prices during the period from July 28, 2000 to June 16, 2008. They found that oil prices have a significantly positive effect on stock prices.

In short, the existing literature has provided mixed evidence on the effect of oil prices on stock returns. Specifically, some studies found the negative effect of oil prices on stock returns while others reported the positive impact of oil prices on stock returns. The impact of oil prices on stock returns depends on the nature of the shock (Kilian and Park, 2009). If oil prices increase as a result of uncertainty about future oil supply shortage, oil prices could have a negative impact on stock returns, while oil price changes caused by an unanticipated global economic expansion could have a positive effect on stock returns. Based on the cash-flow theory and empirical evidence reviewed, it is hypothesized that oil prices have negative effects on stock returns for the HNX.

3. DATA AND RESEARCH METHODOLOGY

3.1. Data

The data utilized in this study include weekly series of HNX-Index, WTI crude oil prices and geopolitical risks (GPRs) index covering the period from January 20, 2010 to December 31, 2023. The HNX-Index is a market capitalization weighted index calculated from all stocks traded at the Hanoi Stock Exchange (HNX). The GPRs index is the Index developed by Caldara and Iacoviello (2022). All data are obtained from the Wednesday in order to avoid weekend effects of stock trading and to minimize the number of holidays. The data sources are specifically presented in Table 1.

3.2. Research Methodology

To examine the asymmetric effects of oil prices on stock returns for the HNX, the baseline regression model is employed in this study as follows:

$$R_t = \beta_0 + \beta_1 LO_t + LGPR_t + \varepsilon_t \quad (1)$$

where:

- R_t: Market return of HNX at week t.

The weekly market returns are computed by the following equation:

$$R_t = Log(P_t) - Log(P_{t-1}) \quad (2)$$

where:

- P_t: HNX-Index at week t;
- P_{t-1}: HNX-Index at week t-1.
- LO_t: Natural logarithm of WTI crude oil price at week t.
- $LGPR_t$: Natural logarithm of the GPRs Index at week t;

To investigate the short-term and long-term asymmetric effects of oil prices on the market returns for HNX, we apply the nonlinear autoregressive distributed lag (NARDL) bounds testing approach

Table 1: Data sources of the study

Data	Data source
HNX-Index	Investing.com (https://www.investing.com, accessed on 30 January 2024)
Oil prices	Investing.com (https://www.investing.com, accessed on 15 January 2024)
GPRs Index	Caldara and Iacoviello's website (https://www.matteoiacoviello.com, accessed on 15 January 2024)

which was proposed by Shin et al. (2014) as an extended model of the ARDL model of Pesaran et al. (2001). In this model, oil prices are decomposed in positive and negative partial sum series. It is important to note that the NARDL bound requires no series under consideration is integrated of order 2 or higher (Truong et al., 2024). Therefore, the order of integration of all variables should be detected before performing the bounds test. In this study, the ADF and Phillips-Perron tests are used to examine whether the studied variables are stationary.

3.2.1. NARDL bound test for cointegration

Before investigating the short-term and long-term effects of oil prices on the market returns, the NARDL bound test is employed to examine the cointegration between variables in the model. The NARDL bound test of cointegration is estimated by using the following equation:

$$\Delta R_t = \beta_0 + \sum_{i=1}^{q_1} \beta_{1i} \Delta R_{t-i} + \sum_{i=0}^{q_2} \beta_{2i} \Delta LO^{+}_{t-i} + \sum_{i=0}^{q_3} \beta_{3i} \Delta LO^{-}_{t-i} + \sum_{i=0}^{q_4} \beta_{4i} \Delta LGPR_{t-i} + \lambda_1 R_{t-1} + \lambda_2 LO^{+}_{t-1} + \lambda_3 LO^{-}_{t-1} + \lambda_4 LGPR_{t-1} + \varepsilon_t \quad (3)$$

where,

- Δ indicates the first difference of the variables.
- LO^+ is positive changes of oil prices.
- LO^- is negative changes of oil prices.

The null hypothesis (H_0) of the NARDL bound test is no cointegration in the long-term between variables. If the null hypothesis is rejected, the short-term and long-term effects of the oil prices on the market returns are estimated by equation (4) and (5), respectively.

$$\Delta R_t = \phi_0 + \sum_{i=1}^{q_1} \phi_{1i} \Delta R_{t-i} + \sum_{i=0}^{q_2} \phi_{2i} \Delta LO^{+}_{t-i} + \sum_{i=0}^{q_3} \phi_{3i} \Delta LO^{-}_{t-i} + \sum_{i=0}^{q_4} \phi_{4i} \Delta LGPR_{t-i} + +\delta ECM_{t-1} + \varepsilon_t \quad (4)$$

$$R_t = \phi_0 + \sum_{i=1}^{q_1} \phi_{1i} R_{t-i} + \sum_{i=0}^{q_2} \phi_{2i} LO^{+}_{t-i} + \sum_{i=0}^{q_3} \phi_{3i} LO^{-}_{t-i} + \sum_{i=0}^{q_4} \phi_{4i} LGPR_{t-i} + \varepsilon_t \quad (5)$$

4. EMPIRICAL FINDINGS

4.1. Market Returns of the HNX and Oil Prices for the Period from 2010 to 2023

On the basis of the collected data, the descriptive statistics of the market returns and oil prices for the period from January 2, 2010 to December 31, 2023 are computed and presented in Table 2. It is shown in Table 2 that the mean of weekly market returns of the HNX over the sample period is slightly positive and the standard deviation is rather high compared to the average weekly market return. Specifically, the mean of weekly market returns is only 0.01% while the standard deviation is 1.44%. In addition, statistics presented in Table 2 indicate that WTI crude oil prices fluctuated highly over the sample period. Specifically, the average oil prices is 76.99 USD, ranging from 20.37 USD to 124.97 USD, with the standard deviation of 23.67.

4.2. Unit Root Tests

As mentioned above, before using the NARDL bound test for cointegration, the unit root test must be performed as a required condition to check whether the variables used in the model have unit roots. In other words, the unit root test helps to verify whether variables are stationary or not at different orders. The unit root tests are used for both cases with and without time trends. The results of ADF and Phillips-Perron tests are presented in Table 3.

The results derived from the ADF test indicate that the null hypothesis of a unit root is significantly rejected at 1% level for R and LGPR series at the level, indicating that R and LGPR series are integrated to the order zero or I(0). In addition, Table 3 confirms that the null hypothesis of a unit root cannot be rejected at the conventional significant level (5%) for $LO^+$and LO^- series because the t-statistic is smaller than their corresponding critical value (MacKinnon's critical value). However, when the first differences are taken and tested for a unit root, the null hypothesis is significantly rejected for these series, indicating that they are stationary. With the evidences, it is concluded that LO^+ and LO^- series are integrated of order 1, denoted as I(1). Furthermore, the results of Phillips-Perron test consistently confirm that R and LGPR series are I(0) and LO^+ and LO^- series are I(1). Based on these results, it is concluded that all the variables in the model satisfy the conditions of the NARDL bound test even with or without trend.

Table 2: Summary statistics of the market returns and oil prices (2010-2023)

Variables	Obs.	Min.	Mean	Max.	SD
Market returns of the HNX	715	−0.0634	0.0001	0.0448	0.0144
WTI crude oil prices	715	20.37	76.99	124.97	23.67

Source: Own calculation on the basis of data obtained from the Investing.com Caldara and Iacoviello's website

4.3. NARDL Bound Test for Cointegration

As discussed above, this study employs the NARDL bound test proposed by Shin et al. (2014) to determine the cointegration between variables in the model. Based on the Akaike Information Criterion, the best model selected for the bounds test is ARDL (3,0,1,0). The results of the bounds reported in Table 4 confirm that the null hypothesis of no co-integration among variables can be rejected at the significant level of 1%. The rejection of the null hypothesis means that there is a long-term equilibrium relationship between the market returns and the independent variables in the model. Therefore, the NARDL model can be employed to estimate the short-term and long-term coefficients of the model.

4.4. Diagnostic Tests for the NARDL Model

To check the validity and reliability of the estimated results from the NARDL approach, diagnostic tests of Breach-Godfrey for serial correlation and ARCH (autoregressive conditionally heteroscedastic) for heteroscedasticity are employed in this study. The results of Breusch-Godfrey test presented in Table 5 confirm that the null hypothesis of no serial correlation in the model can not be rejected at the significance level of 5%, meaning that serial correlation is not present in the residuals. However, the results of ARCH test indicate that the null hypothesis of no ARCH effects can be rejected at the significance level of 1%. This evidence implies that the residuals of the model are heteroskedasticity.

4.5. Short-Term and Long-Term Effects of Oil Prices on the Market Returns

With the evidence of long-run equilibrium relationship between the market returns and the regressors, the short-term and long-term asymmetric effects of oil prices on the market returns are estimated by employing the NARDL (1,0,2,0,1) model. Due to existence of heteroskedasticity in the model, the heteroskedasticity-consistent standard errors developed by White (White standard errors) is applied in this study. The estimated short-term and long-term coefficients of the NARDL model are presented in Tables 6 and 7, respectively. In the short-term, oil prices have significantly asymmetric effects on the market returns at the 5% level. In other words, the positive and negative changes in oil prices have a different effect on the market returns. Specifically, a 1% increase in positive changes of oil prices immediately leads to 0.85% decrease in the market returns. However, a 1% increase in negative changes of oil prices is associated with 14.87% decrease in the market returns. However, the results presented in Table 6

Table 3: Results of unit root tests

Variables	ADF test		Phillips-Perron test	
	Constant	Constant and linear trend	Constant	Constant and linear trend
R				
Level	−23.91***	−24.03***	−24.73***	−24.68***
LO^+				
Level	−2.37	−0.60	−1.82	−0.88
First difference	−10.57***	−27.82***	−28.67***	−28.58***
LO^-				
Level	−0.74	−2.45	−0.99	−2.02
First difference	−7.91***	−7.97***	−23.19***	−23.13***
LGPR				
Level	−5.74***	−8.14***	−23.94***	−23.98***

***indicates significance at 1% level

indicate that in the short-term, the GPRs does not impact on the market returns. In addition, the coefficient of error correction terms is −0.8154 and statistically significant at the 1% level, meaning that 81.54% of the disequilibria from the previous week is converged and corrected back to the long-run equilibrium in the current week.

In the long-term, the estimated results confirm that both the negative and positive changes of oil prices have significantly negative effects on the market returns at the 5% level. Specifically, in the long-term, a 1% increase in oil prices is associated with 1.04% decrease in the market returns, while a 1% decrease in oil prices results in 1.10% decrease in the market returns. However, in the long-term, the GPRs have no significant effects on the market returns.

The main finding of this study is that in the long-term oil prices have negative effects on the market returns. This evidence is consistent with previous findings of Jones and Kaul (1996), Sadorsky (1999), Chen (2010), Cunado and de Gracia (2014), Raza et al. (2016), Elian and Kisswani (2017) and de Jesus et al. (2020). There are some reasons to explain the negative effects of oil prices on the HNX's market returns. First, Vietnam has experienced high economic growth over the last some decades. In addition, Vietnam is an oil-importing country. Therefore, increases in oil prices could deteriorate economic activities due to increases in production costs. In other words, fluctuations in oil prices have negative effects on expected returns of stocks. Second, increases in oil prices can be associated with increases in expected inflation. Therefore, higher oil prices lead to higher discount rates. Based on the cash-flow theory, it can be concluded that an increase in oil prices results in a decrease in the market returns. Moreover, the results of the error correction model reveals that 81.54% of the disequilibria from the previous week is converged and corrected back to the long-run equilibrium in the current week. The adjustment speed in this case is rather high, indicating that the system will quickly get back to the long-term equilibrium after a short-term shock.

Table 4: Results of the bounds test

Model	k	F-statistic	Significance level	Critical value	
				Lower bounds I (0)	Upper bounds I (1)
NARDL (3,0,1,0)	3	47.54***	5%	3.23	4.25
			1%	4.29	5.61

k represents the number of regressors. ***indicates significance at 1% level

Table 5: Results of Breusch-Godfrey and ARCH tests

Diagnostic test	Statistics	P-value	Conclusions
Autocorrelation (Breusch-Godfrey test) H_0: No serial correlation	1.83	0.16	Fail to reject H_0
Heteroskedasticity (ARCH test) H_0: No ARCH effects	30.77	0.00	Reject H_0

Table 6: Estimated short-term coefficients of the NARDL model

Variables	Coefficients	t-statistic
ΔR(−1)	−0.0999	−1.48
ΔR(−2)	−0.0699	−1.61
ΔLO^{+}	−0.0085	−2.22**
ΔLO^{-}	0.1487	4.70***
ΔLGPR	−0.0026	−0.90
ECM(−1)	−0.8154	−9.51***

***and** indicate significance at 1% and 5% levels respectively

Table 7: Estimated long-term coefficients of the NARDL model

Variables	Coefficients	t-statistic
Constant	0.0059	0.86
LO+	−0.0104	−2.23**
LO-	−0.0110	−2.41**
LGPR	−0.0031	−0.91

*** and ** indicate significance at 1% and 5% levels respectively

4.6. Structural Stability Tests

Because the NARDL approach is sensitive to structural breaks while the studied variables are quite sensitive to global events, the stability of the estimated coefficients needs to be checked. To investigate the long-term stability of the coefficients in the model, the cumulative sum of the recursive residuals (CUSUM) and the

Figure 1: Plots of cumulative sum of recursive residuals

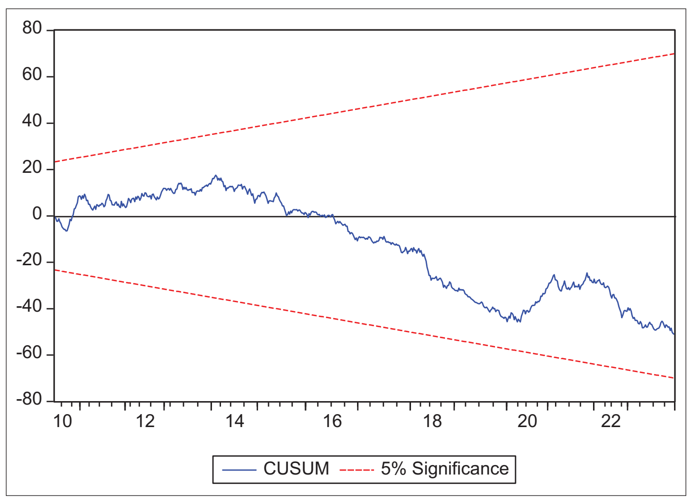
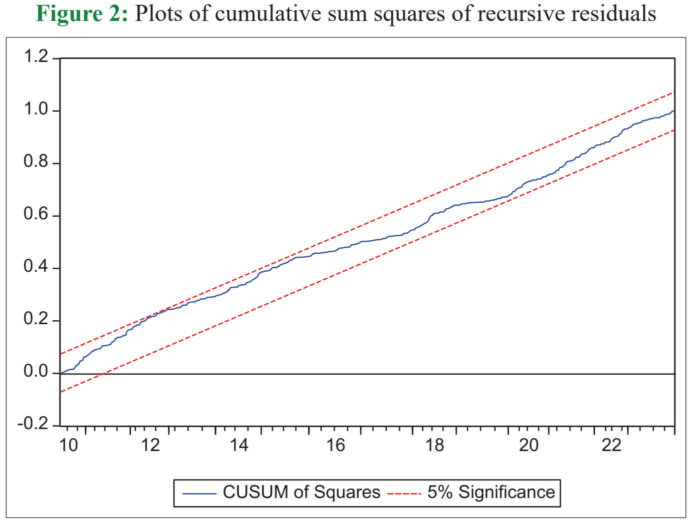


Figure 2: Plots of cumulative sum squares of recursive residuals



cumulative sum of squared recursive residuals (CUSUMSQ) tests proposed by Brown et al. (1975) are used in this study. The results of the tests presented in Figures 1 and 2 show that the plots of CUSUM and CUSUMSQ line within the critical bounds at the 5% level of significance. These results indicate that the model is stable over the sample period.

5. CONCLUSION

This study examines the asymmetric effects of oil prices on stock returns for the HNX. The empirical findings derived from the NARDL bounds testing approach confirm that oil prices have negative asymmetric effects on the market returns in both the short-term and long-term. Specifically, in the short-term, a 1% increase in positive changes of oil prices leads to a 0.85% decrease in the market returns while a 1% increase in negative changes of oil prices is associated with a 14.87% decrease in the market returns. In the long-term, a 1% increase in oil prices is associated with a 1.04% decrease in the market returns, while a 1% decrease in oil prices results in a 1.10% decrease in the market returns. Moreover, the results confirm that the GPRs has no effects on the market returns in both the short-term and long-term. Finally, the results of the error correction model show that 81.54% of the disequilibria from the previous week is converged and corrected back to the long-run equilibrium in the current week.

These findings imply that the HNX is capturing the effects of oil prices on a variety of economic activities. Therefore, oil price shocks can be seen as a signal to predict the future economics. Based on this implication, we propose that investors can use oil prices to forecast stock prices and establish effective hedging strategies.

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