Journal of Open Innovation: Technology, Market, and Complexity 9 (2023) 100152

Contents lists available at ScienceDirect

Journal of Open Innovation: Technology, Market, and Complexity

journal homepage: www.sciencedirect.com/journal/journal-of-open-innovation-technology-market-and-complexity

Dynamics of speed of leverage adjustment and financial distress in the Indian steel industry

Mohd Abdullah [a], Ishfaq Gulzar [b], Asiya Chaudhary [b], Mosab I. Tabash [c,*], Umra Rashid [d], Ishrat Naaz [e], Ammar Ali [b]

[a] GITAM School of Business, GITAM (Deemed to be University), Hyderabad, India
[b] Department of Commerce, Aligarh Muslim University, Aligarh, India
[c] College of Business, Al Ain University, Al Ain, United Arab Emirates
[d] Department of Business Administration, Aligarh Muslim University, Aligarh, India
[e] GITAM School of Business, GITAM (Deemed to be University), Visakhapatnam, India

ARTICLE INFO

JEL Classification:
G32
C4
O1

Keywords:
Speed of adjustment panel data
GMM
Capital structure
India
Z- Score
Econometrics

ABSTRACT

Business managers strive to attain the optimal capital structure (OCS), which allows them to raise capital at a minimal cost, thereby maximising their returns. Balancing risk and reward is crucial in determining the target capital structure. Therefore, understanding the optimal leverage ratio and the Speed at which leverage adjustments are made is vital to managers. This study examines the optimal leverage ratio, the speed of adjustment, and the factors contributing to achieving the target capital structure for select 208 steel firms, particularly in an emerging economy like the Indian steel industry. A partial adjustment model is utilised, employing the Generalised Method of Moments (GMM) technique. Additionally, the Altman Z-score is employed to evaluate the financial distress of these steel firms. Very few studies have specifically focused on determining the Speed of adjustment (SOA) using GMM of emerging economies like the Indian steel industry. The findings indicate that steel firms take approximately 2.13 years to reach their target leverage, supporting the existence of the dynamic trade-off theory. The results also highlight the relationship of selected variables (Profitability, Growth, Size, Tangibility, NDTS, Liquidity, and Financial Distress) with the Speed of leverage adjustment and the weak financial position of these businesses.

1. Introduction

Leverage decisions are one of the widely discussed topics in corporate finance. To enhance the value of shareholders of a company, an efficient Capital Structure (CS) decision is indispensable for the business. A poor decision on the debt-to-equity ratio could lead to the firm's financial distress and eventual insolvency. Managers toil to attain the target CS, which helps them raise capital at a minimal cost and earn the best possible return. Pandey (2005) also states that to attain the target CS, the company must establish an equilibrium between risk and reward. Thus, getting an ideal CS has been a crucial and significant concern for business managers for a long time and is even relevant in recent years.

Ever since Modigliani and Miller (1958) introduced their groundbreaking proposition on the irrelevance of capital structure, numerous theories have emerged to assist in making financial decisions. MM (1958) paved the way for other scholars to think and invest more time in solving the conundrum of CS decision theories. But MM (1958) has some impractical assumptions, such as static theories based on a single time period and a perfect market condition or absence of the tax. However, running a business is a continuous process, and a firm changes its CS continuously throughout its life. To explain the reported financing behaviour, various explanations have been put forth. Among the notable theories, we find the Trade-off theory, formulated by Robichek and Myers in 1966, the Pecking Order theory, advanced by Myers in 1984, and the Market Timing theory, as put forth by Baker and Wurgler (2002). The dynamic Trade-off model asserts that firms adjust their capital structure in response to various internal and external factors (Fischer et al., 1989).

In contrast, a company's leverage ratio is only the historical outcome

* Corresponding author.
E-mail addresses: mohdabdullah2510@gmail.com (M. Abdullah), Ishfaqgulzar3@gmail.com (I. Gulzar), asiya.chaudhary1@gmail.com (A. Chaudhary), mosab.tabash@aau.ac.ae (M.I. Tabash), rashidumra95@gmail.com (U. Rashid), ishratnaaz@gmail.com (I. Naaz), aliammar2115@gmail.com (A. Ali).

https://doi.org/10.1016/j.joitmc.2023.100152
Received 26 September 2023; Received in revised form 10 October 2023; Accepted 11 October 2023
Available online 13 October 2023

of financing decisions due to the Pecking order or Market timing, influenced by the timing of capital markets and minimising unfavourable selection costs. The Trade-off argument would therefore be supported above the other two theories if there were evidence that businesses actively change their leverage ratio. Testing for leverage-targeted behaviour is a widely employed tactic in the literature (Flannery and Rangan, 2006). Researchers from both developed and developing nations have supported the idea that businesses usually have a planned OCS that they want to obtain by modifying their current level of debt as per dynamic'Trade-off theory (Aybar-Arias et al., 2011; Abdeljawad et al., 2013).

Firms are predicted to gradually return to the target if they stray from it as a result of micro or macro leverage shocks. The Trade-off theory receives clear empirical support from pertinent empirical research that examines the so-called CS Speed of Adjustment (SOA). Businesses actively work toward a target CS but are limited by adjustment expenses (Ozkan, 2001; Frank and Shen, 2013; Gaud et al., 2005; Flannery and Rangan, 2006). These findings provide strong evidence in favour of a dynamic Trade-off theory, where businesses adjust to a target CS, with the SOA, a measure of how soon they reach the target, being controlled by the relative costs of adjustment and deviation to the target CS. There could be an argument that established capital structure determinants in a developing country like India could also be applicable there, negating the need for reinvention. However, while addressing this debate, Delcoure (2007) can be referred to which explores whether CS factors found in emerging European nations can be extrapolated to neighbouring Western economies & the study suggests that such application is not feasible, demonstrating that the factors influencing capital structure are indeed unique to each country.

Steel Industry is among India's most prominent core industries and produced over 118.20 million tonnes of steel, ranking second only to China. It has witnessed a transition in its production for the past 10–12 years. Moreover, the government policy allowing 100% FDI has boosted the investment of almost $ 17.20 Billion in India in the last 20 years. Furthermore, the Indian government has also allocated $ 8.6 million towards the steel industry in its budget (IBEF 2023). To the best of the authors' knowledge, very few studies have been conducted focusing on finding the Speed of adjustment and the bankruptcy position of the steel-producing industry. The key rationale for considering India as a base for studying dynamic capital structure theory is that India is one of the most important emerging markets in the world by the year 2030. The Indian steel industry is contributing significantly to its economic growth, capital formation, and employment generation and is considered important in the international steel circle. According to the Joint Plant Committee (JPC), Steel production in India has shown a growth of 3.6% over CY 2020 and produced 118.1 million tonnes (World Steel Association, 2023). Moreover, there is an anticipation that steel production will reach 42 million tonnes by the end of 2026–27, and the steel exports will reach approximately 5.5 million tonnes, compared to the current 1.7 million tonnes, generating foreign exchange earnings of around 33,000 crore rupees. Consequently, steel companies are now compelled to reevaluate their debt-equity ratios in order to mitigate costs.

Due to its cyclical nature, high capital intensity, and sensitivity to raw material costs, the steel industry's leverage decisions set it apart from other industries. The industry deals with global competition, regulatory difficulties, and large infrastructure investments. Environmental issues and technological advancements influence leverage decisions, especially in emerging countries like India. However, establishing good leverage decisions in the steel business requires a special understanding of these aspects and a long-term perspective. Despite being the second largest producer of steel, Indian steel companies tend to depend on external capital as they are not financially self-sufficient. Therefore, it becomes crucial to assess their capital structure decisions thoroughly. With the rapid expansion of sectors like construction, housing, transportation, and power generation, domestic demand for steel and exports has grown substantially over the years (Dutta & Mukherjee, 2010). The industrial sector has made significant progress thanks to the steel industry, which has played a leading role (Balakrishnan, 2016), even though it is one of the most energy-intensive industries in most developed economies (Lutz et al., 2005). Being capital and technology-intensive, the steel industry also holds a critical role in a nation's defence and economy, and its performance tends to fluctuate in sync with macroeconomic conditions over time (Yeh et al., 2011).

Steel is a critical component for the progress of any modern economy in today's world (Takeh and Navaprabha, 2015). It is often seen as the foundation of the manufacturing industry (Preeti) and a fundamental driver of the development of contemporary society and the global economy (Balakrishnan, 2016). A country's per capita steel consumption is considered a crucial factor influencing socio-economic development and the living standards of its population (Takeh and Navaprabha, 2015). With the rapid expansion of sectors like construction, housing, transportation, and power generation, domestic demand for steel and exports has grown substantially over the years (Dutta & Mukherjee, 2010). The industrial sector has made significant progress thanks to the steel industry, which has played a leading role (Balakrishnan, 2016), even though it is one of the most energy-intensive industries in most developed economies (Lutz et al., 2005).

Leading metal producers in the country are expected to opt for internal accruals instead of relying on debt-based funding to finance their capital expenditure (capex) in FY24, and the primary driver behind this decision, as cited by top executives, is the increased capital costs; and this reluctance to take on debt is influenced by two key factors: favourable raw material prices and an unfavourable interest rate environment (Moneycontrol, 2023).

In FY24, India's foremost metal producers, including Hindalco Industries, JSW Steel, Steel Authority of India, Tata Steel, and Hindustan Zinc, have collectively allocated approximately Rs 63,400 crore for capex. Among these companies, three have signalled their intent to utilise internal accruals to finance their capex for the year, while the remaining two are optimistic about reducing their debt burden despite engaging in capex activities.

According to the reports, JSW Steel's net debt increased to Rs 66,797 crore from Rs 59,345 in the March quarter, driven by higher working capital, and the company is now working towards acquiring stakes (For example, securing a 20% ownership share in Tech Resources' steel manufacturing coal division and completing the acquisition of NMDC Steel, as mentioned by Joint Managing Director & CEO) in order improve its debt structure (Bloomberg, 2023).

According to another report, "Domestic primary steel manufacturers are likely to see their leverage, in terms of net debt to earnings before interest, tax, depreciation and amortisation (EBITDA) ratio, remain below 2.0 times this fiscal (compared to an estimated 1.6–1.7 times in fiscal 2023) despite undertaking capital expenditure to cater to growing demand," Crisil said (Bloomberg, 2023).

These reports suggest that leverage does exist in firms' capital structure, and firms must meticulously decide their debt-equity mix to avoid incurring losses. By studying their SOA and the impact of select variables with Speed of adjustment, steel firms can adjust their capital structure and make prudent decisions regarding the key factors to consider that impact the SOA.

This research examines the leverage dynamics of India's steel business while considering the current corporate environment's dynamism and volatility, considering fresh empirical aid for the Trade-off theory. This theory was supported by several authors (Drobetz et al., 2015; Vo et al., 2022; Alnori and Alqahtani, 2019; Kannadhasan et al., 2018; Zhou et al., 2016).

2. Literature review and hypotheses development

2.1. Empirical evidence on SOA

The Trade-off theory has evidence of empirical support from pertinent empirical studies examining the CS SOA. Numerous studies using domestic and multinational samples show an affirmative relationship with SOA, suggesting that businesses do return to goal leverage (Drobetz et al., 2015; Alnori and Alqahtani, 2019). In recent studies, several other authors also confirmed the results (Elsas and Florysiak, 2015; Haron et al., 2013; Kannadhasan et al., 2018; Öztekin and Flannery, 2012; Vo et al., 2022). Additionally, since firms frequently regulate their current debt levels to match the desired leverage ratio, as per the dynamic Trade-off theory, the issue of endurance in CS decisions has lately alluded researchers in advanced as well as emerging nations (Leary et al., 2005; Flannery and Hankins, 2011; Abdeljawad et al., 2013; Morais et al., 2022) are the recent studies that concentrated on European listed companies and used GMM to estimate their dynamic panel data models.

Capital research is seen to advance gradually in emerging nations as well. The study was done from the perspective of developing economies (Mai et al., 2017; Hussain et al., 2018; Memon, 2018; Ahsan et al., 2016; Haron, 2013; Haron, 2018). In India, most recent studies like Bajaj et al. (2020) employed System GMM (Blundell and Bond, 1998) to compare NSE-listed Indian firms and Chinese firms for the years2009–2018 and found that Indian companies reverted to goal at a comparatively higher rate than Chinese firms and mentions inflation rate, stock market development and bond market capitalisation as significant determinants for Indian firms. Moreover, a study by Kumar (2022) focused on energy and metal commodity prices within the Indian context. The study utilised a price adjustment model based on the theory of storage to estimate the time-varying Systematic Originated Risk (SOA) of the commodity market. The results revealed that the SOA for energy commodity prices was approximately 41.8%, whereas for metal commodity prices, it was about 31.6%.

Furthermore, Khan et al. (2022) conducted a study to find the SOA, optimal leverage ratio, and bankruptcy position of the Indian Telecom firms by tools like Altman Z-Score and partial adjustment model, GMM technique. However, empirical studies that concentrate on the dynamic characteristics of CS, estimate the SOA relative to the aim, and identify factors that influence the pace of adjustment are still lacking. Gulzar and Imamul Haque (2022) focused on manufacturing companies and confirmed that the role of CS varies across industries, and the desired target leverage is an important factor in elucidating the current debt levels and adjustment strategies employed by manufacturing companies. Notably, there is not enough research done on India.

Despite significant research efforts and numerous recent contributions that have enhanced our comprehension of the target leverage dynamics of firms, the SOA remains the most pertinent issue in CS research to date (Morais et al., 2022; Huang and Ritter, 2009). The statement is still valid because, of other things, presently, there is scant literature about SOA of steel companies along with finding the impact of various variables with SOA. The main aim of this research is to fill this gap. The research hypotheses tested in the paper's empirical section are then developed.

2.2. Debt adjustment to the target level

According to empirical studies in different nations, companies alter their real debt concerning a target debt ratio. Kremp et al. (1999) discovered debt adjustments of 0.53 and 0.28 for listed businesses in Germany and France, respectively, for both countries. Shyam-Sunder and Myers (1999) found 0.59 for public limited American companies. The ratios for listed businesses in Spain were 0.79; in Britain, they were 0.57; and in Switzerland, they ranged from 0.14 to 0.387, depending on how much debt they used, Miguel and Pindado (2001). Similarly, Haron (2013) and Khan et al. (2022) also confirm that firms occasionally adjust to their target debt. Accordingly, the following hypothesis is formulated:

H_1. : Firms adjust to their target debt level to achieve optimal debt ratio in the Indian Steel Industry.

2.3. Profitability and speed of adjustment

As per the Peckingorder theory, the majority of successful businesses are capable of financing business with their capital and hence turn less toward debt (Titman and Wessels, 1988; Hussain et al., 2018; Bayrakdaroglu, Ege and Yazıcı 2013; Mukherjee and Mahakud, 2010; and Sardo and Serrasqueiro, 2017). So, it can be inferred that there is an adverse relation between the company's Profitability and the adjustment rate. Since most authors predict negative relationships the following hypotheses are formulated:

H_2. There is a negative correlation between Profitability and SOA in Indian Steel Industry.

2.4. Firm size and speed of adjustment

According to several authors (De Jong et al., 2008; Deesomsak, Mitton, 2007), there is an affirmative relation between the Size of a firm and its debt level, according to the Trade-off theory. Due to the support provided by top-tier analysts, larger companies can access capital markets with remarkable ease (Trejo-Pech et al., 2021). Another study (Robiatun and Witiastuti, 2021; Chadha and Seth, 2021; Memon et al., 2020) assessed the relationship between the two variables and claimed that smaller businesses experience higher adjustment costs than larger enterprises. As per the Pecking Order theory (Delcoure, 2007; Rajan and Zingales, 1995; Kouki and Ben Said, 2011), debt and business size are negatively related. Additionally, larger businesses are less likely to have information asymmetry, which results in cheaper funding and rapid adjustment. Hence, the formulated hypothesis is presented as follows:

H_3. There is a significant correlation between Size and SOA in the Indian Steel Industry.

2.5. Growth and speed of adjustment

Trejo-Pech et al. (2021), Moyo et al. (2013), Chadha and Seth (2021), Hergli and Teulon (2014), Irfan (2011), Hussain et al. (2018), among others, imply a positive association between Growth and leverage. However, considerable risks are inherent in these behaviours; authors examine the negative correlation of Growth with SOA, which aligns with the principles of the Trade-off theory (Rajan and Zingales, 1995; Sardo and Serrasqueiro, 2017; Fama and French, 2002; Kim and Sorensen, 1986; Frank and Goyal, 2009). Investment prospects are more excellent for growth companies. However, as borrowing levels rise, the expenses associated with financial hardship rise, which causes the ideal ratio to decline. Consequently, the ability to borrow is reduced, which results in a negative relationship between the two. So, hypothesis is formulated as follows:

H_4. There is a negative correlation between Growth and SOA in the Indian Steel Industry.

2.6. Tangibility and speed of adjustment

Since they offer value as collateral, tangible assets make a more significant percentage of the claims for security made by creditors. As per trade-off theory, leverage and Tangibility have a positive relationship. A corporation is less likely to file for bankruptcy if it has more tangible assets than it does when it relies more heavily on debt (Rajan & Zingles, 1995; Friend and Lang, 1988; Baker and Martin, 2011). The Pecking order theory, which is backed by Harris and Raviv (1991) and Moyo et al. (2013), Mukherjee and Mahakud (2010), Bayrakdaroglu

et al. (2013), Irfan (2011), predict a negative association between the two variables.

H_5. There will be a negative correlation between Tangibility and SOA in the Indian Steel Industry.

2.7. Non-debt tax shield and speed of adjustment

As per Tradeoff theory, a negative correlation exists between NDTS (Non-debt tax shields) and leverage, as companies with higher NDTS tend to have lower debt ratios. This notion is supported by several empirical research, including DeAngelo and Masulis (1980), Frydenberg (2004),Mukherjee and Mahakud (2010), and Titman and Wessels (1988).

H_6. : There is a negative correlation between NDTS and SOA in Indian Steel Industry.

2.8. Liquidity and speed of adjustment

According to the Trade-off theory, leverage and liquidity have an affirmative association. Strong liquidity signals comparatively more leverage because it can pay its short-tenure obligations with more significant cash flows (Ross , 1977). Conversely, the Pecking order theory asserts a conflict between the two since it contends that liquid enterprises employ more retained earnings to finance their investment projects. The Pecking order theory has been supported by several studies such as Titman and Wessels (1988), Myers (1984), Rajan and Zingales (1995), Ozkan (2001), Cahyono and Chawla (2019), Nguyen et al. (2012).

H_7. : There is a negative correlation between Liquidity and SOA in Indian Steel Industry.

2.9. Financial distress and speed of adjustment

Altman's Z score calculates the financial distress. Given that companies with higher leverage typically face a greater risk of financial distress, the Z score is anticipated to be adversely correlated with the amount of debt (Correa et al., 2007, He et al., 2021, Antoniou et al., 2008, Khan et al., 2022).

H_8. : There is a negative correlation between financial distress and SOA in the Indian Steel Industry.

3. Methodology

3.1. Data

The study's empirical research is primarily based on financial information from Indian steel businesses. There were 709 public limited companies in the CMIE Prowess database which belong to the steel sector. After data mapping and clipping, data for 208 companies were available for the past ten years, from 2013 to 2022. Firms with incomplete records of variables were omitted. The data was analysed using STATA (version 15) software for dynamic panel estimation, and only firm or company-specific variables were considered in this study. These six components act as the "core model of leverage." The leftover factors are the least reliable (Frank and Goyal, 2009).

3.2. Variable description

3.2.1. Dependent variable

Leverage has been used to study the dependent variable. It is a measure of CS that can be computed in numerous ways (Titman and Wessels, 1988). Here, leverage is calculated by dividing total debt by the total assets (Rajan and Zingales, 1995; Fama and French, 2002; Booth et al., 2001; Pandey and Chotigeat, 2004).

3.2.2. Independent variable

Based on prior research, only firm-specific explanatory variables are considered. The selection of variables and their forms are influenced by both theoretical and empirical factors. Profitability, Tangibility, Non-debt tax shield (NDTS), Liquidity, firm Size, Growth potential, and financial distress (likelihood of bankruptcy) are the firm-level determinants used in this study.

Table 1 describes the variables used for the study. These are precisely firm-specific variables supported by various authors in previous studies.

3.3. Model estimation

We employ the partial-adjustment model to calculate how quickly a specific firm counteracts the deviation from the target, following Flannery and Rangan (2006), Miguel and Pindado (2001), Lemmon et al. (2008), Kannadhasan et al. (2018), Oztekin and Flannery (2012), and Çolak et al. (2018)). The corporation can rapidly change its CS to a target in a free market economy. Because of this, the observed debt ratio for business' i′ at a time 't' should match the desired debt ratio, $Lev^*_{It} = Lev_{it}$.

Table 1
Variable Description.

S. No	Variable (Codes)	Definition	Sources
1	Leverage (Lev)	Total Debt / Total Assets	Rajan and Zingales (1995),Booth et al. (2001), Pandey (2001),Mukherjee and Mahakud (2010), Chen (2004), Mat Nor et al. (2011), Abor (2005),Nguyen et al. (2012), Alipour et al. (2015), Sofat and Singh (2017), Touil and Mamoghli (2020), Vo et al (2021)
2	Profitability(Prof)	EBIT / Total Assets	Titman and Wessels (1988),Booth et al. (2001), Pandey (2001), Abor (2005), Alipour et al. (2015), Sofat and Singh (2017), Nguyen et al. (2021)
3	Size (Size)	Natural Logarithm of Total Assets	Titman and Wessels (1988),Booth et al. (2001), Chen (2004), Pandey (2001), Bolarinwa and Adegboye (2020), Handoo and Sharma (2014),Sardo and Serrasqueiro (2017), Nguyen et al. (2021), Vo et al., 2022, He (2021)
4	Growth (Growth)	Percentage Change in Total Assets	Titman and Wessels (1988),Bhaduri (2002),Frank and Goyal (2009), Touil (2020)
5	Tangibility (Tang)	Fixed Assets / Total Assets	Rajan and Zingales (1995),Booth et al. (2001), Pandey (2001), Memon et al. (2015), Khemiri and Noubbigh (2018), Vo et al. (2021), He (2021), Abdeljawad and Nor (2011), Kayo and Kimura (2011)
6	Non Debt Tax Shied (NDTS)	Depreciation and Amortization / Total Assets	Titman and Wessels (1988), Huang and Song (2006),Deesomsak et al. (2004), Touil (2020), Vo et al. (2021)
7	Liquidity (Liq)	Current Assets / Current Liabilities	Ozkan (2001), Alipour et al. (2015), Handoo and Sharma (2014), Khémiri and Noubbigh (2018), Rani et al. (2020), Mat Nor et al. (2011),Nguyen et al. (2012)
8	Financial Distress (Bankruptcy Probability)	Altman Z-Score Model	Correa et al. (2007), He (2021), Antoniou et al. (2008),Khan et al. (2022)

Source: Authors Compilation

A corporation can decide against quickly changing the target if the market is unreliable. Indeed, businesses might not be able to fully adapt to the ideal debt ratio in different periods if there are enormous cost adjustments or the financial systems cannot supply their financial needs. Thus, the following formalisation of a partial adjustment model is possible, Gaud et al. (2005); Haron (2013); Khan et al. (2022).

$$Lev_{it} - Lev_{it-1} = \lambda it(Lev^{*}_{it} - Lev_{it-1}) \quad (1)$$

To calculate the desired leverage ratio, the equation presented below is employed.

$$Lev^{*}_{it} = \beta x_{it} + \varepsilon_{it} \quad (2)$$

with $i = 1.$, N (Number of firms) and $t = 1.$, T (Time period). Lev_{it} is the real leverage ratio for firm i in the year t. Lev^{*}_{it} is the target leverage ratio for a firm i^{th}in the year t^{th}, λ is the Speed of adjustment (SOA), x_{it} is a K x 1 vector of the explanatory variables, β is a K x 1 vector of the constants, and ε_{it} is an error term. Combining Eqs. (1) and (2) with Lev_{it} as the formula's subject. The resulting equation is as follows:

$$Lev_{it} = (1-\lambda)Lev_{it-1} + \lambda\beta x_{it} + \alpha_t + \gamma_i + \varepsilon_{it} \quad (3)$$

The unobserved firm-specific effect, denoted as αt, is assumed to be constant over time "t, "γi is an unobserved time-specific effect considered constant over i, and εit is an error term. GMM (Hansen, 1982; Jagannathan et al., 2002) impacts empirical financial research, particularly regarding issues with capital structure and finance in a broader perspective. Endogeneity is the relationship between variables and the error term. Ozkan (2001) suggested GMM addresses the endogeneity issue. In another study, GMM model is used to determine the Speed of adjustment, which is captured by a time constant as well as firm constant coefficients, and analyse how capital structure CS advances in relation to its optimal level. The partial adjustment model is estimated using the Generalized Method of Moments estimators. Arellano and Bond (1991) developed to deal with the endogeneity issue in a dynamic panel model. This approach helps to correct for endogeneity and obtain reliable parameter estimates.

The model is built using the following methodology:

$$\begin{aligned} LEV_{it} = {} & LEV_{it-1} + \beta_1 PROF_{it} + \beta_2 GROWTH_{it} + \beta_3 SIZE_{it} + \beta_4 TANG_{it} \\ & + \beta_5 LIQ_{it} + \beta_6 NDTS_{it} + \beta_7 Zscore_{it} + \alpha_t + \gamma_i + \varepsilon_{it} \end{aligned} \quad (4)$$

In the model, αt represents unobserved firm-specific effects that are assumed to remain constant over time "t." Similarly, γi represents unobserved time-specific effects considered constant over "i." Additionally, εit denotes the error term.

The tests conducted herein are akin to those outlined in the works of Gaud et al. (2005) and Ozkan (2001). Here the null hypothesis is assumed to be of no autocorrelation, which means AR (1) or technically 1st order serial autocorrelation of residuals and AR (2) all follow a consistent distribution N. (0,1). According to Arellano and Bond (1991), estimates are only meaningful if the residuals do not exhibit 2nd order serial autocorrelation.

The Instrumental variable (IV) estimation method is suggested by Gaud et al., (2005), Ozkan (2001), and Drobetz and Wanzenried (2006). This article employs the Arellano and Bond two-step GMM estimate approach (1991).

3.4. Robustness check

The GMM uses the instruments, and Sargan's test, developed by Hansen in 1982, is used to determine the accuracy of the GMM model's instruments. Arellano and Bond identify two special checks that address the consistency concern with the GMM estimator. The Sargan/Hansen test, AR (1), and AR (2) tests are also included by default. Verifying the tools' resilience is a crucial diagnosis in the Dynamic panel data estimate process.

The differenced residuals are examined by the Arellano-Bond test for autocorrelation as well. 1st order and 2nd order serial correlation are two of these tests' frequently used iterations. These examinations aid in assessing the reliability of devices.

3.5. Financial distress (Z Score Model)

This section examines steel firms' financial performance and economic health. Z-Score's financial tools have been applied to this purpose. The cause of the companies' declining performance has been identified using the Z-Score model by Altman. The Z-score approach identifies businesses in financial trouble and at risk of bankruptcy (Reddy and Reddy, 2013). Altman's Z-score investigates the company's profitability, solvency, liquidity, leverage, and efficiency to forecast its Profitability and determine whether it is likely to go bankrupt. Working capital, EBIT, retained earnings, total assets, the book value of equity, and total liabilities are some of the variables this model considers when calculating the Z-score for the companies. Therefore, the initial Z-score model was created especially for enterprises (Aasen, 2011).

Altman's original Z-score formula is:

$$Z = 1.2y1 + 1.4y2 + 3.3y3 + 0.6y4 + 0.99y5$$

Where: y_1 = Working Capital/Total Assets.
y_2 = Retained Earnings/Total Assets
y_3 = Earnings Before Interest and Taxes/Total Assets
y_4 = Market value of Equity/Book value of Total Liabilities
y_5 = Sales/Total Assets
Z Score = Overal l Index

In 1990, MacKie-Mason made revisions to the original Z-score formula by removing the component of the Market value of Equity divided by Book value of total liabilities. This modification was done to facilitate the analysis of the firm's credit standing (CS) and to define the debt ratio as a separate variable within the equation. After the MacKie-Mason study, the updated Z-score was adopted by several researchers (for instance, Güner et al., 2008 and Graham et al., 1998).

The modified version is, therefore:

$$= 3.3(EBIT/TA) + 1.0(Sales/TA) + 1.2(WC/TA) + 1.4(RE/TA)$$

Where EBIT is Earning Before Interest and Taxes, WC is Working Capital, RE is retained earnings, and TA is the Total of Assets. Because the leverage ratio is a primary variable in this investigation, the improved version of MacKie-Mason (1990) was employed (Lee et al., 2011).

An enterprise with a higher Z-score is financially healthier and less distressed than a lower Z-score. Table 2 below shows the various zones of the Z-score.

4. Empirical results and interpretation

4.1. Descriptive results

Table 3 is related to descriptive statistics of the variables, which depict significant variation in the leverage values with 0 as the minimum

Table 2
Z Score.

Z Score	Zone	Comments
Below 1.8	Distress	The likelihood that the company will have financial difficulty soon is considerable, and it may be forced to take drastic measures to stay in business.
Between 1.8 and 2.99	Grey	The company is in the grey category, which suggests there is a lower likelihood that it may soon experience financial trouble.
Above 2.99	Safe	The company demonstrates strong financial stability, minimizing the likelihood of encountering financial difficulties in the future.

Source: Author's Compilations from literature

Table 3
Descriptive Statistics.

Variable	Obs	Mean	Std.Dev.	Min	Max
Lev	2080	0.371	0.332	0	4.247
Prof	2080	0.057	0.137	-1.052	3.263
Size	2080	3.245	0.787	1.356	6.362
Growth	2080	0.164	3.104	-.638	141.109
Tang	2080	0.297	0.173	0.012	0.987
NDTS	2080	0.025	0.015	0.002	0.154
LIQ	2080	1.484	2.98	0	109
zScore	2080	2.026	1.646	-6.367	12.452

Source: Author's Computation using Stata Output

and 4.247% as the maximum value, and a mean of 0.371. The mean value of leverage indicates that steel firm liabilities contribute to approximately 37% of the value of the assets, indicating a lower debt ratio, which is consistent with the results (Tripathy and Asija, 2017). The mean value of Growth is 3.104 indicating Indian steel firms are poised towards high future Growth, and the mean value of liquidity is 1.484 indicating there is not much difference between the minimum and maximum value of Profitability, NDTS, and Tangibility. The mean value is also less for these variables, indicating that there is less variation within these variables respectively. The minimum and maximum values of liquidity are 0 and 109, which suggests that Indian steel firms have a better liquidity position. Overall, it indicates few firms are not performing well, whereas the rest are self-reliant, posing a consistent balance between them.

4.2. Multicollinearity

As shown in Table 4, we employed the Variance Inflation Factor test and found that the mean VIF value is 1.338, less than 10 (Hair, 2006). Therefore, all the variables are suitable for testing SOA to target the leverage of steel firms.

4.3. Speed of adjustment

Using the Generalized Method of Moments, this study examined the Optimal Leverage ratio (OLR), SOA, and factors that help selected steel firms achieve their goals. 1st-order and 2nd-order autocorrelation tests reveal no autocorrelation issue in data. Similarly, the Hansen J statistic shows whether an instrument is valid. The lagged leverage seems affirmative and significant, confirming that the leverage ratio tends to converge with time toward the target CS, which aligns with the dynamic trade-off hypothesis.

Table 6 shows that the lagged value of leverage is 0.5300 at 10% significance level. Therefore, the rate of adjustment is 0.4700 (1–0.5300). It implies that steel firms close 47% of the gap between existing and target(goal) CS in a year. By using the formula of SOA (0.5)/ ln(1- λ) by Huang and Ritter (2009), the value comes out to be 1.09 years (Table 5), which means it takes 1.09 years to offset half of the target leverage from the current leverage. In other words, after converting the rate of adjustment in years (Huang and Ritter, 2009; Ameer, 2010) by using a formula (1/rate of adjustment) as suggested by Mukherjee and Mahakud (2010). We observe that steel firms take 2.13 years (Table 5) to reach the target leverage indicating the existence of dynamic Trade-off theory (Mukherjee and Mahakud, 2010; Flannery and Rangan, 2006; Clark et al., 2009). The more rapid adjustment occurs, the bigger the predicted advantages of bridging the gap to the target CS will be per the dynamic trade-off theory.

Table 4
Variance Inflation Factor.

	VIF	1/VIF
Tang	1.738	.576
zScore	1.608	.622
NDTS	1.45	.69
Prof	1.324	.755
Size	1.217	.822
Liq	1.029	.971
Growth	1.002	.998
Mean VIF	**1.338**	.

Source: Author's Computation Using Stata Output

Table 6
Dynamic Panel Regression Analysis.

lev	Coef.	St. Err.	t-value	p-value	Sig
L.lev	0.531	0.016	33.73	0.000	* **
Prof	-0.111	0.036	-3.09	0.002	* **
Size	0.031	0.025	1.25	0.210	
Growth	-0.001	0.000	-7.70	0.000	* **
Tang	0.107	0.036	2.99	0.003	* **
NDTS	-0.512	0.251	-2.04	0.042	* *
Liq	-0.002	0.001	-2.20	0.028	* *
zScore	-0.048	0.007	-6.53	0.000	* **
Year	-0.003	0.001	-2.15	0.032	* *
Constant	5.812	2.588	2.25	0.025	* *
Mean dependent var.	0.382		SD dependent var.	0.339	
Number of obs.	1872		Chi-square	1387.772	
Group variable	*Company*		*No. of obs.*	*1872*	
Time variable	*Year*		*No. of groups*	*208*	
No. of instruments	*64*		*Obs.per group: min*	*9*	
Wald chi2(9)	*1387.77*		*Avg.*	*9.00*	
Prob > chi2	*0.000*		*Max*	*9*	

* ** $p < 0.01$, * * $p < 0.05$, * $p < 0.1$
Arellano-Bond test for AR(1) in first differences: $z = -2.87$ Pr$> z = 0.004$
Arellano-Bond test for AR(2) in first differences: $z = -0.40$ Pr$> z = 0.688$
Source: Author's Computation Stata Output

Table 5
SOA.

Lev (−1) λ	0.5300 * **
Rate of adjustment	0.4700
Years	2.13
Half-Life	1.09

Source: Author's Calculation Stata Output

The research findings show that companies have goal leverage ratios and promptly reshape their target ratio. Hence H1 for debt adjustment is supported. Businesses must therefore weigh the cost of adjustment and the costs of being outside of their desired ratios. The businesses promptly modify their leverage ratios to reach their goal debt ratios.

From Table 6, it can be inferred that Profitability, Growth, NDTS, Liquidity, and financial distress (Z score) have a significant negative relationship with debt adjustments. In contrast, Tangibility has a significant positive relation with debt adjustment, but Size has an insignificant impact on debt adjustment.Hence H2, H4, H5, H6, H7, and H8 are significant and supported, whereas H3 is found to be insignificant.

It can be seen in Table 6 that the coefficient of Profitability is − 0.111, which means it is significantly negative with debt adjustment, thus supporting pecking order theory, meaning firms pick internal funds over external funds. The results also conform with the results of Drobetz et al. (2007); Memon et al., 2015; Khemiri & Noubbigh, 2018; Frank and Goyal (2009); Oino and Ukaegbu (2015); Rajan and Zingales (1995); Titman & Wessels (1998); Bolarinwa and Adegboye (2020);Sardo and Serrasqueiro (2017); and Kayhan and Titman (2007); and Hussain et al. (2018)). In our study, Size is considered to be insignificantly related to debt adjustment and is not supported by the literature. Tangibility has a coefficient value of 0.107, which means it has a significantly positive relation with leverage ,thus supporting the Pecking Order theory. This means that debt-holders are inclined to lend to Indian steel firms to carry out their financiall obligations, which increases firms' Profitability. Our

results are consistent with those of Bolarinwa and Adegboye (2020); Rajan and Zingales (1995); Khemiri and Noubbĩgh (2018).

Further, the coefficient value of Growth is − 0.001, which is significantly negative with debt adjustments, thereby supporting the Trade-off theory. The results are consistent with the results of (Memon et al., 2015; Khémiri and Noubbigh, 2018) and are contrary to the effects of Arias et al. (2012). Liquidity has a coefficient value of − 0.002, which means it is significantly negative and conforms to the findings of Khemiri and Noubbĩgh, (2018). Hence, the results support the Pecking order theory. This means that Indian Steel firms cannot pay their short-term obligations and are forced to find other sources of finances. NDTS has a coefficient value of − 0.512, which states that it has a significantly adverse relationship with debt adjustment and therefore supports the Trade-off theory. This is due to the fact that NDTS is considered to be a substitute for tax benefits for using debt. These findings are consistent with Deangelo and Masulis (1980). The relationship of debt adjustment with financial distress (Z score) is significantly negative. The above results demonstrate that financial distress reduces the adjustment rate toward the desired debt ratio. This is because bankruptcy comes with some direct cost. The results imply that financial distress is a significant factor in determining the transaction costs of steel companies in India. This study backs up the conclusions made by Mirza et al. (2017), Khan et al. (2022).

5. Conclusion, limitations, implications, and future directions

The findings of our study shed light on adjustment framework of capital structure of the Indian steel industry. It gives new evidence of the application of dynamic trade-off theory in the Indian Steel industry. This study discusses the two aspects of econometric and financial distress. The first one is finding the CS speed of adjustment by applying dynamic panel data analysis, and the other one is finding the bankruptcy position of the steel industry in India. The result of the study states that steel firms take 2.13 years to achieve the target leverage, indicating a dynamic trade-off theory (‘Flannery and Rangan, 2006; Clark et al., 2009; Mukherjee and Mahakud, 2010). Profitability, Growth, NDTS, Liquidity, and Bankruptcy (Z score) have a significant negative correlation with debt adjustments. In contrast, Tangibility has a significant positive relationship with debt adjustment, but Size has an insignificant impact on debt adjustment. The result also reveals that the financial standing of steel firms in India was weak overall. Therefore, these businesses must improve their working capital, Profitability, sales, and leverage positions.

It is recommended that leading companies in the market, such as ArcelorMittal Nippon Steel India Ltd., Jindal Stainless Ltd., Steel Authority of India Ltd., Uttam Galva Steels Ltd., Prakash Industries Ltd., Mukand Ltd., etc., should Concentrate on restructuring their debt obligations, managing interest payments, and formulating novel strategies to address financial distress while enhancing their financial practices. On the other hand, JSW Steel Ltd and Tata Steel Ltd fall into the Grey Zone of the Z-Score, indicating that they need to pay close attention to their debts and interest payments to ensure the efficient operation of their businesses.

The findings suggest that a dynamic trade-off theory can be inferred from the results. in the Indian steel industry, as it can quickly adjust its debt levels to achieve its target ratio. One potential explanation for the observed Speed of adjustment could be that companies face substantial costs when they deviate from their target leverage, and their leverage ratios persist over time. However, the coefficient of the lagged leverage ratio suggests that this adjustment process incurs costs, as it falls somewhere between zero and one. It aligns with the notion that firms may weigh the costs of two distinct types of expenses: modifying their target ratios and being out of equilibrium.

As the leverage framework is influenced by firm-specific variables, they take centre stage in our analysis. The study does not include the variables that are country-specific. Due to specific characteristics in the Indian steel industry, the results can be exclusive to steel companies. However, different industries on a global and national scale can be considered. Only the steel industry is considered for studying eight core industries in India.

This study implies that this study will help the management and steel firms, in general, to adjust their CS following their risk-reward analysis taking into consideration the time it takes to adjust to their target capital structure since it impacts the financial productivity as well as the financial distress of the steel firms. The study has implications for corporate executives, investors, and policymakers in India regarding the transition costs associated with changing a steel company’s financing decisions. Firms can use these results while selecting target capital structure. Considering the importance of capital structure on investors’ decisions, this study will help investors to make their decisions not only by focusing upon the capital structure but also by considering the other determining factors which are addressed in this study.

Furthermore, government entities can make policies according to their leverage structure to prevent the steel firms from incurring losses and repay their debts after considering the impact of the Speed of adjustment on CS.

Future directions to this study would be to survey core Industries other than the steel industry, like cement, electricity, Petroleum, natural gas, coal, refinery products, and Fertilizer being vital industries of a country that helps in nation-building. In this study, we have conducted research based on firm-specific variables. Future research could include country-specific variables (such as interest rate, GDP, and inflation) to get a holistic macro-level view. Considering the continuously changing economic conditions, further studies can also assess the impact of economic uncertainties on the speed of leverage adjustments, capital structure, and financial distress in different industries and sectors across various countries. Further, researchers can also conduct a comparative study of firms in the energy sector across different emerging or developed countries. Additionally, a few factors related to human resources, such as intellectual capital and corporate social responsibility can also be considered, as they are significantly related with firm’s capital and also affect firm performance significantly (Al-Shammari et al., 2022; Ali et al., 2023).

Funding

There is no funding received for this research.

Ethical statement

Not applicable, there is no any involvement of human or animals while conducting this study.

CRediT authorship contribution statement

Mohd Abdullah: Conceptualization, Methodology, Software. **Ishfaq Gulzar:** Data curation, Writing – original draft. **Asiya Chaudhary:** Visualization, Investigation. **Mosab I. Tabash:** Supervision, Writing – original draft. **Umra Rashid:** Software, Validation. **Ishrat Naaz:** Writing – review & editing. **Ammar Ali:** Conceptualization, Methodology.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Aasen, M.R. (2011), "Applying Altman’s Z-score to the financial crisis: an empirical study of financial distress on Oslo stock exchange", master’s thesis.

Abdeljawad, I., Nor, F.M., Ibrahim, I., Abdul, R., 2013. Dynamic capital structure trade-off theory: evidence from Malaysia. Proc. 3rd Glob. Account. 9 (6), 1–10. Finance and Economics Conference 5-7 May.
Abdeljawad, I., & Nor, F. M. (2011). Timing behavior versus adjustment towards the target: What determines the capital structure dynamics.
Abor, J., 2005. The effect of capital structure on profitability: an empirical analysis of listed firms in Ghana. J. Risk Res. 6 (5), 438–445.
Ahsan, T., Wang, M., Qureshi, M.A., 2016. How do they adjust their capital structure along their life cycle? An empirical study about capital structure over life cycle of Pakistani firms. J. Asia Bus. Stud. 10 (3), 276–302. https://doi.org/10.1108/jabs-06-2015-0080.
Ali, J., Naaz, I., Ali, T., 2023. Does corporate social responsibility improve value-added intellectual capital efficiency in food and agribusiness firms in India? Int J. Discl. Gov. https://doi.org/10.1057/s41310-023-00196-2.
Alipour, M., Mohammadi, M.F.S., Derakhshan, H., 2015. Determinants of capital structure: an empirical study of firms in Iran. International Journal of Law and Management 57 (1), 53–83.
Alnori, F., Alqahtani, F., 2019. Capital Structure and Speed of adjustment in non-financial firms: does Sharia compliance matter? evidence from Saudi Arabia. Emerg. Mark. Rev. 39, 50–67. https://doi.org/10.1016/j.ememar.2019.03.008.
Al-Shammari, M.A., Banerjee, S.N., Rasheed, A.A., 2022. Corporate social responsibility and firm performance: a theory of dual responsibility. Manag. Decis. 60 (6), 1513–1540.
Ameer, R., 2010. Determinants of corporate hedging practices in Malaysia. Int. Bus. Res. 3 (2) https://doi.org/10.5539/ibr.v3n2p120.
Antoniou, A., Guney, Y., Paudyal, K., 2008. The determinants of capital structure: capital market oriented versus bank-oriented institutions. J. Financ. Quant. Anal. Vol. 43 (No. 1), 59–92.
Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Rev. Econ. Stud. Vol. 58 (No. 2), 277–297.
Aybar-Arias, C., Casino-Martínez, A., López-Gracia, J., 2011. On the adjustment speed of smes to their optimal capital structure. Small Bus. Econ. 39 (4), 977–996. https://doi.org/10.1007/s11187-011-9327-6.
Bajaj, Y., Kashiramka, S., Singh, S., 2020. Capital structure dynamics: China and India (Chindia) perspective. Eur. Bus. Rev. 32 (5), 845–868. https://doi.org/10.1108/ebr-09-2019-0203.
Baker, H.K., Martin, G.S. (2011). Capital Structure and corporate financing decisions. https://doi.org/10.1002/9781118266250.
Baker, M., Wurgler, J., 2002. Market timing and capital structure. J. Financ. Vol. 57 (No. 1), 1–32.
Balakrishnan, C., 2016. A study on financial performance of steel industry in India. Int. J. Adv. Res. Innov. Ideas Educ. 2 (4), 252–261.
Bayrakdaroglu, A., Ege, I., Yazici, N., 2013. A panel data analysis of capital structure determinants: empirical results from turkish capital market. Int. J. Econ. Financ. 5 (4) https://doi.org/10.5539/ijef.v5n4p131.
Bhaduri, S.N., 2002. "Determinants of capital structure choice: a study of the Indian corporate sector". Appl. Financ. Econ. Vol. 12 (No. 9), 655–665. https://doi.org/10.1080/09603100010017705.
Blundell, R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. J. Econ. 87 (1), 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8.
Bolarinwa, S.T., Adegboye, A.A., 2020. Re-examining the determinants of capital structure in Nigeria. J. Econ. Adm. Sci. 37 (1), 26–60. https://doi.org/10.1108/jeas-06-2019-0057.
Booth, L., Aivazian, V., Demigurc-Kunt, A., Maksimovic, V., 2001. "Capital structure in developing countries". J. Financ. Vol. 56 (No. 1), 87–130.
Cahyono, Satriyo Budi, Chawla, Arvinder Singh, 2019. Dynamic capital structure in Indonesian case: do industry-specific variables affect adjustment speeds? Invest. Manag. Financ. Innov. 16 (2), 218–235. https://doi.org/10.21511/imfi.16(2).2019.19.
Chadha, S., Seth, H., 2021. Ownership structure and capital structure: a panel data study. Int. J. Bus. Innov. Res. 24 (3), 385. https://doi.org/10.1504/ijbir.2021.113515.
Chen, J.J., 2004. Determinants of capital structure of Chinese-listed companies. Journal of Business Research 57 (12), 1341–1351.
Clark, B.J., Francis, B.B., Hasan, I., 2009. DO firms adjust toward target capital structures? Some international evidence. SSRN Electron. J. https://doi.org/10.2139/ssrn.1364095.
Çolak, G., Gungoraydinoglu, A., Öztekin, Ö., 2018. Global leverage adjustments, uncertainty, and country institutional strength. J. Financ. Inter. 35, 41–56. https://doi.org/10.1016/j.jfi.2018.01.010.
Correa, C., Basso, L. C., Nakamura, W. T. (2007). What determines the capital structure of the largest Brazilian firms? An empirical analysis using panel data. *An Empirical Analysis Using Panel Data.*
De Jong, A., Kabir, R., Nguyen, T.T., 2008. Capital structure around the world: The roles of firm- and country-specific determinants. J. Bank. amp; Financ. 32 (9), 1954–1969. https://doi.org/10.1016/j.jbankfin.2007.12.034.
DeAngelo, H., Masulis, R.W., 1980. Optimal capital structure under corporate and personal taxation. J. Financ. Econ. 8 (1), 3–29. https://doi.org/10.1016/0304-405x(80)90019-7.
Deesomsak, R., Paudyal, K., Pescetto, G., 2004. The determinants of capital structure: Evidence from the Asia Pacific region. J. Multinatl. Financ. Manag. 14 (4–5), 387–405. https://doi.org/10.1016/j.mulfin.2004.03.001.
Delcoure, N., 2007. The determinants of capital structure in transitional economies. Int. Rev. Econ. amp; Financ. 16 (3), 400–415. https://doi.org/10.1016/j.iref.2005.03.005.
Drobetz, W., Wanzenried, G., 2006. "What determines the speed of adjustment to the target capital structure? Appl. Financ. Econ. Vol. 16 (No. 13), 941–958.
Drobetz, W., Pensa, P., Wanzenried, G., 2007. Firm characteristics, economic conditions and capital structure adjustments. SSRN Electron. J. https://doi.org/10.2139/ssrn.924179.
Drobetz, W., Schilling, D.C., Schröder, H., 2015. Heterogeneity in the speed of capital structure adjustment across countries and over the business cycle. Eur. Financ. Manag. Vol. 21 (No. 5), 936–973.
Elsas, R., Florysiak, D., 2015. Dynamic capital structure adjustment and the impact of fractional dependent variables. J. Financ. Quant. Anal. 50 (5), 1105–1133. https://doi.org/10.1017/S0022109015000496.
Fama, E.F., French, K.R., 2002. Testing trade-off and pecking order predictions about dividends and debt. Rev. Financ. Stud. 15 (1), 1–33. https://doi.org/10.1093/rfs/15.1.1.
Fischer, E.O., Heinkel, R., Zechner, J., 1989. 'Dynamic capital structure choice: theory and tests. J. Financ. vol. 44 (1), 19–40.
Flannery, M.J., Rangan, K.P., 2006. Partial adjustment toward capital structures. J. Financ. Econ. Vol. 79 (No. 3), 469–506.
Flannery, M.J., Hankins, K.W., 2011. Estimating dynamic panel models in corporate finance. SSRN Electron. J. https://doi.org/10.2139/ssrn.1108684.
Frank, M.Z., Goyal, V.K., 2009. Capital structure decisions: which factors are reliably important? Financ. Manag. Vol. 38 (No. 1), 1–37.
Frank, M.Z., Goyal, V.K., 2009. Capital structure decisions: which factors are reliably important? Financ. Manag. 38 (1), 1–37. https://doi.org/10.1111/j.1755-053x.2009.01026.x.
Frank, M.Z., Shen, T., 2013. Common factors in corporate capital structure. SSRN Electron. J. https://doi.org/10.2139/ssrn.2288767.
Friend, I., Lang, Larry H.P., 1988. An empirical test of the impact of managerial self-interest on corporate capital structure. J. Financ. 43 (2), 271–281. https://doi.org/10.1111/j.1540-6261.1988.tb03938.x.
Frydenberg, S., 2004. Determinants of corporate capital structure of Norwegian Manufacturing Firms. SSRN Electron. J. https://doi.org/10.2139/ssrn.556634.
Gaud, P., Jani, E., Hoesli, M., Bender, A., 2005. "The capital structure of Swiss companies: an empirical analysis using dynamic panel data. Eur. Financ. Manag. Vol. 11 (No. 1), 51–69.
Graham, J.R., Lemmon, M.L., Schallheim, J.S., 1998. Debt, lease, taxes, and the endogeneity of corporate tax status. J. Financ. Vol. 53 (No. 1), 131–162.
Gulzar, Ishfaq, Imamul Haque, S.M., 2022. Determining the key factors of corporate leverage in Indian manufacturing firms using dynamic modelling. Cogent Bus. Manag. 9, 1. https://doi.org/10.1080/23311975.2022.2149145.
Hair, J.F., 2006. Multivariate Data Analysis. Pearson Education.
Handoo, A., Sharma, K., 2014. A study on determinants of capital structure in India. Chicago IIMB Management review 26 (3), 170–182.
Hansen, L.P., 1982. Large sample properties of generalized method of moments estimators. Econometrica Vol. 50 (No. 4), 1029–1054.
Haron, R., 2018. Firm-level, ownership concentration and industry level determinants of capital structure in an emerging market: Indonesia evidence. Asian Acad. Manag. J. Account. Financ. 14 (1), 127–151. https://doi.org/10.21315/aamjaf2018.14.1.6.
Haron, R., Ibrahim, K., Nor, F.M., Ibrahim, I., 2013. Factors affecting Speed of adjustment to target leverage: Malaysia evidence. Glob. Bus. Rev. 14 (2), 243–262. https://doi.org/10.1177/0972150913477469.
Harris, M., Raviv, A., 1991. The theory of capital structure. J. Financ. Vol. 46 (No. 1), 297–355.
He, Y., Xu, L., Yang, M., 2021. The impact of tunnelling on financial distress and resolution: Evidence from listed firms in China. International Journal of Finance & Economics 26 (2), 1773–1792.
Hergli, S., Teulon, F. (2014). Capital structure's explanatory factors: The Maghreb case, IPAG business school, working papers series.
Huang, R., Ritter, J.R., 2009. Testing theories of capital structure and estimating the speed of adjustment. J. Financ. Quant. Anal. Vol. 44 (No. 2), 237–271.
Hussain, H.I., Abidin, I.S., Kamarulzaman, R., Shawtari, F.A., 2018. The impact of state-affiliated directors on the Capital Structure Speed of adjustment in an emerging market. Pol. J. Manag. Stud. 18 (1), 133–148. https://doi.org/10.17512/pjms.2018.18.1.11.
Jagannathan, R., Skoulakis, G., Wang, Z., 2002. Generalized methods of moments. J. Bus. amp; Econ. Stat. 20 (4), 470–481. https://doi.org/10.1198/073500102288618612.
Kannadhasan, M., Thakur, B.P., Gupta, C.P., Charan, P., 2018. Testing capital structure theories using error correction models: Evidence from China, India, and South Africa. Cogent Econ. Financ. 6 (1), 1443369 https://doi.org/10.1080/23322039.2018.1443369.
Kayhan, A., Titman, S., 2007. Firms' histories and their capital structures☆. J. Financ. Econ. 83 (1), 1–32. https://doi.org/10.1016/j.jfineco.2005.10.007.
Kayo, E.K., Kimura, H., 2011. Hierarchical determinants of capital structure. Journal of banking & finance 35 (2), 358–371.
Khan, T., Shamim, M., Khan, M.A., 2022. Leverage strategies of Indian telecom sector: a dynamic panel data approach. Indian Growth Dev. Rev. 15 (1), 139–164. https://doi.org/10.1108/igdr-03-2021-0045.
Khémiri, W., Noubbigh, H., 2018. Determinants of capital structure: evidence from sub-Saharan African firms. Q. Rev. Econ. Financ. 70, 150–159.
Kim, W.S., Sorensen, E.H., 1986. Evidence on the impact of the agency costs of debt on corporate debt policy. J. Financ. Quant. Anal. 21 (2), 131. https://doi.org/10.2307/2330733.
Kouki, M., Ben Said, H., 2011. Capital structure determinants: new evidence from French panel data. Int. J. Bus. Manag. 7 (1) https://doi.org/10.5539/ijbm.v7n1p214.

Kremp, E., Stöss, E., Gerdesmeier, D., 1999. Estimation of a debt function: evidence from French and German firm panel data. Jt. Res. Dtsch. Bundesbank Banq. De. Fr. 139–194.
Kumar, S., 2022. Speed of adjustment in energy and metal prices: Evidence from India. Resour. Policy 78, 102911. https://doi.org/10.1016/j.resourpol.2022.102911.
Leary, Mark, T., Roberts, Michael, R., 2005. DO firms rebalance their capital structures? J. Financ. 60 (6), 2575–2619. https://doi.org/10.1111/j.1540-6261.2005.00811.x.
Lee, S., Koh, Y., Kang, K.H., 2011. Moderating effect of capital intensity on the relationship between leverage and financial distress in the U.S. restaurant industry. Int. J. Hosp. Manag. 30 (2), 429–438. https://doi.org/10.1016/j.ijhm.2010.11.002.
Lemmon, M.L., Roberts, M.R., Zender, J.F., 2008. "Back to the beginning: persistence and the cross section of corporate capital structure". J. Financ. Vol. 63 (No. 4), 1575–1608.
Lutz, C., Meyer, B., Nathani, C., Schleich, J., 2005. Endogenous technological change and emissions: the case of the German steel industry. Energy Policy 33 (9), 1143–1154.
MacKie-Mason, J., 1990. Do taxes affect corporate financing decisions? J. Financ. Vol. 45 (No. 5), 1471–1493. https://doi.org/10.2307/2328746.
Mai, Y., Meng, L., Ye, Z., 2017. Regional variation in the capital structure adjustment speed of listed firms: Evidence from China. Econ. Model. 64, 288–294. https://doi.org/10.1016/j.econmod.2017.03.028.
Memon, P.A., Md Rus, R., Ghazali, Z., 2015. Dynamism of capital structure: Evidence from Pakistan. Journal of International Business and Economics 3 (1), 52–63.
Memon, P.A., Md-Rus, R., Ghazali, Z.B., 2020. Adjustment speed towards target capital structure and its determinants. Econ. Res. -Èkon. 34 (1), 1966–1984. https://doi.org/10.1080/1331677x.2020.1860792.
Miguel, A., Pindado, J., 2001. Determinants of capital structure: new evidence from Spanish panel data. J. Corp. Financ. Vol. 7 (No. 1), 77–99.
Mirza, S.S., ur Rehman, A., Zhang, X.Z., 2017. Adjustment behaviour of leverage in Chinese firms: an empirical analysis of overall firms, state-owned and non state-owned enterprises. Asian Acad. Manag. J. Account. Financ. 12 (2), 95–126. https://doi.org/10.21315/aamjaf2016.12.2.5.
Mitton, T., 2007. Why have debt ratios increased for firms in emerging markets. Eur. Financ. Manag. 14 (1), 127–151. https://doi.org/10.1111/j.1468-036x.2007.00430.x.
Modigliani, F., Miller, M., 1958. The cost of capital, corporation finance and the theory of investment. Am. Econ. Rev. Vol. 48 (No. 3), 361–397.
Morais, F., Serrasqueiro, Z., Ramalho, J.J.S., 2022. Capital structure speed of adjustment heterogeneity across zero leverage and leveraged European firms. Res. Int. Bus. Financ. 62, 101682 https://doi.org/10.1016/j.ribaf.2022.101682.
Moyo, V., Wolmarans, H., Brummer, L., 2013. Trade-off or pecking order: evidence from South African manufacturing, mining, and retail firms. Int. Bus. amp; Econ. Res. J. (IBER 12 (8), 927. https://doi.org/10.19030/iber.v12i8.7989.
Mukherjee, S., Mahakud, J., 2010. Dynamic adjustment towards target capital structure: evidence from Indian companies. J. Adv. Manag. Res. Vol. 7 (No. 2), 250–266.
Myers, S.C., 1984. The capital structure puzzle. J. Financ. Vol. 39 (No. 3), 575–592.
Nguyen, D.T., Diaz-Rainey, I., Gregoriou, A. (2012), Financial Development and the Determinants of Capital Structure in Vietnam, February 22. Available from: ⟨http://www.dx.doi.org/10.2139/ssrn.2014834⟩.
Nguyen, T., Bai, M., Hou, Y., Vu, M.C., 2021. Corporate governance and dynamics capital structure: evidence from Vietnam. Global Finance Journal 48, 100554.
Oino, I., Ukaegbu, B., 2015. The impact of profitability on capital structure and speed of adjustment: an empirical examination of selected firms in Nigerian Stock Exchange (Available at). Res. Int. Bus. Financ. 35, 111–121. https://doi.org/10.1016/j.ribaf.2015.03.004.
Ozkan, A., 2001. Determinants of capital structure and adjustment to long run target: evidence from UK company panel data. J. Bus. Financ. Account. Vol. 28 (Nos 1/2), 175–198.
Öztekin, Ö., Flannery, M.J., 2012. Institutional determinants of capital structure adjustment speeds. J. Financ. Econ. 103 (1), 88–112. https://doi.org/10.1016/j.jfineco.2011.08.014.
Pandey, I.M., 2005. Financial Management, nineth ed. Vikas Publishing House, New Delhi.
Pandey, I.M., Chotigeat, T., 2004. Theories of capital structure: Evidence from an emerging market. Stud. Econ. Financ. 22 (2), 1–19. https://doi.org/10.1108/eb028777.
Pandey, I. M. (2001). Capital structure and the firm characterstics: evidence from an emerging market.
Rajan, R.G., Zingales, L., 1995. What do we know about capital structure? Some evidence from international data. J. Financ. Vol. 50 (No. 5), 1421–1460.
Rani, N., Yadav, S.S., Tripathy, N., 2020. Capital structure dynamics of Indian corporates. Journal of Advances in Management Research 17 (2), 212–225.
Robiatun, B., Witiastuti, R.S., 2021. The heterogeneity of Speed of adjustment capital structure across industrial sectors. Manag. Anal. J. 10 (1), 103–114. https://doi.org/10.15294/maj.v10i1.45317.
Ross, S.A., 1977. The determination of financial structure: the incentive-signalling approach. Bell J. Econ. 8 (1), 23. https://doi.org/10.2307/3003485.
Sardo, F., Serrasqueiro, Z., 2017. Does dynamic trade-off theory explain Portuguese SME capital structure decisions? J. Small Bus. Enterp. Dev. Vol. 24 (No. 3), 485–502. https://doi.org/10.1108/JSBED-12-2016-0193.
Shyam-Sunder, L., Myers, S.C., 1999. "Testing static trade-off against pecking order models of capital structure. J. Financ. Econ. Vol. 51 (No. 2), 219–244.
Sofat, R., Singh, S., 2017. Determinants of capital structure: an empirical study of manufacturing firms in India. International Journal of Law and Management 59 (6), 1029–1045.
Takeh, A., Navaprabha, J., 2015. Capital structure and its impact on financial performance of Indian steel industry. Int. J. Manag. (IJM) 6 (6), 29–38.
Titman, S., Wessels, R., 1988. The determinants of capital structure choice. J. Financ. Vol. 43 (No. 1), 1–19.
Touil, M., Mamoghli, C., 2020. Institutional environment and determinants of adjustment speed to the target capital structure in the MENA region. Borsa Istanbul Review 20 (2), 121–143.
Trejo-Pech, C.O., Kyaw, N.N.A., He, W., 2021. Capital structure adjustment behavior of listed firms on the mexican stock exchange. J. Econ. Financ. 45 (4), 573–595. https://doi.org/10.1007/s12197-021-09555-7.
Tripathy, N., Asija, A., 2017. The impact of financial crisis on the determinants of capital structure of listed firms in India. J. Int. Bus. Econ. 18 (1), 101–121. https://doi.org/10.51240/jibe.2017.1.5.
Vo, T.A., Mazur, M., Thai, A., 2022. The impact of COVID-19 economic crisis on the speed of adjustment toward target leverage ratio: An international analysis. Financ. Res. Lett. 45, 102157. https://doi.org/10.1016/j.frl.2021.102157.
Zhou, Q., Tan, K.J.K., Faff, R., Zhu, Y., 2016. Deviation from target capital structure, cost of equity and speed of adjustment. J. Corp. Financ. Vol. 39, 99–120, 10.1016/j.j.