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Firm and Macroeconomic Determinants of Debt: Pakistan Evidence

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Abstract

This study investigates the role of firm specific factors, macroeconomic factors, and firms' heterogeneity in determining the debt levels of non-financial listed firms of Pakistan. Study implies static panel data modeling using pooled OLS and fixed effect regression as estimation techniques, with two different proxies of debt. Profitability, tangibility, and size of the firm appear to affect debt level significantly across different proxies and different estimation techniques. Interest rate and inflation are significant determinants of debt in fixed effect estimation. Study also confirms the existence of firm specific influence on debt.

Keywords: Capital structure, fixed effect regression, macroeconomic factors, panel data, Pooled OLS

1. Introduction

The foundation of research in firm's financing decisions is laid by Modigliani and Miller (1958). They conclude, on the basis of some unrealistic assumptions, such as zero taxes and no bankruptcy costs, that firms' financing decisions do not affect the firms' values. Later relaxing the assumption of zero taxes and ignoring bankruptcy cost, Modigliani and Miller (1963) conclude that financing decisions does matter and firms can use 100% debt. Since then numerous studies have been conducted and their major focus is investigating the determinants of firms' capital structure in developed countries such as Titman and Wessels (1988) for US, Rajan and Zingales, (1995) for G-7,

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Drobetz and Fix (2005) for Switzerland, and Vivani (2008) for France. Empirical studies focusing the developing countries on the issue of capital structure are limited in number. Some cross country studies like De Jong, Kabir, and Nguyen, (2008) are there that consider developing countries including Pakistan.

Recently the area of capital structure in Pakistan has started to get attention of the researchers. Few studies such as Hijazi and Tarique (2006), Shah and Khan (2007), Sheikh and Wang (2011), and Javid and Imad (2012) are there that consider Pakistan exclusively. But the area of firms financing behavior in Pakistan is still very open for further research as extant studies use very limited set of determinants, are inconsistent in their findings, and use mainly annual reports to extract the data which may be subject to error. Still there is gap in the literature of the capital structure of Pakistan in terms of investigating the impact of macroeconomic variables, institutional environment, financial sector development, and some other firm specific variables using an international database such as Compustat or Datastream.

This study is aimed at partially filling that gap by investigating the effect of firm level and macroeconomic factors affecting capital structure decisions of non-financial listed firms of Pakistan using firm fixed effect regression, random effect regression and pooled OLS models. The findings of this paper suggest that in Pakistan, profitability, tangibility, and size of the firm appear to be the significant determinants of debt across different proxies of debt and different estimation techniques. Profitability has negative significant effect, while size and tangibility have positive significant effect on debt. Cash and non debt tax shield are seemed to have significant negative impact on debt in pooled OLS. Increased R-square in fixed effect estimation suggests that firms' heterogeneity in terms of variables determining the level of debt exist. Interest rate and inflation are significant determinants of debt in fixed effect estimation. Tax rate and GDP are insignificant across both estimation techniques and both proxies of debt.

The rest of the paper is structured as follows. Section 2 discusses some of the studies related to capital structure decisions in Pakistan, followed by discussion of the determinants, their measurement, and hypothesis in section 3. Section 4 explains modeling and methodology. Results are discussed in section 5 followed by conclusion in section 6.

2. Extant studies of capital structure: Pakistani context

Some empirical studies have recently started to investigate the firms' capital structure decisions in Pakistan. Hijazi and Tariq (2006) investigate the factors affecting the debt of firms in cement industry firms listed at Karachi Stock Exchange (KSE) Pakistan. Using firm specific determinants of debt, such as firm size, tangibility of assets, profitability, and growth, the study reports the significant impact of all variables except firm size. Shah (2007) investigates the leverage determinants in pre and post financial sector reforms in Pakistan. Using growth, tangibility, size, and profitability as the regressors of the leverage, study finds tangibility to be positively related with debt in both pre and post financial sector reforms, while size, growth, and profitability are found to be negatively related.

Hasan and Butt (2009) examine the impact of corporate governance on financial leverage of the public corporations of Pakistan. Firm size and profitability have been considered as the control variable. The study finds the significant relationship between the control variables (size and profitability) and the leverage. This study reveals the positive relationship of the debt with board size, and institutional ownership and negative relationship of the debt with managerial ownership. Sheikh and Wang (2011) investigate the factors affecting the leverage in manufacturing sector of Pakistan. The debt (long term debt and short term debt) is used as the dependent variable. The study finds the negative relationship between debt and profitability, tangibility, earnings volatility, and liquidity. Firms' size is found to be positively associated with debt ratio. Non debt tax shield is found to be insignificant in determining the leverage in manufacturing sector. Javid and Imad (2012) investigate the factors affecting various components of debt in Pakistan using firm specific variables of tangibility, growth, profitability, and size. This study identifies the differences in the determinants of various types of debts such as long term debt and short term debt. Study finds the positive relationship of debt with tangibility and negative relationship of profitability with debt. The study further finds large firms use long term leverage and small firms using short term leverage.

These and some other studies have particularly focused on firm specific variables determining the corporate debt in Pakistan using limited set of variables, firm year observations, firms annual reports or SBP's Balance Sheet Analysis of Joint Stock Companies report. This study makes use of international database Datastream, and a comprehensive set of variables, including macroeconomic variables.

3. Determinants of leverage, their measurement, and hypothesis

Pecking order theory identifies the hierarchy of financing choices starting with internal funds. Profitability increases the availability of internal finance; hence it reduces the dependence on external funds (Myers and Majluf, 1984). This establishes the inverse relationship of earnings with the debt ratios. The trade-off theory of the capital structure predicts a positive relationship; because low earnings may increase the probability of bankruptcy (Fama and French, 2002), thus restricting the use of debt. Rajan and Zingales (1995) and some others report the negative significant relationship of profitability with leverage. Frank and Goyal (2003) find the positive relationship of profitability with leverage. Ilyas (2008) reports significant negative relationship of profitability with debt ratios for Pakistan. So inconsistencies in results with respect to profitability across different studies induce us to reconsider this variable. We hypothesize negative relationship of profitability with debt and measure it as the ratio of EBIT to total assets. Trade-off theory suggests the positive relationship of firms' tangibility with debt because availability of collateral reduces the risk for lenders hence more debt can be used (Delcoure, 2007). Rajan and Zingales (1995) and De Jong *et al.* (2008) report positive significant relationship of tangibility with leverage. Sheikh and Wang (2011) for Pakistan find negative relationship of tangibility with leverage. Given this inconsistency, tangibility, measured as ratio of fixed assets to total assets, is investigated with hypothesis that it has positive relationship with debt.

Larger firms are expected to be diversified; hence their chances for being bankrupt are lower (Titman & Wessels 1988). Such firms may use more debt hence a direct relationship is established. However, Rajan and Zingales (1995) argue in favor of inverse relationship because the asymmetric information problems are likely to be low for large companies. Positive relationship is reported in the studies of Drobetz and Fix (2005) and others. De Jong *et al.* (2008) for 14 countries in their sample report negative relationship of firm's size with leverage. Conflicting results stimulate us to investigate this variable further. For this study we hypothesize the positive relationship on the basis of diversification argument. This study use the natural logarithm of total assets as the proxy of size, following Haron Ibrahim, Nor, and Ibrahim (2013). Volatility in the firms' earnings enhances the probability of firms being bankrupt due to their inability to meet the contractual claims (Sheikh & Wang, 2011). This suggests that firms with volatile earnings should use lower debt. Same is hypothesized for this study. De Jong *et al.* (2008) find mixed results regarding the relationship and significance of earning volatility with leverage. Earning volatility, following Deesomsak, Paudyal, & Pescetto (2004), is measured as the absolute difference between the annual change in EBIT and average of this change in percentages.

Firms' growth prospects are intangible and cannot be used as collateral; hence trade-off theory establishes the negative relationship with debt (Sheikh & Wang, 2011). Antoniou *et al.* (2008) confirms negative significant relationship of growth with leverage. Sheikh and Wang (2011) report insignificant relationship for Pakistan. We hypothesize the negative relationship of growth with leverage. We use market-to-book ratio as proxy of the firms' growth prospects, following Haron *et al.* (2013). The higher the tax rates the more will be benefit of using debt because high interest expense will bring more tax shield (Antoniou *et al.* 2008). This establishes the positive relationship of firms' tax rate with leverage. We hypothesize the positive relationship of leverage with firms' effective tax rates. De Jong *et al.* (2008) find mixed results regarding the impact of firm tax rates on its debt. Antoniou *et al.* (2008) report the inverse relationship of effective tax rate with debt. Following Antoniou *et al.* (2008) and De Jong *et al.* (2008) we use ratio of taxes paid to pre-tax income as the measure of firm's tax rates.

Non debt tax shield is the alternative of tax shield obtained from debt financing (DeAngelo and Masulis, 1980). Hence it establishes the negative relationship. Negative relationship is hypothesized in this study. Empirical studies report the mixed results regarding the impact of non debt tax shield with debt. Deesomsak *et al.* (2004) report the negative significant relationship, while Antoniou *et al.* (2008) report positive relationship of non debt tax shield with market debt. We use the ratio of depreciation, depletion, and amortization to total assets as the measure of this variable. Pecking order theory suggests that firms with high cash flows use less debt. We hypothesize negative relationship of cash with debt. Bhaduri (2002) reports negative significant impact of cash on debt. Following Bhaduri (2002), ratio of cash to total assets is used as proxy of cash.

Low interest rate in economy induces firms to use more debt and vice versa. Same has been confirmed in the survey study by Drobetz *et al.* (2006). Antoniou *et al.* (2008) find the negative impact of interest rate with debt. Deesomsak *et al.* (2004) conclude the positive significant influence of interest rate on debt. We hypothesize the negative

relationship of interest rate with debt and use lending rate from the World Development Indicators (WDI) of World Bank as the proxy. High inflation may lead to high interest rate (Brigham & Ehrhardt, 2005) hence reducing the use of debt by the firms. Taggart (1985), as cited in Frank and Goyal (2009), argues that if inflation is high, the real value of tax deductions will be high. Hence tradeoff theory predicts positive relationship of inflation with debt. We hypothesize negative effect of inflation on debt. Joeveer (2013) report the negative significant relationship of inflation with debt. Annual growth in Consumer Price Index (CPI) from WDI database is taken as the proxy of inflation. Economic conditions are represented with the GDP growth rate (De Jong *et al.* 2008). De Jong *et al.* (2008) argue that good economic conditions lead to the use of high debt. Hanousek and Shamshur (2011) find the negative significant relationship of GDP with debt. On the contrary Kayo and Kimura (2011) conclude the positive significant relationship of GDP growth rate with debt. We hypothesize the positive relationship of GDP with debt for this study. Annual growth in nominal GDP from the WDI is used as the proxy.

4. Data and methodology

4.1 Data

This study uses the global database named Thomson Financials Worldscope for extracting the data of firm specific variables. For macroeconomic variables WDI database of the World Bank has been used. Use of global database, such as Worldscope, allows the maximum comparability (Delcoure, 2007). This database contains the financial data of 271 Pakistani firms. Excluding firms from financial industries such as banks, insurance companies, mutual funds and others; a final sample of 143 firms is used. Exclusion of financial firms is based on the reason that such firms are subject to special regulations such as minimum equity requirements. The data of the 12 years from 2001-2012 has been taken. An unbalanced panel data with 1353 firm year observations has been used.

This study uses the two proxies of debt i) the ratio of total liabilities to total assets and ii) the ratio of long term debt (LTD) to total assets (TA) at book values. First measure is commonly used in many studies such as Joeveer (2013) and Delcoure (2007) and the second one in the studies of Cho *et al.* (2014) and others.

4.2 Methodology

In this study the firms' debt is assumed to be the linear function of *m* firm explanatory variables and *k* macroeconomic factors. The relationship is presented in the following equation:

$$D_{it} = a_0 + a_m X_{it} + \gamma_k + Z_t + \varepsilon_{it} \tag{1}$$

Where D_{it} is the debt of the cross section (firm *i*) at time *t*, X_{it} is the vector of the firm specific explanatory variables, Z_t are the macroeconomic variables, a and γ are coefficients, and ε_{it} is the error term. Since the explanatory variables considered in this study are profitability (PRO), tangibility (TAN), size (SIZ), earning volatility (ERV), growth (GRO), tax rate (TXR), non debt tax shield (NDT), cash (CSH), interest rate (INR), gross domestic product growth (GDP), and inflation(INF); so equation (1) can be specifically written as:

$$D_{it} = a_0 + a_1 PRO_{it} + a_2 TAN_{it} + a_3 SIZ_{it} + a_4 ERV_{it} + a_5 GRO_{it} + a_6 TXR_{it} + a_7 NDT_{it} + a_8 CSH_{it} + \gamma_9 INR_t + \gamma_{10} GDP_t + \gamma_{11} INF_t + \varepsilon_{it} \tag{2}$$

Equation 2 is estimated using pooled OLS method (also called common constant method). This method assumes that intercept (a_0) is same for the all the cross sections (Asteriou & Hall, 2007), in our case all firms. The firms sampled for this study may be heterogeneous and can have different intercepts (constants) due to different management styles, philosophies, and markets they serve (Haron, 2014). Fixed effect method of estimation considers this heterogeneity, and allows for different intercepts for each cross section (firm). In the fixed effects method the slope coefficients are considered constant or same for all firms. For using fixed effect method, equation (2) is modified as under:

$$D_{it} = a_{0i} + a_1 PRO_{it} + a_2 TAN_{it} + a_3 SIZ_{it} + a_4 ERV_{it} + a_5 GRO_{it} + a_6 TXR_{it} + a_7 NDT_{it} + a_8 CSH_{it} + \gamma_9 INR_t + \gamma_{10} GDP_t + \gamma_{11} INF_t + \varepsilon_{it} \tag{3}$$

Equation (3) is almost similar to equation (2), except subscript i is added to intercept a_0 to account for the different intercepts for all firms. To choose suitable estimation models between fixed effect and random effects, Hausman (1978) test is used.

5. Empirical results and discussion

Table 1 reports the Pearson's correlation coefficients between the variables. Asteriou and Hall (2007) state that many researchers appear to consider that correlation coefficient of more than 0.9 may cause the problems in estimation. Considering this as the benchmark, the table shows that correlations among the independent variables are comparatively small and thus there shouldn't be the concerns for multicollinearity. Correlation coefficients between GDP and inflation and GDP and interest are higher but still lower than 0.9 suggested by Asteriou and Hall (2007).

Table 2 reports the results of the pooled OLS and fixed effects estimation techniques for both measures of the leverage. Pooled OLS is used under the hypothesis that there are no individual firm effects on leverage decisions. To account for the firms heterogeneity (individual differences) fixed effect and random effects estimation techniques are used. We have reported the results on the basis of effect after conducting Hausman (1978) test. Null hypothesis of similar coefficients under fixed effect and random effects estimators is rejected as the p-value is less than .05.

Table:1 Correlation Matrix

	D_{TL}	D_{LTD}	GRO	PRO	TAN	TXR	NDT	CSH	ERV	INR	GDP	INF	SIZ
GRO	0.033	-0.047	1.000										
PRO	-0.418	-0.283	0.186	1.000									
TAN	0.213	0.581	0.006	-0.259	1.000								
TXR	0.026	-0.001	-0.004	-0.005	0.008	1.000							
NDT	0.071	0.104	0.074	-0.004	0.293	0.044	1.000						
CSH	-0.211	-0.200	0.031	0.241	-0.202	-0.022	-0.024	1.000					
ERV	0.051	0.132	-0.041	-0.092	0.100	-0.013	-0.004	-0.044	1.000				
INR	0.084	-0.036	-0.063	-0.149	0.002	-0.069	-0.116	-0.148	0.054	1.000			
GDP	-0.072	0.023	0.060	0.141	-0.005	0.069	0.099	0.122	-0.039	-0.878	1.000		
INF	0.041	0.003	-0.061	-0.109	0.006	-0.027	-0.066	-0.057	0.010	0.507	-0.781	1.000	
SIZ	0.218	0.136	-0.040	0.004	-0.001	-0.052	-0.052	-0.162	0.018	0.134	-0.119	0.045	1.000

Table 2 reports the Pearson's correlation coefficients between dependent and independent variables. The measures of the debt used in this study are total liabilities to total assets (D_{TL}) and long term leverage measured as long term debt to total assets (D_{LTD}). Growth (*GRO*) is measured as market value of equity to book value of equity. Profitability (*PRO*) is measured as EBIT divided by total assets. Tangibility (*TAN*) is measured as the ratio of net property, plant, and equipment to total assets. Size (*SIZ*) is measured as natural logarithm of total assets. Tax rate (*TXR*) is measured as total taxes divided by taxable income or pretax income. Non debt tax shield (*NDT*) is measured as ratio of depreciation, depletion, and amortization expense to firms' total assets. Cash (*CSH*) is measured as cash divided by total assets. Earning volatility (*ERV*) is measured as the absolute difference between the annual percentage change in EBIT and average of this change. GDP growth rate (*GDP*) is the annual growth in nominal GDP. Interest rate (*INR*) is the maximum lending rate from World Bank's World Development Indicators (WDI). Inflation (*INF)* is annual growth in consumer price index from WDI.

Column 1 of table 2 shows the results of pooled OLS using total liabilities to total assets as measure of debt. Size of the firms has positive significant effect on the use of debt supporting the Titman and Wessels (1988) and trade-off theory argument that large firms can use more debt as the probability of being bankrupt is low due to diversification.

Growth is found significantly affecting the debt levels but its sign is positive. Positive significant impact of growth on debt is in alignment of the pecking order theory. Ameer (2013) also report the positive significant influence of growth under the OLS estimation technique. Profitability has negative significant effect on debt and it is in line with pecking order theory. Similar results for the profitability are reported in studies such as Drobetz and Fix (2005).

Tangibility has positive significant effect on debt suggesting that firms in Pakistan use tangible assets for having secured debt. The positive influence of tangibility on debt is also reported by De Jong *et al.* (2008). Cash has negative significant impact on borrowing which is justified by the pecking order theory. Our results regarding the cash match with those of the Bahaduri (2002) and Vivani (2008). Under this OLS method other firm related variables and macroeconomic variables determining leverage are found insignificant.

Table:02 Determinants of debt using pooled OLS and firm fixed effects Models

Variables	Pooled OLS		Fixed Effect	
	D_{TL} (1)	D_{LTD} (2)	D_{TL} (3)	D_{LTD} (4)
CONS	-0.17930	-0.21337	0.10504	-0.49031
	(-0.81)	(-1.68)	(0.45)	(-3.39)
SIZ	0.04286***	0.01697***	0.02866*	0.03465***
	(7.51)	(5.20)	(2.11)	(4.14)
GRO	0.00494***	-0.00044	0.00059	0.00063
	(3.95)	(-0.61)	(0.72)	(1.25)
PRO	-0.69952***	-0.14725***	-0.40150***	-0.10294***
	(-12.99)	(-4.78)	(-9.29)	(-3.86)
TAN	0.08639***	0.36911***	0.06597	0.38845***
	(2.58)	(19.28)	(1.34)	(12.77)
TXR	0.00347	-0.00022	0.00178	-0.00010
	(1.10)	(-0.12)	(1)	(-0.09)
NDT	0.53642	-0.44690**	-0.54934	-0.28585
	(1.53)	(-2.22)	(-1.35)	(-1.14)
CSH	-0.34062**	-0.15889*	-0.08557	0.00240
	(-2.13)	(-1.73)	(-0.80)	(0.04)
ERV	0.00000	0.00002**	-0.00001	0.00001
	(0.15)	(2.50)	(-0.91)	(1.52)
GDP	0.00427	0.00239	0.00081	0.00338
	(0.33)	(0.32)	(0.12)	(0.78)
INF	0.00058	0.00158	-0.00026	0.00249**
	(0.15)	(0.73)	(-0.13)	(1.97)
INR	0.00306	-0.00690	0.00176	-0.01076***
	(0.33)	(-1.29)	(0.33)	(-3.27)
R-Square	0.25510	0.39110	0.82300	0.8318
Adjusted R- square	0.24620	0.38380	0.79090	0.8012

Table 2 reports the results of the pooled OLS and fixed effects estimation techniques for both measures of the leverage. Coefficients significantly different from zero at the 1%/5%/10% level are marked with ***/**/*.

Column 2 of table 2 shows the OLS estimation results using LTD to TA as the measure of the debt. Size and tangibility are found to have positive influence, and profitability, non debt tax shield, and cash have negative significant influence at 1%, 5%, and 10% level of significance respectively. Negative significant relationship of non debt tax shield with debt supports the argument of alternative of debt tax shield of DeAngelo and Masulis (1980).

Positive significant influence of earning volatility is against our expectation and remains inconclusive like De Jong *et al.* (2008) and Antoniou *et al.* (2008). Macroeconomic variables again turn out to be insignificant in this model.

Column 3 of table 2 depicts the result of the fixed effect estimator taking in account the firm heterogeneity, using TL to TA as the measure of debt. The explanatory power of the model is higher than the pooled OLS as R square has substantially increased suggesting that there are firm specific omitted variables that affect the leverage. The unaccounted firm specific variables may be management philosophy and organizational culture etc. The results of this model reveal that the profitability has significant negative impact on debt and size has significant positive impact. All other firm specific variables and macroeconomic variables turn out to be insignificant.

Column 4 of table 2 reports the result of fixed effect estimator using LTD to TA ratio as the proxy of debt. Size and tangibility have consistently significant positive influence and profitability has negative significant impact on debt. Macroeconomic variables, inflation and interest rate, are found to have significant influence on firms' debt. Inflation has positive significant effect supporting the argument of Taggart (1985) as cited in Frank and Goyal (2009). Interest rate is significant and negatively affects the debt ratios of the firms. Pakistani firms seem to avoid use of debt when interest rate in economy is high. Results regarding the impact of interest rate on debt meet our expectations. Similar results are reported by Antoniou *et al*. (2008) and Haron and Ibrahim (2012).

To sum up, profitability, tangibility, and size of the firm appear to be the significant determinants of debt across different proxies of debt and different estimation techniques in Pakistan. Cash and non debt tax shield have significant negative impact on debt in pooled OLS. Increased R-square in fixed effect estimation suggests that firms' heterogeneity in terms of variables determining the level of debt does exist. Interest rate and inflation are significant in fixed effect estimation. Tax rate and GDP are insignificant across both estimation techniques and proxies.

6. Conclusion

This empirical study aimed at understanding the effect of firm specific and macroeconomic variables on debt in Pakistan, using pooled OLS and firm fixed effect regressions. An unbalanced panel data from 2001 to 2012 of 143 listed firms of Pakistan is extracted from Thomson Financials Worldscope database. This study employs the two measures of debt namely total liabilities to firms' total assets ratio and long term debt to total assets ratio.

Results reveal that in Pakistan, firms' profitability has negative significant effect on their debt levels. This finding is supported by pecking order theory of Myers and Majluf (1984). Size of the firm has positive significant effect on debt supporting the argument that large firms are diversified and hence their chances of being bankrupt are less. So Trade-off theory lends support to this finding. Tangibility has also significant positive effect on debt reflecting the increased use of debt against collateral. These three independent variables are found to be consistent across the estimation techniques and measures of debt. Cash is found to affect negatively to debt in pooled OLS for both measures of debt. This finding is also supported by the pecking order theory. Non debt tax shield is found to be negative significant in pooled OLS using LTD to TA ratio. GDP growth rate and tax rate are insignificant in both of the estimation techniques and measures of debt. Inflation and interest rate have significant impact on long term debt of the firms using firm fixed effect estimation technique. Use of the firms fixed effect technique enhances the explanatory power of the model suggesting that individual firms' heterogeneity matters in determining the debt.

Future studies regarding the capital structure decisions in Pakistan may consider impact of institutional environment such as financial market development and corruption perception index. The studies of capital structure using dynamic modeling may be another future research area for Pakistan.

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