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DETERMINANTS OF CAPITAL STRUCTURE
OF ENGINEERING SECTOR OF PAKISTAN

This research is conducted to evaluate which determinants have influence on the leverage of the engineering sector. This research is designed on capital structure of the engineering sector. The research data is on 32 firms, from 1998 to 2008. The results are concluded by applying descriptive analysis, correlation analysis and regression analysis. 6 determinants (profitability, growth, size, tangibility, risk and investment opportunity) are examined. The purpose is to investigate which factors have strong influence on the leverage. The analysis reveals that profitability, tangibility and investment opportunities have significant negative association with the leverage while the size and growth have significant positive correlation with the leverage. The impact of risk is not significant. The study also discusses the reason of the relations between these factors. Furthermore, the leverage of engineering sector is compared to other sectors.

Keywords: capital structure; engineering sector; growth; size; tangibility; Pakistan.

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ЧИННИКИ, ЩО ВИЗНАЧАЮТЬ СТРУКТУРУ КАПІТАЛУ
У МАШИНОБУДУВАННІ ПАКИСТАНА

*У статті досліджено чинники, що визначають вплив левериджу на галузь машинобудування. Досліджено структуру капітала даної галузі, використано дані по 32 фірмам з 1998 по 2008 роки. Дані проаналізовано методами описового аналізу, кореляційного та регресійного аналізів. Розглянуто 6 визначальних чинників — прибутковість, зростання, розмір, відчутність активів, ризик та можливість інвестування. За результатами аналізу, прибутковість, відчутність активів та можливості інвестування з левериджем корелюються негативно, а розмір та зростання — позитивно. Вплив ризику є незначним. Також досліджено взаємозв'язок між усіма пере
рахованими чинниками. Леверидж у машинобудуванні порівняно з показниками інших галузей.*

Ключові слова: структура капіталу; машинобудування; зростання; розмір; відчутність активів; Пакистан.

Форм. 1. Рис. 1. Табл. 4. Літ. 10.

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ФАКТОРЫ, ОПРЕДЕЛЯЮЩИЕ СТРУКТУРУ КАПИТАЛА
В МАШИНОСТРОЕНИИ ПАКИСТАНА

В статье исследованы факторы, определяющие влияние левериджа на отрасль машиностроения. Исследована структура капитала данной отрасли, использованы данные по 32 фирмам с 1998 по 2008 годы. Данные проанализированы методами описательного анализа, корреляционного и регрессионного анализов. Рассмотрены 6 определяющих факторов — прибыльность, рост, размер, осязаемость активов, риск и возможность инвестирования. По результатам анализа, прибыльность, осязаемость активов и возможности для инвестирования с левериджем коррелируются негативно, а

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размер и рост — позитивно. Влияние фактора риска незначительно. Также исследована взаимосвязь между всеми перечисленными факторами. Леверидж в машиностроении сравнен с показателями других отраслей.

Ключевые слова: *структура капитала; машиностроение; рост; размер; осязаемость активов; Пакистан.*

1. Introduction. It is the main issue how a firm finances its operations and which sources of fund influence firm's growth. When a firm needs funds it can issue equity in the form of shares or can use a loan which can be short-term or long-term. The composition of a loan and equity is called capital structure. It is a very crucial decision for a firm that what should be the combination of a loan and equity. Financial managers are concerned with what would be the best amalgamation of capital structure. Managers have a concern with the least expensive source of funding. Every business has a dissimilar combination depending on its requirements and operating expenses. Thus, each company has its own loan-equity ratio. The indispensable motive of any business is to increase its value. This can be achieved by making the best combination of a loan and equity ratio. A healthy proportion of a loan and equity is a symbol of a firm's robustness. The choice of capital structure is not only concerned with what sort of financing should be but is also concerned with selecting the best mixture of finance. So the financial managers are needed to adopt such strategies which ensure a firm's value. The Investors are concerned with a strong balance sheet. The ideal balance sheet must carry a balanced proportion of loan and equity because it minimizes uncertainty. The balance sheet which has too much loan is specified as over-levered. The strength of a company' balance sheet can be analyzed by 3 extensive categories of investment-quality measurements: asset performance, working capital adequacy and capital structure (Loth, 2006). A standard balance sheet reveals that assets are utilized in a better and efficient way. A firm has sufficient working capital to pay off its short term obligations and capital consists of reasonable proportion of loan and equity. A firm with this standardized balance sheet can survive in the time of recession. It indicates that a firm has a potential to face the dynamic environment. In this paper capital structure draws the attention among these investment-quality measurements.

Many factors should be considered while setting the ratio of loan and equity. These factors must be analyzed while deciding the target of loan-equity ratio. Firms have to pay for the adverse selection of this target ratio so deep analysis is required for determinants of the capital structure. The factors cause variation in the leverage. Different theories like Modigliani and Miller (1958; 1963) theorem, Static Trade-Off Theory (1984), Pecking Order Theory (1984), Agency Cost Theory (1976) and Signaling Theory (1977) support different factors and provide indication regarding the choice of capital structure. The analysts must explore and gain insights about these factors for a proper analysis. The evaluation of these factors telles the managers which variables must be controlled and which sources of finance must be prioritized in deficit or surplus situation. These factors include sales stability, prevailing market conditions, financial flexibility, enterprise internal conditions, operating structure, size of company etc. All factors influencing the capital structure need focused attention while setting the target of loan and equity ratio. All factors should be observed to get the optimum capital structure. Main intention of this paper is to examine the

determinants which have influence on capital structure of engineering sector and also analyze the financial behavior of this sector, which factors force a firm to borrow more and how they maintain debt equity ratio. This paper seeks to determine the following key points:

- Does the choice of capital structure mainly depend on tangibility, growth, size, profitability, risk and investment opportunities?
- Does the engineering sector prefer more loan than other sectors?

As this sector causes a great variation in country's income so indepth analysis of this sector would be useful for the government. Though the main intentions of this research are to prove the following points:

- To confirm that leverage and profitability have a negative relation.
- To verify that leverage and growth have a positive relation.
- To prove that leverage and size have a positive relation.
- To confirm that leverage and tangibility have a positive relation.
- To verify that leverage and risk have a negative relation.
- To prove that leverage and investment opportunities have a positive relation.

2. Literature Review. Enormous empirical work has been carried out on capital structure. The cornerstone of corporate finance is Modigliani and Miller (1958; 1963) theorem. By the supposition of the perfect market MM theorem recommends that the firms use higher loan to get tax shield benefit on interest payments. Myers (1984) brings about a landmark contribution in the field of finance and introduces Static Trade-Off Theory. By considering this theory, the firms set specific ratio of equity and loan taking into account the requirements and nature of the dealing then progressively move to attain it. Myers and Majluf (1984) introduce Pecking Order theory. This theory elucidates the firms pursue a hierarchy for financing their operations. The firm's sources of finance are prioritized. Firstly the firms choose to use internal fund like retained earnings. If retained earnings is not sufficient then the firms raise capital by loan and finally firms issue equity if more funds are needed. Agency cost theory by Jensen and Meckling (1976) proposes that agency problem occurs by the concern clashes either between creditors and investors or between managers and shareholders. The hypothesis of agency cost proposes the firm's managers are mostly indulged in maximizing their own profit than maximizing shareholders' capital. So equity holders of a firm discourage these profits through proper check and balance on which the cost incurred. Moreover, loan capital is used as a fair device to diminish the conflicts between investors and managers because the leverage does not only compel the managers to generate funds for obligatory interest expenses rather decreases free cash flows. So, high fraction of leverage in the capital structure is used as a useful tool to minimize the incurred cost. Signaling theory by Ross (1977) suggests that when the managers issue debt for a company then it gives a signal to the investors that a firm expects high cash flow in future and have a capacity to pay interest. When a firm forecasts higher cash flows and high earnings in the future then it raises capital through loan. The managers don't want to share higher gains with other shareholders. In case of worse future outlooks the managers prefer to gain capital by issuing equity. In this way losses are shared between different shareholders.

Wen et al. (2002) research on Chinese firms. 60 firms for the period 1996 to 1998 are analyzed. Main purpose of this research is ascertaining association between CG

and capital structure decision. The author examines the influence of board size, composition of board, responsibility period of CEO and CEOs' fixed return on leverage. There are other control variables − return on asset (ROA) and company size. Huge board size means a lot of pressure from board to manage capital. In Chinese firms there are supervisory committees which play the role of directors and senior management. Board composition involves the percentage of outside directors. Outside directors have an active participation in decision-making. The managers face prudent monitoring from outside directors because they are more concerned with performance and avoid leverage. So a significant inverse relation exists between leverage and board composition. Overall conclusion shows stronger corporate governance results in lower leverage. Chinese firms have sound corporate governance and don't prefer loan. Firms are inclined towards less leverage when the proportion of outside directors is higher and when the size of board is larger. Great number of outside executives and larger team size don't allow the firms to use extensive leverage.

Zhang (2010) studies the product category effects on capital structure. Product category has different product market like Iron & Steel, Chemicals & Pharmaceuticals, Food & Drink, Textiles & Clothing, Electronics & Instrumentation, Automotive, Aerospace, Rail & Ship and other type of products. 220 SMEs from British manufacturing industry are analyzed. The results recommend that fixed assets, profitability, and employees working in an organization have positive and growth has a negative association with loan/equity ratio. It is also analyzed that age has irrelevant association with the loan/equity ratio of British SMEs. Profitability is the most significant determinant for a financer because it represents stability in cash. Product category has its influence on determinants of capital structure. Dissimilar product market has different financing behavior. Product market where growth is high due to high profits in that market profitability is negatively associated with leverage. Moreover, product market where tangible assets are large in size has high loan ratio.

Mukherjee and Mahakud (2010) researched Indian firms. The purpose of their research was to identify distinct factors which determine the capital structure of a firm and how efficiently the firms conquer their target of capital structure. In this study the determinants of loan ratio and the determinants of acclimation speed to target loan ratio are analyzed. To evaluate the determinants of loan ratio variables like tangibility, size, profitability, tax benefit on interest, book to market ratio, inflation, research and development intensity and industry median are used. Book leverage increases with the increase in total assets and market leverage decreases with the increase in total assets. Tangibility and profitability is negatively significant for market leverage. M/B ratio are negatively significant with both leverages which imply that the firms avoid the risk of debt and are conscious about the cost of financing. Research and development is negatively significant for market leverage. It refers that the firms with sound R&D opt equity. To examine the acclimation speed to target debt level 3 variables such as gap between actual and target leverage, size of a company and growth opportunity are analyzed. Acclimation speed is very prompt and so distance is positively correlated with adjustment speed of loan ratio. Size has also influence on adjustment speed and is negatively correlated with it. Rapidly growing firms adjust quickly to target debt level.

Sheikh (2011) researches the elements that influence the capital structure of manufacturing sector. The investigation is done on 160 firms. The self-determining variables

in this study are size, ROA, total fixed assets (asset structure), tax benefit on interest, earnings instability, growth opportunities, and liquidity. Debt ratio is the predictor variable. It is the ratio of total liability over total assets. Results indicate that 61% of total assets are captured by total debt. It seems that Pakistani firms use more leverage than the firms of other developing countries, but use less leverage than the firms of other developed countries like Germany, France, Japan, Italy. The results on volume of a firm, return on assets, convertible assets and total fixed assets are at 5% significant. Earnings instability shows no significant results whereas tax benefit on interest and growth potential demonstrate insignificant results. According to the findings, liquidity and ROA have a significant inverse relation with leverage ratio, this confirms that the firms pursue the POT to finance their funds. Highly profitable or greater liquidate firms prefer internal funds. Size has a significant positive correlation with leverage ratio, this is confirmed by the trade-off theory. This theory suggests that the risk is diversified at large firms. Earning volatility has a negative relation with debt. In our country the foremost source of borrowing is a bank so the banks hesitate to issue loan to the firms with volatile earning. Tangibility had a negative relation with loan. Manufacturing firms depend on short-term loan because bond market is not strong and the cost of long-term bank loan is high. Agency cost also leads to increase in debt. As a result of a conflict of interest the managers don't use assets efficiently. This research is a significant contribution in the field of finance especially for Pakistan. Firm distinct factors which are pertinent to capital structure of other developing nations are also significant for Pakistan.

3. Research Methodology. This research uses 6 independent variables that are profitability, growth, size, tangibility, risk and investment opportunities. Leverage is taken as a dependent variable. Independent variables are the determinants of capital structure which have impact on leverage. This research is confined to Pakistan's engineering firms.
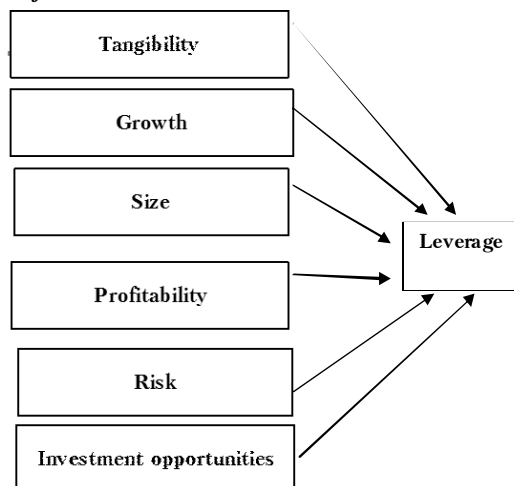
3.1. Theoretical framework.

Figure 3.1. **Theoretical framework**

3.2. Data Collection. Data is taken from "Balance Sheet Analysis of Joint Stock Companies Listed on Karachi Stock Exchange" for the period from 1998 to 2008.

3.3. Sample. This study targes Engineering Sector, primarily all 40 firms which are scheduled on the KSE. After screening out data, the default firms excluded and then the remaining 32 firms have been selected for the longitudinal data analysis.

3.4. Statistical Model:

$$LV_{it} = \alpha + \beta_1(PRO_{it}) + \beta_2(GRO_{it}) + \beta_3(SIZE_{it}) + \beta_4(TAN_{it}) + \beta_5(RISK_{it}) + \beta_6(INVST_{it}) + \varepsilon$$

where: α = The intercept of the equation;

β = The change coefficient for X_{it} variables;

ε = error term;

i = The number of the firms, i.e., $i = 1, 2, 3....N$ (in this study $N = 32$ firms);

t = The time period, i.e., $t = 1, 2, 3...T$ (in this study $T = 10$ years);

LV_{it} = Leverage of ith company at t time period is calculated as Total liabilities by total assets of ith firm;

PRO_{it} = Profitability of ith company at t time period is calculated as EBT by total assets of ith firm;

GRO_{it} = Growth of ith company at t time period is calculated as annual percentage change in total sales of ith firm;

$SIZE_{it}$ = Size of ith company at t time period is calculated as log of total assets for ith firm;

TAN_{it} = Tangibility of ith company at t time period is calculated as fixed assets after depreciation by total assets of ith firm;

$RISK_{it}$ = Risk of ith company at t time period is calculated as EBIT by financial expenses of ith firm;

$INVST_{it}$ = Investment opportunities of ith company at t time period is calculated as accumulated retained earnings by total assets of ith firm.

4. Empirical Results

4.1. Descriptive Analysis. Prior to interpreting the leverage and the influence of its determinants the descriptive analysis helps to examine the data. Descriptive analysis gives an apparent view of raw data and summarizes it. It gives good indicators to analyze the data. The tables of descriptive analysis show the mean of each independent and dependent variable. The purpose is to explore the influence of each determinant on the leverage. Total 300 observations are taken and all are being observed for all 6 variables. The highest mean value risk is 46.2 whereas investment opportunity is 0.17 which is the lowest value of mean.

The table of descriptive statistics is given below:

Table 4.1. **Descriptive Statistics**

Variables	Mean	Median	SD	Variance	Skewness	kurtosis
LV	.6535	.6005	.29603	.088	1.887	4.735
PROF	.0706	.0808	.16902	.029	-5.024	57.977
GRO	31.8889	17.7500	90.92998	8268.262	6.701	65.694
SIZE	6.9545	6.8948	1.35937	1.848	-.030	-.443
TAN	.3408	.3238	.19131	.037	.376	-.633
RISK	46.2287	5.7485	141.44958	20007.985	5.268	32.656
INVST	.1697	.2648	.37149	.138	-2.021	6.017

The average value of leverage (LV) is 65% for all the firms in the sample. No significant dispersion is found in the leverage data. On other hand, risk has a very sig-

nificant dispersion whereas profitability has the lowest value of standard deviation. The reason for this dispersion is that risk value is not properly estimated and provides no margin. It causes a sudden failure in a market. Profitability, size and investment opportunities are negatively skewed and move in negative direction. The values of the mean and median in leverage are very close which confirms normality of the variable. The positive values of kurtosis i-e values of profitability, growth, risk and investment opportunities show that their data distribution is sharper than normal.

Table 4.2. **Comparison of Different Sectors:**

Sr. #	Sector	% change in leverage by other factors	% of leverage
1	Energy sector	24%	59%
2	Automobile sector	29%	59%
3	Sugar and allied industry	46%	08%
4	Textile sector	46%	65%
5	Engineering sector	62%	65%
6	Non life insurance sector	70%	50%
7	Cement sector	74%	71%
8	Chemical sector	91%	51%

Table 4.2 provides a wider view on the leverage by comparing several sectors. After scrutinizing different sectors it is analyzed that the leverage of Pakistani firms is strongly influenced by other factors. The impact of other factors is higher in chemical sector and lower in energy sector. The % of leverage is higher in cement sector and lower in sugar & allied industry.

4.2. Regression. Regression comprises 3 tables. First we discuss a model summary which is actually a predicting model. The value of coefficient of determination = R^2 indicates that 62% variation in leverage is caused by these independent variables. The independent variables have great influence on leverage for decision on capital structure as the value is above average. R = 79% shows that these variables are strongly correlated. The difference between adjusted R^2 and R^2 is very ideal and fair. Standard error of estimation is the amount of uncertainty and its value is 15% which is not so impressive to consider and almost meets the certainty requirement of the model. The next part is about the analysis of variance that tests whether the model is considerably better at predicting the outcome or mean is best estimate. The F test statistic and its corresponding p-value (Significance F) certainly indicate the overall goodness of fit for the model. (The p-value (0.000) is considered highly significant as it is less than 1%.)

The next part is concerned with the parameters of the model. The results in Table 4.3 confirm that leverage is 6.4% when the rest of the variables is constant. Growth (GRO) and size (SIZE) of a firm have positive influence on the dependent variable (LV). It shows that each unit changes in size increases leverage by 5.56%. By considering size of a firm it is analyzed that larger firms have significant assets providing security for loan so such firms are in favor debt. The assets simply use collateral for loan. Besides, a firm with large number of assets may use them to generate cash and ample cash enables a firm to pay interest without any intricacy so firms go for more debt. Its results have significant impact on leverage.

Table 4.3. **Summary Output of the Regression Analysis**

Variables	F	t-values	Expected	Actual
PRO	-.485	-3.857***	-ive	-ive
GRO	.000	1.638*	+ive	+ive
SIZE	.051	5.562***	+ive	+ive
TAN	-.135	-2.164**	+ive	-ive
RISK	-8.14E-005	-1.013	-ive	-ive
INVST	-.572	-13.611***	-ive	-ive

Adjusted R^2 = 61.5%
F-value = 16.432***
***, ** , * are significant at 1%, 5% and 10% respectively.

The significant positive relation with growth indicates that when a firm generates more revenue, id. e., increases its sales, then it can loan burden (cost of loan) easily and such a firm seeks to take more loan as it has sufficient cash to pay interest. The other aspect by following pecking order theory may be that high growing firms need more investment and sustaining growth require more funds so the need of funds is fulfilled by taking loan. Profitability (PRO), tangibility (TAN) and investment opportunities (INVST) have significant negative relation with leverage. Each unit increases in profitability, tangibility and investment opportunities will decrease leverage by 3.9%, 2.2% and 14% respectively. Highly profitable firms prefer internal funds instead of external funds. The firms with high gains prefer their retained earning as compared to go for a loan. Profitability strengthens the firms internal resources and facilitate firm's further investment. So the firms' with high retained earning don't encourage debt for investment. The impact of tangibility depicts that the firms' lower number of fixed assets cause asymmetry problems and may not undervalue their stock and have to issue debt instead of equity. With the limited fixed assets a firm can't issue equity at fair prices and has to raise debt. By concerning the negative influence of investment opportunity on leverage it is suggested to retain earnings which are not paid out as dividends to reinvest in a company for further cash generating projects. In this case a company doesn't need external funds because its retained earning is sufficient to meet money requirement. Risk also has negative effect on leverage. Risk measures interest coverage ratio which shows how efficiently the firms pay their interest payments from their earning. Higher ratio means lower risk and lower risk tends to decrease in leverage but its results are not significant. Specific results of the regression analysis for considering the hypothesis are demonstrated below:

Table 4.4. **Hypothesis Results**

Sr. #	Variable	Observed	Actual	Supporting/ Rejected
H_1	PRO	-ive	-ive	Supported
H_2	GRO	+ive	+ive	Supported
H_3	SIZE	+ive	+ive	Supported
H_4	TAN	+ive	-ive	Rejected
H_5	RISK	-ive	-ive	Supported
H_6	INVST	-ive	-ive	Supported

5. Conclusion. This research has been conducted on 32 firms of engineering sector. The data is analyzed for the period of 1998-2008. The impact of 6 determinants (profitability, growth, size, tangibility, risk and investment opportunities) on leverage

is discussed. These variables are selected on the basis of the prior research. The authentic results are concluded by applying statistic measures on these variables. To check the relation between the variables 3 methods are applied. Descriptive analysis indicates that the data in this research is symmetric and normally distributed. Correlation analysis depicts that independent variables are mutually correlated with each other. Finally, regression analysis shows leverage is strongly affected by all these independent variables. The relation of all hypotheses except tangibility is accepted. 5 out of 6 variables reveal the significant results.

Engineering firms prefer internal sources in case of high profitability and investment opportunity. These both situations enable firms to discourage loan. High profitability means internal funds are sufficient to meet the requirement of debt. In the situation of high profitability firms follow the pecking order theory. The measure of investment opportunity shows that amount of the retained earning is reinvested for further financing of business. So there is no need to go for external funds. The firms with high tangibility also discourage loan because high tangibility doen't raise the question of asymmetric problems and firms can easily underprice their stocks to issue equity instead of debt. Size is significantly positively correlated with loan. The large firms use benefits of their assets and provide assets for loans. Growth has a significant positive relation with leverage. High growth firms need debt for further growth and higher growth enables firm to bear loan burden easily. Besides this risk has a negative relation with leverage but the insignificant results eliminate its influence. High risk indicates that the firm's interest coverage ratio is lower and this firm is unable to pay the prompt payment of interest and it increases the need of debt for financing. The leverage in engineering sector is highly influenced by these factors. However, not only in engineering sector the importance of these factors is quite visible but in other sectors as well. The analysis draws attention to capital structure which is a very prolific issue of research in corporate finance.

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