Dynamic adjustment towards target capital structure: evidence from Indian companies

Sulagna Mukherjee and Jitendra Mahakud
Department of Humanities and Social Sciences, IIT Kharagpur, Kharagpur, India

Abstract

Purpose – The purpose of this paper is to study the dynamics of capital structure in the context of Indian manufacturing companies in a partial-adjustment framework during the period 1993-1994 to 2007-2008.

Design/methodology/approach – This paper specifies a partial-adjustment model and uses the generalized method of moments technique to determine the variables which affect the target capital structure and to find out the factors affecting the adjustment speed to target capital structure.

Findings – Firm-specific variables like size, tangibility, profitability and market-to-book ratio were found to be the most important variables which determine the target capital structure across the book and market leverage and the factors like size of the company, growth opportunity and the distance between the target and observed leverage determine the speed of adjustment to target leverage for the Indian manufacturing companies.

Research limitations/implications – The behavioural variables like managers' confidence and attitude towards raising the external finance have not been incorporated in the model to determine the target capital structure due to the data constraint.

Practical implications – This paper has implications for corporate managers in India, for example, to consider the various adjustment costs while altering the financing decisions of the company with other variables like flexibility of the manager, direct cost of debt and equity.

Originality/value – This paper is first of its kind to study both the determination of target capital structure and the speed of adjustment to target capital structure in the context of Indian companies.

Keywords India, Gearing, Manufacturing industries, Capital structure, Corporate finances

Paper type Research paper

Introduction

A fundamental issue in corporate finance involves understanding how firms choose their capital structure. There is no unique view that explains the capital structure decision of the firm. The literature on capital structure has focused on four main theories such as trade-off theory, pecking order theory, market-timing theory and inertia theory to explain corporate leverage ratios. The trade-off theory of corporate capital structure assumes that firms strive to maintain an optimal capital structure that balances the costs and benefits associated with varying degrees of financial leverage. This optimal level is achieved by making trade-off between the gains from debt or equity to loss from them. Benefits include interest tax shield and the costs include bankruptcy costs, agency costs, etc. It suggests that every firm has an optimal debt ratio defined by a point where benefits of interest tax shield gets offset by costs of financial distress. This often leads to "target adjusted" mean reverting behaviour in debt ratios in time (Myers, 1984). The pecking order theory argues that a firm's security issue is based upon the information asymmetry between the managers and external equity holders. This theory predicts that under information asymmetries between firms' managers and the markets, projects are first financed with internally generated funds followed by safe and risky debt, and finally by equity. Baker and Wurgler (2002) posit the market-timing theory of capital

Journal of Advances in Management Research
Vol. 7 No. 2, 2010
pp. 250-266

0972-7981
DOI 10.1108/09727981011085020

structure, whereby a firm's observed capital structure is a cumulative reflection of its past capital raising choices and that managers make these choices to benefit current shareholders. Under the market-timing theory a firm's issuance decision is based upon capital market conditions at the time funds are being raised. Both pecking order and market-timing theories do not predict an optimal capital structure for the firm, and hence provide no implications regarding the rebalancing of a firm's capital structure.

Welch (2004) proposes that managerial inertia leads to persistence in firm capital structure and that past changes in equity prices is the single most important factor in explaining leverage ratios for firms. The dynamic trade-off theory of capital structure has argued that every firm has target leverage and there is always a difference between the observed and target leverage due to the presence of market imperfections and adjustment costs. In the absence of adjustment costs the rebalancing of leverage ratio is costless and therefore, the firms can continuously rebalance their capital structures toward an optimal level of leverage. However, in the presence of such costs the firms do not adjust instantaneously to their optimal capital structure, but instead adjust partially. This dynamic trade-off theory has recently found strong support in the empirical capital structure literature (see e.g. Jalilvand and Harris, 1984; Fischer *et al.*, 1989; Hovakimian *et al.*, 2001; Fama and French, 2002; Leary and Roberts, 2005; Flannery and Rangan, 2006; Huang and Ritter, 2009). With the empirical success of partial-adjustment models to measure the speed of adjustment, the literature has begun to examine the factors affecting of the speed of adjustment to the target capital structures (see Faulkender *et al.*, 2008; Flannery and Hankins, 2007; Byoun, 2008).

There is limited work done related to dynamic trade off theory of capital structure in the context of Indian corporate sector (see e.g. Rajbhandary, 1997; Bhaduri, 2002; Mahakud and Bhole, 2003). To our knowledge there is no literature available on the determination of factors which affect the speed of adjustment to target capital structure in the context of Indian companies. In this context, this paper has tried to fill this gap by estimating the capital structure equation in the dynamic model framework in the case of Indian companies. We analyse the effects of firm-specific characteristics as well as time-specific factors on the target leverage. Most of the researchers have used only the book values of the leverage ratios for their analysis, but the book values of the leverage ratio may not capture the market dynamics, so that we have incorporated both book and market value of the leverage ratio for the analysis. We have measured the speed of adjustment of target capital structure and also determine the factors which affect the speed of adjustment. The robustness of the results has been tested across various alternative definitions of corporate capital structure.

The rest of the paper is organized as follows. Next section discusses about the brief review of prior studies on dynamic tradeoff theory of capital structure. Then, we discuss a dynamic framework, constructed to measure the speed of adjustment and determine the factors which determine the speed of adjustment. Next section describes our panel of Indian non-financial company data. After reporting the results, the robustness of the results is tested in the next section. Finally, summary and conclusions of the research are reported.

Earlier studies on capital structure dynamics

The prior studies on dynamics of corporate capital structure have focused on various issues such as:

- examining the existence of the optimal or target capital structure ratio and estimation of the speed of adjustment at which the companies try to reach the target; and
- factors that determine the adjustment speed.

The research on the first issue of the capital structure dynamics has been started by Jalilvand and Harris (1984) and they have documented that firm's financial behviour is characterized by partial adjustment to long-run financial targets. All the companies try to achieve that target ratio with an adjustment speed. Fischer *et al.* (1989) study the difference between a firm's maximum and minimum debt ratios over time and identify characteristics of firms with larger swings of their capital structures. Their results were consistent with capital structure choice in the presence of adjustment costs in a dynamic setting. Heshmati (2001) has argued that theories of capital structure do not explain observed differences in debt ratios but rather the differences in optimal leverage ratios across firms. In the presence of adjustment costs, it might be cheaper for firms not to fully adjust to their targets even if they recognize that their existing leverage ratios are not optimal. Hovakimian *et al.* (2001) have found that there is a tendency of firms to make financial choices that move them toward a target debt ratio and the target ratio may change over time depending upon the firms' profitability and stock price changes.

Using Spanish data, De Miguel and Pindado (2001) develop a target adjustment model that allows explaining a firm's leverage in terms of its debt in the previous period and its target debt level, the latter being a function of well-known firm characteristics, such as profitability, growth and tangibility of assets. Their setup endogenizes the target debt ratio, which allows identifying the determinants of the optimal or target capital structure rather than the observed one. Their empirical results reveal that Spanish firms face lower adjustment costs than US firms. According to Fama and French (2002) the target leverage ratio is not observable but it may be imputed from the other variables of the firms like debt-to-equity itself, size, growth options and non-debt tax shields. Lööf (2004) has compared the dynamics of capital structure across the two different types of financial systems such as, market-based system i.e. USA and UK; and bank-based system i.e. Swedish. His results have revealed that the deviation from the target debt level is smaller for the highly equity dependent US firms than Swedish firms. Leary and Roberts (2005) have shown that firms do rebalance their capital structure infrequently in the presence of adjustment costs. Flannery and Rangan (2006) have provided conflicting assessments about how firms choose their capital structures. Distinguishing among the various theories of capital structure and using a more general, partial-adjustment model of firm leverage they found that firms do have target capital structures and the typical firm closes about one-third of the gap between its actual and its target debt ratios each year. Huang and Ritter (2009) made an attempt to construct a new econometric method to deal with the biases in estimates of the speed of adjustment towards the target capital structure and their study has revealed that the speed of adjustment of the firms are moderate with a half life of 3.7 years.

The second line of research in capital structure dynamics has been concentrating on the determination of the speed of adjustment to target capital structure. The researchers have argued that the adjustment speed varies across firms and time period because of the varying adjustment costs incurred by the firms. They have argued that the adjustment cost of the company depends upon the size of the firm, growth opportunity, profitability and the distance between the observed and optimal debt ratio. Therefore, the adjustment speed of the company is also determined by these factors. Banerjee *et al.* (2004) were the

first to estimate the speed of adjustment towards the target capital structure and identifying the determinants of the speed of adjustment simultaneously. Using US and UK data, they hypothesize that the speed of adjustment is dependent on the absolute difference from the target debt ratio, growth opportunities and firm size. Contrary to what they expected, their results reveal that firms with higher growth opportunities adjust slower towards the target capital structure, and that larger firms adjust to changes in capital structure more readily. However, they do not find a significant relationship between the likelihood of adjustment and the absolute difference between target leverage in the current period and observed leverage at the end of the lagged period. In the similar study Lööf (2004) has concluded that equity capital dominated countries' firms adjust faster towards the target leverage compared to the debt dependent countries and growth opportunity, size and distance between target and observed debt ratio are the major determinants of adjustment speed.

Haas and Peeters (2004) have found that profitability and age of firms have been the most robust determinants of the targets capital structure for central and eastern European firms. Drobertz and Wanzenried (2006) carried out a study on the Swiss firms to analyse the impact of firm-specific characteristics and macroeconomic factors on the speed of adjustment to the target debt ratio. Their findings conclude that faster growing firms and those firms which are away from the optimal capital structure adjust more readily. They also conclude that the speed of adjustment towards the target leverage has been pro-cyclical. Xu (2009) has tried to study the capital structure adjustment mechanisms of firms that experience substantial changes in leverage. Adjustments appear to be asymmetric among firms with both large increases and decreases in debt ratios. Speed of adjustments were found to be affected by market-timing opportunities and if there is persistence effect of equity market timing then the firms' rebalancing process becomes slow.

Faulkender *et al.* (2008) have analysed the impact of adjustment costs on the speed of adjustment to the target leverage ratio. In their study the adjustment costs have been explained through the cash flow of the companies. They have argued that the firms with large positive cash flows are most likely to be distributing excess capital can choose the form of their payouts to move their target capital structure. Symmetrically firms with significantly negative free cash flows should have low adjustment costs because they must raise external capital to cover their financing deficit. Given their need to raise capital, they are likely to issue securities that will move them towards their target capital structure. Therefore, the firms with large positive or negative cash flows are likely to confront a relatively low marginal cost of adjusting leverage and, hence, manifest relatively rapid adjustment speeds. Firms with free cash flows close to zero are unlikely to be issuing or repurchasing, and will therefore confront the largest incremental costs. They have found that adjustment speeds to be faster for the firms for whom incremental adjustment costs have been lower and the speed has been lower for the firms for whom the incremental costs have been higher. Their results are in line with the dynamic trade-off theory of capital structure. Qian *et al.* (2009) have made an attempt to study the determinants of capital structure and the factors affecting the speed of adjustment for the publicly listed companies of China. Their results showed that target leverage ratios do exist but the speed of adjustment is very slow. Their study concluded that firm-specific factors like size of the company and growth opportunity affect the speed of adjustment and the firms that are away from the target leverage adjust faster thereby supporting the fact that costs of deviations are costly and the firms want to rebalance with the costs of adjustments.

In India, there are few empirical studies based on dynamics of capital structure. Rajbhandary (1997) in his study have accounted that adjustment costs play the significant role on determination of corporate capital structure. Bhaduri (2002) has concluded that the optimal capital structure choice is influenced by factors such as growth, cash flow, size and industry characteristics. His study also found the existence of restructuring costs in attaining an optimal capital structure. Mahakud and Bhole (2003) have shown that the firm-specific variables like the cost of borrowing, cost of equity, size of firm, collateral value of assets, liquidity and non-debt tax shields affect the corporate capital structure in India. The recent studies on the dynamics of corporate capital structure are not available in the case of Indian corporate sector. This study has tried to bridge this research gap in terms of methodology and the period of study.

To sum up we can say the factors which affect the target capital structure and the speed of adjustment to target capital structure have been varied across countries but some common firm-specific factors like size, growth, tangibility and profitability play the important role in determining the optimal capital structure and variables like the distance between target and observed debt ratio, size and growth have been more influencing factors for determination of speed of adjustment to target leverage for all the countries.

Empirical framework

An empirical framework has been constructed to estimate the adjustment speed to target capital structure and to identify the factors which affect the speed of adjustment in the context of Indian manufacturing companies. This section has been divided into three sub-sections such as model specification and methodology, measures of leverage ratios, determinants of leverage ratios and determinants of adjustment speed to target leverage.

Model specification and methodology

We specify a dynamic panel data model to analyse the impact of adjustment costs and other firm-specific control variables on optimal leverage ratios of the firm. Let the optimal leverage ratio for firm i, at time t be denoted as $D/E^{*}_{i,t}$. It is specified as a function of a vector of firm and time-varying variables. Specifically, in this model, the optimal leverage is allowed to vary across firms and over time. Since factors that determine a firm's optimal leverage may change over time, it is likely that the optimal debt ratio itself may also move over time for the same firm. Thus, this formulation explicitly accommodates the dynamic nature of a firm's capital structure decision.

The model is specified as follows:

$$D/E^{*}_{i,t} = \alpha + \beta \acute{X}_{i,t} \tag{1}$$

where $D/E^{*}_{i,t}$ is the target leverage ratio and X the firm-specific variables.

Equation (1) provides an estimate of each firm's target leverage ratio, which we define as the debt ratio that firms would choose in the absence of information asymmetries, transaction costs and other adjustment costs. However, in an imperfect market, in the presence of adjustment costs firms may not fully adjust their actual debt ratio from the previous period to the current target debt ratio. Therefore, we have used a standard partial-adjustment model as used by Hovakimian *et al.* (2001) as follows:

$$(D/E_{i,t} - D/E_{i,t-1}) = \lambda(D/E^{*}_{i,t} - D/E_{i,t-1}) + \varepsilon_{it} \tag{2}$$

where $D/E_{i,t}$ and $D/E_{i,t-1}$ represent leverage for firm i in period's t and $t-1$, and λ represents the adjustment speed and this adjustment parameter represents the

magnitude of the desired adjustment between two subsequent periods or the rate of convergence of $D/E_{i,t}$ to its target level, $D/E^{*}_{i,t}$. The effects of the adjustment costs are represented by the restriction that $|\lambda| < 1$, which is a condition that $D/E_{i,t-1}$ tends to $D/E^{*}_{i,t}$ as $t \to \infty$. Leverage values that deviate from their target level will be regarded as sub-optimal. If $\lambda = 1$, then the adjustment process is completed within one period and the firm at time t is at its target leverage level. If $\lambda < 1$, then the adjustment from year $t - 1$ to t falls short of the adjustment required to be at the target level. If on the other hand, $\lambda > 1$, the firm over-adjusts by making more adjustment than it is required.

Equation (2) can be written as:

$$D/E_{i,t} = \lambda D/E^{*}_{i,t} + (1 - \lambda)D/E_{i,t-1} + \varepsilon_{it} \tag{3}$$

Putting the value of $D/E^{*}_{i,t}$ from Equation (1) in Equation (2) we get:

$$D/E_{i,t} = (1 - \lambda)D/E_{i,t-1} + \lambda\beta\acute{X}_{i,t} + \varepsilon_{it} \tag{4}$$

We also take the first difference of Equation (4) to eliminate the firm's fixed effects and thereby avoid any correlation between unobserved firm-specific characteristics and the explanatory variables:

$$\Delta D/E_{i,t} = (1 - \lambda)\Delta D/E_{i,t-1} + \lambda\beta\Delta X_{i,t} + \Delta\varepsilon_{it} \tag{5}$$

Further we have endogenized both the target level of adjustment and the adjustment factor to reach the target level, so that we extend the partial-adjustment process in Equation (4) to allow for per period degree of adjustment in the following way:

$$D/E_{i,t} = (1 - \lambda_{it})\, D/E_{it-1} + \lambda_{it}(D/E)^{*} + \varepsilon_{it} \tag{6}$$

where λ_{it} is not necessarily equal to λ. Now substituting Equation (1) in Equation (6), we get:

$$D/E_{i,t} = (1 - \lambda_{it})D/E_{it-1} + \lambda_{it}(\alpha + \beta X_{it}) + \varepsilon_{it} \tag{7}$$

Specifying λ_{it} as a linear function of factors affecting the transaction costs as well as the unobserved firm-specific effects the equation can be specified as:

$$\lambda_{i,t} = k + \phi Z'_{it} \tag{8}$$

where Z' is the vector of variables which affect the transaction costs of the company and k the unobservable factors related to company.

Substituting Equation (8) in Equation (7) we get:

$$D/E_{i,t} = [1 - (k + Z'_{it}\phi)]D/E_{i,t-1} + (k + z_{it}\phi)(\alpha + \beta X_{i,t}) + \varepsilon_{it} \tag{9}$$

$$D/E_{i,t} = (1 - k)D/E_{i,t-1} - Z'_{it}\phi D/E_{i,t-1} + (k + z_{it}\phi)(\alpha + \beta X_{i,t}) + \varepsilon_{it} \tag{10}$$

We have used the dynamic panel data method and more specifically the generalized method of moments (GMM) technique as suggested by Arellano and Bond (1991). They prove that GMM estimation provides consistent parameter estimates by utilizing

instruments that can be obtained from orthogonality conditions that exist between the lagged values of the variables and the disturbances. We have estimated Equations (5) and (10) separately to measure the adjustment speed to target leverage and determine the factors which affect the speed of adjustment to target capital structure.

Measures of leverage

Though there are vast literatures available on the various theories of capital structure but none of them talks about a clear cut definition of leverage. The choice of leverage depends upon the type of analysis one wants to carry out. There are two questions which basically a researcher face in order to select a leverage ratio – first is which particular ratio to choose and secondly whether to use book value of leverage or market value of leverage. Following Rajan and Zingales (1995) we have used the ratio of total debt to total capital where capital is defined as total debt plus total equity. This measure of leverage takes into account the capital employed and thereby gives a best representation of the effects of past financing decisions. This definition of leverage also relates to the agency problem associated with debt, as suggested by Jensen and Meckling (1976) and Myers (1977). For checking the robustness of the result we will be using two other definitions of leverage which are the ratio of total liabilities to total assets and ratio of debt (both short term and long term) to total assets.

The next question which comes automatically while selecting an appropriate definition of leverage is whether it should be computed as book or market value of equity. There are strong arguments both in favour of book and market leverage. Book leverage gives a better reflection of the management's target debt ratio and it is unaffected by volatility of market prices. On the other hand, market value of equity is dependent on a number of factors which are out of direct control of the firm and therefore it fails to reflect the underlying alterations initiated by a firm's decision makers. On the contrary the researcher in favour of market leverage puts their argument in favour of market value of leverage by stating that book leverage is a "plug number" (Frank and Goyal, 2009) used to balance the left hand and right hand sides of the balance sheet rather than a managerially relevant number (Welch, 2004). Welch (2004) has also argued that book value can take negative values. Moreover book measure is backward looking and it measures what has already taken place while market leverage is forward looking. In our study we will be using both the definition of book and market leverage but since the market value of debt is not available we will be using quasi-market leverage, where the book value of equity will be replaced by the market value of equity but debt will be valued at its book value.

Determinants of leverage

In our empirical analysis we have used the variables like size of the company, tangibility, non-debt tax shields, profitability, market to book ratio, research and development intensity, inflation and industry median to determine the optimal leverage ratio. The measures of these variables and their expected relationship with the leverage ratios are explained below. Size of the firm (SZ) may increase leverage because larger firms are more transparent, have lower asset volatility and have better access to public debt markets. It is measured as the natural logarithm of total assets. Tangible assets may be used as collateral and so may be associated with higher leverage. Tangibility (TANG) is measured as the ratio of fixed assets to total assets. Non-debt tax shield (NDTS) is measured as the ratio of depreciation to total assets. Firms with more depreciation expenses have less need for the interest deductions provided by debt

financing. Therefore, a negative relationship can be expected between leverage and non-debt tax shield. Profitability (PROF) is associated with the availability of internal funds and thus may be associated with less leverage. Another hypothesis is that profitable firms face more free cash flow problems in which case effective governance might call for more leverage. We measure profitability as the ratio of net income to total assets. A higher market to book ratio (M/B) is generally taken as sign of more attractive future growth options, which a firm tends to protect by limiting its leverage. It is measured as market to book ratio of assets. Research and development intensity (RDIN) is measured as the research and development expenditure as a proportion of total assets. Firms which have more intangible assets in the form of research and development expenses will prefer to have more equity. Therefore, a negative relationship can be expected between research and development intensity and leverage.

Industry median (INDM) is the firm's lagged industry median debt ratio and is used to capture industry characteristics which is not captured by other explanatory variables. Leverage ratios show a great deal of variability across different industries and these exhibitions of difference do have several meanings. One probable interpretation can be that managers use the industry median as a benchmark while selecting their own firm's leverage. Another interpretation can be that industry effects do reflect a set of correlated factors which are otherwise not taken into consideration. Higher industry median is expected to result in more debt. Inflation is assumed to be directly linked with the real cost of debt and equity. High inflation rate increases both the real cost of debt and equity. Therefore, the expected relation between inflation and leverage depends on the relative cost of debt to equity. If the relative real cost of debt is more than the cost of equity then the leverage ratio declines and if the real cost of debt is less than the cost of equity then the leverage increases. Therefore the impact of inflation on leverage can be empirically determined.

Determinants of the speed of adjustment

Following Drobertz and Wanzenried (2006) and Liu (2009) we have taken three variables such as distance between observed leverage and target leverage, size of the company and growth opportunity, which may have the impact on the speeds of adjustment towards the target capital structure. The expected relationship between adjustment speed and these three variables is explained below. The speed of adjustment towards the target capital structure level critically depends on how far away a firm's capital structure is from the target level. Therefore, we define a variable denoted as DIST which is the absolute difference between target leverage and observed leverage. This variable is defined as $|D/E^{*}_{i,t} - D/E_{i,t}|$, where $D/E^{*}_{i,t}$ is the fitted value from the fixed effect regression (results are not reported due to the lack of space) of the debt ratio of firm i on the capital structure determinants as of time t. The speed of adjustment is expected to be more rapid, the farther away the firm's capital structure is from its target level. Therefore, we predict a positive relationship between DIST and the adjustment speed. In this regard another argument is that if the major portion of the adjustment costs are fixed costs and fixed costs are very high then the firms may be reluctant to change the leverage more rapidly, so that a negative relationship can be hypothesized between DIST and the adjustment speed. Sorting out between the two arguments is an empirical matter. For larger firms the adjustment costs are relatively small to change the capital structure ratio and thereby they are more readily able to adjust to the target capital structure. Larger firms also do have better access to publicly available information thereby implying that they have

better access to debt and equity. Hence a positive relationship is expected between size and the speed of adjustment. A growing firm do find it easier to avail several alternative sources of financing and this makes them easier to make change in its capital structure. A low growth firm have lesser opportunities to avail in order to raise funds from the market and swap debt against equity to change its capital structure. Therefore, a positive relationship is expected between growth and adjustment speed.

Data

Our sample targets all the companies available in the PROWESS data base maintained by Centre for Monitoring the Indian Economy (CMIE). However, we have made several adjustments because of data constraints and other specific fundamental reasons. Following Rajan and Zingales (1995), we have excluded all financial firms because their financing policies are determined by many exogenous factors. Since leverage ratio is one of the significant concerns for manufacturing companies, this study has emphasized on that specific companies. We have selected those companies which have continuous data for the period 1992-1993 to 2007-2008, which represents the period of liberalization in India in order to have a balanced panel. We have identified nine major industry sub-groups within the manufacturing industry. We have found 891 companies which have the continuous data for the above-mentioned period and they all belong to the manufacturing industry. While calculating the certain variables we have lost one year data for all the companies. Therefore, the period of analysis of the study has been from 1993-1994 to 2007-2008.

Table I provides the information on the sample. The majority of the companies belong to chemicals, machinery, metal and metal products, food and beverages, transport, non-metallic mineral products, together they comprise about 80 per cent of the firms belonging to these industry groups.

Table II shows the summary statistics of the variables used in the empirical analysis. The correlation matrix presented in Table III concludes that although for some variables we find that the correlation coefficients are statistically significant, at the same time the values are very low thereby ruling out the possibility of multicollinearity.

Discussion of empirical results

The empirical results are discussed in two sub-sections. In the first sub-section we report the results of determination of target capital structure and the second section we provide the results for estimation of factors affecting the adjustment speed.

Categories	Total no. companies	Percentage to total
Food and beverages	80	8.98
Textiles	62	6.96
Chemicals	262	29.4
Non-metallic mineral products	74	8.31
Metal and metal products	101	11.34
Machinery	187	20.99
Transport	75	8.41
Miscellaneous manufacturing	44	4.94
Diversified	6	0.67
Total	891	100

Table I.
Firms in different industry groups

Source: Computed from Prowess database maintained by CMIE

Variables	Mean	Median	Standard deviation
SZ	2.05	2.01	0.72
TANG	0.67	0.65	0.35
NDTS	0.04	0.02	0.62
PROF	1.00	0.89	0.67
M/B	1.21	1.17	21.33
INFL	5.85	5.42	2.35
RDIN	0.003	0.00	0.01
(TD/TA)B	0.38	0.34	0.42
(TD/TC)B	0.67	0.59	0.68
(TL/TA)B	0.69	0.77	0.25
(TD/TA)M	0.60	0.51	0.59
(TD/TC)M	0.55	0.59	0.31
(TL/TA)M	0.66	0.72	0.26

Notes: TD is total debt; TA is total assets; TC is total capital; TL is total liability; B is book leverage; M is market leverage

Table II.
Summary statistics the variables used in the empirical analysis

Variable	SZ	TANG	NDTS	PROF	M/B	RDIN	INFL
SZ	1						
TANG	−0.035*	1					
NDTS	−0.075*	−0.014	1				
PROF	−0.09*	−0.13*	0.001	1			
M/B	0.01*	−0.03*	0.003	0.02*	1		
RDIN	0.12*	−0.05*	−0.006	0.03*	0.02*	1	
INFL	−0.10*	−0.07*	0.02*	−0.004	0.02*	−0.01*	1

Note: *Statistically significant at the 10 per cent level

Table III.
Correlation matrix of the independent variables

Determination of target leverage

Table IV shows the GMM estimations results of determination of leverage ratio during the period 1993-1994 to 2007-2008. All the test statistics support the use of GMM method and provide the evidence of no autocorrelation (Z_2 statistics), significance of the specification of model (Wald test) and validity of instrumental variables (Sargan test).

Table IV shows the regression coefficients results of both the book and market value of leverage ratios. The estimates of $(1 - \lambda)$ for book and market definition of leverage are more or less same, the reported coefficients are 0.59 and 0.57, which imply that firms close by 41 i.e. (1 − 0.59) to 43 i.e. (1 − 0.57) per cent the gap between current and desired leverage within one year. At this rate, it takes around 2.5 years to reach the firm's desired leverage. Such a rapid adjustment toward a firm-specific capital ratio suggests the existence of trade-off theory and rules out the existence of the dominance of pecking order theory in firms' debt ratio decisions (Flannery and Rangan, 2006).

For both book and market value of leverage definitions, it is found that size is statistically significant but it has the positive relationship with the book leverage and negative relationship with the market leverage. The difference in the results for book and market leverage ratios could be due to the changing nature of the market data. The positive effect of size on the leverage ratio may reflect several features. First, large firms might have better access to financial markets to raise long-term debt. Second, the ratio of

Variables	Book ratio Coefficients	Book ratio *t*-statistics	Market ratio Coefficients	Market ratio *t*-statistics
$(LEV)_{-1}$	0.59^{***}	39.95	0.57^{***}	49.18
SZ	-1.02^{***}	−29.60	0.098^{***}	10.00
TANG	-1.07^{***}	−3.43	-0.04^{***}	−5.40
NDTS	−0.008	−1.21	0.013^{***}	5.63
PROF	-0.07^{***}	−5.04	-0.049^{***}	−10.94
M/B	-0.0003^{**}	−2.04	-0.0001^{*}	−1.85
RDIN	−0.087	−0.16	-0.31^{*}	−1.87
INDM	0.57^{***}	20.55	0.31^{***}	30.44
INFL	−0.001	−0.87	-0.004^{***}	−6.64
Wald test	$\chi^2(9) = 105.26$ (0.041)		$\chi^2(9) = 143.04$ (0.037)	
Z_2	−0.83 (0.4063)		−0.39 (0.6811)	
Sargan test	$\chi^2(90) = 116.35$ (0.34)		$\chi^2(90) = 163.59$ (0.26)	
NOB	11,581		11,581	

Notes: For GMM, each variable is in its first difference form. Figures in parentheses are the *t*-statistics. *, ** and *** show the 10, 5 and 1 per cent level of significance, respectively; (1) Second order autocorrelation of residuals (z_2 statistics), which is distributed as standard normal N(0,1) under the null of no serial correlation; (2) Wald test is a test of joint significance of the estimated coefficients which is asymptotically distributed as chi-square under the null of no relationship; and (3) Sargan test of over identifying restrictions, which is asymptotically distributed as chi-square under the null of instrumental validity. The figures in the parenthesis for the test statistics are the degrees of freedom

Table IV.
GMM estimation result of capital structure (1993-1994 to 2007-2008)

bankruptcy costs to the firm value is higher for smaller firms since these costs include fixed costs which can be negligible for large firms. Since bankruptcy risk increases with borrowings, small firms borrow less than the large firms. Finally, the positive coefficient of the size is in line with the prediction that small firms are more vulnerable to a liquidation risk when they are in financial distress since banks are generally tougher against small firms. The negative relationship between size and market leverage can be attributed to the fact that the existence of information asymmetry between firm insiders and capital markets are lower for large firms, so that large firms are more capable of issuing sensitive securities like equity and therefore have lower debt.

The regression coefficients of tangibility are significant for both the book and market definition of leverage but with the negative sign. The negative impact of tangibility can be attributed to the fact that higher tangible assets have been associated with low information asymmetry which can make the external equity cheaper than debt financing. Non-debt tax shield has a negative relationship with the book leverage ratio, but it is not statistically significant. For market leverage, it has been positive and statistically significant. The positive impact of non-debt tax shield on leverage implies that it may not be used as a substitute for interest tax shields. The regression coefficients of profitability are all negative and statistically significant at 1 per cent level. The negative effect of profitability on debt ratio reflects the deviations from the target, which is offset when firms reset their capital structure (Hovakimian *et al.*, 2004). This result also concludes that firms have target debt ratios, but also prefer internal financing to external funds.

Market-to-book ratio has a negative impact on leverage ratios. The negative relation implies that firms are concerned with future as well as current financing costs. Balancing current and future costs, it is possible that firms with large expected growth

opportunities maintain low-risk debt capacity to avoid financing future investments with new equity offerings or even foregoing these investments. Therefore, the firms with larger expected investments have less current leverage. In this context the other argument is that the costs from issuing debt has been higher because of more conflicts between bond holders and share holders with substantial growth opportunities. Therefore, firms with more investment opportunities carry less leverage to signal the market that they do not engage in underinvestment and asset substitution (Jensen, 1986). The regression coefficient for research and development intensity is negative and statistically significant for only the market value of leverage. The negative relation can be explained by the fact that firms which has more intangible assets in the form of research and development expenses will have more of equity and less of debt.

The regression coefficients of industry median are statistically significant for book and market definition of leverage with positive signs. This result is very much consistent with our expected hypothesis. This positive impact of industry median on leverage ratio in the case of Indian companies reflects that the companies may be following the industry for choosing their optimal capital structure. The regression coefficient of inflation is statistically significant only for the market value of leverage with a negative sign. The negative impact of inflation on leverage implies that high inflation rates increase the real cost of debt more than the cost of equity, so that it is costlier to raise debt capital as compared to equity in that period.

Determination of adjustment speed to target leverage

Table V shows the empirical results of the firm-specific determinants of speed of adjustment to target capital structure. From Equation (10) we can see that the coefficient of the interaction term of lagged value of coefficient and the determinants of adjustment speed has been negative. Therefore, it is important to interpret the signs of the respective estimates for the coefficients of the interaction terms accordingly. A negative sign in the interaction term implies a faster adjustment speed and a positive sign implies a lower adjustment speed.

There is evidence of a statistically strong and positive relationship between the speed of adjustment and the distance variable. This result confirms the idea that the

Variables	(TD/TC) book Coefficients	*t*-statistics	(TD/TC) market Coefficients	*t*-statistics
$(LEV)_{-1}$	0.45^{*}	23.00	0.52^{*}	20.19
$(LEV)_{-1} \times DIST$	-0.0008^{*}	−7.83	-1.24^{*}	−11.68
$(LEV)_{-1} \times SIZE$	-1.26^{*}	−14.67	-0.29^{*}	−26.03
$(LEV)_{-1} \times GROWTH$	0.003^{*}	12.10	-0.0003^{*}	−2.46
Wald test statistics	$\chi^2(12) = 4{,}618.22$		$\chi^2(12) = 61{,}099.97$	
Z_2 statistics	−1.20 (0.2313)		−1.39 (0.2419)	
Sargan test	$\chi^2(77) = 84.67$ (0.57)		$\chi^2(77) = 91.23$ (0.49)	

Notes: For GMM, each variable is in its first difference form. Figures in parentheses are the *t*-statistics. * shows 1 per cent level of significance; (1) Second order autocorrelation of residuals (z_2 statistics), which is distributed as standard normal N(0,1) under the null of no serial correlation; (2) Wald test is a test of joint significance of the estimated coefficients which is asymptotically distributed as chi-square under the null of no relationship; and (3) Sargan test of over identifying restrictions, which is asymptotically distributed as chi-square under the null of instrumental validity. The figures in the parenthesis for the test statistics are the degrees of freedom

Table V.
The determinants of speed of adjustment

firm's cost of maintaining a sub optimal debt ratio is higher than the cost of adjustment and the fixed costs of adjustments are not significant. Therefore, the companies which are sufficiently away from their target leverage always want to reach the optimal very quickly. We find a positive relationship between size of the company and the adjustment speed. This result lends support to the hypothesis that for large firms the adjustment costs are relatively lesser than the small firms due to the less asymmetric information. Therefore, the adjustment speed to the target leverage ratio has been more for large firms than small firms. The estimated coefficient of the interaction term with growth is statistically significant but it is positive for book leverage and negative for market leverage. The results for market leverage are consistent with our hypothesis. This result indicates that firms with higher growth opportunities adjust faster towards their target leverage. This result confirms the hypothesis that a growing firm may find it easier to change its capital structure by altering the composition of new issuances.

Robustness

The discussions of target debt ratios and the speed of adjustment towards the target capital structure have been tested across other definitions of leverage ratios. We have used the other two definitions of leverage namely total debt to total assets and total liabilities to total assets. Both the book and market definition of leverage have been used in this context for the period 1993-1994 to 2007-2008. From the results thus obtained from Table VI we can conclude that the regression coefficients of size, non-debt tax shields, profitability, inflation, industry median are all significant for all the two different definitions of book and market leverage. The speed of adjustment has varied from 45 to 60 per cent across the two definition of leverage including both the book and market value of leverage. These findings are consistent with the results obtained from other definition of leverage discussed earlier.

Table VII represents the robustness check of the determinants of adjustment speed towards the target capital structure across the other two definitions of leverage. We find that the estimates coefficients of distance with respect to adjustment speed are statistically significant for all the book and market values of leverage across the definitions and it has the positive impact on adjustment speed to the target leverage.

The estimated coefficients of the interaction term of size with the lagged value of leverage are not only statistically significant but also have a negative sign supporting our hypothesis. This implies that across the definitions size has been one of the most influencing factors which affect the adjustment speed. The estimated coefficients of growth with the interaction term is statistically significant for book leverage ratio measured by total debt to total assets and market leverage ratio measured by total liabilities to total assets. It has a positive sign for the book definition of leverage and negative sign with the market value of leverage. For the market leverage only our hypothesis is valid i.e. higher growth firms adjust faster towards target leverage level.

Conclusions and managerial implications

This study has made an attempt to study the dynamic trade-off theory of capital structure in the context Indian manufacturing industries in a partial-adjustment framework. The uniqueness of the paper lies in the fact that not only we have tried to find out factors which affect the leverage ratio of the company but we have also made an attempt to study the factors which affects the adjustment speed to target capital

Variables	TD/TA		TL/TA	
	Book	Market	Book	Market
$(LEV)_{-1}$	0.43***	0.40***	0.55***	0.46***
	(22.36)	(31.83)	(30.85)	(41.16)
SZ	−0.63***	0.005	0.12***	0.12***
	(−34.97)	(0.17)	(14.84)	(14.73)
TANG	0.003	−0.049*	−0.02**	−0.05***
	(0.24)	(−1.69)	(−3.13)	(−6.42)
NDTS	−0.045***	0.014**	0.01***	0.01***
	(−10.81)	(1.98)	(5.51)	(7.48)
PROF	−0.089***	−0.086***	−0.025***	−0.02***
	(−11.21)	(−6.05)	(−6.87)	(−7.30)
M/B	0.0003**	−0.00002	−0.00003	−0.0001**
	(3.06)	(−0.12)	(−0.81)	(−2.75)
RDIN	−0.065	−0.27	0.038	−0.35**
	(−0.22)	(−0.51)	(0.27)	(−2.44)
INDM	1.24***	0.75***	0.24***	0.42***
	(17.08)	(25.34)	(5.22)	(39.31)
INFL	0.005***	−0.007***	−0.001***	−0.003***
	(4.85)	(−3.40)	(−3.20)	(−6.19)
Wald test	$\chi^2(9) = 2{,}728.91$	$\chi^2(9) = 3{,}474.94$	$\chi^2(9) = 1{,}531.86$	$\chi^2(9) = 16{,}520.20$
results	(0.00)	(0.00)	(0.00)	(0.00)
Z_2	1.46 (0.14)	1.37 (0.19)	−0.17 (0.8612)	−1.02 (0.3096)
Sargan test	$\chi^2(90) = 54.42$	$\chi^2(90) = 83.88$	$\chi^2(90) = 89.10$	$\chi^2(90) = 91.88$
NOB	11,581	11,581	11,581	11,581

Notes: For GMM, each variable is in its first difference form. Figures in parentheses are the *t*-statistics. *, ** and *** show the 10, 5 and 1 per cent level of significance, respectively; (1) Second order autocorrelation of residuals (z_2 statistics), which is distributed as standard normal N(0,1) under the null of no serial correlation; (2) Wald test is a test of joint significance of the estimated coefficients which is asymptotically distributed as chi-square under the null of no relationship; and (3) Sargan test of over identifying restrictions, which is asymptotically distributed as chi-square under the null of instrumental validity. The figures in the parenthesis for the test statistics are the degrees of freedom

Table VI.
GMM estimation result of optimal capital structure

structure of the company. We estimated the speed adjustment for all firms regardless of whether there are deviations of the firms' capital structures from their target levels and how far away the deviations are. The results showed that firm-specific variables like size, tangibility, profitability, market-to-book ratio are statistically significant across both the book and market definition of leverage. The speed of adjustment towards the target capital structure is around 33 per cent which validates the fact that there is an existence of optimal capital structure for Indian manufacturing companies and they do want to achieve it. In this context we have also tried to find out the factors which affect the adjustment speed to target capital structure. We found that size and distance do affect the speed of adjustment through the varying adjustment costs. These results imply that firms that are farther away from the target leverage tend to adjust faster, supporting the hypothesis that substantial deviations from an optimal target capital structure are costly and that firm's trade off these costs with the costs of readjustment. We also found that larger companies do the adjustment more rapidly than smaller companies. It could be due to the low issuance costs faced by the large companies than the small companies.

Variables	(TD/TA) Book	(TD/TA) Market	(TL/TA) Book	(TL/TA) Market
$(LEV)_{-1}$	0.15***	0.37***	0.24***	0.10***
	(6.13)	(10.95)	(7.35)	(6.28)
$(LEV)_{-1} \times DIST$	−0.0006***	−0.19***	−1.22***	−1.25***
	(−6.37)	(−75.85)	(−135.99)	(−219.69)
$(LEV)_{-1} \times SIZE$	−0.008*	−0.37***	−0.029**	−0.08***
	(−1.68)	(−22.53)	(−2.10)	(−13.13)
$(LEV)_{-1} \times GROWTH$	0.002***	−0.00007	−0.0001	−0.002**
	(10.24)	(−0.13)	(−0.97)	(−2.14)
Wald test	$\chi^2(12) = 2{,}593.36$	$\chi^2(12) = 13{,}652.88$	$\chi^2(12) = 22{,}449.26$	$\chi^2(12) = 117{,}145.8$
Z_2	1.06 (0.28)	−0.47 (0.63)	−1.24 (0.18)	−1.39 (0.15)
Sargan test	$\chi^2(77) = 62.56$	$\chi^2(77) = 69.84$	$\chi^2(77) = 71.34$	$\chi^2(77) = 56.47$

Notes: For GMM, each variable is in its first difference form. Figures in parentheses are the *t*-statistics. *, ** and *** show the 10, 5 and 1 per cent level of significance, respectively; (1) Second order autocorrelation of residuals (z_2 statistics), which is distributed as standard normal N(0,1) under the null of no serial correlation; (2) Wald test is a test of joint significance of the estimated coefficients which is asymptotically distributed as chi-square under the null of no relationship; and (3) Sargan test of over identifying restrictions, which is asymptotically distributed as chi-square under the null of instrumental validity. The figures in the parenthesis for the test statistics are the degrees of freedom

Table VII.
The determinants of speed of adjustment across definitions towards target capital structure

The robustness of the results has also been tested across the other definitions of leverage namely total debt to total assets and total liabilities to total assets. It is found that the variables like non-debt tax shield, profitability, inflation and industry median are playing the significant role for determination of optimal leverage ratio in India. We find that size and distance play the significant role for determination of adjustment speed to target capital structure across both the alternative definitions of leverage. The overall results are consistent with the dynamic trade-off theory of capital structure. It has the implications for the Indian corporate managers. The managers should consider the various adjustment costs while altering the financing decisions of the company with other practical variables like flexibility of the manager, direct cost of debt and equity. The positive relationship between the distance and adjustment speed to target capital structure signals the managers that the cost of maintaining the sub-optimal leverage has been costlier than the other adjustment costs faced by the company to achieve the optimal or target leverage ratio. Therefore, the managers should take appropriate steps to achieve the target in the appropriate time.

References

Arellano, M. and Bond, S. (1991), "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations", *The Review of Economics Studies*, Vol. 58, pp. 277-97.

Baker, M. and Wurgler, J. (2002), "Market timing and capital structure", *Journal of Finance*, Vol. 57, pp. 1-32.

Banerjee, S., Heshmati, A. and Wihlborg, C. (2004), "The dynamics of capital structure", *Research in Banking and Finance*, Vol. 4, pp. 275-97.

Bhaduri, S. (2002), "Determinants of capital structure: a study of the Indian corporate sector", *Journal of Applied Financial Economics*, Vol. 12, pp. 655-65.

Byoun, S. (2008), "How and when do firms adjust their capital structures toward targets?", *Journal of Finance*, Vol. 63, pp. 3069-96.

De Miguel, A. and Pindado, J. (2001), "Determinants of capital structure: new evidence from Spanish panel data", *Journal of Corporate Finance*, Vol. 7, pp. 77-99.

Drobertz, W. and Wanzenried, G. (2006), "What determines the speed of adjustment to the target capital structure?", *Applied Financial Economics*, Vol. 16, pp. 941-58.

Fama, E. and French, K. (2002), "Testing tradeoff and pecking order predictions about dividends and debt", *Review of Financial Studies*, Vol. 15, pp. 1-33.

Faulkender, M., Flannery, M., Hankins, K. and Smith, J. (2008), "Are adjustment costs impeding realization of target capital structure?", *Proceedings of the 68th Annual AFA Meeting, New Orleans, LA, 4-6 January.*

Fischer, E., Heinkel, R. and Zechner, J. (1989), "Dynamic capital structure choice: theory and tests", *Journal of Finance*, Vol. 44, pp. 19-40.

Flannery, M. and Hankins, K. (2007), "A theory of capital structure adjustment speed", working paper.

Flannery, M. and Rangan, K. (2006), "Partial adjustment towards target capital structures", *Journal of Financial Economics*, Vol. 79, pp. 469-506.

Frank, M. and Goyal, V. (2009), "Capital structure decisions: which factors are reliably important?", *Financial Management*, Vol. 67, pp. 1-37.

Haas, R. and Peeters, M. (2004), "The dynamic adjustment towards target capital structures of firms in transition economies", Working Paper No. 87, European Bank for Reconstruction and Development, London, June.

Heshmati, A. (2001), "The dynamics of capital structure: evidence from Swedish micro and small firms", *Research in Banking and Finance*, Vol. 2, pp. 199-241.

Hovakimian, A., Hovakimian, G. and Tehranian, H. (2004), "Determinants of target capital structure: the case of dual debt and equity issues", *Journal of Financial Economics*, Vol. 71, pp. 517-40.

Hovakimian, A., Opler, T. and Titman, S. (2001), "The debt-equity choice", *Journal of Financial and Quantitative Analysis*, Vol. 36, pp. 1-24.

Huang, R. and Ritter, J. (2009), "Testing theories of capital structure and estimating the speed of adjustment", *Journal of Financial and Quantitative Analysis*, Vol. 44, pp. 237-71.

Jalilvand, A. and Harris, R. (1984), "Corporate behavior in adjustment to capital structure and dividend targets: an econometric study", *Journal of Finance*, Vol. 39, pp. 127-45.

Jensen, M. (1986), "Agency costs of free cash flow, corporate finance, and takeovers", *American Economic Review*, Vol. 76, pp. 323-9.

Jensen, M. and Meckling, W. (1976), "Theory of the firm: managerial behavior, agency costs and ownership structure", *Journal of Financial Economics*, Vol. 3, pp. 305-60.

Leary, M. and Roberts, M. (2005), "Do firms rebalance their capital structure?", *Journal of Finance*, Vol. 60, pp. 2575-619.

Liu, L. (2009), "Historical market-to-book in a partial adjustment model of leverage", *Journal of Corporate Finance*, Vol. 15, pp. 602-12.

Lööf, H. (2004), "Dynamic optimal capital structure and technical change", *Structural Change and Economic Dynamics*, Vol. 15, pp. 449-68.

Mahakud, J. and Bhole, L. (2003), "Determinants of corporate capital structure in India: a dynamic panel data analysis", *ICFAI Journal of Applied Finance*, Vol. 9, pp. 41-53.

Myers, S. (1977), "Determinants of corporate borrowing", *Journal of Financial Economics*, Vol. 5, pp. 147-75.

Myers, S. (1984), "The capital structure puzzle", *Journal of Finance*, Vol. 39, pp. 575-92.

Qian, Y., Tian, Y. and Wirjanto, T. (2009), "Do Chinese publicly listed companies adjust their capital structure toward a target level?", *China Economic Review*, Vol. 20, pp. 662-76.

Rajan, R. and Zingales, L. (1995), "What do we know about capital structure? Some evidence from international data", *Journal of Finance*, Vol. 50, pp. 1421-60.

Rajbhandary, A. (1997), "Capital structure of firms in developing countries: results for India", unpublished manuscript.

Welch, I. (2004), "Capital structure and stock returns", *Journal of Political Economy*, Vol. 112, pp. 106-31.

Xu, Z. (2009), "The impact of market timing on Canadian and US firms capital structure", working paper, Bank of Canada, Ottawa.

Further reading

Sargan, J. (1958), "The estimation of economic relationships using instrumental variables", *Econometrica*, Vol. 26, pp. 393-415.

About the authors

Sulagna Mukherjee is a Senior Research Fellow in the Department of Humanities and Social Science, Indian Institute of Technology Kharagpur, Kharagpur, India. She has completed her Master's in Economics from Calcutta University and MPhil in International Trade and Finance from Jadavpur University. Her areas of research comprises of corporate finance, and financial markets.

Jitendra Mahakud is Assistant Professor of Economics and Finance at the Indian Institute of Technology Kharagpur India. He obtained his PhD degree from Indian Institute of Technology, Mumbai, India, in Corporate Finance. His areas of research and teaching include financial institutions and markets, corporate finance, investment management, financial econometrics, macroeconomics and monetary economics. He has published more than 20 papers in leading national and international journals. He has co-authored a book titled *Financial Institutions and Markets: Structure, Growth and Innovations* published by Tata McGraw-Hill. Jitendra Mahakud is the corresponding author and can be contacted at: jmahakud@yahoo.com