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Sana Tauseef
Institute of Business Administration, Karachi, Pakistan

Heman Das Lohano
Institute of Business Administration, Karachi, Pakistan

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Sana Tauseef · Heman D. Lohano

Abstract We examine the impact of debt ratios on returns on equity based on panel data for 179 companies from the non-financial corporate sector of Pakistan for the years 2000 to 2015. The least squares fixed effects estimator reveals that the debt ratio has a significant positive effect on return on equity up to an optimal debt level of 40 percent beyond which it has a significant negative effect.

Keywords Panel data · Debt financing · Profitability · Pakistan · Non-financial firms.

1 Introduction

One of the crucial financial decisions faced by firms in the corporate sector is the determination of the relative levels of debt and equity used for financing their assets. This is referred to as the capital structure of the firm. Many theoretical as well as empirical studies have been carried out to examine the effect of capital structure on firms' profitability. Interest in this topic has emerged since the seminal article by Modigliani and Miller (1958). They developed a theoretical model to demonstrate that the profitability of firms is not affected by the amount of debt, assuming that the capital market is perfect.

However, given the real world of imperfect capital markets, where the firms have to pay taxes and face the risk of bankruptcy, Scott (1976) developed a theoretical model to show that the amount of debt does affect the firms' profitability and there exists an optimum capital structure for a firm. Numerous studies have been conducted to understand the impact of debt on the profitability of firms (Myers, 2001). Some empirical studies have shown a negative

Sana Tauseef
Institute of Business Administration, University Road, Karachi-Pakistan
E-mail: sasghar@iba.edu.pk

Heman D. Lohano
Institute of Business Administration, University Road, Karachi-Pakistan

effect of debt financing on the firm's profitability while other studies have shown a positive effect. Studies by Majumdar (1997) and Mahakud and Misra (2009) using data from India, found that debt financing has a negative effect on firm's profitability. They attributed this to the high interest burden, agency costs, and the ownership and control of lending financial institutions by the government. Moreover, the negative effect of debt on profitability may also arise because of the conflict of interest between debt holders and shareholders (Jensen and Meckling, 1976).

Opler and Titman (1994) found that highly leveraged firms experience greater losses during industry downturns due to indirect costs, such as research and development as compared to firms with lower leverage. Cheng (2009) used data for listed companies in Taiwan and found a significant negative effect of debt on the operating performance of all firms other than the firms with high cash flows. Yazdanfar and Öhman (2015) using Swedish data, also reported a higher debt ratio to have a negative effect on firms' profitability.

(Qureshi and Yousaf, 2014) investigated the determinants of the firm's financial performance in Pakistan using data for non-financial companies from 1987 to 2008 and found the debt ratio to be adversely affecting the return on assets. Another study in Pakistan by (Habib et al., 2016) also found similar results for the non-financial firms.

Literature also supports the notion that debt financing has a positive effect on firm's profitability. Baker (1973) found that large amount of financial leverage is likely to increase profitability. According to Jensen (1986), use of debt reduces the agency costs by disciplining the managers of the firm in the management of cash flows as the firms are committed to make a fixed payment on debt financing. Ross (1977) argued that higher leverage of a firm is a signal to the market of its profitable future prospects. According to Heinkel (1982), a positive relationship between debt financing and the value of the firm would exist if capital suppliers have imperfect information about the firm or if the insiders are better informed about the firm's true value. Graham (1996) showed that debt provides significant tax benefits to firms that face relatively higher marginal tax rate.

The previous empirical studies, discussed above, have assumed a monotonic relationship showing either a negative or a positive effect of debt financing on firms' profitability. The exception is Tauseef et al (2013), who found a non-monotonic relationship between debt-to-asset ratio and return on equity. Using firm level data from the textile industry for five years over the period from 2003 to 2008, they found a non-linear effect of the debt-to-asset ratio on the return on equity, with the return on equity initially increasing until an optimum debt level is reached, after which the return on equity starts declining. This finding is consistent with the theoretical model developed by Scott (1976), who extended the Modigliani and Miller (1958) model by relaxing the assumption of perfect capital markets and showed that an optimal capital structure exists for a firm. Furthermore, the tradeoff theory proposes determining a moderate level of debt ratio considering the benefits of debt financing such as tax savings and the costs of debt financing like bankruptcy risks and financial distress [(Baxter, 1967); (Myers, 2001)].

In this research, we evaluate the effect of debt ratio on firms' profitability to empirically determine the optimum level of debt ratio for the firms in the non-financial corporate sector of Pakistan. Non-financial corporate sector includes the major industries of Pakistan, such as textile, sugar, automobile, cement, food, refinery, fuel, energy, and many other industries. Determining the optimum level of debt ratio will help policy makers and managers in designing appropriate debt policy for stable and sustainable growth of firms. This is particularly important for Pakistan, where industrial sector accounts for 21 percent of GDP and is a major source of tax revenues (Government of Pakistan, 2017).

In this study, we estimate multiple linear regression models using panel data for companies from the non-financial corporate sector of Pakistan over a 16-year period from 2000 to 2015. We extend the work of Tauseef et al (2013) in three major ways. Firstly, we use latest firm level data from 13 different industries including the textile industry over a longer time period. The latest data is particularly important after the financial crisis of 2008. Secondly, in addition to conducting analysis of all firms in the non-financial corporate sector, we also conduct a separate analysis for two subgroups of these firms: textile and non-textile firms. The separate analysis is conducted due to different features of these subgroups of industries. The textile industry is a big subsector and export oriented. The share of the textile industry in the national exports and the employment of industrial labor force is 62 percent and 40 percent respectively (Government of Pakistan, 2017). Finally, we include the firm's market share as an additional explanatory variable. The market share measures the firm's competitiveness in the respective industry and is reported as an important factor affecting firm's profitability (Gale, 1972).

Literature has also shown an extensive cross-sectional heterogeneity in profitability and capital structure of firms due to industry specific factors and firm specific factors [(Schwartz and Aronson, 1967); (MacKay and Phillips, 2005); (Miao, 2005); (Talberg et al., 2008)]. Furthermore, there is a variation in the economic environment over time due to changes in tax structure, inflation and other macroeconomic variables. Thus, we estimate a panel data model with two-way error components to control for firm specific effects as well as time specific effects.

2 Data

For this study, we use panel data for companies from the non-financial corporate sector of Pakistan, listed on the Karachi Stock Exchange for 16 years from 2000 to 2015. Data was obtained from the financial statement analysis reports published by the State Bank of Pakistan.[1] In the year 2015, there were 384 non-financial companies. We excluded the companies with missing observations and the companies that had negative equity. The study sample consists of panel data for 179 non-financial firms for 16 years.

Our sample includes 74 firms from the textile industry and 105 firms from

[1] The data has been taken from SBP Balance Sheet Analysis reports of joint stock companies (2005, 2008) and SBP Financial Statement Analysis reports (2014, 2016).

the other 12 industries including chemicals and pharmaceuticals, sugar, automobile, manufacturing, food, paper, refinery, fuel and energy, cement, information and communication, paper, electric machinery, and other service activities, as categorized by the State Bank of Pakistan (various years). The industry wise composition of the sample is presented in table A.1 in Appendix A.

3 Econometric model and estimation methods

For the purpose of evaluating the effect of capital structure on firms' profitability, we follow the model developed by Abor (2007) and Tauseef et al (2013). The empirical model used in the study is as follows:

$$ROE_{it} = \beta_0 + \beta_1 DA_{it} + \beta_2 DA_{it}^2 + \beta_3 FS_{it} + \beta_4 SG_{it} + \beta_5 MS_{it} + \mu_i + \lambda_t + \varepsilon_{it}. \quad (1)$$

In equation (1), the dependent variable is the return on equity (ROE), which is a measure of firm's profitability. ROE is the ratio of annual after-tax net income of a firm to its total equity, and it measures the rate of return on equity. The explanatory variables include debt-to-asset ratio (debt ratio), its squared term, firm size, sales growth rate, and market share. Debt ratio (DA) indicates the capital structure of the firm. It is the ratio of total debt to total assets. The total debt of the sample firms includes current debt, bank loans, loans from other financial institutions, term finance certificates, preferred equity, and employee benefit obligations. Though the usual definition of capital structure excludes short-term debt, but because of substitutability between short and long-term debt, use of total debt as a measure of financial leverage is considered more appropriate (Schwartz and Aronson, 1967). The squared term of the debt ratio is included to examine whether the relationship between debt ratio and ROE is monotonic or non-monotonic. Firm size (FS) indicator is measured by the natural logarithm (ln) of total assets in billion rupees (Rs.). Sales growth rate (SG) is computed as the rate of change in sales from the previous year. Market share (MS) is computed as the firm's sales as a proportion of the total industry sales.

The model in equation (1) includes a two-way error component to control for unobserved firm-specific effects (i), such as brand name and management quality, and the unobserved year-specific effects (t), such as inflation and tax rates. Including the two-way error component in the model corrects for the potential omitted variable bias. The firm-specific effects and year-specific effects can be assumed to be fixed parameters or random variables. As the panel data is for 16 years, not representing a random sample, we use the fixed effects for years (Baltagi, 2008). The panel data includes data for 179 firms, which include 74 textile firms and 105 non-textile firms. Given the large number of firms, the firm-specific effects may be random or fixed. We estimate the fixed effects model using least squares fixed effects estimator. We estimate the random effects model using the Swamy-Arora feasible GLS estimator. We test whether the firm-specific effects are random or fixed using the Hausman test (Baltagi, 2008).

In our econometric model in equation (1), we assume that the explanatory

variables are exogenous. However, some of these variables may be endogenous due to omitted variables or reverse causality. Future research could address the issue of endogeneity. Explanatory variables in equation (1) include the debt ratio and its squared term. When the coefficient estimates of both the variables are statistically significant, it shows a statistical evidence of quadratic relationship between the expected value of ROE and debt ratio. In this case, we can determine the optimal debt ratio (DA*) that maximizes the expected value of return on equity as follows:

$$DA^* = \frac{-\hat{\beta}_1}{2\hat{\beta}_2} \tag{2}$$

where $\hat{\beta}_1$ is the estimated coefficient on debt ratio and $\hat{\beta}_2$ is the estimated coefficient on its squared term. The maximization of expected value of return on equity for a positive level of debt ratio requires that $\hat{\beta}_1$ is positive and $\hat{\beta}_2$ is negative. We construct the confidence interval for DA* using the delta method.

4 Results and discussion

4.1 Descriptive statistics

Table 1 presents the descriptive statistics of the variables over the sixteen-year period. The statistics for the two subsamples, textile and non-textile, are also presented separately. The statistics show that the mean return on equity is 13.7 percent. Non-textile firms have reported a higher mean return on equity (17.4 percent) as compared to textile firms (8.4 percent). However, the return on equity for non-textile firms has also been more volatile than that for textile firms as indicated by their standard deviation.

The mean debt ratio is 55.6 percent. Textile firms, on average, have a higher proportion of the total assets financed by total debt (60.7 percent) as compared to non-textile firms (52 percent). The firm size is measured by the total assets. The mean total assets are Rs. 2.066 billion (see table 1). The mean sales growth rate is 17.4 percent. The mean sales growth rate of textile firms is slightly less (16.5 percent) than that for non-textile firms (18.1 percent). The mean market share of the sample firms is 7.3 percent. The mean market share of textile firms is very small (1.35 percent). The statistics on market share show that textile firms are more competitive and are smaller in size as compared to non-textile firms.

4.2 Regression results

In this section, we present the regression results of the econometric model specified in Section 3. This model has two-way error components. As explained above, we use the fixed effects for years and test whether the firm-specific effects are random or fixed using the Hausman test, presented in table 2. The results show that the p-value of the test statistic is less than 0.05 for both textile and non-textile firms, so the test rejects the null hypothesis of random effects. Thus,

Table 1: Descriptive statistics for the period 2000-2015

Variable	Mean textile firms	Mean non-textile firms	Mean all firms
Return on equity	0.084	0.174	0.137
	(0.577)	(0.802)	(0.719)
Debt-to-asset ratio	0.607	0.52	0.556
	(0.177)	(0.22)	(0.208)
Firm size	1.686	2.384	2.066
	(1.296)	(1.896)	(1.683)
Sales growth rate	0.165	0.181	0.174
	(0.548)	(0.474)	(0.506)
Market share	0.014	0.114	0.073
	(0.017)	(0.172)	(0.141)
Number of firms	74	105	179
Number of observations	1184	1680	2864

Note: Standard deviations are given in parentheses

we use the fixed effects for firm-specific effects in the model. Table 3 presents the regression results using fixed effects for the firm-specific as well as year-specific effects. In this regression, the coefficient of determination (R-squared) is between the range of 0.16 to 0.19.

Table 2: Results of Hausman Test for firm-specific effects

	Chi-Square Statistic	Degrees of Freedom	p-value
Textile Firms	11.866	5	0.037
Non-Textile Firms	14.141	5	0.015
All Firms	9.135	5	0.104

Table 3: Regression results of panel data model

	Textile Firms	Non-Textile Firms	All Firms
Dependent variable: Return on equity			
Constant	-1.414***	0.192	-0.264
	(0.334)	(0.26)	(0.201)
Debt ratio	1.398***	1.246***	1.296***
	(0.523)	(0.476)	(0.357)
Debt ratio squared	-1.838***	-1.530***	-1.637***
	(0.461)	(0.432)	(0.32)
Firm size (ln of total assets)	0.180***	-0.032	0.028
	(0.041)	(0.030)	(0.023)
Sales growth rate	0.051	0.093**	0.085***
	(0.031)	(0.041)	(0.026)
Market share	3.012	0.454	0.405
	(3.502)	(0.424)	(0.375)
Firm-specific fixed effects	Yes	Yes	Yes
Year-specific fixed effects	Yes	Yes	Yes
Number of observations	1184	1680	2864
R-squared	0.193	0.163	0.161

Note: The standard errors of coefficient estimates are given in parentheses. ** and *** indicate statistical significance at 5% and 1%, respectively.

The results show that the debt ratio and its squared term are statistically significant at the 1 percent level for each case: textile firms, non-textile firms, and all firms (table 3). We find that the relationship between the predicted return on equity and debt ratio is quadratic, i.e., debt ratio has a significant positive effect on return on equity up to an optimal level of debt ratio beyond which it has a significant negative effect. These findings are consistent with the theoretical model developed by Scott (1976), who showed that firms have an optimal capital structure.

Using the coefficient estimates on debt ratio and its squared term, the optimal debt ratio is estimated as 38 percent for textile firms, 41 percent for non-textile firms, and 40 percent for all non-financial firms, with 95 percent confidence intervals [27, 49], [30, 52], and [32, 48], respectively. These findings are consistent with the tradeoff theory, which suggests a moderate level of debt ratio based on the benefits of debt financing such as tax savings and the costs of debt financing like bankruptcy risks and financial distress (Baxter, 1967) (Myers, 2001). The different levels of optimal debt ratio for textile and non-textile firms is justified by literature which documents that firms in different industries have different optimal financial structures based on typical asset structures and stability of earnings within the industries (Schwartz, 1959).

The results show that firm size is statistically significant at 1 percent level for textile firms and the sign of the estimated coefficient is positive. This indicates that larger textile firms have a relatively higher return on equity. The sales growth rate is statistically significant for non-textile firms and all firms, and the sign of the estimated coefficient is positive. This indicates that firms with higher sales growth rate achieve higher return on equity. The coefficient estimate on market share is statistically not significant in any regression.

In this study, return on equity has been used as a measure of firm's profitability. Shareholders are generally interested in the return on equity as it measures how efficiently the firm uses their invested money to generate profits. However, for robustness checks, we have investigated the impact of debt ratio on return on assets (ROA) as the firm's performance indicator (table A.2 in Appendix A). Consistent with the findings of previous studies (Qureshi and Yousaf, 2014) (Habib et al., 2016) our results show a negative effect of debt ratio on ROA for all non-financial firms and for textile firms.

5 Conclusion and policy implications

In this study, we evaluated the effect of the debt ratio on the return on equity using panel data for firms from the non-financial sector of Pakistan. We find a non-monotonic and nonlinear relationship between debt ratio and return on equity. Debt ratio has a significant positive effect on return on equity up to an optimal level beyond which it has a significant negative effect. The optimal debt ratio is estimated as 38 percent for textile firms, 41 percent for non-textile firms, and 40 percent for all non-financial firms. The findings of this study are in line with the tradeoff theory, which supports a moderate level of debt ratio, and also with the theoretical model developed by Scott (1976), which is based

on the real world of imperfect capital markets, and showed that there exists an optimal capital structure for a firm. Results of our study suggest that firms have an optimal capital structure that maximizes their profitability. Firms with a high debt ratio can make higher return on equity by adjusting the capital structure to a lower debt ratio level.

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Appendix

Table A1: Number of sample firms in each industry

Industry	Number of Firms
Textile	74
Non-Textile	105
Chemicals and Pharmaceuticals	24
Sugar	20
Automobile	12
Manufacturing	10
Food	6
Paper	6
Refinery	6
Fuel and Energy	5
Cement	4
Information and Communication	4
Electric machinery	4
Other Service Activities	4
Total	179

Table A2: Regression results of panel data model with ROA

	Textile Firms	Non-Textile Firms	All Firms
Dependent variable: Return on assets (ROA)			
Constant	0.015	0.086	0.149***
	(0.066)	(0.191)	(0.028)
Debt ratio	-0.372***	1.025***	-0.145***
	(0.104)	(0.349)	(0.05)
Debt ratio squared	0.153	-1.409***	-0.071
	(0.091)	(0.318)	(0.045)
Firm size	0.023***	-0.017	0.001
	(0.008)	(0.022)	(0.003)
Sales growth rate	0.017***	0.039	0.023***
	(0.006)	(0.03)	(0.004)
Market share	1.503***	0.401	0.241***
	(0.694)	(0.311)	(0.053)
Firm-specific FE	Yes	Yes	Yes
Year-specific FE	Yes	Yes	Yes
No. of Obs	1184	1680	2864
R-squared	0.193	0.163	0.161
Mean dependent variable (ROA)	0.047	0.088	0.073
SD of dependent variable (ROA)	-0.12	-0.571	-0.12

Note: The standard errors of coefficient estimates are given in parentheses. ** and *** indicate statistical significance at 5% and 1%, respectively.