FINANCE AND BANKING
IJFB VOL 15 NO 1 (2025) P-ISSN 2574-6081 E-ISSN 2574-609X
Journal homepage: https://www.cribfb.com/journal/index.php/ijfb
Published by American Finance & Banking Society, USA

TESTING SEMI-STRONG FORM MARKET EFFICIENCY: THE CASE OF INDIAN PHARMA SECTORS

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ARTICLE INFO

Article History:

Received: 16th March 2025
Reviewed & Revised: 16th March to 14th July 2025
Accepted: 16th July 2025
Published: 20th July 2025

Keywords:

Aggressiveness Index, Semi-Strong Market Efficiency, Tobin's Q

JEL Classification Codes:

G12, G14

Peer-Review Model:

External peer review was done through double-blind method.

ABSTRACT

The Efficient Market Hypothesis (EMH) holds that security prices fully reflect all publicly available information, leaving no scope for abnormal gains from fundamental or technical analysis. Despite extensive research, the semi-strong form of EMH remains inconclusive in developing markets. This study examines the degree of semi-strong-form efficiency in the Indian pharmaceutical industry. It explores how effectively the stock prices of leading firms, Sun Pharmaceutical, Dr. Reddy's Laboratories, Zydus Life Sciences, Cipla, and Torrent Pharmaceuticals, reflect publicly accessible information. The analysis covers five years from 2018–19 to 2022–23 and utilizes the Core Competency Strategic Intent (CCSI) model to assess the relationship between firm fundamentals and market valuation. Tobin's Q (market value to book value) and employee cost as a percentage of sales are considered representative indicators of valuation and strategic intent. Empirical results show that stock prices in this sector respond more rapidly to short-term, quantifiable factors such as sales performance. In contrast, long-term strategic elements exert a weaker effect on valuation. A numerical evaluation of Tobin's Q across firms indicates varying degrees of mispricing, suggesting both overvaluation and undervaluation. Overall, the study finds that the Indian pharmaceutical sector exhibits only partial adherence to the semi-strong form of market efficiency, as investors appear to prioritize immediate financial outcomes over comprehensive strategic fundamentals.

INTRODUCTION

The efficiency of financial markets remains a central concern in finance and investment research. The valuation of securities depends on investors' rational interpretation of publicly available information, as the accuracy and timeliness of that data guide decisions to buy or sell. According to the Efficient Market Hypothesis (EMH), as introduced by Fama (1970), stock prices should instantaneously incorporate all available information, ensuring that no investor can consistently earn abnormal returns. However, the practical validity of this hypothesis, particularly its semi-strong form, remains debated in both developed and emerging markets. In emerging economies like India, where market information asymmetry and behavioral biases persist, the question of whether public announcements and firm fundamentals are accurately reflected in stock prices remains a significant scientific question.

Recent studies (e.g., Kumar & Raju, 2021; Mishra & Taneja, 2022; Gupta et al., 2023; Dutta & Sharma, 2024) have highlighted that market responses to financial disclosures in India vary considerably across sectors, suggesting incomplete efficiency. Research in developed markets has also revealed mixed evidence (e.g., Chen et al., 2021; Fernandes & Costa, 2022), indicating that even mature markets exhibit deviations from perfect informational efficiency. Moreover, advancements in algorithmic trading and digital transparency (Patel & Singh, 2023; Ali & Rehman, 2025) have reshaped how information influences price adjustments, underscoring the need to re-examine market efficiency in sector-specific contexts, such as the pharmaceutical industry.

This study tests the semi-strong form of the EMH in the Indian pharmaceutical sector—an industry characterized by high research intensity, stringent regulation, and global competitiveness. Using data from five major pharmaceutical companies over five financial years (2018–19 to 2022–23), the research employs the Core Competency Strategic Intent (CCSI) model to assess the relationship between market valuation and strategic performance indicators. The central scientific problem addressed is whether publicly available financial and strategic information is fully and promptly

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 https://doi.org/10.46281/ijfb.v15i1.2715

To cite this article: Joshi, J., & Joshi, K. (2025). TESTING SEMI-STRONG FORM MARKET EFFICIENCY: THE CASE OF INDIAN PHARMA SECTORS. *Indian Journal of Finance and Banking*, *15*(1), 10-18. https://doi.org/10.46281/ijfb.v15i1.2715

integrated into stock prices. The study aims to determine the extent to which the market reflects firm fundamentals and to identify deviations that indicate potential over- or undervaluation of securities.

LITERATURE REVIEW

Market efficiency has remained one of the most debated concepts in financial economics for over five decades. Rooted in the Efficient Market Hypothesis (EMH) proposed by Fama (1970), the theory asserts that security prices fully reflect all available information, leaving no room for investors to achieve abnormal returns consistently. However, subsequent empirical studies have revealed variations in efficiency over time, across regions, and by sector, particularly in emerging economies such as India (Poshakwale, 1996; Gupta & Gupta, 1997; Malkiel, 2003). The Indian stock market has undergone a significant transformation following the establishment of the National Stock Exchange in 1992, which introduced electronic trading and improved transparency, yet the persistence of anomalies continues to challenge the EMH framework (Deshpande, 2017; Gupta & Narwal, 2022).

Empirical investigations of market behavior have traditionally relied on weak-form and semi-strong form efficiency tests. Studies employing serial correlation and runs tests reported that the Bombay Stock Exchange (BSE) exhibited significant deviations from weak-form efficiency, suggesting that past prices could still predict future movements (Poshakwale, 1996; Worthington & Higgs, 2004). Similar evidence of inefficiency was observed in other developing markets, including Bangladesh (Ahmed, 2021), Pakistan (Habibah et al., 2017), and Saudi Arabia (Khoj & Akeel, 2020), where price randomness was undermined by investor sentiment and delayed information diffusion. In contrast, research on mature markets, such as the United States and Western Europe, indicates a closer approximation to informational efficiency (Malkiel, 2003; Chen et al., 2021).

At the sectoral level, the pharmaceutical industry provides a distinct context for testing market efficiency, given its high reliance on innovation, regulatory compliance, and strategic investment decisions. McKinsey & Company (2020) identified the Indian pharmaceutical sector as the third-largest in the world, contributing significantly to global exports and employment. This industry's complex structure—balancing R&D intensity and market regulation—creates both information asymmetry and speculative opportunities. Studies by Mukhopadhyay (2007) and Dutta and Sharma (2024) identified macroeconomic variables such as exchange rate fluctuations, foreign investment inflows, and inflation as strong predictors of stock returns, implying that market prices may not fully incorporate all relevant fundamentals.

From a behavioral finance perspective, the persistence of “rational bubbles” (Mukhopadhyay, 2007) demonstrates that even rational investors may participate in overpricing, anticipating that others will continue to drive prices upward. This phenomenon aligns with the "greater fool" theory, in which investment decisions are driven more by market expectations than by intrinsic value. Such patterns are evident in high-volatility sectors like pharmaceuticals, where policy shifts, patent approvals, and global health crises have amplified speculative behavior (Kalamen et al., 2025).

Further evidence from global studies suggests that market irrationality differs by region and sector. Gupta and Basu (2011) documented weak-form inefficiency across Asian markets, while Fernandes and Costa (2022) highlighted limited semi-strong form efficiency even in developed economies. More recent analyses by Patel and Singh (2023) and Ali and Rehman (2025) argue that algorithmic trading has improved information absorption rates but has not eliminated inefficiencies, particularly where fundamental data are complex or delayed.

Within the Indian context, sectoral research remains limited. Existing studies have focused mainly on aggregate indices rather than industry-specific analysis. The pharmaceutical sector's unique combination of innovation-driven growth and strategic human capital investment offers fertile ground for testing semi-strong market efficiency. Employee expenses, which constitute a significant share of operational costs, can serve as a proxy for strategic intent. At the same time, Tobin's Q ratio (Brainard & Tobin, 1968) provides a measure of market valuation relative to asset replacement value. The Core Competency Strategic Intent (CCSI) framework (Hamilton et al., 1998) integrates these indicators, allowing for a structured assessment of whether the market adequately prices firm-level fundamentals.

Recent studies (Gupta et al., 2023) emphasize that the post-pandemic environment has magnified the gap between short-term performance indicators and long-term strategic fundamentals. Firms that invest aggressively in innovation and workforce expansion often experience delayed market recognition, suggesting partial inefficiency in the semi-strong sense. Thus, examining the linkage between Tobin's Q and employee expenses provides a meaningful avenue for assessing how efficiently public information is processed in the Indian pharmaceutical market.

In summary, while global and regional evidence supports the semi-strong form of EMH only partially, empirical validation in industry-specific contexts remains scarce. The Indian pharmaceutical sector, with its high strategic intensity and macroeconomic importance, offers a compelling platform for investigating this theoretical gap.

Therefore, the purpose of this study is to empirically evaluate the semi-strong form of market efficiency in the Indian pharmaceutical sector by analyzing the relationship between firms’ market-to-book value ratios (Tobin’s q) and strategic intent, measured through employee expenses as a percentage of total sales, using the Core Competency Strategic Intent (CCSI) model. The following hypotheses are proposed for this study:

H_0: There is a positive and statistically significant association between a firm’s market-to-book value ratio (Tobin’s q) and its level of strategic intent, represented by the aggressiveness index (employee expenses as a percentage of sales).

MATERIALS AND METHODS

The present study examines the behaviour of stock prices in the pharmaceutical sector of India to determine whether they follow a random pattern or are influenced by significant factors, such as the Tobin's Q ratio. The aim is to ascertain whether

the market adequately incorporates crucial information when valuing pharmaceutical stocks. Additionally, the study seeks to pinpoint instances of overvaluation or undervaluation by assessing the Company's investment aggressiveness, which reflects its efforts to enhance its fundamental metrics. Data analysis was conducted using publicly available information on the market-to-book ratio (Tobin's q) and the proportion of employee expenses to sales. The study spans five financial years, from 2018-19 to 2022-23, and focuses on five major pharmaceutical companies: Sun Pharma, Dr. Reddy's, Zydus Life Sciences, Cipla, and Torrent. Various metrics, including sales, employee cost-to-sales ratio, price-to-book ratio (Tobin's q), and the average market price of the stock, were analysed to assess their relationships. A summary of the data for each Company used in the study is provided in Table 1. Multiple correlation analysis was used to assess the strength of relationships among the variables discussed earlier. The average stock price for each Company during the study period was used for analysis.

RESULTS AND DISCUSSIONS

Of the five firms analyzed, four demonstrated a strong positive correlation between annual Revenue and market valuation (see Table 2). For instance, Cipla exhibited a correlation coefficient of 0.925 between Revenue (in crores) and its average stock price, suggesting that the market responded to readily available data such as revenue figures, which aligns with the assumptions of semi-strong market efficiency. However, when evaluating the relationship between the Market-to-Book Ratio (here, Tobin's q) and the firm's strategic posture (measured by the Aggressiveness Index), the correlation was negative, indicating a lack of alignment between the two variables. In Cipla's case, the correlation between Tobin's Q and strategic intent stood at -0.690.

In several instances, while there was a strong positive link between the average market price and Revenue, the association between Tobin's Q and strategic intent was clearly negative. For example, Sun Pharma's stock price-to-revenue correlation was 0.867, while its strategic intent-to-q ratio reflected a weaker negative association ($r = -0.165$). This pattern suggests that market participants tend to rely more on simple, accessible financial indicators, such as Revenue, rather than on more abstract or delayed signals, such as strategic direction or internal firm intent.

Table 1. Data of selected sample companies (FY 2018-19 to 2022-23)

Firm Name	Financial Year	Revenue (in Crores)	Market-to-Book Ratio (MV/BV)	Staff Expenses (in Crores)	Staff Cost as a Percentage of Revenue"
Sun Pharma	2018-19	26,415	5.32	1625	0.062
	2019-20	29,065	5.03	1571.34	0.054
	2020-21	32,837	3.46	1702.77	0.052
	2021-22	33,498	5.73	1805.9	0.054
	2022-23	38,654	8.93	2000.78	0.052
Dr Reddy	2018-19	14,281	2.75	1843	0.129
	2019-20	15,448	3.29	1931.9	0.125
	2020-21	17,517	3.32	2030.2	0.116
	2021-22	19,047	4.25	2270.1	0.119
	2022-23	21,545	3.71	2434.6	0.113
Zydus Life Science	2018-19	11,904	5.01	26.48	0.002
	2019-20	13,165	4.14	30.91	0.002
	2020-21	14,253	2.43	31.68	0.002
	2021-22	14,403	3.54	163.83	0.011
	2022-23	15,265	2.7	163.56	0.011
Cipla	2018-19	15,155	3.1	1785.94	0.118
	2019-20	16,362	2.7	1839.84	0.112
	2020-21	17,131	1.96	1911.08	0.112
	2021-22	19,159	3.3	1703.58	0.089
	2022-23	21,763	3.65	1729.16	0.079
Torrent	2018-19	5,982	4.64	826.07	0.138
	2019-20	7,672	6.59	1014.06	0.132
	2020-21	7,939	6.52	1061.76	0.134
	2021-22	8,004	7.13	1097.12	0.137
	2022-23	8,508	7.46	1097.93	0.129

Source: Authors' compilation

Table 2 illustrates that the correlation between Revenue (in Crores) and stock prices is generally stronger than that between the Market-to-Book Ratio and strategic investment behaviour, which is intended to capture future potential or intrinsic firm value.

Even if strategic intent does not exhibit a positive correlation with Tobin's Q within the same accounting period, its effects may be more visible in subsequent periods. Table 3 explores this by analyzing the relationship between the Aggressiveness Index and Tobin's Q with a one-year time lag. The results indicate that firms like Sun Pharma and Torrent show a meaningful positive association, while others continue to display weak or negative relationships.

Based on these observations, the null hypothesis stating a positive association between Tobin's Q and strategic intent is rejected. The evidence supports the view that investors operating under bounded rationality may prioritize easily interpretable figures, such as Revenue or profits, while undervaluing more complex strategic indicators. This highlights a market tendency to price stocks based on straightforward and publicly visible information, potentially overlooking more nuanced or future-oriented signals embedded in strategic decisions.

The observed influence likely applies across all firms in the sample, as a significant segment of the pharmaceutical sector is subject to external factors, including global economic shifts, supply-and-demand imbalances, and unforeseen events such as natural disasters. As previously mentioned, such discrepancies may lead to stock mispricing, creating arbitrage opportunities. The Core Competency Strategic Intent (CCSI) model provides a valuable framework for analyzing a firm's fundamentals and assessing whether its stock is undervalued or overvalued. This presents a potential extension of the study.

Table 2. Interrelationship Matrix of Key Financial Indicators by Firm

		Revenue	Market-to-Book	Staff Cost as a Percentage of Revenue (Strategic Intent)
Sun Pharma	Market-to-Book	0.636		
	Staff Cost as a Percentage of Revenue	-0.793	-0.165	
	Market Price (average of stock)	0.867	0.832	-0.408
Dr Reddy	Market-to-Book	0.757		
	Staff Cost as a Percentage of Revenue	-0.913	-0.623	
	Market Price (average of stock)	0.749	0.819	-0.823
Zydus Life Science	Market-to-Book	-0.896		
	Staff Cost as a Percentage of Revenue	0.718	-0.368	
	Market Price (average of stock)	0.547	-0.425	0.731
Cipla	Market-to-Book	0.576		
	Staff Cost as a Percentage of Revenue	-0.976	-0.690	
	Market Price (average of stock)	0.925	0.537	-0.933
Torrent	Market-to-Book	0.984		
	Staff Cost as a Percentage of Revenue	-0.712	-0.659	
	Market Price (average of stock)	0.822	0.819	-0.395

Source: Authors' compilation

Table 3. Correlation Results of the Aggressiveness Index of 2018-19 with Tobin's Q of 2020-21

Company	Correlation between Tobin's Q and Aggressiveness Index
Sun Pharma	0.95
Dr Reddy	0.16
Zydus	-0.13
Cipla	0.52
Torrent	0.88

Source: Authors' compilation

Currently, the model includes only one strategic intent indicator, Staff Cost as a Percentage of Revenue, but it holds flexibility for future enhancement. Additional variables such as customer retention rates or advertising-to-revenue ratios could also be integrated into the model and tested alongside the Market-to-Book Ratio (Tobin's q). This would allow for a more comprehensive evaluation of strategic positioning and market valuation.

Figures 1 through 4 track the movement of Tobin's Q and the Aggressiveness Index (used here to denote strategic intent based on staff expenditure) over several financial years. In these visuals, the Aggressiveness Index is standardized to 1, while the Market-to-Book Ratio reflects the average market valuation per share across the corresponding fiscal year. Both axes are uniformly scaled to ensure consistency and ease of comparison. Yearly average values were used to examine the co-movement of Tobin's Q and strategic intent indicators, as shown in Table 4 for the 2018–19 to 2022–23 period. These transition plots (Figures 1–4) are instrumental for investors in evaluating how firm positioning evolves and assist in identifying both current and prospective valuation scenarios. The framework is especially valuable for medium-term investment planning. For instance, Figure 1 highlights that both Torrent and Sun Pharma significantly ramped up their staff-related investments to scale operations, with Torrent also achieving a relatively higher Market-to-Book Ratio. Other firms, by contrast, trailed in either metric.

Table 4. Computed Values for Visualizing Tobin's Q and Aggressiveness Index over Time

Financial Year	Firm Name	Revenue (in Crores)	Market-to-Book Ratio	Staff Cost as a Percentage of Revenue	Aggressiveness Index	Staff Expenses (in Crores)
2018-19	Sun Pharma	26415	5.32	0.06	0.68	1625
	Dr Reddy	14281	2.75	0.13	1.44	1843
	Zydus	11904	5.01	0.00	0.02	26.48
	Cipla	15155	3.1	0.12	1.31	1785.94
	Torrent	5982	4.64	0.14	1.54	826.07
	Average			0.09		
2019-20	Sun Pharma	29065	5.03	0.05	0.63	1571.3
	Dr Reddy	15448	3.29	0.13	1.47	1931.9
	Zydus	13165	4.14	0.00	0.03	30.91
	Cipla	16362	2.7	0.11	1.32	1839.84

	Torrent	7672	6.59	0.13	1.55	1014.06
	Average			0.09		
2020-21	Sun Pharma	32837	3.46	0.05	0.62	1702.77
	Dr Reddy	17517	3.32	0.12	1.40	2030.2
	Zydus	14253	2.43	0.00	0.03	31.68
	Cipla	17131	1.96	0.11	1.34	1911.08
	Torrent	7939	6.52	0.13	1.61	1061.76
	Average			0.08		
2021-22	Sun Pharma	33498	5.73	0.05	0.66	1805.9
	Dr Reddy	19047	4.25	0.12	1.45	2270.1
	Zydus	14403	3.54	0.01	0.14	163.83
	Cipla	19159	3.3	0.09	1.08	1703.58
	Torrent	8004	7.13	0.14	1.67	1097.12
	Average			0.08		
2022-23	Sun Pharma	38654	8.93	0.52	3.05	20078
	Dr Reddy	21545	3.71	0.11	0.66	2434.6
	Zydus	15265	2.7	0.01	0.06	163.56
	Cipla	21763	3.65	0.08	0.47	1729.16
	Torrent	8508	7.46	0.13	0.76	1097.93
	Average			0.17		

Source: Authors' compilation

As seen in Figure 2, Torrent displayed a notably stronger Aggressiveness Index than its peers, several of which lagged on both indicators or excelled in only one. Given its fundamental positioning in the model, Torrent stands out as a strong growth stock. In Figure 3, Torrent and Dr. Reddy consistently maintained favorable values for both strategic intent and valuation, reinforcing their suitability for medium-term investment. Conversely, Sun Pharma appears to have streamlined its operations, as reflected in a lower Tobin's Q. This could imply upside potential over the next 2–3 years.

Figure 4 indicates that both Torrent and Dr. Reddy continued to lead in workforce investment, an indicator of business expansion. A prudent fund manager should recognize that internal management, equipped with confidential strategic insights, likely responds to evolving market demands through deliberate staffing and investment decisions. With this in mind, both Torrent and Dr. Reddy, supported by robust fundamentals, are well-positioned to attract medium-term investors. Sun Pharma, too, made notable improvements in its Aggressiveness Index.

Following the onset of the COVID-19 pandemic in 2021, there was a surge in activity within the pharmaceutical space. As reflected in Figure 5, the market has recalibrated its valuation of Sun Pharma accordingly. This figure also reveals that firms generally realigned their Tobin's Q values post-pandemic. Among them, Torrent emerges as undervalued, offering a compelling case for medium-term investment consideration.

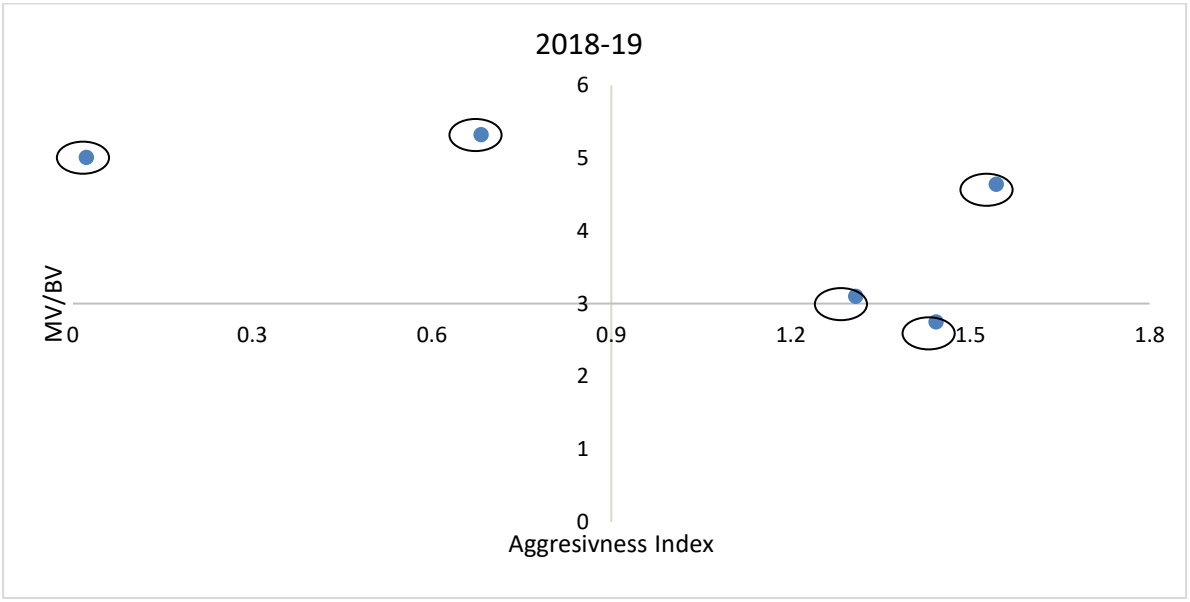

Figure 1. CCSI Matrix for 2018-19 FY

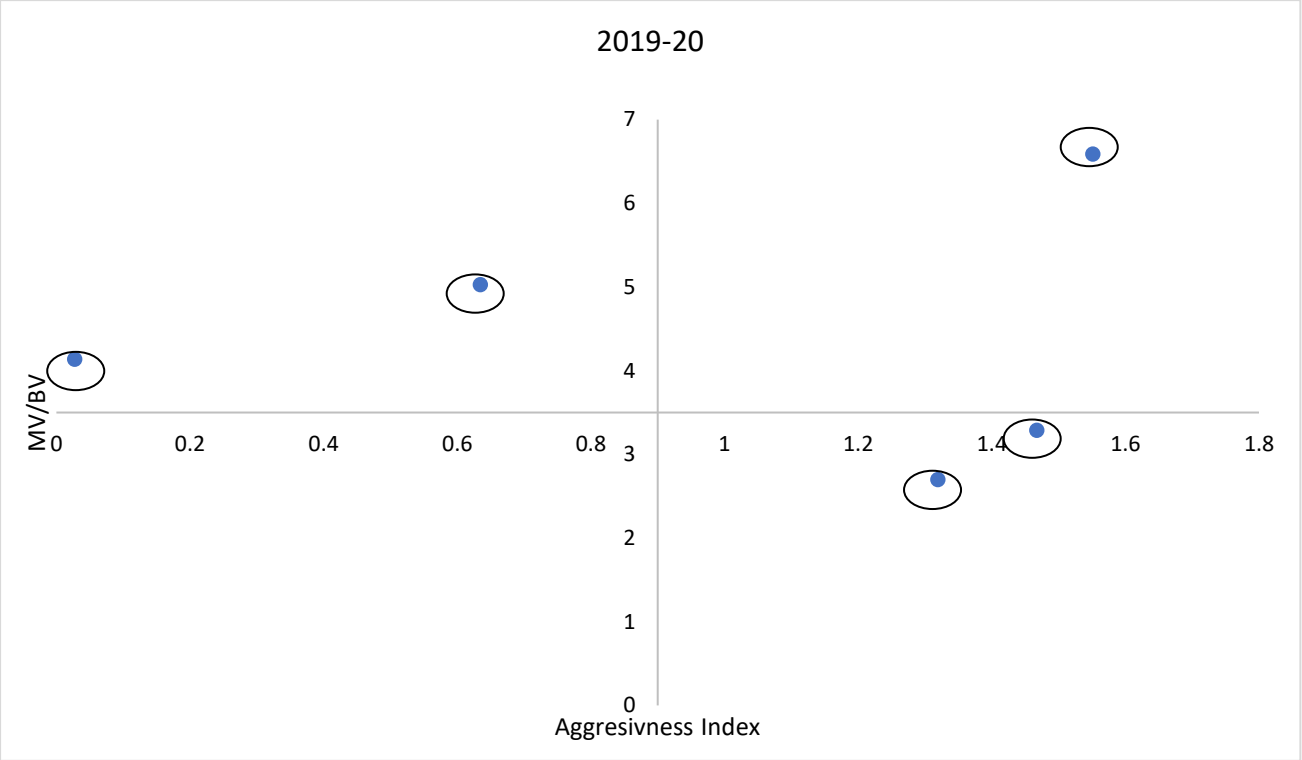

Figure 2. CCSI Matrix for 2019-20 FY

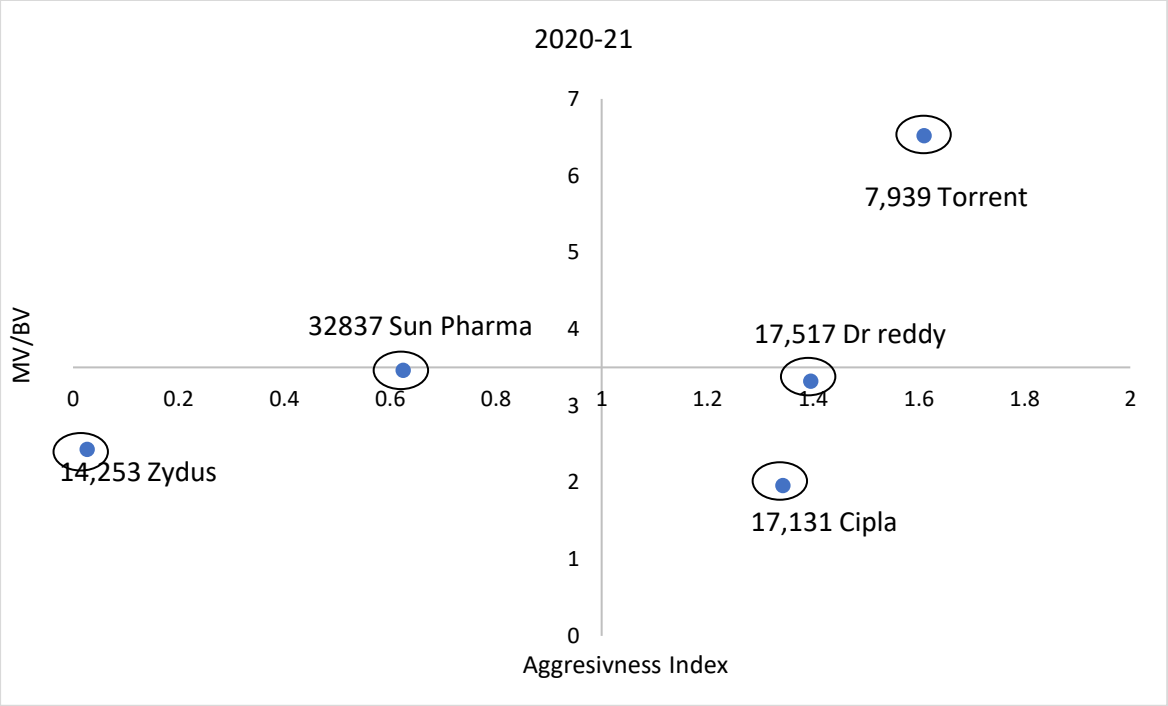

Figure 3. CCSI Matrix for 2020-21 FY

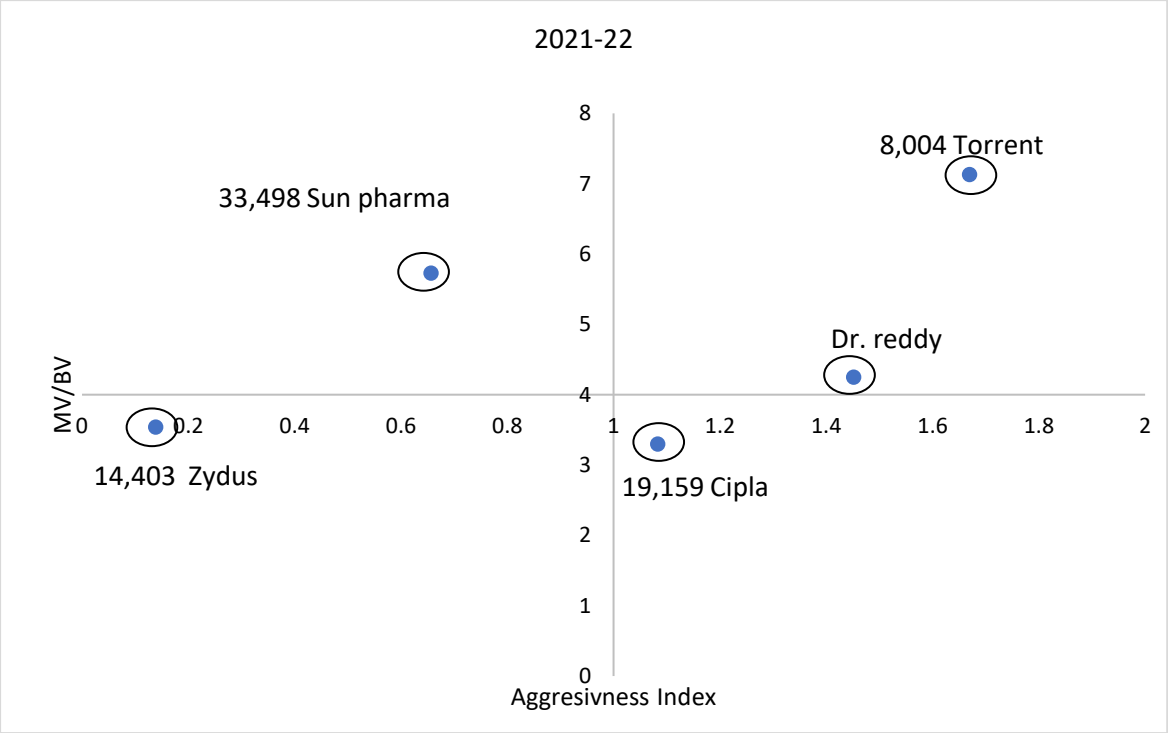

Figure 4. CCSI Matrix for 2021-22 FY

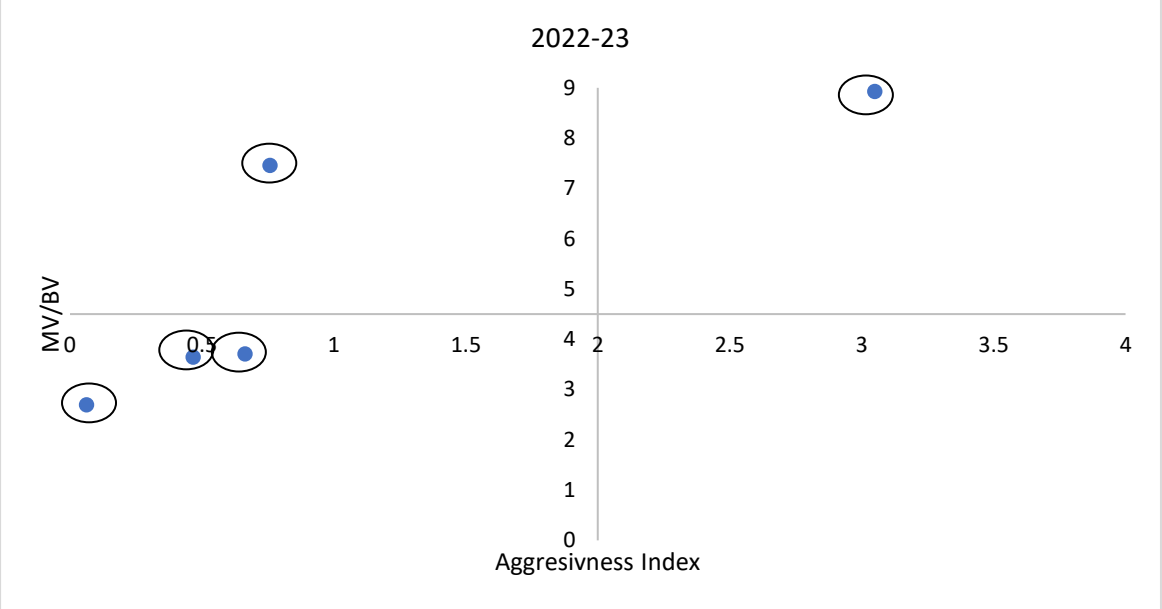

Figure 5. CCSI Matrix for 2022-23 FY

CONCLUSIONS

The primary purpose of this study was to evaluate the semi-strong form of the Efficient Market Hypothesis (EMH) in the context of the Indian pharmaceutical industry, using publicly available information, including earnings announcements and strategic indicators. The empirical findings demonstrate that the Indian pharmaceutical market exhibits only partial efficiency. Stock prices tend to respond more strongly to immediately quantifiable variables, such as sales, rather than to strategic investments reflected in employee expenditures. This suggests that the market still favors short-term, tangible outcomes over long-term value creation factors.

The analysis of Tobin's Q and the Aggressiveness Index indicates a weak or negative correlation between firm aggressiveness and market valuation. In contrast, the positive correlation between sales and market prices suggests that investors respond more consistently to observable performance indicators. Among the firms analyzed, Torrent Pharmaceuticals and Dr. Reddy's Laboratories displayed stronger fundamentals and consistent growth, positioning them as relatively undervalued and potentially favorable options for medium-term investors.

This paper makes a unique contribution by applying the Core Competency Strategic Intent (CCSI) model to assess the linkage between human capital investment and market valuation in the Indian pharmaceutical sector. The findings enhance theoretical understanding of market semi-efficiency and provide a practical decision-making framework for portfolio and fund managers seeking to identify undervalued securities in information-sensitive markets.

From a managerial perspective, the results underscore the importance of transparent, timely disclosure of fundamental performance metrics to enhance market confidence and valuation accuracy. However, the study is limited to five years (2018–2023) and a small set of firms, which constrains the generalizability of its results.

Future research could extend this analysis to other high-growth sectors, integrate additional indicators such as R&D expenditure and brand valuation, and employ time-series econometric models to capture dynamic efficiency patterns. A broader comparative study across industries and post-pandemic market phases could provide deeper insights into the evolving nature of informational efficiency in emerging economies like India.

Author Contributions: Conceptualization, J.J. and K.J.; Methodology, J.J.; Software, J.J.; Validation, J.J.; Formal Analysis, J.J. and K.J.; Investigation, J.J.; Resources, J.J.; Data Curation, J.J.; Writing – Original Draft Preparation, J.J. and K.J.; Writing – Review & Editing, J.J. and K.J.; Visualization, J.J.; Supervision, K.J.; Project Administration, J.J.; Funding Acquisition, J.J. and K.J. Authors have read and agreed to the published version of the manuscript.

Institutional Review Board Statement: Ethical review and approval were waived for this study, due to that the research does not deal with vulnerable groups or sensitive issues.

Funding: The authors received no direct funding for this research.

Acknowledgments: The authors sincerely thank the anonymous reviewers for their thoughtful comments and constructive suggestions that greatly improved the quality of this paper.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to restrictions.

Conflicts of Interest: The authors declare no conflict of interest.

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