Peer-reviewed research

# Testing the Forecasting Power of Oil Prices in the Volatility of REITS: The Role of Asymmetries and Economic Conditions

Kazeem O. Isah[1a], Peter B.D. Moores-Pitt[1], Paul-Francois Muzindutsi[1]

[1] School of Commerce, University of KwaZulu-Natal, Durban, South Africa

Keywords: REITs, Oil prices, Asymmetries, Economic conditions

JEL Classifications: C22 Time-Series Models - Dynamic Quantile Regressions - Dynamic Treatment Effect Models - Diffusion Processes, C53 Forecasting and Prediction Methods - Simulation Methods, G10 General

https://doi.org/10.46557/001c.156399

Energy RESEARCH LETTERS

Vol. 7, Issue Early View, 2026

This study examines whether oil prices can predict the volatility of Real Estate Investment Trusts (REITs). Using a multi-predictor framework grounded in the CAPM and APT, we model both symmetric and asymmetric oil price effects, extending the framework to incorporate economic conditions. Bias-adjusted OLS and FQGLS estimators are employed to address potential endogeneity and heteroscedasticity. Out-of-sample tests show that models incorporating asymmetric oil dynamics and economic conditions yield superior forecasts. By focusing on REIT volatility, the study demonstrates the importance of accounting for asymmetry and macroeconomic context, offering valuable implications for risk management, portfolio allocation, and policy in real estate markets.

## I. Introduction

Crude oil is widely regarded as the world's most pivotal commodity, and its impact on financial markets has been extensively examined in the economic literature. Studies have explored key relationships, such as those between oil prices and stock markets (Basher et al., 2018), oil prices and exchange rates (Kumar & Singh, 2022), and oil prices and bonds (Rehman et al., 2022). There is also strong evidence that oil price fluctuations influence housing markets in both developed and emerging economies (Salisu & Gupta, 2021). Thus, oil prices may spill over into property markets. One segment of property-related investment that would quickly respond to oil price fluctuations, due to its liquid nature, is Real Estate Investment Trusts (REITs). Because of their liquidity and tradable exposure to income-producing real estate, REITs have grown into a major asset class, with a U.S. market capitalization exceeding $1.4 trillion. Their volatility is particularly important because it reflects risk exposure directly relevant for portfolio management, hedging, and financial stability, whereas returns alone may not fully capture underlying risk.

Despite a growing body of research examining the effects of oil price fluctuations on various financial markets, including stock returns (Salisu & Isah, 2017), bond yields (Rehman et al., 2022), and housing markets (Salisu & Gupta, 2021), the influence of oil price variations on REIT volatility remains relatively underexplored, particularly from a forecasting perspective. Several studies have investigated this relationship: Nazlioglu et al. (2020) find that oil shocks significantly predict REIT returns and volatility, highlighting evidence of asymmetric responses, while Bonato et al. (2022) show that oil market conditions influence REIT performance, particularly during periods of economic stress. Other recent contributions (e.g., Danila, 2024) have focused on oil shocks as a way to address endogeneity concerns. Building on this literature, we directly examine oil price fluctuations and their effect on REIT volatility, employing a framework designed to mitigate endogeneity issues while capturing key statistical properties of financial time series, such as heteroscedasticity, persistence, and autocorrelation.

Moreover, the ability of oil prices to forecast REIT volatility may be shaped not only by their direct movements but also by the asymmetric manner in which markets respond to shocks under varying economic conditions. A growing body of evidence suggests that markets often react more strongly to negative oil price movements, such as demand-driven collapses associated with recessions, than to positive ones signaling economic expansion (Chen et al., 2020; Salisu & Isah, 2017). This implies that upward and downward changes in oil prices may not convey the same information and treating them symmetrically may obscure important channels through which risks are transmitted to real estate markets. Ignoring these asymmetries may lead to an underestimation of how investors reassess risk based on oil price direction. Incorporating economic conditions is crucial because expansions and recessions modulate the

a Corresponding author email: kzamboja@yahoo.com

**Table 1. Preliminary results**

| | Descriptive statistics | | | |
|---|---|---|---|---|
| | **Mean** | **Std. Dev.** | **Skewness** | **Kurtosis** |
| REITs_Vol | 0.1847 | 6.5620 | -1.3540 | 10.3363 |
| OP | 72.410 | 21.8949 | 0.0716 | 2.7342 |
| GECON | -0.1720 | 1.2047 | -3.1997 | 21.0969 |
| | **Conditional Heteroscedasticity and Autocorrelation** | | | |
| | ARCH-LM (10) | ARCH-LM (20) | Q-stat (10) | Q-stat (20) |
| REITs_Vol | 255.4910*** | 124.8014*** | 1004.6*** | 1048.7*** |
| OP | 20.2908*** | 9.1952*** | 1012.5*** | 1154.0*** |
| GECON | 8.0891*** | 3.7595*** | 189.46*** | 266.34*** |

Note: *** denotes statistical significance at the 1% level, indicating rejection of the null hypotheses of no conditional heteroskedasticity and no autocorrelation, respectively.

impact of oil shocks on real estate demand and, consequently, REIT volatility.

In this study, we jointly consider asymmetries and economic conditions in predicting REIT volatility. Focusing on the U.S., a large oil consumer with a sizable and highly liquid REIT market, enhances the global relevance of our findings. Overall, this study contributes to the literature by providing a more nuanced understanding of how oil price shocks, filtered through economic conditions and asymmetric market responses, influence REIT volatility—a key measure for both investors and policymakers.

## II. Data and Methodology

This study employs monthly time-series data from April 2006 to May 2025. While REIT indices and oil prices (OP) are available at a daily frequency, the global economic conditions (GECON) index is reported monthly; consequently, all variables are aggregated to a monthly frequency for consistency. REIT volatility is measured using realized volatility, defined as the square root of the realized variance of REIT returns. Oil price movements are captured via the first-differenced logarithm of WTI crude oil prices, with asymmetric dynamics obtained through positive and negative partial sum decompositions. The GECON index reflects global macroeconomic indicators, which is appropriate given the historical dominance of the U.S. in financial markets. Data sources include REIT indices from Investing.com, oil prices from FRED, and GECON from Baumeister et al. (2021).

Prior to analysis, formal pre-tests are conducted to assess volatility and dependence structures. First, differencing and log transformations address non-stationarity. Table 1 presents descriptive statistics alongside ARCH-LM and Ljung–Box Q-statistics for REIT volatility, oil prices, and GECON. Results indicate that REIT volatility is highly leptokurtic and skewed, with significant ARCH effects and autocorrelation at lags 10 and 20. Oil prices and GECON similarly exhibit conditional heteroskedasticity and serial correlation, consistent with volatility clustering documented in the literature. These characteristics validate the use of volatility-based modeling frameworks as appropriate tools for capturing the dynamics of REITs and oil prices.

Having established the volatility characteristics of REITs, our hypothesis that oil prices can serve as a predictor for REIT volatility is supported by the capital asset pricing model (CAPM) and the arbitrage pricing theory (APT). These two foundational frameworks in finance examine how various shocks and risk factors impact asset returns. Methodologically, we adopt the linear multi-predictor framework of Makin et al. (2014) to construct our baseline predictive model, specified as follows.

$$reit_{vol,t} = \alpha + \beta OP_{t-1} + \varepsilon_t \tag{1}$$

where $reit_{vol,t}$ represents the realized volatility obtained from REIT returns, while OP is the logarithm of the first difference of WTI crude oil prices. To account for the asymmetric dynamics of oil prices, we partition the changes in oil price movements into the partial sums of positive and negative changes as follows.

$$reit_{vol,t} = \alpha + \beta_1 OP^{+}_{t-1} + \beta_2 OP^{-}_{t-1} + \varepsilon_t \tag{2}$$

Equations (1) and (2) present our restricted predictive models, which focus on the impact of oil price fluctuations on REIT volatility from both symmetric and asymmetric perspectives. Equation (3) offers an unrestricted extension of Equation (2), indicating that the asymmetric effects of oil prices on the predictability of REIT volatility may depend on prevailing economic conditions.

$$\begin{aligned} reit_{vol,t} &= \alpha + \beta_1 OP^{+}_{t-1} + \beta_2 OP^{-}_{t-1} \\ &\quad + \beta_3 GECON_{t-1} + \varepsilon_t \end{aligned} \tag{3}$$

The central premise is that the unrestricted predictive model in Equation (3), which captures both the asymmetric dynamics of oil prices and the impact of economic conditions, is more effective at accurately forecasting the volatility of REITs than the restricted models outlined in Equations (1) and (2).

However, it is important to note that there may be a correlation between the error term and the predictor series in the equations provided above, which could lead to endogeneity bias and the potential effect of persistence. To address this issue, Lewellen (2004) developed a bias-adjusted OLS estimator that mitigates the endogeneity problem, as shown in Equation (4) below.

$$reit_t = \alpha_0 + \beta'_{adj} x_{t-1} + \delta(x_t - \rho x_{t-1}) + \varepsilon_t \tag{4}$$

**Table 2. Regression results**

| *Model Types* | $OP_t$ | $OP_t^+$ | $OP_t^-$ | $GECON_t$ |
|---|---|---|---|---|
| Restricted Model [Without Asymmetry] | 0.1807*** (0.0316) | | | |
| Restricted Model [With Asymmetry] | | 0.3879*** (0.0267) | -0.2018 (0.2727) | |
| Unrestricted Model [Asymmetry & Economic Conditions] | | -0.2549** (0.0224) | 0.4854*** (0.1320) | -0.1027*** (0.0072 |

Note: For each of the alternative models under consideration, the values in parentheses represent the standard errors, while ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The OLS estimator adjusted for potential bias in Equation (4) is denoted by $\beta_{adj} = \hat{\beta} - \delta\left(\hat{\rho} - \rho\right)$, while the endogeneity bias caused by the correlation between $\varepsilon_t$ and $x_t$ is corrected by the including the additional term $\delta(x_t - \rho x_{t-1})$. Here $\rho$ and $\rho$ are fitted coefficients of one period-lagged $(x_{t-1})$. The term $x$ as used herein is a vector representing oil prices and economic conditions. To further account for the probable effect of conditional heteroskedasticity, which is common in time-series data, Westerlund and Narayan (2015) suggest pre-weighting all the data by $\frac{1}{\sigma_v}$ and then estimating the resulting equation via the feasible quasi generalized least squares (FQGLS).

To evaluate the out-of-sample forecasting abilities of the restricted and unrestricted predictive models under consideration, we employ a pairwise method for performance assessment. We focus on the Campbell and Thompson (C-T, 2008) test and the Clark and West (C-W, 2007) test, which are standard measures for nested models. Our analysis utilizes 75% of the total sample period for both in-sample and out-of-sample forecasts.

## III. Results

Table 2 reports the results of the predictive regressions across all estimated models. Overall, we cannot reject the null hypothesis regarding the impact of oil prices on REIT volatility, a finding consistent with Nazlioglu et al. (2020) and Bonato et al. (2022). Importantly, our analysis confirms that the relationship is asymmetric, with statistically significant effects primarily occurring during positive oil price shocks. This suggests that rising oil prices, potentially signaling inflationary pressures or increased operational costs, amplify REIT volatility, whereas declining prices do not elicit a comparable response. Our findings also underscore the moderating role of economic conditions: periods of strong growth or contraction can intensify or dampen the sensitivity of REIT volatility to oil price movements. This aligns with theoretical perspectives on conditional heteroskedasticity and supports prior evidence that macroeconomic states shape commodity–financial market interactions (Bouri et al., 2018; Huang & Lee, 2017). From a practical standpoint, these insights highlight the need for diversification strategies, particularly during periods of rising oil prices, and suggest that understanding state-dependent effects can enhance hedging and risk management practices. A core contribution of this study is the evaluation of out-of-sample predictive performance. Table 3 shows that models incorporating both asymmetries and economic conditions consistently outperform restricted models across in-sample and out-of-sample horizons. This superiority, confirmed by the C-T and C-W tests, demonstrates that accounting for asymmetric oil price dynamics and macroeconomic context improves forecasting accuracy, corroborating evidence from asset pricing and real estate literature (Chen et al., 2020; Engle & Gallo, 2013). In sum, recognizing the influence of asymmetric oil price shocks and economic conditions allows investors and policymakers to make more informed decisions, enhancing REIT portfolio management, stabilizing market volatility, and supporting broader financial and economic resilience.

## IV. Conclusion

This study investigates the influence of oil prices on REIT volatility, offering insights for both investors and policymakers. Our findings demonstrate that models incorporating the fundamental characteristics of oil prices generate more accurate forecasts of REIT volatility than models that omit these factors. Accounting for asymmetric market responses, where price increases and decreases affect volatility differently, further enhances predictive performance. Additionally, economic conditions play a crucial role in shaping and amplifying the effects of oil price asymmetries. By capturing the dynamic interactions among oil prices, macroeconomic conditions, and REIT volatility, this study provides practical guidance for risk management, investment strategy, and policy formulation in real estate markets. Future research could examine additional macroeconomic or financial factors to refine forecasting models and further improve our understanding of REIT volatility dynamics.

Submitted: June 15, 2025 AEST. Accepted: October 04, 2025 AEST. Published: July 20, 2026 AEST.

**Table 3. In-sample and out-of-sample forecast performance evaluations**

| | In-Sample | Out-of-Sample | | |
|---|---|---|---|---|
| | | *h* = 4 | *h* = 8 | *h* = 12 |
| **Unrestricted Model vs Restricted Model using C-T test** | | | | |
| Model 1 vs Model 3 | 0.7634 | 0.7657 | 0.7616 | 0.7637 |
| Model 2 vs Model 3 | 0.6486 | 0.6477 | 0.6371 | 0.6357 |
| **Unrestricted Model vs Restricted Model using C-W test** | | | | |
| Model 1 vs Model 3 | 0.0883*** [17.3436] | 0.0879*** [17.6184] | 0.0888*** [17.8806] | 0.0895*** [18.3537] |
| Model 2 vs Model 3 | 0.0513*** [11.3672] | 0.0502*** [11.3058] | 0.0490*** [11.1865] | 0.0480*** [11.1176] |

Note: A positive C-T value indicates that the unrestricted model outperforms the alternative predictive models (the restricted model), while a negative value suggests the opposite. For the C-W test, the value in square brackets is the *t*-statistic associated with the test coefficient and is evaluated against critical values of 1.28, 1.64, and 2.00 for the 10%, 5%, and 1% levels of significance, respectively.

## References


Basher, S. A., Haug, A. A., & Sadorsky, P. (2018). The impact of oil-market shocks on stock returns in major oil-exporting countries. *Journal of International Money and Finance*, *86*, 264–280. https://doi.org/10.1016/j.jimonfin.2018.05.003

Baumeister, C., Leiva-León, D., & Sims, E. (2021). Tracking weekly state-level economic conditions. *Review of Economics and Statistics*, 1–45.

Bonato, M., Cepni, O., Gupta, R., & Pierdzioch, C. (2022). Forecasting realized volatility of international REITs: The role of realized skewness and realized kurtosis. *Journal of Forecasting*, *41*(2), 303–315. https://doi.org/10.1002/for.2813

Bouri, E., Gupta, R., & Roubaud, D. (2018). Asymmetric volatility spillovers between oil and stock markets: Evidence from China and the United States. *Energy Economics*, *74*, 100–110.

Campbell, J. Y., & Thompson, S. B. (2008). Predicting excess stock returns out of sample: cananything beat the historical average? *Review of Financial Studies*, *21*, 1509–1531. https://doi.org/10.1093/rfs/hhm055

Chen, Y., Zhang, Y., & Wang, Z. (2020). Asymmetric volatility spillovers between crude oil and other major asset markets. *Energy Economics*, *88*, 104771.

Clark, T. D., & West, K. D. (2007). Approximately normal tests for equal predictive accuracy in nested models. *Journal of Econometrics*, *138*, 291–311. https://doi.org/10.1016/j.jeconom.2006.05.023

Danila, N. (2024). Financial interdependencies: Analyzing the volatility linkages between real estate investment trusts, Sukuk, and oil in GCC countries. *IJFS*, *12*(3), 1–11. https://doi.org/10.3390/ijfs12030092

Engle, R. F., & Gallo, G. M. (2013). Asymmetric volatility and risk spillovers in the global equity markets. *Journal of International Money and Finance*, *32*, 1–25.

Huang, W., & Lee, C. (2017). The effects of uncertainty measures on commodity prices from a time-varying perspective. *International Review of Economics & Finance*, *53*, 1–15.

Kumar, P., & Singh, V. K. (2022). Does crude oil fire the emerging markets currencies contagion spillover? A systemic perspective. *Energy Economics*, *116*, 106384. https://doi.org/10.1016/j.eneco.2022.106384

Lewellen, J. (2004). Predicting returns with financial ratios. *Journal of Financial Economics*, *74*, 209–235. https://doi.org/10.1016/j.jfineco.2002.11.002

Makin, A. J., Narayan, P. K., & Narayan, S. (2014). What expenditure does Anglosphere foreign borrowing fund? *Journal of International Money and Finance*, *40*, 63–78. https://doi.org/10.1016/j.jimonfin.2013.08.020

Nazlioglu, S., Gupta, R., Gormus, N. A., & Soytas, U. (2020). Price and volatility linkages between international REITs and oil markets. *Energy Economics*, *88*, 104779. https://doi.org/10.1016/j.eneco.2020.104779

Rehman, M. U., Shahzad, S. J. H., Ahmad, N., & Vo, X. V. (2022). Dependence dynamics of US REITs. *International Review of Financial Analysis*, 102124. https://doi.org/10.1016/j.irfa.2022.102124

Salisu, A. A., & Gupta, R. (2021). How do housing returns in emerging countries respond to oil shocks? A MIDAS Touch. *Emerging Markets Finance and Trade*, *57*(15), 4286–4311. https://doi.org/10.1080/1540496X.2020.1807322

Salisu, A. A., & Isah, K. O. (2017). Revisiting the oil price and stock market nexus: A nonlinear Panel ARDL approach. *Economic Modelling*, *66*, 258–271. https://doi.org/10.1016/j.econmod.2017.07.010

Westerlund, J., & Narayan, P. K. (2015). Testing for predictability in conditionally heteroskedastic stock returns. *Journal of Finance and Economics*, *13*(2), 342–375.