

Financial Health Assessment of Indian Startup-Origin E-Commerce Firms Using Altman Z-Score: Evidence from 2019-2024

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Abstract

India has experienced the emergence and growth of various start-up-origin e-commerce firms operating across diverse digital platform segments. These firms have been showing high growth rates, huge investor interests and large market expansions but still, the conservative approach of understanding their financial health and long term survival stays relevant. The present study examines the financial health of selected Indian start-up-origin e-commerce companies using the modified Altman Z-Score model during the period 2019–2024. The findings reveal significant variations in financial health among the selected firms and indicate that market-value-related variables strongly influence Altman Z-Scores in digital platform businesses. The study further suggests that although the Altman Z-Score model remains useful for assessing financial health, its interpretation in start-up-origin digital firms should be made carefully due to the strong impact of market valuation and growth-oriented business structures.

Keywords: Financial health; Altman Z-Score; digital platform businesses; e-commerce firms; start-up-origin

I. INTRODUCTION

India's digital economy has witnessed its peak growth over the last few years, mainly caused by fast internet access, increase in people using smartphones, better digital payment systems and changing consumer orientation. The expansion of platform-based business models has led to a significant reshaping of retail and service industries. This has resulted in the rapid growth of e-commerce start-ups like Nykaa, Zomato, Paytm, Delhivery IndiaMART, etc. Investors are keenly interested in the capacity of these companies to grow scale, show innovation with technology and expand in the market size.

But, despite their quick growth scale, the question on their sustainable financial health still stays in existence. In the earlier times, traditional businesses had a different set of goals, in contrary to which, e-commerce start-ups frequently prioritize client acquisition, technological advancement, and market share expansion over spontaneous short term financial gain. Due to this reason, even after becoming public, many of the e-commerce

businesses still record deficits in operational funds, negative retained earnings, and dependency on investment from outside. Their actual financial strength and long-term success are called into question by this circumstance. For better calculation of surviving years and profit making, forecasting financial distress has grown in significance for investors. One such model, developed by Edward Altman in the year 1968 to evaluate and analyse a company's financial health is the Altman Z-Score model. It's a unique model that estimates the probability of financial distress and insolvency by analysing a number of accounting and market factors together. Its applicability in context with various industries has been demonstrated by earlier research. Not only this, its accuracy has also been proved by past researches. (Altman, 2018; Rashid et al., 2023).

Even though the past researches show a different picture, there is still a lot of debate on authenticity and correctness of the predictions of financial distress models in the industry of digital platform firms. Compared to traditional manufacturing enterprises, for which the Altman model was

originally developed, e-commerce start-ups often have asset-light corporate structures, seek aggressive growth strategies, and are valued largely on market expectations. There is no strong data available on effectiveness of Altman Z-Score model for predicting the financial health of e-commerce companies especially in the developing economies like India.

In this context, the current study looks at the financial health of selected Indian e-commerce start-ups from 2019 to 2024 using a modified Altman Z-Score model. The study also examines whether traditional financial distress indicators are still relevant for evaluating modern digital platform businesses in a technology-driven and investor-focused landscape.

Against this background, the present study examines the financial health of selected Indian start-up-origin e-commerce firms using the Altman Z-Score model during the period 2019–2024. The study focuses on six listed digital firms—Nykaa, IndiaMART, CarTrade Tech, Delhivery, Zomato, and Paytm—representing different segments of India's digital economy. By using secondary financial data and statistical analysis using SPSS, this study aims at understanding financial health trends and the suitability of the Altman Z-Score model in the context of contemporary digital platform enterprises

II. REVIEW OF LITERATURE

Altman, E. I. (2018): The paper by Edward I Altman reflects on 50 years of **Altman Z-score model** and acts as both a historical review and a practical guide to bankruptcy prediction and credit risk analysis. Through his findings, it is clearly visible that Altman Z-score remains one of the most influential and practical credit-risk models even after 50 years because of its simplicity, transparency, and strong predictive power. Altman mentions that financial distress is usually a gradual deterioration, not a sudden event and can often be identified early through accounting and market indicators. The paper also highlights that although newer AI and machine-learning techniques may improve prediction accuracy, transparent and interpretable models like the Z-score are still preferred in real-world finance because practitioners trust models

which they can understand and implement. Though credit-risk analysis has evolved from simple ratio analysis to machine learning and AI-based systems but these quantitative models are still valuable complements to credit rating agencies and act as bankruptcy prediction tools.

Al-Manaseer, S. R., & Al-Oshaibat, S. D. (2018):

The paper analysed 21 Jordanian insurance companies using the revised Altman Z-score model to check if it can accurately predict financial distress. The paper also emphasizes on the fact that even most regulated financial sectors like insurance can face severe financial risk if management and financial policies are weak therefore financial distress prediction is valuable for proactive decision-making. For this simple financial ratio models can be used as they still effectively identify financially weak companies. One must remember that factors like liquidity, profitability, and leverage are critical indicators of financial health. The study strongly supports the use of the Altman Z-score together with other financial prediction models and considering broader economic conditions as an early warning system for financial distress.

Rashid, F., Khan, R. A., & Qureshi, I. H. (2023):

The research proposes a conceptual and literature-based review of the Altman Z-score and its significance across industries and economies. The study suggests that the financial models must adapt to different economic and industrial contexts and combining multiple financial indicators improves prediction accuracy. The Altman Z-score possess all the characteristics and is flexible and broadly applicable. The model functions as an early warning system for managers, lenders, and investors. Overall, the paper confirms that despite changes in global financial systems, the Altman Z-score model continues to be relevant, adaptable, and effective in assessing the financial stability of firms across different sectors and economic environments. The study highlights that the model has successfully evolved over time to suit: public companies, private firms and emerging economies.

Anjum, S. (2012): The author in this paper discusses the evolution of Z Score model and compares it with: neural networks, logit analysis and recursive partitioning models. The research also

supports the argument that early warning signs for any type of financial distress appears in the financial ratios of the company beforehand. Also, combining multiple financial indicators gives better prediction accuracy than relying on a single ratio. The author explains that Altman's MDA-based Z-score became highly influential because it improved prediction accuracy compared to earlier single-ratio methods and remains one of the most trusted bankruptcy prediction tools in finance. The author also believes that though financial prediction models are useful tools, but they should not replace professional judgment

Rana, S., Amritesh, S., Tyagi, S., & Beniwal, T. (2025): In the given paper, the author tries to study the major financial reasons why start-ups fail, especially during their first five years of operation. It is concluded that Start up failure is often systemic and is not caused by one isolated mistake. Even though access to capital remains a major barrier for entrepreneurs, early-stage financial planning is critical for survival. The entrepreneurs need to have budgeting and forecasting skills along with financial discipline and contingency planning because entrepreneurial success requires financial literacy, not just innovation. Instead of aggressive optimism, the entrepreneur must practice conservative forecasting which will help avoiding excessive hiring, unrealistic assumptions on sales growth and unsustainable spending. For continuous growth, proper cashflow management and sustainable revenue should stay prime focus and rapid expansion should not be the target.

Miranda, V. E., Prejean, E. A., Parker, C., & Liao, W. (2022): In this paper, the author examines the major financial risks like cybersecurity threats, fraud, taxation, legal liabilities, payment risks, supply chain disruptions and fund challenges faced by e-commerce start-ups and discusses strategies to manage those risks effectively. The ecommerce start-ups businesses face risks beyond traditional business problems thus require specialized financial risk management strategies. The larger the digital marketplace becomes, the greater the financial and operational risks. The risk management approach should be proactive instead of reactive which is why cash-flow management and financial discipline are

essential for start-up sustainability. Entrepreneurs need strong financial and legal knowledge, not just technical or marketing skills. Thus the long term success of the business, entrepreneurs need strong financial and legal knowledge, not just technical or marketing skills.

Sharif, S., & Saleem, H. M. N. (2024): The paper examines the major causes (determinants) of financial distress in businesses through comprehensive literature review. It is concluded that even if a company appears profitable, proper cashflow management, good leadership and avoiding excessive debt can help survive financial distress. In the situation of a severe economic shock, even the most well managed firm faces operational disruptions, thus modern financial risk analysis must become more dynamic and technology-driven. According to the author, the future financial distress may increasingly come from technological and environmental changes.

Erwin, Safitri, T. A., Alfiana, & Syahrin, M. (2024): The paper discusses how start-ups can manage financial risks effectively in the digital era. Poor financial management can destroy even highly innovative start-ups. Cash-flow planning is one of the most important tools for start-up sustainability. Cybersecurity is now a core financial-management issue, not just a technical issue thus revenue diversification, proactive planning and adoption of FinTech tools such as AI, Big Data, and blockchain can increase financial stability and long-term survival chances. Also, technology can significantly improve start-up financial decision-making. Not only this, the paper also concludes, that strong liquidity management is essential for maintaining operations and growth.

Khurana, M. K., Kushwaha, U. S., Baniya, P., & Yadav, M. (2020): The paper gives an overview of Indian start up ecosystem and analysed current market trends, government initiatives, start-up opportunities and the future potential of e-commerce in India. It emphasises that India's digital transformation, supported by internet growth, smartphones, government initiatives, and digital payments, has created massive opportunities for e-commerce start-ups. Technology has lowered entry barriers for entrepreneurs and enabled start-ups to

reach large markets with limited resources i.e digital infrastructure is one of the biggest enablers of start-up growth. Not only this, the government policy can significantly accelerate entrepreneurial ecosystems. Along with it even social media has become an essential part of digital business strategy. But the author worries that rapid growth also creates operational and financial pressures for start-ups. Start-up success depends not only on innovation, but also on strong business and financial planning.

Asif, M., Tiwari, S., Saxena, A., Chaturvedi, S., & Bhardwaj, S. (2024): The paper examines the validity of Altman Z-Score by predicting bankruptcy risk for companies listed on India's National Stock Exchange. Supporting the earlier stated findings, the author concludes that financial distress can often be detected several years before actual bankruptcy using financial ratios and the Altman Z-score model. A combination of liquidity, profitability, leverage, and efficiency ratios gives a strong picture of company health. This strong applied finance research paper demonstrates that companies that cannot generate sustainable profits gradually lose financial stability. The author finds that Altman Z-score has high predictive accuracy and it is effective for Indian listed firms.

III. RESEARCH GAP

Indian e-commerce companies are a growing part of the economy, thus their financial stability is crucial for the nation's growth and success. For the development of an economy, it is important to make sure that all the industries work profitably and their financial health stays intact. The Altman Z-Score model and predicting financial distress have been studied a lot earlier. Most studies focus on traditional businesses and industries and a very few studies have used the Altman Z-Score to analyse e-commerce companies that originated as start-ups. Digital platform companies have a different foundation of performing operations in comparison to traditional businesses because they have very few assets, grow faster and rely more on market value. Thus it becomes necessary to check if traditional financial distress models still work for digital platform companies. This study uses the modified Altman Z-Score to analyse some e-commerce companies from the period: 2019 to 2024. The aim

is to bridge the gap of applicability of the given model and understand how competent it is for digital e-commerce start-ups. There is a need to use the Altman Z-Score model in context with the digital platform companies and predict distress in these companies to conclude if it is valid for assessing financial health of such start-ups. The study contributes to the existing research on financial distress prediction and highlights the need for research in this area. The findings can help investors and stakeholders make important financial decisions and use this model as a tool for evaluating financial stability.

IV. OBJECTIVES OF THE STUDY

- 1.To evaluate the financial health of selected Indian e-commerce firms using the Altman Z-Score model.
- 2.To examine changes in financial health indicators across the study period.
- 3.To compare financial stability among firms at different stages of growth.
- 4.To examine the relevance of the Altman Z-Score model for digital platform companies by comparing market-value and book-value equity approaches to isolate valuation bias.

V. RESEARCH HYPOTHESES

H1: The traditional Altman Z-Score significantly overestimates the financial health of asset-light digital platform firms due to market capitalization bias (X4).

H2: Substituting the Market Value of Equity with the Book Value of Equity in the X4 component reveals significant underlying financial distress among the sampled startup-origin firms.

H3: Significant differences exist in financial health and structural valuation characteristics across the selected e-commerce firms.

VI. RESEARCH METHODOLOGY

A. Research Design

The study employs a quantitative, exploratory research design to evaluate the financial health of selected Indian digital platform firms using the Altman Z-Score model. A longitudinal approach and an unbalanced panel dataset were used to account

for differences in firm listing periods.

B. Data Sources and Study Period

The study is based on secondary financial data collected from company annual reports, stock exchange disclosures, financial statements, and investor relations portals. It covers the period 2019-2024 based on the availability of audited financial data for the selected firms.

C. Sample Selection

The six Indian-origin digital companies - Nykaa, IndiaMART, CarTrade Tech, Delhivery, Zomato, and Paytm - form the sample. These companies operate across various areas of e-commerce, including web marketplaces, logistics, food delivery, and electronic payments. The selection of firms was based on data availability, public listing status, and the variety of digital business models. Some companies participated in the study by supplying samples. Sample Companies Included in the Study:

S.No	Company	Segment	Firm Type
1	Nykaa	Beauty E-commerce	Startup-origin
2	IndiaMART	B2B Marketplace	Mature Digital Firm
3	CarTrade Tech	Auto Marketplace	Startup-origin
4	Delhivery	Logistics Platform	Startup-origin
5	Zomato	Food Delivery Platform	Startup-origin
6	Paytm	Digital Payments	Startup-origin

D. Altman Z-Score Model

The study applies the modified Altman Z-Score VII.

model to assess the financial health of non-manufacturing firms. The model is expressed as:

$$Z = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4$$

Where:

(X1) = Working Capital / Total Assets

(X2) = Retained Earnings / Total Assets

(X3) = EBIT / Total Assets

(X4) = Market Value of Equity / Total Liabilities

The classification criteria are as follows:

- $Z > 2.6 \rightarrow$ Safe Zone
- $1.1 < Z < 2.6 \rightarrow$ Grey Zone
- $Z < 1.1 \rightarrow$ Distress Zone

Extension of the Model

This study derives another version of the score (Z), which uses Book Value of Equity in the X₄ ratio rather than Market Value of Equity, to ensure the robustness of the findings and gain a deeper understanding of the reason for the high Z-Scores.

Modified Model:

$$Z = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4(\text{Book})$$

E. Statistical Tools and Techniques

The collected data were analyzed using SPSS software. Descriptive statistics, correlation analysis, and one-way ANOVA were used to analyze the financial characteristics of the selected companies and to assess whether the Altman Z-Score model could be applied in the digital platform industry.

DATA ANALYSIS AND RESULTS

Table 1 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
X1	29	.121763758	.734007895	.372480641	.140240559
X2	29	-.980842891	.402405483	-.255017438	.377267754
X3	29	-.127837435	.192621261	.021997896	.093393806
X4	29	2.407002188	188.370188370	31.324847647	40.510295592
Altman Z-Score	29	5.039403478	198.058310473	34.651032052	42.207307687
Valid N (listwise)	29				

Table 1 above shows the statistics for the ratios of Indian e-commerce companies (X1 to X4), and the Altman Z-Scores for 29 firm-year observations. We can clearly see that there is a difference between

what is going on with these companies and how the market values them. The average Altman Z-Score is very high at 34.651. However, when we look at how these companies are doing, we see that they are not

making much money. X3 Mean is 0.022, and they are losing a lot of capital.

The lowest Altman Z-Score we found was 5.039, which is way high than the safe zone score of 2.6. The main reason for this discrepancy is the market valuation of these companies (X4 which has mean of 31.325). This is lower than what we would expect from companies with a lot of assets. But some Indian e-commerce companies (such as digital companies) do not have a lot of assets. So, their market value is

much higher than we would expect. These statistics show us that the Altman Z-Score is not a good way to measure the health of Indian e-commerce companies as it does not take into account the true value of these companies. We need to use an approach that looks at the book value of these companies to get a clearer picture of their financial situation.

Table 2 Correlations						
		X1	X2	X3	X4	Altman Z-Score
X1	Pearson Correlation	1	-.146	.026	-.180	-.163
	Sig. (2-tailed)		.450	.892	.351	.398
	N	29	29	29	29	29
X2	Pearson Correlation	-.146	1	.733***	-.085	-.049
	Sig. (2-tailed)	.450		<.001	.660	.801
	N	29	29	29	29	29
X3	Pearson Correlation	.026	.733***	1	-.158	-.123
	Sig. (2-tailed)	.892	<.001		.412	.526
	N	29	29	29	29	29
X4	Pearson Correlation	-.180	-.085	-.158	1	.999**
	Sig. (2-tailed)	.351	.660	.412		<.001
	N	29	29	29	29	29
Altman Z-Score	Pearson Correlation	-.163	-.049	-.123	.999**	1
	Sig. (2-tailed)	.398	.801	.526	<.001	
	N	29	29	29	29	29
** Correlation is significant at the 0.001 level (2-tailed).						
Table 3						
ANOVA						
Altman Z-Score						
	Sum of Squares	df	Mean Square	F	Sig.*	
Between Groups	27952.456	5	5590.491	5.864	.001	
Within Groups	21928.335	23	953.406			
Total	49880.791	28				
* Confidence Interval: 95%						

Tables 2 and 3 above provide the Pearson correlation matrix and 'One-Way ANOVA' results. These tables evaluate the interrelationships and directional variations of the variables within the sampled digital platform firms.

Table 2 (correlations matrix) shows that the market valuation proxy X4 is almost perfectly and statistically correlated with the final Altman Z-Score ($r=0.999$, $p<0.001$). The relationship between the market value-based dimensions and the overall financial health score produced within the traditional Altman structure is very strong. This provides empirical evidence that market value-based

dimensions have a dominant and almost exclusive influence on the overall score. In contrast, the three internal operational indicators (liquidity, retained earnings, and operating profitability) have insignificant and very weak correlations with the overall Z-Score. As we can see in the above table, for liquidity X1: $r = -0.163$, $p = 0.398$, for retained earnings X2: $r = -0.049$, $p = 0.801$; and for operating profitability X3: $r = -0.123$, $p = 0.526$). This helps to affirm that the model's ultimate score is insulated against underlying balance sheet problems, as long as market valuations stay elevated. In addition, there is a strong positive correlation between X2 and X3 ($r = 0.733$, $p < 0.001$). This quantifies the logical

relationship between a firm's capacity to generate earnings from its operations, and its long term build-up of balance sheet reserves.

The 'One-Way ANOVA' results (Table 3) are used to investigate sectoral dynamics further and determine whether financial health profiles are equal across entities. The results of the analysis show a statistically significant difference in Altman Z-Scores among the selected e-commerce companies ($F = 5.864$, $p = 0.001$). This is a huge difference, which shows that Indian startup-origin listed companies are not homogeneous, as they are

grouped under the umbrella of digital platforms. They have very different capitalization matrices, operations, and growth-phase dynamics, that cannot be precisely captured by a single financial distress metric which is based solely on market prices.

The results revealed a statistically significant difference in financial health scores among selected companies ($F = 5.864$, $p = 0.001$), indicating statistical heterogeneity in the financial and valuation features of digital platform companies in India.

Table 4 Comparative Robustness Analysis: Market vs. Book Value Z-Scores

Company	Year	Altman Z-Score M	Zone	Altman Z-Score B	Zone
Nykaa	2020-21	124.568	Safe	2.238	Grey
Nykaa	2021-22	39.206	Safe	3.637	Safe
Nykaa	2022-23	35.355	Safe	2.727	Safe
Nykaa	2023-24	23.781	Safe	1.727	Grey
Nykaa	2024-25	30.671	Safe	1.659	Grey
IndiaMART	2019-20	15.487	Safe	3.444	Safe
IndiaMART	2020-21	38.578	Safe	7.811	Safe
IndiaMART	2021-22	27.574	Safe	7.913	Safe
IndiaMART	2022-23	16.738	Safe	6.556	Safe
IndiaMART	2023-24	13.955	Safe	5.209	Safe
IndiaMART	2024-25	11.604	Safe	6.045	Safe
CarTrade Tech	2021-22	8.888	Safe	1.795	Grey
CarTrade Tech	2022-23	5.087	Safe	2.587	Grey
CarTrade Tech	2023-24	5.163	Safe	1.336	Grey
CarTrade Tech	2024-25	5.039	Safe	1.587	Grey
Delhivery	2021-22	15.042	Safe	1.616	Grey
Delhivery	2022-23	15.695	Safe	5.524	Safe
Delhivery	2023-24	12.441	Safe	4.694	Safe
Delhivery	2024-25	11.202	Safe	4.520	Safe
Zomato	2020-21	198.058	Safe	14.189	Safe
Zomato	2021-22	71.013	Safe	22.195	Safe
Zomato	2022-23	52.793	Safe	10.936	Safe
Zomato	2023-24	92.754	Safe	7.475	Safe
Zomato	2024-25	62.486	Safe	7.211	Safe
Paytm	2021-22	28.727	Safe	2.934	Safe
Paytm	2022-23	8.278	Safe	2.496	Grey
Paytm	2023-24	12.085	Safe	2.032	Grey
Paytm	2024-25	14.658	Safe	3.394	Safe

A comparative robustness analysis was conducted across all 29 firm-year observations to achieve Objective 4 and identify potential valuation bias. The Modified Altman Z-Score B (replacing Market Capitalization with Book Value of Equity) was systematically compared with the conventional

Altman Z-Score M (using Market Capitalization).

The empirical findings show a significant structural difference between the two methods:

- The Valuation Mirage: According to the conventional model (Z-score M), all firm-year

observations, including extreme market-driven anomalies like Zomato in 2020-21 (Z-score $M = 198.058$) and Nykaa in 2020-21 (Z-score $M = 124.568$), fall uniformly in the Safe Zone ($Z > 2.6$).

- **The Reality Shift:** Several well-known platforms instantly enter the Grey Zone ($1.1 < Z < 2.6$), revealing underlying operational flaws, when public market optimism is eliminated using the Modified Book-Value technique (Z-score B). For example, CarTrade Tech constantly stays in the Grey Zone, hitting a low of 1.336 in 2023-24, whereas Nykaa's 'Z-score B' compresses considerably to 1.659 by 2024-25. Similarly, Paytm enters the Grey Zone in 2022-23 (Z-score $B = 2.496$) and 2023-24 (Z-score $B = 2.032$), highlighting the capital loss that conventional stock market weightings statistically concealed.
- **The Fundamental Exceptions:** IndiaMART has consistently maintained its 'Safe Zone' status under both frameworks (strong Z-score B of 7.913 in 2021-2022), supporting the ANOVA evidence of sector heterogeneity. This is because its financial strength is supported by real operating profits (X3) and positive retained earnings (X2). At the same time, Zomato and Delhivery show genuine fundamental resilience in their later fiscal years, maintaining strong Z-score B ratings (Zomato's FY24 Z-score $B = 7.475$), which are propelled by better unit economics and post-IPO capital reserves.

In the end, our robustness analysis quantitatively proves that the conventional Altman Z-Score produces a structural valuation illusion for asset-light digital platforms. This supports the need for a book-value adjustment both practically and academically.

VIII. DISCUSSION

When applied to the Indian digital economy, the empirical results provide a critical, dual-perspective assessment of financial distress models. Our findings show that this seeming safety is a statistical illusion, even if the conventional Altman Z-Score framework (Z-score M) place 100% of the sampled firm-years safely within the "Safe Zone" (Mean =

34.651). The correlation analysis ($r = 0.999$, $p < 0.001$) verifies that the market valuation proxy (X4) nearly entirely determines the final output of the traditional model. Traditional liabilities are negligible in asset-light e-commerce platforms, but investor sentiment greatly inflates public equity valuations. Serious internal operational vulnerabilities, such as capital erosion through cash burn (X2 Mean = -0.255) and inadequate operating margins (X3 Mean = 0.022), are entirely concealed by this enormous weight of X4.

This evaluation fog could be determined by the application of the Modified Book-Value (Z-score B). Notable firms including Nykaa, CarTrade Tech, and Paytm join the "Grey Zone" after the speculative market buzz ends, displaying their balance sheet flaws. Financial heterogeneity is shown by the "One-Way ANOVA" results ($F = 5.864$, $p = 0.001$), with profitable exceptions like India MART, which receives a real Safe Zone rating in both models due to ongoing operational profits (X3) and retained earnings (X2). In the context of predicting the insolvency of digital platforms, we may see that while the Standard Altman Z-Score takes market capitalisation into consideration, it essentially eliminates this distortion by using book-value equity.

However, the findings also demonstrated that X4 (Market Value of Equity/Total Liabilities) had a significant impact on the ratings. The Altman Z-Score and X4 have a very substantial positive association, according to the correlation study. Therefore, market valuation is the main determinant of financial health in the context of digital platform firms.

IX. CONCLUSION AND IMPLICATION

The purpose of this study is to analyse the financial position of e-commerce businesses in India by comparing the traditional Altman Z-Score based on market value with an alternative approach using book value. The results show that the Safe Zone approach with the traditional model remains the same (Mean = 34.651) which indicates a mirage of valuation. This is consistent with the traditional model, which posits that an asset-light business with low liabilities and high market capitalisation (X4) can mask operational problems such as serious

capital erosion (X_2 Mean = -0.255). Speculative market capitalisations influence the Modified Book-Value model most of the time. In such a situation, weak businesses move to the Grey Zone while structurally profitable businesses like IndiaMART stay in the Safe Zone. This is yet another confirmation of the high degree of diversity in the sector ($F = 5.864$, $p = 0.001$).

This is particularly relevant to the primary financial stakeholders. For investors and venture capitalists, the absence of book value metrics leads to the conclusion that using market-based bankruptcy predictors creates an illusory sense of safety. For financial analysts and regulators, the results on the digital economy underscore the importance of revisiting financial distress and insolvency thresholds in light of market capitalization. This research also shows that modern, asset-light digital businesses under speculative pressure cannot be analyzed using traditional accounting models. Thus, the research presents a methodologically important contribution for digital business studies.

X. LIMITATIONS AND FUTURE RESEARCH

This study offers important insights into the structural valuation distortions of the Altman Z-Score in the digital economy, but it also has some limitations. The sample was restricted to 29 firm-year observations of listed Indian e-commerce companies due to data availability, which may limit the generalisability to the broader unlisted startup ecosystem. In addition, the analysis was based solely on secondary financial data and on a single structural change (Book Value of Equity). Future studies may extend this scope by using a larger dataset of unlisted tech startups, fintechs, and SaaS firms across emerging economies.

Researchers should also benchmark this modified Altman model against alternative financial distress architectures, such as the Ohlson O-Score or the Zmijewski model. They should deploy extended longitudinal horizons and advanced panel-data methodologies to track long-term insolvency

trajectories across an entire macroeconomic cycle.

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