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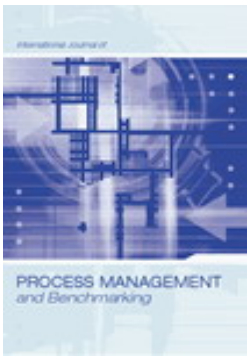

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Pecking order approach vs. trade-off approach: multifaceted testing of appropriateness for the financing pattern of Indian automobile industry

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Abstract: This paper investigates the impact of determinants of financial structure on capital structure in the Indian automobile sector post-financial crisis. The paper presents an empirical study using panel data from 11 prominent automobile companies on listed in the Bombay Stock Exchange or National Stock Exchange. The study covers ten years following the financial crisis of 2008–2009, specifically from 2009–2010 to 2018–2019. Correlation analysis and panel data regression models are used to identify the determinants of capital structure in the Indian automobile industry. The study identified five key factors that influence the optimal capital structure in the Indian automobile industry: size, tangibility, growth, debt service capacity, and liquidity. Additionally, this study aims to determine which of the two competing theories, namely the trade-off theory and the pecking order theory, provides a better explanation for the factors determining the capital structure of the Indian automobile sector.

Keywords: capital structure; automobile industry; panel data; pecking order theory; trade-off theory.

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Latika Malhotra is an accomplished academician holding a PhD in Organisational Behaviour along with a Master's in Business Management. With an impressive career spanning over 14 years, she currently holds a position of an Associate Professor at the Institute of Information Technology and Management located in Delhi. Her expertise shines through her dedicated teaching career, encompassing both undergraduate and postgraduate levels. She has diverse experience in teaching and research in a number of management subjects like OB/HRM, economics and finance, project management, communication skills, etc. Her research endeavours have garnered national and international recognition and have been published in various journals indexed in Scopus, Web of Science, ABDC, UGC-CARE, etc. She has also been honoured with best paper awards, underscoring her profound impact in the specialised field of organisational behaviour and human resource management.

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1 Introduction

The capital structure is an imperative managerial decision. In today's scenario, managers are confronted with the most appropriate financing mix that would eventually benefit their shareholders' wealth. Hampton (1992) and Vijayalakshmi and Manoharan (2014), also suggested that a firm should concentrate on designing an optimum financial structure to achieve its fundamental objective, i.e., maximisation of firm value. Therefore, financial managers must cultivate an appropriate capital mix that is most beneficial for the organisation. Such capital structure can be developed by considering the various aspects that impact the composition of financial sources configuring the funding policies of a firm. Several factors influence the investment structure decisions of a company, and such bearing of particular factors changes over time. Hence, financial executives must frequently comprehend each factor's approach to their company's financial policies to design an ideal capital structure. Following the conventional beliefs from the various model such as net earnings, net operating earnings, and Modigliani and Miller approach of capital structure, many contemporary theories have developed that predicted the relationship of several determinants with the corporation's investment structure choices in detail. The two of these modern theories – *trade-off and pecking order approaches* are said to be competitors of each other (Ambadkar, 2010).

The trade-off model aligns with the conventional thought of Kraus and Litzenberger (1973), suggesting that the financial composition of a corporation is decided with the level of fixed obligation and equity in the mix to achieve equilibrium between the leverage tax shield benefits, agency costs and financial distress. Whereas the pecking-order approach proposed that a corporation follow a particular sequence of funding its assets, i.e., a firm prefers to first use its internally generated funds like retained earnings as a prime source; however, if the investment is higher than available funds, it would seek funds through debt and lastly, as a last resort, resort funds through fresh equity. The two theories have predicted the associations of factors like size, profitability, tangibility, volatility, growth, liquidity, and dividend with the capital structure. Ever since these two competing modern approaches emerged, the financial system and its contributing factors have been a significant consideration among economic researchers. Several studies have tried to identify the determining factors of financial construct and the applicability of these theories to such determinants in various sectors across countries. However, previous studies contradictory and mixed results documentation further necessitated comprehensive research on the capital composition determinants.

The projections of these contemporary approaches are applicable in most industries across countries (Tripathi, 2018). However, every economy and industry are different from one another, and their capital structure may differ amongst countries (Song and Philippatos, 2004; Hall et al., 2004), as well as industries (Bhattacharjee, 2010; Dawood et al., 2011; Dalal, 2013). Thus, the present research intends to identify the pertinency of these approaches (trade-off approach and pecking order approach) on the financial composition factors of the automobile industry in India. Being a capital-intensive industry, it requires sizeable investment and consequently necessitates its financial executives to carefully design the capital structure after comprehending the factors determining its financial structure.

The study comprehensively works on the research question: Which of the theories above holds more relevance in the association of contributing factors with the financial structure of the automotive sector in India? Therefore, the present research aims to undertake a diverse examination to enquire the determinants influencing the capital mix and to trace the practicability of these theories on the relationship of identified elements of capital structure in the Indian automobile manufacturing industry. For this purpose, the decade from 2009–2010 to 2018–2019 has been taken as it represents the period, post the financial crisis 2008–2009 and before the COVID outbreak 2019–2020, to avoid manipulating results due to any of the stated causes.

2 Literature review

The relevance of determinants of financial structure emerged from the Modigliani and Miller's (1958) approach, which asserted that a concern's worth is separate from its capital mix composition in the absence of taxes. The assumption of the non-existence of taxes was strongly criticised and consequently resulted in the subsequent research of Modigliani and Miller in 1963, concluding a favourable impact of leverage tax shield, one of the financial structure's determining factors, on the organisation's value. Ever since then, there has been continual debate on identifying the determining factors of the ideal financial building that ultimately enhances the worth of shareholders, and numerous modern theories have developed that predicted the affiliation of various determining components with the financial assembly decisions of a company in detail.

According to the arguments of Kraus and Litzenberger (1973), the ideal level of leverage and equity can be attained by bringing logrolling amid the debt tax-cover perks and financial blues and agency charges as the large chunk of edge in the financial structure of a firm will boost the financial dejection costs that eventually will offset the advantage enjoyed because of the credit tax-shield. Moreover, the vigorous rendition of the trade-off theory proposed by Fischer et al. (1989) suggests an elastic capital structure in which the upper boundaries and the lower boundaries for raising the debt can be fixed, and within these boundaries, restructuring the debt of the firm and equity can be attempted to stabilise its capital structure. Quite a reverse, Donaldson (1990) proposed the pecking order theory, which does not predict any favourable financial structure but suggests a specific financing sequence of financing the firm investments. It recommends using internally generated funds first; if it requires further funds, it would seek funds through the debt and, as a final recourse, through fresh equity. Another theory that Majluf and Myers (1984) regarded as the modified pecking order theory recognises the presence of asymmetrical facts, signalling theory, financial distress cost and the firm's sticky dividend policies. They recognised the reasoning behind the sequential financing strategy by stating that the firms keep a check on their debt levels and retain them within the caution limits to reserve their borrowing capacity, referred to as financial slack, to use it when they need additional funds, and to avoid financing through any risky securities issuance. Both theories projected the associations in factors like size, profitability, tangibility, volatility, growth, liquidity, and dividend with the capital structure. Since these two competing modern theories emerged, the debate on capital determinants has intensified, and numerous contributions have been made. Several authors have tried to test the relationship of various factors on the financial mix structure, but the results documented were contradictory and mixed, as discussed below:

2.1 Size

The role of size on leverage is unclear and vague. Some of the empirical research studies show that size possesses a positive relation with leverage and supports the trade-off approach, which prognosticates a reverse association between size and the likelihood of bankruptcy and, thus, an affirmative association between size and leverage (Remmers et al., 1974; Huang and Song, 2002; Rajan and Zingales, 1995; Buferna et al., 2005; Ambadkar, 2010; Deepa, 2011; Mukherjee and Mahakud, 2012). Whereas other studies show a negative relation supporting the pecking order theory that facilitates the prediction of more prominent firms exhibiting a growing preference for internal funds about debt (Titman and Wessel, 1988; Chen, 2003; Purohit and Khanna, 2012; Tripathi, 2018). Test the bearing of size on debt ratios, the study assumes the hypothesis mentioned below:

H_1 There is a substantial bearing of size on the leverage ratios of the automobile industry in India.

2.2 Profitability

The static trade-off approach shows a converse association between distress cost and profitability and, therefore, exhibits an affirmative affiliation with leverage. Peterson and Rajan (1994), Singh (1995), Pandey (2004), Buferna et al. (2005) and Deepa (2011) supported the static trade-off approach by confirming an affirmative relationship between them. Whereas Kakani (1999), Booth et al. (2001), Bhaduri (2002), Chen (2003), Mallikarjunappa and Goveas (2007), Chakraborty (2010), Ambadkar (2010) and Tripathi (2018) confirmed the estimations of pecking order approach indicating a firm's preference to use residual profits initially, subsequently debt and after that equity to finance its projects, and hence show the existence of inverse relation of profitability with leverage. On the grounds of this literature, the following hypothesis is posited:

H_2 There is a substantial bearing of profitability the leverage ratios of the automobile industry in India.

2.3 Tangibility

Creditors demand high-interest rates and set strict terms and conditions for firms having fewer assets to use as collateral. To avoid these severe conditions, firms may opt for equity in place of debt financing (Ambadkar, 2010). The trade-off theory also proposes that an elevated ratio of tangible holdings reduces the cost of debt and increases the debt capacity of a firm (Rajan and Zingales, 1995; Tripathi, 2018). Kakani (1999) found that tangibility positively relates to total debt and long-term debts. Still, the former found a substantial and later adverse relation with short-run debt. The pecking order approach suggests that due to agency cost, a firm with less tangibility may opt for a higher level of debt as it serves to curb managers' tendency to spend the organisational cash on their perquisites by reducing the availability of free cash for wasteful expenses (DeAngelo and Masulis, 1980; Mallikarjunappa and Goveas, 2007; Deepa, 2011). In contrast, some empirical results showed an insignificant association between the trade-off and pecking order approach (Titman and Wessel, 1988; Bhaduri, 2002). Test the bearing of tangibility on debt ratios, the study posited the below-mentioned hypothesis:

H_3 There is a substantial bearing of tangibility on the leverage ratios of the automobile industry in India.

2.4 Volatility

As per the trade-off and pecking order approach, company with variable earnings opt lower debt portion to avoid the possibility of bankruptcy and suggest an inverse affiliation among the volatility and its leverage. The pecking order approach also states that a firm with high volatility in earnings accumulates its cash during years with good returns to avoid under-investment crises in the forthcoming period (Myers, 1984; Bhat, 1980; Mittal and Singla, 1992; Kakani, 1999; Gonenc, 2005). Huang and Song (2002) and Ambadkar (2010) discovered a positive relation between the debt and volatility indicating that company with volatile income inclines to borrow more debt. Some studies like Titman and Wessel (1988), Baral (2004) and Deepa (2011) highlighted insignificant associations between the firm's leverage and variations in its income. On the grounds of this literature the following hypothesis is extended:

H_4 There is a substantial bearing of volatility on the leverage ratios of the automobile industry in India.

2.5 Growth

As stated in the trade-off approach, growth has an inverse relationship with leverage because growth opportunities possess high risk and return relationships, leading to higher bankruptcy costs and avoiding raising funds via debt financing. Similarly, the pecking order approach advices a positive relationship by reasoning that higher the growth means a more requirements for finance and hence requires raising funds from debt sources. Kakani (1999), Bevan and Danbolt (2000), Baral (2004) and Deepa (2011) supported the pecking order theory and found a significant positive relationship with all the debt ratios. In comparison, Titman and Wessel (1988) stated an inverse affiliation among the growth of the company and influence with the reasoning that growth opportunities cannot be collateralised to raise funds and do not generate instant income. Ambadkar (2010) stated that to avoid agency costs, a growing firm may issue short-period debt rather than long-period debt. Bhat (1980) and Tripathi (2018) found that growth rate has no significant relationship with leverage. Test the bearing of growth on debt ratios, the study assumes the following hypothesis:

H_5 There is a substantial bearing of growth on the leverage ratios of the automobile industry in India.

2.6 Non-debt tax shield

Masuils and DeAngelo (1980) claimed that since the tax cover is available on debt and non-debt tax shield (NDTS), firms may decide on a lower proportion of debt in their financial mix to avoid the probability of insolvency and further cost of debt capital from an additional unit of debt. With the same argument, the trade-off approach also suggests an adverse association between NDTS and leverage. Tripathi (2018) supported the theory and found an inverse relationship. Kakani (1999), Huang and Song (2002) found NDTS positively impact on short term debt and an adverse impact on long-period debt ratios.

Ambadkar (2010) established that NDTS is adversely related to short term debt and completely associated to long tem and total debt. Titman and Wessel (1988), Mallikarjunappa and Goveas (2007) and Deepa (2011) found an insignificant relation between the two. Hence, the following hypothesis is posited by the study:

H_6 There is a substantial bearing of NDTS on the leverage ratios of the automobile industry in India.

2.7 Debt service capacity (DSC)

The debt service capacity (DSC) is applied to ascertain the capacity of a company to atone for its fixed payments on its outstanding debt. It informs lenders whether the firm can bear the interest expenses even if its profits significantly fall in any upcoming year. The higher the DSC ratio, the additional debt an organisation can have in its financial structure. Therefore, a positive relationship between DSC and leverage (Bhat, 1980; Mittal and Singla, 1992; Tripathi, 2018). Whereas Mallikarjunappa and Goveas (2007) found a negative relationship between them, stating that firms might like to avoid financial distress involved in debt financing. Baral (2004) and Ambadkar (2010) found a statistically insignificant relationship between DSC and leverage. Test the bearing of debt service capacity on debt ratios, the study assumes the following hypothesis:

H_7 There is a substantial bearing of debt service capacity on the leverage ratios of the automobile industry in India.

2.8 Uniqueness

Bhaduri (2002) indicated that companies with exclusively distinct products find it hard to borrow due to their restrictive use of finance and less tactile assets and deduced an inverse association between uniqueness and leverage. Wessel and Titman (1988) gave a model that links a company's liquidation choice to its bankruptcy position. They argued that the clientele, employees, and traders of companies that churn out distinctive merchandises undoubtedly grieve proportionately excessive costs at the time of liquidation because their employees and merchants have only job-specific expertise. Their clients may find it strenuous to obtain substitutes for their distinctive produces. Therefore, this uniqueness and distinction is presumed to be adversely related to a firm's debt ratios. The trade-off approach also prophesies an opposite relation between identity and an organisation's leverage (Ambadkar, 2010; Tripathi, 2018). Kakani (1999) also found an affirmative association between uniqueness and the firms' short-period debt and total debt. Mallikarjunappa and Goveas (2007) indicated a weak positive relation of uniqueness with leverage. On the grounds of these literatures the hypothesis given below is developed:

H_8 There is a substantial bearing of uniqueness on the leverage ratios of the automobile industry in India.

2.9 Liquidity

Liquidity is the amount that is readily available for investment and spending. According to the pecking order hypothesis, businesses with more substantial financial assets might

utilise them as an alternative internally reserve for capital to borrow, resulting in smaller amounts of debt and pointing to a possible inverse link between liquidity and leverage. The trade-off theory shows a positive relationship, as firms with higher liquidity demonstrate their capability to placate the short-term liabilities and, thus, increase the debt-issuing capacity of that firm supported the pecking order approach and posited an adverse relation between the two (Mallikarjunappa and Goveas, 2007; Ambadkar, 2010). Bazaz (2015) found a puzzling relationship and confirmed the pertinence of pecking order and trade-off theories due to the positive connection of liquidity with total debt and negative with long term and short term fixed obligations. Hence, the following hypothesis is posited by the study:

H_9 There is a substantial bearing of liquidity on the leverage ratios of the automobile industry in India.

2.10 Dividend

The dividend is that part of earnings which is paid to the shareholders. The larger the dividend amount, the lesser will be left as retained earnings to finance the future investments; in this case, firms will go for debt issue to arrange funds for their future investments. It has also been suggested by the pecking order approach and indicated the affirming association between dividends and debt. Whereas the trade-off approach suggested an inverse relation between them, reasoning that the dividend payout can be higher only when the firm adopts a lower level of leverage in its capital structure, subsequently has to pay a lower cost of debt and saves a larger part of the earnings that are to be dispersed as a dividend. Ambadkar (2010) and Bazaz (2015) also found that dividend payouts possess a statistically significant inverse relationship with different leverage ratios. But Tong and Green (2005) supported the pecking order approach and found an affirmative association between dividends paid and a firm's debt. On the grounds of this literature, the following hypothesis is posited:

H_{10} There is a substantial bearing of dividends on the leverage ratios of the automobile industry in India.

3 Research methodology

The paper presents a descriptive and empirical study using panel data from 11 prominent automobile companies operating under the Bombay Stock Exchange or National Stock Exchange for a 10-year financial period from 2009–2010 to 2018–2019 collected from the PROWESS database sustained by the CMIE. The study executed the panel data regression analysis on ten factors of capital mix as predictor variables and four leverage ratios as predicting variables, as summarised in Table 2, carefully chosen through an intensive literature review.

Table 1 presents the compendium of projections of the trade-off approach and the pecking order approach concerning the association between leverage and the above-mentioned financial structure determinants.

To assess the effect of those, as mentioned earlier, on financial structure from the micro perspective, it is necessary to investigate the bearing of determinants on the most significant constituents of financial structure. Conventionally, long-term debt has been considered a prominent capital structure component. The long-term debt-to-equity proportion is the most acceptable measure of financial structure to express the relationship between debt funds and equity funds. Most of the researchers have adopted the ratio described above to represent the financing strategies of the companies and therefore, following Titman and Wessel (1988), Mittal and Singla (1992), Kakani (1999), Garg and Shekhar (2002), Bhattacharjee (2010), Ambadkar (2010), Deepa (2011), Rasoolpur (2012), Kavitha (2014), Sofat and Singh (2017) and Tripathi (2018), this study as well adopted LTD/NW ratio as one of the measures of financial structure. Many researchers like Rajan and Zingales (1995), Bevan and Danbolt (2000), Drobetz and Fix (2005), Ambadkar (2010), Ali (2011), Tongkong (2012), Anshu and Kapil (2014), Bhattacharjee and Dash (2015), Bazaz (2015), Jagannathan and Narayanarao (2017), Merve (2018), Kaur et al. (2020) and Ghayas and Khan (2020) studied the combined influence of short-term and long-term debt ratios on company value. Following their work, this study also adopted two total debt ratios, i.e., TD/TA and TD/NW. As a result, the present study undertakes four ratios to represent the financial structure of the industry, i.e., long-term debt/total asset (LTD/TA), long-term debt/net worth (LTD/NW), total debt/total assets (TD/TA) and total debt/net worth (TD/NW).

Table 1 Summary of relationship predictions of pecking order and trade-off approaches amid determinants and leverage

S. no.	*Determinant of capital structure*	*Pecking order approach prediction*	*Trade-off approach prediction*
1	Size	–ve	+ve
2	Profitability	–ve	+ve
3	Tangibility	–ve	+ve
4	Volatility	–ve	–ve
5	Growth	+ve	–ve
6	Non-debt tax shield	No prediction	–ve
7	Debt service capacity	No prediction	No prediction
8	Uniqueness	No prediction	–ve
9	Liquidity	–ve	+ve
10	Dividend	+ve	–ve

The mathematical panel data regression models to empirically inspect the impact of selected factors on the leverage measures of the selected automobile companies are as follows:

1 Pooled ordinary least square (POLS) or panel least square model:

$$LEV_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 PROF_{it} + \beta_3 TANG_{it} + \beta_4 VOL_{it} + \beta_5 GROW_{it} + \beta_6 NDTS_{it} + \beta_7 DSC_{it} + \beta_8 UNIQ_{it} + \beta_9 LIQ_{it} + \beta_{10} DIV_{it} + \varepsilon_{it}$$

2 Fixed effect model (FEM):

$$LEV_{it} = \beta_{0i} + \beta_1 SIZE_{it} + \beta_2 PROF_{it} + \beta_3 TANG_{it} + \beta_4 VOL_{it} + \beta_5 GROW_{it} + \beta_6 NDTS_{it} + \beta_7 DSC_{it} + \beta_8 UNIQ_{it} + \beta_9 LIQ_{it} + \beta_{10} DIV_{it} + \gamma_2 D_{2it} + \gamma_3 D_{3it} + \gamma_4 D_{4it} + \ldots + \gamma_{11} D_{11it} + \varepsilon_{it}$$

3 Random effect model (REM):

$$LEV_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 PROF_{it} + \beta_3 TANG_{it} + \beta_4 VOL_{it} + \beta_5 GROW_{it} + \beta_6 NDTS_{it} + \beta_7 DSC_{it} + \beta_8 UNIQ_{it} + \beta_9 LIQ_{it} + \beta_{10} DIV_{it} + \omega_{it}$$

Table 2 Table representing the summary of variables

S. no.	*Dependent variables*	*Independent variables*			
		Determinant of capital structure	*Acronyms*	*Measurement*	*Researchers followed the measurement*
1	LTD/TA, LTD/NW, TD/TA, and TD/NW	Size	SIZE	Natural log of sales	Bhat (1980), Titman and Wessel (1988), Bevan and Danbolt (2000), Booth et al. (2001), Huang and Song (2002), Drobetz and Fix (2005), Baral (2004), Mallikarjunappa and Goveas (2007), Ambadkar (2010), Deepa (2011) and Tripathi (2018)
2		Profitability	PROF	PBITDA/TA	Tripathi (2018)
3		Tangibility	TANG	Net fixed assets/net total assets	Bevan and Danbolt (2000), Huang and Song (2002), Drobetz and Fix (2005), Buferna et al. (2005), Mallikarjunappa and Goveas (2007), Ambadkar (2010) and Tripathi (2018)
4		Volatility	VOL	SD of PBITDA/TA	Deepa (2011)
5		Growth	GROW	Year-on-year growth in sales	Mallikarjunappa and Goveas (2007) and Tripathi (2018)
6		Non-debt tax shield	NDTS	Dep and Amort/TA	Mallikarjunappa and Goveas (2007), Chakraborty (2010) and Deepa (2011)
7		Debt service capacity	DSC	PBITDA/interest expense	-
8		Uniqueness	UNIQ	R&D expenditure/net sales	Titman and Wessel (1988), Bhaduri (2002), and Ambadkar (2010)
9		Liquidity	LIQ	CA/CL	Mallikarjunappa and Goveas (2007), Ambadkar (2010), Rasoolpur (2012) and Bazaz (2015)
10		Dividend	DIV	Equity dividends/PAT	Bhat (1980), Baral (2004) and Ambadkar (2010)

Here,

- LEV – the value of the dependent variable (leverage or debt ratios), i.e., LTD/TA, LTD/NW, TD/TA and TD/NW
- β_0 – constant term across sample companies
- β_{0i} – constant term of each sample company
- $\beta_1, \beta_2, \beta_3, \ldots, \beta_n$ – coefficients of the independent variables
- SIZE, PROF, TANG, VOL, GROW, NDTS, DSC, UNIQ, LIQ and DIV are the independent variables that predict LEV's value
- γ – coefficients for individual companies (e.g., γ_2 for Atul Auto Ltd., γ_3 for Bajaj Auto Ltd. and so on)
- D_2, D_3, D_4, … and D_{11} are dummy variables for the second, third, fourth, … till eleventh sample company. D_1 is not taken since having it will cause perfect multicollinearity
- ε_{it} – ε being the error value for individual i at time t
- ω_{it} = composite error (individual specific error + model specific error).

4 Results and interpretation

The study took on the empirical investigation of panel data to recognise the bearing of financial structure determinants on the leverage ratios of automobile corporations over the duration of this study. The correlation results found a negative affirmation of profitability, debt service capacity and liquidity, whereas a positive affirmation of tangibility and uniqueness with all the leverage ratios at a 5% significance level. However, there is statistically no significant correlation of size, volatility, growth and non-debt tax shield with leverage ratios. Lastly, the dividend is significantly correlated with only TD/TA.

Table 3 indicates the results of panel data regression analysis for selected capital structure factors on long periods and total debt ratios (capital mix) for the sample automobile companies in India. Regression models' sturdiness is confirmed through the lowest score of the selected information criterion, specifically the Akaike information criterion (AIC). The models' Durbin-Watson statistic values between from 1.2 to 1.9, close to 2. It seems the data are auto-correlated, which could be due to some specification error. The validity of the models for examining the association amongst the elements of the capital mix and leverage ratios was proven with their F-statistics values considerable at the 5% level. The adjusted R-square estimates of all the models disclosed a better predictive capacity as they range from 60% to 90% of the fluctuation in the leverage ratios of the industry.

Table 3 Representing regressions results of determinants on various measures of capital structure

Debt ratios / Determinants	LTD/TA		LTD/NW		TD/TA		TD/NW	
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*	*Model 8*
	Pooled reg model	*Fixed effect model*	*Pooled reg model*	*Fixed effect model*	*Pooled reg model*	*Fixed effect model*	*Pooled reg model*	*Fixed effect model*
Size	0.017 (3.920)**	–0.031 (–2.278)**	0.044 (3.047)**	–0.093 (–2.022)**	0.006 (0.871)	–0.035 (–1.559)	0.023 (0.709)	–0.116 (–1.112)
Profitability	0.052 (0.626)	0.054 (0.759)	0.169 (0.608)	0.097 (0.401)	0.046 (0.334)	0.152 (1.285)	0.011 (0.018)	0.193 (0.350)
Tangibility	0.370 (4.821)**	0.561 (6.362)**	1.012 (3.944)**	1.404 (4.668)**	0.285 (2.234)**	0.545 (3.709)**	0.916 (1.587)	1.873 (2.744)**
Volatility	–0.049 (–0.487)	–0.058 (–0.687)	–0.138 (–0.412)	–0.209 (–0.728)	–0.052 (–0.310)	–0.050 (–0.360)	–0.334 (–0.444)	–0.416 (–0.640)
Growth	0.053 (1.737)	0.000 (0.017)	0.172 (1.704)	0.019 (0.210)	0.098 (1.936)	0.120 (2.672)**	0.344 (1.508)	0.464 (2.225)**
Non-debt tax shield	–1.225 (–3.379)**	–0.407 (–1.232)	–3.206 (–2.646)**	–1.713 (–1.519)	–0.661 (–1.098)	0.214 (0.389)	–3.156 (–1.158)	–2.257 (–0.882)
Debt service capacity	–0.023 (–4.415)**	–0.012 (–2.072)**	–0.068 (–3.978)**	–0.045 (–2.306)**	–0.036 (–4.193)**	–0.016 (–1.793)	–0.150 (–3.879)**	–0.103 (–2.327)**
Uniqueness	2.351 (3.454)**	–0.067 (–0.097)	7.740 (3.403)**	–0.264 (–0.112)	0.766 (0.677)	–0.911 (–0.793)	3.817 (0.746)	–4.035 (–0.755)
Liquidity	–0.020 (–1.938)	–0.004 (–0.451)	–0.075 (–2.144)**	–0.019 (–0.673)	–0.091 (–5.257)**	–0.051 (–3.676)**	–0.339 (–4.319)**	–0.182 (–2.839)**
Dividend	0.014 (1.113)	–0.004 (–0.477)	0.045 (1.105)	–0.049 (–1.418)	0.032 (1.576)	0.009 (0.517)	0.130 (1.422)	–0.034 (–0.434)
R-square	0.739	0.875	0.701	0.851	0.686	0.849	0.637	0.815
Adjusted R-square	0.712	0.847	0.671	0.817	0.655	0.815	0.600	0.774
F statistics	27.96**	31.06**	23.207**	25.400**	21.649**	25.046**	17.344**	19.665**
AIC	–2.925	–3.479	–0.512	–1.026	–1.909	–2.460	1.109	0.613
SIC/BIC	–2.655	–2.964	–0.242	–0.511	–1.639	–1.944	1.379	1.128
HQC	–2.816	–3.270	–0.402	–0.817	–1.799	–2.250	1.218	0.822
Durbin-Watson	1.751	1.922	1.649	1.830	1.236	1.570	1.356	1.640
Chow test	9.672**	8.952**	9.612**	8.626**				
Hausman test	96.72**	89.522**	96.116**	86.264**				

Note: **Significant at 5% level.

4.1 Panel data regression analysis results on LTD/TA ratio

In Model 1, the pooled regression model shows a significant F-statistics value of 27.96, validating the model for the present study, and its adjusted R-square value indicates that the model can explain almost 71% variation in the LTD/TA ratio. The results reveal that size, tangibility and uniqueness have a significant negative impact at a 5% level on the leverage ratio, and uniqueness owns a higher coefficient value of 2.35. Further, debt service capacity and non-debt tax cover adversely impact long-term debt ratios as their t-statistics are –3.379 and –4.415, respectively. It shows that automobile companies with high debt service capacity and non-debt tax shield borrow less long-term obligatory funds to finance their total assets.

Since the Chow test and Hausman test results show significant cross-section chi-square value, the study selects the fixed effect model to study the relationship between the determinant of capital structure and LTD/TA ratio, whose results are shown in Model 2. The model gives a significant F-statistic value of 31.06 at a 5% level, leading to the model's validity. The results state a better predictive capacity of the model with its adjusted R-square value of 0.847. Like the pooled regression model, FEM also found a significant positive impact of tangibility and an adverse impression of debt service capacity on the LTD/TA ratio. Unlike the previous model, FEM shows a substantially negative size effect on the leverage ratio. It led to rejecting null hypotheses and accepting the alternate Hypotheses H_1, H_3 and H_7, confirming that size, tangibility and debt service capacity significantly impact the LTD/TA ratio.

4.2 Panel data regression analysis results on LTD/NW ratio

In model 3, the F-statistics value of 23.207 of the pooled regression model is significant at the 5% level and shows the model's validity. The adjusted R-square of the model indicates that the selected determinants of capital structure can explain 67% of changes in the LTD/NW ratio. As per its results, non-debt tax shield, debt service capacity and liquidity indicate a significant negative impact at a 5% level on the debt-equity ratio. On the other hand, the model presents a significant positive effect of size, tangibility and uniqueness with LTD/NW ratio, and the latter with the highest coefficient value of 7.740, stating that as the expenditure on research and development increases, the automobile company seeks more funds from long-term debt sources.

In the model selection process, the Chow and Hausman tests show significant cross-section chi-square values. Therefore, the article accepts the fixed effect model 4, for studying the impact of the determinant of capital arrangement on the LTD/NW ratio. This model has a significant F-statistic value of 25.40 at a 5% level, showing the model's validity. Its results also disclosed the significant positive impact of tangibility on the LTD/NW ratio with a high coefficient value of 1.404. However, FEM results contradict the pooled regression result of size by showing its significantly negative impact on LTD/NW, implying that the large automobile companies use more of their shareholders' funds and raise less long-term borrowing. The debt service capacity also significantly negatively impacts the ratio, as shown by its t-statistic value of –2.306. Based on the FEM results, the study rejects the null hypotheses that size, tangibility and debt service capacity have no impact on the LTD/NW ratio and accepts the alternate Hypotheses H_1, H_3 and H_7 for the same.

4.3 Panel data regression analysis results on TD/TA ratio

Model 5 indicates the results of panel data regression analysis of independent variables on TD/TA and found valid from the significant F-statistics value of 21.649 at the 5% level. Its adjusted R-square value shows that the selected determinants of capital structure can explain almost 65% of changes in the TB/TA ratio. Its results show that debt service capacity and liquidity have a significant negative impact. Tangibility discloses a significant positive effect on the total debt to total asset ratio, indicating that automobile companies with more collateralised assets raise more debt funds.

Due to the significant cross-section chi-square value of the Chow test and the Hausman test, the article accepted the FEM 6, to represent the relationship of the determinant of capital composition with the TD/TA ratio. The model has a significant F-statistic value of 25.046 and has a better predictive capacity of 81%, as shown by its adjusted R-square value. The FEM results indicate a significant positive impact on growth and a significant adverse effect on liquidity. Further, like the pooled regression model 5, the FEM results also show a significant positive impact of tangibility on the TD/TA ratio. It led the study to reject the null hypotheses and accept the alternate hypotheses (H_3, H_5 and H_9) that tangibility, growth and liquidity significantly impact the TD/TA ratio.

4.4 Panel data regression analysis results on TD/NW ratio

In model 7, panel data regression analysis' result of each independent variable on the TD/NW ratio demonstrates a significant value of F-statistics, i.e., 17.344. It can explain 60% of the TD/NW ratio's variation. The results disclose that debt service capacity and liquidity significantly negatively impact the said ratio, showing that automobile companies with large PBITDA and current assets depend less on long-term and short-term obligatory funds.

Since the Chow test and Hausman test results show significant F-statistics and cross-section chi-square value, the study rejects both the pooled regression and random effect models, and selects the fixed effect model 8, to study the affiliation between the determinant of capital building and TD/NW ratio. The FEM gives a significant F-statistic value of 17.344 and has a better predictive capacity of 77%. Like the pooled regression model, FEM also found a significant negative impact of debt service capacity and liquidity on the TD/NW ratio. Unlike the previous model, FEM shows a significant positive effect of tangibility and growth on the debt ratio. It led the study to reject null hypotheses and accept the H_3, H_5, H_7 and H_9 hypotheses.

5 Findings and discussion

This empirical study inspected the bearing of financial structure determinants on the leverage ratios of automobile concerns post the financial crisis period of 2008–2009, i.e., from 2009–2010 to 2018–2019. For the analysis purpose, the study used a panel data regression model with ten determinants of capital structure, i.e., SIZE, PROF, TANG, VOL, GROW, NDTS, DSC, UNIQ, LIQ and DIV and four leverage ratios, i.e., LTD/TA, LTD/NW, TD/TA, and TD/NW.

Table 4 Epilogue of panel data analysis results on debt ratios and theories implications

Debt ratios / *Determinants*	*Long-term debt to total asset*		*Long-term debt to net worth*		*Total debt to total assets*		*Total debt to net worth*	
	Significance result	*Theory implication*	*Significance result*	*Theory implication*	*Significance result*	*Theory implication*	*Significance result*	*Theory implication*
Size	Significant (–ve)	Pecking order theory	Significant (–ve)	Pecking order theory	X	___	X	___
Profitability	X	___	X	___	X	___	X	___
Tangibility	Significant (+ve)	Trade-off theory	Significant (+ve)	Trade-off theory	Significant (+ve)	Trade-off theory	Significant (+ve)	Trade-off theory
Volatility	X	___	X	___	X	___	X	___
Growth	X	___	X	___	Significant (+ve)	Pecking order theory	Significant (+ve)	Pecking order theory
Non-debt tax shield	X	___	X	___	X	___	X	___
Debt service capacity	Significant (–ve)	No prediction	Significant (–ve)	No prediction	X	___	Significant (-ve)	No prediction
Uniqueness	X	___	X	___	X	___	X	___
Liquidity	X	___	X	___	Significant (–ve)	Pecking order theory	Significant (-ve)	Pecking order theory
Dividend	X	___	X	___	X	___	X	___

According to the panel data regression results of the fixed effect models, being selected as the better model to represent the relationship between the determinant of capital structure with debt ratios, it is established that tangibility has a substantial affirmative influence on all the debt ratios, showing consistency (Rajan and Zingales, 1995; Akinyomi and Adebayo, 2013; Handoo and Sharma, 2014; Kavitha, 2014; Bhattacharjee and Dash, 2015; Bazaz, 2015; Sofat and Singh, 2017; Merve, 2018; Ghayas and Khan, 2020; Kaur et al., 2020). It also confirms the prediction of the trade-off theory, showing that an increase in automobile companies' sales and fixed assets increases their long-term and overall debts. It highlights that automobile companies, having large fixed assets to use as collateral securities, raise more long-term debt to fund their additional sales.

Further, a significant negative impact of debt service capacity on LTD/TA, LTD/NW and TD/NW ratios shows that when the automobile companies have increasing PBITDA to pay off their fixed payment obligations, they prefer taking less debt. It may be because automobile companies prefer to spend their profits internal funds on future investment opportunities rather than attracting lenders to handle debts (Mallikarjunappa and Goveas, 2007; Basu and Rajeev, 2013; Handoo and Sharma, 2014; Sofat and Singh, 2017).

Similarly, size has shown a significant negative impact on LTD/TA and LTD/NW but not on total debt ratios. It may be due to the presence of short-term debt. It indicates that size as a determinant does not significantly influence short-term debts, but it substantially impacts the long-term debt of the automobile industry in India. It corroborates the prediction of the pecking order theory that large automobile companies add more retained earnings and rely more on internal funds rather than long-term debt funds to finance their total assets and support the results (Handoo and Sharma, 2014; Bazaz, 2015; Sofat and Singh, 2017; Tripathi, 2018).

The FEM results evidence the prediction of pecking order theory by indicating a significant positive impact of growth on total debt ratios, i.e., TD/TA and TD/NW. Due to the inclusion of short-term debt, growth exhibits insignificant bearing on long-term debt. It suggests that automobile firms with mounting sales raise more short-term debts against shareholders' funds to finance their operations. The results support the findings of Ali (2011), Ali and Hossain (2011), Tongkong (2012), Handoo and Sharma (2014) and Vergas et al. (2015). Quite the reverse, liquidity manifested a significant negative impact on TD/TA and TD/NW ratios, suggesting that the automobile firms with large liquid assets have less requirement of raising additional funds from short-term debt because of insignificant influence on long-term leverage ratios, as they can finance their operations through their available working capital. Again, it manifested the prediction of the pecking order theory and supported the results (Ambadkar, 2010; Ali and Hossain, 2011; Merve, 2018; Kaur et al., 2020; Ghayas and Khan, 2020).

Table 4 presents a summary result of the panel data regression using the fixed effect model and implications of the predictions of theories regarding the relationship between various debt ratios and capital structure determinants of the Indian automobile industry.

6 Managerial implication

The study has significant managerial contributions to the Indian automobile companies. It is a fresh effort to comprehend the bearing of financial structure determinants on various leverage measures on the worth of companies in the automobile sector of India with a

more detailed evaluation. It inspected the influence of ten factors on indicators of capital mix construction. These indicators represent the different categories of debt ratios: long-period and total debt ratios.

The study will lead the way for the finance executives of automobile companies to frame their ideal capital structure as it is grounded on the recent figures and studied the post-recession period from 2009–2010 to 2018–2019. This study scrutinises the impression of determinants on the financial mix of the automobile sector. It will act as a directory to the managers that shows the significance of considering the size, tangibility, growth, debt service capacity and liquidity factors before framing their debt policies, as they possess a noteworthy bearing on the capital mix of the sector.

Further, the research also tracks the applicability of the predictions of two contending philosophies, explicitly the pecking order approach and the trade-off approach, on the financing pattern and elements of capital mix of the automobile sector in India. Corporate financial executives can consider the suggested theory's implications while making financing decisions.

Investors can also comprehend the influence of various factors on automobile manufacturers' financial mix decisions. This way, they will be cautious about their investments in the sector and make decisions for further investments based on the riskiness of the segment. The study can also be presented to any financial institution by firms for better understanding of their capital mix, to inspect the bearing of financial structure measures on the business value, and to assess the sanctioning of debt amount further.

7 Conclusions

The present research examination is operated on panel data regression analysis models to identify the bearing of financial structure determinants on its measures in automobile associations for 10 years after the financial recession of 2008–2009. For this examination, the study selected ten determinants, i.e., SIZE, PROF, TANG, VOL, GROW, NDTS, DSC, UNIQ, LIQ and DIV, and four indicators of capital structure, which comprised two long-term debt ratios, i.e., LTD/TA and LTD/NW, and two total debt ratios, i.e., TD/TA and TD/NW.

The study, based on the detailed investigation of the effects of these elements on the indicators of financial structure, concluded that size, tangibility, growth, debt service capacity and liquidity have significant importance in the financial structure decision of the automobile manufacturing sector in India. Tangibility was found to influence all the capital arrangement decisions of the sector positively and confirmed the implication of the trade-off approach. At the same time, size evidenced the applicability of the pecking order theory by revealing a negative impression of the long-term debt policies of the industry. Growth and liquidity disclosed a significant impression on the industry's total debt ratios, showing influence on the TD/TA and TD/NW ratios. The affirming impact of growth and the adverse effect of liquidity reiterate the appropriateness of the pecking order theory on the automobile industry in India. None of these theories have predicted debt service capacity's relation with leverage. In contrast, the present study found a noteworthy negative influence on three capital structure indicators except TD/TA debt ratios in the automobile industry in India. Therefore, it is recommended that the sector

exercise caution when determining its capital structure composition, particularly regarding debt service coverage.

The present research is restricted to examining microeconomic components as the factors of the financial structure of automobile manufacturing companies in India. Further research can be done by investigating the influence of macroeconomic determinants like inflation rate, GDP, exchange rate, forex reserves, financial markets' efficiency, and India's political and legal environment. The capital structure has an added comprehensive picture of the automobile industry in India.

8 Limitation

This research is grounded on the secondary data collected from the database of CMIE (Centre for Monitoring Indian Economy) PROWESS. The quality of the study purely hinges on the accuracy and reliability of secondary data, and the drawbacks of the formation in the database will also apply to the data analysis. Secondly, the paper scrutinises capital structure determinants of leading automobile manufacturing establishments operating under BSE /NSE on the data collection date; other companies in the automobile sector, like the Auto Ancillary sector, are not considered. Further, the sample firms chosen were restricted to eleven automobile corporations due to restrictions such as lack of continuous listing, negative net worth in some years, and inaccessibility of data relating to those organisations in the prowess database. Lastly, the study is confined to only ten years, from 2009–2010 to 2018–2019.

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