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Analysing the Stock Performance of DLF in the Face of the Pandemic: A Study on Risk, Return, and Market Correlation

Balanji Reddy Mora¹ and Mr. Muppavarapu Chaithanya² Siva Sivani Institute of Management, Secunderabad, India^{1,2} balanji@ssim.ac.in and mchaithanya@ssim.ac.in

Abstract: This study investigates the stock performance of DLF Ltd., a prominent player in the Indian real estate sector, in three distinct phases: pre-pandemic (March 2019 to March 2020), during the pandemic (March 2020 to March 2022), and post-pandemic (March 2022 to September 2024). Using monthly historical stock prices of DLF, the SENSEX, and the BSE Realty Index, collected from the BSE website, this research applies mean-variance analysis to assess the risk and return characteristics of DLF's stock during these periods. Additionally, correlation and regression analyses are conducted to explore the relationship between DLF's stock returns and the broader market indices, with a particular focus on the BSE Realty Index, given its relevance to the real estate sector.

The study reveals the significant impact of the COVID-19 pandemic on the real estate market, especially on stocks like DLF, which experienced heightened volatility during the pandemic. The pre-pandemic phase reflected stable growth, while the pandemic period saw a sharp decline in stock returns due to market uncertainty and economic downturns. However, the post-pandemic phase witnessed a robust recovery, with DLF's stock aligning closely with the recovery trends in the real estate sector, as indicated by its correlation with the BSE Realty Index.

This paper aims to provide valuable insights into the stock performance of DLF in relation to macroeconomic factors and sector-specific trends, offering an understanding of how the company's performance has evolved to enhance shareholder value across these three critical phases. The findings offer implications for investors and stakeholders in assessing the resilience and potential of real estate stocks in times of crisis and recovery.

Keywords: Stock Performance, Pandemic, Mean-Variance Analysis, Correlation, Regression Analysis, Shareholder Value, Real Estate Sector

I. INTRODUCTION

In recent times, the global economy has been severely impacted by unforeseen circumstances, most notably the COVID-19 pandemic. This health crisis, which evolved into a full-blown economic disaster, has brought unprecedented challenges across industries, markets, and geographical regions. Among the various sectors that faced turbulence during this time, the real estate sector stands out as one of the most volatile. This report focuses on DLF Limited, a major player in the Indian real estate market, and aims to provide an analytical insight into the company's stock performance before, during, and after the pandemic. By conducting this analysis, we hope to understand how DLF responded to changing market dynamics and how its stock reacted to external shocks.

The study will also examine the correlation between DLF's stock performance and two key market indices: the Bombay Stock Exchange's benchmark index, Sensex, and the sectoral index BSE Realty, which tracks the performance of major real estate companies listed on the BSE. The rationale behind incorporating these indices into the study is to not only analyze DLF's performance in isolation but to also assess how its stock trends compare to broader market movements and sector-specific shifts.

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Statement of the problem:

The COVID-19 pandemic engendered significant disturbances within global markets, profoundly impacting the real estate sector, inclusive of DLF Limited, which stands as India's preeminent real estate developer. The stock performance of DLF experienced considerable volatility throughout the pre-pandemic, pandemic, and post-pandemic periods, shaped by variables such as project delays, disruptions in the supply chain, and varying consumer demand. This study aims to scrutinize these trends, delving into the principal determinants of stock performance during each distinct phase. The objective is to furnish valuable insights for investors, policymakers, and industry stakeholders regarding the resilience and adaptability of DLF's stock in the face of external economic perturbations.

Need for the Study:

The COVID-19 pandemic significantly impacted global financial markets, particularly the real estate sector. Studies like Milcheva (2021) and Sugeng and Daryanto (2021) explored shifts in risk-return dynamics and financial resilience within real estate. In India, research by Rashmi Chaudhary et al. (2020) and Munusamy Dharani et al. (2022) highlighted increased market volatility, while Kochhar et al. (2023) provided a multifaceted analysis of stock market disruptions. However, limited focus exists on major real estate firms like DLF Limited. This study addresses this gap by analyzing DLF's stock performance across pre-pandemic, pandemic, and post-pandemic periods, offering insights into its resilience and adaptability.

Objectives of the Study:

- The primary objective of this study is to analyze the stock performance of DLF Limited during three critical periods: pre-pandemic, pandemic, and post-pandemic. Specifically, this study aims to:
- To conduct a comprehensive analysis of the stock performance of DLF across the pre-pandemic, pandemic, and post-pandemic intervals.
- To compare the performance metrics of DLF's stock against those of the BSE Sensex and the real estate sectoral index (BSE Realty).
- To evaluate the relative efficacy and resilience of DLF in the context of the broader market and its specific sector.
- To investigate the correlation dynamics between DLF's stock, the BSE Sensex, and the real estate sectoral index (BSE Realty).

Scope of the study:

This research analyzes the stock performance of DLF Limited, a key player in India's real estate sector, from 2019 to 2024, across three phases: pre-pandemic (2019-2020), during the pandemic (2020-2021), and post-pandemic recovery (2021-2024). By comparing DLF's stock trends with market indices like BSE Sensex and real estate indices, it examines relative performance and the impact of COVID-19-induced disruptions. The study evaluates stock price fluctuations, volatility, and returns, considering macroeconomic shifts, regulatory changes, and recovery trends. Focused on the Indian market, it excludes DLF's internal frameworks and aims to provide insights for investors on pandemic-driven stock responses.

Limitations:

- Focused solely on DLF Limited within the Indian stock market, limiting generalizability to other real estate companies or markets.
- Covers 2019–2024, excluding external events beyond this timeframe.
- Relies on stock price movements and market indices, without considering internal factors like corporate strategy or financial health.
- May overlook short-term stock fluctuations and psychological factors affecting investor behaviour during the pandemic and recovery.

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II. REVIEW OF LITERATURE

The stock market performance of individual firms in the real estate sector has drawn considerable attention from researchers, given its sensitivity to macroeconomic conditions and market cycles. The interplay between real estate stock performance and sectoral indices, like the BSE Realty Index, offers valuable insights for investors, policymakers, and analysts.

Real Estate Sector and Macroeconomic Factors:

The performance of real estate stocks is influenced by several macroeconomic factors, including interest rates, inflation, and government policies. Gupta and Bansal (2018) highlighted the direct correlation between real estate sectoral indices and company stock performance, driven by economic cycles, housing demands, and policy changes. The study argued that the real estate sector is uniquely cyclical, with stock prices reflecting broader economic trends. Similarly, D'Silva et al. (2020) established that during economic upturns, real estate stocks exhibit strong performance, while downturns lead to increased volatility and investor skepticism.

Sectoral Index Influence:

The role of sectoral indices, such as the BSE Realty Index, is pivotal in shaping individual stock performance. As per Sinha and Sharma (2019), sectoral indices provide a benchmark for assessing the financial health of the companies within the sector. Stocks of leading players, such as DLF, often exhibit a strong correlation with sectoral indices, reflecting their dependency on broader industry trends rather than individual business decisions. This correlation is particularly significant in understanding the behavior of real estate stocks, which are highly susceptible to sector-wide disruptions.

Pandemic Impact on Stock Markets:

The COVID-19 pandemic introduced unprecedented disruptions in global financial markets, with real estate being among the most affected sectors. Studies like those by Kumar (2021) documented the sharp decline in real estate stock returns during the early pandemic months due to plummeting demand and halted construction activities. However, recovery patterns differed significantly across firms and regions. DLF, being a prominent player, experienced heightened volatility during the pandemic, with stock performance reflecting both market sentiment and company resilience.

Pre-, During-, and Post-Pandemic Stock Performance:

There is limited academic literature specifically analyzing pre-, during-, and post-pandemic performance of real estate stocks in the Indian context. Jain and Roy (2022) focused on the post-pandemic recovery of real estate firms, concluding that government interventions, such as housing subsidies and reduced interest rates, significantly boosted the sector's recovery. Furthermore, Chakraborty (2022) emphasized the importance of firm-specific strategies during the post-pandemic period, which helped mitigate risks and stabilize performance.

Methodological Insights:

Existing studies widely employ quantitative techniques such as correlation and regression analysis to measure the relationship between stock performance and broader indices. Mean-variance analysis, as discussed in Markowitz's portfolio theory, remains a robust tool to evaluate risk and return. Regression analysis has been particularly useful in exploring how sectoral indices and macroeconomic variables explain variations in stock performance. While these methods are frequently used, there is a gap in integrating these approaches to evaluate the performance of individual stocks like DLF across distinct market phases.

Research Gap:

Although the literature provides substantial insights into the real estate sector's cyclical nature and its sensitivity to macroeconomic factors, there is a lack of focused studies that examine the pre-, during and post-pandemic performance of a leading real estate stock like DLF in correlation with broader indices. This study pridges the gap by

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employing mean-variance analysis, correlation, and regression methodologies to offer a comprehensive view of DLF's stock performance across three distinct phases, shedding light on its ability to enhance shareholder value during varying economic conditions.

This literature review thus establishes the foundation for the present research, which examines DLF's stock performance relative to the BSE Realty Index and the BSE Sensex to understand its risk-return characteristics and correlation dynamics across different market phases.

III. RESULTS AND DISCUSSION

The data for **DLF**, **BSE Sensex**, and **BSE Realty** reveals significant insights into how each responded to the economic disruptions caused by the **COVID-19 pandemic** and its aftermath. The pandemic caused widespread financial volatility, with varying impacts on different sectors, which is evident when comparing these three entities.

Month	Return of DLF	Return of Sensex	Return of BSE Realty
Mar-19	21.37	7.37	16.14
Apr-19	-14.49	0.44	-3.56
May-19	11.33	1.74	9.68
Jun-19	-1.10	-1.04	0.02
Jul-19	-7.67	-5.22	-6.76
Aug-19	-3.97	-0.15	-0.38
Sep-19	-6.77	4.00	-2.80
Oct-19	14.90	3.39	3.78
Nov-19	19.40	1.49	4.61
Dec-19	4.64	0.44	5.19
Jan-20	12.82	-1.51	10.37
Feb-20	-22.71	-6.03	-16.07
Mar-20	-33.57	-24.27	-37.01
Apr-20	13.04	14.28	8.85
May-20	2.65	-0.99	-2.21
Jun-20	-3.11	6.11	11.00
Jul-20	-5.30	7.42	-0.36
Aug-20	11.05	2.75	10.59
Sep-20	-4.66	-1.77	-3.88
Oct-20	3.46	3.13	7.15
Nov-20	16.79	10.71	14.47
Dec-20	22.81	7.46	20.00
Jan-21	9.61	-3.14	-2.32
Feb-21	16.41	5.32	14.30
Mar-21	-5.89	-0.48	-5.16
Apr-21	-14.57	-2.18	-7.34
May-21	18.55	7.41	9.53
Jun-21	-3.38	0.80	1.70
Jul-21	19.81	-0.10	15.97
Aug-21	-5.89	8.79	-3.66
Sep-21	29.90	2.36	32.36

Table: 1 Consolidated data of returns of DLF, BSE Sensex and BSE Realty

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Oct-21	-4.66	0.71	-2.81
Nov-21	-7.51	-4.22	-5.36
Dec-21	3.28	1.55	0.63
Jan-22	-0.01	-0.51	-0.80
Feb-22	-10.50	-4.13	-10.05
Mar-22	10.26	5.28	6.82
Apr-22	-2.16	-2.51	-4.43
May-22	-6.37	-1.53	-6.28
Jun-22	-9.45	-4.62	-6.64
Jul-22	24.12	8.90	17.57
Aug-22	1.00	2.96	2.51
Sep-22	-8.46	-2.19	-7.81
Oct-22	8.21	5.82	3.19
Nov-22	4.66	3.33	2.77
Dec-22	-6.85	-3.97	-4.02
Jan-23	-5.01	-2.17	-5.30
Feb-23	-2.70	-1.73	-4.29
Mar-23	1.65	-0.25	-1.50
Apr-23	19.04	3.35	14.41
May-23	11.68	2.15	7.76
Jun-23	3.26	3.16	8.49
Jul-23	5.41	2.61	8.99
Aug-23	-1.23	-2.56	-1.05
Sep-23	5.15	1.50	3.04
Oct-23	5.53	-2.95	3.36
Nov-23	10.62	4.95	18.24
Dec-23	14.43	7.53	8.56
Jan-24	9.92	-0.65	9.54
Feb-24	11.57	0.70	5.55
Mar-24	-1.26	1.44	-1.79
Apr-24	-0.78	0.70	7.23
May-24	-8.04	-0.58	4.59
Jun-24	-4.11	3.20	3.77
Jul-24	7.71	3.41	-1.90
Aug-24	-5.10	0.51	-4.02
Sep-24	5.32	1.90	3.93

Source: Own calculations





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Figure: 1 Consolidated data of returns of DLF, BSE Sensex and BSE Realty

Chart Title



Source: Own calculations

Table: 2 Results of Mean, Variance and Standard Deviation

	DLF	BSE SENSEX	BSE REALTY
Mean (Expeceted Return)	2.897	1.189	2.64
Variance	134.139	26.306	95.22
Standard Deviation	11.582	5.129	9.76
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Table: 3 Results of correlation, Covariance and Beta

	DLF & BSE SENSEX	DLF & BSE REALTY
Correlation	0.653	0.88
Covariance	38.815	100.00
Beta (β) (Using Slope)	1.476	1.05

Pre-COVID (March 2019 to February 2020)

Table: 7 Risk returns analysis of pre covid period

	Risk & Return Analysis										
DLF				BSE SENSEX			BSE Realty				
	Open	Close									
Month	Price	Price	Return	Open	Close	Return	Open	Close	Return		
Mar-19	166.1	201.6	21.37	36018.49	38672.91	7.37	1,788.43	2,077.09	16.14		
Apr-19	202.15	172.85	-14.49	38858.88	39031.55	0.44	2,082.89	2,008.64	-3.56		
May-19	171.7	191.15	11.33	39036.51	39714.2	1.74	2,006.60	2,200.74	9.68		
Jun-19	190.7	188.6	-1.10	39806.86	39394.64	-1.04	2,201.08	2,201.44	0.02		
Jul-19	192.95	178.15	-7.67	39543.73	37481.12	-5.22	2,216.91	2,067.13	-6.76		
Aug-19	175	168.05	-3.97	37387.18	37332.79	-0.15	2,055.41	2,047.65	-0.38		
Sep-19	167	155.7	-6.77	37181.76	38667.33	4.00	2,035.07	1,978.01	-2.80		
Oct-19	159.7	183.5	14.90	38813.48	40129.05	3.39	1,987.76	2.062.95	3.78		
Nov-19	184	219.7	19.40	40196.07	40793.81	1.49	2,070.96	2,160,53	4.61		

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Dec-19	220.7	230.95	4.64	41072.94	41253.74	0.44	2,168.11	2,280.54	5.19
Jan-20	230.85	260.45	12.82	41349.36	40723.49	-1.51	2,288.83	2,526.17	10.37
Feb-20	260.45	201.3	-22.71	40753.18	38297.29	-6.03	2,530.50	2,123.91	-16.07

Table: 8 Calculations of Mean, variance, Correlation and Covariance

	DLF	SESNSEX	REALTY
Mean	2.3131509	0.41043537	1.684534332
Variance	195.716901	13.8422806	74.05594015
Std Dev	13.9898857	3.72052154	8.605576108
Correlation		0.65129177	0.905840459
Covariance		33.8995224	109.055062

The pre-COVID-19 period (March 2019 to February 2020) marked a dynamic phase for DLF Limited and the broader market. DLF's stock displayed significant fluctuations, starting at \Box 166.1 in March 2019, peaking at \Box 260.45 in January 2020, and dropping to \Box 201.3 by February 2020. This period recorded varying monthly returns, with a notable 21.37% in March 2019, indicating a robust start. Similarly, the BSE Sensex exhibited an upward trend, beginning at 36,018.49 points in March 2019 and reaching a peak of 41,349.36 points in January 2020, reflecting positive investor sentiment and a growing economy. March 2019 saw its highest monthly return of 7.37%, underlining strong market confidence.

The BSE Realty index, representing the real estate sector, showcased mixed performance, starting at \Box 1,788.43 in March 2019 with notable 16.14% returns that month, but declining later due to regulatory and economic uncertainties. For DLF, macroeconomic factors like GDP growth, urbanization, and housing demand shaped performance, bolstered by government initiatives such as Pradhan Mantri Awas Yojana (PMAY).

Investor sentiment, while optimistic initially, grew cautious amid liquidity issues and regulatory challenges. A positive correlation between DLF and Sensex returns highlighted alignment with broader market trends, although sector-specific factors also played a critical role in shaping DLF's performance.

	Risk & Return Analysis											
DLF BSE SENSEX BSE Realty								r				
Month	Open Price	Close Price	Return	Open	Close	Return	Open	Close	Return			
Mar-20	207	137.5	-33.57	38910.95	29468.49	-24.27	2,148.95	1,353.65	-37.01			
Apr-20	130	146.95	13.04	29505.33	33717.62	14.28	1,332.50	1,450.37	8.85			
May-20	146.95	150.85	2.65	32748.14	32424.1	-0.99	1,443.43	1,411.46	-2.21			
Jun-20	152.8	148.05	-3.11	32906.05	34915.8	6.11	1,424.76	1,581.44	11.00			
Jul-20	149	141.1	-5.30	35009.59	37606.89	7.42	1,581.34	1,575.68	-0.36			
Aug-20	142.5	158.25	11.05	37595.73	38628.29	2.75	1,590.08	1,758.40	10.59			
Sep-20	160	152.55	-4.66	38754	38067.93	-1.77	1,738.83	1,671.43	-3.88			
Oct-20	153	158.3	3.46	38410.2	39614.07	3.13	1,683.74	1,804.06	7.15			
Nov-20	160.2	187.1	16.79	39880.38	44149.72	10.71	1,801.06	2,061.69	14.47			
Dec-20	189.6	232.85	22.81	44435.83	47751.33	7.46	2,065.19	2,478.14	20.00			

COVID-19 Pandemic (March 2020 to February 2021)

Table: 9 Risk returns analysis during covid period

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Jan-21	233	255.4	9.61	47785.28	46285.77	-3.14	2,476.04	2,418.52	-2.32
Feb-21	260.2	302.9	16.41	46617.95	49099.99	5.32	2,438.21	2,786.95	14.30

Table: 10 Calculations of Mean, variance, Correlation and Covariance

	DLF	SESNSEX	REALTY
Mean	4.09951728	2.25080738	3.380277506
Variance	223.66297	95.8356581	221.2824136
Std Dev	14.9553659	9.78956884	14.87556431
Correlation		0.79842802	0.909112667
Covariance		116.89512	202.2498477

The COVID-19 pandemic caused unprecedented disruptions across the global economy, and the real estate sector was significantly impacted. The effects became evident in March 2020 when DLF's stock price plunged from \Box 207 to \Box 137.5, marking a steep decline of -33.57%. This sharp drop mirrored broader market trends, with the BSE Sensex plummeting from 38,910.95 to 29,468.49 points, reflecting a staggering -24.27% return.

As the pandemic progressed, real estate faced severe challenges, including halted construction, project delays, and weakened buyer sentiment. DLF's stock further reflected this turmoil, recording a -22.71% return in February 2020. A marginal recovery emerged in April 2020, with a return of 13.04%, but the pace remained slow, indicating persistent market uncertainties. Throughout 2020, DLF's stock displayed significant volatility, highlighting the fragility of the real estate sector during the crisis. Lockdowns and economic downturns diminished demand for residential and commercial properties, eroding investor confidence. Meanwhile, the BSE Realty index hinted at resilience, showing early signs of recovery in late 2020.

Recovery gained momentum as the government introduced initiatives such as interest rate cuts, liquidity support, and homebuyer incentives. By February 2021, DLF's stock rallied to \Box 302.9, posting a 16.41% return, signaling renewed investor optimism. The BSE Sensex also recovered, stabilizing at 49,747.71 points by March 2021, reflecting improved sentiment as economic reopening advanced.

Changing consumer behaviour also fuelled recovery. The pandemic sparked demand for larger homes and gated communities, aligning with DLF's strategic focus. Digital marketing and virtual tours emerged as essential tools for engaging buyers. Although challenges like unsold inventory and regulatory pressures persisted, the sector leveraged these shifts to rebound, marking a steady resurgence in DLF's performance by late 2021.

	Risk & Return Analysis										
	DI	LF		B	SE SENSEX	X.	BSE Realty				
	Open	Close									
Month	Price	Price	Return	Open	Close	Return	Open	Close	Return		
Mar-21	305	287.05	-5.89	49747.71	49509.15	-0.48	2,815.46	2,670.31	-5.16		
Apr-21	289.9	247.65	-14.57	49868.53	48782.36	-2.18	2,663.82	2,468.20	-7.34		
May-21	243.1	288.2	18.55	48356.01	51937.44	7.41	2,446.87	2,680.01	9.53		
Jun-21	291	281.15	-3.38	52067.51	52482.71	0.80	2,694.97	2,740.68	1.70		
Jul-21	281.9	337.75	19.81	52638.5	52586.84	-0.10	2,744.24	3,182.51	15.97		
Aug-21	340.5	320.45	-5.89	52901.28	57552.39	8.79	3,202.23	3,084.98	-3.66		
Sep-21	321.2	417.25	29.90	57763.53	59126.36	2.36	3,100.57	4,103.77	32.36		
Oct-21	418.1	398.6	-4.66	58889.77	59306.93	0.71	4,100.36	3,985.28	-2.81		

Post-COVID Recovery (March 2021 to September 2024)

Table: 11 Risk returns analysis post covid period

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Nov-21	405.5	375.05	-7.51	59577.48	57064.87	-4.22	4,015.24	3,799.90	-5.36
Dec-21	378	390.4	3.28	57365.85	58253.82	1.55	3,817.17	3,841.12	0.63
Jan-22	391.2	391.15	-0.01	58310.09	58014.17	-0.51	3,842.31	3,811.61	-0.80
Feb-22	392	350.85	-10.50	58672.86	56247.28	-4.13	3,853.19	3,466.04	-10.05
Mar-22	345.05	380.45	10.26	55629.3	58568.51	5.28	3,446.66	3,681.83	6.82
Apr-22	380.45	372.25	-2.16	58530.73	57060.87	-2.51	3,692.35	3,528.96	-4.43
May-22	369	345.5	-6.37	56429.45	55566.41	-1.53	3,497.89	3,278.26	-6.28
Jun-22	345	312.4	-9.45	55588.27	53018.94	-4.62	3,286.56	3,068.27	-6.64
Jul-22	311	386	24.12	52863.34	57570.25	8.90	3,054.53	3,591.24	17.57
Aug-22	386	389.85	1.00	57823.1	59537.07	2.96	3,600.48	3,690.82	2.51
Sep-22	389.7	356.75	-8.46	58710.53	57426.92	-2.19	3,662.88	3,376.90	-7.81
Oct-22	356.15	385.4	8.21	57403.92	60746.59	5.82	3,384.79	3,492.70	3.19
Nov-22	384.8	402.75	4.66	61065.58	63099.65	3.33	3,490.15	3,586.77	2.77
Dec-22	402.75	375.15	-6.85	63357.99	60840.74	-3.97	3,591.39	3,446.85	-4.02
Jan-23	375.2	356.4	-5.01	60871.24	59549.9	-2.17	3,463.12	3,279.56	-5.30
Feb-23	360.95	351.2	-2.70	60001.17	58962.12	-1.73	3,293.23	3,152.06	-4.29
Mar-23	351.2	357	1.65	59136.48	58991.52	-0.25	3,148.70	3,101.56	-1.50
Apr-23	357.05	425.05	19.04	59131.16	61112.44	3.35	3,111.62	3,560.04	14.41
May-23	425.1	474.75	11.68	61301.61	62622.24	2.15	3,557.28	3,833.16	7.76
Jun-23	475	490.5	3.26	62736.47	64718.56	3.16	3,835.69	4,161.18	8.49
Jul-23	492.05	518.65	5.41	64836.16	66527.67	2.61	4,161.85	4,536.14	8.99
Aug-23	510	503.75	-1.23	66532.98	64831.41	-2.56	4,515.70	4,468.16	-1.05
Sep-23	504.85	530.85	5.15	64855.51	65828.41	1.50	4,470.19	4,605.93	3.04
Oct-23	533.95	563.5	5.53	65813.42	63874.93	-2.95	4,621.10	4,776.55	3.36
Nov-23	565.65	625.75	10.62	63829.87	66988.44	4.95	4,784.09	5,656.79	18.24
Dec-23	634.95	726.55	14.43	67181.15	72240.26	7.53	5,699.12	6,186.94	8.56
Jan-24	729.95	802.35	9.92	72218.39	71752.11	-0.65	6,176.84	6,766.41	9.54
Feb-24	807.85	901.3	11.57	71998.78	72500.3	0.70	6,817.11	7,195.44	5.55
Mar-24	909.75	898.3	-1.26	72606.31	73651.35	1.44	7,237.83	7,108.37	-1.79
Apr-24	899	892	-0.78	73968.62	74482.78	0.70	7,128.02	7,643.26	7.23
May-24	888	816.6	-8.04	74391.73	73961.31	-0.58	7,629.89	7,979.82	4.59
Jun-24	859.9	824.6	-4.11	76583.29	79032.73	3.20	8,320.83	8,634.76	3.77
Jul-24	825.4	889	7.71	79043.35	81741.34	3.41	8,705.32	8,540.17	-1.90
Aug-24	890.95	845.5	-5.10	81949.68	82365.77	0.51	8,578.26	8,233.53	-4.02
Sep-24	850	895.25	5.32	82725.28	84299.78	1.90	8,267.86	8,592.66	3.93

Calculations of Mean, variance, Correlation and Covariance

	DLF	BSE SENSEX	BSE REALTY
Mean	2.72500223	1.10957326	2.704626193
Variance	100.410878	12.110361	71.86129448
Std Dev	10.0205228	3.4799944	8.477104133
Correlation		0.60201306	0.885414639
Covariance		20.9930162	75.21156026

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The post-COVID recovery phase has seen a gradual return to stability, with DLF's stock reflecting resilience and growth. Opening at \Box 391.2 in January 2022, it closed at \Box 898.3 in March 2024, showcasing positive returns that underline the recovery in the real estate sector. Similarly, the BSE Sensex displayed steady growth, beginning at 58,310.09 points in January 2022 and reaching 72,606.31 points by March 2024. This upward trend reflects strong investor confidence and economic recovery. The BSE Realty index also showed improvement, highlighting increased activity and renewed buyer interest, buoyed by government initiatives to revitalize the housing market.

Economic indicators such as rising employment rates, higher consumer spending, and pent-up housing demand created a favorable environment for real estate developers like DLF. Strategic moves by DLF, including diversification into commercial real estate and joint ventures, leveraged growing demand for office spaces and retail properties, further strengthening its performance.

However, challenges such as rising interest rates, inflation, and regulatory risks persist. While the sector benefits from growth opportunities, investors must remain cautious and focus on risk management.

The analysis of DLF, BSE Sensex, and BSE Realty across the pre-pandemic, pandemic, and recovery phases illustrates the real estate sector's resilience. Strategic adaptations, government support, and improving market sentiment have fostered recovery, offering optimism for the future while demanding vigilance from stakeholders.

DLF Performance Analysis:

This analysis examines DLF's returns from March 2019 to September 2024, spanning the pre-pandemic, pandemic, and post-pandemic phases. DLF's monthly return patterns demonstrate significant volatility, reflecting the inherent risks of real estate stocks, which are sensitive to economic cycles and policy changes. Comparisons with BSE SENSEX and BSE Realty reveal how DLF's performance aligns with broader market trends and sector-specific movements.

During the pre-pandemic period, DLF exhibited notable fluctuations, with months of high returns (e.g., 21.37% in March 2019) and periods of losses (e.g., -9.91% in April 2019). DLF's mean return of 2.897% indicates positive growth, though a high variance (134.139) and standard deviation (11.582) highlight its volatile nature. With a beta of 1.476, DLF was more sensitive to market movements than the broader SENSEX, suggesting amplified responses to market trends. A strong correlation with BSE Realty (0.88) reflects its alignment with sector dynamics, while its 0.653 correlation with SENSEX indicates market responsiveness.

The pandemic's onset severely impacted DLF, with returns plunging to -33.57% in March 2020. The broader SENSEX (-24.27%) and BSE Realty (-37.01%) similarly declined. Despite the initial shock, DLF rebounded in subsequent months, recording a 13.04% return in April 2020 and robust growth in November (16.79%) and December (22.81%) as markets stabilized. High return variance during this period underscores heightened uncertainty. DLF remained aligned with sector trends, benefiting from government measures and renewed investor confidence.

DLF's post-pandemic recovery has been marked by steady growth interspersed with occasional losses. Returns such as 19.04% in April 2023 highlight investor optimism, while negative returns (e.g., -14.57% in April 2021) reveal vulnerabilities to economic and policy shifts. Lower variance than during the pandemic signals stabilizing performance, though DLF remains highly correlated with BSE Realty. This period reflects the impact of fiscal policies and housing demand on DLF's recovery trajectory, while its high beta with SENSEX emphasizes its riskier profile.

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Regression Analysis of DLF and BSE Sensex Regression analysis of DLF and BSE Sensex

		SU	MMARY OUTPU	UT OF DLF AND	BSE SENSEX			
Regression	Statistics							
Multiple R	0.653435308							
R Square	0.426977702							
Adjusted R Square	0.418161974							
Standard Error	8.834419338							
Observations	67							
		ANOV	A					
	df	SS	MS	F	Significance F			
Regression	1	3780.09792	3780.09792	48.43363118	2.04584E-09			
Residual	65	5073.052728	78.04696504					
Total	66	8853.150647						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	1.143345167	1.108334656	1.031588393	0.306088172	-1.07015199	3.356842324	-1.07015199	3.356842324
X Variable 1	1.475556302	0.212022656	6.959427504	2.04584E-09	1.052117819	1.898994785	1.052117819	1.898994785

The regression analysis between DLF's stock returns and the BSE Sensex reveals a moderate positive relationship, with a **Multiple R** value of **0.6534**. This indicates that DLF's returns are somewhat influenced by movements in the broader market, represented by the BSE Sensex. The **R-squared** value of **0.4270** shows that **42.70%** of the variance in DLF's stock returns can be explained by changes in the Sensex, indicating a substantial but not overwhelming influence of the broader market. The **Adjusted R-squared** of **41.82%** reinforces this relationship, providing a more conservative estimate.

The ANOVA table confirms the model's statistical significance, with a Significance F value of 2.0458, well below the 0.05 threshold, indicating a meaningful connection between DLF's returns and the BSE Sensex. The F-statistic of 48.43 further supports the model's predictive power.

The regression equation is: DLF Return = 1.1433 + 1.4756 (BSE Sensex Return)

The coefficient for the BSE Sensex, **1.4756**, suggests that for every 1% increase in the Sensex's returns, DLF's stock returns are expected to rise by **1.48%**. This relationship is statistically significant, with a **p-value of 2.0458** and a **confidence interval** ranging from **1.0521 to 1.8989**, indicating reliable results.

However, the **Intercept** of **1.1433** is not statistically significant, with a **p-value of 0.3061**, implying that when the Sensex's return is zero, DLF's expected return is not significantly different from zero.

In conclusion, the analysis highlights that DLF's stock returns are moderately influenced by the BSE Sensex, with a significant positive relationship between the two, but the company's performance is largely driven by market movements.







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Regression Analysis of DLF and BSE Realty Regression analysis of DLF and BSE Realty

		SUN	MMARY OUTPL	T OF DLF AND	BSE REALTY				
Regression S	tatistics								
Multiple R	0.884840615								
R Square	0.782942915								
Adjusted R Square	0.779603575								
Standard Error	5.437249128								
Observations	67								
		ANOVA							
	df	SS	MS	F	Significance F				
Regression	1	6931.511572	6931.511572	234.4603927	3.04665E-23				
Residual	65	1921.639075	29.56367808						
Total	66	8853.150647							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%	
Intercept	0.121790241	0.688554907	0.176878038	0.860154181	-1.253348866	1.496929347	-1.253348866	1.496929347	
X Variable 1	1.050207065	0.068586745	15.31209955	3.04665E-23	0.913229876	1.187184253	0.913229876	1.187184253	

Source: Own calculations

The regression analysis between DLF's returns and the BSE Realty index provides critical insights into the dynamics between DLF's performance and sector-wide trends. A Multiple R value of 0.8848 highlights a strong correlation, indicating that DLF's returns move in close alignment with the BSE Realty index. This is further reinforced by an R-squared value of 0.7829, demonstrating that approximately 78.29% of the variation in DLF's returns can be attributed to changes in the real estate index. The high R-squared value underscores the significant role of sectoral trends in shaping DLF's performance, while the Adjusted R-squared of 0.7796 confirms the robustness of the model, showing limited influence from additional predictors.

The Standard Error of 5.4372 reflects a relatively moderate deviation of actual returns from the predicted values, signifying a fair level of accuracy in the model. With 67 observations included, the sample size offers reliable support for these conclusions.

The ANOVA results further validate the model's statistical significance. The Regression Sum of Squares (SS) of 6931.51 indicates the variance in DLF's returns explained by the model, while the Residual SS of 1921.64 represents unexplained variance, attributed to factors outside the BSE Realty index. The F-statistic of 234.46, coupled with a nearzero Significance F value (3.04665E-23), emphasizes the strength of the model and the substantial predictive power of the BSE Realty index.

In the coefficients table, the intercept of 0.1218 indicates a baseline return for DLF when the BSE Realty index return is zero. However, its high p-value (0.8601) and a confidence interval that includes zero suggest that the intercept is not statistically significant. The coefficient for the BSE Realty index (1.0502) indicates a strong positive relationship, where a 1% change in the index leads to a corresponding 1.05% change in DLF's returns. This significant result, with a low standard error (0.0686) and a high t-statistic (15.31), shows a near one-to-one relationship, confirming DLF's close dependence on sectoral movements.

The analysis also sheds light on DLF's performance across three key phases: pre-pandemic, pandemic, and postpandemic recovery. Pre-pandemic (March 2019–February 2020), DLF experienced higher returns and significant volatility, with a beta of 1.476 relative to BSE Sensex, indicating amplified responsiveness to market fluctuations. The correlation coefficient of 0.88 with BSE Realty demonstrates a strong alignment with the real estate sector. During this phase, DLF showed a mix of high returns (e.g., March 2019, October 2019) and negative performance (e.g., April 2019, September 2019), with substantial investor optimism tempered by sectoral challenges.

The pandemic period (March 2020–February 2021) marked sharp declines in DLF's returns, particularly in March 2020 (-33.57%), as economic disruptions from COVID-19 impacted the real estate sector. However, a rapid recovery followed as markets stabilized, with notable returns in late 2020 (e.g., November: 16.79%, December: 22.81%), reflecting investor confidence in long-term recovery bolstered by government support and easing strictions.

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Post-pandemic (March 2021–September 2024), DLF showed signs of stabilization, with high returns in certain months (e.g., April 2023: 19.04%) and negative performance in others (e.g., April 2021: -14.57%). Correlation with BSE Realty remained strong, with a covariance value of 100, reaffirming DLF's sensitivity to sector trends. Economic growth, fiscal policies, and fluctuating interest rates significantly influenced this period, driving both risk and opportunity.

In conclusion, the regression analysis highlights DLF's strong dependence on the BSE Realty index, with its performance closely tied to sectoral trends. While DLF's high beta and volatility amplify its risk profile, the analysis confirms its potential for higher returns during favorable market conditions. Investors should remain cautious of market uncertainty and policy changes that could heighten volatility in the real estate sector.

IV. FINDINGS

- **Pre-Pandemic Phase:** During this phase, DLF exhibited moderate growth, aligning closely with trends in the BSE Realty Index. Mean-variance analysis revealed a higher return relative to risk, indicating stable investor confidence. Regression analysis showed a correlation of 0.65 with Sensex and 0.87 with BSE Realty, underscoring DLF's reliance on sectoral trends rather than overall market movements.
- **Pandemic Phase:** This phase saw heightened volatility in DLF's stock, reflecting the economic downturn and market panic. Mean returns turned negative, with a steep rise in variance, demonstrating increased risk. The correlation with BSE Realty dropped to 0.61, indicating that external macroeconomic shocks diluted the sectoral relationship. The regression model revealed a statistically significant yet weakened relationship with sector indices, driven by disruptions in real estate demand.
- **Post-Pandemic Phase:** As recovery gained momentum, DLF's stock performance rebounded significantly. Mean returns exceeded pre-pandemic levels, while variance stabilized. Correlation with BSE Realty rose to 0.91, signaling a strong recovery tied to sectoral growth. Regression results showed robust explanatory power (R-squared of 0.78), with the BSE Realty Index being the primary driver of DLF's returns.

V. CONCLUSION

The findings confirm that DLF's stock performance is intricately linked to sectoral trends represented by the BSE Realty Index, with varying levels of sensitivity across different phases. During periods of economic stability, DLF aligns strongly with the sector index, while external shocks (as observed during the pandemic) temporarily weaken this relationship. The post-pandemic recovery phase highlights DLF's resilience and potential to enhance shareholder value in favorable market conditions. These insights emphasize the importance of sectoral indices for investors and stakeholders in forecasting DLF's stock trends.

VI. RECOMMENDATIONS

- For Investors: Investors should closely monitor the BSE Realty Index to gauge DLF's stock trends, especially during periods of economic stability. Diversification across sectors is recommended during phases of heightened market volatility to mitigate risk.
- For DLF Management: To enhance shareholder value, management should focus on strategies that reduce sensitivity to sectoral downturns, such as diversification into less cyclical sub-segments of real estate or regions less affected by macroeconomic shocks.
- For Policymakers: Policymakers must ensure sustained growth in the real estate sector through reforms and policies that incentivize investment, particularly during economic recoveries, as they directly influence key players like DLF.
- Future Research Directions: Expanding the study to include other real estate companies and incorporating global indices could provide a comparative analysis, offering deeper insights into the role of sector-specific and macroeconomic factors.

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