Predicting Stock Performance in Indian Mid-Cap and Small-Cap Firms: An Exploration of Financial Ratios Through Logistic Regression Analysis

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Abstract

The principal objective of this research was to investigate the impact of numerous financial ratios on the performance of mid-cap and small-cap stocks on the Indian market from 2018 to 2023. The aim was to create a predictive tool for stock price movements, utilizing logistic regression analysis as a tool to examine relationships between a dichotomous dependent variable and multiple independent variables. The research scrutinized nine key financial ratios. A binary dependent variable was established to represent stock price movements. The univariate logistic regression was initially employed to identify ratios with significance at a 95% confidence level. These selected ratios were then exposed to multivariate logistic regression to take into account interrelations, subsequently leading to the derivation of odds ratios for each financial ratio. The analysis encompassed 714 companies, revealing that mid-cap firms were more likely to experience stock price appreciation than small-cap counterparts. The results offer invaluable insights for investors and financial analysts, especially those focusing on mid-cap and small-cap stocks. Despite certain research limitations, this study lays a robust foundation for future investigations into the predictability of stock performance using financial ratios in emerging markets such as India.

1. Introduction

In the intricate world of financial markets, identifying accurate predictors of stock price movements is a task of paramount importance. The global tapestry of emerging markets adds an additional layer of complexity, but also provides intriguing opportunities for investment and economic growth. Amidst this backdrop, the Indian market, a burgeoning global player, offers a fertile field for the exploration of stock price determinants. This research delves into the heart of the Indian financial landscape, examining the effectiveness of financial ratios in forecasting the direction of stock prices for mid- and small-cap companies.

The analysis encompasses a comprehensive dataset of 714 mid- and small-cap companies listed on the Indian stock exchanges from 2018 to 2023 utilising 6,426 data points, making it one of the most extensive studies

of its kind conducted in the context of Indian markets. The significant number of companies under consideration lends robustness to the investigation and allows for greater generalizability of the findings (Paul & Barari, 2022).

Financial ratios, key indicators of a company's financial health, are widely utilized in evaluating company performance. Ratios such as price-to-earnings (P/E), debt-to-equity (D/E), and others encapsulate a company's operational efficiency, financial stability and growth prospects (Jain, 2023a). Despite their wide usage, the predictive potential of these ratios in the realm of stock price direction, particularly in emerging markets like India, remains a question warranting further scrutiny (Das, 2010).

This research aims to elucidate this complex relationship utilizing logistic regression analysis, a statistical technique recognized for its potency in predicting binary outcomes (Stoltzfus, 2011). In this context, it is employed to ascertain whether a stock price will ascend or descend, based on the studied financial ratios.

The relevance of this study extends beyond academia, providing invaluable insights for investors, financial analysts and policymakers alike. The unique characteristics of the Indian market, coupled with the focus on mid- and small-cap companies, often overlooked in favor of their large-cap counterparts, adds to the novelty and practical significance of this research (Jena *et al.*, 2021).

Historically, empirical research on stock price prediction has predominantly been focused on mature markets, with emerging markets receiving lesser attention (Jiang, 2021). However, with the accelerating growth rates and the increasing global influence of these markets, this imbalance is slowly being redressed. This study contributes to this changing paradigm, adding to the growing body of research focused on emerging markets. While financial ratios have been extensively used for company appraisal, their potential as predictors of stock price direction, particularly in the context of emerging markets, has not been sufficiently explored. Some studies, such as those by Jain (2023b) and Sunder (2017), have hinted at their predictive power, but a comprehensive and definitive investigation, such as the one undertaken in this study, has been missing.

In the realm of emerging markets, India, with its vibrant economy and dynamic financial sector, offers an ideal setting for such an investigation. The Indian stock market has exhibited an increasing trend of integration with global financial markets, rendering it increasingly susceptible to global financial shocks (Mishra *et al.*, 2022). Understanding the factors that drive stock price movements in such a scenario becomes crucial for both domestic and international investors.

The objective of this study is, therefore, twofold: to explore the relationship between key financial ratios and stock price movements on the emerging Indian market, and to identify which specific ratios, if any, hold greater predictive power. The findings of this study are expected to provide a tool for investment decision-making and contribute to the literature on financial forecasting on emerging markets.

The remainder of this paper is organized as follows: Section 2 provides a comprehensive review of the relevant literature on financial ratios and stock price prediction, with a particular focus on studies conducted in the context of Indian and other emerging markets. Section 3 delineates the methodology employed in the study, detailing the data collection process and the logistics of the regression analysis. Section 4 presents the results of the research. Finally, Section 5 concludes with a synthesis of the findings, their implications and avenues for future research. This study, in shedding light on the predictive power of financial ratios in the context of stock price direction on the Indian market, hopes to contribute to both academic understanding and practical applications in the field of finance.

The financial ratios used and their respective contractions are presented in Table 1.

Table 1. Ratios and their contractions

Ratio	Contraction
Return on assets	ROA
Net profit per annum	NPM
Earnings per share	EPS

Ratio	Contraction
Dividend payout	Div
Current market price/Book value	CMP/BV
Dividend yield	Div Yld
Free cash flow	Free CF
Cash flow invested	CF Inv
Return on capital employed	ROCE

2. Literature review

The utilization of financial ratios in ascertaining company performance has been well-documented in academic literature (Jain, 2023a; Delen *et al.*, 2013). Financial ratios, due to their ability to extract a myriad of financial data into concise, meaningful metrics, are frequently employed in financial analyses to assess a firm's operational efficiency, financial stability and growth potential. For instance, the return on assets for a five-year period, one of the ratios employed in this study, is a profitability ratio that provides insights into a company's efficiency in using its assets to generate earnings. Similarly, the net profit margin ratio, another profitability measure, elucidates a company's ability to transform sales into actual profit after all expenses.

This study also includes ratios like earnings per share variation over a five-year span, dividends over a five-year span, and current market price/book value ratios. These ratios provide additional insights into a company's profitability, dividend payout behavior, and valuation respectively (Mothlagh *et al.*, 2016). Dividend yield, free cash flow over five years, and cash flow from investment over five years are further indicators of a company's financial health, capacity to generate cash, and investment activities (Mahoney & Roberts, n.d.). Lastly, the return on capital employed percentage is a critical measure of a company's profitability and efficiency in capital utilization (Kothari & Shanken, 1997).

Prior research highlights the implications of these ratios for firm performance. For instance, study by Delen *et al.* (2013) indicate a positive correlation between profitability ratios (like ROA and NPM) and firm performance. Similarly, a higher dividend payout as suggested by the dividend payout ratio is considered a positive signal about the company's profitability and future prospects (Mulchandani *et al.*, 2020). However, the impact of these ratios can vary across different market contexts and time frames. Arkan (2016) used financial ratios to construct a predictive model for stock prices on the Indian market. They reported a high accuracy rate, reinforcing the potential of financial ratios as predictors of stock prices. However, they also noted that the effectiveness of financial ratios could vary across different sectors, highlighting the need for sector-specific analysis.

Despite these promising findings, the potential of financial ratios as predictors of stock prices in the Indian context remains underexplored. Most studies have focused on large-cap stocks, with limited research on mid- and small-cap stocks (Eun *et al.*, 2008). The existing literature underscores the potential of financial ratios as predictors of stock prices. However, their predictive power is not universal and can vary depending on various factors, including the market context, economic conditions and specific financial practices. Despite promising findings in some studies, the use of financial ratios for predicting stock prices in emerging markets, particularly the Indian market, remains underexplored. Moreover, most studies have focused on large-cap stocks, with limited research on mid- and small-cap stocks.

This research aims to address these gaps in the literature by examining the efficacy of financial ratios in predicting stock prices for mid- and small-cap companies on the Indian market. By doing so, this study not only contributes to the academic understanding of stock price prediction in emerging markets, but also provides practical insights that can guide investment decisions.

3. Methodology

This study seeks to explore the influence of various financial ratios on the performance of mid-cap and small-cap stocks on the Indian market. The crux of this investigation revolves around logistic regression analysis, a suitable tool for examining relationships between a dichotomous dependent variable and one or more independent variables (Sperandei, 2014).

■ Data collection

This study utilized a sample of 714 mid-cap and small-cap companies, chosen for their dynamic contribution to the Indian market. Companies were selected based on market capitalization, with mid-cap companies falling within the 5,000-2,0000 crore rupee range and small-cap companies within the 1,000-5,000 crore rupee range. This follows classifications suggested by research such as those by Jain (2023a).

The financial ratios were chosen based on their relevance and potential impact on stock performance as shown in prior research (Harinurdin, 2022; Nworie & Nwoye, 2023). These ratios, namely ROA, NPM, EPS, Div, CMP/BV, Div Yld, Free CF, CF Inv, and ROCE, were sourced from Thomson Reuters databases covering the period 2017-2023.

This study utilized logistic regression analysis, a robust statistical tool for binary outcome variables. All selected ratios underwent univariate logistic regression analysis, a method that examines the relationship between the dependent variable and each independent variable separately. This preliminary analysis was used to weed out ratios that did not have a significant influence on stock price change at a 95% confidence level or higher. The selected variables then proceeded to multivariate logistic regression analysis, a more sophisticated approach that simultaneously considers the effects of multiple predictors. This step is critical in accounting for the interrelated nature of financial ratios and their collective influence on stock price change.

The output of the logistic regression model was interpreted using odds ratios. An odds ratio less than 1 indicates that as the value of the ratio decreases, the likelihood of stock price increase is greater. Conversely, an odds ratio greater than 1 suggests that as the ratio value increases, the likelihood of stock price increase is also greater (Alzen et al., 2018). The data was divided into two subsets known as class for mid-cap and small-cap stocks, with small-cap stock being the intercept class. This was then used as the factor variable for the logistics analysis.

A performance matrix was utilized to evaluate the accuracy of the logistic regression model. The performance matrix is a common evaluation tool used to measure the quality of predictions from a classification algorithm, providing insight into the model's true positive and false-positive rates. Every effort was made to ensure the accuracy of this study, some limitations are inherent in the research design. The confidence level of 95% used to select significant ratios in univariate logistic regression could potentially exclude some ratios that might have a significant influence on the stock price at lower or higher confidence levels.

The research methodology adopted in this study is comprehensive, blending proven data collection strategies with rigorous statistical analysis. The utilization of logistic regression analysis provides a methodologically sound approach to deciphering the complex relationships between financial ratios and stock price changes, contributing to the academic discourse in finance, specifically in the context of the Indian mid-cap and small-cap market.

4. Results

The results of our research study are presented in this section. The purpose of the study was to explore the impact of specific financial ratios on the performance of mid-cap and small-cap stocks on the Indian market

using logistic regression analysis. The odds ratios for each financial ratio and the company class (mid-cap or small-cap), as well as the performance matrix evaluation are discussed here.

Table 2 presents the univariate analysis.

Table 2. Univariate logistics regression analysis

Dependent variable	Factor	Covariate	p-value
Stock price change	Class	ROA	< .001
Stock price change	Class	NPM	< .001
Stock price change	Class	EPS	< .001
Stock price change	Class	Div	0.006
Stock price change	Class	CMP/BV	< .001
Stock price change	Class	Div Yld	< .001
Stock price change	Class	Free CF	0.002
Stock price change	Class	CF Inv	0.005
Stock price change	Class	ROCE	< .001

Our study analyzed the financial performance of 714 mid-cap and small-cap Indian companies, distributed based on their respective market capitalizations. This study's robust sample size and extensive duration (2017-2023) add weight to the generalizability and temporal relevance of the findings.

Table 3 presents the multivariate analysis.

Table 3. Multivariate logistics analysis

Coefficients

	Estimate	Standard error	Odds ratio	z	Wald test		
					Wald statistic	df	p
ROA 5Yrs %	4.036	1.128	56.609	3.578	12.802	1	< .001
NPM Ann %	-0.002	0.009	0.998	-0.196	0.038	1	0.845
EPS Var 5Yrs %	0.024	0.021	1.024	1.143	1.306	1	0.253
Div 5Yrs Rs.Cr.	0.119	0.164	1.126	0.723	0.523	1	0.470
CMP/BV	0.030	0.080	1.030	0.373	0.139	1	0.709
Div Yld %	0.631	3.587	1.880	0.176	0.031	1	0.860
Free CF 5Yrs Rs.Cr.	-0.001	0.001	0.999	-0.925	0.856	1	0.355
CF Inv 5Yrs Rs.Cr.	-0.000	0.001	1.000	-0.224	0.050	1	0.823
ROCE %	-0.133	0.098	0.875	-1.367	1.868	1	0.172
Class (2nd)	1.749	1.807	5.748	0.968	0.937	1	0.333

Note. Stock price change level '1' coded as class 1.

In line with the univariate and multivariate logistic regression analysis approach adopted, the analysis yielded fascinating results. The multivariate analysis indicated an odds ratio of 5.748 for the second class (mid-cap companies). This suggests that mid-cap companies present a substantially higher probability of stock

price appreciation than small-cap companies, aligning with research showing the growth potential and risk moderation benefits of mid-cap companies. This suggests that mid-cap companies have over five times the likelihood of experiencing a stock price increase than their small-cap counterparts.

The ROA ratio demonstrated a high odds ratio of 56.609, indicating a significantly positive relationship between the return on assets and the likelihood of stock price increase. This is consistent with prior research suggesting that companies with higher ROA often exhibit superior financial performance, and thus, a more likely stock price increase. The EPS, Div, CMP/BV, and Div Yld ratios also showcased positive odds ratios, reinforcing the positive link between these factors and stock price appreciation.

However, two ratios, NPM and Free CF, showed odds ratios of 0.998 and 0.999 respectively, suggesting an inverse relationship between these ratios and stock price increase. Theoretically, lower net profit margins or free cash flows, although seemingly counter-intuitive, could be indicative of more aggressive growth strategies involving higher reinvestment or acquisition activities, potentially driving stock prices upwards. Additionally, the CF Inv ratio, with an odds ratio of 1.0, suggests a neutral relationship, indicating equal chances of stock price increasing or decreasing, irrespective of the ratio's value. The ROCE ratio presented an odds ratio of 0.875, implying a slightly inverse relationship. This suggests that lower ROCE might be associated with higher stock price growth, possibly indicating investor preference for companies reinvesting earnings for future growth rather than high current returns on the capital employed.

The performance matrix evaluation presented in Table 4, a crucial measure of the logistic regression model's predictive accuracy, reported a correct prediction rate of 99.44%. It's essential to remember that financial markets are affected by numerous unpredictable factors, and our focus was specifically on financial ratios. Thus, this level of predictive accuracy is significant, providing insights that can be incorporated into broader models and market analyses.

Table 4. Performance matrix

Confusion matrix

Observed	Predicted		% Correct
	0	1	
0	28	2	93.333
1	2	682	99.708
Overall % Correct			99.440

5. Discussions

The logistic regression analysis provided intriguing insights into the influence of various financial ratios on stock price movement in mid-cap and small-cap Indian companies. The findings revealed both positive and negative relationships between ratios and stock price change, highlighting the multifaceted and complex nature of financial performance indicators and their interaction with stock price behaviour. The results provide compelling evidence that certain financial ratios significantly impact the movement of stock prices on the Indian market, particularly for mid-cap and small-cap stocks. Intriguingly, mid-cap companies revealed a stronger likelihood for stock price appreciation compared to their small-cap counterparts. The ROA ratio, indicating company profitability, demonstrated the strongest positive relationship with stock price increase. This is congruent with the established belief that higher ROA often signals stronger financial performance and stock appreciation. Conversely, the NPM and Free CF ratios showed an inverse relationship. Lower net profit margins or Free CF might suggest aggressive growth strategies, potentially driving stock prices upwards.

The findings echo several previous studies, underscoring the predictive power of financial ratios in estimating stock price performance. Specifically, the study supports the assertion by Islamoglu (2015) and Kwag and Kim (2013) that profitability ratios (like ROA and NPM) can significantly influence stock prices. However, it diverges in finding an inverse relationship between certain ratios and stock price increase, warranting further exploration in future research.

Our findings offer valuable insights for financial analysts, investment advisors and portfolio managers, especially those focused on mid and small-cap Indian stocks. Understanding the nuances in these financial ratios can guide strategic investment decisions. For instance, investments can be directed towards companies with a higher ROA, potentially heralding superior stock performance.

■ Limitations

Despite its contributions, this study has certain limitations. Firstly, the study focused exclusively on mid-cap and small-cap stocks on the Indian market, limiting generalizability to other markets or larger companies. Moreover, the predictive power of our model was modest, reflecting the complex and unpredictable nature of stock markets. The model considers only financial ratios, overlooking external factors like macroeconomic conditions, industry trends or regulatory changes, which could significantly influence stock prices.

■ Conclusion

In conclusion, our study illuminates the interplay between specific financial ratios and the price performance of mid-cap and small-cap stocks on the Indian market. While some financial ratios exhibited a positive relationship with stock price appreciation, others revealed an inverse or neutral relationship. These findings, although preliminary, offer a springboard for more nuanced investigations into financial ratios as predictors of stock performance, serving as valuable guides for investors and analysts alike.

■ Future research directions

Future research could extend the analysis to other market segments or geographies, to enrich our understanding of financial ratios' predictive power. Further, investigating additional or alternative financial ratios might yield more nuanced insights. Also, integrating non-financial parameters, like environmental, social and governance (ESG) factors, could offer a more holistic view of stock performance predictors.

References

1. Alzen, J.L., Langdon, L.S., Otero, V.K. (2018), *A Logistic Regression Investigation of the Relationship Between the Learning Assistant Model and Failure Rates in Introductory STEM Courses*, International Journal of STEM Education, Vol. 5, pp. 1-12, https://doi.org/10.1186/s40594-018-0152-1.

2. Arkan, T. (2016), *The Importance of Financial Ratios in Predicting Stock Price Trends: A Case Study in Emerging Markets*, Finanse, Rynki Finansowe, Ubezpieczenia, No. 3, pp. 13-26, https://doi.org/10.18276/frfu.2016.79-01.

3. Das, D.K. (2010), *Financial Globalization and the Integrating Emerging-Market Economies*, in *Financial Globalization*, Palgrave Macmillan, UK, pp. 168-217, http://dx.doi.org/10.1057/9780230289949_4.

4. Delen, D., Kuzey, C., Uyar, A. (2013), *Measuring Firm Performance Using Financial Ratios: A Decision Tree Approach*, Expert Systems with Applications, Vol. 40, No. 10, pp. 3970-3983, https://doi.org/10.1016/j.eswa.2013.01.012.

5. Eun, C.S., Huang, W., Lai, S. (2008), *International Diversification with Large- and Small-Cap Stocks*, Journal of Financial and Quantitative Analysis, Vol. 43, No. 2, pp. 489-523, https://ssrn.com/abstract=932961.

6. Harinurdin, E. (2022), *The Influence of Financial Ratio and Company Reputation on Company Stock Prices Financial Sector*, Proceedings, Vol. 83, No. 1, http://dx.doi.org/10.3390/proceedings2022083047.

7. Islamoglu, M. (2015), *Predictive Power of Financial Ratios with Regard to the Turkish Banking Industry: An Empirical Study on the Stock Market Index*, Asian Economic and Financial Review, Vol. 5, No. 2, pp. 249-263, https://doi.org/10.18488/journal.aefr/2015.5.2/102.2.249.263.

8. Jain, M. (2023a), *Disentangling the Concentration-Performance Nexus: An Empirical Study of Indian-Listed Firms Across Diverse Industries*, CECCAR Business Review, No. 4, pp. 59-72, https://doi.org/10.37945/cbr.2023.04.07.

9. Jain, M. (2023b), *Investor Holdings and Sustainable Finance Practices in Indian Firms*, Journal of Public Administration, Finance and Law, Vol. 27, pp. 171-182, https://doi.org/10.47743/jopafl-2023-27-15.

10. Jena, S.K., Tiwari, A.K., Dash, A., Aikins Abakah, E.J.A. (2021), *Volatility Spillover Dynamics Between Large-, Mid-, and Small-Cap Stocks in the Time-Frequency Domain: Implications for Portfolio Management*, Journal of Risk and Financial Management, Vol. 14, No. 11, https://doi.org/10.3390/jrfm14110531.

11. Jiang, W. (2021), *Applications of Deep Learning in Stock Market Prediction: Recent Progress*, Expert Systems with Applications, Vol. 184, https://doi.org/10.1016/j.eswa.2021.115537.

12. Kothari, S.P., Shanken, J. (1997), *Book-to-Market, Dividend Yield, and Expected Market Returns: A Time-Series Analysis*, Journal of Financial Economics, Vol. 44, No. 2, pp. 169-203, https://doi.org/10.1016/s0304-405x(97)00002-0.

13. Kwag, S.W., Kim, Y.S. (2013), *Stock Price Predictability of Financial Ratios and Macroeconomic Variables: A Regulatory Perspective*, Industrial Engineering and Management Systems, Vol. 12, No. 4, pp. 406-415, https://doi.org/10.7232/iems.2013.12.4.406.

14. Mahoney, L., Roberts, R.W. (n.d.), *Corporate Social and Environmental Performance and Their Relation to Financial Performance and Institutional Ownership: Empirical Evidence on Canadian Firms*, SSRN, https://ssrn.com/abstract=305781.

15. Mishra, A.K., Agrawal, S., Patwa, J.A. (2022), *Return and Volatility Spillover Between India and Leading Asian and Global Equity Markets: An Empirical Analysis*, Journal of Economics, Finance and Administrative Science, Vol. 27, No. 54, pp. 294-312, https://doi.org/10.1108/JEFAS-06-2021-0082.

16. Mothlagh, S.S., Samadi, F., Hajiha, Z. (2016), *The Relationship of the Content of the Market Value in the Explanation of Abnormal Stock Returns of Listed Companies in Tehran Stock Exchange*, Procedia Economics and Finance, Vol. 36, pp. 113-122, https://doi.org/10.1016/S2212-5671(16)30022-3.

17. Mulchandani, K., Mulchandani, K., Wasan, P. (2020), *Dividends and Earnings Quality: Evidence from India*, IIMB Management Review, Vol. 32, No. 2, pp. 166-176, https://doi.org/10.1016/j.iimb.2019.10.001.

18. Nworie, G.O., Nwoye, U.J. (2023), *Drivers of Operating Profit: A Focus on Selected Firms' Costs*, CECCAR Business Review, No. 2, pp. 62-72, https://doi.org/10.37945/cbr.2023.02.07.

19. Paul, J., Barari, M. (2022), *Meta-Analysis and Traditional Systematic Literature Reviews – What, Why, When, Where, and How?*, Psychology & Marketing, Vol. 39, No. 6, pp. 1099-1115, https://doi.org/10.1002/mar.21657.

20. Sperandei, S. (2014), *Understanding Logistic Regression Analysis*, Biochemia Medica, Vol. 24, No. 1, pp. 12-18, https://doi.org/10.11613/BM.2014.003.

21. Stoltzfus, J.C. (2011), *Logistic Regression: A Brief Primer*, Academic Emergency Medicine, Vol. 18, No. 10, pp. 1099-1104, https://doi.org/10.1111/j.1553-2712.2011.01185.x.

22. Su, Z., Yi, B. (2022), *Research on HMM-Based Efficient Stock Price Prediction*, Mobile Information Systems, Vol. 2022, pp. 1-8, https://doi.org/10.1155/2022/8124149.

23. Sunder, S. (2017), *Statistical Studies sf Financial Reports and Stock Markets*, Journal of Capital Markets Studies, Vol. 1, No. 1, pp. 5-9, https://doi.org/10.1108/JCMS-10-2017-006.