The Determinants of Corporate Debt Maturity for NSE-Listed Corporates

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Abstract

The maturity structure of corporate debt is one of the significant financing choices that a firm must make simultaneously while deciding how to finance its operational and investment decisions. Even though the capital structure is one of the scrutinized topics of interest in the area of corporate finance literature, there are scarce studies investigating corporate debt maturity—even less so in the context of emerging markets. The choice of a suitable debt maturity structure is extremely relevant for firms as it can enable them to avoid mismatch by aligning assets in line with liabilities, address agency related problems, sidestep the ill effects of cost of capital and signal about the firms' earning quality and value. The study investigates the firm-specific and macroeconomic determinants that are significant for a debt maturity structure of Indian corporate firms. A sample of 29 non-financial firms listed on the National Stock Exchange during the period 2008–2016 was taken to test the hypothesis. Employing fixed effects panel data analysis, the study provides an empirical evidence that firm size, liquidity, asset maturity and base rate have significant effects on debt maturity choice in the Indian context, whereas tax effects, growth rate, firm quality and wholesale price index are not significantly related to the debt maturity structure.

Introduction

The cutting-edge work of Modigliani and Miller (1958) presented a basis for what is conventionally characterized as the modern corporate finance. The basic Modigliani-Mille (M&M) theorem states that in the absence of taxes, bankruptcy costs, agency costs and asymmetric information, and in an efficient market, the value of a firm is unaffected by how that firm is financed. In their paper (Miller, 1977; Miller & Modigliani, 1961; Modigliani & Miller, 1963), they elaborated on the conditions under which the firm would be largely indifferent to the sources of its financing in an efficient capital structure. 'I will argue that even in a world in which interest payments are fully deductible in computing corporate income taxes, the value of the firm, in equilibrium will still be independent of its capital structure' (Miller, 1977). In other words, decisions about the debt maturity can never improve the value of a firm.

Nevertheless, in a real market, especially in developing countries like India, where the capital markets are not efficient,

choosing the appropriate debt maturity structure can largely affect the firms' value, avoid mismatch while aligning assets structure in line with liabilities, can mitigate the ill effects of cost of capital, address agency-related problems and can signal significant information about firms' earning quality (Cai, Fairchild & Guney, 2008). Capital structure and dividend policy are presumably the widely studied issues in corporate finance. However, the maturity structure of the firm's financing has sought little attention until now, particularly in the context of emerging economies like India. In this study, we extend the existing literature on corporate debt in India to analyse the determinants of the maturity structure of the firm's debt using a significant sample of 29 non-financial firms listed on the National Stock Exchange (NSE). Further, focusing on a single country brings out country-specific details and characteristics not emphasized in cross-country studies.

Almeida et al. (2009) further revealed a novel link between the debt maturity structure and corporate investment in the light of the 2007 credit crisis and pointed out the

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importance of the debt maturity structure for corporate financial flexibility. The study documented that the immediate impact of the financial crises made financially constrained firms from the USA and Europe to run through cash reserves; to cut back on capital investment, employment, research and development spending, marketing expenditures and dividends; to run on their bank credit lines; and to sell assets to procure cash. It becomes evident from this that focusing firms in emerging markets will even face stricter financial constraints than similar firms in developed market, if such a situation arises. Evidence even suggests that the debt maturity structure is a significant variable in understanding how credit supply shocks get transmitted in the corporate sector. The fact that the debt maturity structure has crucial implications for macroeconomic and financial stability in developing economies (e.g., Schmukler & Vesperoni, 2006) makes this issue worthy of note. In such a context, understanding how firms manage their debt thus becomes more than an academic question than to become a real-world problem for practising managers as well as for economic policymakers.

Various theories, that is, agency theory, signalling and liquidity risk theory, matching principles and tax benefit theory, try to identify the maturity structure of corporate debt. However, which is the best theory in explaining the debt maturity structure? One approach to the problem is to revisit the determinants of the debt maturity structure using a more robust technique. To the best of our understanding, there are hardly any empirical studies with regard to the debt maturity structure in the Indian context. This study bridges this gap in the literature and also attempts to update the existing inconclusive evidences and further analyses the role of monetary authorities in promoting the availability of long-term debt (LTD) finance. The importance of non-mutually exclusive views on agency costs, liquidity, signalling and taxes for the liability term structure of firms operating in a transition economy has been confirmed in this study. The study presents robust evidence that constrained and unconstrained firms respond differently to liquidity risk and, therefore, practice distinct debt maturity strategies (Stephan, Talavera, & Tsapin, 2011).

The article is organized as follows. The next section presents the theoretical framework underlying the prominent theories on the corporate debt maturity structure and the current empirical studies investigating the same. The third section details the methodology, the data sources and describes the variables used in the empirical model. The fourth section reports the empirical results and findings in the context of modelling the corporate debt maturity structure. The final section concludes the article.

Literature Review

Before the study proceeds to develop an empirical model for the determinants of the corporate debt maturity structure in India, there is a strong need to present a survey of theoretical literature in order to depart towards our empirical research. There are mainly four types of debt maturity theories which cover aspects of agency costs—signalling and liquidity risks, matching principles and tax effect theories. We consider each in turn by defining the suggested variables that could have an impact on the debt maturity structure. In literature, there has been a practice of using corresponding proxies to formulate the hypothesis regarding the relationship of debt maturity with other firm characteristics and macroeconomic variables.

Theoretical Framework

Agency Theory

'External financing comes with costs and benefits, on one hand, it disciplines management, but on the other hand, it makes the firm vulnerable in its product markets' (Bolton & Scharfstein, 1990). Thus, there is evidently a role of debt in reducing agency costs between shareholders and managers. Myers (underinvestment and asset substitution, 1977) represented that short-term debt mitigates the 'underinvestment' problem. 'Firms do not pursue relatively riskier projects because creditors get more benefits from these investments'. The underinvestment problem gets more severe if a firm has more growth opportunities. When firms grow very quickly, their financing needs exceed their internal resources, while large firms tend to grow at rates that could be financed without access to long-term credit or to the stock market (Demirgüç-Kunt, & Maksimovic, 1998). Faster the firm's growth, the more restricted is their access to credit.

Following earlier research, the study operationalizes agency-related costs with growth opportunities and firm size. Therefore, the testable hypotheses under the agency (or contracting cost) theory are:

H_1: High growth opportunities have a negative impact on the debt maturity structure.

H_2: Firm size has a positive effect on the debt maturity structure.

Signalling and Liquidity Risk Theories

As per Flannery's 'Asymmetric Information and Risky Debt Maturity Choice' (March 1986), firm's choice of risky debt maturity can signal insiders' information about firm quality. With positive transaction costs, high-quality firms sometimes effectively signal their true quality to the market. Therefore, the signalling hypothesis is also extracted from information asymmetry, and it suggests that the maturity choice is used by firms as a way to signal their high quality to the market and as a result, this signal reduces the firm's cost of capital (Flannery, 1986). This theory suggests that the issuance of short-term debt is a positive signal of the good quality of the firm.

Thus, Flannery (1986) derived a separating equilibrium with positive transaction costs in which riskier borrowers are not able to afford costs of short-term debt and prefer

LTD, while low-risk borrowers prefer short-term debt. Kale and Noe (1990) suggested that similar separating equilibrium is possible even in a framework without transaction costs (Kale & Noe, 1990). Consequently, the testable hypotheses under the signalling and liquidity risk theories can be stated as:

H_3: Firms' quality has a negative effect on the debt maturity structure.

H_4: Liquidity has a positive impact on the debt maturity structure.

H_5: Leverage has a positive effect on the debt maturity structure.

Matching Principles

Stohs and Mauer's (1996) found that larger, less risky firms with longer term asset maturities use longer term debt. They measure the asset maturity by taking the ratio of the weighted maturity of current assets and the weighted maturity of fixed assets. If physical assets are more, then these assets can be used as collateral, reducing the creditor's risk of suffering such agency costs of debt. Hence, high tangible assets are expected to be associated with high LTDs. Hence, the testable hypothesis under the matching principle theory is stated as:

H_6: The asset maturity structure has a positive impact on the debt maturity structure.

Tax Hypothesis

As per Gordon and Lee (2006), the net tax gain from the use of corporate debt is proportional to nominal interest rates so that firms respond in the times of high-interest rates. On the same grounds, it can be hypothesized that firms should shift towards more LTD as long-term rates rise relative to short-term rates. LTD is more expensive so the firm can avoid more taxes while having higher profitability. This theory represents that the optimum debt maturity structure is a trade-off between tax advantages for firm debts and disadvantages of agency costs. However, Kane, Marcus and McDonald (1985) by constructing an option valuation model have provided empirical evidence against the universal validity of such advantages. They state that meaningful measure of advantage to debt is the extra rate of return, net of the market premium for bankruptcy risk. It indicates that the tax shield advantage is inversely related to debt maturity. In other words, if the effective tax rate is low, then firms prefer to issue LTD. Further, as per Graham (2000), large, liquid, profitable firms with low expected distress costs use debt conservatively. The testable hypothesis under the trade-off theory can be:

H_7: Tax effects have a negative impact on the corporate debt maturity structure.

Empirical Review of the Literature

There is a dearth of empirical studies on the debt maturity structure; although there are quite few research studies that have dealt with the issue indirectly; for example, Titman and Wessels (1988), Barclay and Smith (1995), Bevan and Danbolt (2002) employed alternative measures of borrowing (long term and short term) and associated them with firm-specific characteristics while investigating the determinants of borrowing choice of the firms. Existing literature dealing directly with the subject of debt maturity majorly concentrate on the developed markets of the USA and the UK (e.g., Barclay & Smith, 1995; Guedes & Opler, 1996; Johnson, 1997; Mitchell, 1993; Ooi, 1999; Ozkan, 2000, 2002; Scherr & Hulburt, 2001; Stohs & Mauer, 1996). Cross-country studies (Antoniou, Guney, & Paudyal [2006] analyse the case of France, Germany and the UK) on the debt maturity choice are far too limited and so are studies in the context of developing economies.

Korner (2007) analysed the firm-level determinants of the maturity structure of Czech corporate debt for the time period 2000–2004 and discovered LTD to increase with company size, leverage and asset maturity; while growth options, corporate-tax rate, collateralizable assets and company-level volatility were found to be statistically insignificant for the debt maturity structure in the findings.

Terra (2011) tested the main theories of corporate debt maturity in a multi-country setting in an effort to explore country-specific differences, by using a sample of 1,693 non-financial firms from the 7 largest economies of Latin America and from the USA over a 16-year period from 1987 to 2002. The study employed dynamic panel modelling and discovered that there is a significant dynamic component in the assessment of a firm's maturity structure, and firms bear moderate adjustment costs towards its optimal maturity. Further, the determinants of the maturity structure and their impact were found to be similar between Latin American countries and the USA, in spite of noticeable differences in the financial and business environments of these countries. The study also found certain empirical substantiation for each theoretical hypothesis tested, though no theoretical proposition alone was sufficient to elucidate the debt maturity choice. By considering a sample of South-American countries, Kirch and Terra (2012) showed that a country's level of institutional quality has a first-order effect on the corporate debt maturity structure. Zheng, El Ghoul, Guedhami and Kwok (2012) corroborated that national culture is a significant determinant of the cross-country variations in corporate debt maturity. Fan, Titman and Twite (2012) documented that firms from countries with weaker laws and government corruption tend to have shorter debt maturities, and those from countries with explicit bankruptcy codes have longer debt maturities.

Correia et al. (2014) explored the impact of firm-level factors as well as the institutional environment on debt

maturity for a sample of 3,306 non-financial listed firms from 13 European countries for the year 2011 using multiple regression framework. Among the firm-level variables, firm size, asset maturity and leverage ratio were found to have a significant positive impact on debt maturity choices of firms. Else, debt maturity was found to decrease when firm quality and firm value volatility increase. All the firm-level variables except growth opportunities and effective corporate tax rate were found in agreement with the earlier theoretical predictions. The results further suggest that the type of legal system has a substantial impact on debt maturity and the greater the size of the banking system in the economy, the lower is the inclination of firms for LTD.

Orman and Koksal (2015) investigated if and when the principal theories of the debt maturity structure are relevant in understanding the debt maturity choices using a sample of 11,687 non-financial firms (both large publicly traded and small privately held firms) in Turkey from 2004 to 2013 and employed panel fixed effects model for the same. The findings were largely consistent with the liquidity risk theory and partially with the agency theory specifically in case of medium-size and large-size publicly traded firms. The signalling theory was found relevant only while using the sample of large publicly traded firms, while little evidence was discovered indicating the relevance of taxes and borrower–lender relationships for maturity decisions. The results strongly suggested that firms with high leverage also have long debt maturity, whereas though size, credit quality and asset maturity were found to be significant but the results largely differed depending upon the type of firm group being considered. The stability of the economic environment as proxied by inflation and interest rate volatility was also found to influence debt maturity decisions.

Gul et al. (2012) explored the determinants of the corporate debt maturity structure for a sample of 23 banks listed on the Karachi Stock Exchange (KSE) over the period 2005–2009. The findings revealed that LTD increases with asset maturity, while it declines with operating cycle and company size. The leverage and firm quality were found statistically insignificant in the study. Tax rate was depicted to have a direct positive relationship with the debt maturity in the pooled model but insignificant in the fixed effects model.

Awartani, Belkhir, Boubaker and Maghyereh (2016) investigated the state of the corporate debt maturity structure in the MENA region and its firm-related and institutional determinants using a sample of 444 listed firms over the period 2003–2011, and utilized static panel data modelling. The study documented a restricted use of longer term debt by MENA firms as compared to the previously reported literature on other parts of the world and found leverage, firm size, asset tangibility to be positively associated with debt maturity and default risk to be negatively related to debt maturity. Furthermore, better quality institutions, stronger rule of law, improved regulatory effectiveness, better

creditors' legal protection and more developed financial intermediaries were discovered to be associated with greater use of LTD by MENA firms.

Etudaiye-Muhtar, Ahmad and Matemilola (2017) employed a dynamic partial adjustment model to highlight the role of firm-specific and institutional variables on the debt maturity structure (both short- and long-term debt maturity structures) of 599 non-financial firms in 9 selected African countries for the period 2003–2012. The findings revealed that debt maturity structure choice for non-financial firms in the sample set is dynamic while adjusting to the optimal debt maturity structure. Furthermore, firm-level variables, that is, leverage, firm size and asset structure were found to provide support for the contracting cost, matching principle and signalling theories of the debt maturity structure. Institutional variables such as the rule of law, regulatory quality and private credit were discovered to have positive significant effects on the debt maturity structure, thereby implying that better quality institutions can promote longer term debt maturity structures.

More recently, empirical studies even emphasized the role played by corporate governance in the choice of the debt maturity structure. Datta, Iskandar-Datta and Raman (2005), Jiraporn and Kitsabunnarat (2007) and Brockman, Martin and Unlu (2010) found that managerial ownership, the strength of the shareholders' rights and CEO compensation incentives have a significant impact on debt maturity choice, respectively. However, research on non-US firms remains largely missing.

Objective and Methodology

The study classifies the determinants of corporate debt maturity into two categories: firm-specific and macro-economic determinants. Firm-specific determinants are adapted from the extant strand of the literature and uncover most of the firm-specific determinants used in previous empirical studies on this topic. We control for firm characteristics such as growth opportunities (Antoniou et al., 2006; Barclay et al., 2003; Guedes & Opler, 1996; Myers, 1977), firm size (Cho et al., 2014), profitability (Demirgüç-Kunt & Maksimovic, 1999; Fan et al., 2012), leverage (Barclay et al., 2003; Custodio et al., 2013; Johnson, 2003; Myers, 1977; Stohs & Mauer, 1996), asset maturity (Antoniou et al., 2006; Cai et al., 2008; Custodio et al., 2013; Morris, 1976), liquidity risk (Diamond, 1991), tangibility (Antoniou et al., 2006; Demirgüç-Kunt & Maksimovic, 1999; Fan et al., 2012; Myers & Rajan, 1998), tax effects (Brick & Ravid, 1985; Kane et al., 1985; Zheng et al., 2012). Regarding macroeconomic determinants, there is a growing body of literature that contends that a number of country characteristics affect the firms' debt maturity choice.

The objective of the article is to identify firm-specific and macroeconomic determinants that are significant for the debt maturity structure of Indian corporate firms. The alternate hypothesis taken into consideration is that the

firm-specific and macroeconomic determinants do not impact the debt maturity structure of Indian corporates.

Data Sources

The data has been taken from the annual financial reports of NIFTY50 index constituent[1]—Indian public-listed firms listed on the NSE for the period 2008–2016. Banks are excluded due to their unique regulatory capital requirements and for information homogeneity of the firms. A sample of 29 Indian non-financial firms listed on the NSE during the period 2008–2016 was taken to test the hypothesis (refer to Table A1).

CAPTILAINE[2] database has been used to extract detailed balance sheets and income statements for NIFTY50 companies. Amongst these, the basis of selection for the companies is the availability of financial data and positive value of total debt (TD) for the period under study so as to rule out the possibility of an undefined dependent variable. These firms do not hold any changes in their financial year during the research period. According to these criteria, the study finally takes into account 29 firms listed on the NSE of India Ltd and 261 firm-year

observations correspondingly. Table A2 also lists data sources for firm-specific and macroeconomic variables used in the study.

Methodology

A panel data of 29 companies across 8 years has been used. To constrain the efforts for variable selection in the initial stage, past studies on debt maturity have been leveraged. Variables selected take into consideration all aspects such as agency costs, signalling and liquidity risks, tax effect theories and matching principles. Macroeconomic variables have been used as control variables in the study. As described in Table A2, apart from the dependent variable long-term debt to total debt (LTDTD), 10 independent variables have been defined which are potential determinants or predictor variables.

At the outset, the visualization of dependent variable across the 29 firms was carried out. After that, the descriptive statistics was done for all the variables listed in Table 1. A detailed analysis of panel variables was done for overall, between variables varying between time and within variables varying within the firm.

Variables Used in the Study

Table 1. Variable Description

Variables	Symbol	Measure	Expected Sign
Debt maturity	LTDTD	Ratio of long-term debt (debt maturing in more than one year) to total debt	NA
Agency (contracting cost) theory			
Growth rate	GROWTH	Sales growth to total asset growth	−
Firm size	LNSA	Natural logarithm of firm's total sales	+
Signalling and liquidity risk theories			
Firm quality	PROFIT	Earnings before interest and tax to net sales	−
Liquidity	CR	Ratio of current assets to current liabilities	+
Leverage	TDTA	Ratio of the book value of total debt to the book value of total assets.	+
Matching principle theory			
Asset maturity	NFADEP	Ratio of net fixed assets to gross block depreciation. (Measures the rate at which assets are being consumed.)	+
Tax hypothesis			
Effective tax rate	EFTAX	Ratio of current year taxes to profits before tax	−
Macroeconomic variables			
Base rate (prime lending rate has been replaced by base rate in July 2010)	BR	The minimum rate set by the Reserve Bank of India below which banks are not allowed to lend to its customers. It has been taken into account since banks are the principal contributor of debt capital.	−
Wholesale price index	WPI	The price of a representative basket of wholesale goods, and is sometimes used as a central measure of inflation. It has a significant role in deciding the sales growth and hence directly influences the company growth.	−
Wholesale price index YoY change ratio	WPIL1	Signifies the relative change in prices and hence determines the market sentiments owing to consumers' varying propensity to spend.	−

Source: Authors' formulation based on review of literature.

Hypotheses Used in the Study

The following hypotheses are set out for empirical testing in the context of Indian firms:

H$_1$: Growth rate is negatively related to debt maturity.

H$_2$: Firm size is positively related to debt maturity.

H$_3$: Firm quality is inversely related to debt maturity.

H$_4$: Liquidity is positively related to debt maturity.

H$_5$: Leverage is positively related to debt maturity.

H$_6$: Asset maturity is positively related to debt maturity.

H$_7$: Effective tax rate is negatively related to debt maturity.

H$_8$: Base rate is inversely related to debt maturity.

H$_9$: Wholesale price index is inversely related to debt maturity.

H$_{10}$: Wholesale price index change ratio is inversely related to debt maturity.

Panel Least Squares with Fixed Effects

The data being used in this study is balanced panel data. The dependent variable 'debt maturity' is influenced by many more variables which do not form part of this exercise, for example, efficient management practices, business conditions as per geographical location of the firm, marketing strategies employed, relationship with stakeholders such as distributors, etc. Due to this effect, the estimates in the regression model can be inconsistent. So to minimize the inconsistency due to the omission of these variables, this study uses firm-specific control variables which can be of fixed effect type or random effect type.

Fixed effect explores the relationship between the dependent variable LTDTD and predictor variables within a firm. However, predictor variables may or may not be influenced by individual characteristics of a firm. That is why there is an assumption of the correlation between firm's error term and predictor variables. Using fixed effects, this influence is controlled. It eliminates the effect of those time-invariant characteristics so that the net impact of the predictors on the outcome variable can be assessed (Baltagi, 2008).

Original panel equation $y_{it} = \alpha + \beta x_{it} + u_i + \varepsilon_{it}$

changes to $y_{it} = \alpha_i + \beta x_{it} + \varepsilon_{it}$

When the within firm variance is minimal, it implies that the variables are more towards time-variant nature; and since fixed effects control for the time-invariant characteristics, it will not work well in such cases.

The fixed-effects model controls for all time-invariant differences between the individuals so that the estimated coefficients of the fixed-effects models cannot be biased due to omitted time-invariant characteristics.

One side effect of the features of the fixed-effects model is that it cannot be used to investigate time-invariant causes of the dependent variables. Technically, time-invariant characteristics of the individuals are perfectly collinear with the dummy variables used for firms. Practically, fixed-effects models are designed to study the causes of changes within a firm. A time-invariant characteristic cannot cause such a change because it is constant for each person.

Another method to apply fixed effects is to introduce dummy variables into the model. So the equation of fixed effects model becomes

$$
\begin{aligned}
LTDTD_{it} = {} & \beta_0 + \beta_1\left(GROWTH_{it}\right) + \beta_2\left(LNSA_{it}\right) \\
& + \beta_3\left(PROFIT_{it}\right) + \beta_4\left(CR_{it}\right) + \beta_5\left(TDTA_{it}\right) \\
& + \beta_6\left(NFADEP_{it}\right) + \beta_7\left(EFTAX_{it}\right) + \beta_8\left(BR_{it}\right) \\
& + \beta_9\left(WPI_{it}\right) + \beta_{10}\left(WPIL1_{it}\right) + y_1\left(DC_1\right) \\
& + y_2\left(DC_2\right) + y_3\left(DC_3\right) + \cdots + y_{27}\left(DC_{27}\right) \\
& + y_{28}\left(DC_{28}\right) + \varepsilon
\end{aligned}
$$

where i represents the firm and t is the time;

    y_i is coefficient of the dummy variable DC_i for ith firm;

    β_0 is the intercept;

    β_n are coefficients for independent variables, x_{it}; and

    ε is the error term.

Analysis and Interpretation

Basic Analysis

The preliminary visualization of dependent variables across the 29 firms has been carried out (Figure 1). After that, the descriptive statistics for all the variables (listed in detail in Table A2) have been presented in Table 2. A detailed analysis for panel variables has been carried out for overall, between variables varying between time and within variablesvarying within the firm (Table 3). Table 4 displays the correlations among the variables selected in the study.

Now we take a look at the variables in the data set. A preliminary investigation into the data can provide insights about the variance distributions in the panel data which, to a great extent, help in determining the analysis techniques to be used for the study.

As it can be seen in Figure 1, debt maturity (LTDTD) varies between 0 and 1 by definition, and here in the majority of the firms (denoted by Compid), it follows decreasing trend over the years.

Table 2 reports the summary statistics of the variables used in our analysis. As observed in the table, dependent
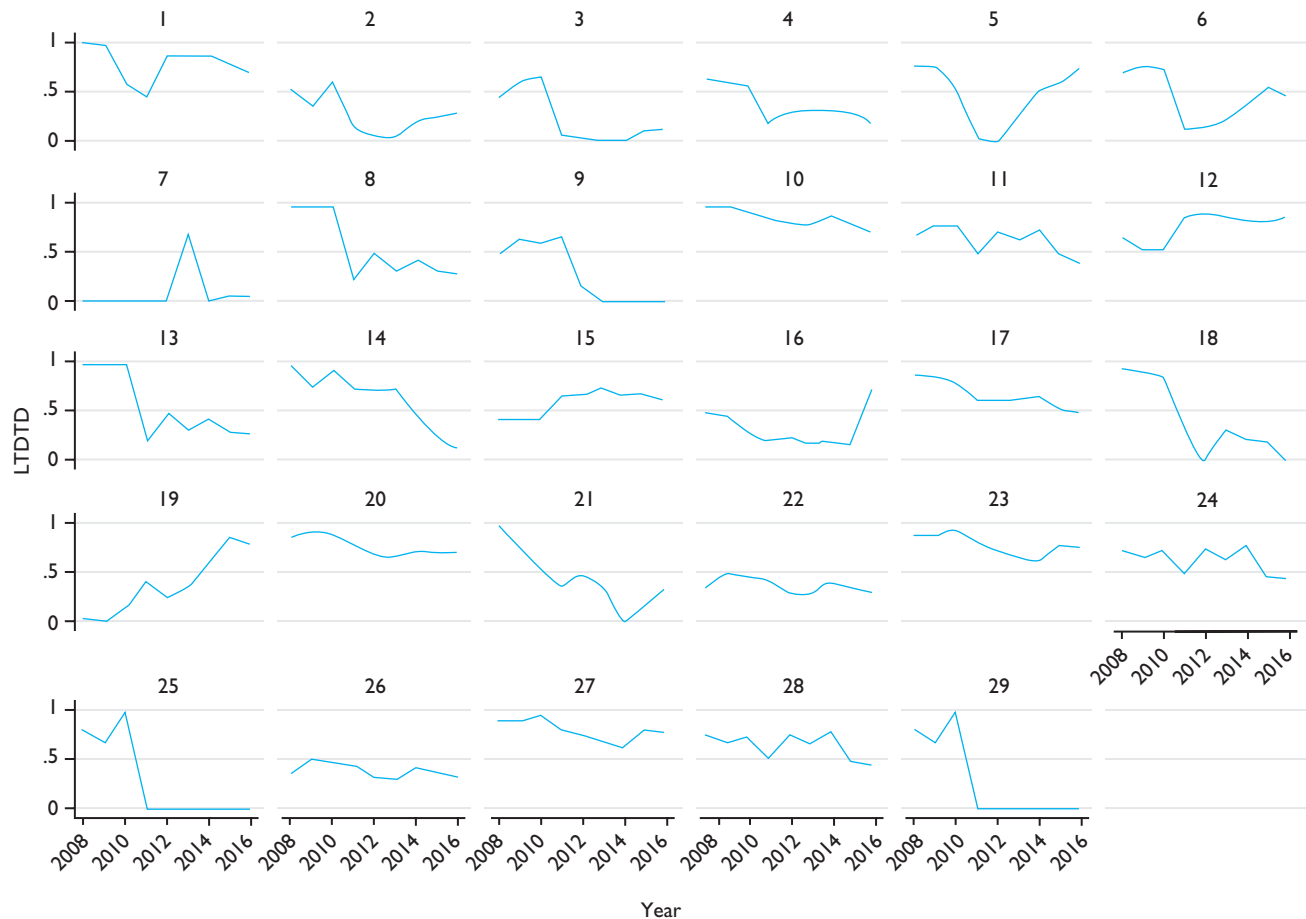
Figure 1. Dependent Variable Debt Maturity Visualizations Across the Firms
Source: Authors' expression using Stata 13.

Table 2. Descriptive Statistics of the Variables

Variables	Obs.	Mean	Std. Dev.	Min	Max
LTDTD	261	0.5100	0.3017	0.00	0.9873
GROWTH	261	0.1222	10.5722	−86.3237	64.5942
LNSA	261	1.0232	0.1427	0.6706	1.3009
PROFIT	261	0.1875	0.1266	−0.0799	0.6441
CR	261	0.2358	0.1700	0.0335	1.1330
TDTA	261	0.3379	0.2256	0.0003	0.8465
NFADEP	261	0.5995	0.1452	0.2855	0.9249
EFTAX	261	0.7025	6.1717	−16.1484	69.7590
BR	261	11.2167	1.9046	8.8750	14.1250
WPI	261	152.8922	23.1921	116.6300	181.1900
WPIL1	261	1.0533	0.0363	0.9751	1.0956

Source: Authors' testing results using Stata 13 on variables used in the study.

variable LTDTD varies from 0 to 0.9873 with an average value of 0.51. Among the independent variables, GROWTH, EFTAX and WPI depict the wide range of variations for the selected 29 non-financial firms, while there is not much variation in the trend variable WPIL1. The same is supported by their average and measures of dispersion in Table 2.

Coming to panel data, the overall variation in variables can be accounted for in two ways: (a) how the variables are varying within the firm over the time horizon, called 'within variation' and (b) how the variables are varying with time which can be seen over the years by averaging the variables over all the firms, which is called 'between variation'. Since balanced panel data has been used, there are no missing values to be treated in the data set.

As can be observed in Table 3, both between and within variations are similar in the dependent variable 'debt maturity' (LTDTD). There is more of 'within' variation in 'growth rate' (GROWTH) and effective tax rate (EFTAX)—rightly so, as these are more or less driven largely by business environment. 'Firm size' (LNSA), 'firm quality' (PROFIT), 'liquidity' (CR), 'leverage ratio' (TDTA) and 'asset maturity' (NFADEP) have larger 'between' variation, as supported by the fact that these are firm-specific variables which largely depend on the decision-making within a firm according to its goals and business practices.

Table 3. Detailed Variance Analysis for Panel Variables

Variables		Mean	Std. Dev	Min	Max
LTDTD	Overall	0.5100	0.3017	0.0000	0.9873
	Between		0.2050	0.0943	0.8501
	Within		0.2243	0.0059	1.2106
GROWTH	Overall	0.1222	10.5722	−86.3237	64.5942
	Between		3.5325	−9.3271	7.3378
	Within		9.9838	−76.8743	57.3787
LNSA	Overall	1.0232	0.1427	0.6706	1.3009
	Between		0.1374	0.7876	1.2537
	Within		0.0454	0.8980	1.1398
PROFIT	Overall	0.1875	0.1266	−0.0799	0.6441
	Between		0.1189	0.0334	0.6036
	Within		0.0483	−0.0343	0.4463
CR	Overall	0.2358	0.1700	0.0335	1.1330
	Between		0.1553	0.0480	0.8451
	Within		0.0744	−0.0066	0.6809
TDTA	Overall	0.3379	0.2256	0.0003	0.8465
	Between		0.2160	0.0194	0.6239
	Within		0.0752	0.0686	0.6152
NFADEP	Overall	0.5995	0.1452	0.2855	0.9249
	Between		0.1372	0.3501	0.8556
	Within		0.0533	0.4715	0.8689
EFTAX	Overall	0.7025	6.1717	−16.1484	69.7590
	Between		1.9341	−1.4370	7.5884
	Within		5.8706	−14.0090	62.8731
BR	Overall	11.2167	1.9046	8.8750	14.1250
	Between		0.0000	11.2167	11.2167
	Within		1.9046	8.8750	14.1250
WPI	Overall	152.89	23.19	116.63	181.19
	Between		0.00	152.89	152.89
	Within		23.19	116.63	181.19
WPILI	Overall	1.0533	0.0363	0.9751	1.0956
	Between		0.0000	1.0533	1.0533
	Within		0.0363	0.9751	1.0956

Source: Authors' analysis using Stata 13.

Correlation Analysis

It is imperative to check correlation among the variables before proceeding with regression models. Table 4 reports the results of the pair-wise correlation between all the variables in the data set. The selected variables do not suffer from multicollinearity, as can be observed from the analysis. The following relation is drawn from the correlation analysis:

- The dependent variable debt maturity is positively correlated with firm size and leverage, and inversely related to growth rate as predicted by the earlier theories. Wholesale price index is negatively correlated with debt maturity as expected. However, the negative correlation between debt maturity and liquidity, and the positive association between debt maturity and effective tax rate are contradictory to what theory predicts; the correlation is, however, not significant in the case of liquidity.
- There is a significant correlation between firm size (LNSA) and other variables. Its negative correlation with firm quality (PROFIT) supports the 'underinvestment problem' hypothesis put forth under the agency theory by Myers.
- Firm size (LNSA) shows a positive correlation with the leverage ratio (TDTA) which implies that larger firms tend to be more leveraged.
- The negative correlation between firm size (LNSA) and asset maturity (NFADEP) signals that the rate of consumption of assets is higher in larger firms, which can be said to be fairly true.
- A positive correlation between debt maturity (LTDTD) and leverage ratio (TDTA) signifies that highly leveraged firms with higher debt are having a larger proportion of LTD components in their total debt.
- Firm quality (PROFIT) is negatively related to leverage ratio (TDTA) as margins do take a hit when interest is being paid for financing assets, which in turn increases net cost of an asset.

Table 4. Correlation Analysis Results

Variables	LTDTD	GROWTH	LNSA	PROFIT	CR	TDTA	NFADEP	EFTAX	BR	WPI	WPILI
LTDTD	1.00										
GROWTH	−0.11*	1.00									
LNSA	0.10*	−0.08	1.00								
PROFIT	−0.03	0.04	−0.53***	1.00							
CR	−0.07	0.01	−0.43***	0.49***	1.00						
TDTA	0.43***	−0.08	0.42***	−0.32***	−0.32***	1.00					
NFADEP	0.07	0.06	−0.53***	0.33***	0.21***	−0.02	1.00				
EFTAX	0.11*	0.02	0.07	−0.09	−0.02	0.11*	−0.09	1.00			
BR	0.39***	−0.06	−0.23***	0.08	0.07	0.08	0.04	0.10	1.00		
WPI	−0.34***	0.01	0.28***	−0.11*	−0.05	−0.06	−0.04	−0.09	−0.79	1.00	
WPILI	0.02	0.04	−0.11*	0.01	0.04	0.00	−0.01	−0.01	0.00	−0.37***	1.00

Source: Authors' testing results using Stata 13.
Notes: *** signifies 1%, ** 5% and * 10% levels of significance (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$).

Before proceeding with the panel fixed effects model estimates, Lagrange Multiplier test and Hausman specification test were duly conducted to validate the justification of the panel model being used for analysis purposes in the study.

Panel Unit Root Tests for the Variables

Variables are tested by using the most commonly used panel unit root test, that is, Levin, Lin and Chu (LLC; 2002). The hypotheses of the panel unit root are as follows:

H$_0$: $\rho = 0$ (unit root in panel data set)

H$_1$: $\rho < 0$ (no unit root in panel data set)

Table 5. Panel Unit Root Test Results

Variables	Statistic	P-value
LTDTD	−6.3519	0.0000
GROWTH	−18.9370	0.0000
LNSA	−7.2162	0.0000
PROFIT	−8.1593	0.0000
CR	−10.8498	0.0000
TDTA	−190	0.0000
NFADEP	−2.5729	0.0050
EFTAX	−24.4336	0.0000
BR	−11.1140	0.0000
WPI	−10.7200	0.0000
WPIL1	−19.6288	0.1001

Source: Authors' testing results using Stata 13.

Table 5 depicts the results of the panel unit root tests for the variables. LLC test reveals that surprisingly all the variables are stationary at level. Hence, we can conclude that all the variables selected in the study are eligible for panel regressions.

Estimation Results

Table 6 summarizes the estimation results based on balanced panel data from the year 2008 to 2016. There are several notable results that surface from our analysis. The findings with regard to growth rate (GROWTH) lend support to Myers' (1977) proposition that firms with high growth opportunities shorten the debt maturity, as the observed relation is found to be negative but not statistically significant. Firm size (LNSA) variable, though significant, is not consistent with the predicted sign as the results depict that firm size varies inversely with debt maturity. The observed relation of firm quality (PROFIT) with debt maturity is not consistent with the signalling theory and the same is found insignificant. The coefficient associated with liquidity (CR) is of the expected

Table 6. Results of Panel Fixed Effects Using Least Squares Dummy Variable Model

Variables	Coefficient	Std. Error	t-Statistic	Prob.
GROWTH	−0.0005	0.0001	−0.41	0.682
LNSA	−1.4410	0.5955	−2.42	0.016
PROFIT	0.0246	0.2971	0.08	0.934
CR	0.4622	0.1723	2.68	0.008
TDTA	0.0694	0.1840	0.38	0.706
NFADEP	0.5202	0.2366	2.20	0.029
EFTAX	0.0004	0.0021	0.18	0.856
BR	0.0373	0.0128	2.92	0.004
WPI	0.0006	0.0014	0.42	0.676
WPIL1	−0.4331	0.4373	−0.99	0.323
R-squared	0.6312	*F*-statistic		10.0000
Adjusted *R*-squared	0.5681	Prob (*F*-statistic)		0.0000

Source: Authors' testing results using Stata 13.

sign, thereby implying that companies find it convenient to raise external financing against more liquid assets, since liquid assets offer lenders better value in the event of liquidation or short notice sale. Hence, it implies that greater LTD is required in the capital structure of firms with a higher amount of current assets. The relation between leverage (TDTA) and debt maturity (LTDTD) is positive as expected, hence signifying that highly leveraged companies are keener to take LTD, so as to offset the higher probability of liquidity risk and to defer exposure to bankruptcy risk; however, the same has been found insignificant in the current study. Asset maturity (NFADEP) is found to have a positive and significant association with the debt maturity structure, which is highly consistent with the matching principle theory. This is due to the fact that if debt has a shorter maturity as compared to the assets, the company may not have sufficient cash readily available to repay the principal at due date; and likewise, if debt's maturity is longer than that of the assets, the cash flows accruing from the assets might drain, while the debt payments might remain outstanding. Also as defined in this study, higher the value of NFADEP, slower is the speed of consuming assets. Thus, it is consistent with the matching principles theory that if tangible assets are high, then these assets can be used as collateral, diminishing the lender's risk of suffering such agency costs of debt. The association between the effective tax rate and the debt maturity structure is statistically insignificant. This is contradictory to the theory and against the hypothesized relationship between flotation costs, tax shield and debt maturity.

Among macroeconomic variables, base rate (BR) is significant but positive, contrary to the predicted sign; thereby implying that if the rate of interest is low, firms will prefer lower LTD, which seems to be inconclusive.

The observed relation of wholesale price index with debt maturity is not in accordance with the predicted one, whereas the association between wholesale price index change ratio and debt maturity is negative in line with the predicted sign, but again it is statistically insignificant too.

In the model estimates, R^2 is 63.12 per cent and adjusted R^2 is 56.81 per cent; hence, indicating that more than 56 per cent of the variation in debt maturity (LTDTD) can be explained by the explanatory variables.

Conclusion

The study empirically investigates the firm-specific and macroeconomic determinants of debt maturity structure decisions using a sample of 29 non-financial Indian firms listed on the NSE during the period 2008–2016. The results suggest that firm size, liquidity, asset maturity and base rate are the significant determinants of the debt maturity choice; though firm size and base rate do not have the predicted effect on debt maturity as hypothesized. Growth rate, leverage and wholesale price index change ratio do have the predicted effect on debt maturity; however, results are not statistically significant. A reason for the insignificant coefficients can be attributed to the measurement issues. The study does not produce any statistical evidence to conclude that effective tax rate and firm quality have an impact on debt maturity

which can be a probable outcome of an underdeveloped debt market. Macroeconomic control variables are not significant barring base rate, for which, also, the study does not provide conclusive evidence as opposite signs are shown by fixed effect models.

The study suggests that the debt maturity choice is mainly determined by internal characteristics of the company and not the external environment. It further suggests that the present theoretical framework does not provide an ample and general explanation of the corporate debt maturity structure of the firm. As a matter of fact, theories are a mere collection of partial explanations for this phenomenon. The gap in theoretical research in this instance becomes apparent in the empirical analysis where various hypotheses are at best only partially supported.

The current study has certain limitations. First, the size of the sample used is quite small relative to the universe of listed firms in the Indian stock markets. Second, the definition of debt maturity used in the study tends to consider LTD as homogenous, while in reality, debt issues might have provisions that make them largely heterogeneous. Third, the other macroeconomic indicators such as regulatory quality, rule of law, voice and accountability can be considered in the future studies. Lastly, cross-country variation in the debt maturity structure can be empirically investigated in depth in the context of emerging economies.

Appendices

Table A1. List of Firms Selected for the Study

S. No.	Symbol	Company Name	Industry
1	ADANIPORTS	Adani Ports and Special Economic Zone Ltd	Services
2	AMBUJACEM	Ambuja Cements Ltd	Cement & Cement Products
3	ASIANPAINT	Asian Paints Ltd	Consumer Goods
4	AUROPHARMA	AurobindoPharma Ltd	Pharma
5	BPCL	Bharat Petroleum Corporation Ltd	Energy
6	BHARTIARTL	Bharti Airtel Ltd	Telecom
7	COALINDIA	Coal India Ltd	Metals
8	DRREDDY	Dr. Reddy's Laboratories Ltd	Pharma
9	EICHERMOT	Eicher Motors Ltd	Automobile
10	GAIL	GAIL (India) Ltd	Energy
11	GRASIM	Grasim Industries Ltd	Cement & Cement Products
12	HINDALCO	Hindalco Industries Ltd	Metals
13	ITC	I T C Ltd	Consumer Goods
14	IDEA	Idea Cellular Ltd	Telecom
15	LT	Larsen & Toubro Ltd	Construction
16	LUPIN	Lupin Ltd	Pharma
17	M&M	Mahindra & Mahindra Ltd	Automobile

| S. No.	Symbol	Company Name	Industry
18	MARUTI	Maruti Suzuki India Ltd	Automobile
19	ONGC	Oil & Natural Gas Corporation Ltd	Energy
20	RELIANCE	Reliance Industries Ltd	Energy
21	SUNPHARMA	Sun Pharmaceutical Industries Ltd	Pharma
22	TATAMOTORS	Tata Motors Ltd	Automobile
23	TATASTEEL	Tata Steel Ltd	Metals
24	ULTRACEMCO	UltraTech Cement Ltd	Cement & Cement Products
25	ZEEL	Zee Entertainment Enterprises Ltd	Media & Entertainment
26	TATAMOTORS	Tata Motors Ltd	Automobile
27	TATASTEEL	Tata Steel Ltd	Metals
28	ULTRACEMCO	UltraTech Cement Ltd	Cement & Cement Products
29	ZEEL	Zee Entertainment Enterprises Ltd	Media & Entertainment

Source: Authors' own compilation.
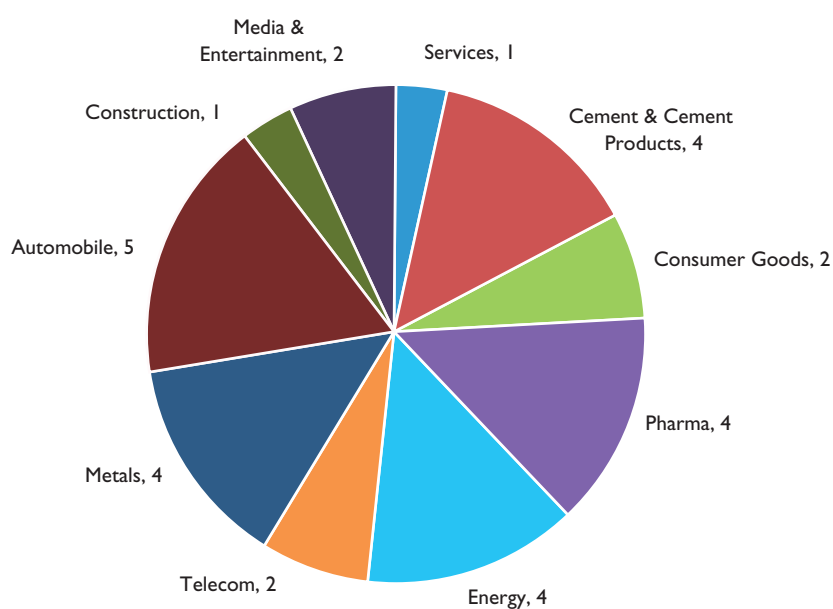
Figure A1. Breakdown of Sample Firms by Industry Type
Source: Authors' own design.

Table A2. The Definitions of the Variables and Their Computation

S No.	Type/Variable	Symbol	Definition	Formulae	Source
0	Debt maturity (Dependent Variable)	LTDTD	Long-term debt: Total debt	Convertible debentures	BS
				+ Non-convertible debentures	BS
				+ Partly convertible debentures	BS
				Less: Debentures calls-in-arrears	BS
				+ Term loans institutions	BS
				+ Term loans banks	BS
				+ Term loans others	BS
				+ Borrowings from Government of India	BS
				+ Debentures/bonds	BS
				+ Loans from group Cos	BS
				+ Loans from banks	BS
				+ Loans from institutions	BS
				+ Loans from GOI/PSUs	BS
				+ Fixed deposits/total debt	BS

(Table A2 Continued)

S No.	Type/Variable	Symbol	Definition	Formulae	Source
Agency Costs					
1	Growth rate	GROWTH	Sales growth to total asset growth	Sales turnover YoY growth/total assets YoY growth	IS BS
2	Firm size	LNSA	Natural log of total sales	Natural log of total sales/10	BS
Signalling and Liquidity Risks					
3	Firm's quality	PROFIT	EBIT/Net sales	Operating profit-depreciation/net sales	IS IS
4	Liquidity	CR	CA:CL	Total current assets/current liabilities*10	BS BS
5	Leverage ratio	TDTA	BV of total debt: BV of total assets	Total debt/total assets	BS BS
Matching					
6	Asset maturity	NFADEP	Net fixed assets: Gross block	Net block/gross block	BS BS
Tax effect theories					
7	Effective tax rate	EFTAX	Tax expense: Pre-tax profit	Tax for the current year/profit before tax	IS IS
Macroeconomic variables					
8	Base rate	PLR	http://www.tradingeconomics.com/india/bank-lending-rate		
9	Wholesale price index	WPI	http://www.eaindustry.nic.in/display_data.asp		
10	WPI YoY change ratio	WPIL1	Base Year: 2004–2005 = 100		

Source: Authors' own calculations.

Notes

1. Semi-annual revision takes place in the index constituents. The list taken up for the study is as accessed on January 2017.
2. See https://www.capitaline.com/

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