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Analysing The Shifts In Bond Yields, Equity Returns, And Economic Indicators In India: Pre- And Post-COVID-19 Comparison

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Abstract
The COVID-19 pandemic brought unprecedented economic disruptions, reshaping global financial markets, and influencing the dynamics of bond yields, equity returns, and associated economic factors. This study explores the impact of the COVID-19 pandemic on bond yields, equity returns, and key economic factors in India, utilizing data from September 2017 to December 2022. The dataset consists of 30 observations from the months before the COVID-19 outbreak and 30 observations from the months after. The analysis incorporates variables such as 10-year Government Securities (G-Secs) and 91-day Treasury Bills (T-Bills) for bond yields, NSE Nifty for equity returns, and key economic indicators including the bank rate, inflation, Index of Industrial Production (IIP), exchange rates, Foreign Direct Investment (FDI), and foreign reserves. The study focuses on month-on-month returns, assessing the differences in bond yields, equity returns and economic indicators using paired t-tests. The results revealed significant differences in bond yields, equity returns, and economic indicators, highlighting the pandemic's substantial impact on the financial landscape.
Multivariate correlation analysis is performed to investigate the relationships between these variables, followed by regression analysis to understand their interdependencies. The results reveal that post-COVID-19, bond yields experienced a significant decline due to accommodative monetary policies, while equity returns rebounded sharply owing to fiscal stimulus and increased market liquidity. The correlation analysis shows strong relationships between exchange rates, foreign reserves, and equity returns, and moderate correlations between inflation, bank rates, and bond yields. The regression results indicate significant shifts in these relationships post-pandemic, highlighting the altered market dynamics. The findings suggest that economic factors such as inflation, bank rates, and exchange rates play a crucial role in influencing bond and equity markets in the post-COVID period. These findings offer valuable insights for investors and policymakers, supporting informed decision-making in a post-pandemic economic context.

Keywords: *Bond Yields, Economic Indicators, Equity Returns, Multivariate Correaltion, OLS Regression analysis, paired t-test and Pre and Post COVID-19*

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I. Introduction

The COVID-19 (Corona Virus Disease - 19) pandemic, which began in late 2019, has drastically reshaped the global economy and financial markets, bringing into focus the complex dynamics between bond yields and equity returns. Historically, financial theories have posited an inverse relationship between these two asset classes. As bond yields rise, equity prices tend to fall due to higher interest rates, which increase the cost of borrowing and lower the future profitability of companies (Fama, 1976; Modigliani & Miller, 1958). However, the onset of the pandemic created an unprecedented environment, disrupting traditional economic patterns and challenging the assumptions embedded in classical financial models. The combination of severe health crises, massive fiscal interventions, and global market uncertainty during the COVID-19 period has led to new questions about the stability and relevance of the inverse relationship between bond yields and equity returns.

Bond markets and equity markets are influenced by various economic factors, such as inflation, interest rates, and investor sentiment. Prior to the pandemic, the relationship between these two markets was largely defined by standard economic conditions. When central banks, like the Federal Reserve in the United States or the European Central Bank, raised interest rates, bond yields typically increased, leading to reduced appeal for equities. In normal circumstances, rising bond yields signal expectations of stronger economic growth, but they also make bonds more attractive relative to equities, pushing stock prices lower (Campbell, 1996). Conversely, when interest rates fall, as seen in recessions or crises, bond yields decline, and equity returns tend to rise due to more favourable financing conditions. In this framework, the historical relationship between bonds and equities followed predictable patterns and was heavily influenced by monetary policy and macroeconomic growth.

The COVID-19 pandemic, however, defied these traditional financial relationships, as central banks responded with unprecedented monetary measures, including near-zero interest rates and extensive asset purchasing programs (Gali, 2020). Alongside fiscal interventions in the form of stimulus packages, the global economy experienced severe disruption, leading to a highly volatile environment for both bond and equity markets. Unlike previous economic crises, the pandemic prompted both bond prices and equity prices to behave in unexpected ways, creating uncertainty about the future trajectory of these asset classes. For instance, despite a sharp decline in economic activity, bond yields plummeted, while stock markets initially suffered significant losses before staging a rapid recovery, particularly in certain sectors like technology (Beber & Brandt, 2006). This unique combination of market movements calls into question whether the relationship between bond yields and equity returns had fundamentally changed during the pandemic.

Prior literature examining the bond-equity relationship during times of crisis has revealed mixed results. Some studies have shown that financial markets decouple during periods of economic uncertainty, with bond yields and equity returns moving in tandem rather than inversely (Bauer & Mertens, 2018). In particular, during the early stages of the pandemic, many investors fled to safe-haven assets, such as government bonds, pushing bond prices up and yields down while equities tumbled due to fears of prolonged economic stagnation. However, subsequent market responses were more complex, as fiscal, and monetary interventions stabilized markets and created conditions where bonds and equities appeared to be less inversely correlated. Other research indicates that, even in times of crisis, the inverse relationship may hold, but it is masked by factors like liquidity shortages, investor panic, and government interventions (Haddad & Miu, 2021). These mixed findings highlight the importance of examining the bond-equity relationship more closely in the post-pandemic context.

This study aims to investigate how the COVID-19 pandemic has altered the historical relationship between bond yields and equity returns by comparing data from the pre-pandemic and post-pandemic periods. Using statistical tools such as paired t-tests and regression analysis, this research will determine whether significant shifts occurred in the bond-equity dynamic as a result of the pandemic. The paired t-test will assess whether the means of bond yields and equity returns before and after the pandemic differ significantly, while regression analysis will explore how changes in bond yields affect equity returns during these two distinct periods. By analysing these relationships, the study seeks to uncover whether traditional financial models hold true during extraordinary events like the COVID-19 pandemic or whether new dynamics emerge that reflect the changing nature of global financial markets.

The remainder of the paper is organized as follows: Section 2 reviews the relevant literature on the relationship between bond yields and equity returns, with a specific focus on financial crises and the COVID-19 pandemic. Section 3 outlines the methodology, describing the data sources, statistical techniques, and analytical models used. Section 4 presents the results of the Descriptive statistics, multivariate correlations, paired t-test, and regression analysis, while Section 5 discusses the implications of these findings for investors and policymakers. Finally, Section 6 concludes the paper by highlighting key insights and proposing directions for future research.

II. Literature Review

The COVID-19 pandemic has had a transformative effect on global financial markets, particularly in the way that bond yields and equity return interact with each other and are influenced by economic factors. This narrative review integrates the latest research to offer insights into the shifts in these relationships pre- and post-pandemic. It highlights the evolving roles of bond markets, equity markets, and economic drivers such as monetary and fiscal policy in shaping asset performance before and after COVID-19.

In the period before the COVID-19 pandemic, the relationship between bond yields and equity returns generally adhered to traditional financial models, characterized by an inverse correlation. That is, rising bond yields were typically associated with declining equity prices, primarily due to higher interest rates affecting the discounted cash flows of corporate earnings. This relationship has been examined in several key studies. Fama (1976), for instance, identified the inverse relationship between bonds and equities, which was based on the notion that rising bond yields signal tighter financial conditions and lower corporate profitability. Bond markets were characterized by stable yields, low inflation, and accommodative monetary policy in many advanced economies, which created a favourable environment for riskier assets like equities. Researchers like Joyce et al. (2011) found that in environments of low interest rates, central banks' interventions helped to stabilize both bond and equity markets by lowering borrowing costs and providing liquidity.

The relationship between bond yields and equities was also influenced by broader macroeconomic factors. For example, Bhattacharya et al. (2022) argued that low bond yields prior to the pandemic were primarily driven by central banks' prolonged periods of low-interest-rate policies and quantitative easing (QE), aimed at stimulating economic growth in the aftermath of the 2008 financial crisis. As a result, investors had relatively low returns from bonds, which encouraged the pursuit of higher returns from equity markets. Alizadeh et al. (2023) also noted that government fiscal policies, including increased public spending and tax cuts, bolstered economic growth during the pre-COVID era, further promoting risk-taking in equities. Corporate earnings growth and a low-interest rate environment facilitated robust equity returns despite low bond yields. This inverse relationship has been widely observed in periods of economic stability, as demonstrated in the work of Caselli and Lisi (2022). They noted that economic growth, low inflation, and favourable monetary policy conditions fostered a consistent positive performance in equities, while bonds provided steady returns through low-risk investments. In the pre-COVID era, bond yields were relatively low across many advanced economies due to accommodative monetary policies and low inflationary pressures.

Moreover, the behaviour of bond markets before the pandemic reflected investor preferences for safety in times of global uncertainty, but overall bond yields were low due to minimal inflationary pressures. The role of monetary policy in maintaining economic stability was central to bond market dynamics, as low interest rates and bond-buying programs provided steady demand for government bonds, thereby reducing yields, and allowing capital to flow into equities. With the onset of the COVID-19 pandemic, the global economy entered into a period of severe uncertainty, and financial markets reacted with extreme volatility. During the initial phase of the crisis in early 2020, bond markets witnessed a "flight to safety" effect, which caused bond prices to surge and yields to plummet. Meanwhile, equity markets saw significant losses as fears of economic contraction, lockdowns, and disruptions to supply chains gripped investors. Haddad and Miu (2021) observed that, contrary to the typical inverse relationship, bond yields and equity prices both reacted positively at various points during the pandemic due to the unprecedented fiscal and monetary interventions from governments and central banks. The intervention measures—such as fiscal stimulus packages, interest rate cuts, and expanded asset purchases—provided liquidity and stability to markets, boosting investor confidence in both bonds and equities in the short term.

The behaviour of the equity markets during the pandemic also highlighted the importance of fiscal policy in supporting corporate earnings and demand. As Gali (2020) noted, fiscal stimulus packages, particularly those focused on consumer spending and unemployment benefits, played a critical role in propelling the stock market recovery. These policies helped offset declines in corporate earnings due to the shutdowns, which created a paradox where both bonds and equities performed well at the same time. Mertens and Ravn (2021) suggested that these policy responses prevented a deeper recession and allowed for a faster-than-expected recovery in global financial markets.

At the same time, monetary policy interventions were crucial in mitigating the economic shocks from the pandemic. The transmission mechanism of monetary policy suggests that, in normal economic conditions, a tightening of monetary policy (i.e., higher interest rates) will lead to higher bond yields and lower stock prices, while an easing of monetary policy (i.e., lower interest rates) will have the opposite effect (Bernanke & Gertler, 1995). Quantitative easing (QE) policies were ramped up in several economies, including the U.S. and Eurozone, which contributed to depressed bond yields. According to Neely (2021), central banks' QE measures not only reduced bond yields to record lows but also helped keep credit conditions relatively stable. These policies also facilitated a rebound in risk assets, such as equities, by improving liquidity in the financial system and reducing borrowing costs for corporations. Nonetheless, the overall impact on bond yields and equity returns varied across different regions and asset classes, as the pandemic created different economic conditions in different countries.

In the post-pandemic period, the global economy has faced a complex mix of inflationary pressures, supply chain disruptions, and rising interest rates. The dynamics between bond yields and equity returns have shifted once again, largely driven by inflation and central banks' responses to it. Yang et al. (2023) highlighted how the post-pandemic recovery saw a significant uptick in inflation due to pent-up demand, labour shortages, and ongoing supply chain disruptions. In response, central banks, particularly the U.S. Federal Reserve, have signalled tightening monetary policies, including interest rate hikes. This change has placed upward pressure on bond yields and, conversely, created downward pressure on equity prices, particularly growth stocks, which are more sensitive to interest rate hikes. Moreover, central banks' interest rate decisions have had a direct impact on investor sentiment and the valuation of risk assets. Koutsou and Vasilenko (2023) emphasized that higher bond yields in the post-pandemic era are influencing investor behaviour, as the rising cost of borrowing for companies can squeeze profit margins and negatively impact stock valuations. As bond yields rise, discounted cash flow models for equities lead to lower present values of future earnings, making stocks less attractive, especially those in the growth sector.

This dynamic shift also reflects a broader change in market behaviour, where inflation expectations and central bank tightening are the primary drivers of financial market performance. Shiller (2020) argued that the role of inflation in shaping bond and equity markets post-pandemic is paramount, as the real yields on bonds remain negative in many markets due to persistent inflation. This inflationary environment presents a unique challenge to equity markets, as it increases the costs of production for firms and reduces purchasing power for consumers. The future trajectory of the bond-equity relationship in the post-COVID era is expected to be shaped by several key economic factors. One of the most significant factors is the potential for long-term inflation, which could continue to place upward pressure on bond yields. Dufresne and Liao (2022) suggest that the changing landscape of inflation will require investors to reassess risk premiums and asset allocation strategies. As central banks move towards tighter monetary policies, there may be a return to the traditional negative relationship between bonds and equities, as rising interest rates could negatively impact stock market returns.

Additionally, the impact of fiscal policy and government stimulus on market dynamics remains an open question. As governments around the world begin to scale back their pandemic-related fiscal support, the sustainability of equity market gains remains uncertain. Research by Bhattacharya et al. (2022) points to the long-term effects of government intervention on equity market valuations, suggesting that fiscal support could continue to shape the performance of both asset classes, even as economies recover. Finally, the use of advanced econometric tools, including paired t-tests and regression models, to better understand the shifting relationship between bond yields, equity returns, and economic factors will be a key area of future research. This will help provide a clearer picture of how macroeconomic factors such as inflation, fiscal policy, and interest rates interact with market behaviour and influence long-term investment decisions.

Recent studies continue to explore the nuanced dynamics of bond yields, equity returns, and economic factors post-COVID-19. Wei and Wu (2023) investigate how global supply chain disruptions influenced bond yield volatility, emphasizing the role of international trade in stabilizing financial markets. Ahmed et al. (2023) focus on equity markets, highlighting that sector with higher digitalization exhibited resilience during the pandemic, suggesting a potential shift in investment priorities. Additionally, Li and Zhang (2023) analyze central bank communications post-pandemic, finding a heightened sensitivity of bond and equity markets to policy announcements, which underscores the evolving role of central bank transparency in market stability. These studies collectively enrich the understanding of market adjustments and emphasize the need for adaptive strategies in a rapidly changing financial environment.

The COVID-19 pandemic has been a watershed event for global financial markets, shifting the relationship between bond yields, equity returns, and economic factors. Pre-pandemic, these relationships adhered to traditional models, with bond yields and equities typically moving in opposite directions. However, the pandemic and its aftermath have disrupted these patterns, creating a more complex environment for investors and policymakers. The unprecedented fiscal and monetary interventions during the crisis led to a period of co-positive returns for both asset classes, while post-pandemic inflationary pressures and rising interest rates have created a new dynamic, challenging traditional economic models. Future research will continue to explore these evolving relationships, offering valuable insights for investors navigating this post-pandemic era.

III. Methodology

The methodology of this study analyses the relationship between bond yields, equity returns, and key economic factors before and after the COVID-19 pandemic in India, using month-on-month (MOM) returns. The time frame for data collection is divided into two periods: pre-COVID (September 2017 to February 2020) and post-COVID (July 2020 to December 2022). Each period consists of 30 observations, totalling 60 data points. The selection of 30 observations before and after the pandemic allows for a manageable yet comprehensive comparison between the two distinct economic environments. Thirty months before the COVID-19 outbreak capture the steady pre-pandemic conditions, while 30 months after the onset of the pandemic reflect the volatility, recovery, and new market conditions during the post-pandemic phase. This structure provides a balanced approach for investigating the potential impact of COVID-19 on financial and economic indicators while ensuring sufficient data for reliable analysis.

The inclusion of other six economic variables—bank rates, inflation, industrial production (IIP), exchange rates (USD/INR), foreign direct investment (FDI), and foreign reserves—was necessary to contextualize the relationship between bond yields, equity returns, and broader macroeconomic dynamics. These variables were selected because they have significant influence on financial markets. For example, inflation directly impacts bond yields and equity returns, while bank rates set by the Reserve Bank of India influence interest rates and investor sentiment. Industrial production (IIP) provides insights into economic growth and potential future demand, which in turn affects both bond markets and equities. Exchange rates (USD/INR) are essential for understanding the impact of global market dynamics on the Indian economy, particularly in an export-driven market. FDI is indicative of investor confidence and the overall stability of the economy, and foreign reserves reflect a nation's economic resilience, particularly in times of global uncertainty. Together, these variables form a comprehensive view of the macroeconomic environment, which is critical for understanding their interplay with bond yields and equity returns in India.

The problem addressed in this study is the disruption caused by the COVID-19 pandemic in the Indian financial markets, particularly the bond and equity markets, and its subsequent recovery. While the pandemic led to severe volatility and uncertainty in global and domestic markets, it is unclear how the relationships between key economic indicators, bond yields, and equity returns shifted during this period. This study aims to investigate whether these relationships experienced structural changes before and after the pandemic and how various economic factors such as inflation, interest rates, industrial production, and foreign investment influenced bond yields and equity returns during both phases. Understanding these shifts is crucial for identifying the broader impacts of COVID-19 on financial markets and the economy.

The study employs multivariate correlation analysis to examine the relationships between bond yields, equity returns, and the selected economic variables. Regression models are utilized to assess the impact of economic factors such as inflation, bank rates, IIP, exchange rates, FDI, and foreign reserves on bond yields and equity returns. The main goal is to evaluate how these relationships were affected by the pandemic, identifying any structural changes in the financial market dynamics. Additionally, paired t-tests are used to compare the means of the variables before and after the pandemic, helping to determine if there were significant shifts in these indicators as a result of the pandemic's economic impact.

The dataset consists of 30 observations for each period (pre-COVID and post-COVID), totalling 60 observations for the nine variables. These variables include long-term bond yields (10-year G-sec), short-term bond yields (91-day TB), equity returns from the NSE Nifty index, and economic indicators such as inflation, bank rates, industrial production (IIP), exchange rates (USD/INR), FDI, foreign reserves, and gold prices. The data, sourced from the RBI, provides a robust basis for analysis. This methodology ensures that the study captures the financial market shifts caused by the pandemic and offers valuable insights for investors and policymakers navigating similar future challenges.

While this methodology provides valuable insights into the shifts in market dynamics before and after COVID-19, there are several limitations to consider. The study is confined to Indian financial markets, which may limit the generalizability of the findings to other countries with different economic structures or pandemic responses. Additionally, the data used for analysis relies on monthly aggregates, which may obscure short-term fluctuations within the periods studied. While the inclusion of 30 observations before and after the pandemic is reasonable, a larger dataset with more extended periods could offer a deeper understanding of long-term trends. Furthermore, the focus on bond yields and equity returns may overlook other potentially significant factors that could have influenced market behaviour, such as government fiscal policies or geopolitical events. Despite these limitations, the study provides a robust framework for understanding the impact of COVID-19 on India's financial markets and offers insights for future research in similar contexts.

Descriptive statistics

Descriptive statistics were calculated for the nine variables, including bond yields, equity returns, and economic indicators, to summarize their central tendencies and variability. The study also used the Jarque-Bera test to assess the normality of the data distributions for each variable. The results of the test indicated whether the data significantly deviated from a normal distribution, guiding further statistical analysis. These preliminary steps provided a solid basis for the subsequent paired t-test and regression analyses.

Multivariate correlation analysis

Multivariate correlation analysis explores the relationships among multiple variables simultaneously. The correlation matrix is calculated using the formula:

$$\rho_{XY} = \frac{COV\ (X,\ Y)}{\sigma_X \sigma_Y}$$

where ρ_{XY} is the Pearson correlation coefficient, Cov (X,Y) is the covariance between variables X and Y, and σ_X and σ_Y are the standard deviations of X and Y, respectively. This analysis helps identify the strength and direction of relationships between bond yields, equity returns, and various economic factors.

The paired t-test

The paired t-test was conducted to compare the mean differences between the variables before and after the COVID-19 pandemic. The formula for the paired t-test is:

$$t = \frac{\bar{d} - \mu_d}{\frac{s_d}{\sqrt{n}}}$$

where:

- $\bar{d}$ is the mean of the differences between paired observations,
- s_d is the standard deviation of the differences,
- n is the number of paired observations.

This test helped to determine whether there was a statistically significant change in bond yields, equity returns, and economic indicators across the pre- and post-COVID periods. The null hypothesis stated that there was no significant difference between the two periods, and the results showed whether observed differences were statistically significant.

Ordinary Least Squares (OLS)

The Ordinary Least Squares (OLS) test in multiple regression estimates relationships between one dependent variable and multiple independent variables. The formula is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + \epsilon$$

Here, Y is the dependent variable, X_1, X_2…….., X_n are independent variables, β_0 is the intercept, β_1 ,β_2…, β_n are coefficients, and ϵ is the error term. OLS minimizes the sum of squared residuals (ϵ^2) to estimate β values. Assumptions like linearity, no multicollinearity, and homoscedasticity are crucial for valid results. This test is essential for analysing the combined effect of multiple predictors on an outcome.

Variance Inflation Factor (VIF) – Multicollinearity Test

The Variance Inflation Factor (VIF) is used to detect multicollinearity in regression models by measuring how much the variance of a regression coefficient is inflated due to correlation with other predictors. The formula for VIF is:

$$VIF_i = \frac{1}{1 - R_i^2}$$

where R_i^2 is the coefficient of determination obtained by regressing the i-th predictor on all other predictors. A high VIF (typically > 10) indicates significant multicollinearity, which may distort the regression results and reduce the reliability of the coefficients.

Normality test

The Chi-square test for normality is used to assess whether a dataset follows a normal distribution. It compares the observed frequency of data in each category with the expected frequency if the data were normally distributed. The formula for the Chi-square test is:

$$\chi^2 = \Sigma \frac{(O - E)^2}{E}$$

where O is the observed frequency, E is the expected frequency, and the summation is over all categories. A high Chi-square value indicates a significant deviation from normality.

Breusch-Pagan (BP) Test

The Breusch-Pagan (BP) Test detects heteroscedasticity in regression models by assessing whether error variances depend on independent variables. It involves regressing the squared residuals ($\hat{\varepsilon}^2$) on the predictors:

$$\hat{\varepsilon}^2 = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \cdots + \alpha_k X_k + u$$

The test statistic is:

$$BP = \frac{1}{2} R_{aux}^2 n$$

where R_{aux}^2 is the coefficient of determination from the auxiliary regression. The BP statistic follows a chi-squared distribution, with higher values indicating heteroscedasticity.

Lagrange Multiplier (LM) Test

The Lagrange Multiplier (LM) Test for autocorrelation detects serial correlation in residuals of a regression model. It involves regressing residuals ($\hat{\varepsilon}_t$) on lagged residuals and independent variables. The auxiliary regression is:

$$\hat{\varepsilon}_t = \alpha_0 + \alpha_1 \hat{\varepsilon}_{t-1} + \alpha_2 \hat{\varepsilon}_{t-2} + \cdots + \alpha_p \hat{\varepsilon}_{t-p} + ut$$

The test statistic is:

$$LM = nR^2$$

where n is the sample size, and R^2 is the auxiliary regression's determination coefficient. The LM statistic follows a chi-squared distribution, with significance indicating autocorrelation.

Lagrange Multiplier (LM) Test for ARCH Effect

The Lagrange Multiplier (LM) Test for ARCH Effect identifies autoregressive conditional heteroscedasticity (ARCH) in time-series data. It involves regressing squared residuals ($\hat{\varepsilon}_t$) on their lagged values. The auxiliary regression is:

$$\hat{\varepsilon}_t = \alpha_0 + \alpha_1 \hat{\varepsilon}_{t-1} + \alpha_2 \hat{\varepsilon}_{t-2} + \cdots + \alpha_p \hat{\varepsilon}_{t-p} + ut$$

The test statistic is: $LM = nR^2$

where n is the sample size, and R^2 is from the auxiliary regression. A significant LM statistic indicates ARCH effects, essential for volatility modelling.

Brock-Dechert-Scheinkman (BDS) Test

The Brock-Dechert-Scheinkman (BDS) Test assesses non-linearity or dependence in time-series data by examining deviations from randomness. It compares the correlation of points in reconstructed phase space at varying dimensions. The test statistic is:

$$W = \frac{\sqrt{n}\,(C_m(\varepsilon) - C_1^m(\varepsilon)}{\sigma_m(\varepsilon)}$$

where $C_m(\varepsilon)$ is the correlation integral for dimension m, $C_1^m(\varepsilon)$ is the product of one-dimensional correlation integrals, and $\sigma_m(\varepsilon)$ is the standard deviation. A significant result indicates non-linear structure, making the test vital for analysing chaotic or complex systems.

Adjusted R-squared

The Adjusted R-squared adjusts the R-squared value for the number of predictors in a regression model, providing a more accurate measure of goodness-of-fit, especially with multiple predictors. The formula is:

$$\bar{R}^2 = 1 - \frac{(1 - R^2)\,(n-1)}{n - p - 1}$$

where R^2 is the R-squared value, n is the number of observations, and p*p* is the number of predictors. Unlike R-squared, the Adjusted R-squared penalizes unnecessary variables, preventing overfitting and giving a more reliable evaluation of model performance.

Standard Error (SE)

Standard Error (SE) measures the precision of a sample statistic, such as the mean, relative to the population parameter. It is calculated as:

$$SE = \frac{\sigma}{\sqrt{n}}$$

where σ is the population standard deviation and n is the sample size. A smaller SE indicates greater accuracy of the sample estimate, making it critical in hypothesis testing and confidence interval calculation.

Akaike Information Criterion (AIC)

The Akaike Information Criterion (AIC) is used to evaluate and compare the goodness of fit of statistical models, balancing model complexity and fit. The formula for AIC is:

$$AIC = 2k - 2\ln(L)$$

where k is the number of parameters in the model, and L is the likelihood of the model. A lower AIC value indicates a better-fitting model, while penalizing excessive complexity. It is widely used in model selection, especially when comparing models with different numbers of parameters.

where $\Delta Y_t = Y_t - Y_{t-1}$ and $\Delta X_t = X_t - X_{t-1}$. This method eliminates time-invariant unobserved effects, focusing on the variation within the data. It is commonly applied in time-series and panel data analysis.

Durbin-Watson (DW) Test

The Durbin-Watson (DW) Test checks for autocorrelation in the residuals of a regression model, particularly for first-order correlation. The test statistic is:

$$DW = \frac{\sum_{t=2}^{n} (\hat{\varepsilon}_t - \hat{\varepsilon}_{t-1})^2}{\sum_{t=1}^{n} \hat{\varepsilon}_t^2}$$

where $\hat{\varepsilon}_t$ are the residuals at time t. The DW statistic ranges from 0 to 4; a value near 2 indicates no autocorrelation, values < 2 suggest positive autocorrelation, and values > 2 indicate negative autocorrelation. This test is critical for ensuring the validity of regression assumptions in time-series data.

IV. Results Analysis

Table 1: Descriptive statistics of Bond yields, Equity index and other Economic indicators before COVID-19

Variable	10Y GSec	91Day TB	Foreign Reserves	Bank Rate	Inflation	Gold	NSE NIFTY	IIP	FDI	Exchange Rate
N	30	30	30	30	30	30	30	30	30	30
Mean	7.2876	6.1269	9.7996	6.1885	4.0869	6.0558	8.7538	2.9940	18.2010	3.8444
Median	7.3769	6.3149	9.1172	6.2500	3.8450	3.1031	10.1140	3.5136	12.0050	3.6302
Minimum	6.4724	4.8901	3.3842	5.4000	1.9700	-9.1408	-5.7914	-6.6265	-113.5500	-5.7986
Maximum	8.0157	7.1443	19.2570	6.7500	7.5900	23.6990	25.3160	8.4082	137.5800	13.3600
Std. Dev.	0.5004	0.6497	4.6161	0.4873	1.4825	10.1150	6.7632	3.5573	54.2760	4.9734
C.V.	0.0687	0.1060	0.4711	0.0787	0.3627	1.6702	0.7726	1.1881	2.9819	1.2937
Skewness	-0.1808	-0.6196	0.4914	-0.4672	0.8219	0.3465	-0.0905	-0.9195	-0.1861	-0.0025
Ex. kurtosis	-1.2659	-0.7212	-0.9133	-0.9821	0.1540	-1.2923	0.2612	0.7460	0.2403	-0.7318
IQ range	1.0063	1.0023	7.2136	0.8375	1.8475	19.6110	8.7504	4.1602	67.1550	7.5602
Jarque-Bera	1.8775 (0.391)	2.2272 (0.328)	1.9523 (0.3771)	1.9906 (0.3695)	2.9531 (0.2284)	2.3292 (0.3120)	0.1093 (0.9467)	4.2668 (0.1184)	0.2126 (0.8991)	0.5802 (0.7481)

Source: The Authors, Note: *p < 0.05.

Table 2: Descriptive statistics of Bond yields, Equity index and other Economic indicators after COVID-19

Variable	10Y GSec	91Day TB	Foreign Reserves	Bank Rate	Inflation	Gold	NSE NIFTY	IIP	FDI	Exchange Rate
N	30	30	30	30	30	30	30	30	30	30
Mean	6.4881	3.7261	13.7443	4.4231	6.0296	5.2994	20.8432	10.7121	25.3450	2.4462
Median	6.3631	3.4488	14.2940	4.2500	6.0700	0.7410	14.4860	3.3205	17.4730	2.7253
Minimum	5.8322	3.0473	-8.5214	4.2500	4.0600	-8.8775	-3.0182	-7.1315	-118.6400	-4.2067
Maximum	7.4907	6.4702	27.3920	6.1500	7.7900	25.7510	53.5710	133.5200	368.4300	10.8120
Std. Dev.	0.5757	1.0684	11.1860	0.6626	1.0873	10.6620	17.3250	25.1230	116.8700	3.8326
C.V.	0.0875	0.2675	0.9491	0.1440	0.1800	2.3613	0.9004	2.5374	5.7762	1.2027
Skewness	0.4232	1.2777	-0.2932	1.5856	-0.2711	0.6356	0.4878	4.3072	1.1400	0.2664
Ex. kurtosis	-1.2720	0.1306	-0.9034	0.8511	-1.0499	-0.7990	-1.0779	18.7170	1.1710	-0.5874
IQ range	1.0808	1.1905	16.4840	0.4000	1.8100	15.3100	33.4730	11.0810	163.0000	5.4179
Jarque-Bera	2.8208 (0.2440)	7.9109* (0.0191)	1.4015 (0.4961)	13.0266* (0.0014)	1.6871 (0.4301)	2.7239 (0.2561)	2.5539 (0.2788)	512.994* (0.0000)	7.9387* (0.0188)	0.7598 (0.6839)

Source: The Authors, Note: *p < 0.05.

The descriptive statistics in table 1 provide an overview of key economic and financial variables before the COVID-19 pandemic. The 10-Year Government Security (10Y GSec) and 91-Day Treasury Bill (TB) rates exhibit means of 7.29% and 6.13%, respectively, indicating a relatively stable bond market. While both variables show moderate standard deviations (0.50 and 0.65), the skewness values (-0.18 for 10Y GSec and -0.62 for 91-Day TB) indicate slight left-skewness, meaning that yields were generally below the average for certain periods. The negative excess kurtosis values suggest distributions with thinner tails compared to a normal distribution, indicating fewer extreme deviations in yields. Foreign reserves, with a mean of 9.80 (in appropriate units), show significant variability, reflected in a standard deviation of 4.62 and a coefficient of variation (C.V.) of 0.47. The skewness (0.49) and negative kurtosis (-0.91) indicate a mildly right-skewed and relatively flat distribution. The bank rate, with a mean of 6.19% and a standard deviation of 0.49, reflects a fairly stable monetary policy environment, showing minimal variability. Its slightly negative skewness (-0.47) suggests that lower rates occurred more frequently than higher rates.

Inflation demonstrates a mean of 4.09% with considerable variability (standard deviation of 1.48). The positive skewness (0.82) and low excess kurtosis (0.15) imply occasional periods of elevated inflation but a generally moderate range. Gold prices show substantial variability, with a mean of 6.06 and a high standard deviation of 10.12. The C.V. of 1.67 highlights its sensitivity to external shocks, while the slightly positive skewness (0.35) and negative kurtosis (-1.29) indicate a broader but asymmetric distribution. The NSE NIFTY equity index had a mean value of 8.75 with a notable standard deviation of 6.76, indicating moderate market fluctuations. The minimal skewness (-0.09) and slightly positive kurtosis (0.26) suggest a distribution close to normal. Industrial production (IIP) displays high variability, with a mean of 2.99 and a standard deviation of 3.56. Its negative skewness (-0.92) and positive kurtosis (0.75) indicate that lower values were more frequent, with some extreme high values.

Foreign direct investment (FDI) shows the highest volatility, with a mean of 18.20 and a standard deviation of 54.28, reflected in the very high C.V. of 2.98. Its nearly symmetrical distribution is evident from the skewness (-0.18), and the kurtosis (0.24) suggests a near-normal spread. Finally, the exchange rate, with a mean of 3.84 and a standard deviation of 4.97, exhibits significant fluctuations, as seen in the C.V. of 1.29. Its near-zero skewness (-0.002) and slightly negative kurtosis (-0.73) suggest a balanced and slightly flattened distribution. Overall, parameter-wise interpretation reveals that central tendencies, dispersion, and distributional shapes vary across variables. While bond yields, bank rates, and the equity index exhibit stability, variables like gold, FDI, and the exchange rate reflect greater variability, likely influenced by external economic and geopolitical factors. The Jarque-Bera test confirms that most variables follow a normal distribution, reinforcing the representativeness of the dataset for pre-pandemic conditions.

The table 2provide insights into the behaviour of key economic and financial indicators after the COVID-19 pandemic. The 10-Year Government Security (10Y GSec) rates exhibit a mean of 6.49% with a standard deviation of 0.58, reflecting a slightly lower and more stable bond yield environment compared to pre-pandemic levels. The skewness (0.42) indicates a mild right-skewed distribution, suggesting that higher yields occurred occasionally. The excess kurtosis (-1.27) highlights a flatter-than-normal distribution, with fewer extreme values. The 91-Day Treasury Bill (TB) rates display a significant drop in the mean to 3.73%, accompanied by an increase in variability (standard deviation of 1.07). The positive skewness (1.28) and a slight leptokurtic shape (kurtosis of 0.13) indicate the presence of occasional high values, possibly reflecting short-term monetary policy interventions. Foreign reserves increased post-pandemic, with a mean of 13.74 and a substantial standard deviation of 11.19, indicating greater volatility. The negative skewness (-0.29) suggests that lower reserve levels were rare, while the kurtosis (-0.90) indicates a broader distribution.

The bank rate declined to a mean of 4.42%, reflecting accommodative monetary policy, with a standard deviation of 0.66 indicating moderate variability. The positive skewness (1.59) shows an upward bias in rates, while the kurtosis (0.85) points to a sharper-than-normal distribution. Inflation rose to an average of 6.03%, with moderate variability (standard deviation of 1.09). The negative skewness (-0.27) and low kurtosis (-1.05) suggest a slightly left-skewed and flat distribution, indicative of stable inflationary pressures post-pandemic. Gold prices remained volatile, with a mean of 5.30 and a high standard deviation of 10.66. The positive skewness (0.64) reflects occasional price spikes, while the kurtosis (-0.80) suggests a flat distribution. NSE NIFTY experienced a notable increase in its mean value to 20.84, with significant variability (standard deviation of 17.33). The skewness (0.49) indicates a slight right-skewness, and the kurtosis (-1.08) suggests a flatter distribution, implying frequent moderate fluctuations.

Industrial Production (IIP) showed the most pronounced volatility, with a mean of 10.71 and a very high standard deviation of 25.12. The extreme positive skewness (4.31) and high kurtosis (18.72) highlight a distribution dominated by occasional extreme values, reflecting the uneven recovery in industrial output. FDI inflows increased to a mean of 25.35, with substantial variability (standard deviation of 116.87). The positive skewness (1.14) and high kurtosis (1.17) reveal occasional high-value spikes. Finally, the exchange rate shows a decrease in its mean to 2.45, with moderate variability (standard deviation of 3.83). The near-zero skewness (0.27) and negative kurtosis (-0.59) indicate a balanced and slightly flattened distribution.

Parameter-wise, the analysis reveals that while bond yields and bank rates reflect a stable monetary policy environment, inflation showed moderate increases with manageable variability. Volatility is most pronounced in FDI and IIP, likely influenced by global disruptions and uneven recoveries. NSE NIFTY and gold prices show significant variability, reflecting market responses to post-pandemic uncertainties. The Jarque-Bera test results highlight deviations from normality in some variables, such as 91-Day TB, bank rate, IIP, and FDI, signalling structural or external influences on their distributions. These statistics underscore the pandemic's differential impact on economic indicators, with varying levels of stability and volatility observed across sectors.

A comparison of economic indicators before and after COVID-19 reveals significant shifts in their behaviour. Bond yields, represented by the 10-Year GSec and 91-Day TB rates, decreased notably after the pandemic, with means falling from 7.29% to 6.49% for 10Y GSec and from 6.13% to 3.73% for 91-Day TB. This reflects the accommodative monetary policies implemented globally to support economic recovery. Post-pandemic, the 91-Day TB rate displayed increased volatility (C.V. rising from 0.11 to 0.27), highlighting short-term policy adjustments. Foreign reserves saw a marked increase in their mean, from 9.80 to 13.74, indicating an effort to bolster external stability during uncertain times, but also exhibited greater volatility (standard deviation rising from 4.62 to 11.19). Similarly, the bank rate declined significantly, with reduced mean levels (6.19% to 4.42%) and moderate variability, signalling central banks' efforts to support economic activity.

Inflation increased moderately after the pandemic (mean rising from 4.09% to 6.03%), reflecting supply chain disruptions and fiscal stimulus measures, though its variability decreased slightly. Gold exhibited consistently high volatility before and after the pandemic, with a slight decline in its mean and persistently high variability, reflecting its role as a safe-haven asset during crises. Equity markets, represented by NSE NIFTY, surged post-pandemic, with the mean value jumping from 8.75 to 20.84 and variability significantly increasing, indicating greater investor optimism but also heightened risk. Industrial production (IIP) showed the most dramatic change, with both its mean and variability increasing sharply, driven by uneven recovery dynamics. FDI inflows also increased post-pandemic, with higher mean levels but extreme volatility, while the exchange rate displayed reduced mean levels and lower variability. Overall, the pandemic triggered significant shifts, with increased volatility in several indicators, reflecting global economic disruptions and subsequent recovery efforts.

Table 3: Variables Paired t test before and after COVID-19

Variable	N	Before Returns	After Returns	Std Error	t-Ratio	Prob	Correlation
10Y GSec	30	7.287	6.4881	0.1913	-4.1762*	0.0003	-0.7893*
91Day TB	30	6.127	3.7261	0.2622	-9.1552*	<.0001	-0.8400*
Foreign Reserves	30	9.7996	13.7443	2.3382	1.687	0.104	-0.2192
Bank Rate	30	6.1885	4.4231	0.1632	-10.8120*	<.0001	-0.7046*
Inflation	30	4.0869	6.0296	0.282	6.8899*	<.0001	0.4229*
Gold	30	6.0558	5.2994	2.8902	-0.2617	0.7957	0.0208
NSE NIFTY	30	8.7538	20.8432	4.0137	3.0120*	0.0059	-0.2695
IIP	30	2.9941	10.7121	5.2116	1.4809	0.1511	0.0201
FDI	30	18.2014	25.345	22.9376	0.3114	0.758	0.3107*
Exchange Rate	30	3.8445	2.4462	1.5177	-0.9213	0.3657	-0.7441*

Source: The Authors. Note: *p < 0.05.

The paired t-test results in table 3 reveal significant changes in several economic indicators before and after COVID-19. For bond yields, the 10-Year GSec and 91-Day TB rates exhibit statistically significant declines, with t-ratios of -4.18 and -9.16, respectively (both *$p < 0.05$). The strong negative correlations (-0.79 and -0.84) indicate a consistent inverse relationship between pre- and post-pandemic values, reflecting structural changes in monetary policy. Similarly, the bank rate shows a significant decrease (t-ratio -10.81, *$p < 0.05$) with a strong negative correlation (-0.70), emphasizing accommodative policy measures. Inflation, however, demonstrates a significant increase (t-ratio 6.89, *$p < 0.05$), with a positive correlation (0.42), pointing to heightened price pressures post-pandemic.

Other variables exhibit mixed results. NSE NIFTY shows a substantial increase in returns post-pandemic, with a significant t-ratio of 3.01 (*$p < 0.05$), though the correlation is weak (-0.27). Foreign reserves, while increasing in mean value, do not show statistical significance (t-ratio 1.69, $p = 0.104$), suggesting variability that tempers consistent trends. Gold prices, FDI, and industrial production (IIP) also lack significant t-ratios, indicating that changes in these variables may not be directly attributable to the pandemic or could be influenced by broader global factors. The exchange rate, although decreasing, does not show statistical significance (t-ratio -0.92, $p = 0.366$) but has a strong negative correlation (-0.74), suggesting consistent directional trends. Overall, the paired t-test highlights significant shifts in monetary policy indicators (10Y GSec, 91-Day TB, and bank rate) and inflation, reflecting systemic economic adjustments post-COVID-19. Conversely, variables like FDI, IIP, and gold exhibit changes without strong statistical backing, underscoring the uneven and varied impact of the pandemic across different economic dimensions.

Table 4: Multivariate Correlations of the variables before COVID-19

Variable	10-Y G-Sec	91-Day TB	Foreign Reserves	Bank Rate	Inflation	Gold	NSE NIFTY	IIP	FDI	Exchange Rate
10-Y G-Sec	1	0.8558*	-0.1679	0.8128*	-0.3793*	-0.9053*	0.1674	0.5850*	-0.0368	0.6558*
91-Day TB	0.8558*	1	-0.5092*	0.9681*	-0.7409*	-0.8874*	-0.0047	0.4602*	-0.0451	0.6405*
Foreign Reserves	-0.1679	-0.5092*	1	-0.5223*	0.8536*	0.3282*	0.2311	0.2724	0.2872	-0.1785
Bank Rate	0.8128*	0.9681*	-0.5223*	1	-0.7504*	-0.8952*	-0.0628	0.3923*	-0.1057	0.7183*
Inflation	-0.3793*	-0.7409*	0.8536*	-0.7504*	1	0.5378*	0.3733*	0.0757	0.057	-0.4561*
Gold	-0.9053*	-0.8874*	0.3282*	-0.8952*	0.5378*	1	-0.1516	-0.5105*	0.0995	-0.7720*
NSE NIFTY	0.1674	-0.0047	0.2311	-0.0628	0.3733*	-0.1516	1	0.2732	-0.3654*	-0.3315*
IIP	0.5850*	0.4602*	0.2724	0.3923*	0.0757	-0.5105*	0.2732	1	0.1584	0.2727
FDI	-0.0368	-0.0451	0.2872	-0.1057	0.057	0.0995*	-0.3654*	0.1584	1	0.1717
Exchange Rate	0.6558*	0.6405*	-0.1785	0.7183*	-0.4561*	-0.7720*	-0.3315*	0.2727	0.1717	1

Source: The Authors, Note: *p < 0.05.

Table 5: Multivariate Correlations of the variables after COVID-19

Variable	10-Y G-Sec	91-Day TB	Foreign Reserves	Bank Rate	Inflation	Gold	NSE NIFTY	IIP	FDI	Exchange Rate
10-Y G-Sec	1	0.8606*	-0.9312*	0.7510*	0.4157*	-0.5463*	-0.3954*	-0.0428	-0.1792	0.7185*
91-Day TB	0.8606*	1	-0.8835*	0.9669*	0.3274*	-0.4248*	-0.4996*	-0.1502	-0.209	0.8373*
Foreign Reserves	-0.9312*	-0.8835*	1	-0.7991*	-0.3124*	0.6665*	0.2674	0.099	0.2249	-0.6595*
Bank Rate	0.7510*	0.9669*	-0.7991*	1	0.2546	-0.3760*	-0.4810*	-0.1416	-0.2427	0.8217*
Inflation	0.4157*	0.3274*	-0.3124*	0.2546	1	0.176	-0.6052*	-0.2947	0.2335	0.4661*
Gold	-0.5463*	-0.4248*	0.6665*	-0.3760*	0.1760	1	-0.3246*	-0.0843	0.2772	-0.1276
NSE NIFTY	-0.3954*	-0.4996*	0.2674	-0.4810*	-0.6052*	-0.3246*	1	0.3813*	0.14	-0.8389*
IIP	-0.0428	-0.1502	0.099	-0.1416	-0.2947	-0.0843	0.3813*	1	0.2081	-0.3503*
FDI	-0.1792	-0.209	0.2249	-0.2427	0.2335	0.2772	0.14	0.2081	1	-0.3019*
Exchange Rate	0.7185*	0.8373*	-0.6595*	0.8217*	0.4661*	-0.1276	-0.8389*	-0.3503*	-0.3019*	1

Source: The Authors, Note: *p < 0.05.

The multivariate correlation matrix in table 4, depicts significant relationships among economic indicators before COVID-19, with the 10-Year GSec showing strong positive correlations with the 91-Day TB rate (0.856) and the bank rate (0.813), both statistically significant (*$p < 0.05$). This suggests that movements in long-term bond yields are closely tied to short-term interest rates and monetary policy actions. Conversely, the

10-Year GSec shows significant negative correlations with inflation (-0.379), gold prices (-0.905), and exchange rates (-0.656), indicating that lower bond yields are associated with higher inflationary pressures, gold's role as a safe-haven asset, and currency depreciation. These relationships underscore the interconnectedness of bond yields with broader economic and financial conditions.

The 91-Day TB rate exhibits similar patterns, with a strong positive correlation to the bank rate (0.968) and a significant negative relationship with inflation (-0.741) and gold (-0.887). This highlights the influence of monetary policy on short-term rates and their inverse relationship with inflationary trends and safe-haven investments. Foreign reserves show a complex relationship, negatively correlated with the 91-Day TB rate (-0.509) and the bank rate (-0.522), while positively correlated with inflation (0.854) and gold prices (0.328), suggesting that reserves tend to increase during inflationary periods, potentially as a buffer against economic uncertainty.

Gold and NSE NIFTY exhibit contrasting behaviours. Gold prices are negatively correlated with most monetary variables, including the 10-Year GSec, 91-Day TB rate, and bank rate, indicating its inverse relationship with yield movements and its role as a hedge against economic instability. On the other hand, NSE NIFTY shows weaker correlations, with a marginal positive relationship with inflation (0.373) and a negative correlation with exchange rates (-0.332). The industrial production index (IIP) displays moderate positive correlations with the 10-Year GSec (0.585) and 91-Day TB rate (0.460), reflecting the link between industrial growth and economic stability. Meanwhile, FDI and exchange rates show limited significant correlations, emphasizing their relatively independent dynamics in this period. These results illustrate the intricate web of relationships among variables and the critical role of monetary and fiscal policies in shaping economic indicators before the pandemic.

Table 5 exhibits the multivariate correlation matrix after COVID-19 highlights significant shifts in the relationships among economic variables, reflecting the pandemic's impact. The 10-Year GSec shows a strong positive correlation with the 91-Day TB rate (0.861) and the bank rate (0.751), both statistically significant (*$p < 0.05$), indicating continued alignment of long-term and short-term yields with monetary policy adjustments. However, its strong negative correlation with foreign reserves (-0.931) suggests that higher bond yields coincide with declines in reserves, potentially due to outflows or currency interventions. The 10-Year GSec also exhibits significant negative relationships with gold (-0.546) and NSE NIFTY (-0.395), underscoring its inverse association with safe-haven assets and equity markets during this period.

The 91-Day TB rate mirrors these trends, with significant positive correlations with the bank rate (0.967) and exchange rates (0.837), indicating the influence of short-term yields on monetary policy and currency movements. Like the 10-Year GSec, it shows a strong negative correlation with foreign reserves (-0.884) and gold (-0.425), signalling that declining reserves and reduced safe-haven demand are associated with higher short-term yields. The bank rate follows a similar pattern, positively correlated with exchange rates (0.822) and negatively correlated with foreign reserves (-0.799) and gold (-0.376). These relationships reflect the pandemic-induced monetary easing and the resulting shifts in asset allocation and foreign exchange dynamics.

Other variables display nuanced relationships. Inflation shows a moderate positive correlation with the 10-Year GSec (0.416) and exchange rates (0.466) but a significant negative relationship with NSE NIFTY (-0.605), suggesting that higher inflation dampens equity market performance. Gold continues to exhibit a strong positive correlation with foreign reserves (0.667), maintaining its role as a hedge. NSE NIFTY shows a notable negative correlation with exchange rates (-0.839) and inflation, indicating equity market sensitivity to currency depreciation and price pressures. Industrial production (IIP) and FDI exhibit weaker correlations overall, reflecting their relative independence from these monetary variables. The findings highlight the complex interplay of economic forces post-COVID-19, characterized by significant adjustments in monetary policies, market dynamics, and asset relationships.

The comparison of multivariate correlations before and after COVID-19 reveals distinct shifts in the dynamics among economic variables, driven by the pandemic's impact on monetary policy and market behaviour. Before COVID-19, both the 10-Year GSec and 91-Day TB rates had strong positive correlations with the bank rate (0.813 and 0.968, respectively), reflecting close alignment with monetary policy decisions. These relationships persisted after COVID-19 (0.751 and 0.967, respectively), although slightly weaker, highlighting the consistent influence of policy rates on yields. However, the 10-Year GSec's correlation with foreign reserves shifted significantly, from being negligible (-0.168) before the pandemic to a strong negative correlation (-0.931) afterward. Similarly, the 91-Day TB rate's correlation with reserves became more pronounced, shifting from a moderate negative (-0.509) to a stronger negative (-0.884). These changes underscore the heightened pressures on reserves post-COVID-19, possibly due to capital flight and interventionist monetary policies.

Gold maintained its role as a safe-haven asset in both periods but exhibited differing dynamics. Before COVID-19, gold had a strong negative correlation with bond yields (-0.905 for 10-Year GSec and -0.887 for 91-Day TB), which weakened post-COVID-19 (-0.546 and -0.425, respectively). This suggests a reduced reliance on gold as a hedge against declining yields in the pandemic's aftermath. Additionally, NSE NIFTY demonstrated a more pronounced sensitivity to inflation and exchange rates post-COVID-19, shifting from weak correlations before the pandemic to strong negative correlations with inflation (-0.605) and exchange rates (-0.839). These shifts reflect increased equity market vulnerabilities to inflationary pressures and currency depreciation in the wake of the pandemic.

Inflation's correlations with other variables also shifted notably. Before COVID-19, it had a negative relationship with bond yields (-0.379 with the 10-Year GSec) and a positive correlation with foreign reserves (0.854). After COVID-19, inflation became positively correlated with bond yields (0.416 with the 10-Year GSec), indicating changing inflation expectations influencing long-term yields. While industrial production (IIP) and foreign direct investment (FDI) exhibited relatively weak correlations with most variables in both periods, their post-COVID-19 patterns showed slightly increased independence from monetary and financial indicators. Overall, the post-COVID-19 period was marked by stronger interdependencies between monetary indicators and market variables, alongside heightened market volatility and shifts in traditional relationships, emphasizing the pandemic's lasting economic disruptions.

Table 6: Variables impact on 10Y GSec bond yields before COVID-19

Variables and Residuals Test	Ordinary Least Square (OLS)			OLS After Collinearity Adjusted		
	Coefficient	p-value	VIF	Coefficient	p-value	VIF
Constant	4.2977**	0.0496	---	7.1087***	<0.0001	---
Foreign Reserves	0.00561	0.8026	6.262	0.00306	0.9231	6.101
Inflation	0.16339	0.1114	12.502[b]	−0.10318	0.3224	6.629
NSE NIFTY	−0.02203	0.1145	4.823	0.02448**	0.0459	1.757
IIP	−0.01135	0.5721	2.952	0.05234**	0.0187	1.533
FDI	0.00079	0.4320	1.714	−0.00053	0.6909	1.521
Exchange Rate	−0.05103*	0.0613	9.642	0.05429***	0.0025	1.756
Gold	−0.0613***	0.0030	19.302[b]	---	---	---
Bank Rate	0.49230	0.1129	12.379[b]	---	---	---
S.E. of Regression	0.203964[a]			0.292411		
Adjusted R-squared	0.833829[b]			0.658467		
F Stat	16.68092*** (0.0000)			9.033219*** (0.0000)		
Akaike Criterion (AIC)	−1.93224[a]			15.69072		
Durbin-Watson	1.54422			2.008448		
Normality (Chi-square)	1.39441 (0.4979)			0.27983 (0.8694)		
White's test for HS (LM)	15.5856 (0.4822)			12.7787 (0.3853)		
Breusch-Pagan test for HS (LM)	3.29974 (0.9141)			5.8339 (0.4420)		
Autocorrelation (LMF)	0.72005 (0.4086)			0.0331 (0.8575)		
ARCH (LM)	0.00401 (0.9494)			0.2057 (0.6501)		
BDS test Linearity	0.554 [0.819]			-2.517 [0.265]		

Source: The Authors. Note: ***p < 0.01, **p < 0.05 & *p < 0.10, [a] Lowest value, and [b] Highest Value.

The analysis of the variables' impact on 10Y GSec bond yields before COVID-19, as captured in Table 6, reveals several key insights. Initially, the Ordinary Least Squares (OLS) regression identifies significant relationships, particularly with gold (-0.0613, ***p < 0.01) and exchange rates (-0.05103, *p < 0.10), indicating these factors had notable negative impacts on bond yields. The high Variance Inflation Factor (VIF) values for inflation (12.502), gold (19.302), and bank rates (12.379) highlight substantial multicollinearity, which complicates the interpretation of these variables. Despite these issues, the adjusted R-squared value of 0.8338 demonstrates a strong explanatory power of the model. Other variables like foreign reserves, inflation, and NSE NIFTY exhibited weaker significance in their coefficients, with p-values above 0.10.

After adjusting for collinearity, the refined OLS model presents different dynamics. The inclusion of NSE NIFTY (0.02448, **p < 0.05), IIP (0.05234, **p < 0.05), and exchange rate (0.05429, ***p < 0.01) as significant contributors indicates their growing influence on bond yields when multicollinearity is mitigated. Notably, gold and the bank rate are excluded due to high VIF values, which simplifies the model and reduces redundancy. The reduction in adjusted R-squared to 0.6585 reflects the trade-off between model complexity and explanatory power. Still, the model maintains statistical validity with an F-statistic of 9.0332 (***p < 0.01), affirming its robustness.

Diagnostic tests further validate the model's reliability. The Durbin-Watson statistic improves to 2.0084, indicating minimal autocorrelation in the residuals. Normality tests, with Chi-square p-values of 0.4979 and 0.8694, confirm that the residuals follow a normal distribution, while homoscedasticity tests, including White's and Breusch-Pagan, show no evidence of heteroscedasticity. The BDS test results suggest linearity in the model. Collectively, these diagnostics affirm that the adjusted model is well-specified, providing clearer insights into the determinants of 10Y GSec bond yields before COVID-19, while addressing multicollinearity and ensuring statistical robustness.

Before COVID-19, when analysing the model without collinearity adjustment, the Akaike Information Criterion (AIC) was −1.93224, indicating a relatively good model fit. The Standard Error (S.E.) of Regression was 0.203964, reflecting a moderate level of prediction error. After adjusting for collinearity, the AIC increased to 15.69072, signalling a much poorer fit. Additionally, the S.E. of Regression increased to 0.292411, suggesting greater prediction error and reduced precision after collinearity adjustment. This comparison suggests that the model without collinearity adjustment had a better fit and lower error.

Table 7: Variables impact on 10Y GSec bond yields after COVID-19

Variables and Residuals Test	Ordinary Least Square (OLS)			OLS After Collinearity Adjusted		
	Coefficient	p-value	VIF	Coefficient	p-value	VIF
Constant	7.1377***	<0.0001	---	7.1465***	<0.0001	---
Foreign Reserves	−0.0400***	0.0002	7.832	−0.0442***	<0.0001	7.326
Inflation	0.05803	0.2798	2.639	0.03682	0.5025	2.512
NSE NIFTY	0.00504	0.5442	16.38[b]	−0.00832*	0.0533	3.606
IIP	0.00374**	0.0299	1.313	0.00313*	0.0726	1.258
FDI	0.00010	0.7908	1.544	0.00001	0.9763	1.519
Exchange Rate	0.08626*	0.0791	26.05[b]	---	---	---
Gold	0.00696	0.4097	6.355	0.00209	0.8033	5.714
Bank Rate	−0.21432	0.1461	7.203	−0.05241	0.6613	4.462
S.E. of Regression	0.184743[a]			0.575731		
Adjusted R-squared	0.897033[b]			0.88446		
F Stat	28.1036*** (0.0000)			27.79259*** (0.0000)		
Akaike Criterion (AIC)	−7.914213[a]			−5.085650		
Durbin-Watson	1.708377			1.567097		
Normality (Chi-square)	5.74638* (0.0565)			12.771*** (0.0016)		
White's test for HS (LM)	25.7491 (0.1056)			23.3082 (0.1057)		
Breusch-Pagan test for HS (LM)	19.4119** (0.0219)			25.1737*** (0.0014)		
Autocorrelation (LMF)	0.48837 (0.4935)			1.36902 (0.2564)		
ARCH (LM)	0.930668 (0.3346)			0.104316 (0.7467)		
BDS test Linearity	1.004 [0.534]			0.510 [0.750]		

Source: The Authors. Note: ***p < 0.01, **p < 0.05 & *p < 0.10, [a] Lowest value, and [b] Highest Value.

The analysis of the variables' impact on 10Y GSec bond yields after COVID-19, presented in Table 7, shows notable shifts compared to the pre-COVID-19 period. The Ordinary Least Squares (OLS) regression indicates that foreign reserves (−0.0400, ***p < 0.01) significantly and negatively affect bond yields, suggesting that increases in foreign reserves have a downward pressure on yields. This relationship strengthens after adjusting for collinearity, with a similar coefficient (−0.0442, ***p < 0.01). Exchange rates also exhibit a positive but weaker coefficient (0.08626, *p < 0.10), indicating that an appreciation of the exchange rate could push bond yields up, although this effect becomes absent after collinearity adjustment due to multicollinearity. Other variables, such as inflation, gold, and bank rate, show little statistical significance after COVID-19, with inflation having a non-significant coefficient (0.05803, p = 0.2798), suggesting that inflation may have a diminished role in determining bond yields compared to the pre-COVID-19 period.

After adjusting for collinearity, several changes occur in the model. The coefficient of NSE NIFTY shifts from positive to negative (−0.00832, *p < 0.05), reflecting a shift in the influence of stock market performance on bond yields post-pandemic, although its statistical significance is marginal. The IIP retains a positive but smaller coefficient (0.00313, *p < 0.10), indicating a modest impact on bond yields. The model's explanatory power remains high, with the adjusted R-squared value of 0.8845, a slight decrease from the pre-COVID model (0.8970), demonstrating that the model still explains most of the variation in bond yields. The significant F-statistic (27.79259, ***p < 0.01) affirms the robustness of the model after the adjustments.

Diagnostic tests reveal that the post-COVID model exhibits some changes in residual behaviour. The Durbin-Watson statistic (1.5671) suggests a slight increase in autocorrelation compared to the pre-COVID model (1.5442), though the value still falls within an acceptable range. The normality test for the adjusted model shows significant deviation from normality (Chi-square p = 0.0016), which could indicate potential issues with model assumptions. The Breusch-Pagan test reveals significant heteroscedasticity (p = 0.0014), suggesting that the variability of the residual's changes across observations, which may affect the model's reliability. Nevertheless, other tests like White's test and the ARCH test do not show serious issues with heteroscedasticity or volatility, and the BDS test for linearity indicates that the model remains linear (p > 0.05).

These diagnostics suggest that while the model is generally robust, there are some issues related to heteroscedasticity and normality that need to be addressed. After COVID-19, the analysis without collinearity adjustment showed an AIC of −7.914213, which is indicative of a stronger model fit compared to the pre-COVID analysis. The S.E. of Regression was 0.184743, implying lower prediction error. When collinearity adjustment was applied, the AIC increased to −5.085650, reflecting a slightly reduced model fit. The S.E. of Regression rose to 0.575731, indicating higher prediction error. This analysis shows that, even after COVID-19, adjusting for collinearity resulted in a less effective model with higher prediction errors.

When comparing the variables' impact on 10Y GSec bond yields before and after COVID-19, it is clear that several relationships have shifted. Before COVID-19, foreign reserves had a positive but non-significant impact on bond yields (p = 0.8026), while after COVID-19, they became significantly negative (−0.0400, ***p < 0.01). This suggests that the bond market's sensitivity to changes in foreign reserves has increased post-pandemic. Additionally, exchange rates had a negative relationship with bond yields before COVID-19 (−0.05103, *p < 0.10) but turned positive after the pandemic (0.08626, *p < 0.10), indicating a change in how exchange rate fluctuations are influencing bond yields. Inflation, which was more influential pre-COVID-19 (0.16339, p = 0.1114), became less significant after COVID-19 (0.05803, p = 0.2798), reflecting a shift in macroeconomic factors' role in determining yields.

The relationship between stock market performance and bond yields also shifted significantly. Before COVID-19, NSE NIFTY had a negative coefficient (−0.02203, p = 0.1145), but after the pandemic, it became negative and statistically significant after collinearity adjustment (−0.00832, *p < 0.05). This suggests that stock market volatility or performance has become a more important factor in determining bond yields in the post-pandemic period, albeit with a smaller effect. Other variables such as IIP and FDI also show changes in their coefficients and significance. While IIP had a small but positive impact before COVID-19 (−0.01135, p = 0.5721), its post-COVID coefficient (0.00313, *p < 0.10) remained positive but smaller and significant, indicating that industrial production continues to influence bond yields, though to a lesser extent.

Diagnostic tests further reveal that the model's explanatory power remains high in both pre- and post-COVID-19 periods, though with some differences. The adjusted R-squared value slightly decreased from 0.8970 before COVID-19 to 0.8845 after, suggesting a marginal reduction in the model's explanatory power after the pandemic. Furthermore, the post-COVID model shows greater evidence of heteroscedasticity, as indicated by the significant Breusch-Pagan test (p = 0.0014), compared to the pre-COVID model, where heteroscedasticity was less pronounced. Autocorrelation and normality issues also became more apparent in the post-COVID model, although these problems were not severe enough to invalidate the overall results. These diagnostic shifts reflect changes in the relationships between variables and suggest that further adjustments may be needed to address the evolving economic environment.

Table 8: Variables impact on 91Day Treasury Bills yields before COVID-19

Variables and Residuals Test	Ordinary Least Square (OLS)			OLS After Collinearity Adjusted		
	Coefficient	p-value	VIF	Coefficient	p-value	VIF
Constant	0.45937	0.7468	---	6.8994***	<0.0001	---
Foreign Reserves	0.00398	0.7972	6.262	0.00988	0.7007	6.101
Inflation	−0.06901	0.3174	12.502[b]	−0.3477***	0.0004	6.629
NSE NIFTY	−0.00168	0.8554	4.823	0.02513**	0.0139	1.757
IIP	0.01366	0.3280	2.952	0.06513***	0.0008	1.533
FDI	0.00102	0.1501	1.714	−0.00035	0.7416	1.521
Exchange Rate	−0.03016	0.1036	9.642	0.03733***	0.0080	1.756
Gold	−0.01936	0.1309	19.302[b]	---	---	---
Bank Rate	0.98558***	0.0001	12.379[b]	---	---	---
S.E. of Regression	0.140456[a]			0.236438		
Adjusted R-squared	0.953265[b]			0.867568		
F Stat	64.74201*** (0.0000)			28.29597*** (0.0000)		
Akaike Criterion (AIC)	−21.33101[a]			4.642124		
Durbin-Watson	1.603085			1.715743		
Normality (Chi-square)	4.0774 (0.1301)			3.01015 (0.2220)		
White's test for HS (LM)	22.8919 (0.1166)			8.91238 (0.7103)		
Breusch-Pagan test for HS (LM)	5.70176 (0.6805)			6.61495 (0.3579)		
Autocorrelation (LMF)	0.842582 (0.3722)			0.373609 (0.5486)		
ARCH (LM)	0.526151 (0.4682)			0.0121265 (0.9123)		
BDS test Linearity	-0.888 [0.613]			1.597 [0.421]		

Source: The Authors. Note: ***p < 0.01, **p < 0.05 & *p < 0.10, [a] Lowest value, and [b] Highest Value.

The analysis of Table 8 reveals the impact of various variables on 91-day Treasury Bill (TB) yields before COVID-19, both with and without collinearity adjustment. When considering the ordinary least squares (OLS) results, the model shows a relatively high R-squared value of 0.953265, indicating that a significant portion of the variation in TB yields can be explained by the included variables. The Akaike Information Criterion (AIC) of −21.33101, which is the lowest value in the analysis, suggests that the model without collinearity adjustment fits the data quite well. The Standard Error (S.E.) of regression is 0.140456, reflecting a relatively low level of prediction error. Significant variables include the Bank Rate, which has a substantial positive effect on TB yields (coefficient = 0.98558, p-value = 0.0001), and Inflation, which shows a negative impact on TB yields (coefficient = −0.06901, p-value = 0.3174). Other variables like NSE Nifty, IIP, and Exchange Rate demonstrate some influence but with weaker statistical significance in the unadjusted model.

After adjusting for collinearity, the results show a lower adjusted R-squared value of 0.867568, indicating a reduced model fit. The AIC increases to 4.642124, suggesting that the model fit has worsened after addressing collinearity. The S.E. of regression rises significantly to 0.236438, indicating a higher level of prediction error after the adjustment. Key changes in the coefficients include Inflation, which becomes highly significant with a negative impact on TB yields (coefficient = −0.3477, p-value = 0.0004), and NSE Nifty, which also shows a positive and statistically significant relationship with TB yields (coefficient = 0.02513, p-value = 0.0139). The Exchange Rate retains its positive impact, with a coefficient of 0.03733 (p-value = 0.0080). In this adjusted model, several variables that were significant in the unadjusted version, like Bank Rate and Gold, lose their impact or become omitted.

The diagnostic tests suggest that the model without collinearity adjustment exhibits stable residuals and good fit. The Durbin-Watson statistic of 1.603085 indicates minimal autocorrelation, and the normality test (Chi-square p-value = 0.1301) shows no major issues with the residuals following a normal distribution. Homoscedasticity tests (White's and Breusch-Pagan) suggest no significant heteroscedasticity, and the BDS test confirms the linearity of the model. After the adjustment for collinearity, the Durbin-Watson statistic improves slightly to 1.715743, indicating minimal autocorrelation. However, the tests for normality and heteroscedasticity show slightly better p-values, reflecting an overall more stable model post-adjustment. Despite this, the increase in AIC and the slight decrease in adjusted R-squared suggest that addressing collinearity may have compromised the model's overall fit, and the rise in S.E. indicates higher prediction error after the collinearity adjustment.

Table 9: Variables impact on 91Day Treasury Bills yields after COVID-19

Variables and Residuals Test	Ordinary Least Square (OLS)			OLS After Collinearity Adjusted		
	Coefficient	p-value	VIF	Coefficient	p-value	VIF
Constant	0.07632	0.9225	---	0.06677	0.9307	---
Foreign Reserves	−0.0367***	0.0003	7.307	−0.0375***	0.0001	6.904
Inflation	−0.03536	0.5085	2.632	−0.03973	0.4380	2.510
NSE NIFTY	−0.00394	0.6365	16.342[b]	−0.00674*	0.0871	3.568
IIP	0.00018	0.9120	1.311	0.00005	0.9725	1.257
FDI	0.00046	0.2311	1.544	0.00044	0.2360	1.518
Exchange Rate	0.01801	0.7033	25.730[b]	---	---	---
Gold	0.00428	0.5486	4.504	0.00344	0.6037	4.077
Bank Rate	0.9893***	<0.0001	7.035	1.0245***	<0.0001	4.104
S.E. of Regression	0.18631			0.182498[a]		
Adjusted R-squared	0.96959			0.970822[b]		
F Stat	112.5935*** (0.0000)			134.0886*** (0.0000)		
Akaike Criterion (AIC)	−7.936698[a]			−9.720965		
Durbin-Watson	1.904162			1.817395		
Normality (Chi-square)	4.62744* (0.0988)			4.11107 (0.1280)		
White's test for HS (LM)	20.0717 (0.2170)			19.1629 (0.1588)		
Breusch-Pagan test for HS (LM)	13.6315* (0.0918)			12.8645* (0.0754)		
Autocorrelation (LMF)	0.00689468 (0.9346)			0.0631613 (0.8041)		
ARCH (LM)	0.227114 (0.6336)			0.161558 (0.6877)		
BDS test Linearity	4.068** [0.047]			4.135** [0.041]		

Source: The Authors. Note: ***p < 0.01, **p < 0.05 & *p < 0.10, [a] Lowest value, and [b] Highest Value.

Table 9 analyses the impact of various variables on 91-day Treasury Bill (TB) yields after COVID-19, with a focus on both ordinary least squares (OLS) estimation and the model adjusted for collinearity. In the unadjusted model, Foreign Reserves show a statistically significant negative impact on TB yields (coefficient = −0.0367, p-value = 0.0003), and the Bank Rate has a large positive effect (coefficient = 0.9893, p-value < 0.0001). The adjusted R-squared value for the unadjusted model is 0.96959, indicating a strong fit, and the F-statistic of 112.5935 (p-value < 0.0001) confirms that the overall model is statistically significant. The Akaike Information Criterion (AIC) is −7.936698, reflecting a good model fit. The S.E. of Regression is 0.18631, suggesting a moderate level of prediction error. Diagnostic tests reveal no significant issues with normality (Chi-square p-value = 0.0988), homoscedasticity (White's test p-value = 0.2170), or autocorrelation (LMF p-value = 0.9346), and the BDS test indicates linearity in the model (p-value = 0.047).

When adjusting for collinearity, the model fit slightly improves, with an adjusted R-squared value of 0.970822 and a significant F-statistic of 134.0886 (p-value < 0.0001). The AIC decreases to −9.720965, indicating a better fit after collinearity adjustment. The coefficient for Foreign Reserves remains significant (coefficient = −0.0375, p-value = 0.0001), and Bank Rate continues to show a significant positive relationship with TB yields (coefficient = 1.0245, p-value < 0.0001). While the S.E. of Regression decreases to 0.182498, suggesting slightly reduced prediction error, other variables such as Inflation, NSE Nifty, and IIP exhibit no significant relationships with TB yields after adjustment. The model shows an improvement in collinearity, with lower Variance Inflation Factors (VIFs), particularly for variables like NSE Nifty and IIP, which drop to more acceptable values (around 3.5 or lower).

The diagnostic tests for the adjusted model still show relatively robust performance. The Durbin-Watson statistic of 1.817395 suggests a slight improvement in autocorrelation compared to the unadjusted model (1.904162), indicating minimal residual autocorrelation. While the normality test p-value (0.1280) and the

White's test p-value (0.1588) suggest no significant violations of normality or heteroscedasticity, the Breusch-Pagan test for heteroscedasticity shows a marginally significant result (p-value = 0.0754), indicating the presence of slight heteroscedasticity. The BDS test continues to support linearity with a p-value of 0.041. Overall, the adjusted model appears to be statistically sound, showing stronger explanatory power for TB yields after COVID-19 and addressing issues such as multicollinearity while providing relatively good model fit and prediction accuracy.

When comparing the analysis of 91-day Treasury Bill yields before and after COVID-19, significant differences in the model's performance and the impact of variables can be observed. Before COVID-19, the unadjusted model demonstrated a very strong fit with an adjusted R-squared of 0.953, and a highly significant F-statistic (64.74201). Foreign Reserves, Inflation, NSE Nifty, IIP, and the Bank Rate all had varying impacts, with Bank Rate showing a particularly strong positive effect (coefficient = 0.98558, p-value < 0.0001). The Akaike Information Criterion (AIC) of −21.33101 and the Standard Error (S.E.) of Regression of 0.140456 suggest a relatively low prediction error and a good overall model fit. The diagnostic tests did not indicate any major issues, with the model being linear and free from significant autocorrelation or heteroscedasticity. After adjusting for collinearity, however, the AIC increased to 4.642124, the S.E. of Regression rose to 0.236438, and the explanatory power of the model decreased (Adjusted R-squared = 0.867568), indicating a less effective model post-adjustment.

In contrast, after COVID-19, both models demonstrated similar overall performance, with the unadjusted model having a very strong fit (Adjusted R-squared = 0.96959) and the AIC of −7.936698 suggesting a strong model fit as well. The significance of Foreign Reserves and Bank Rate persisted, with both showing significant relationships with TB yields (coefficient for Foreign Reserves = −0.0367, p-value = 0.0003; Bank Rate = 0.9893, p-value < 0.0001). After collinearity adjustment, the model fit improved slightly (Adjusted R-squared = 0.970822) and the AIC improved to −9.720965. The S.E. of Regression decreased slightly to 0.182498, suggesting reduced prediction error. However, diagnostic tests revealed minor heteroscedasticity issues (Breusch-Pagan test p-value = 0.0754), though the model still passed the tests for normality and linearity. Overall, both before and after COVID-19, the models exhibited strong statistical significance, but the post-COVID analysis shows a more nuanced change in the behaviour of variables, with adjustments for collinearity leading to modest improvements in fit and error rates.

Table 10: Variables impact on NSE NIFTY Returns before COVID-19

Variables and Residuals Test	Ordinary Least Square (OLS)			OLS After Collinearity Adjusted		
	Coefficient	p-value	VIF	Coefficient	p-value	VIF
Constant	34.02880	0.3818	---	−53.3508*	0.0627	---
Foreign Reserves	0.07026	0.8539	6.273	−0.16437	0.7728	6.077
Inflation	3.6809**	0.0291	10.926[b]	2.13592	0.2523	6.511
10Y GSec	−6.35367	0.1145	7.611	7.90840**	0.0459	3.107
IIP	−0.46301	0.1643	2.677	0.20175	0.6383	2.042
FDI	0.00106	0.9512	1.779	−0.03345	0.1572	1.376
Exchange Rate	−1.6071***	<0.0001	4.087	−0.68602**	0.0465	2.324
Gold	−1.2386***	0.0001	13.667[b]	---	---	---
Bank Rate	3.28645	0.5462	14.099[b]	---	---	---
S.E. of Regression	3.463409[a]			5.255077		
Adjusted R-squared	0.737758[a]			0.396256		
F Stat	9.791473*** (0.0000)			3.734711** (0.0126)		
Akaike Criterion (AIC)	145.335[a]			165.9078		
Durbin-Watson	1.781973			1.717929		
Normality (Chi-square)	0.806767 (0.6680)			1.3359 (0.5127)		
White's test for HS (LM)	22.6692 (0.1228)			18.5674* (0.0995)		
Breusch-Pagan test for HS (LM)	11.8565 (0.1577)			5.42066 (0.4910)		
Autocorrelation (LMF)	0.00992097 (0.9218)			0.224049 (0.6416)		
ARCH (LM)	0.198283 (0.6561)			0.612297 (0.4339)		
BDS test Linearity	-0.538 [0.808]			0.100 [0.975]		

Source: The Authors. Note: ***p < 0.01, **p < 0.05 & *p < 0.10, [a] Lowest value, and [b] Highest Value.

The analysis of NSE NIFTY returns before COVID-19 in table 10 reveals significant variations between the Ordinary Least Squares (OLS) model and the model after adjusting for collinearity. In the unadjusted OLS model, the most notable variables affecting NSE NIFTY returns were the Exchange Rate, Gold, and Inflation. The Exchange Rate showed a highly significant negative relationship (coefficient = −1.6071, p-value < 0.0001), and Gold also exhibited a strong negative impact (coefficient = −1.2386, p-value < 0.0001). Inflation had a positive relationship with NSE NIFTY returns (coefficient = 3.6809, p-value = 0.0291). The model, however, had a relatively low adjusted R-squared value of 0.737758, indicating that only 73.8% of the variation in NIFTY returns could be explained by the included variables. The Akaike Information Criterion (AIC) value of 145.335 further suggests that the model might not provide the best fit. Diagnostic tests show no major issues with autocorrelation (Durbin-Watson = 1.781973), and normality tests indicate that the residuals are normally distributed (p-value = 0.6680). However, White's test for heteroscedasticity reveals some concerns with heteroscedasticity (p-value = 0.1228), suggesting that the variability in residuals may not be constant across observations.

After adjusting for collinearity, the model's explanatory power significantly decreased, with the adjusted R-squared dropping to 0.396256. The AIC value increased to 165.9078, further indicating a decrease in model fit. Notably, several coefficients changed sign or lost their significance. The constant term turned negative and marginally significant (coefficient = −53.3508, p-value = 0.0627), while the previously positive coefficient for Inflation became insignificant (coefficient = 2.13592, p-value = 0.2523). The Exchange Rate's effect remained negative but was now less significant (coefficient = −0.68602, p-value = 0.0465). The 10Y GSec variable, which was not significant in the unadjusted model, showed a positive and statistically significant effect (coefficient = 7.90840, p-value = 0.0459). Diagnostic tests indicate improved residual behaviour with no major autocorrelation issues (Durbin-Watson = 1.717929) and no severe heteroscedasticity (White's test p-value = 0.0995). The BDS test suggests that the model remains linear, but the lower adjusted R-squared and higher AIC point to reduced model fit after the collinearity adjustment.

In summary, the model before COVID-19 without collinearity adjustment provided a more robust fit, with higher explanatory power and more significant relationships between key variables. However, after adjusting for collinearity, the model became less effective, with reduced explanatory power and changes in the significance of various variables. Although the post-adjustment model showed no severe issues with residuals or heteroscedasticity, the significant drop in adjusted R-squared and the increase in AIC indicate that the adjustment resulted in a less accurate representation of the data. This suggests that collinearity adjustment may have introduced complexity without improving the model's ability to predict NSE NIFTY returns.

Table 11: Variables impact on NSE NIFTY Returns after COVID-19.

Variables and Residuals Test	Ordinary Least Square (OLS)			OLS After Collinearity Adjusted		
	Coefficient	p-value	VIF	Coefficient	p-value	VIF
Constant	−1.85636	0.9703	---	−8.24748	0.7361	---
Foreign Reserves	−0.05168	0.8823	16.403[b]	---	---	---
Inflation	−2.73896*	0.0512	2.275	−2.7124**	0.0458	2.235
10Y GSec	3.12295	0.6016	12.683[b]	3.78936	0.3265	5.461
IIP	−0.03124	0.5223	1.604	−0.03325	0.4679	1.479
FDI	0.00196	0.8487	1.547	0.00189	0.8501	1.544
Exchange Rate	−5.1912***	<0.0001	7.407	−5.2196***	<0.0001	6.825
Gold	−0.41563**	0.0205	3.421	−0.4270***	0.0071	2.702
Bank Rate	7.90667**	0.0439	6.550	8.2106**	0.0122	4.560
S.E. of Regression	5.035701			4.917105[a]		
Adjusted R-squared	0.915519			0.919451[b]		
F Stat	38.92922*** (0.0000)			46.65919* (0.0000)		
Akaike Criterion (AIC)	183.2831			181.3158[a]		
Durbin-Watson	1.663659			1.65376		
Normality (Chi-square)	0.445272 (0.8004)			0.444854 (0.8005)		
White's test for HS (LM)	13.151 (0.6616)			11.9029 (0.6141)		
Breusch-Pagan test for HS (LM)	5.83804 (0.6653)			5.79888 (0.5634)		
Autocorrelation (LMF)	0.349141 (0.5615)			0.397758 (0.5353)		
ARCH (LM)	2.31816 (0.1278)			2.3447 (0.1257)		
BDS test Linearity	1.948 [0.317]			2.001 [0.273]		

Source: The Authors. Note: ***p < 0.01, **p < 0.05 & *p < 0.10, [a] Lowest value, and [b] Highest Value.

The analysis of NSE NIFTY returns after COVID-19, as presented in Table 11, highlights important relationships between variables, both before and after adjusting for collinearity. In the unadjusted Ordinary Least Squares (OLS) model, the Exchange Rate showed a highly significant negative relationship with NIFTY returns (coefficient = −5.1912, p-value < 0.0001), indicating a strong inverse correlation. Inflation also had a negative but marginally significant effect (coefficient = −2.73896, p-value = 0.0512), while Gold demonstrated a significant negative effect (coefficient = −0.41563, p-value = 0.0205). The Bank Rate was another significant variable, with a positive relationship to NIFTY returns (coefficient = 7.90667, p-value = 0.0439). The model's overall fit was strong, with an adjusted R-squared of 0.915519, suggesting that about 91.5% of the variation in NIFTY returns could be explained by the included variables. The Akaike Information Criterion (AIC) value of 183.2831, although relatively high, indicates a reasonable model fit. Diagnostic tests showed no issues with autocorrelation (Durbin-Watson = 1.663659), and normality tests revealed that the residuals followed a normal distribution (Chi-square p-value = 0.8004). White's and Breusch-Pagan tests for heteroscedasticity showed no significant evidence of heteroscedasticity (p-values = 0.6616 and 0.6653, respectively), and the BDS test confirmed linearity in the model (p-value = 0.317).

After adjusting for collinearity, the model still retained much of its explanatory power, with an adjusted R-squared slightly improving to 0.919451. The AIC decreased to 181.3158, suggesting a better model fit compared to the unadjusted model. The Exchange Rate remained highly significant, with a similar negative relationship (coefficient = −5.2196, p-value < 0.0001), and the gold variable remained significant but with a slightly stronger negative coefficient (coefficient = −0.4270, p-value = 0.0071). The Bank Rate continued to show a significant positive effect (coefficient = 8.2106, p-value = 0.0122), and Inflation retained its negative relationship, though now at a higher significance level (coefficient = −2.7124, p-value = 0.0458). However, the 10Y GSec variable remained insignificant (p-value = 0.3265), indicating that its impact on NIFTY returns was not substantial. Diagnostic tests for the adjusted model revealed no major issues with residuals, as the Durbin-Watson statistic remained near 1.65376, indicating minimal autocorrelation. Additionally, the tests for normality and heteroscedasticity showed no significant problems (Chi-square p-value = 0.8005, White's p-value = 0.6141, Breusch-Pagan p-value = 0.5634). The BDS test continued to indicate linearity in the adjusted model (p-value = 0.273).

In summary, the results from Table 11 demonstrate that the model explaining NSE NIFTY returns after COVID-19 shows strong explanatory power both before and after adjusting for collinearity. While the unadjusted model had high significance for several variables like the Exchange Rate, Gold, and Inflation, the collinearity-adjusted model provided an even better fit, as reflected in the marginally improved adjusted R-squared and decreased AIC. Both models exhibited strong diagnostic results, with no major concerns regarding autocorrelation, normality, or heteroscedasticity. The results indicate that while collinearity adjustment did not drastically change the relationships between the variables, it improved the overall model fit, particularly in explaining the impact of the Exchange Rate and Gold on NIFTY returns.

In comparing the models before and after COVID-19 (Tables 10 and 11), a few key differences emerge. Before COVID-19, the model for NSE NIFTY returns showed a relatively lower adjusted R-squared (0.737758) and higher AIC (145.335), suggesting a less efficient fit compared to the post-COVID model. The unadjusted OLS model highlighted the significant impact of variables like Exchange Rate, Gold, and Inflation, with notable coefficients for Gold (−1.2386, p-value = 0.0001) and Exchange Rate (−1.6071, p-value < 0.0001), which were highly significant. The S.E. of Regression was relatively high at 3.463409, indicating a moderate level of prediction error. After collinearity adjustment, the model's fit worsened, as seen in the lower adjusted R-squared (0.396256) and higher AIC (165.9078). This deterioration in model performance was reflected in weaker statistical significance for most variables, and the overall predictive capability dropped substantially, especially for variables like Foreign Reserves and Inflation.

In contrast, after COVID-19, the model showed a marked improvement in terms of model fit, as reflected by the adjusted R-squared of 0.915519 in the unadjusted OLS model, which increased slightly to 0.919451 after collinearity adjustment. The AIC decreased to 181.3158 after collinearity adjustment, indicating better model fit compared to the pre-COVID analysis. Key variables, such as Exchange Rate, Gold, and Bank Rate, remained significant in both models, although collinearity adjustment did not drastically change the coefficient magnitudes. The S.E. of Regression was slightly lower after adjustment (4.917105), signalling reduced prediction error. Diagnostic tests in the post-COVID model showed no significant issues with residuals, as indicated by the Durbin-Watson, normality, and heteroscedasticity tests, suggesting a more reliable and robust model after COVID-19. Despite the overall improvement, collinearity adjustment did not change the significance of the key predictors dramatically, indicating the importance of these variables in both periods.

V. Implications Of The Findings For Investors And Policymakers

The findings from the analysis of bond yields, equity returns, and economic factors before and after COVID-19 carry profound implications for both investors and policymakers. For investors, the changing dynamics between bonds and equities, especially the erosion of traditional negative correlations during the pandemic, have reshaped portfolio diversification strategies. The heightened sensitivity of these assets to inflation and interest rate changes underscores the need for more adaptive and diversified approaches, including exploring alternative assets like commodities or inflation-protected securities. Additionally, the differential impact of the pandemic across global markets requires investors to adopt a more region-specific approach, considering localized economic conditions, fiscal policies, and recovery trajectories. Understanding the implications of central bank decisions and fiscal interventions is now more critical than ever, as these significantly influence asset pricing and market sentiment.

For policymakers, the pandemic has reinforced the importance of coordinated fiscal and monetary policy in mitigating economic shocks and stabilizing financial markets. Central banks face the challenge of managing inflationary pressures while avoiding excessive tightening that could harm equity markets and economic recovery. Fiscal policymakers, on the other hand, must balance short-term interventions, such as stimulus programs, with long-term structural adjustments to address shifts in labour markets, supply chains, and consumer behaviour. Ensuring financial market stability, improving regulatory frameworks, and addressing systemic risks are key priorities in preparing for future crises. The findings call for a collaborative effort between market participants and policymakers to adapt to the post-pandemic financial landscape and foster sustainable economic growth.

VI. Conclusion

In conclusion, the analysis of bond yields, equity returns and economic indicators before and after the COVID-19 pandemic reveals a significant shift in their relationship, as shown by multivariate correlations, paired t-test, and regression results. Before the pandemic, the relationship between bond yields (such as 10-Year GSec and 91-Day TB rates) and equity returns exhibited a traditional inverse correlation. This negative relationship was in line with classical financial theory, where rising bond yields often reflected increasing interest rates, leading to lower equity returns as investors shifted their preferences toward safer government bonds. The paired t-test for the pre-pandemic period confirmed that there was no statistically significant change in equity returns and bond yields, suggesting that the markets were operating within expected norms.

However, the onset of the COVID-19 pandemic caused a profound change in this relationship. The regression analysis conducted for the post-pandemic period revealed a shift in how bond yields and equity return responded to economic variables. Interestingly, the relationship became less predictable, with bond yields not consistently moving inversely with equity returns. The paired t-test indicated that the differences in bond yields and equity returns before and after the pandemic were statistically significant, emphasizing the dramatic impact of the crisis on financial markets. The regression models revealed that bond yields were more responsive to inflation expectations and fiscal policies post-pandemic, while equity returns were increasingly driven by factors such as market sentiment, government stimulus programs, and shifts in global risk appetite.

The regression results also highlighted that the post-pandemic period saw bond yields and equity returns exhibiting more of a co-movement during periods of market uncertainty, especially when both asset classes were influenced by the broader economic policies and risk aversion. This change was reflected in the regression coefficients, which showed weaker negative correlations between bond yields and equity returns compared to the pre-pandemic period. The paired t-test reinforced these findings, with a significant shift in mean differences for both bond yields and equity returns when compared to the pre-pandemic phase, marking the evolving nature of financial markets in a post-COVID world.

In summary, the COVID-19 pandemic altered the long-standing relationship between bond yields and equity returns, as correlation results, paired t-test, and regression results demonstrated significant changes in their interactions. The pandemic's economic impact, combined with government interventions and shifts in investor behaviour, created new dynamics in the financial markets. The pre-pandemic negative correlation between bond yields and equity returns gave way to a more complex, sometimes positive correlation, highlighting the need for investors to reconsider traditional financial strategies. These findings suggest that in the aftermath of the pandemic, the financial markets are less predictable, requiring a reassessment of how bond yields and equity returns are expected to move in tandem or in opposition moving forward.

VII. Scope For Further Research

The analysis of bond yields, equity returns, and economic factors before and after COVID-19 opens avenues for further research, particularly in understanding the long-term implications of the pandemic on financial markets. Future studies could explore how permanent structural changes, such as shifts in monetary policy frameworks, evolving investor behaviour, and increased reliance on technology, influence asset correlations and market volatility. Additionally, examining the interplay between financial markets and broader economic factors, such as climate risks and geopolitical tensions, could provide deeper insights into emerging challenges. Comparative analyses across different regions and economic structures, as well as sectoral impacts within equities, would enrich understanding and inform global investment strategies and policy responses. Finally, incorporating machine learning and big data analytics could enhance forecasting models to better anticipate market dynamics in the face of unprecedented global events.

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