**Original Research Article**

**An Impact Study on Nifty Index through Quantile Regression**

**Abstract:**

This study examines the effects of global and domestic factors on the Nifty 50 index, using weekly data from November 1995 to October 2024. The approach uses quantile regression to capture the varied correlations across different market quantiles. Findings demonstrate that the Dow Jones exerts a considerable impact across all quantiles, signify the interdependence of global markets. Gold and the US bond yield are other significant influences, whereas the Dollar Index has mixed effects. Interestingly, WTI crude oil has no substantial impact. The study provides vital insights for investors and policymakers, emphasising the role of global trends in determining India's stock market.

**1. Introduction:**

Nifty and Dow Jones are both popular stock market indices that provide insights into the performance of the stock markets in their respective countries. Nifty as a list of the top 50 companies in India. The National Stock Exchange’s stock market index is known by its official name, Nifty 50. The Nifty 50 is the most active trade index in India, representing a variety of stock from various industries. Dow Jones Industrial Average, often referred to as Dow Jones or DJIA. It provides insight into how these 30 significant American companies are performing in the stock market. Essentially, it's like a pulse check for the U.S. stock market, giving a glimpse of its overall health and indicating the direction of U.S. market. Investors, analysts, and anybody else with an interest in finance closely follow these indices since they are vital resources for comprehending the functioning of the stock market. A unique kind of oil, West Texas Intermediate (WTI) crude oil is mostly extracted in the United States, with Texas serving as a significant production hub. It holds a prominent position as one of the most actively traded and well-known forms of crude oil across the globe. The connections between Nifty 50, WTI crude oil, and other economic indicators are quite tangled. When oil prices change, it can affect the profitability of companies in Nifty 50, which, in turn, can influence the stock market. There's an interesting relationship between gold and the Nifty 50. An increase in gold prices may cause investors to seek out gold as a safe haven, which could result in a decrease in their investment in equities, particularly those in the Nifty 50. US bond yields are the actual return a bond holder will get when the buyer of the bond sale their holdings in the market. The bond yields are changed frequently throughout the market hour. When these yields go up, it often makes investing in bonds more attractive, which can draw money away from stocks like those in Nifty 50. Conversely, when bond yields drop, stocks may become a more appealing option, potentially benefiting Nifty 50. The strength of the US dollar relative to six other important foreign currencies is gauged by the Dollar Index. An increase in the Dollar Index may draw investors' attention away from emerging markets like India and toward U.S. assets, which could have an effect on the Nifty 50. Therefore it is imperative to study these variable impact on nifty index so that investors can know which variable is more important for Indian stock market.

**2. Review of literature:**

The Indian stock market and US bond yields are inversely correlated. Indian stock markets typically see a dip in response to an increase in US bond yields, and vice versa when those yields collapse. Bond yields and the stock market frequently move in direct opposition to one another. Equity markets often perform worse when bond yields increase and better when bond yields decrease. This relationship may not last for very long, but after around five to ten years, it becomes apparent. Bond yields have been typically used by analysts and investors as an important leading indicator(Paul & Reddy, 2022). However, a study (Balakrishnan & Rahman, 2022)found that the US bond yield does not affect foreign institutional investor (FII) inflows or the Indian stock market performance. In recent research conducted by (Paul & Reddy, 2022), an in-depth analysis was carried out to understand how US quantitative easing (QE) influences the 10-year Indian government bond in both the short and long terms. The findings from this study shed light on the substantial impact that US QE has on the Indian bond market.

The US dollar index has a major impact on the performance of the Indian stock market. An upsurge in the dollar index frequently triggers a decline in the Indian stock markets, impacting sentiments related to trade and investments, and vice versa. A study (Kumar & Robiyanto, 2021) found that the influence of the dollar index on emerging markets like India and China is indeed notable. However, it's important to recognize that while this impact remains substantial in specific instances, it may not hold true universally across the board. The effects vary, and what's significant in some cases may not be as prevalent in others. Another study (Tran & Nguyen, 2022) explored the correlation among the stock market, gold prices, and the US dollar (USD) using a Panel Data Vector Auto-Regression (PVAR) model. The investigation revealed a noteworthy finding: during the COVID-19 pandemic, the US dollar index exhibited a dynamic interdependence with the stock market.

Gold and the Indian stock market often have an inverse relationship. During economic uncertainty, investors may flock to gold as a safe-haven asset, causing a decline in the stock market. Conversely, a stable stock market can reduce the appeal of gold for investors. (Tripathy, 2016) explored the evolving connection between gold prices and stock market prices in India. Notably, the study uncovered a crucial observation there appears to be no causal relationship between gold prices and stock market prices in the short term. (Afsal & Haque, 2016) investigates the price movements in the gold market and their relationship with the stock market in Saudi Arabia. The study found that there is a slightly inverse relationship between the gold price and stock prices. (Al-Ameer et al., 2018) research considers the relationship between gold and the stock market in Germany. The research revealed a fluctuating correlation between gold and the stock market, showcasing variations across different periods.

The Indian stock market is notably impacted by fluctuations in crude oil prices. A rise in crude oil prices often leads to a decrease in stock market performance due to increased production costs and reduced consumer spending, influencing market sentiment negatively. Crude oil prices have a positive and significant effect on the stock market index of an established economy like India(Sreenu, 2022). Fluctuations in oil prices significantly influence the Indian stock market (Rahman & Kodikal, 2019).

The Indian stock market frequently follows changes in the Dow Jones index. Positive Dow Jones trends often translate into higher investor confidence in Indian markets, and vice versa, demonstrating the interdependence and worldwide influence on the Indian stock market. Analysing the co-integration between Indian and U.S. stock markets (Bhattacharjee & Das, 2020) found that there is no co-integration between the NSE Nifty and NASDAQ. This implies that a long-term equilibrium relationship is absent between these indices. However, (Khondekar et al., 2009) study the relationship between the USA and Indian stock market and conclude that there is a significant relationship between the two markets. From the above literature review, the researchers found that no work has been done on the impact study of Dow Jones, gold, crude oil, US bond yield, and dollar index on the Nifty 50, particularly in the Indian context.

**2.1 Research objective:**

* To study the impact of Dow Jones, crude oil, gold, bond yields, and the dollar index on the Nifty 50.

**3. Research methodology:**

For the study of the impact of Dow Jones, crude oil (WTI), gold (dollar denomination), US 10-year bond yield, and dollar index on the nifty50 index, data has been taken from investing.com. The period of study includes weekly data from November 5th, 1995, to October 27th, 2024. Here nifty is a dependent variable, and Dow Jones, WTI crude, gold (dollar denomination), US 10-year bond yield, and dollar index are independent variables. Before testing the impact of these variables, researchers decided to test the stationarity of these variables as it is utmost needed for any econometric model(Petrică et al., 2017)In order to apply any econometric model data stationarity is required so we decided to take return series of the above variables.

The return series are expressed are as follows.

$$r\_{it}=ln\frac{p\_{it}}{p\_{it-1}}$$

$r\_{it}$ – return series of all variables $p\_{it}$ – Price of day “t”

$p\_{it-1}$- Price of day “t-1” $ln$ – Log of natural base

**Quantile Regression**

The quantile model is effective in cases where there is hetroskedasticity and non-normality in the residual distribution (Koenker & Bassett, 1978; Koenker & Hallock, 2001).

The Quantile Regression is described by the following equation.

 $Y\_{t}=X\_{t}^{'}β\_{q}$, where $β\_{q}$ is the vector of unknown parameters related to the $q^{th}$ Quantile further the median regression also called least absolute deviation regression minimizes$ \sum\_{t}^{}\left|e\_{t}\right|$. The quantile Regression minimize $\sum\_{t}^{}q\left|e\_{t}\right|+\sum\_{t}^{}\left(1-q\right)|e\_{t}|$ which is a sum that produces the asymmetric penalties q$|e\_{t}|$ representing under prediction and (1-q)$ |e\_{t}|$ for over prediction.

$$Y\_{i}=β\_{q0}+β\_{q1}X\_{1}+β\_{q2}X\_{2}+…β\_{qn}X\_{n}+ϵ\_{qi}$$

Where$β\_{q0}$, $β\_{q1}$ are unknown parameter associated with qth quantile and $ϵ\_{qi}$ is the error associated with qth quantile such that 0 < q < 1.

**4. Data analysis and Findings:**

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Figure 1: Raw data Figure2: Return series data



In Figure 1 the level data are not in stationary so we decided to take return series as these are in stationary.

Table 1: Descriptive statistics

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variables | RNIFTY | RWTI | RGOLD | RDOW | RDINDEX | RBYIELD |
|  Mean | 0.00215 | 0.0009 | 0.001292 | 0.001426 | 0.000144 | -0.000207 |
|  Median | 0.00397 | 0.00447 | 0.001808 | 0.002911 | 0.000458 | -0.000861 |
|  Maximum | 0.14357 | 0.27576 | 0.1258 | 0.12084 | 0.047744 | 0.313009 |
|  Minimum | -0.1738 | -0.3469 | -0.101316 | -0.200298 | -0.044346 | -0.408479 |
|  Std. Dev. | 0.03051 | 0.05322 | 0.022883 | 0.024114 | 0.010606 | 0.046539 |
|  Skewness | -0.2636 | -0.6007 | -0.030297 | -0.974539 | 0.074224 | -0.014106 |
|  Kurtosis | 6.06931 | 7.81663 | 5.91969 | 11.7476 | 4.055323 | 11.43596 |
|  Jarque-Bera | 611.011 | 1552.51 | 537.2806 | 5060.124 | 71.55181 | 4483.471 |
|  Probability | 0 | 0 | 0 | 0 | 0 | 0 |
| ADF(P Value) | 0 | 0 | 0 | 0 | 0 | 0 |
|  Observations | 1512 | 1512 | 1512 | 1512 | 1512 | 1512 |

The descriptive statistics shows in table 1 and it is found that the Indian market nifty is more attractive market as the mean return is highest .00215 further the WTI crude oil market is most volatile having highest standard deviation value .05322. As the p value for Jarque-Bera statistics is less than.05 at the 5% level of significance, the distributions of variables are not normal. The variables are in stationary as it confirmed from augmented dicky fuller test as the p value are less than .05. To check the impact of these variables on nifty we first test ordinary least square (OLS) but after doing it we found the deviation OLS assumptions that the error term distribution must follow normality(Gujarati, 2003).

Table 2: Ordinary Least Square

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| RWTI | 0.011837 | 0.013984 | 0.846426 | 0.3974 |
| RGOLD | 0.091488 | 0.035337 | 2.588995 | 0.0097 |
| RDOWJONES | 0.474804 | 0.030973 | 15.32983 | 0 |
| RDINDEX | -0.267067 | 0.075801 | -3.523262 | 0.0004 |
| RBONDYIELD | 0.051202 | 0.016255 | 3.149962 | 0.0017 |
| C | 0.001388 | 0.00071 | 1.95663 | 0.0506 |
| R-squared | 0.192724 | Mean dependent var |  | 0.002145 |
| Adjusted R-squared | 0.190043 | S.D. dependent var |  | 0.030514 |
| S.E. of regression | 0.027462 | Akaike info criterion |  | -4.348089 |
| Sum squared resid | 1.14E+00 | Schwarz criterion |  | -4.326973 |
| Log likelihood | 3293.155 | Hannan-Quinn criter. |  | -4.340226 |
| F-statistic | 71.90644 | Durbin-Watson stat |  | 1.976591 |
| Prob(F-statistic) | 0 |  |  |  |

Table 3: Auto correlation and Heteroscedasticity

|  |
| --- |
| Breusch-Godfrey Serial Correlation LM Test: |
| F-statistic | 0.148557 |  Prob. F(2,1504) | 0.862 |
| Obs\*R-squared | 0.298636 |  Prob. Chi-Square(2) | 0.8613 |
| Heteroscedasticity Test: Breusch-Pagan-Godfrey |
| F-statistic | 0.821926 |  Prob. F(5,1506) | 0.534 |
| Obs\*R-squared | 4.114772 |  Prob. Chi-Square(5) | 0.533 |
| Scaled explained SS | 9.382573 |  Prob. Chi-Square(5) | 0.0947 |

Figure 3: OLS error term distribution

 In table 3 it is found that the OLS model is violate the assumptions of homoscedasticity and autocorrelation of error term and further the distribution of error term not following normality as the p value of Jarque-Bera test is less than .05 confirmed from figure 3, so we decided to proceed to Quantile Regression which is robust to deal heteroscedasticity.

Table 4: Quantile Regression output at different Quantiles

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Var/tau | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| WTI | 0.0021(.94) | 0.0057(.74) | (-).003(.83) | .00611(.71) | 0.0066(.71) | 0.0167(.41) | 0.0172(.36) | 0.0179(.36) | 0.0381(.06) |
| GOLD | 0.1010(.16) | 0.0920(.03) | 0.0865(.04) | 0.1047(.03) | 0.0947(.05) | 0.0649(.16) | 0.0678(.15) | 0.1220(0) | 0.1150(.02) |
| DOW | 0.4474(0) | 0.4605(0) | 0.4952(0) | 0.4860(0) | 0.4889(0) | 0.4696(0) | 0.4950(0) | 0.5084(0) | 0.5044(0) |
| DINDEX | (-)0.277 (.08) | (-)0.247(.02) | (-)0.316(0) | (-)0.213(.03) | (-)0.153(.10) | (-)0.150(.09) | (-)0.098(.25) | (-)0.143(.08) | (-)0.300(0) |
| BONDYIELD | 0.02043(.30) | 0.0490(0) | 0.0423(.07) | 0.0290(.18) | 0.0360(.07) | 0.0447(.01) | 0.0327(.04) | 0.0458(.02) | 0.0755(0) |
| C | (-).0306 (0) | (-)0.017(0) | (-)0.009(0) | (-)0.003(0) | 0.0020(0) | 0.0080(0) | 0.0140(0) | 0.0212(0) | 0.0313(0) |
| Pseudo R-squared | 0.0975 | 0.10427 | 0.10646 | 0.10167 | 0.09610 | 0.09083 | 0.09047 | 0.09817 | 0.108320 |
| Prob(Quasi-LR stat) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

\*The p value of corresponding coefficient are in bracket ( )

From Table 4, the WTI crude have no significant impact on nifty throughout all the quintiles as the p value are more than .05. In case of gold it is not significant at .1, .6 and .7 but it has significant impact on nifty in all others quantiles. Interestingly the US market has significant impact on Indian stock market as the Dow has significant impact on nifty across all quantiles because the p value are less than .05 across all quantiles. The dollar index have significant impact at .2, .3, .4 and .9 quantiles. Apart form .3, .4 and .5 quantile the US 10 year bond yield have significant impact on nifty. The quasi LR statistics p values are less than .05 so it is assumed that the model is stable. The median, or.5 quantile regression equation, will be as follows: Nifty50 (.5q) = .0020+.0066\*WTI+.0360\*Bond yield+(-.153)\*Dollar index+.4889\*Dowjones+.0947\*Gold (US Dollar). At the middle level of Nifty (50 % of the distribution) 1 percent change in WTI is associated with .66 percentage increase in nifty, similarly 1 percentage change in bond yield creates .36 percentage change in nifty, but increase of dollar index 1 percentage changes having negatively impact nifty .153 percentage. 1 percentage change in Dow and gold creates.48 percentage and .094 percentage in nifty respectively.

Figure 4: Graphical presentation of coefficient of independent variable across the quantiles



From figure 4 it is found that the coefficient of different independent variable across different quantile varies.

**5. Conclusion:**

The study's findings provide crucial insights into how key global and domestic issues affect the Nifty 50 index. The work uses quantile regression to provide a robust analysis that accounts for heteroscedasticity and non-normality in the dataset. The findings show that the Dow Jones has a consistent and significant influence across all quantiles, illustrating the interdependence of the Indian and US stock markets. Similarly, gold prices have a considerable impact on the Nifty across most quantiles, proving its importance as a safe-haven asset in times of market instability. The impact of the US 10-year bond yield and the Dollar Index varies by quantile, with the bond yield positively influencing the Nifty in multiple quantiles while the Dollar Index has a negative association at higher quantiles. Interestingly, WTI crude oil had no significant influence, implying that oil price swings did not directly impact the Indian stock market during the study period. These findings emphasise the role of global market dynamics in determining the Indian stock market. Understanding these links can help policymakers develop mitigation methods for exogenous shocks. This research provides investors with useful insights into the key drivers of the Nifty, allowing them to make more informed investment decisions. Future research could expand this approach to include more factors and investigate dynamic relationships during times of increased global economic instability.

**References:**

Afsal, E. M., & Haque, M. I. (2016). *Market Interactions in Gold and Stock Markets: Evidences from Saudi Arabia*. *6*(3).

Al-Ameer, M., Hammad, W., Ismail, A., & Hamdan, A. (2018). *The Relationship of Gold Price with the Stock Market: The Case of Frankfurt Stock Exchange*. *8*(5).

Balakrishnan, C., & Rahman, H. (2022). Does the United States Bond Yield Affect Foreign Institutional Investor Inflows to India and Indian Stock Market? *Asian Economics Letters*, *3*(4). https://doi.org/10.46557/001c.37526

Bhattacharjee, A., & Das, J. (2020). *Examining the Nexus Between Indian and U.S. Stock Market: A Time Series Analysis* (SSRN Scholarly Paper 3560386). https://papers.ssrn.com/abstract=3560386

Gujarati, D. N. (2003). *Basic Econometrics*. McGraw Hill. https://books.google.co.in/books?id=byu7AAAAIAAJ

Khondekar, M., Ghosh, D., & Ghosh, K. (2009). *RELATIONSHIP BETWEEN USA AND INDIAN STOCK MARKETS: A TIME SERIES ANALYSIS*.

Koenker, R., & Bassett, G. (1978). Regression Quantiles. *Econometrica*, *46*(1), 33–50. JSTOR. https://doi.org/10.2307/1913643

Koenker, R., & Hallock, K. F. (2001). Quantile regression. *Journal of Economic Perspectives*, *15*(4), 143–156. https://doi.org/10.1257/jep.15.4.143

Kumar, J. J. A., & Robiyanto, R. (2021). The Impact of Gold Price and Us Dollar Index: The Volatile Case of Shanghai Stock Exchange and Bombay Stock Exchange During the Crisis of Covid-19. *Jurnal Keuangan Dan Perbankan*, *25*(3), 508–531. https://doi.org/10.26905/jkdp.v25i3.5142

Paul, M., & Reddy, K. S. (2022). US QE and the Indian Bond Market. *Journal of Quantitative Economics*, *20*(1), 137–157. https://doi.org/10.1007/s40953-021-00257-9

Petrică, A., Stancu, S., & Ghițulescu, V. (2017). Stationarity – The Central Concept in Time Series Analysis. *International Journal of Emerging Research in Management and Technology*, *6*, 6–16. https://doi.org/10.23956/ijermt/V6N1/107

Rahman, H., & Kodikal, R. (2019). Ups And Downs In The Indian Economy: The Impact Of Crude Oil Prices. *International Journal of Scientific & Technology Research*, *8*, 846–857.

Sreenu, N. (2022). Impact of crude oil price uncertainty on indian stock market returns: Evidence from oil price volatility index. *Energy Strategy Reviews*, *44*, 101002. https://doi.org/10.1016/j.esr.2022.101002

Tran, O., & Nguyen, H. (2022). The interdependence of gold, US dollar and stock market in the context of COVID-19 pandemic: An insight into analysis in Asia and Europe. *Cogent Economics & Finance*, *10*(1), 2127483. https://doi.org/10.1080/23322039.2022.2127483

Tripathy, N. (2016). A Study on Dynamic Relationship between Gold Price and Stock Market Price in India. *European Journal of Economics, Finance and Administrative Sciences*.