# HOW FIRMS' CHARACTERISTICS AFFECT FINANCIAL LEVERAGE: AN ANALYSIS OF PHARMACEUTICALS AND CHEMICAL INDUSTRY OF BANGLADESH

*Kumar Debasis Dutta*[1]

## Abstract

Financial leverage indicates to the proportions of fixed income securities especially debt that a firm employs to fund its operation. Many elements have been proven to influence strongly the firm's leverage. As many studies have tested and revealed conflicts, the validity of theoretical determinants needs to be examined further. This paper aims to examine the validity of eight chosen leverage determinants for pharmaceuticals and chemicals industry of Bangladesh. Financial data of this industry are analyzed either to confirm or refute the assumptions of correlation between selected determinants and leverage. The study employs the quantitative research design, which is a combination of deductive approach, quantitative method and experimental strategy. The findings statistically confirm the negative relationships of growth, size and tangibility and positive relationships of earning volatility, DOL, and DFL with leverage respectively.

**Key words:** Financial leverage, Pharmaceuticals and Chemicals Industry, Bangladesh.

## Introduction

Financial leverage refers to the extent of debt (and preferred stock) that a corporation, partnership or other economic entity utilizes to conduct its operations; which is often measured with the ratio of debt to equity or debt to asset. Whether the businesses are big or small, they need fund to fulfill their business activities and to achieve their goals and objectives. Every kind of organizations need financing to meets its fixed assets and working capital requirements, and an optimum financing is the accelerator of profitable business activities. Accordingly, the leverage decision of a company is at the heart of other decisions in the area of corporate finance. Designed leverage provides an organized way to raise capital. Since capital is expensive for all business, it is particularly important for business to determine target leverage for firms. The challenges of finding the exact leverage are laying in finding the optimum debt - equity mixture. Determining the optimum mix of debt and equity involves evaluating a variety of factors or determinants. Following such a context the study has been conducted for the purpose of identifying the various variables or factors related to leverage of pharmaceuticals and chemicals industry of Bangladesh. Designing the leverage in the most optimal way can reduce the difference between success and failure. That's why the overall objective of this paper is to investigate the dynamics involved in the determinants of the leverage of selected industry in Bangladesh. Here the pharmaceutical chemicals industry is chosen to analyze because of its socio-economic importance for the development of Bangladesh. This industry is one of the most developed hi-tech sectors of Bangladesh's economy. This industry is matter of substantial pride to the country. By now, 97% of country's demand for medicines is produced locally mainly by local companies (Pharmabiz, 2013). The pharmaceutical sector of Bangladesh is expanding rapidly and some companies

[1] Kumar Debasis Dutta, Assistant Professor, Department of Finance and Banking, Patuakhali Science and Technology University, Email: debasisdutta@pstu.ac.bd

have already certified by different international regulatory authorities like UK-MHRA, Australia-TGA, EU, etc. for quality management and quality products manufacturing. Moreover, few companies are on the road to achieve US-FDA approval. The industry has positively increasing contribution to the GDP of the country from year to year.

The aim of this study is to identify the determinants that shape leverage of a firm or to empirically examine the link between a number of potential leverage determinants and the characteristics of pharmaceuticals and chemicals industry of Bangladesh. To explore the relevance and theoretical gap of capital structure with market reality of pharmaceuticals and chemicals industry of Bangladesh is another focus of this study.

## Materials and Methods

### Sources and collection of data

Twenty seven pharmaceutical and chemical companies listed in the Dhaka Stock Exchange (DSE) of Bangladesh were considered as sample in this study. Secondary data were collected from the published financial statements of selected companies for the period of six years i.e. from 2009 to 2014.

### Variables in the study

In order to analyze the determinants of leverage, the following key variables were identified: growth opportunity, size, interest coverage (TIE), profitability, tangibility, earning volatility, degree of operating leverage (DOL) and degree of financial leverage (DFL). These variables are classified into following category:-

### Independent variable:

Growth Opportunity: Theoretically, growth opportunity is negatively related with the firm's leverage. Particularly, growth rate indicates a high equity financing and a low debt financing. Firms with low, negative growth rate, tend to employ debt to limit agency costs of managerial discretion and to discipline the firm's managerial attitudes (Jensen 1986). Again high-growth firms may not issue debt to pursue their investments, particularly the firms with high leverage (Myer 1977). Here growth is calculated with the following formula:

$$\text{Growth} = \frac{\text{Net Sales}_1 - \text{Net Sales}_0}{\text{Net Sales}_0} = \text{Percentage change in Net Sales}$$

Firm's Size: Several studies nominated firm's size as a determinant of leverage (Booth et al. 2001). From the trade-off theory's viewpoint, the firm's size should have a positive relationship with the firm's leverage. Since bigger firms have well-diversified portfolio, less risks and thus larger borrowing capacity, they suffer less from costs of financial distress (Rajan and Zingales 1995). Empirically, many studies approved this positive relationship. While few dissented, however, the evidence was insignificant (Kester 1986; Titman and Wessels 1988). However, the firm's size can be defined differently such as: logarithm of total assets (Mouamer 2011), net sales adjusted by inflation rate (Karadeniz et al. 2009) or alternatively logarithm of net sales and quick ratio (Titman and Wessel 1988). In this study size is defined as the logarithm of net sales.

Interest coverage ratio: Interest coverage ratio or times-interest-earned (TIE) indicates how strong the operating income of a firm to deal with its annual interest (Brigham and Houston 2007). Interest coverage ratio is considered here as TIE and calculated as follows:

$$\text{TIE} = \frac{\text{EBIT}}{\text{Annual Interest}}$$

Theoretically, TIE is negatively correlated with firm's leverage (Harris and Raviv 1988).

Profitability: Wald suggests that profitability is the most significant determinant of leverage, and its effect is considered the largest (Wald 1999). According to trade-off theory, profitable firms should implement high leverage to exploit the tax deductibility of interest paid on debt. Moreover, high profitability apparently leads to the increase in lenders and agents 'rating (Rajan and Zingales 1995). High leverage should be employed to discipline management attitudes, ensure that managers pay out profits. (Jensen 1986.) Overall, they suggest a positive dependence between leverage and profitability. However, pecking order proposes an opposite direction. With the effect of asymmetric information, firms prioritize using retained earnings (Myers 1984; Meyers and Majluf 1984). A majority of empirical studies approves that profitability significantly and negatively relates to the firm's leverage. Profitability is derived here as follows:

$$\textbf{Profitability} = \frac{\textbf{EBIT}}{\textbf{Total Assets}}$$

Tangibility: Tangibility refers to the extent of fixed assets a firm uses. Tangible assets are defined as property, plants and equipment. However, high level of fixed assets indicates that creditors' guaranty during bankruptcy and it also gives non-debt tax shield (Bevan and Danbolt 2002) of depreciation. Theoretically, tangibility and use of debt are negatively related to each other. Here tangibility is calculated as follows:

$$\textbf{Tangibility} = \frac{\textbf{(Fixed Assets+ Investment)}}{\textbf{Total Assets}}$$

Earning Volatility: A firm with greater volatility of earnings appears to have higher business risk and default risk. The optimal leverage can help managers decrease the level of volatility (Titman and Wessels 1988). Some empirical studies pointed out the negative correlation between volatility and the firm's leverage (Bradley et al. 1984; Friend and Lang 1988), while, some are against that conclusion (Kim and Sorense 1986).

$$\textbf{Earning Volatility = Percentage Change in NI}$$

Operating Leverage: Operating leverage refers to the amount of fixed operating costs in the firm. Particularly, the degree of operating leverage (DOL) measures the effect of fixed costs on the firm's profit as DOL equals to fixed costs divided by operating profit (Block and Hirt 1977). Here DOL is calculated as follows:

$$\textbf{DOL} = \frac{\textbf{\% Change in EBIT}}{\textbf{\% Change in Sales}}$$

Financial Leverage: Financial leverage indicates the amount of fixed income securities firm uses to finance its capital needs. The degree of financial leverage (DFL) is expressed as the percentage change in earnings per share (EPS) over the percentage change in earnings before taxes and interest (EBIT). The DFL equation is addressed as below:

$$\textbf{DFL} = \frac{\textbf{\% Change in EBS}}{\textbf{\% Change in EBIT}} = \frac{\textbf{EBIT}}{\textbf{(EBIT−Interest)}}$$

**Dependent variables**

Leverage: The dependent variable used in this study is leverage ratio i.e. debt to asset ratio. It can be measured by dividing the total debt by total assets. A firm's debt ratio or leverage can be illustrated as below:

$$\textbf{Debt Ratio/ Leverage} = \frac{\textbf{Total Debt}}{\textbf{Total Asset}}$$

**Data analysis**

Statistical tools were used to analyze and evaluate the aforesaid variables. Using SPSS and STATA correlation matrix, regression and robust regression analysis were run to measure the directions and strengths of relationship among variables and to evaluate the relationship of leverage with firm's characteristics.

**Research Hypotheses**
Consistent with the existing literature and empirical hypothesis, the following hypotheses were developed to test the relationship between leverage and firm's characteristics. The hypotheses of the study were:
$H_o$-Company characteristics has no significant effect on capital structure
$H_1$- Company characteristics has significant effect on capital structure

**Research Model**
Multiple-regression model is used to find out the association between leverage and firms characteristics in the context of Bangladesh. OLS regression model and robust regression model are formulated to check the relationship between leverage and firms' characteristics. The effects are studied here by using the following equation:

$$da_{it} = \alpha + \beta_1 g_{it} + \beta_2 sa_{it} + \beta_3 pro_{it} + \beta_4 tan_{it} + \beta_5 tie_{it} + \beta_6 ear_{it} + \beta_7 DFL_{it} + \beta_8 DOL_{it} + \varepsilon_{it}$$

Where,   da   :   Leverage          DOL   :   Degree of operating leverage
         g    :   Growth            DFL   :   Degree of financial leverage
         sa   :   Size              A     :   Constant term
         pro  :   Profitability     $\beta_1$-$\beta_8$ :   Coefficients
         tan  :   Tangibility       i     :   Firm
         tie  :   Interest coverage T     :   Year
         ear  :   Earning volatility E     :   Error term

## Results and Discussion
**Leverage trend of pharmaceuticals and chemicals industry**
Table-1 shows the industry average of leverage (debt asset ratios) of 27 pharmaceuticals and chemicals companies from the year 2009 to 2014. The lowest industry average of leverage is found in 2012 (0.27) and the highest industry average is found in 2009 (0.34).

**Table 1: Yearly Leverage ratios**

| Sl. No. | Company (Trading quote[2]) | Leverage | | | | | | Company Average |
|---|---|---|---|---|---|---|---|---|
| | | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 | |
| 1 | ACI | 0.35 | 0.33 | 0.36 | 0.57 | 0.54 | 0.58 | 0.45 |
| 2 | ACIFORMULA | 0.31 | 0.37 | 0.37 | 0.39 | 0.35 | 0.49 | 0.38 |
| 3 | ACTIVEFINE | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 4 | AFCAGRO | 0.17 | 0.31 | 0.22 | 0.23 | 0.29 | 0.25 | 0.25 |
| 5 | AMBEEPHA | 0.46 | 0.82 | 0.78 | 0.77 | 0.63 | 0.92 | 0.73 |
| 6 | BEACONPHAR | 0.14 | 0.18 | 0.19 | 0.21 | 0.26 | 0.48 | 0.24 |
| 7 | BXPHARMA | 0.05 | 0.04 | 0.06 | 0.08 | 0.08 | 0.06 | 0.06 |
| 8 | BXSYNTH | 0.79 | 0.72 | 0.71 | 0.76 | 0.81 | 0.79 | 0.76 |
| 9 | CENTRALPHL | 0.05 | 0.02 | 0.19 | 0.22 | 0.33 | 0.32 | 0.19 |
| 10 | FARCHEM | 0.05 | 0.06 | 0.05 | 0.04 | 0.04 | 0.04 | 0.05 |
| 11 | GHCL | 0.19 | 0.06 | 0.15 | 0.06 | 0.15 | 0.17 | 0.13 |
| 12 | GLAXOSMITH | 0.06 | 0.06 | 0.09 | 0.09 | 0.07 | 0.08 | 0.08 |
| 13 | IBNSINA | 0.53 | 0.46 | 0.40 | 0.46 | 0.55 | 0.53 | 0.49 |
| 14 | IMAMBUTTON | 0.45 | 0.80 | 0.65 | 0.69 | 0.54 | 0.81 | 0.66 |
| 15 | JMISMDL | 0.48 | 0.57 | 0.50 | 0.53 | 0.43 | 0.54 | 0.51 |
| 16 | KEYACOSMET | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 17 | KOHINOOR | 0.94 | 0.70 | 0.73 | 0.76 | 0.77 | 0.75 | 0.77 |

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[2] Company trading quote are taken from: http://www.dsebd.org/companylistbyindustry.php?industryno=18

| Sl. No. | Company (Trading quote[2]) | Leverage | | | | | | Company Average |
|---|---|---|---|---|---|---|---|---|
| | | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 | |
| 18 | LIBRAINFU | 0.14 | 0.07 | 0.08 | 0.07 | 0.09 | 0.07 | 0.09 |
| 19 | MARICO | 0.53 | 0.25 | 0.38 | 0.46 | 0.41 | 0.45 | 0.41 |
| 20 | ORIONINFU | 0.73 | 0.47 | 0.39 | 0.68 | 0.48 | 0.44 | 0.53 |
| 21 | ORIONPHARM | 0.22 | 0.20 | 0.19 | 0.15 | 0.26 | 0.26 | 0.21 |
| 22 | PHARMAID | 0.36 | 0.46 | 0.40 | 0.34 | 0.33 | 0.38 | 0.38 |
| 23 | RECKITTBEN | 0.04 | 0.03 | 0.02 | 0.02 | 0.08 | 0.07 | 0.04 |
| 24 | RENATA | 0.14 | 0.26 | 0.08 | 0.09 | 0.10 | 0.10 | 0.13 |
| 25 | SALVOCHEM | 0.42 | 0.25 | 0.35 | 0.49 | 0.42 | 0.38 | 0.39 |
| 26 | SQURPHARMA | 0.03 | 0.04 | 0.03 | 0.07 | 0.03 | 0.05 | 0.04 |
| 27 | WATACHEM | 0.14 | 0.10 | 0.04 | 0.04 | 0.34 | 0.12 | 0.13 |
| Industry Average | | 0.29 | 0.28 | 0.27 | 0.31 | 0.31 | 0.34 | |

The average leverage of the selected companies in 2014 is 0.29. Leverage ratios of 12 companies are lying above this average and rest 15 are at below the average. In 2013 the average leverage of the industry is 0.282. 10 companies are lying above and 17 are at below of the average. The industry average of leverage in 2012 is 0.274. Here 12 companies are lying above and rest 15 companies are lying below the average. In 2011 the average is 0.307. It is found that 11 companies are lying above average and the other 16 companies are below the average. Industry average in 2010 is 0.310. 15 companies are lying above average and rest 12 companies are below the average. In 2009, the average leverage is 0.338. 13 companies are lying above the average and rest 14 companies are below the average. Active Fine Chemicals Limited (ACTIVEFINE) and Keya Cosmetics (KEYACOSMET) are showing insignificant use of leverage in 2014.

**Correlation between leverage and its factors**
Correlation measures the liner relationship between two variables and indicates whether they are positively or negatively related. Result shows a negative relation of *leverage (i.e. da)* with growth, size, profitability and interest coverage *(i.e. g, sa, pro and tie)* ratios respectively as their *r* value is negative and those are -0.2071, -0.3585,-0.1287, -.1761 respectively which means the values of *g, sa, pro, tie* ratios will go to the opposite direction of *da* ratio. However tangibility, earning volatility and degree of operating and financial leverage *(i.e. tan, ear, dfl and dol)* ratios have positive relation with *da* ratio as their *r* value for *da* are 0.0228, 0.0267, 0.3296 and 0.0064 respectively. The change in *da* ratio looks mostly dependent on the change in *sa and dfl* as they have highest *r* relative to other independent variables. On the other hand leverage seems more or less unaffected whether there is any change in *dol*.

**Table 2: Correlation matrix**
Cor da g sa pro tan tie ear dfl dol (obs=162)

| | da | g | sa | pro | Tan | tie | ear | dfl | dol |
|---|---|---|---|---|---|---|---|---|---|
| Da | 1 | | | | | | | | |
| G | -0.207 | 1 | | | | | | | |
| Sa | -0.359 | 0.171 | 1 | | | | | | |
| Pro | -0.129 | -0.163 | -0.041 | 1 | | | | | |
| Tan | 0.023 | -0.143 | -0.319 | 0.028 | 1 | | | | |
| Tie | -0.176 | -0.023 | 0.088 | 0.458 | -0.187 | 1 | | | |
| Ear | 0.027 | 0.396 | 0.061 | -0.081 | -0.006 | 0.059 | 1 | | |
| Dfl | 0.330 | -0.047 | -0.093 | -0.149 | 0.078 | -0.407 | -0.125 | 1 | |
| Dol | 0.006 | -0.045 | 0.112 | 0.130 | -0.123 | -0.029 | -0.041 | -0.023 | 1 |

**Analyzing the factors that affect leverage**

From the model summary it can be observed that the coefficient of determination ($R^2$) is 0.293 means about 29% variability of leverage *(da)* is explained by the independent variables. In multiple regressions adjusted R-squared value is more accepted than R-square value which represents the same meaning as R-squared value. According to that about 26 % of variability of leverage is explained by independent variables like *growth, size, profitability, tangibility, interest coverage, earning volatility, dfl and dol.* As there is little difference between adjusted R-squared value and R-squared value that is only 3%, the independent variables included in this model are not random or arbitrary. **Prob.> F** value indicates the probability of regression output not by chance. Smaller the significance value, greater the probability that the regression result is not by chance or random. As **Prob.> F** value is 0.000, model result is not random or not by chance. Coefficient column provides more insight about the model. Findings suggest that growth and size have statistically significant relationship with debt/asset ratio or leverage. And these relationships are valid at 1% level of significance (i.e. t test: -3.13; Sig-0.002, t test: -4.86; Sig-0.000). Theoretically it is also anticipated that companies with relatively high growth rate, may have lower financial leverage and utilize less debt in the capital structure (Azizi, 2009). Firms, in accordance to capital structure arguments, prefer internal sources to other externals in order to meet the financial requirements; hence, employed, in those entities with high profitability once, it is called for; consequently less need to find external resources (Frank and Gouyal, 2009). Again high level of asset also reduces the firm's dependency on external sources i.e. debt. Earning volatility and degree of financial leverage are also showing significant positive relationships with debt/asset ratio at 5% (i.e. t test: 2.29; Sig-0.023) and 1% (i.e. t test: 3.94; Sig-0.000) level of significance respectively. Tangibility is showing a significant negative relationship with debt/asset ratio. This relationship is significant at 10% (i.e. t test:-1.88; Sig-0.062) level of significance.

So 1% increase in *g and sa* will decrease the *da* ratio by 0.257% and 0.13% respectively. As like 1% increase in *tan,* ratios will decrease *da* ratio by 0.094% as the sign of coefficient is negative. However, 1% increase in *ear, dfl* ratios will increase *da* ratio by 0.054% and 0.059% respectively. Standard error represents the standard deviation of coefficient. So chance of deviation from resulted coefficient of independent variables that is *g, sa, pro, tan, tie, ear, dfl, dol* are 8.23%, 2.686%, 6.85%, 5.03%, 0.92%, 2.359%, 1.49%, 0.01% respectively. T-stat value represents the distance of standard deviation of coefficient of independent variables from zero in the number line and is obtained by dividing coefficient by standard deviation. So *g, sa, pro, tan, tie, ear, dfl, dol* ratios standard errors are -3.23, -4.86, -1.53, -1.88,-0.14, 2.29, 3.94, and 0.69 away from 0 on number line. As all of the values are close to 0 it indicates smaller deviation from the coefficient of independent variables.

P value tests the null hypothesis. If p value is less than 0.05 then null hypotheses is rejected which means changes in dependent variables are responsible for changes in independent variables and vice versa. We can see from the table-3 that *g, sa, ear, dfl* ratios have p value less than 0.05 and is significant which means changes in *da* ratio are responsible for changes in *g, sa, ear, dfl* ratios. On the other hand, p value of *pro, tan, tie, dol* ratios are higher than 0.05 and the changes in *da* ratio are not responsible for or affected by the changes in the *pro, tan, tie, dol* ratios.

**Table 3: Regression Analysis**
reg da g sa pro tan tie ear dfl dol

| Source | SS | df | MS | | Number of obs. | 162 |
|---|---|---|---|---|---|---|
| Model | 3.037 | 8 | 0.380 | | F( 8, 153) | 7.94 |
| Residual | 7.314 | 153 | 0.048 | | Prob > F | 0.000 |
| Total | 10.351 | 161 | 0.428 | | R-squared | 0.293 |
| | | | | | Adj R-squared | 0.257 |
| | | | | | Root MSE | 0.219 |

| da | Coef. | Std. Err. | t | P>t |
|---|---|---|---|---|
| g | -0.257 | 0.082 | -3.13 | 0.002 |
| sa | -0.131 | 0.027 | -4.86 | 0.000 |
| pro | -0.105 | 0.069 | -1.53 | 0.128 |
| tan | -0.095 | 0.050 | -1.88 | 0.062 |
| tie | -0.001 | 0.009 | -0.14 | 0.888 |
| ear | 0.054 | 0.024 | 2.29 | 0.023 |
| dfl | 0.059 | 0.015 | 3.94 | 0.000 |
| dol | 0.000 | 0.000 | 0.69 | 0.489 |
| _cons | 1.532 | 0.267 | 5.74 | 0.000 |

**Analysis of Robust Regression:**

From Results of robust regression it is found that growth and size has significant negative relationship with debt/asset ratio or leverage at 1% level of significance (i.e. t test: -3.20; Sig-0.002, t test: -4.92; Sig-0.000). Tangibility is showing a significant negative relationship with leverage at 5% (i.e. t test: -2.22; Sig-0.028) level of significance. On the other hand earning volatility, degree of operating leverage and degree of financial leverage all have significant positive relationships with leverage. Relationships of earning volatility and degree of operating leverage with leverage are valid at 5 %( i.e. t test: 2.13; Sig-0.034, t test: 2.02; Sig-0.045) level of significance whereas degree of financial leverage and leverage relationship is significant at 1% (i.e. t test: 3.56; Sig-0.000) level of significance.

**Table 4: Analysis of Robust Regression**
. rreg da g sa pro tan tie ear dfl dol

| Huber iteration1: maximum difference in weights | = .515 |
|---|---|
| Huber iteration2: maximum difference in weights | = .054 |
| Huber iteration 3: maximum difference in weights | = .011 |
| Biweight iteration4: maximum difference in weights | = .152 |
| Biweight iteration5: maximum difference in weights | = .004 |

| Number of obs. | | | | 161 |
|---|---|---|---|---|
| F( 8, 153) | | | | 8.000 |
| Prob > F | | | | 0.000 |
| da | Coef. | Std. Err. | t | P>t |
| g | -0.276 | 0.086 | -3.20 | 0.002 |
| sa | -0.140 | 0.028 | -4.92 | 0.000 |
| pro | -0.067 | 0.072 | -0.93 | 0.353 |
| tan | -0.117 | 0.053 | -2.22 | 0.028 |
| tie | -0.007 | 0.010 | -0.67 | 0.502 |
| ear | 0.053 | 0.025 | 2.13 | 0.034 |
| dfl | 0.056 | 0.016 | 3.56 | 0.000 |
| dol | 0.001 | 0.001 | 2.02 | 0.045 |
| cons | 1.636 | 0.282 | 5.81 | 0.000 |

## Conclusion

This study examines only firm specific factors that influence the companies leverage ratio. The effect of another group of macroeconomic factors like inflation, stock market value and GDP growth rate could have a significant role in determining a firm's capital structure choice decisions. In this study the regression results show that, profitability, and tie are statistically insignificant in affecting leverage holding other things constant. The results also show a significant positive relationship of DOL, earning volatility and DFL to leverage. On the other hand, growth, size, tangibility of firms inversely and significantly related with leverage.

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