Doctoral Dissertation

Corporate Capital Structure: Determinants, Productivity and Value Relevance

Department of Business Administration
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By
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Abstract

After the seminal works of Modigliani and Miller (1958, 1963), thousands of researches are conducted in order to understand & explain the behaviors of the capital structures, and the performance relevance of the capital structure choices. Yet, do not have any common set of knowledge in the capital structures and the better performance of the business corporations because of the use of debt in the capital structure is inconclusive. The objective of this thesis are to add the new knowledge with the existing literatures in the behaviors of the capital structures, in the process of the productivity analysis and in the performance relevance of the corporate capital structure choices. To achieve the objectives, this thesis used data from a corporate sector-pharmaceuticals sector of Bangladesh.

The first part of the study reviews all of the important theories and concepts developed in the corporate capital structures until till date in an aggregate manner. The empirical part shows that the leverage ratios- defined by short-term debts, long-term debts, total debts and book value are significantly correlated, the leverage ratios defined by earnings before interest & taxes over interest and earnings before interest, taxes & depreciation over interest are positively perfectly correlated, book value based and market value based leverage are not correlated, short-term loans are three times compare to long-term debts, firms are reluctant in paying tax and allotment in research & development expenses are insufficient, human capital cost do not have effect on any kind of leverage. These empirical evidences are new and original; deserve to be appeared in the corporate finance text book, important for the policy makers and researchers in the field. The study shows that industry median average, non-debt tax shield, and uniqueness (R&D) positively & significantly affects financial leverage and size, tangibility, tax rate, dividend pay-out, agency cost, business risk, GDP growth, & money growth negatively & significantly affects financial leverage. The selling, general and administrative expenses positively affects short-term debts, negatively affects long-term debts and have no significant effects on total debts.

The second part of the study is about the productivity analysis of the sector. The study shows that the productivity of the sector increased only by 1.3 per cent per year over the period 2006-2007. This growth rate is the end result of the product of the increase in the efficiency by 4.1 per cent per year and the decline in the technical progress by 2.7 per cent per year. In another way, the reasons of the low productivity growth are the decline in the productivity for the 50 per cent of the sample industries and the time periods. The study also shows that there is a mismatch between the leverage ratios of the productivity growth industries and the productivity declined industries, a sign for the necessity of the further studies whether leverage causes productivity growth. Besides, the study shows that the Malmquist productivity change index & its components and the traditional measures of the corporate performance present different aspects of the corporate performance.

The final part of the study reported that the differences in the corporate environments, leverage measures, data analysis techniques, uncommon control variables, performance measures, data issues, market type-bank or market-based economies, and market locations produced the different results in the previous studies about the effects of the leverage on the firm performance. The study also reveals that the changes in the leverage ratios and their squares are strongly positively correlated, the changes in the leverage do not affect the Malmquist productivity change index & its components and the Malmquist productivity change index & its components do not affect the changes in leverage. Hence it is proved that the leverage does not improve the corporate performance and the corporate performance does not affect the leverage.

The studies provided significant academic and managerial contributions. The academic contributions are: the theoretical integration in the first part; the design for productivity analysis and improvement in second part, and the two new models to test the affect of the changes in leverage on the firm performance & the affect of firm performance on the changes in leverage. The managerial contributions are: the empirical evidences of the first part, the empirical information of the second part and the empirical evidences of the final parts including the leverage irrelevance**.** The academic contributions and the empirical findings of the study deserve to appear in the text book of the corporate finance.

Declaration

A version of chapter 2 is published in the following Journal

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Acronyms

BBC	Banker, Charnes, & Cooper
BVA	Book Value of Assets
CCR	Charnes, Cooper, & Rhodes
CFO	Cash Flow from Operations
CIP	Commercially Important Person
CRS	Constant Returns to Scale
DEA	Data Envelopment Analysis
DMU	Decision Making Unit
EBIT	Earnings before Interest and Taxes
EBITD	Earning Before Interest, Taxes and Depreciation
EFFCH	Efficiency Change
EPS	Earnings Per Share
GDP-	Gross Domestic Product
MPI-	Malmquist Productivity Index
MVA	Market Value of Assets
NDTS	Non-Debt Tax Shield
OCFA	Operating Cash Flow to Total Assets
OLS	Ordinary Least Squares
PECH	Pure Efficiency Change
R&D	Research & Development
ROA	Return On Assets
ROE	Return On Shareholder's Equity
ROS	Return On Sales
RPE	Return per Employee
SECH	Scale Efficiency Change
SEM	Structural Equation Modeling
SGA	Selling General and Administrative
TECHCH	Technical Change
TFP	Total Factor Productivity
TFPCH	Total Factor Productivity Change Index
TSW	Total Salary and Wages
VRS	Variable Returns to Scale

Chapter 1: Introduction

After the famous works of Modigliani and Miller (1958, 1963), thousands of researches are conducted in order to understand the capital structure behaviors, and the performance relevance of the capital structure choices. So far, do not have any unique set of behaviors of capital structures and the matter of using the debt in the capital structure for the better performance is inconclusive. The objectives of this thesis are to add new knowledge with the existing knowledge in the capital structure behaviors, the capital structure productivity analysis and the performance relevance of the corporate capital structure choices. To achieve the objectives, this thesis used data from a corporate sector-pharmaceutical sector of Bangladesh.

Bangladesh is a fast growing economy with an average annual gross domestic product (GDP) growth rate of about 6 per cent per year since 1990s. Bangladesh is the seventh largest in terms of the total population, thirty-fifth largest in terms of the purchasing power parity total GDP, fifty sixth largest in terms of the nominal total GDP, one hundred forty second largest in terms of the per purchasing power parity capita income and one hundred fifty fourth largest in terms of the nominal per capita income in the world (IMF 2014). This year, Bangladesh has moved from developing country to the low-middle income country based on the per capita income (World Bank 2015). The main forces in the economic growth of the country are the growth in the corporate sectors and the growth in the remittance. However, the capital structure behaviors analysis, the capital structure productivity analysis and the performance relevance of the corporate capital structure choices have not received the due importance in Bangladesh. One of the objectives of this thesis is to fulfill this gap.

Pharmaceutical sector is the most technologically developed, the third largest in terms of the contribution to the government revenue (Saad 2012) and the second largest in terms of the earning foreign currency sector in Bangladesh. Including small, medium and large pharmaceutical industries, there are 263 registered pharmaceutical industries in Bangladesh of

which 209 are functioning, 29 are non-functioning and 25 are suspended on till date. But only 30 pharmaceutical companies are listed in the stock exchange. The pharmaceutical products produced in Bangladesh fulfills the 97 per cent of the local demand (Wikipedia 9/14/2015) and the qualities are comparable with the international standards. After fulfilling the local demand, the sector exports to the 83 countries in the world including UK, Europe and America. Thirty companies exported worth of US$48.3 million pharmaceutical products in FY 2011/12 (Bangladesh Bureau of Statistics). The export is about 8 per cent of the total production of the pharmaceutical products. Although the volume of the export is not large, the sector is growing very fast. The annual compounding growth rate is about 26.20 per cent between 2002 and 2010. In the world, Bangladesh market has achieved the highest growth rate in 2010 (IMS Health). However the capital structure behaviors analysis, the capital structure productivity analysis and the performance relevance of the corporate capital structure choices for the pharmaceutical sector are absent on till date. Some of the objectives of this thesis are to fulfill these gaps and accelerate the productivity growth of the sector.

In order to achieve the objectives: to know the capital structure behaviors, to conduct the capital structure productivity analysis and to check the performance relevance of the corporate capital structure choices this study uses data from 14 pharmaceuticals companies listed at Dhaka Stock Exchange Limited-the main stock exchange of Bangladesh for the seven years: 2006-2012. The data is collected from the annual reports of the companies reserved at Bangladesh Securities and Exchange Commission library, Dhaka Stock Exchange Limited library, Chittagong Stock Exchange Limited library and University of Liberal Arts library. The book value based data is used in this study if not indicated otherwise. The Macroeconomic related data is collected from various issues of Bangladesh Statistical Yearbook and various publications of the central bank of Bangladesh-Bangladesh Bank. The data is analyzed by using the descriptive statistics, correlation analysis, ordinary least squares, and Malmquist productivity analysis techniques.

The first part of the research (research report chapter-2) is conducted in order to review all of the important theories and concepts developed in the corporate capital structures until till date in an aggregate manner. The empirical part answered important questions like: Can leverage ratios defined by short-term debts, long-term debts, total-debts, debt/(debt+equity), earnings before interest & taxes over interest and earnings before interest, taxes & depreciation over interest be summarized? What is the relationship between book-value based and market-value based leverage? What is the attitude of the companies toward tax payment and research & development expenses? What is the proportion of the short-term debts and long-term debts to the total debts? Can size of the company be represented either by natural log of the sale or natural by log of the assets? Do human capital affects the financial leverage of a company? What are the determinants of the corporate capital structure? etc.

The empirical part of the study reveals that the leverage ratios defined by short-term debts, long-term debts, total debts and book value of assets are correlated. Similarly, the leverage ratios defined by short-term debts, long-term debts, total debts and market value of assets are correlated. However, book value based and market value based leverage ratios are not correlated. The leverage ratios defined by earnings before interest & taxes over interest and earnings before interest, taxes & depreciation over interest are positively perfectly correlated. Besides, short-term loans are three times more compare to long term debts, firms are reluctant in paying tax, allotment in research and development expenses are insufficient, total sales & total assets can be alternative to be the proxy of the size of the firm and human capital cost do not have effect on any kind of leverage. These empirical evidences are original, significant and deserve to appear in the text book of the corporate finance.

In addition, industry median average, non-debts tax shield, uniqueness (R&D) positively significantly affects financial leverage and size, tangibility, tax rate, dividend pay-out, agency cost, business risk, GDP growth, and money growth negatively significantly affects financial leverage. The selling, general and administrative expenses positively affect short-term debts,

negatively affects long-term debts and have no significant effects on total debts.

The objective of the second part of the thesis (research report chapter-3) is to study the productivity of the corporate sector in Bangladesh. More specifically, to estimates the Malmquist productivity change index for the corporate sector in Bangladesh, to investigate the reasons of the Malmquist productivity change index, to check whether the leverage ratios of the productivity growth & the productivity declined industry are the same or different and to check the relationship between the traditional measures of the corporate performance & the Malmquist productivity change index & its components.

To achieve the objectives, this part of the thesis reviews various aspects of the productivity and the productivity management. The study shows that productivity is increased by 1.3 percent per year over the period 2006-2012. This growth is due to increase in the efficiency by 4.1 per cent per year and decline in the catching up by 2.7 per cent per year. In another way, the productivity of the seven industries out of the fourteen industries is increased and the productivity of the seven industries out of the fourteen industries is decreased over the sample period. Similarly, the productivity is decreased during the 50 per cent of the sample periods. A study of the leverage ratios of the productivity growth and the productivity declined industries shows that there is a mismatch between the leverage ratios of the two groups. Moreover, a relationship study shows that the Malmquist productivity change index & its components and the traditional measures of the corporate performance present different aspects of the corporate performance.

The last part of the thesis (research report chapter-4) identified the reasons behind the discrepancies in the result from the past empirical studies about the affect of the leverage on the firm performance. Most importantly, by using the Malmquist productivity change index & its components as the proxy for the corporate performance, the affect of changes in the leverage on the corporate performance and the affect of the corporate performance on the

changes in the leverage are identified. The study also checked the relationship between the changes in the leverage ratios and their squares.

The study reveals that the reasons for the discrepancies are the differences in the corporate environments, leverage measures; data analysis techniques, uncommon control variables, performance measures, data issues, market type-bank or market-based economy, and market locations. Besides, the study shows that the changes in leverage and the square of the changes in leverage are very strongly positively correlated; the changes in the leverage do not affect the Malmquist productivity change index and its components. The reserve causality tests show that the Malmquist productivity change index & its component do not affect the changes in the leverage. Hence, it is proved that the change in the leverage does not improve the corporate performance and the corporate performance does not affect the leverage. Thus, the thesis achieved its objectives.

The studies provided significant academic and managerial contributions. The academic contributions are: the theoretical integration in the first part; the design for productivity analysis and improvement in second part, and the two new models to test the affect of the changes in leverage on the firm performance & the affect of firm performance on the changes in leverage. The managerial contributions are: the empirical evidences of the first part, the empirical information of the second part and the empirical evidences of the final parts including the leverage irrelevance**.** The academic contributions and the empirical findings of the study deserve to appear in the text book of the corporate finance.

The rest of the thesis is organized as under: chapter 2 is about the theoretical integration of the various important theories, concepts, empirical evidences, and the derived empirical evidences from the study. Chapter 3 deals with the Malmquist productivity analysis of the corporate sector and the relationship between the traditional measures of the corporate performance and the Malmquist productivity change index & its components. Chapter 4 is about the performance relevance of the corporate capital structure choices. Chapter 5 is the

conclusion of the study and the future research directions. The study ends with the references list.

Chapter 2: Corporate Capital Structure: A Theoretical Integration and Some Empirical Evidences

Abstract

This research reviews all of the relevant important theories and concepts developed in corporate capital structure until till date in an aggregate manner. The empirical part of the study reveals that the leverage ratios defined in short-term debts, long-term debts, total debts and book value of assets are correlated. Similarly, the leverage ratios defined in short-term debts, long-term debts, total debts and market value of assets are correlated. However, book value based and market value based leverage ratios are not correlated. The leverage ratios defined in earnings before interest & taxes over interest and earnings before interest, taxes & depreciation over interest are positively perfectly correlated. Besides, short-term loans are three times more compare to long term debts, firms are reluctant in paying tax, allotment in research & development expenses are insufficient. total sales & total assets can be alternative to be proxy of the size of the firm and human capital cost do not have effect on any kind of leverage. In addition, industry median average, non-debts tax shield, uniqueness (R&D) positively significantly affects financial leverage and, and size, tangibility, tax rate, dividend pay-out, agency cost, business risk, GDP growth, and money growth negatively significantly affects financial leverage. The selling, general and administrative expenses positively affect short-term debts, negatively affect long-term debts and have no significant effects on total debts.

Keywords: determinants, financial leverage, book value based leverage, market value based leverage

1. Introduction

After the famous works of Modigliani and Miller (1958, 1963), inspired by Durand (1952) and Allen (1954), many theories are developed to explain the capital structure behaviours of the firms. There are some supports for each of the theories. As a result, writing a paper on a part of capital structure is good for a paper but not good for our unified understanding in capital structure because a group of theories conflict with the other group of theories or a concept is not included in the other concept. Realizing the truth, Fama and French (2005) conclude, "it is probably time to stop running empirical horse races between them (trade-off & pecking order theory) as stand-alone stories for capital structure. Perhaps, it is best to regard the two models as stable mates with each having elements of truth that help explain some aspects of financing". Similarly, Barclay and Smith (2005) also assert: Although the pecking order theory is incapable of explaining the full array of financial policy choice, this does not mean that information costs are unimportant in corporate decision making. On the contrary, such costs will influence corporate financing choices and, along with other costs and benefits, must be a part of a unified theory of corporate financial policy. As a result, researchers are looking for common factors affecting capital structures, instead of testing trade-off theory or pecking order theory or other concepts of capital structure since late 1980s.

But the path of looking for common factors, accelerated from 1988 after the classic paper of Titman and Wessels (1988), are not in the right track. All of the studies suffer from serious flaw (s) at least in the variables selection to present factors affecting financial leverage. As in the variable selection, in the research path, valuable knowledge created by an empirical study in terms of the variables, excluded in the later empirical studies and revealed new findings which are a problem for our unified understanding in capital structure. For instance, the variables-industry classification and uniqueness included in the paper of Titman and Wessels (1988) and found significant are not included in the paper of Rajan and Zingles (1995). Consequently, there is no common set of determinants of optimal capital structure. Table 1 shows the limitations of the six papers published in the esteemed journals.

Table 1. Studies in determinants of corporate capital structure

Author	Technique	Findings	Limitations	Published
Titman and Wessels (1988)	SEM	All factors are insignificant except industry classification	Only industry classification is significant	Journal of Finance
Hariss and Raviv (1991)	Literature Survey	In general, leverage increases in fixed assets, non-debt tax shield, general & administrative expenses, growth and size and decreases with volatility, advertisement, research & development, bankruptcy probability, profitability, and uniqueness.	Methodology, no empirical evidence, not consistent with findings of other studies.	Journal of Finance
Rajan and Zingels (1995)	Regression Analysis	Size, growth, profitability, tangibility are important factors	Methodology, human capital, industry median , expected inflation not included	Journal of Finance
Frank and Goyal (2009)	Econometri -c Analysis	Six core factors: profitability, growth, size, industry classification, tangibility and inflation	Only USA data, methodology, human capital variable not considered	Financial Manage ment
Matsa (2010)	Regression Analysis	Tangibility, growth, sales, profitability, bankruptcy probability and human capital bargaining variable are significant.	Only USA data, methodology, industry variable, expected inflation variable is not considered	Journal of Finance
Berk et.al (2010)	Theoretical Paper	Moral hazard or information asymmetry not important, human cost of bankruptcy and industry classification are important, debt can be used as a strategic variable to save in wages and salary, capital-intensive firms uses higher leverage.	Not mentioned whether the human capital factor has multicollinearity with other factors. no empirical evidence.	Journal of Finance

Source: Literature Review.

In this paper, all of the theories and concepts are developed in the field capital structure until till date are considered in aggregate manner. Based on the theories and the concepts, up-to-date indicators of the factors affecting capital structure are identified and proposed. The data is analyzed by descriptive statistics, correlation analysis, and ordinary least squares method (OLS). OLS is used as the panel data is poolable.

The broad objective of this study is to determine the determinants of the corporate capital structure. In consistent with the broad objective, the specific objectives are: (i) to consider the important theories and concepts developed until till date in an aggregate manner, (ii) to extract factors from the theories and concepts, (iii) to present the up-to-date indicators for the factors, (iv) to determine the factors affecting the corporate capital structure, (v) to identify the effect of human capital cost on financial leverage, and (vi) to supple the empirical evidences on various issues of the capital structure.

The data is collected on 28 variables based on availability of the required data. 8 variables are selected to present financial leverage and 20 variables are selected to present the determinants of the capital structure. However, the number of independent variables are decreased to 12 by checking multi-co-linearity. Among the financial leverage variables, short term debts is positively strongly related with total debts (0.82). As majority of the financial economists used short-term debts to total assets, long-term debts to total debts and total debts as the measure of financial leverage or capital structure, this study determined the determinants of the financial leverage defined in terms of short-term debts, long-term debts and total debts.

In order to achieve the objectives, this study uses data from 14 pharmaceuticals companies listed at Dhaka Stock Exchange Limited-the main stock exchange of Bangladesh for the seven years: 2006-2012. The data is collected from the annual reports of the companies reserved at Bangladesh Securities and Exchange Commission library, Dhaka Stock Exchange Limited library, Chittagong Stock Exchange Limited library and University of Liberal Arts library. The book value based data is used in this study if not indicated otherwise. The Macroeconomic related data is collected from various issues of Bangladesh statistical yearbook and various publications of the central bank of Bangladesh-Bangladesh Bank.

The first section of the thesis is about introduction to the thesis. The second section of the thesis deals with the theories and concepts of capital structure. The third section of the thesis is about the determinants of the capital structure. The fourth section is about the measures of capital structure. The fifth section is about the empirical results. They study ends with concluding remarks.

2. Theories of Capital Structure

2.1 Trade-Off Theory of Capital Structure Choice

Scott (1976) argued to determine the optimal amount of debt based on the trade-off of the benefits and costs of the debts. The benefits of the debt comes from the cheaper rate of

interest compare to cost of equity, the tax deductibility of the interest payments, and the reduction of available cash in the hands of managers which stops misuse of funds and hence reduces agency cost between managers and shareholders (Jensen & Meckling, 1976). On the other hand, the costs come from the agency costs, the financial distress cost, human bankruptcy cost and personal tax (Miller, 1977). When profitable firm increases debt in the capital structure, at the beginning stage, the marginal benefits of the using debts is higher than the marginal costs of the using debts. At a point, the marginal cost of benefits of using debt is equal to the marginal cost of using debts. After the point, the marginal costs of using debts become higher than the marginal benefits of using debts. So, optimal level of debt is determined at the point where marginal costs of using debt is equal to the marginal benefits of using debts. As a result, the important implication of this model is that the corporate farms have optimal debt ratio that maximizes the value of the firm. Figure 1 shows pictorial presentation of static trade off theory.

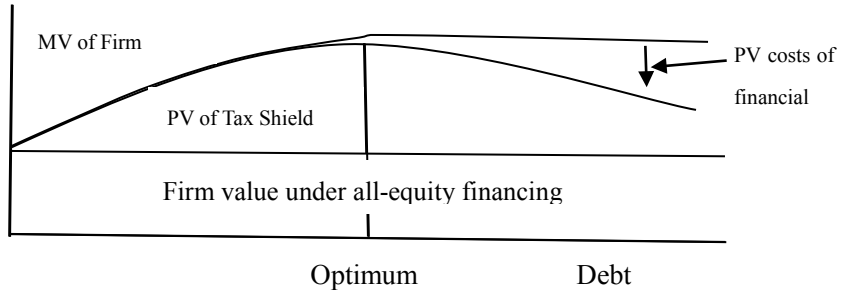

Figure 1. The static trade-off theory of optimal capital structure

2.2 Agency Cost Theory of Capital Structure Choice

2.2.1 Agency Cost Theory

Jensen and Mackling (1976), Fama and Jensen (1983) and Fama (1980) argued that agency cost is substantial, and it arises from the conflict of interest between managers and shareholders and the managers and bondholders. The agency costs of debt those may be created by shareholders/managers and reduces firm values are summarized as under: (a) Debt Overhang/Under Investment Problem: Shareholders may give up some positive NPV projects thinking that the value fully be captured by the debts (Myers, 1977). (b) Transfer of Assets/Asset Substitution: Equity holders may take very high risky negative NPV projects. If the projects become successful they get most of it. They look for the upper side and the down

side of the projects is left for the bond holders (Jensen & Meckling, 1976; Galai & Masulis, 1976). (c) Short-sighted Investment Value: Instead of looking to firm value, shareholders may be interested for the short-term profit (Grinblatt & Titman, (2001). and (d) Reluctance to Liquidate Problem: Shareholders may be reluctant to liquidate the firm when the liquidation value is more than the ongoing firm value (Grinblatt & Titman, 2001).

As shareholders may take the above selfish strategies, bond holders take measures to mitigate and minimize the problems. They will increase the cost of debt and will not offer debts without debt indenture. However, the above costs can be eliminated by using only equity in the capital structure. But that will increase the agency cost of equity with other disadvantages. The cost of equity can by minimized by using moderate level of debt in the capital structure. Jensen (1986) argued, in his seminal work, free cash flow hypothesis, that using debt require payment of fixed interest, which in turn reduces available cash to the managers and thus reduce the possibility of misuse of the funds and minimize the agency cost of the equity. Furthermore, Grossman and Hart (1988) argued that debt reduces excess perquisite consumption.

2.2.2 Employee Bargaining / Human Capital Theory

Sarig (1988) propounded a theory called Employee Bargaining Theory in the area of modern corporate finance. High unionized firms and firms have staff of easily transferable skills should use high debt. In addition, Chang (1992) argued that the firms using more debt pay less as salary and wages. Berk et al. (2010) did not found any evidence that firms will have to bear sizeable bankruptcy costs. They argued that costs of using debt are not generated from moral hazard or information asymmetry rather it is from human cost of bankruptcy. Like Berk et al. (2010), Matsa (2010) showed that debt can be used as a strategic variable in order to save in wages and salary. Consequently, the debt ratio and salary and wages ratio should have negative relationship. Matsa (2010) found significant and negative relationship but Graham and Harvey (2001) did not find any evidence to support the employee bargaining theory and

concluded that debt is not used for employee bargaining.

2.3 Asymmetric Information Theory of Capital Structure

2.3.1 Pecking Order Theory

Myers (1984), Myers and Majluf (1984) argued that capital structure is a matter of preference of financing to the firms. The preference is designed based on two important factors: the information asymmetry and the transaction costs. Because of information asymmetry, investors may think that managers issue equities when it is overpriced. To remove this fear from the investors, in general, the equity prices are under-priced. Consequently, the investors accept this opportunity and grab the most of the positive NPV of the projects. The other important factor that influences the capital structure preference is transaction cost of securities. Transaction costs is zero or very low for the internal funds. But the debt and equity issue are subject to transaction costs. Hence, to avoid these problems, managers should use internal sources of finance first and then the external sources second. According to the theory, managers should use internal funds: retained earnings, provident fund, depreciation fund, deferred payment of dues etc first and, if need, external sources: debt, convertible debt second and equity last. There are three important implications of this theory those are odd with trade of theory: there is no target debt equity ratio, profitable firm use less debt, and firms prefer to maintain financial slack.

2.3.2 Signalling Theory

Signalling theory of Ross (1977) argues that issuing debt or increasing debt in the capital structure conveys positive message about the companies' future performances to the markets. The investors' think that a company would not use the debt if the future earnings would not be enough to pay the interest payments. However, several authors argue that to make the investors foolish, the managers can issue debt. But in reality that may not be the case. Because if the managers take loan when not necessary, they will have to pay the expenses in future. Brander and Lewis (1986) showed that debt conveys positive signal to the capital market about the production policy of the firm. Based on this theory, a positive relationship is

expected between the share price and the debt ratio. Graham and Harvey (2001) did not find any evidence to support signalling theory.

2.3.3 Credit Ratings/Supply Side Factors

Flannery (1986) argued that firm borrows short-term, if there is a possibility of improvement in the credit rating of the firm in future. Faulkender and Petersen (2006) explained that rated firms can take more debts than unrated firms as unrated firms have restriction to excess in finance markets. They used rated or not rated dummy variable to measure this variable. Frank and Goyal (2009) argued that high debt rating means less information asymmetry and hence firms can raise capital by issuing equity. Graham and Harvey (2001) finds that in general credit rating is important in debt decision making but not used in making decision between short-term vs long-term. Kisgen (2006) showed that firms near credit rating change-upgrade or down grade issue less debt compare to equity. Besides, Voutsinas and Werner (2011) showed that monetary condition and supply of credit are important in corporate financing decision especially small firms face constrains in recession.

2.3.4 Market Timing Theory of Leverage

The Market Timing Theory (Myers, 1984) explains that managers want to accelerate market value of the firm on the changes of stock prices. They issues stock, when the stock price is high and issue debt when the stock price is low. In the field, Baker and Wurgler (2002), Korajczyk, Lucas, and McDonald (1990), and Loughran and Ritter (1995) found evidence for the market timing theory. Lucas and McDonald (1990) argued that if because of information asymmetry, the stock price is low; equity will be issued after the release of the information. Graham and Harvey (2001) found significant evidence to support Lucas and McDonald (1990). Because of adverse selection problem related with time, a negative relationship between leverage and stock price may exist (Frank & Goyal, 2009). Besides, Myers (1977) argued that higher market to book may be because of expectation of future growth. Present market value of assets is also possible to estimate from the recent stock prices. So, Frank and

Goyal (2009) summarized the effects those can be examined the relationship and stock market are: (i) growth (ii) adverse selection cost (iii) asset price change and (iv) market timing. But, stock price, sometimes, not only gives very misleading information, but also collapse. As a result, it should not be used to find any relationship between leverage and stock. Hence, Welch (2004) argued that previous all variables used to find the relationship between stock market and leverage are wrong. The relationship should be determined based one stock market returns.

2.4 Product Market & Industrial Organization Variables and Capital Structure

2.4.1 Industry Specific

Capital market is under substantial product and industry influences. Titman (1984) argues that the firms producing sensitive products uses less debt so that the customers and the suppliers do not become worried about their firms become financially distressed, Bradley et al. (1984) showed that debt ratio is industry specific and industry classification can explain 54 per cent of the variation in the debt ratio. Harris and Raviv (1991) have claimed, based on a field survey, “drugs, instruments, electronics and foods have low leverage while paper, textile, steel air lines, and cement have consistently large leverage”.

2.4.2 Industrial Organization Variables and Capital Structure

Industrial Organization variables: demand, supply of the product, cost parameters, strategic variables-price and quantity, bargaining game between management and suppliers, output, research & development and marketing (advertising) expenses, plant capacity, location, product characteristics and extent of competition may be related with capital structure (Harris & Raviv 1991). In addition, Brander and Lewis (1986) argued that high strategic interaction in the product market results high leverage, oligopolistic organization uses more debts than monopolistic organization and most of the firms use long term debts. Besides, Maksimovic (1988) showed that elasticity of demand and debt level should be positively related. If high reputation of product quality is not required and products are not unique than high leverage

will exists (Titman, 1984). To sum up, debt issue lowers cost and price of the products and increases profit.

2.5 Other Theories of Capital Structure Choice

2.5.1 The Effect of Transaction Costs on Debt Ratio

Fisher, Heinkel, and Zechner (1989) argued that transaction costs effect the capital structure. In addition, Leary and Roberts (2005) argued that the cost of issuing debt is substantially lower than the cost of issuing equity. Altinkilic and Hansen (2000) estimated the cost of issuing equity is about 5.38 per cent and the cost issuing debt is about 1.09 per cent. Graham and Harvey (2001) find moderate evidence in support of the explanation of Fisher, Heinkel, and Zechner (1989). In addition, Titman and Wessels (1988) argued that small firms are discouraged to issue debts because of transaction cost of debt. Graham and Harvey (2001) do not find enough support for the effect of transaction on debts.

2.5.2 Corporate Control

Harris and Raviv (1988) argued that capital structure is a tool to control the firm. In details, firms use more debt to have more control to the existing shareholders in the business instead of equity. Furthermore, the firms also use debt to avoid the take-over target of the influential firms. Graham and Harvey (2001) finds that equity is issued so that the share of a particular shareholder decreased but this decision is not related with managerial ownership and debt decisions & takeover threats are independent of debt decisions. Williamson (1988) argued that greater use of equity requires greater administrative type measures in order to reduce opportunistic behaviour of the managers. On the other hand, greater use of debt decreases strategic real options in the hand of managers.

2.6 Corporate Strategy Perspective

Strategy researcher Simerly and Li (2000) showed that the level of environmental dynamism is very important in capital structure planning and should be a determinant of capital structure. The environmental dynamism is a composite factor of effect of many factors. The rate, instability and magnitude of environmental change can be regarded as environmental dynamism. In addition, the number of firms in the sector and technological change are also included in the environmental dynamism. Figure-2 shows the three attributes of industry dynamics right hand side shows the characteristics of high environmental dynamism and left hand side shows the characteristics of low environmental dynamism.

Higher environmental dynamism means lower possibility of correct prediction of present and future state. Consequently, in future uncertainty environment, creative managerial decision plays important role in the success and survival of the organization. However, when firm increases debt in the capital structure, managerial real options decreases in the hand of manager in future uncertain environment because of increase of covenants in the debt indenture. So, the level of environmental dynamism and the level of debt should be negatively for the firm's better performance. For example, the firms having high environmental dynamism should use low debt; the firms having low environmental dynamism should use high debt, and firms having medium level of environmental dynamism should use medium level of debt for the better performances. Environmental dynamism for each firm in the same industry will be the same while will be different for firms across the industries.

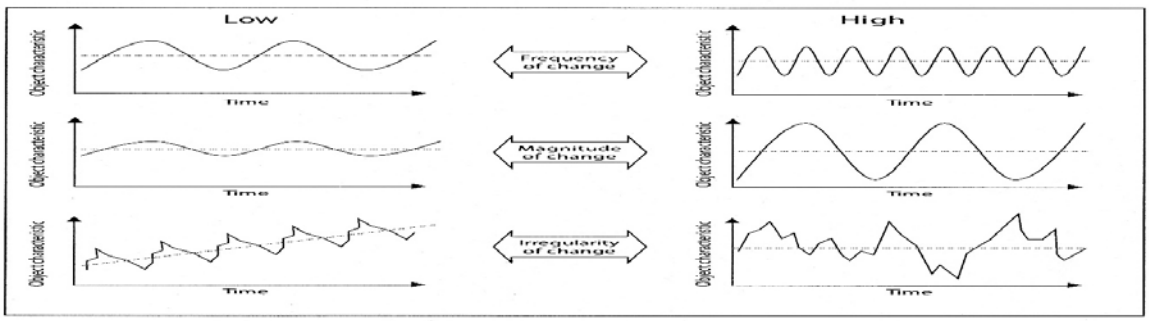

Figure 2. Attributes of industry dynamics

Source: Hauschild, Knyphausen-AufseB and Rahmel (2011).

3. Control Variables of Capital Structure

There are various internal and external factors to determine capital structure of a firm. The macro variables of the economy of a country like tax policy of government, inflation rate, and capital market condition are the major external factors that affect the capital structure of a firm. The characteristics of an individual firm, which are termed here as micro/internal factors, also affect the capital structure of enterprises. Based on the literature review, the following determinants of capital structure are considered in this paper:

3.1 Human Capital/Bargaining Power

Sarig (1988) argued that high unionized firms and firms have staff of easily transferable skills should use high debt. In addition, Chang (1992) argued that the firms using more debt pay less as salary and wages. Furthermore, Berk et al. (2010) did not found any evidence that firms will have to bear sizeable bankruptcy costs. They argued that costs of using debt are not generated from moral hazard or information asymmetry rather it is from human cost of bankruptcy. Like Berk et al. (2010), Matsa (2010) showed that debt can be used as a strategic variable in order to save in wages and salary. Consequently, the debt ratio and salary and wages ratio should have negative relationship. Matsa (2010) found significant and negative relationship but Graham and Harvey (2001) did not find any evidence to support the employee bargaining theory and concluded that debt is not used for employee bargaining.

3.2 Size

Size is used as four proxies for (i) easy access to capital market, (ii) financing costs (iii) information asymmetry, and (iv) sufficiency of internal funds. Firstly, large firms are well known in the market, have more access in the capital market, more diversified, less vulnerable to the business cycles and business risk and hence can borrow at the favourable interest rate compare to the small firms in the finance markets. Hence, trade-off theory predicts that size and leverage should be positively related. Huang and Song (2002), Rajan and Zingales (1995), and Friend and Lang (1988) reported positive relationship between size and financial leverage.

Secondly, Smith (1977) argued that size can be a proxy for financing costs. Larger firms pay comparatively lower amount compare to small firms for equity issue and long term loans. As a result, smaller firms will be less levered than larger firms and will prefer short-term compare to long-term debts. So, here also, a positive relationship is expected.

Thirdly, size can be a proxy for information asymmetry. Large size means large information to the outside investors, and less information asymmetry (Fama & Jensen, 1983) and low possibility of under pricing of equity. As a result, larger firms can issue more equity to raise funds (Rajan & Zingales, 1995). Hence, size of the firm should be negatively related with leverage according to pecking order theory. Finally, the packing order theory (Myers & Majluf, 1984) argues that large or old firms can fulfil financing needs from internal sources. Hence a negative relationship is expected. Kester (1986), Kim and Sorensen (1986) and Titman-Wessels (1988) reported negative relationship. Three proxies are used by the researches to present size in their different studies: the logarithm of the sales of the firm, logarithm of the total assets and logarithms of the no. of employees.

3.3 Growth Opportunities

Growth opportunities do not generate present income, cannot be collateralized, increases high agency cost of debt, reduce free cash flow and hence generate low agency cost of managerial discretion. Growth opportunities have present value but, if growing firms face financial distress and then bankruptcy, the growth opportunities do not add any value to the value of the firm. Hence the growth firms offer higher agency cost and possibility to invest sub-optimally. So, growing firms should have less debt but more equity financing (Myers, 1977). As a result, trade off theory predicts a negative relationship between expected growth opportunities and leverage ratio. Smith and Watts (1992), Titman and Wessels (1988) reported a negative relationship between growth opportunities and the leverage.

However, Titman and Wessels (1988) and Myers (1977) argued that if firms' uses short term financing for long-term financing these problems can be minimized. Hence short-term financing should be positively related with growth opportunities. Jensen and Meckling (1976), Smith and Warner (1979), and Green (1984) argued that the agency costs of growth opportunities could be minimized if the projects would be financed by convertible debts. Hence growth opportunities and convertible debts should be positively related. In addition, a positive relationship may exist as larger growth opportunities means larger demand for funds for investments. As a result, firm will use debt financing instead of equity financing as pecking order theory (Myers & Majluf 1984) predicts. Market to book value ratio is widely used proxy to present growth opportunities. Myers (1977) argued that market value to book value ratio can be higher on the prediction that future cash flows will be higher from the operations. In practice, Rajan and Zingales (1995), Adam and Goyal (2008) used this variable as proxy. However, this ratio is not useable, if stock mispricing occurs. Other proxy variables used by researchers to present growth opportunities of the firms are capital expenditure to total assets, research & development over sales. Titman and Wessels (1988) used growth in assets to present growth opportunities.

3.4 Profitability

Profitable firm has lower expected cost of bankruptcy. As a result, According to the trade-off theory, profitable firm should take debt up to a level to receive the tax shield advantage. Besides, free cash flow hypothesis (Jensen, 1986) argues to use more debt for profitable firms to reduce available cash to the managers to reduce inefficient use of the fund by managers. As a result, a positive relationship should exist. However, the relationship may be inversed-negative, if the dynamic trade off model is in application (Strebulaev, 2007). Unlike static trade off model, dynamic trade off model predicts the relationship between profitability and leverage can be negative as profitable firms passively accumulate profits (Kayhan & Titman, 2007). Besides, pecking order theory (Donaldson, 1961; Myers, 1984; Myers & Majluf, 1984) argues that financing strategy of a firm depends on the preference of financing,

and because of information asymmetry and transaction costs, firm uses internal funds first and external sources second. When external fund is necessary to raise funds, debt is preferred to equity. Since profitable firms can manage fund from internal sources, the profitability and the leverage should be negatively related. Rajan-Zingales (1995), Huang and Song (2002), Titman and Wessels (1988), Friend and Lang (1988) and Kester (1986) reported negative relationship between profitability and leverage. The widely used proxy variables are-the ratio of earnings before interest, tax and depreciation over total assets (Rajan & Zingels, 1995, Bevan et al., 2002), and operating income (EBIT) divided by total sales (Titman & Wessels, 1988).

3.5 Industry Classification

Financial leverage varies from industry to industry. Ross, Westerfield and Jaff (2012), Bradley et al. (1984) and Lemmon, Roberts, and Zender (2000) argued that capital structure is industry specific. As evidence, Bradley et al. (1984) showed that industry classification can explain 54 per cent of the variations in the debt ratio. Furthermore, Harris and Raviv (1991) based on a field survey have claimed that "drugs, instruments, electronics and foods have low leverage while paper, textile, steel air lines, and cement have consistently large leverage". Besides, Titman (1984) argues that the firms producing sensitive products uses less debt so that the customers and the suppliers do not become worried about their firms become financially distressed.

There are two possible reasons for being the industry classification significant. Hovakimaian Hovakimaian and Tehranian (2004) argued that industry includes some omitted factors and hence become significant. The omitted factors may be industrial organization variables not included in other types of variables. Firms in the same industry face the same types of forces to set financing strategy hence has different debt level compare to firms in the other sectors (Frank & Goyal, 2009). The factor could reflect industry heterogeneity in terms of sales, assets, business risk, need of finance, range of products, opportunity to access to finance

markets, seasonal needs, technology or regulation and competition etc. Another explanation is that firms set industry median leverage as firms' target leverage. If there are any deviation from the targets than firms move to the industry median leverage. Gilson (1997), Hull (1999), Hovakimian, Opler, and Titman (2001), Faccio and Masulis (2005), and Flannery and Rangan (2006) presented and supported this argument.

The trade-off theory predicts that higher industry median average enforces higher leverage and higher industry median growth will enforce lower financial leverage. In addition, when regulated dummy is considered, regulated firms have stable cash flows and possess lower expected cost of financial distress and hence should have higher financial leverage. By contrast, regulated firms have low possibility of managerial discretion, that reduces agency cost between shareholders and managers hence encourages lower of debts. Industry median average leverage, industry median growth leverage and regulated dummy and dummy variables are used to check the effect of industry classification on the capital structure of the firm.

3.6 Environmental Dynamism

There is no unique index or method for measuring environmental dynamism. However, Boyd (1995), Dess and Beard (1984), Keats and Hitt (1988), Rasheed and Prescott (1992), Wholey and Brittain (1989) suggested a measure called environmental dynamism index to measure environmental dynamism is widely used. The environmental dynamism index is estimated by running a regression for each industrial sector. In details, a regression of sales on time dummy variable is conducted for each industrial sector and the standard errors of time dummies are divided by average sales value to generate the index. A negative relationship is expected between leverage and environmental dynamism is expected for the better performance. Simerly and Li (2000) reported a negative relationship. Figure-3 describes the relationship between environmental dynamism, leverage and firm performance.

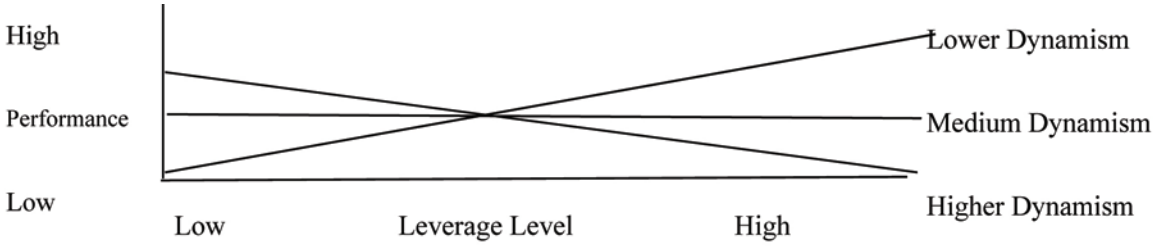

Figure 3. An illustration of different leverage level, dynamism levels & performances

3.7 Tangibility of Assets

Firms having more intangible assets can face difficulty in debt financing as intangible assets are not accepted as collateral because of difficulty in valuation of intangibles assets. Besides, Jensen and Meckling (1976), Galai and Masulis (76), Myers (1977) argued that asset substitution my take place or firms can invest sub-optimally during financial distress. Consequently, financial institutions and banks ask corporations for the collateral at the time of lending because of agency costs of the debts to save them (Jensen & Meckling, 1976). Furthermore, if debt is collateralized, the loan could not be used in unauthorized projects. In addition, Scott (1977) argued that firms increase the value of the equity holders by issuing secured debt in the expense of unsecured creditors. Hence trade-off theory predicts that firms' tangibility should be positively related with the leverage. Moreover, Pecking order theory (Myers & Majluf, 1984) argued that firms find convenient issuing secured debts compared to issuing equity because of asymmetric information and transaction costs. These costs can be eliminated by issuing secured debt against tangible assets with known values. Thus firms having more tangible assets can take more secured debts.

On the other hand, collateralize able assets and financial leverage may be negatively related for three reasons: (i) managers' propensity of consuming more perquisites compare to optimal consumption, (ii) presence of bulk unique assets and (iii) asymmetric information about the assets value. Firstly, Grossman and Hart (1982) argued that by adding debt in the capital structure, the consumption of perquisites can be reduced. Because adding debt as capital increases possibility of bankruptcy also. As a result, managers will not consume excess as they will lose their jobs, if the firms face bankruptcy. So, by adding more debts in the

managers could be aligned. Secondly, Stakeholder co-investment theory predicts that firms having more unique assets have very specialized labour and add larger liquidation cost at liquidation time. So, firms having more unique assets should have lower financial leverage (Titman, 1984). In order to control unique assets those acquired and accumulated from discretionary expenses- selling, general and administrative expenses, and research and development expenses, should have lower debt. Finally, if asymmetric information is about fixed assets in place, financial leverage should be lower. Rajan and Zingales (1995), Titman and Wessels (1988), and Friend and Lang (1988) reported a positive relationship, whereas Booth et al. (2001) and Huang and Song (2002) reported a negative relation between tangibility and leverage. The variables used to measure nature of the assets are: tangibility, research and developments expenses, uniqueness dummy, and selling, general and administrative expenses to sales.

3.8 Tax Rate

Trade-off theory predicts that companies under the higher tax rate should use more debt to receive more tax advantage. However, Fama and French (1998) declared use of debt in the capital structure has no net advantage. In addition, Mackie-Mason (1990) claim: "Nearly everyone believes taxes must be important to financing decision, but little support has been found in empirical analysis". Tax may negatively significantly affects financial leverage when owners of the industries want to pay higher tax and use less amount of debts to become commercially important person (CIP) in the country. Matheson (2006) supported the negative effect of tax on the leverage. The proxies are (1) Tax rate = tax paid/total assets, (2) NOL carry forwards/assets.

3.9 Supply-Side Factors

Credit Rating: Supply side of the credit also plays important roles in capital structure variations (Faulkender & Petersen, 2006). Firms' intention to add debt in the capital structure may be hampered because of restriction in the market from the debts supplier's side. Firms'

poor credit rating may be a problem to raise debt from the market. Similarly, non-credit rated firms may have disadvantageous position compare to credit rated firm. So, Firms facing restriction in the access to raise funds from the credit markets will use more equity. However, credit rating is one kind of publish-out of information. High rated firms have less information asymmetry problem and those firms should use more equity and less debt under the prediction of trade-off theory. Two types of proxies are used to represent this variable: dummies for credit ratings, and dummy for rated and non-rated firms.

3.10 Debt Market Conditions

Barry et al. (2008) argued that firms use more debt when present interest rate is lower than the historical interest rate. Higher inflation means paying lower to the lender at the time of inflation and real value of tax advantage which is higher at the time of inflation (Taggart, 1985) may result positive relationship between inflation and leverage under the prediction of Trade-off theory. Market timing theory is also predict a similar relationship if the managers issue debts when inflation rate is higher compare to current interest rate (Ritter & Warr, 2002). Term spread is a very credible variable to present the economic growth and economic prospects. If larger term spread means larger growth, agency cost theory predicts, term spread and leverage should be negatively related. Frank and Goyal (2009) used two proxy variables are (i) inflation rate and (ii) term spread rate.

3.11 Macroeconomic Conditions

Macroeconomic condition and leverage of a firm may be related: during expansion of the economy leverage may be positively related and contraction may be negatively related. In the expansion phase, business grows up at a very good rate, industrial production goes up, employment goes up, stock prices goes up and corporate profitability goes up. Gertler and Gilchrist (1993) argued that during expansion followed by recession induced by monetary contraction, financial leverage is increased by large firms and the financial leverages remains unchanged for small firms. During business expansion phase of business cycle, packing order

theory predicts that firms can generate money for financing from internal sources. Consequently expansion and financial leverage should be negatively related. However, bankruptcy cost theory predicts that bankruptcy cost for growth opportunities are high and hence leverage and macroeconomic growth should be negatively related. Macroeconomic variables-GDP growth, EBIT growth, money growth and industrial production growth/ index of leading indicators may be related with financial leverage.

3.12 Stock Market Conditions

Stock market and leverage may be related. Welch (2004) argued that as the capital structure of a company is not rebalanced with the shock of stock prices, the relationship only be estimated with the leverage and the stock market return. A negative relationship is expected between leverage and stock return. The market timing theory also supports that. Besides, time-varying adverse selection also predicts negative relationship between stock price and leverage. In consistent with many authors, Korajczyk, Lucas, and McDonald (1990), Bayless and Chaplinsky (1991) argued that the stock issue is followed by increases in share prices. Frank and Goyal (2009) summarized the relationship those could be checked by between stock market and leverage are: (i) growth (ii) adverse selection cost (iii) asset price change and (iv) market timing and considered two variables to represent the stock market and leverage relationship: (i) Cumulative raw returns and (ii) Cumulative market returns.

3.13 Uniqueness

Titman (1984) argued that firms producing sensitive product uses less debt so that customers, workers and the supplies do not become worried that their firms become financially distressed. In general, firms producing unique products employee job specific human resources with specific skills. At the same time, suppliers supply specific and unique materials and customers purchase unique products which are not common in the market. Consequently, firms producing unique products create huge cost if face liquidation. So, uniqueness and financial leverage should be negatively related.

However, uniqueness can positively affects the financial leverage when uniqueness is explained by information asymmetry theory. Uniqueness is represented by selling, general and administrative expenses or research and development expenses. But investment in selling, general and administrative expenses or in research and development expenses are like investment in intangible assets which are more sensitive on the way to adverse selection problem. As a result, debts are more used with the increase in SGA or/and R&D. Mazur (2007) and Wei (2014) supported the negative effect of uniqueness on the financial leverage.

The most widely used variables are: research and development expenses, selling, general and administrative expenses, and quit rates. Research and development expenses are dedicated for the future products and development which cannot be easily duplicated by competitors in the market. As a result, research and development could be a good proxy for uniqueness. Selling, general and administrative expenses are higher for unique products. So, this is also another candidate to be a proxy for uniqueness. The quit employees rate- quit employees to total employees can be another proxy to represent uniqueness of the firm as employees having job specific skills may find it costly to leave the job.

3.14 Business Risk / Volatility

Business risk is the possibility of being failed in the business. In this study, higher variability of return on assets is treated as the higher business risk and lower variability of return on assets is considered as the lower business risk. Business risk should be negatively related with the financial leverage under trade-off theory. The proxy variables are- the standard deviation of the first differences in the ratio of EBIT over total assets (Wald, 1999).

3.15 Non-Debt Tax Shield

Modigliani and Miller (1963) argued for using tax in order to receive enormous tax shield advantage whereas DeAngelo and Masulis (1980) advocated for non-debt tax shield (NDTS) is an alternative to the tax shield. Other expenses than interest expenses those are reducing tax payments are termed as non-debt tax shield. As tax payments are reduced by NDTS, firms

writing off high depreciation and enjoying investment tax credits can go for low debt. Hence, non-debt tax shield could be negatively related with the leverage. On the other hand, the company having higher NDTS, having higher collateral-able fixed assets. Because of having higher collateral-able fixed assets, the industry can use more debts. Hence, non-debt tax shield could be positively related with the leverage. Downs (1993) presents evidence for the positive effect of NDTS on leverage. The commonly used proxies are depreciation to total assets, investment tax credits to total assets, total non-debt tax shield to total assets.

3.16 Age of the Firm

Age of the firm can be related with leverage positively or negatively. Firstly, age of the firm should be positively related with the debt ratio. In the beginning, normally firms hold equity more than debts. So gradually it gets time to increase debt in the capital structure. Firms maturing gradually, have more intensive relationship with bank and financial institutions, higher information about the debt market and hence higher leverage. Secondly, leverage and age of the firm should be negatively related as maturing firm gets more time to increase equity in the capital structure because of less of information asymmetry and low possibility of under-pricing.

3.17 Dividend Pay-Out

Fama and French (2002) and Byoun (2008) argued that dividend policy and financial leverage should be considered simultaneously. There are two variables to check the relationship between leverage and dividend pay-out. Here, dividend included only cash dividend not stock dividend and other firms of dividend. It can be defined as either the ratio of dividend to total income available to shareholders or dividend to total assts.

3.18 Financial Distress

Altman Z score which is modified by MacKie-Mason (1990) is widely used by financial economist as a proxy for financial distress. It measures ex-ante probability of financial distress (Graham, 1996, 2000). The modified Z= 3.3(EBIT / total assets) + 1.0(sales / total assets) + 1.4(retained earnings / total assets) + 1.2(working capital / total assets). Financial distress negatively affects leverage. However, financial distress positively significantly affects financial leverage when an industry in the financial distress issues debts to get rid of financial distress. Lee, Koh, and Kang (2011) showed that financial distress positively and significantly affects leverage.

3.19 Agency Cost

Agency theory (Jensen & Meckling, 1976; Jensen, 1986) argued that "the optimal structure of leverage and ownership may be used to minimize total agency costs". Following the works of Jensen and Meckling and Jensen, it is accepted that the ownership structure has influence on the leverage. The conflict between the principal and agent can be minimized if the largest shareholder monitor the activities of the agent. Consequently, firms can use more equity if single shareholder holds the large proportion of the total shares. Hence largest percentage shareholder's shareholding should affect the financial leverage negatively. Leland and Pyle (1977) and Berger, Ofek, and Yermack (1997) supported the relationship. Table 2 summarizes candidates for the determinants of the capital structure and their indicators with definitions.

Table 2. Candidates for the determinants of the capital structure and their indicators with definitions

Constructs	Indicators	Definition of Indicators
(b) Determinants	(Causes)	
Human Capital	TSW/TA	Total Salary and Wages to Total Assets
Size of the Firm	LnS	Natural Log of Total Net Sales
	LnA	Natural Log of Total Assets
	LnE*	Natural Log of Total Number of Employees
Growth Opportunities	R&D/S	Research and Development Expenses to Sales
	CE/TA*	Capital Expenditure to Total Assets
	M-to-B*	Market to Book Value
	GTA	Growth in Total Assets(= Change in Nature Log of Total Assets)
Profitability	EBITD/TA	EBITD over total assets (= Cash flow from operations over TA)
	EBIT/TA	Operating income (EBIT) divided by total sales

Industry Classification	MD	Industry Median Average Leverage
	Median G*	Industry Median Growth Leverage
	Dummy*	Dummy Variable for Industry Classification
	ED*	Environmental Dynamism
Tangibility of Assets	FA/TA	Fixed Assets To Total Assets
	R&D/S	Research and Development Expenses to Sales
	SGA/S	Selling, General And Administrative Expenses To Sales
Tax Rate	Tax Rate	Total Tax/Total Assets
	D/TS	Depreciation/Total Assets
Credit Rating*	Rating	Dummy for Credit Rating
	Dummy	Dummy for Rated Non-rated Firms
Debt Market	Inflation	Inflation Rate
Conditions	T-Spread*	Term Spread Rate
	GDPG	GDP Growth
Macroeconomic	EBITG	EBIT Growth,
Conditions	MG	Money Growth
	IPG	Industrial Production Growth
Stock Market	CRR	Cumulative Raw Returns
Conditions*	CMR	Cumulative Market Returns
Uniqueness	R&D/S	Research and Development Expenses to Sales,
	SGA/S	Selling, General and Administrative Expenses to Sales
	Quit Rates*	Quit Rates
Business Risk	BR	σ of the first differences in the ratio of EBIT over total assets
Non-debt Tax Shield	D/TA	Depreciation/Total Assets
	ITC/TA*	Investment Tax Credits/Total Assets
Age of the Firm	Age*	Age of the Firm After Listing
Dividend Payout	Div/I*	Dividend Paid/Net Income
	Div/TA	Dividend Paid/Total Assets
Financial Distress	Modified-Z	Altman Z Score-Modified by MacKie-Mason (1990)
Agency Cost	LS	% of Shares held by Largest Shareholders

Source: Literature Review, *data was not available on the measures for this study.

4. Measures of Capital Structure

In order to determine the determinants of capital structure, it is important to define capital structure or financial leverage. The capital structure is the combination of debt and equity (Horne, 2002). But the word "Capital Structure" has different meaning to different authors. Leverage measure can be defined in terms of convertible bond, short-term debt, long term debt, and total debt. In addition, Measures of leverage can be defined on the basis of inclusion of total liabilities, total assets, net assets, interest expense and EBIT, EBITD. Similarly, leverage can be measured in terms of market value and book value. Thus, it is noticeable that leverage for the same firm can be different based on the variables used to calculate the financial leverage. Which measure should be used is depending on the objective of the measurement.

In defining leverage and determining the determinants of leverage-book value based leverage should be used for several reasons. Myers (1977) argued for book value as it represents assets in hand and not affected by growth opportunities. In addition, book value does not fluctuate and realistic as corporate finance policy guide. Market value comes from share market. But capital structure is not rebalanced after changes in stock price for the rearrangement costs. However, market value based leverage should be used for convincing following reasons. Market value is consistent with wealth maximization goal of the corporate organization. Market value is also managerially relevant (Welch, 2004). Moreover, book value can be negative but asset cannot be negative. Finally, book value is plug number, and book value is backward looking, but, market value is forward looking. As a result, Barclay, Morellec, and Smith (2006) argued that there is no reason to match the two value.

In consistent with the above discussion, Harris and Raviv (1991) summarize the matters as 'the interpretation of the results must be tempered by an awareness of the difficulties involved in measuring both leverage and the explanatory variables of interest. In measuring leverage, one can include or exclude accounts payable, accounts receivable, cash and other short-term debt. Some studies measure leverage as a ratio of book value of debt to book value of equity, others as book value of debt to market value of equity, still others as debt to market value of equity plus book value of debt. In addition to measurement problems, there are the usual problems with interpreting statistical results'. The possible measures of financial leverage are discussed in following.

4.1 Total Liabilities / Total Assets

This is the broadest measure of financial leverage and could be a measure of what is left for the equity holders at the time of liquidation. However this measure does not tell about the level of risk of bankruptcy in the near future. This measure has some other problems. For example, total liabilities include some liabilities which are not related with financing but used for transaction purpose. In the same way, pension liabilities arising from labour contact

markets influence this ratio. Hence liabilities like accounts pay able, pension liabilities overstate this ratio.

4.2 Total Debt / Total Assets

A better measure for financial leverage is total debt to total assets. The liabilities like untaxed reserve and accounts payable do not affect this ratio. As the non-debt liabilities offset some assets which are not considered in this ratio, this ratio as measure of financial leverage is problematic. For example, trade credit level influence this ratio substantially. So, this measure cannot be a true measure of financial leverage. All of the researches used this ratio as a measure of financial leverage.

4.3 Total Debt / Total Net Assets

A corrected measure of the above ratio is total debt to total net assets ratio. This ratio is calculated after the adjustment of total assets for non-debt liabilities. This ratio is not affected by trade credit. Total net assets are equal to total assets minus accounts payable minus other liabilities. The ratio is still influenced by assets held against pension liabilities.

4.4 Long-term Debt / Total Assets

Short term debts are used for mainly transaction purpose while long-term debts are used for financing purpose. So, the ratio should be long-term debt to total assets. All of the researches used this ratio as a measure of financial leverage.

4.5 Short-Term Debt / Total Assets

Titman and Wessels (1988) and Myers (1977) argued that growing firms should use short-term. Flannery (1986) argued that firm borrows short-term, if there is a possibility of improvement in the credit rating of the firm in future. Bevan and Danbolt (2002) finds significant difference in the determinants of corporate capital structure between short-term

and long term debt. They also argued that firm chooses short-term as short term is cheaper than long term debts. Besides, the author of this paper has observed that many companies in the developing country do not have any long term debt. Graham and Harvey (2001) finds that, in general, credit rating is important in debt decision making but not used in making decision between short-term vs long-term.

4.6 Convertible Debt / Total Assets

By issuing convertible debt firm pays low as coupon rate and lender can convert the debt to equity or cash in future at maturity date. Pecking order theory argues that, because of information asymmetry and transportation cost, companies should use internal fund for financing first, debt second, then convertible debt and equity last. The firms having low credit rating and high growth use convertible debt. Jensen and Meckling (1976), Smith and Warner (1979), and Green (1984) argued that the agency costs of growth opportunities could be minimized if the projects would be financed by convertible debts. Because of the implication of convertible debt financing, in this study capital structure is considered in convertible debt also. The ratio to measure capital structure is convertible debt to total assets.

4.7 Debt / (Debt +Equity)

Weston and Brigham (1984) have defined the capital structure as "Capital Structure is the permanent financing of the firm, represented primarily by long-term debt, preferred stock and common equity, but excluding all short-term credit. Thus, a firm's capital structure is only a part of its financial structure. Common equity includes common stock, capital surplus, and accumulated retained earnings". Agency theory developed by Jensen and Meckling (1976), Myers (1977) are concerned and based on agency cost of debt, and agency cost of equity. Consequently, a debt to equity ratio is more relevant. But if a company uses zero equity, then the debt to equity ratio becomes infinity. So the modified equivalent ratio is debt to debt plus equity ratio. Ross et al. (2012) used this ratio to explain the relationship between agency cost and increase in debt. Rajan and Zingales (1995) described the ratio as best for representing past financing behaviour.

The above each ratio should be two based on whether book value or market valued is used in the denominator.

4.8 EBIT / I

Aghion and Bolton (1992) considered capital structure in terms of control of ownership and hence capacity of payment of interest payment is very important. As a result, a measure of interest coverage is more relevant as a capital structure ratio. The interest coverage ratio is EBIT/I. This ratio is all right if an investment equivalent to depreciation is needed to keep the business on going. The ratio is calculated based on the assumption that short-term liabilities and short-term debt will be renewed. In addition, this ratio is very responsive to income oscillation.

4.9 EBITD / I

If investment equivalent to depreciation is not required for keeping the business ongoing than appropriate interest coverage ratio is earning before interest, taxes and depreciation (EBITD) divided by interest (I). This ratio is also based on the assumption that short-term liabilities and short-term debts will be renewed. This ratio is also very sensitive to earning variation.

At the time of conducting, research in corporate capital structure, the researchers should keep the above measures of financial leverage in their minds. Table 3 summarizes measures of capital structure and their definitions.

Table 3. Constructs, indicators of effects and definition of indicators of effects

Constructs	Indicators of Effects	Definition of Indicators
Capital Structure	TL/TA	Total Liabilities/Total Assets
	TD/TA	Total Debt/Total Assets
	TD/TNA*	Total Debt/Total Net Assets
	LTD/TA	Long Term Debt/Total Assets
	STD/TA	Short Term Debt/Total Assets
	CD/TA*	Convertible Debt/Total Assets
	D/(D/E)	Debt/(Debt + Equity)
	EBIT/I	Earnings Before Interest and Tax to Total Interest Paid
	EBITD/I	EBIT & Depreciation to Interest Paid

Source: Literature Review, *measures not used in this study.

5. Some Empirical Evidences

5.1 Correlation between the Book Value Based Leverage Ratios

Leverage can be defined in many ways based on the objective of the study. Table 4 shows the correlation coefficients of all possible pairs of financial leverage based on book value. The table shows that total-debt is positively strongly related with short-term debt (0.82) and positively moderately related with long-term debt (0.54). TD/(TD+TE) and TD/TA is positively strongly correlated (0.83). LD/(LD+TE) and LD/TA is positively strongly correlated (0.91). In addition, EBIT/I and EBITD/I are positively perfectly correlated (1.00) but EBIT/I and EBITD/I are not correlated with other financial leverage ratios. Thus EBIT/I and EBITD/I and other financial leverage ratios represent different aspects of financing. Total liabilities ratio is not related with any other leverage ratio. Hence should not be a candidate for the financial leverage ratio.

Table 4. Correlation between the Leverage Ratios

Debt Ratios	*STD/TA*	*LTD/TA*	*TD/TA*	*TL/TA*	*TD/(TS+TE)*	*LD/(LD+TE)*	*EBIT/I*	*EBITD/I*
STD/TA	1.00							
LTD/TA	0.02	1.00						
TD/TA	**0.82**	**0.54**	1.00					
TL/TA	-0.06	-0.07	-0.08	1.00				
TD/(TS+TE)	**0.62**	**0.57**	**0.83**	-0.08	1.00			
LD/(LD+TE)	0.03	**0.91**	**0.50**	-0.06	**0.69**	1.00		
EBIT/I	-0.06	-0.19	-0.16	-0.03	-0.17	-0.17	1.00	
EBITD/I	-0.06	-0.19	-0.15	-0.03	-0.16	-0.17	**1.00**	1.00

Source: Author's Calculations.

5.2 A Leverage Ratio and the Square of that Leverage Ratio

A leverage ratio and the square of that leverage ratio is very strongly positively correlated. The financial leverage defined by short-term debts to total assets and its square is positively strongly related (0.93), The financial leverage defined by long-term debts to total assets and its square is positively strongly related (0.95), The financial leverage defined by total debts to total assets and its square is positively strongly related (0.95). Consequently, both term cannot be included in the same regression analysis like Margaritis and Psillaki, (2010).

5.3 Short-Term Debt is Three Times of Long-Term Debt

On an average, short-term debt is three times more than long-term debt in the sample industry. The reason is that, in the developing country like Bangladesh, many companies face difficulty to raise long-term finance from capital market. Consequently, the companies' largely depends on short-term loan for the financing purpose. As a result, it is expected that the short-term debt and total debt will be positively strongly related. As expected, the short-term debt ratio and the total debt ratio is positively strongly correlated (0.82). Two companies do not have any short-term debts and five companies have any long-term debts. One company (seven observations) has neither short-term nor long-term debt.

5.4 Tax Payments

Out of eighty-four firm-year observations, ten observations (12 per cent) did not pay any tax. Twenty five observations (30 per cent) pay less than 1 per cent of total assets as tax. The company that pays highest tax compare to total assets-pays 9.20 per cent as tax.

5.5 Research and Development Expenses

Out of eighty-four firm-year observations, fifty seven observations (68 percent) do not have any research and development expenses. The observation that pays highest research and development expenses to sales-pays 0.44 per cent of sales.

5.6 Correlation between Book Value of Assets (BVA) Based and Market Value of Assets (MVA) Based Leverage

Table-5 shows the correlation coefficients between the book value based and market value based leverage. The correlation coefficient between STD/BVA and STD/MVA is 0.41, TD/BVA and TD/MVA is 0.45, LD/BVA and LD/MVA is 0.74. Consequently, leverage defined based on book value and market value are not strongly correlated and presents different information.

Table 5. Correlation between book value based and market value based leverage

Variables	*STD/BVA*	*LTD/BVA*	*TD/BVA*	*TL/BVA*	*STD/MVA*	*LTD/MVA*	*TD/MVA*	*TL/MVA*
STD/BVA	1.00							
LTD/BVA	0.02	1.00						
TD/BVA	**0.81**	**0.54**	**1.00**					
TL/BVA	-0.07	-0.08	-0.10	1.00				
STD/MVA	0.41	0.06	0.35	-0.06	1.00			
LTD/MVA	-0.05	**0.74**	0.35	-0.05	0.27	1.00		
TD/MVA	0.29	0.40	0.45	-0.07	**0.88**	**0.68**	**1.00**	
TL/MVA	-0.07	-0.04	-0.08	0.95	0.11	0.10	0.13	1.00

Source: Author's Calculations.

5.7 Determinants of Capital Structure

5.7.1 Correlation between the Indicators of the Determinants

Data is collected on 23 indicators of the determinants. To check the multi-co-linearity, a Pearson's correlation coefficients analysis is conducted before conducting the regression analyses. The natural log of net sales and natural log of total assets are positively strongly correlated (0.88). Besides, growth in total assets and EBITG are positively strongly correlated (0.95). OCF/TS and OI/TA are positively perfectly correlated (1.0). The median of total debts to total assets (MTD/TA) and the meidan of short-term debts to total assets (MSD/TA) are positively strongly related (0.91). Money growth is negatively strongly related with MTD/TA (-.822) and MSD/TA (-0.734), GDPG is positively strongly related with inflation rate (0.847). Because of strong correlation, lnS, OI/TA, IR, EBITG and MG are dropped from the data analysis. MSD/TA, the median of long term debts to total assets (MLD/TA), and MTD/TA is included in the model define for short-term debts, long-term debts and total debts respectively. MG only included in the equation of long-term debts as it was not correlated with the median long-term debts.

In addition, DeAngelo and Masulis (1980) argued that the non-debt tax shield is an alternative of the tax advantage. However, the correlation analysis shows that the tax rate and the non-debt tax shield are not related (0.19). Many financial economists used R&D/S or SGA/S as a proxy variable to present uniqueness of the product. But the correlation analysis shows that R&D/S and SGA/S are not significantly related (0.16).

5.7.2 The Empirical Models

$$STD/TA=\alpha+\beta_1 MSD/TA_{i,t}+\beta_2 TSW/TA_{i,t}+\beta_3 LnA_{i,t}+\beta_4 GTA_{i,t}+\beta_5 CFO/TA_{i,t}+\beta_6 FA/TA_{i,t}+\beta_7 Tax/TA_{i,t}+\beta_8 D/TA_{i,t}$$
$$+\beta_9 R\&D/S_{i,t}+\beta_{10} SGA/S_{i,t}+\beta_{11} Div/TA_{i,t}+\beta_{12} LS_{i,t}+\beta_{13} BR_{i,t}+\beta_{14} GDPG_{i,t}+\beta_{15} IPG_{i,t}+\varepsilon_{i,t} \quad (1)$$

$$LTD/TA=\alpha+\beta_1 MLD/TA_{i,t}+\beta_2 TSW/TA_{i,t}+\beta_3 LnA_{i,t}+\beta_4 GTA_{i,t}+\beta_5 CFO/TA_{i,t}+\beta_6 FA/TA_{i,t}+\beta_7 Tax/TA_{i,t}+\beta_8 D/TA_{i,t}$$
$$+\beta_9 R\&D/S_{i,t}+\beta_{10} SGA/S_{i,t}+\beta_{11} Div/TA_{i,t}+\beta_{12} LS_{i,t}+\beta_{13} BR_{i,t}+\beta_{14} GDPG_{i,t}+\beta_{15} IPG_{i,t}+\beta_{16} MG_{i,t}+\varepsilon_{i,t} \quad (2)$$

$$TD/TA=\alpha+\beta_1 MTD/TA_{i,t}+\beta_2 TSW/TA_{i,t}+\beta_3 LnA_{i,t}+\beta_4 GTA_{i,t}+\beta_5 CFO/TA_{i,t}+\beta_6 FA/TA_{i,t}+\beta_7 Tax/TA_{i,t}+\beta_8 D/TA_{i,t}$$
$$+\beta_9 R\&D/S_{i,t}+\beta_{10} SGA/S_{i,t}+\beta_{11} Div/TA_{i,t}+\beta_{12} LS_{i,t}+\beta_{13} BR_{i,t}+\beta_{14} GDPG_{i,t}+\beta_{15} IPG_{i,t}+\varepsilon_{i,t} \quad (3)$$

Where i refers to the individual industry and t refers to the time

5.7.3 The Empirical Results

Table-8 shows that the Uniqueness (SGA/S) positively significantly and size, tangibility, agency costs negatively significantly affects financial leverage defined by short-term debts to total assets. NDTS and R&D positively significantly and tax rate; selling general & administrative expenses; dividend payout rate; business risk; GDP growth; and money growth negatively significantly affects financial leverage defined by long-term debts to total assets. Industry median, R&D, positively significantly and tangibility, tax, dividend, and agency cost negatively effects financial leverage defined by total debts to total assets. (Table 8). Many researchers applied either selling, general and administrative or research and development expenses to represent uniqueness. However, this study shows that the variables are not correlated and both are significant determinant.

Table 6. OLS regression results

Name of Variable	STD/TA	LTD/TA	TD/TA
intercept	106.968***	41.672	105.084**
	(2.915)	(1.192)	(2.579)
MD/TA	0.456	0.828	0.616**
	(1.046)	(1.089)	(2.423)
TSW/TA	-20.290	5.562	-14.830
	(-1.355)	(0.508)	(-0.861)
LnA	-2.148*	1.235	-1.259
	(-1.954)	(1.552)	(-1.006)
GTA	1.850	-0.468	1.083
	(1.171)	(-0.409)	(0.603)

CFO/TA	-0.354	0.368	1.506
	(-0.004)	(0.057)	(0.153)
FA/TA	-27.301***	-6.577	-30.174***
	(-3.597)	(-1.184)	(-3.457)
Tax/TA	-39.795	-205.008***	-258.286***
	(-0.545)	(-3.874)	(-3.098)
D/TA	-154.982	336.010***	168.110
	(-1.202)	(3.602)	(1.143)
R&D/S	201.824	3346.609***	3990.266**
	(0.135)	(3.091)	(2.338)
SGA/S	60.419**	-43.961**	22.988
	(2.221)	(-2.224)	(0.739)
Div/TA	-37.819	-55.073**	-80.916**
	(-1.128)	(-2.249)	(-2.113)
Largest Share% (LS)	-0.441***	0.096	-0.350***
	(-3.948)	(1.186)	(-2.733)
BR	15.365	-34.648***	-19.685
	(1.063)	(-3.316)	(-1.198)
GDPG	-2.819	-7.268*	-5.245
	(-0.667)	(-1.713)	(-1.056)
IPG	0.368	0.534	0.214
	(0.683)	(1.397)	(0.355)
MG	-------	-1.090**	--------
		(-2.044)	
Adjusted R Square	0.430	0.370	0.550
N	84	84	84

Note. t statistics are in parentheses. *** means significant at 1% level of significance, ** means significant at 5% level of significance and * means significant at 10% level of significance.

5.7.4 Discussion on the Significant Variables

5.7.4.1 Industry Median Average

Industry median average significantly positively affects financial leverage defined by short-term debts to total assets and financial leverage defined by total debts to total assets. Bradley et al. (1984) showed that industry classification can explain 54 per cent of the variations in the debt ratio. There are two possible reasons for being the industry classification significant. Hovakimaian Hovakimaian and Tehranian (2004) argued that industry includes some omitted factors and hence become significant. The omitted factors may be industrial organization variables not included in other types of variables. Firms in the same industry face the same types of forces to set financing strategy hence has different debt level compare to firms in the other sectors (Frank & Goyal, 2009). The factor could reflect industry heterogeneity in terms of sales, assets, business risk, need of finance, range of products, opportunity to access to finance markets, seasonal needs, technology or regulation and

competition etc. Another explanation is that firms set industry median leverage as firms' target leverage. If there are any deviation from the targets than firms move to the industry median leverage. Gilson (1997), Hull (1999), Hovakimian, Opler, and Titman (2001), Faccio and Masulis (2005), Flannery and Rangan (2006), Ross et al. (2012) presented and supported this argument.

5.7.4.2 Size

Size negatively significantly affects financial leverage defined by short-term debts to total assets and financial leverage defined by total debts to total assets. In Bangladesh for the sample in study, size represents proxy of information asymmetry and availability of internal funds. Firstly, size is a proxy for information asymmetry. Large size means large information to the outside investors, and less information asymmetry (Fama & Jensen, 1983) and low possibility of under-pricing of equity. As a result, larger firms can issue more equity to raise funds (Rajan & Zingales, 1995). Hence, size of the firm negatively affects leverage according to pecking order theory. Finally, the packing order theory (Myers & Majluf, 1984) argues that large or old firms can fulfil financing needs from internal sources. Hence a negative relationship is justified. Kester (1986), Kim and Sorensen (1986) and Titman-Wessels (1988) reported negative relationship.

5.7.4.3 Tangibility

Tangibility and financial leverage may be negatively related for three reasons: (i) managers' propensity of consuming more perquisites compare to optimal consumption, (ii) presence of bulk unique assets and (iii) asymmetric information about the assets value. Firstly, Grossman and Hart (1982) argued that by adding debt in the capital structure, the consumption of perquisites can be reduced. Because adding debt as capital increases possibility of bankruptcy also. As a result, managers will not consume excess as they will lose their jobs, if the firms face bankruptcy. So, by adding more debts in the managers could be aligned. Secondly, Stakeholder co-investment theory predicts that firms having more unique assets have very

specialized labour and add larger liquidation cost at liquidation time. So, firms having more unique assets should have lower financial leverage (Titman, 1984). In order to control unique assets those acquired and accumulated from discretionary expenses- selling, general and administrative expenses, and research and development expenses, should have lower debt. Finally, if asymmetric information is about fixed assets in place, financial leverage should be lower. Booth et al. (2001) and Huang and Song (2002) reported a negative relation between tangibility and leverage.

5.7.4.4 Tax

Tax negatively significantly affects financial leverage defined by short-term debts to total assets and financial leverage defined by total debts to total assets. Matheson (2006) supported the negative effect of tax on the leverage. The owner of the industries want to pay higher tax and use less amount of debts to become commercially important person (CIP) in the country.

5.7.4.5 Non-Debt Tax Shield (NDTS)

NDTS positively significantly affects financial leverage defined by long-term debts to total assets. The company having higher NDTS, having higher collateral-able fixed assets. Because of having higher collateral-able fixed assets, the industry can use more debts. Hence, non-debt tax shield is positively related with the leverage. Downs (1993) presents evidence for the positive effect of NDTS on leverage. However, NDTS is insignificant in the case of short term debts and total debts.

5.7.4.6 Uniqueness (R&D)

Uniqueness positively significantly affects financial leverage defined by short-term debts to total assets and financial leverage defined by total debts to total assets. Uniqueness can positively affects the financial leverage when uniqueness is explained by information asymmetry theory. Uniqueness is represented by research and development expenses. But

investment in research and development expenses are like investment in intangible assets which are more sensitive on the way to adverse selection problem. Mazur (2007) and Wei (2014) supported the negative effect of uniqueness on the financial leverage.

5.7.4.7 Dividend Pay-Out

Dividend pay-out negatively significantly affects financial leverage defined by short-term debts to total assets and financial leverage defined by total debts to total assets. When company pays dividend to the shareholders, the available cash decreases in the hand of managers. Hence less amount of debt is used to decrease cash available in the hand of managers.

5.7.4.8 Agency Cost

The largest shareholdings significantly negatively affects financial leverage defined by short-term debts to total assets and financial leverage defined by total debts to total assets. Agency theory (Jensen & Meckling, 1976; Jensen, 1986) argued that "the optimal structure of leverage and ownership may be used to minimize total agency costs". Following the works of Jensen and Meckling and Jensen, it is accepted that the ownership structure has influence on the leverage. The conflict between the principal and agent can be minimized if the largest shareholder monitor the activities of the agent. Consequently, firms can use more equity if single shareholder holds the large proportion of the total shares. Hence largest percentage shareholder's shareholding should affect the financial leverage be negatively. Leland and Pyle (1977) and Berger, Ofek and Yermack (1997) supports the negative relationship.

5.7.4.9 Business Risk

Business risk negatively significantly affects financial leverage defined by total debts to total assets. Business risk is the possibility of being failed in the business. In this study, higher variability of return on assets is treated as the higher business risk and lower variability of

return on assets is considered as the lower business risk. Business risk is negatively related with the financial leverage under trade-off theory.

5.7.4.10 Macroeconomic Conditions

In the expansion phase, business grows up at a very good rate, industrial production goes up, employment goes up, stock prices goes up and corporate profitability goes up. During business expansion phase of business cycle, packing order theory predicts that firms can generate money for financing from internal sources. Consequently, expansion and financial leverage should be negatively related. However, bankruptcy cost theory predicts that bankruptcy cost for growth opportunities are high and hence leverage and macroeconomic growth should be negatively related.

5.7.4.11 Uniqueness (SGA)

Selling, general and administrative expenses positive significantly effects short-term debts, and negative significantly effects long term-debts, and significant effects on the total debts.

6. Conclusion and Applications of the Study

This research reviews all of the relevant important theories and concepts developed in corporate capital structure until till date in an aggregate manner. The empirical part of the study reveals that the leverage ratios defined in short-term debts, long-term debts, total debts and book value of assets are correlated. Similarly, the leverage ratios defined in short-term debts, long-term debts, total debts and market value of assets are correlated. However, book value based and market value based leverage ratios are not correlated. The leverage ratios defined in earnings before interest & taxes over interest and earnings before interest, taxes & depreciation over interest are positively perfectly correlated. Besides, short-term loans are three times more compare to long term debts, firms are reluctant in paying tax, allotment in research & development expenses are insufficient. total sales & total assets can be alternative

to be proxy of the size of the firm and human capital cost do not have effect on any kind of leverage. All these empirical knowledge are original, significant and deserve to appear at the corporate finance text book.

In addition, industry median average, non-debts tax shield, uniqueness (R&D) positively significantly affects financial leverage and, and size, tangibility, tax rate, dividend pay-out, agency cost, business risk, GDP growth, and money growth negatively significantly affects financial leverage. The selling, general and administrative expenses positively affect short-term debts, negatively affect long-term debts and have no significant effects on total debts. The factors and capital structure information can be used in insolvency prediction, credit risk analysis & macro finance, cost of capital and capital budgeting, corporate governance study and other areas of finance as below.

(1) Financing, investment, dividend, and production policies are important in corporate governance study. Financing determines corporate governance structure which is an important factor in strategic decision making in future. When corporation increases debt in the capital structure, the control status of firm shifts from internal to external control. This shift imposes covenants those limits the strategic choice of managers in future uncertain environment. Williamson (1988) argued that the greater use of equity capital in the capital structure requires more administrative measures in order to reduce opportunistic behavior of the manager.

(2) Capital structure information, specifically, factors are useful for *predicting insolvency*. An insolvency prediction model based on capital structure factors can be an alternative to option pricing based model. By using the capital structure information and the factors data and logistic regression or discriminant analysis, an insolvency model can be formulated. If the assumptions of the discriminant analysis are not satisfied, logistic regression should be used in this regard. In addition to apply as an alternative model, capital structure based model can be applied to cross check with the option pricing model.

(3) The capital structure theories, factors and information can be used in *credit risk analysis and macro finance decision making*. Capital structure information is important for investors to know the position of the firm in future in an unexpected position like recession. The financers can look at the present level of the debts in the capital structure and compare with the target level of debts should be to finance the gap.

(4) Capital structure information is compulsory for estimating *cost of capital and evaluating capital budgeting decision*. For an example, a project scheduled to be financed by equity and produced negative net present value can become a positive if the project if financed by debt partly or fully. 6.5 Capital structure information is useful for economic policy research and efficient cash flow management.

(5) The determinants of capital structure determined in this study are used as control variables in the subsequent study conducted to test the effect of financial leverage on the Malmquist productivity index and its components, and to test the effect of Malmquist productivity index and its components on the financial leverage.

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Chapter 3: Productivity Growth, Efficiency Change, & Technical Progress of a Corporate Sector in Bangladesh: A Malmquist Output Productivity Index Approach

Abstract

The purpose of this study are to estimates the Malmquist productivity change index for the corporate sector in Bangladesh, to investigate the reasons of the Malmquist productivity change index, to check whether the leverage ratios of the productivity growth & the productivity declined industry are the same or different and to check the relationship between the traditional measures of the corporate performance & the Malmquist productivity change index & its components. The study shows that productivity is increased by 1.3 percent per year over the period 2006-2012. This growth is due to increase in the efficiency by 4.1 per cent per year and decline in the catching up by 2.7 per cent per year. In another way, the productivity of the seven industries out of the fourteen industries is increased and the productivity of the seven industries out of the fourteen industries is decreased over the sample period. Similarly, the productivity is decreased during the 50 per cent of the sample periods. A study of the leverage ratios of the productivity growth and the productivity declined industries shows that there is a mismatch between the leverage ratios of the two groups. Moreover, a relationship study shows that the Malmquist productivity change index & its components and the traditional measures of the corporate performance present different aspects of the corporate performance.

Keywords: malmquist productivity index, technical efficiency, technical progress, proxy for corporate performance, leverage and efficiency, DEA-like linear programming problem

1. Introduction

The corporate sectors of Bangladesh are growing substantially and playing substantial role in the growing economy of Bangladesh. To grow more efficiently, it is important for a firm to study its productivity and to take measures, if necessary, to improve the productivity of the firm. In addition, the productivity analysis is of interest to management, regulators, employees, and governments. According to Kendrick (1993), productivity is a very important issue at personal, company, industry and national level. Hence, productivity study is an utmost important activity to the interest groups. Under the importance, the broad objective of this study is to analyze the productivity of a corporate sector of Bangladesh.

Like many other countries, the corporate productivity or performances are analyzed by using financial ratios in Bangladesh. The variables used in the past literature and reported in the annual reports of the firms to represent the firm performance are return on equity, earning per share, return on sales, return per employee, return on total assets, and operating cash flow to total assets etc. However, those ratios are calculated based on one input, hence represent partial productivity and should not be a measure of corporate performance. Because corporate performance is the result of many inputs: capital, labor, material, energy, and other inputs. This study uses a newer technique called Malmquist productivity index to measure the productivity change index of the firms of a corporate sector of Bangladesh.

The broad objective of this study is to estimate the productivity growth, efficiency change and technical progress index of the firms in the sample of the corporate sector in Bangladesh. In consistent with the broad objective, the specific objectives are: (i) to estimate the Malmquist productivity index of the firms in the sample of the corporate sector in Bangladesh. (ii) to identify the sources of the productivity change: efficiency change or technical progress so that measures for the productivity improvement can be taken, (iii) to check the relationship between the financial leverage and Malmquist productivity index of the productivity growth industry and the productivity declined industry, (iv) to determine the correlation coefficients

between the Malmquist productivity Index and its components and other traditional measures of corporate performance in order to check whether the two type indicators express the same aspects of the corporate performance, and (v) to measure and analyse the partial productivity.

This study reports and suggests using a productivity change ratio called Malmquist productivity change index as the measure of corporate performance for four reasons. Firstly, productivity analysis by using the Malmquist productivity index provides the reasons of productivity change and the magnitudes account for the reasons. In other words, what is the reason of the productivity change: technical efficiency change or technical change? And how much of the total change is because of the change in technical efficiency or technical change? Secondly, whereas the other types of productivity are estimated by using either one input or one output, the Malmquist productivity analysis can take into account multiple inputs and outputs to calculate the productivity change index. Thirdly, there is no need of any behavioral assumption like profit maximization or cost minimization. Finally, do not need price data of the input and outputs. For the above advantages, this study uses the Malmquist productivity index to analyze the productivity of the corporate sectors in Bangladesh.

In order to achieve the objectives, this study uses data from 14 pharmaceuticals companies listed at Dhaka Stock Exchange Limited-the main stock exchange of Bangladesh for seven years: 2006-2012 and The data is collected from the annual reports of the companies reserved at Bangladesh Securities and Exchange Commission library, Dhaka Stock Exchange Limited library, Chittagong Stock Exchange Limited library and University of Liberal Arts library.

This study claims three academic contributions. Firstly, the study provides new and original empirical evidence from the data of pharmaceuticals sector in Bangladesh. Secondly, this research showed that the Malmquist productivity change index and its components and the traditional measures of corporate performance present different aspects of corporate performance. Thirdly, this study proposes to use Malmquist productivity change index and its

components as the proxy of corporate performance and to check the effect of leverage on performance and effect of performance on leverage.

The rest of the study is organized as follows: the section 2 discusses about the productivity management and the related ideas: concepts, importance, sources, management, and measures; the section 3 deals with the concept of the models of the study, and allied matters: specification of the model, basic and pictorial presentation of the output distance functions, Malmquist index, the Malmquist productivity index and its decomposition, returns to scale, and data envelopment analysis (DEA); the section 4 discusses about the data of the study and their characteristics, the section 5 presents the results of the study and their analyses and the section 6 presents conclusion of the study and the future research directions.

2. Productivity

The word "productivity" was, probably, first introduced by a French Mathematician-Quesnay in a piece of writing in 1766 (Sumanth, 1998). Unfortunately, the words productivity and efficiency are used interchangeably by many people. But they are different in exact definition. Increase in efficiency does not pledge increase in productivity and increase in efficiency is a necessary condition to increase in productivity, but not sufficient condition. Efficiency is defined as actual output divided by standard output whereas productivity is equal to actual output divided by input consumed. As formula, efficiency and productivity are defined as equation (1).

$$Productivity = \frac{Actual\ Output}{Inputs\ Consumed} \qquad Efficiency = \frac{Actual\ Output}{Standard\ Output} \tag{1}$$

2.1 Importance of Productivity

Increase in productivity is expected in all levels-national, industrial, company and personal (Kendrick, 1993). At personal level, increase in personal productivity results in increase in organizational productivity and the person's living standard. At national level, higher

productivity causes in higher economic and national growth. At company level, higher productivity at company level ensures lower per unit costs and price, higher profitability, and higher competitive position in the market. At industrial level, higher productivity at industrial level strengthens the position of the industrial sector in the home and abroad markets. Thus productivity management is very important to the all concerns.

2.2 Sources of Productivity

Productivity growth can be from one of the four sources: new technology & methodologies, energy utilization, investment and attitudes (Smith, 1993). Introducing new technology or methodology or up-gradation of the technology or methodology can be a source of the productivity growth and introducing or up-gradation generally requires the investments. Another source of the productivity growth may by use of the energy. The use of energy may be from any source, even may be from human mind. The attitudes of employee, employer and management may be the important sources of the productivity growth. From wherever productivity comes, subject to performing standard quality, social responsibility, and performing other management responsibilities, are most welcome by the decision making units.

2.3 Productivity Management

There are four steps in the productivity management (Sumanth, 1998): measurement, evaluation, planning and improvement. The first step of the productivity management is the productivity Measurement. The productivity is measured from one of the three points of the views. Firstly, the present level of productivity is computed and compared with the productivity of the other decision maker for the necessary actions. Secondly, estimating productivity of one period and compared with the other period of the same decision maker. Finally, the productivity of a decision making unit can be studied including many DMUs and periods. This procedure is used in this study to study the productivity of the sample firms. The relevant concern should follow the steps in the continuous manner after every period.

2.4 Productivity Measures

2.4.1 Productivity Ratios

To generate the outputs, firms uses the inputs, and the inputs are processed to generate the outputs in the production process. In other words, the conversion cycle is the inputs to the process, from the process to the outputs (Figure 1). The productivity ratio measures the productivity of this transformation process: how much/many outputs are produce by using the inputs. The higher ratio means the higher productivity and the lower ratio means the lower productivity. The productivity is defined as equation (2).

$$Productivity = \frac{Output}{Input} \tag{1}$$

The figure-1 shows the input-output process.

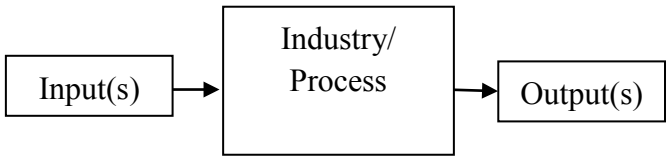

Figure 1. Input-output process

In order to compute the productivity ratio of the firm, the input and output variables data are compulsory. The productivity analysis is a data sensitive technique. The use of more inputs and outputs variables, makes the decision making unit more unique and increase the possibility of comparison with the less numbers of DMUs. As a result, measuring the number of inputs and outputs variables as reasonable as possible is very important. In general, the input variables are capital which may be physical, financial or inventory capital, labour which may be number of labours, number of labour hours, or labour costs: wages & salary, energy costs which may be, oil, gasoline, or other energy costs, and materials costs. The output variables may be gross outputs, net output, may be products, or services.

Based on the number of inputs considered in the productivity calculation, productivity measurement can be divided into three groups: partial productivity, total factor productivity, and total productivity. The three types of the productivity are discussed briefly here. Partial

productivity: Partial productivity (PP) is the quotient obtained by dividing an output by an input of the production. In this regard, we can say capital productivity, labour productivity, material productivity, energy productivity or other input productivity. The advantage of the using and estimating partial productivity index as the index to present corporate performance is that it is easy to calculate, interpret and understand. The disadvantage is that it is overstated. For the better understanding, assume, O = output, L= labour, C = capital, E = energy, M = materials, m = other inputs. Symbolically, partial productivity (PP) is defined as equation (3).

$$PP = \frac{O}{L(or\ M,C,\ E,m)} \tag{3}$$

Total factor productivity (TFP) is the quotient of dividing the output by the capital and the labour. This measure is a better measure than the partial productivity as this measures consider capital- labour substitution. The disadvantage is that it is difficult to calculate, understand and interpret compare to the partial productivity. Symbolically, TFP is defined as equation (4).

$$TFP = \frac{O}{L+C} \tag{4}$$

Total productivity (TP) is the quotient of dividing the output by the all inputs used in the production process. The advantage of the total factor productivity is that it considers all of the inputs used in the production process and the disadvantage is that it is difficult to calculate, understand and interpret. Symbolically, TP is defined as equation (5).

$$TP = \frac{O}{L+M+C+E+m} \tag{5}$$

Based on the objective of the productivity analysis: output maximization, input maximization or both together (output maximization and input minimization), the productivity analysis can be divided into three: output oriented productivity analysis, input oriented productivity analysis and additive productivity analysis. In an output oriented analysis, the objective is to increase in outputs as much as possible for a given level of inputs. In an input oriented

analysis, the objective is decrease in inputs as much as possible by keeping outputs as constant. In the additive productivity analysis, the inputs are decreased as many units as possible and the outputs are increased as many units as possible. For the details in productivity management see Christopher (1993), Sumanth, (1998), Belasco (1990).

3. The Concept of the Model

3.1 Specification of the Model

Determining input and output variables in order to estimate the productivity of the sample firms are one of the biggest challenges of this study because of very limited empirical research in this field. However, Margaritis and Psillaki (2010) used two inputs: labour and capital as input variables and value added as output variables, where the input variables-labour is measured by total labour and capital is measured by fixed assets. The output variables-value added is defined as net profit plus depreciation and labour cost: wages plus salaries plus benefits. The first part (net profit plus depreciation) is the return to capital (capital, land, and assets) and second component (wages plus salaries plus benefits) is the return to labour. In addition, Berger and Bonaccorsi (2006) used total equity to total assets and return on equity as inputs and output variables respectively. Lin, Liu, and Chu (2005) used assets and equity as inputs variables and operating revenue and net income as output variables in order to assess efficiency of the Taiwan's shipping industry.

Data envelopment analysis is a data sensitive technique. Using more number of inputs and outputs variables make the DMUs unique and less possibility of being compared with the more numbers of best practice branches. As a result, as the number of inputs and outputs variables increases, the possibility of being efficient increases and vice-versa. In addition, sample size variables should be substantially more than number of outputs times number of inputs. Mostafa (2007) indicated that sample size should be more than three times of bigger between number of inputs and number of outputs.

In order to select the inputs and outputs variables for this study, this study considered all of the input and output variables available from the literature survey (Table 1). From the literature survey, seven variables are available as input variables and four variables as output variables. A correlation coefficient analysis is conducted in order to check the multi-colinearity and reduce the number of the variables.

Table 1. Inputs and outputs variables

List of inputs variables	List of outputs variables
• Salary and wages (= labour)	• Value added (= EBIT + dep. + wages & salary)
• Fixed assets (= capital)	• Return on equity
• Total assets	• Operating revenue (= sales)
• Total equity to total assets	• Net income (= net profit)
• Equity	
• Debts	
• Total expenses	

Source: Literature Survey.

Table 2 shows the correlation coefficients of the all possible pairs of the input and output variables. The coefficients show that total fixed assets are strongly correlated with total debt (0.84), total equity (0.96), and total assets (0.97). Among these four variables, total fixed assets is selected as one of the input variables. The variables: wages & salary and total expenses are strongly positively correlated (0.90). Between these two variables, wages and salary is accepted as the second input variable. Finally, for the analysis sample, total fixed assets, and wages and salary are selected as input variables. In the case of output variables, sales or revenue and net profit is strongly positively correlated (0.94). From these two variables, net profit is selected as an output variable. And the second output variable is value added. Thus the input variables are total fixed assets and wages and salary and the output variables are net profit and value added.

Table 2. Correlation matrix for the input and output variables

	TD	*TE*	*TA*	*TFA*	*TE/TA*	*W&S*	*Texp*	*S=R*	*NP*	*VA*	*ROE*
Total Debt	1.00										
Total Equity	0.82	1.00									
Total Asset	0.91	0.96	1.00								
Total Fixed Asset	0.84	0.96	0.97	1.00							
TE/TA	0.22	0.44	0.35	0.36	1.00						
Wages and salary	0.80	0.79	0.83	0.76	0.28	1.00					
Total Expenses	0.78	0.76	0.82	0.75	0.29	0.90	1.00				

Sales = Revenue	0.80	0.81	0.86	0.78	0.29	0.88	0.93	1.00			
Net Profit	0.71	0.83	0.84	0.81	0.33	0.80	0.86	0.94	1.00		
Value Added	0.40	0.56	0.54	0.55	0.23	0.51	0.57	0.63	0.67	1.00	
ROE	-0.18	-0.23	-0.20	-0.21	-0.48	-0.09	-0.08	-0.07	-0.08	-0.06	1.00

Source: Author's calculations.

The ratio variables do not follow convex to the origin characteristics, hence: total equity to total assets is not considered as input variable and for the same reasons return on equity is not considered as output variable in this study. In addition, a sensitivity analysis is conducted by using an alternative combination of variables-total assets and total expenses as input variables and sales or revenue and value added as output variables. The sensitivity analysis has produced the similar results to the main analyses.

At the time of the analyses, it is assumed that for an input variable "less is better" and for an output variable "more is better". The Figure 2 presents that industries in the study uses fixed assets and salary & wages as the input variables and produces net income and value added as the output variables.

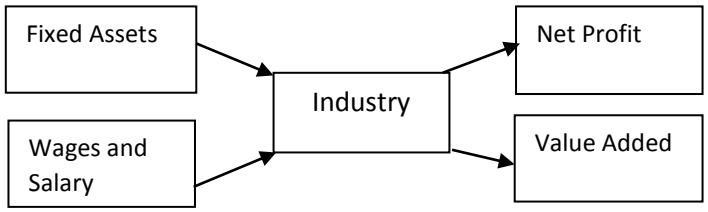

Figure 2. Firm input and outputs

3.2 Output Distance Function

The Malmquist Productivity Index can be constructed by one of the two ways: by using the ratios or by using the distance functions. Mlima (1999) constructed the Malmquist productivity index as a ratio of the Malmquist output-quantity index to the Malmquist input-quantity index. As an alternative, the Malmquist productivity index can be constructed by using the distance functions. The use of the distance functions enables consideration of multiple inputs and multiple outputs. In addition, there is no need of the profit maximization or cost minimization assumption when the Malmquist productivity index is constructed by

using the distance functions. This study determines the Malmquist productivity index by using the distance functions.

Malmquist productivity index are divided into two: Malmquist input-productivity index and Malmquist output-productivity index. The Malmquist input productivity index is constructed based on the input distance functions and the Malmquist output productivity index is constructed based on the output distance functions. An input distance function describes possible maximum decrease in inputs for a given outputs and an output distance function describes possible maximum increase in outputs for a given inputs level. The value of a distance function is varying between 0 and 1. In this study, Malmquist output productivity index is constructed.

In order to define the distance function, consider, a sample of n DMUs and a production technology that by using x^t input producing y^t output in the time period t = 1…T. For considering multiple inputs and outputs, the inputs and the outputs vectors are considered by using inputs, $x^t\ (x_1^t, - - -, x_n^t)$ the firms produces outputs, $y^t\ (y_1^t, -, y_m^t)$ in the time period t =1…T. Assume, P^t is the output set. Now, in the set builder form, the output set is:

$$P^t(x) = \{y^t/x^t:\ x^t \text{ can produce } y^t \text{ at time t}\} \text{ where, t = 1…T}$$

Shepherd (1970) distance function that is used for the Malmquist output productivity index is as follows:

$$D^t(y,x) = min\{\delta \in (0,1]: (y/\delta) \in P^t(x)\} \qquad t = 1…T$$

The value of the distance function is less than or equal of one i.e., $0 \leq D\ (y\ x) \leq 1$ when y is in the output possibility set, i.e. $y \in P(x)$. The value of the distance function is equal to one, i.e. D(y x) =1 when y is on the frontier line and the value of the distance function is less than one, i.e. D(y x) <1 when y belongs in the other area of production possibility set except on the frontier line. If the value of the distance function is one, the DMUs efficient and otherwise not efficient.

The following Figure 3 is a pictorial presentation of the output possibility set and the distance functions for the firm using one input and producing two outputs.

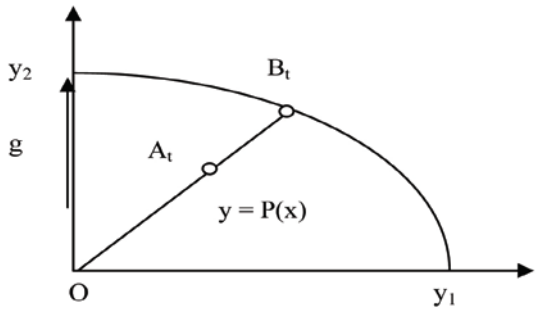

Figure 3. Output possibility set and distance functions

Figure 3 presents a production point and the production possibility frontier of the output-y_1 and y_2. D(y x) indicates the output distance covered by the decision making unit from the production point (O) to the frontier (B_t). The inverse of the D(y x) indicates the proportional increase in the present output (A_t) to reach at the frontier (B_t). By using figure-3, at A_t: $D^t(y^t x^t) = \frac{OA_t}{OB_t} < 1$, and at B_t: $D^t(y^t x^t) = \frac{OB_t}{OB_t} = 1$. The firm producing output at A_t is inefficient as the point is under the frontier curve. On the other hand, the firm producing at B_t point is efficient as the point is on the respective frontier point. To be efficient, the proportional increase of the present output level (A_t) to reach at frontier lever (B_t) is $\frac{OB^t}{OA^t}$.

Figure-4 shows a production point and a frontier at time t and the production point and the frontier at time (t+1). By using the firms' outputs production points and the frontiers, the distance functions are estimated as follows. $D^t(y^t, x^t) = \frac{OA_t}{OB_t}$, $D^t(y^{t+1}, x^{t+1}) = \frac{OA_{t+1}}{OB_t}$, $D^{t+1}(y^t, x^t) = \frac{OA_t}{OB_{t+1}}$, $D^{t+1}(y^{t+1}, x^{t+1}) = \frac{OA_{t+1}}{OB_{t+1}}$. By using the four distance functions, the Malmquist productivity change index is constructed.

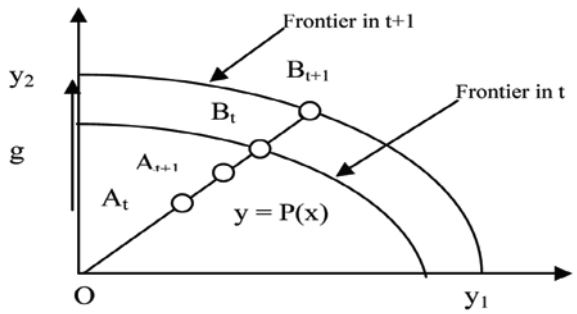

Figure 4. Distance functions and productivity indices

3.3 Malmquist Index

Malmquist (1953) proposed to compare the inputs of one period to the inputs of another period in terms of the maximum factor to reduce the inputs of one period subject to the production of the same outputs. This idea is known as Malmquist input index. Later, based on the Malmquist input index, the Malmquist output index is also developed by a researcher.

3.4 Malmquist Productivity Index and Its Decomposition

The Malmquist productivity index is used to discover the productivity difference between the two firms or one firm over the two periods of time. Malmquist productivity index is the geometric mean of the Malmquist index at the period t and t+1. There are two Malmquist productivity indices: input-oriented Malmquist productivity index and output-oriented Malmquist productivity index. An input-oriented Malmquist productivity index is constructed by using input distance functions those describes maximum reduction in inputs by keeping outputs constant and an output-oriented Malmquist productivity index is constructed by using output distance functions those describe in maximum increase in output by keeping inputs constant. In this study, Malmquist output productivity indices are studied.

According to Caves, Christensen and Diewert (1982), the output based Malmquist productivity index between the period t and (t+1) is as equation (6).

$$MPI_0^{t,\ t+1}(y^t, y^{t+1}, x^t, x^{t+1}) = \sqrt{\left[\frac{D^t(y^{t+1},x^{t+1})}{D^t(y^t,x^t)} \times \frac{D^{t+1}(y^{t+1},x^{t+1})}{D^{t+1}(y^t,x^t)}\right]} \quad (6)$$

Where the notation MPI denotes the Malmquist productivity index between the two periods. The superscript (t, t+1) denotes the time periods and the subscript (o) denotes the orientation. The notation D denotes the distance function. Malmquist productivity index is the geometric mean of the two Malmquist index at the period t and t+1. The first ratio under the square root is the Malmquist output index at time t (MI_o^t) which measures changes in the output from period t to period (t+1) by using period t frontier as the benchmark and The second ratio under the square root (MI_o^{t+1}) is the Malmquist output index at time (t+1) which measures changes

in the output from period t to period (t+1) by using period (t+1) frontier as the benchmark. In the case of output oriented Malmquist productivity index, the index is equal to zero (MPI=0) indicates no productivity change, the Malmquist productivity index is less than one (MPI<1) indicates productivity decline and the Malmquist productivity index is greater than one (MPI>1) indicates productivity growth.

By rearranging the equation (6), Färe et al. (1989) proposed the Malmquist productivity index as a product of efficiency change and technical change as equation (7).

$$MPI_0^{t,\ t+1}(y^t, y^{t+1}, x^t, x^{t+1}) = \frac{D^{t+1}(y^{t+1},x^{t+1})}{D^t(y^t,x^t)} \sqrt{\left[\frac{D^t(y^t,x^t)}{D^{t+1}(y^t,x^t)} \times \frac{D^t(y^{t+1},x^{t+1})}{D^{t+1}(y^{t+1},x^{t+1})}\right]} \quad (7)$$

In equation (7), the first term in front of the square root is the ratio of the two distance functions measures Farrell (1957) technical efficiency change (Effch) from the period t to the period (t+1). The second term measures technological progress (Techch) from the period t to the period (t+1). In other words, the second term, TC, measures the shift in the frontier. The term Farrell technical efficiency is greater than, equal to, or less than one (Effch (>1, =1, <1)) indicates that the firm is closer to frontier, no change, decline in productivity. The second term, Techch, is greater than, equal to, or less than one (Techch (>1, =1, <1)) indicates that the technological best practice has increased, unchanged, declined.

The Malmquist productivity index of firm-A is illustrated by using the following figure-5, considering one input one output case, assuming constant returns to scale and the equation (7). Grifell-Tatje and Lovell (1997) argued to assume constant returns to scale while estimating Malmquist productivity index as Malmquist productivity index may not capture the resulting gains or losses from scale effect while variable returns to scale is assumed. The hidden reasons are the nature of firm level and the aggregate data.

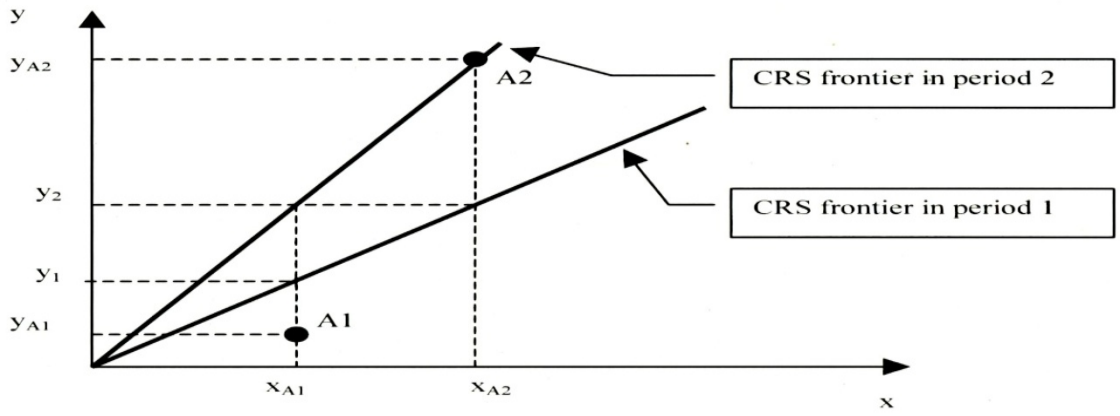

Figure 5. Malmquist productivity index

Source: Kirikal (2005), Kirikal Modified from Coelli, Rao, and Battese (1998).

In the Figure 5, the firm A produces output y by using input x. The firm produces at A1 at time period t and at A2 at time period (t+1). Firm A is inefficient at time t, as the firm is producing at A1, under the frontier line-CRS1. However, the firm A is efficient at time (t+1) and producing at A2, on the frontier-CRS2. The frontier is shifted upward indicates technical advancement/progress. The technical progress includes two components: a time component and a technological component. By using the Figure 5 and the equation (7), the Malmquist productivity index is as equation (8).

$$M_{1,2}(y_{A1},y_{A2},x_{A1},x_{A2}) = \frac{y_{A2}/y_{A2}}{y_{A1}/y_1}\left[\frac{y_{A1}/y_1}{y_{A1}/y_2} x \frac{y_{A2}/y_2}{y_{A2}/y_{A2}}\right]^{1/2} \quad (8)$$

The Figure 5 shows that Malmquist productivity index of firm A is greater than 1 (MPI>1) which means growth in productivity. The sources and their magnitude to the Malmquist productivity index reflected in the efficiency change (Effch) ratio and technical progress (Techch) ratio. The efficiency change in firm A also greater than 1 (Effch > 1) which indicates increase in efficiency. The technical change is also greater than 1 (Techch > 1), upward ship, indicates technological progress.

A Malmquist Productivity index is calculated for the adjacent period by using the four distance functions: $D^t(y^t,x^t), D^t(y^{t+1},x^{t+1}), D^{t+1}(y^{t+1},x^{t+1}),$ *and* $D^{t+1}(y^t,x^t)$. There are many techniques to calculate the value of a distance function. The techniques available for

calculating the values of the distance functions can be grouped in two broad categories: mathematical programming and econometric analysis. However, most widely used technique is the linear programming problem. Färe et al. (1994) developed DEA-friendly Malmquist productivity index. This study applies DEA-like distance functions to estimate the Malmquist productivity index.

The relationship among the Malmquist productivity change index, efficiency change, technical change, pure efficiency change, and scale efficiency change are described in the equation (9).

$$MI = Effch * Techch = Pech * Sech * Techch \quad (9)$$

MI or Tfpch - Malmquist Productivity Index;

Effch - efficiency change;

Techch - technical change;

Pech - pure efficiency change;

Sech - scale efficiency change.

Malmquist productivity index is also known as Malmquist productivity change index, Malmquist total factor productivity change index.

3.5 Constant and Variable Returns to Scale

An important issue in productivity analysis is returns to scale properties of the production technology. The two most frequently returns to scale properties assumed in productivity analysis are constant returns to scale (Charnes, Cooper, & Rhodes, 1978) and variable returns to scale (Banker, Charnes, & Cooper, 1984). According to constant returns to scale, output will increase according to the increase in the input. For instance, if input is increased by 100 per cent then output will also increase by 100 per cent. On the other hand, in the case of variable returns to scale, when input increases, output increases at first and then decreases

according to scale size. In figure-6, according to constant returns to scale, only the decision making unit B is efficient. However, according to variable returns to scale, all the points: A, B, C, and D, are efficient.

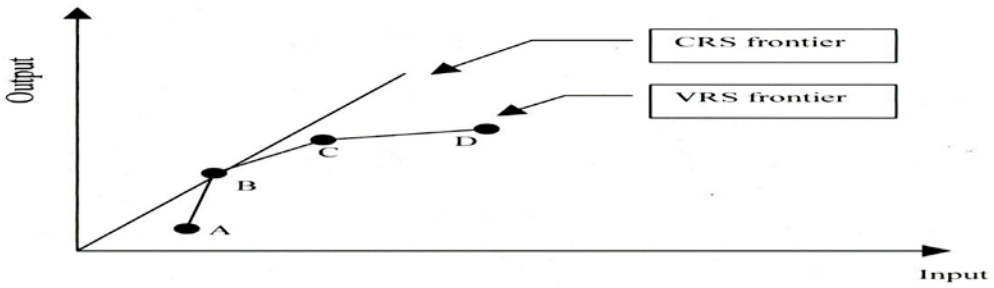

Figure 6. Constant and variable returns to scale

Source: Kirikal (2005), Kirikal Modified from Färe, Grosskopf, & Lovell (1994).

Malmquist productivity analysis can be conducted based on the assumption-production technology follows constant returns to scale or variables returns to scale. However, this study is based on the assumption that production technology follows constant returns to scale. By using one-input, one-output example, Grifell-Tatje and Lovell (1997) showed that total factor productivity is not measured correctly when it is assumed that production technology follows variable returns to scale. This happens because of nature of firm level and aggregate data. Consequently, Malmquist productivity analysis is conducted assuming production technology follows constant return to scale.

3.6 Data Envelopment Analysis

Data envelopment analysis is a linear program based program developed and proposed by Charnes, Cooper, & Rhodes (1978) to measure the efficiency of the DMUs those use the similar type of inputs and produce the similar type of outputs. The proposed model is based on the assumption of constant returns to scale and input orientation. The model forms a pair-wise non-linear efficient frontier and DMUs are compared with the frontier to determine the efficiency of the DMUs. However, model based on the various types of returns to scale and orientations are also developed later. Among the models developed later, Banker, Charnes,

& Cooper (1984) is the most popular model. However, this study is based on the assumption that production technology follows constant returns because of practible-ness of firm-level and aggregate data.

A Malmquist productivity index for a fair of adjacent period is constructed based on a set of the four distance functions: $D^t(y^t, x^t), D^t(y^{t+1}, x^{t+1}), D^{t+1}(y^{t+1}, x^{t+1}), and\ D^{t+1}(y^t, x^t)$. We should solve total n sets for n sample DMUS. There are many econometric and mathematical methods to estimate the values of the distance functions. However, DEA-Like linear programming problems are used to estimate the values of the distance functions in this study. The following a set of four linear programming problems-output-oriented CRS envelopment model are formulated and solved to construct the Malmquist productivity index.

(a) By comparing y^t with the frontier at time t, i. e., determining D^t (y^t, x^t).

$$[D^t(y^t, x^t)]^{-1} = Max\ D \tag{10}$$

subject to

$$\sum_{j=1}^{n} \lambda_j\, x_j^t \leq x^t$$

$$\sum_{j=1}^{n} \lambda_j\, y_j^t \geq Dy^t$$

$$\lambda_j \geq 0, j = 1, \ldots\ldots n$$

(b) By comparing y^{t+1} with the frontier at time t, i. e., determining D^{t+1} (y^{t+1}, x^{t+1}).

$$[D^t(y^{t+1}, x^{t+1})]^{-1} = Max\ D \tag{11}$$

subject to

$$\sum_{j=1}^{n} \lambda_j\, x_j^t \leq x^{t+1}$$

$$\sum_{j=1}^{n} \lambda_j\, y_j^t \geq Dy^{t+1}$$

$$\lambda_j \geq 0, j = 1, \ldots\ldots n$$

(c) By comparing y^{t+1} with the frontier at time t+1, i. e., determining D^{t+1} (y^{t+1}, x^{t+1}).

$$[D^{t+1}(y^{t+1}, x^{t+1})]^{-1} = Max\ D \tag{12}$$

subject to

$$\sum_{j=1}^{n} \lambda_j\, x_j^{t+1} \leq x^{t+1}$$

$$\sum_{j=1}^{n} \lambda_j\, y_j^{t+1} \geq D y^{t+1}$$

$$\lambda_j \geq 0, j = 1, \ldots\ldots n$$

(d) By comparing y^t with the frontier at time t+1, i. e., determining D^{t+1} (y^{t+1}, x^{t+1}).

$$[D^{t+1}(y^{t}, x^{t})]^{-1} = Max\ D \tag{13}$$

subject to

$$\sum_{j=1}^{n} \lambda_j\, x_j^{t+1} \leq x^{t}$$

$$\sum_{j=1}^{n} \lambda_j\, y_j^{t+1} \geq D y^{t}$$

$$\lambda_j \geq 0, j = 1, \ldots\ldots n$$

Where, $x_j^t = (x_{1j}^t, \ldots., x_{mj}^t)$ is the inputs vector, $y_j^t = \left(y_{1j}^t, \ldots., y_{sj}^t\right)$ is the output vector and t = 1,…..T. Where superscript denotes time period and subscript denotes DMU identity. λ_j is the weight given to the DMU, $1 \leq D \leq \infty$ is proportional increase in the outputs keeping the inputs constant. $0 \leq 1/D\ (=\delta) \leq 1$ is a technical efficiency score.

4. Results

4.1 Summary Information on the Input and Output Variables

Table-3 shows the descriptive statistics of the input variable–total fixed assets. The mean fixed assets is stable over the period whereas maximum fixed assets is decreasing during the period and the minimum fixed assets is increasing. These trends mean that total fixed assets of the industries are moving toward a commo size. Table 4 presents descriptive statistics of input variable-wages and salary. The arithmetic mean, maximum and minimum all are substantially increasing. One reason of this increase is increase in salary and wages. Another reason is the increase in total staffs.

Table 3. Descriptive statistics of input variable total fixed asset

Year	Mean	Max	Min
2006	1273685450	8537119221	26723011
2007	1495122703	9029643482	28031685
2008	1928558516	11957773787	28870115
2009	770078631	3587051489	26478542
2010	2432564224	24722574397	20770800
2011	1143238371	4495085038	33709167
2012	1259616149	5406012268	37837094

Source: Author's calculations.

Table 4. Descriptive statistics of input variable wages and salary

Year	Mean	Max	Min
2006	134894014	466494403	3821498
2007	191164379	560972744	4464036
2008	207015139	673231385	5364662
2009	244398839	785490027	6441241
2010	290264456	904506477	6464411
2011	354664611	1023522927	7559213
2012	370281942	1127001587	8735929

Source: Author's calculations.

The descriptive statistics of the output variable-net profit are presented in the Table 5. The arithmetic mean, maximum and minimum all are increasing- may be a sign of productivity growth.

Table 5. Descriptive statistics of output variable net profit

Year	Mean	Max	Min
2006	166226674	1165864616	-17122000
2007	188864268	1303242840	-35567404
2008	284815650	1381863093	6347155
2009	347574362	1890052929	4371801
2010	390443028	2087871791	4993767
2011	461920435	2532054550	7040504
2012	493661116	2897710641	5806652

Source: Author's calculations.

Table 6 presents the descriptive statistics of the output variable- value added. The arithmetic mean, maximum value, and minimum value all are increasing. The increasing trend may be because of increasing in productivity growth. In the Malmquist productivity analysis, the impact of four inputs will be considered simultaneously and will be summarized by an index called Malmquist productivity change index.

Table 6. Descriptive statistics of output variable value added

Year	Mean	Max	Min
2006	440023759	2195138366	14660452
2007	515338621	2744107950	19743957
2008	635347923	2733603888	22331885
2009	770078631	3587051489	26478542
2010	2432564224	24722574397	20770800
2011	1143238371	4495085038	33709167
2012	1259616149	5406012268	37837094

Source: Author's calculations.

4.2 Malmquist Productivity Change Index Summary of Annual Means

Table 7 summarizes the evolution of the productivity growth in the sector. The table shows that productivity is increased by 1.3 per cent on a geometric average during the period 2006-2012, a total of 9.1 per cent for the period. The growth is mainly due to increase in the technical efficiency by 4.1 per cent per year, 28.7 per cent in total for the period and decline in the catching up by 2.7 per cent per year, 18.9 per cent in total for the period. The main reason for the lower average annual productivity growth is the decline in the productivity by 12.9 per cent in the period 2006-7, 12.7 per cent in the period 2008-9 and 3.1 per cent in the period 2011-2.

Table 7. Malmquist productivity change index summary of annual means

Years	No. of Firms	Malmquist TFP Index (Tfpch)	Technical Efficiency Change (Effch)	Technological Change (Techch)	Pure Technical Change (Pech)	Scale Efficiency Change (Sech)
2006-7	14	0.871	0.935	0.931	0.996	0.939
2007-8	14	1.268	1.181	1.074	1.080	1.093
2008-9	14	0.873	1.177	0.741	1.096	1.074
2009-0	14	1.145	0.546	2.100	0.687	0.794
2010-1	14	1.008	1.582	0.637	1.406	1.125
2011-2	14	0.969	1.136	0.853	1.084	1.048
Geo. Mean		1.013	1.041	0.973	1.036	1.005

Source: Author's calculations.

Note. All indexes are geometric averages.

More specifically, the table shows decrease, increase, decrease, increase, unchanged and decline in the productivity during the periods respectively. The table shows that the productivity is increased in the year 2007-8 by 26.8 per cent which is mainly due to increase in technical efficiency-18.1 per cent and partly due to increase in technological progress-7.4 per cent. Later, in the year 2009-10, the technological progress happened by 110 per cent and

the technical efficiency is declined by 45 per cent. Consequently, the net increase in the productivity is only14.5 per cent. The productivity is about unchanged in the year 2010-2011. On the other hand, the productivity is declined by 13 per cent in the period 2006-07 which is about evenly due to decline in technical efficiency and technological progress. In the period 2008-9, the productivity is declined by 13 per cent mainly due to decline in technological progress. Similarly, the productivity is declined by 3 per cent in the period 2011-2 due to decrease in technological progress by 15 per cent. On a geometric average, the productivity growth for the sector is 1.3 per cent.

4.3 The Malmquist Index for Pharmaceutical Industries

Table-8 summarizes the Malmquist productivity change index and its components summary of firm means over the period 2006-2012. The results show that on a geometric average, the productivity of the pharmaceutical industry is increased by 1.3 per cent which is due to 4.1 per cent increase in efficiency and 2.7 per cent decrease in technical progress. The productivity is decreased in the case of seven industry and increased in the case of seven industry out of fourteen industry in the study. The industry-1's productivity is declined by 2 per cent on the account 3 per cent technological decline and 1 per cent increase in technical efficiency. The maximum productivity gain is 17.4 per cent by industry-10, and the maximum productivity loss is 12 per cent by industry-9. The maximum efficiency gain is 26.2 per cent by industry-10 and the maximum efficiency loss is 6 per cent by industry-9. The highest technological progress is 11.4 per cent achieved by industry-13 and the maximum loss is 7 per cent by industry 4.

Table 8. Malmquist index summary of firm means (2006-2012)

Industry	Malmquist TFP Index(Tfpch)	Technical Efficiency Change (Effch)	Technological Change (Techch)	Pure Technical Change (Pech)	Scale Efficiency Change (Sech)
1	0.979	1.010	0.970	1.036	0.975
2	1.046	1.049	0.997	1.000	1.049
3	1.053	1.110	0.949	1.119	0.992
4	0.894	0.967	0.925	0.966	1.001
5	0.953	1.000	0.953	1.000	1.000

6	1.047	1.065	0.983	1.000	1.065
7	0.987	1.020	0.967	1.005	1.015
8	0.969	0.989	0.979	1.000	0.989
9	0.884	0.936	0.945	0.972	0.963
10	1.174	1.262	0.930	1.187	1.064
11	1.092	1.096	0.996	1.081	1.014
12	1.075	1.118	0.961	1.171	0.955
13	1.109	0.995	1.114	0.999	0.996
14	0.958	1.000	0.958	1.000	1.000
G. Mean	1.013	1.041	0.973	1.036	1.005

Source: Author's calculations.

Note. All indexes are geometric averages.

4.4 Leverage & Productivity

Table 8 shows that the productivity of the seven industries: industry 2, 3, 6, 10, 11, 12, & 13 are increased over the period 2006-2012. The productivity of the seven industries: industry 1, 4, 5, 7, 8, 9, & 14 are decreased over the period 2006-2012. At this stage, the leverage ratios are computed separately to investigate whether leverage contributed in the productivity growth. Table 9 &10 shows that the average total debt ratios of the growth industries are 8.13 per cent, 5.77 per cent, and 4.94 per cent for the year 2007, 2008, and 2009 respectively whereas the average total debts ratios of the declined industries are 20.27 per cent, 18.11 per cent, 12.91 per cent for the year 2007, 2008, and 2009 respectively. The total debt ratios for the productivity declined firms are substantially higher than those of the productivity growth industries.

Table 9. Productivity growth industry debt ratios

Year	Short-term	Long-term	Total Debts
2007	5.649	0.054	8.131
2008	4.551	0.040	5.769
2009	3.719	0.016	4.939
2010	4.098	0.016	5.169
2011	8.277	0.142	13.626
2012	8.728	0.331	13.500

Source: Author's calculations.

Note. All means are geometric averages.

However, the average total productivity ratios for the year 2010, 2011, & 2012 for productivity growth industries are 5.17 per cent, 13.63 per cent and 13.50 per cent respectively and the average total productivity ratios for the year 2010, 2011, & 2012 for

productivity declined industries are 4.54 per cent, 4.89 per cent and 4.34 per cent respectively. Clearly, the leverage ratios are substantial lower for the productivity declined industries than those of productivity growth industries.

Table 10. Productivity declined industry debt ratios

Year	Short-term	Long-term	Total Debts
2007	5.642	7.289	20.273
2008	4.286	1.743	18.105
2009	1.424	1.259	12.908
2010	0.855	2.449	4.536
2011	3.707	0.403	4.889
2012	2.617	0.119	4.337

Source: Author's calculations.

Note: All means are geometric averages.

Thus the leverage ratio of the productivity growth industry are lower for the year 2007, 2008, and 2009 and higher for the year 2010, 2011, and 2012 than those of the productivity declined industry. As a trend, the productivity growth industries having an increasing trend of financial leverage and the productivity declined industries having a decreasing financial leverage ratios.

4.5 The Malmquist Productivity Indices and the Standard Measures of Corporate Performance (ROA, ROE, EPS, ROS & OCFA)

Table-11 shows the correlation coefficients between the Malmquist Productivity Index & its components and the standard measures of corporate performance: *Return on Assets* (ROA, defined as net income divided by total assets), *Return on shareholder's Equity* (ROE, defined as net income divided by total shareholder's equity), *Earning per Share* (EPS, defined as net income divided by no. of outstanding shares), *Return on Sales* (ROS, defined as net income divided by net sales), *Return per Employee* (RPE, defined as net income divided by total number of employees), and *Operating cash flow to total Assets* (OCFA, defined as operating cash flow divided by total assets). The information represented by the Malmquist productivity change index and its components and the standard measures of corporate performance are completely different since the correlation coefficients are very small and hence insignificant. Thus the two types of corporate performance proxy: the Malmquist productivity change index

and its components and the standard measures of corporate performance present different aspects of corporate performance.

Table 11. The correlation coefficients between the malmquist productivity index and the standard measures of corporate performance (ROA, ROE, EPS, ROS & OCFA)

Standard Measures	Malmquist TFP Index	Technical Efficiency Change	Technological Change	Pure Technical Change	Scale Efficiency Change
ROA	0.105	-0.042	-0.072	-0.115	0.083
ROE	-0.069	-0.083	-0.065	-0.072	-0.049
EPS	-0.012	0.033	0.065	-0.061	0.151
ROS	0.224	-0.007	0.152	-0.036	0.038
OCFA	0.283	-0.047	0.119	-0.091	0.054

Source: Author's calculations.

5. Conclusions and the Future Research Directions

This study report presents a report on the study-productivity growth, efficiency change and technical progress of pharmaceutical sector in Bangladesh. The study shows that productivity is increased by 1.3 percent per year over the period 2006-2012. This growth is due to increase in the efficiency by 4.1 per cent per year and decline in the catching up by 2.7 per cent per year. In another way, the productivity of the seven industries out of the fourteen industries is increased and the productivity of the seven industries out of the fourteen industries is decreased over the sample period. Similarly, the productivity is decreased during the 50 per cent of the sample periods. A study of the leverage ratios of the productivity growth and the productivity declined industries shows that there is a mismatch between the leverage ratios of the two groups. Moreover, a relationship study shows that the Malmquist productivity change index and its components and the traditional measures of the corporate performance present different aspects of the corporate performance. The study suggests using the Malmquist productivity change index as a proxy of the corporate performance when checking the effect of changes in the leverage on the performance and effect of performance on the changes in the leverage.

Hope that this study established a useful basis for the future researcher in the field. Based on this study, future research agendas are as follows.

(a) More comprehensive research, by including more samples in time & number of the industry and by using the research design of this study, should be conducted in future on the year every year in order to identify the productivity change index, and the reasons of the productivity changes for the managerial decision making.

(b) Further research should be conducted, by including more samples in time & number of the industry and by using the research design of this study, in order to check one of the research findings-the Malmquist productivity change index & its components and the standard measures of the corporate performance measures present different aspects of the corporate performance. In other words, it will be significant to see the relationship between the Malmquist productivity change index & its components and the standard measures of the corporate performance.

(c) In addition, research should be conducted by including more samples in time & number of the industry and by using the research design of this study, to check the dependence of the leverage on the Malmquist productivity change index & its components and the dependence of Malmquist productivity change index & its components on the leverage by considering the Malmquist productivity change index & its components as the proxy of the corporate performance in order to add new knowledge with the existing knowledge about the effect of the leverage on the firm performance and the effect of firm performance on the leverage.

(d) Finally, this research design should be extended to the other sectors: textile, food & allied products, engineering, pharmaceuticals & chemicals, tannery & leather, information technology, fuel & energy, ceramic and cement of the economy in order to make better productivity management decisions in the sectors. The relationship between the debt ratio and

the Malmquist index & its components of a sector should be compared with the other sectors to develop in-depth understanding. Furthermore, to determine the dependence of the leverage on the Malmquist productivity change index & its components and the dependence of the Malmquist productivity change index & its components on the leverage by treating the Malmquist productivity change index and its components as the proxy of corporate performance. The results of one sector should be compared with the other sectors to develop in-depth understanding.

(e) Finally, the researchers should conduct research on different industrial sectors from the different parts of the world so that in-depth understandings are developed.

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Chapter 4: Performance Relevance of Capital Structure Choices

Abstract

This study identified the reasons behind the discrepancies in the result from the past empirical studies about the affect of the leverage on the firm performance. Most importantly, by using the Malmquist productivity change index & its components as the proxy for the corporate performance/value, the affect of changes in the leverage on the corporate performance/value and the affect of the corporate performance/value on the changes in the leverage are identified. The study also checked the relationship between the changes in the leverage ratios and their squares. The study reveals that the reasons for the discrepancies are the differences in the corporate environments, leverage measures, data analysis techniques, uncommon control variables, performance measures, data issues, market type-bank or market-based economy, and market locations. The the study shows that the changes in leverage and the square of the changes in leverage are very strongly positively correlated, the changes in the leverage do not affect the Malmquist productivity change index and its components. The reserve causality tests show that the Malmquist productivity change index & its component do not affect the changes in the leverage. Hence, it is proved that the changes in the leverage do not improve the corporate performance and the corporate performances do not affect the leverage.

Keywords: malmquist productivity change index, efficiency change, technical change, capital structure, industry performance

1. Introduction

What do we know about the affect of financial leverage on firm performance/value from the empirical work done so far? The empirical studies reported positive, negative, and no relationship (table 2, last column). Consequently, we do not have any unified understanding about the affect of financial leverage on firm performance/value. This study identified the reasons of the discrepancies in the previous studies and proposes a new design that is used in this study in order to identify the affect of financial leverage on firm performance which can be used in the different industries in the different parts of the world so that by comparing the results; unified understanding can be developed in future.

The broad objective of this research is to check the affect of financial leverage on firm performance. In consistent to the broad objective, the specific objectives are: to identified the reasons behind the discrepancies in previous studies, to measure the efficiency score of the sample firm using a non-parametric technique-data envelopment analysis, to conduct a Malmquist productivity analysis to identify the productivity growth, efficiency change and technical change in the corporate sector, to check the affect of changes in leverage on the firm performance, to check the affect of firm performance on the changes in leverage and to suggest future research directions for the productivity improvements.

In order to achieve the objectives, this study uses data from 14 pharmaceuticals companies listed at Dhaka Stock Exchange Limited-the main stock exchange of Bangladesh for seven years: 2006-2012 and The data is collected from the annual reports of the companies reserved at Bangladesh Securities and Exchange Commission library, Dhaka Stock Exchange Limited library, Chittagong Stock Exchange Limited library and University of Liberal Arts library. The data used in this study is mainly book-value based data.

There is no unique variable to represent the performance of the firm. The variables used in the past literature to represent firm performance are return on equity, return on sales, return per

employee, return on total assets, EPS and operating cash flow to total assets. These measures represent partial productivity, hence should not be candidate for the corporate performance. However, this research has used a newer measure called Malmquist productivity chage index and its components as the measure of corporate performance. The Malmquist productivity change index and its components are estimated based on multiple inputs and outputs. Specifically, in this study, productivity change index is determined by using total fixed assets, and wages & salary as input variables and net profit, and value added as output variables. A number of sensitivity analyses are conducted by using different set of inputs and outputs but the results are found unchanged.

Two types of the variables are used in this study to check the dependences: dependent variable and independent variables. In the performance model, the dependent variable is the industry productivity change index and in the leverage model, the dependent variable is the changes in leverage. The affect of changes in leverage on the Malmquist productivity & its components and the affect of the Malmquist productivity & its components on the changes in leverage are checked by using ordinary least squares (OLS) regressions. The control variables are selected from the variables used in determining the determinants of capital structure by Uddin (2015a).

Data envelopment analysis (DEA)-like linear programming problem developed by Färe et al. (1994) is used to estimate the efficiency of the firms. As there is no single indicator of firm performance, the efficiency scores is used to form the Malmquist productivity change index and its components which are used as proxy for the industry performance. The OLS regressions are used to check the affect of the changes in financial leverage on firm performance and the affect of the firm performance on the changes in finance leverage. In the both of the tests, a set of firm characteristics are used as control variables.

This study claims four academic contributions: firstly, this study formed two new models to test the affect of the changes in leverage on the changes in firm performance and the affect of

changes in performance on the changes in leverage. Secondly, this study used the Malmquist productivity change index and its components as the proxy for the corporate performance and tested the two competing hypothesis: efficiency risk hypothesis and franchise value hypothesis. Thirdly, the study provides new evidence from the comprehensive and total data of a corporate sector listed at Dhaka Stock Exchange Ltd. Finally, the design used in this study should be used on data from various economy of the world in order to develop unified understanding on the affect of financial leverage on firm performance.

The rest of the study is organized as under: second section is about capital structure and firm performance: affects of leverage on firm performance and affects of firm performance on leverage, third section discusses the reasons for the discrepancies in the previous studies, fourth section is about the models of the study, Fifth section deals with the results of the study, and final section is about conclusion and future direction based on the study.

2. Capital Structure and Firm Performance

2.1 Affects of Leverage on Firm Performance

The basis of the famous agency cost theory (Jensen & Meckling, 1976) is the difference between the objectives of the managers and the objectives of the shareholders. In details, the shareholders want to maximize the value of the firms but the managers want to maximize their consumptions and benefits. As a result, their objectives are not aligned. To solve the problem, Jensen (1986) argued to use debt as an alignment tool to mitigate the agency costs from the conflict of the shareholders and the managers. Jensen argued that using debt will reduce excess cash. Besides, manager will be under pressure to generate sufficient cash to pay fixed interest payments and instalments of loan or the principal and the interest at a time (Grossman & Hart, 1982). Thus use of debt decreases the possibility of misuse of the fund and perquisites consumption of the managers. Hence, all else equal, leverage affects firm performance positively.

However, if debt is used as capital, conflict between the equity holders and the debt holders can generate underinvestment problem or debt overhang problem when there is a default risk (Myers, 1977). In consistent with Myers, Jensen (1986), and Stulz (1990) showed that debt prevents overinvestment problem however creates underinvestment problem. To minimize these costs, debt should not be used in the capital structure. Hence, all else equal, the affect of leverage on firm performance is negative. Thus the affects of leverage on firm performance may be positive or negative or zero.

2.2 Affects of Firm Performance on Leverage

The reverse causality-efficiency may affects financial leverage. The affects of firm performance on leverage are described by two competing hypothesis: efficient-risk hypothesis and franchise-value hypothesis. Berger and Bonaccorsi di Patti (2006) argued that efficient firms are profitable firms. The profits are as defence against portfolio risk in substituting equity for debt. In addition, it is assumed that efficient firms could minimize the total agency cost and financial distressed/bankruptcy cost substantially. Consequently, as per efficient-risk hypothesis, efficient firms can use more debt. In a sense, efficient-risk hypothesis is a version of the trade-off theory where differences in efficiency enforce the process of reaching at optimal capital structure. Hence, all else equal, efficiency affects leverage positively. This affect is termed by substitution effect.

However, efficient firms are profitable firms and efficient firms may be interested in not to use debt in order to protect economic rent generated from the thread of liquidation for the shareholders (Demsetz, 1973; Berger & Bonaccorsi di Patti 2006). So, in addition to substitution effect, there is an income effect. As a result, as per franchise-value hypothesis, efficient firms use less debt. Hence, all else equal, efficiency affects leverage negatively. Thus efficient-risk hypothesis and franchise-value hypothesis predicts efficiency and leverage relationship in opposite direction. Although it is not possible to identify substitution and income effect separately, our specification can determine which effect dominates the other.

3. Reasons for the Discrepancies in the Results of the Previous Studies

Empirical studies are conducted to determine the affects of leverage on firm performance produced different results (table 2, last column). At the same time, a researcher, after conducting a research, tried to compare the results with the results of the others' studies without minimum base for such comparison. For example, Ofori-Dankwa and Julian (2013) compared their results with Simerly and Li (2000). Their comparison is not correct as their studies are not conducted by using the same variables. By a careful examination, the reasons of the discrepancies in the previous studies are identified and reported in this section. The reasons for the discrepancies are corporate environment, leverage measure, data analysis technique, uncommon control variables, performance measure, data issue, market type-bank or market-based economy, and market location (table 2).

3.1 Measuring Performance

Empirical researchers used four types of variables to measure the firm performance: accounting-based measures, productivity-based measures, market-based measure and non-parametric DEA efficiency score. Firstly, the accounting-based measures are return on equity, return on sales, return per employee, return on total assets, EPS and operating cash flow to total assets. The measures reflect short-term profitability of the firm and fine as the measures of short-term performance of the firm. However, there are several problems of using these measures of performance. The measures do not represent long-term performance and long-term return of the firm. Besides, the measures do not consider all of the agency costs. Moreover, the measures are manipulated by insiders and affected by the accounting practice. Last but not least; the measures should not be used when data is collect from developing country where ethical standard is not high.

Secondly, the productivity-based measures used/suggested to measure performance of the firms are profitability per employee and total factor productivity. The profitability per employee is different for capital-intensive and labour-intensive industries. In addition,

productivity is an end result of multiple inputs, and should not be calculated based one input factor. Hence, the productivity per employee is not a good measure of corporate performance. Total factor productivity or technical productivity is a part of the total productivity, which is because of capital input or labour input and is estimated by using Cobb-Douglas production function, is a measure of firm performance. The measure represents the true long-term growth and forward looking performance of the firm (Hu & Izumida, 2008).

Thirdly, the market-based measure is Tobin's Q-the market value of the assets divided by the replacement costs of the assets. This measure is the indicator of the long-term performance of the firm that shows the long-term growth and forward looking performance of the company. The indicator is widely used as a measure of corporate performance. However, Demset and Villalonga (2001) argued that since the numerator of Tobin's Q is partially due to the intangible assets but the denominator is the replacement cost of the fixed assets, hence, this is not a good measure of corporate performance. In addition, the depreciated book value of the assets is used as the replacement cost of the assets.

Finally, the Efficiency score generated by the non-parametric technique called data envelopment analysis (DEA) is used to measure the corporate performance too. This measure can consider multiple inputs and multiple outputs. The technique DEA has several advantages over regression analysis. Unlike regression analysis, there are no functional form, no dependent & independent variables, no matter of parameter estimates and no error term. In addition, in regression analysis, inefficient branches are compared with the respective average of the branches/ respective branches on the regression line. However, in DEA, inefficient branches are compared with best practice branches. Thus different methods of measuring corporate performance have produced different results.

3.2 Measuring Capital Structure (Uddin, 2015a)

In order to determine the determinants of capital structure, it is important to define capital

structure or financial leverage. The capital structure is the combination of debt and equity (Van Horne, 2002). But the word "Capital Structure" has different meaning to different authors. Leverage measure can be defined in terms of convertible bond, short-term debt, long term debt, and total debt. In addition, Measures of leverage can be defined on the basis of inclusion of total liabilities, total assets, net assets, interest expense, EBIT, and EBITDA. Similarly, leverage can be measured in terms of market valued and book value. Thus, it is noticeable that leverage for the same firm can be different based on the variables used to calculate the financial leverage. Which measure should be used is depending on the objective of the measurement.

In defining leverage and determining the determinants of leverage-book value based leverage should be used for several reasons. Myers (1977) argued for book value as it represents assets in hand and not affected by growth opportunities. In addition, book value does not fluctuate and realistic as corporate finance policy guide. Market value comes from share market. But capital structure is not rebalanced after changes in stock price for the rearrangement costs. However, market value based leverage should be used for convincing following reasons. Market value is consistent with wealth maximization goal of the corporate organization. In addition, market value is also managerially relevant (Welch, 2004). Moreover, book value can be negative but asset cannot be negative. Finally, book value is plug number, and book value is backward looking, but, market value is forward looking. As a result, Barclay, Morellec, and Smith (2006) argued that there is no reason to match the two value.

In consistent with the above discussion, Harris and Raviv (1991) summarize the matters as 'the interpretation of the results must be tempered by an awareness of the difficulties involved in measuring both leverage and the explanatory variables of interest. In measuring leverage, one can include or exclude accounts payable, accounts receivable, cash and other short-term debt. Some studies measure leverage as a ratio of book value of debt to book value of equity, others as book value of debt to market value of equity, still others as debt to market value of

equity plus book value of debt. In addition to measurement problems, there are the usual problems with interpreting statistical results.' The possible measures of financial leverage are discussed in following.

3.2.1 Total Liabilities/Total Assets

This is the broadest measure of financial leverage and could be a measure of what is left for the equity holders at the time of liquidation. However this measure does not tell about the level of risk of bankruptcy in the near future. This measure has some other problems. For example, total liabilities include some liabilities which are not related with financing but are used for transaction purpose. In the same way, pension liabilities arising from labour contact markets influence this ratio. Hence liabilities like accounts pay able, pension liabilities overstate this ratio.

3.2.2 Total Debt/Total Assets

A better measure for financial leverage is total debt to total assets. The liabilities like untaxed reserve and accounts payable do not affect this ratio. As the non-debt liabilities offset some assets which are not considered in this ratio, this ratio as measure of financial leverage is problematic. For example, trade credit level influence this ratio substantially. So, this measure cannot be a true measure of financial leverage. All of the researchers used this ratio as a measure of financial leverage.

3.2.3 Total Debt/Total net Assets

A corrected measure of the above ratio is total debt to total net assets ratio. This ratio is calculated after the adjustment of total assets for non-debt liabilities. This ratio is not affected by trade credit. Total net assets are equal to total assets minus accounts payable minus other liabilities. The ratio is still influenced by assets held against pension liabilities.

3.2.4 Long-Term Debt/Total Assets

Short term debts are used for mainly transaction purpose while long-term debts are used for financing purpose. So, the ratio to measure financial leverage should be long-term debt to total assets. All of the researchers used this ratio as a measure of financial leverage.

3.2.5 Short-Term Debt/Total Assets

Titman and Wessels (1988) and Myers (1977) argued that growing firms should use short-term debts. Flannery (1986) argued that firm borrows short-term, if there is a possibility of improvement in the credit rating of the firm in future. Bevan and Danbolt (2000) finds significant difference in the determinants of corporate capital structure between short-term and long term debt. They also argued that firm chooses short-term as short-term is cheaper than long-term debts. Besides, the author of this paper has observed that many companies in the developing country do not have any long term debt. Graham and Harvey (2001) finds that, in general, credit rating is important in debt decision making but not used in making decision between short-term vs long-term.

3.2.6 Convertible Debt/Total Assets

By issuing convertible debts, firm pays low as coupon rate and lender can convert the debt to equity or cash in future at maturity date. Pecking order theory argues that, because of information asymmetry and transportation cost, companies should use internal fund for financing first, debt second, then convertible debt and equity last. The firms having low credit rating and high growth use convertible debt. Jensen and Meckling (1976), Smith and Warner (1979), and Green (1984) argued that the agency costs of growth opportunities could be minimized if the projects would be financed by convertible debts. Because of the implication of convertible debt financing, in this study capital structure is considered in convertible debt also. The ratio to measure capital structure is convertible debt to total assets.

3.2.7 Debt/(Debt +Equity)

Weston and Brigham (1984) have defined the capital structure as “Capital Structure is the permanent financing of the firm, represented primarily by long-term debt, preferred stock and common equity, but excluding all short-term credit. Thus, a firm’s capital structure is only a part of its financial structure. Common equity includes common stock, capital surplus, and accumulated retained earnings.” Agency theory developed by Jensen and Meckling (1976), Myers (1977) are concerned and based on agency cost of debt, and agency cost of equity. Consequently, a debt to equity ratio is more relevant. But if a company uses zero equity, then the debt to equity ratio becomes infinity. So the modified equivalent ratio is debt to debt plus equity ratio. Ross et al. (2012) used this ratio to explain the relationship between agency cost and increase in debt. In addition, Rajan and Zingales (1995) described the ratio as best for representing past financing behaviour.

The above each ratio should be two based on whether book value or market valued is used in the denominator.

3.2.8 EBIT/I

Aghion and Bolton (1992) considered capital structure in terms of control of ownership and hence the capacity of payment of the interest payment is very important. As a result, a measure of interest coverage is more relevant as a capital structure ratio. The interest coverage ratio is EBIT/I. This ratio is all right if an investment equivalent to depreciation is needed to keep the business on going. The ratio is calculated based on the assumption that short-term liabilities and short-term debt will be renewed. In addition, this ratio is very responsive to income oscillation.

3.2.9 EBITDA/I

If investment equivalent to depreciation is not required for keeping the business on going than

appropriate interest coverage ratio is earning before interest, taxes and depreciation (EBITDA) divided by interest (I). This ratio is also based on the assumption that short-term liabilities and short-term debts will be renewed. This ratio is also very sensitive to earning variation.

At the time of conducting research in corporate capital structure, the researchers should keep the above measures of financial leverage in their minds. Table-1 summarizes measures of capital structure and their definitions.

Table 1. Constructs, indicators of the leverage and definitions of the leverage

Constructs	Indicators of leverage	Definitions of leverage
Capital Structure	TL/TA	Total Liabilities/Total Assets
	TD/TA	Total Debt/Total Assets
	TD/TNA*	Total Debt/Total Net Assets
	LTD/TA	Long Term Debt/Total Assets
	STD/TA	Short Term Debt/Total Assets
	CD/TA*	Convertible Debt/Total Assets
	D/(D/E)	Debt/(Debt + Equity)
	EBIT/I	Earnings Before Interest and Tax to Total Interest Paid
	EBITD/I	EBIT & Depreciation to Interest Paid

Source: Literature Review, *measures not used in this study.

3.3 Environmental Dynamism (Uddin, 2015a)

By using the U.S. data for 700 firms form 46 sectors, Simerly and Li (2000) showed that environmental dynamism is a very important variable in determining the relationship between capital structure and firm performance. They showed that firms having high environmental dynamism should use low level of debt for better performance. On the other hand, firms having low environmental dynamism should use more debts for better performance. They concluded that the relationship between financial leverage and firm performance may be positive, negative or insignificant based on environmental dynamism. However, the findings of Ofori-Dankwa and Julian (2013) are opposite of Simerly and Li. By using the data for 55 firs from Ghana they showed that high environmental dynamism firms should use more debt and low environment dynamism firm should use less debt. They argued that institutional differences are the reasons behind the environmental paradox.

3.4 Data Analysis Technique

3.4.1 Single Equation vs. Simultaneous Equation

The various techniques and model specifications used in the study generated different results. In most of the cases, ordinary least square is used to estimate the parameters by assuming that capital structure is exogenously determined. However, when capital structure is endogenously determined, single equation model can generate biased results. In that case, simultaneous equation and instrumental variables regression will generate better estimates. The general form of the simultaneous equations should be as follows:

$$leverage = f\ (performance, controls)$$

$$performance = f\ (leverage, controls)$$

In addition, there may be no systematic affect of financial leverage on the firm performance. However, a statistically significant result may be found because of unobservable heterogeneity among sectors in the study. In that case, fixed effect method and controlling for specific effects will generate better estimates.

3.4.2 Data Envelopment Analysis vs. Regression Analysis

All though many of the empirical papers used regression to examine the empirical affect of leverage on the firm performance, recently a few papers have used data envelopment analysis. The level of productivity is determined by regression analysis and data envelopment analysis is different. The reasons behind these discrepancies are: Unlike regression analysis, DEA compute productivity score based on multiple inputs and multiple outputs variables whereas regression can consider one dependent variable. Moreover, in the data envelopment analysis, inefficient branches are compared with the best practice branches to compute the productivity scores; in the regression analysis, the inefficient branches are compared with the averages of the branches. Figure-1 presents a hypothetical illustration of productivity analysis by using data envelopment analysis and regression analysis.

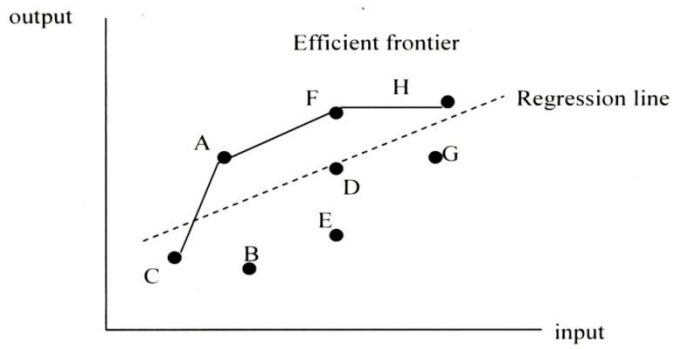

Figure 1. DEA versus regression (Hypothetical illustration)

Source: Lin, Liu, and Chu (2005)

3.5 Uncommon Control Variables

In addition to the variables of leverage and firm performance, different authors used different control variables which can be a cause of producing different results in the analyses. Frank and Goyal (2009) showed that an inclusion of an insignificant variable in the regression equation make a significant variable insignificant. In order to compare the results of the two studies, all of the variables should be the same.

3.6 Data Issues

The data quality, sample/data selection process, objective of the study, source of data, mistakes and biased-ness can be the sources of the discrepancies. For instance, data collected for two sources may produce inconsistent result. In addition, all most all studies collected data from listed companies which are larger than non-listed companies. Furthermore, the data is used from developed country and developing country can produce different results. Because the data collected from different regions-developed and developing may represent the differences in institutional characteristics, legal aspects, regulatory, institutional differences, culture, disclosure levels, and shareholder protection and many other factors.

3.7 Types of Market: Bank-Based/Market-Based

Data collected on the samples from bank-based economy (Anglo-America) and market-based (Japanese-European) generated different results as there are significant different developments in the financial and legal systems of the two national systems of the corporate governance. For instance, block holders and corporate performance are positively related in Continental Europe and East Asian economies whereas the relationships in the market-oriented countries like UK and USA are insignificant. The reasons for the discrepancies in the results of the previous studies are summarized in the Table 2.

Table 2. Summaries at empirical research on the relationship between capital structure and corporate performance

Author	Sample and Period	Data Source	Performance	Leverage	Methodology	Summary at Findings
Simerly and Li (2000)	700 firms, 46 sectors 1988-1992	US Industrial Outlook 94, Compustat, Stern Steward Market Performan -1000 report	ROA, ROI	Long-term debt/equity	OLS	Capital structure may be positively or negatively related based on industrial dynamism. high dynamism-low debt, low dynamism-high debt
Berger and Bonaccorsi di Patti (2006)	US banking industry, 1990-1995	Reports at income and condition (call reports)	Efficiency score	Equity to assets	DEA and Simultaneous equation	Leverage effects performance positively. No evidence at reserve causality.
Ebaid (2009)	non-financial Egyptian listed firms, 1997-2005	Published annual reports	ROA, ROE, Gross pratit margin		Multiple regression analysis	weak-to-no impact
Margaritis and Psillaki (2010)	3 French sectors: Chemical , Textile and Computers, 2002-2005,	Diane data base	Efficiency score	Debt/Assets	DEA and Quartile regression	Positive relationship for whole data set, efficiency effect leverage positively.
Gosh (2012)	1022 NYSE, 244 AMEX firms, 1772 NASDAQ firms, 1985, 1989, 1994, 1999, 2003	Compustat	ROA, ROE, OCF/Assets	D/Assets D/(D+E)	OLS	Negative relationship between capital structure and performance at NYSE firms. no relationship is found between the two variables for NASDAQ firms, AMEX firms
Ofori-Dankwa and Julian (2013)	55 Ghanaian firms, 1996-1999	Ghana Club 100	ROS, practicability per employ	Equity/sales	OLS	Findings at empirical study in developed country may not fully apply in emerging economics. Sometimes may work in opposite direction. stable-equity financing, dynamic debt financing

Source: Literature Survey.

4. The Models of the Study

4.1 The Malmquist Productivity Change Index and Its Components Models (Uddin, 2015b)

4.1.1 Specification of the Model

Determining input and output variables in order to estimate the productivity of the sample firms are one of the biggest challenges of this study because of very limited empirical research in this field. However, Margaritis and Psillaki (2010) used two inputs: labour and capital as input variables and value added as output variables, where the input variables-labour is measured by total labour and capital is measured by fixed assets. The output

variables-value added is defined as net profit plus depreciation and labour cost: wages plus salaries plus benefits. The first part (net profit plus depreciation) is the return to capital (capital, land, and assets) and second component (wages plus salaries plus benefits) is the return to labour. In addition, Berger and Bonaccorsi (2006) used total equity to total assets and return on equity as inputs and output variables respectively. Lin, Liu, and Chu (2005) used assets and equity as inputs variables and operating revenue and net income as output variables in order to assess efficiency of the Taiwan's shipping industry.

Data envelopment analysis is a data sensitive technique. Using more number of inputs and outputs variables make the DMUs unique and less possibility of being compared with the more numbers of best practice branches. As a result, as the number of inputs and outputs variables increases, the possibility of being efficient increases and vice-versa. In addition, sample size variables should be substantially more than number of outputs times number of inputs. Mostafa (2007) indicated that sample size should be more than three times of bigger between number of inputs and number of outputs.

In order to select the inputs and outputs variables for this study, this study considered all of the input and output variables available from the literature survey (Table 3). From the literature survey, seven variables are available as input variables and four variables as output variables. A correlation coefficient analysis is conducted in order to check the multi-colinearity and reduce the number of the variables.

Table 3. Inputs and outputs variables

List of inputs variables	List of outputs variables
• Salary and wages (= labour)	• Value added (= EBIT + dep. + wages & salary)
• Fixed assets (= capital)	• Return on equity
• Total assets	• Operating revenue (= sales)
• Total equity to total assets	• Net income (= net profit)
• Equity	
• Debts	
• Total expenses	

Source: Literature Survey.

Table 4 shows the correlation coefficients of the all possible pairs of the input and output variables. The coefficients show that total fixed assets are strongly correlated with total debt (0.84), total equity (0.96), and total assets (0.97). Among these four variables, total fixed assets is selected as one of the input variables. The variables: wages & salary and total expenses are strongly positively correlated (0.90). Between these two variables, wages and salary is accepted as the second input variable. Finally, for the analysis sample, total fixed assets, and wages and salary are selected as input variables. In the case of output variables, sales or revenue and net profit is strongly positively correlated (0.94). From these two variables, net profit is selected as an output variable. And the second output variable is value added. Thus the input variables are total fixed assets and wages and salary and the output variables are net profit and value added.

Table 4. Correlation matrix for the input and output variables

	TD	*TE*	*TA*	*TFA*	*TE/TA*	*W&S*	*Texp*	*S=R*	*NP*	*VA*	*ROE*
Total Debt	1.00										
Total Equity	0.82	1.00									
Total Asset	0.91	0.96	1.00								
Total Fixed Asset	0.84	0.96	0.97	1.00							
TE/TA	0.22	0.44	0.35	0.36	1.00						
Wages and salary	0.80	0.79	0.83	0.76	0.28	1.00					
Total Expenses	0.78	0.76	0.82	0.75	0.29	0.90	1.00				
Sales = Revenue	0.80	0.81	0.86	0.78	0.29	0.88	0.93	1.00			
Net Profit	0.71	0.83	0.84	0.81	0.33	0.80	0.86	0.94	1.00		
Value Added	0.40	0.56	0.54	0.55	0.23	0.51	0.57	0.63	0.67	1.00	
ROE	-0.18	-0.23	-0.20	-0.21	-0.48	-0.09	-0.08	-0.07	-0.08	-0.06	1.00

Source: Author's calculations.

The ratio variables do not follow convex to the origin characteristics, hence: total equity to total assets is not considered as input variable and for the same reasons return on equity is not considered as output variable in this study. In addition, a sensitivity analysis is conducted by using an alternative combination of variables-total assets and total expenses as input variables and sales or revenue and value added as output variables. The sensitivity analysis has produced the similar results to the main analyses.

At the time of the analyses, it is assumed that for an input variable "less is better" and for an output variable "more is better". The Figure 2 presents that industries in the study uses fixed

assets and salary & wages as the input variables and produces net income and value added as the output variables.

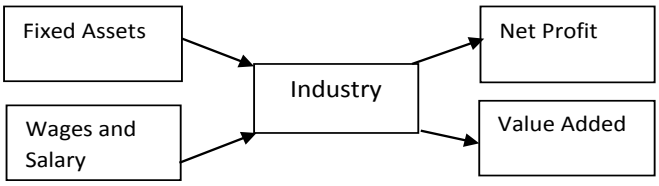

Figure 2. Firm input and outputs

4.1.2 Output Distance Function

The Malmquist Productivity Index can be constructed by one of the two ways: by using the ratios or by using the distance functions. Mlima (1999) constructed the Malmquist productivity index as a ratio of the Malmquist output-quantity index to the Malmquist input-quantity index. As an alternative, the Malmquist productivity index can be constructed by using the distance functions. The use of the distance functions enables consideration of multiple inputs and multiple outputs. In addition, there is no need of the profit maximization or cost minimization assumption when the Malmquist productivity index is constructed by using the distance functions. This study determines the Malmquist productivity index by using the distance functions.

Malmquist productivity index are divided into two: Malmquist input-productivity index and Malmquist output-productivity index. The Malmquist input productivity index is constructed based on the input distance functions and the Malmquist output productivity index is constructed based on the output distance functions. An input distance function describes possible maximum decrease in inputs for a given outputs and an output distance function describes possible maximum increase in outputs for a given inputs level. The value of a distance function is varying between 0 and 1. In this study, Malmquist output productivity index is constructed.

In order to define the distance function, consider, a sample of n DMUs and a production technology that by using x^t input producing y^t output in the time period t = 1…T. For considering multiple inputs and outputs, the inputs and the outputs vectors are considered by using inputs, $x^t\ (x_1^t, - - -, x_n^t)$ the firms produces outputs, $y^t\ (y_1^t, -, y_m^t)$ in the time period t =1…T. Assume, P^t is the output set. Now, in the set builder form, the output set is:

$$P^t(x) = \{y^t/x^t:\ x^t \text{ can produce } y^t \text{ at time t}\} \text{ where, t = 1…T}$$

Shepherd (1970) distance function that is used for the Malmquist output productivity index is as follows:

$$D^t(y,x) = min\{\delta \in (0,1]: (y/\delta) \in P^t(x)\} \qquad t = 1…T$$

The value of the distance function is less than or equal of one i.e., $0 \leq D\ (y\ x) \leq 1$ when y is in the output possibility set, i.e. $y \in P(x)$. The value of the distance function is equal to one, i.e. D(y x) =1 when y is on the frontier line and the value of the distance function is less than one, i.e. D(y x) <1 when y belongs in the other area of production possibility set except on the frontier line. If the value of the distance function is one, the DMUs efficient and otherwise not efficient.

The following Figure 3 is a pictorial presentation of the output possibility set and the distance functions for the firm using one input and producing two outputs.

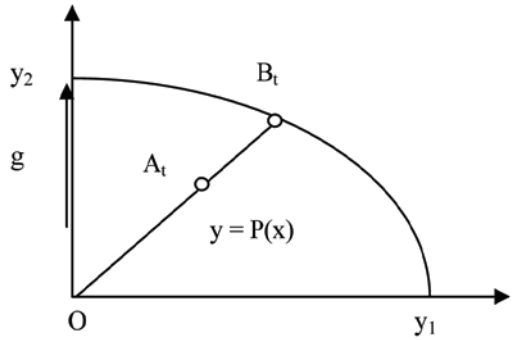

Figure 3. Output possibility set and distance functions

Figure 3 presents a production point and the production possibility frontier of the output-y_1 and y_2. D(y x) indicates the output distance covered by the decision making unit from the production point (O) to the frontier (B_t). The inverse of the D(y x) indicates the proportional increase in the present output (A_t) to reach at the frontier (B_t). By using figure-3, at

A_t: $D^t(y^t x^t) = \frac{OA_t}{OB_t} < 1$, and at B_t: $D^t(y^t x^t) = \frac{OB_t}{OB_t} = 1$. The firm producing output at A_t is inefficient as the point is under the frontier curve. On the other hand, the firm producing at B_t point is efficient as the point is on the respective frontier point. To be efficient, the proportional increase of the present output level (A_t) to reach at frontier lever (B_t) is $\frac{OB^t}{OA^t}$.

Figure 4 shows a production point and a frontier at time t and the production point and the frontier at time (t+1). By using the firms' outputs production points and the frontiers, the distance functions are estimated as follows. $D^t(y^t, x^t) = \frac{OA_t}{OB_t}$, $D^t(y^{t+1}, x^{t+1}) = \frac{OA_{t+1}}{OB_t}$, $D^{t+1}(y^t, x^t) = \frac{OA_t}{OB_{t+1}}$, $D^{t+1}(y^{t+1}, x^{t+1}) = \frac{OA_{t+1}}{OB_{t+1}}$. By using the four distance functions, the Malmquist productivity change index is constructed.

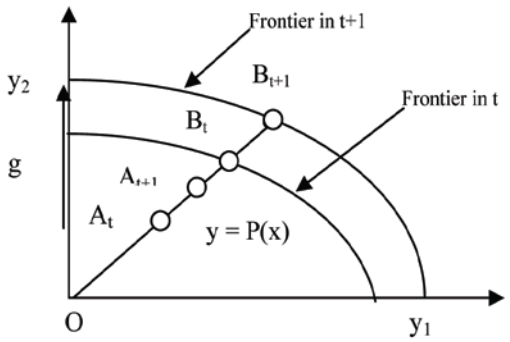

Figure 4. Distance functions and productivity indices

4.1.3 Malmquist Index

Malmquist (1953) proposed to compare the inputs of one period to the inputs of another period in terms of the maximum factor to reduce the inputs of one period subject to the production of the same outputs. This idea is known as Malmquist input index. Later, based on the Malmquist input index, the Malmquist output index is also developed by a researcher.

4.1.4 Malmquist Productivity Index and Its Decomposition

The Malmquist productivity index is used to discover the productivity difference between the two firms or one firm over the two periods of time. Malmquist productivity index is the

geometric mean of the Malmquist index at the period t and t+1. There are two Malmquist productivity indices: input-oriented Malmquist productivity index and output-oriented Malmquist productivity index. An input-oriented Malmquist productivity index is constructed by using input distance functions those describes maximum reduction in inputs by keeping outputs constant and an output-oriented Malmquist productivity index is constructed by using output distance functions those describe in maximum increase in output by keeping inputs constant. In this study, Malmquist output productivity indices are studied.

According to Caves, Christensen and Diewert (1982), the output based Malmquist productivity index between the period t and (t+1) is as equation (1).

$$MPI_0^{t,\ t+1}(y^t, y^{t+1}, x^t, x^{t+1}) = \sqrt{\left[\frac{D^t(y^{t+1},x^{t+1})}{D^t(y^t,x^t)} \times \frac{D^{t+1}(y^{t+1},x^{t+1})}{D^{t+1}(y^t,x^t)}\right]} \quad (1)$$

Where the notation MPI denotes the Malmquist productivity index between the two periods. The superscript (t, t+1) denotes the time periods and the subscript (o) denotes the orientation. The notation D denotes the distance function. Malmquist productivity index is the geometric mean of the two Malmquist index at the period t and t+1. The first ratio under the square root is the Malmquist output index at time t (MI_o^t) which measures changes in the output from period t to period (t+1) by using period t frontier as the benchmark and The second ratio under the square root (MI_o^{t+1}) is the Malmquist output index at time (t+1) which measures changes in the output from period t to period (t+1) by using period (t+1) frontier as the benchmark. In the case of output oriented Malmquist productivity index, the index is equal to zero (MPI=0) indicates no productivity change, the Malmquist productivity index is less than one (MPI<1) indicates productivity decline and the Malmquist productivity index is greater than one (MPI>1) indicates productivity growth.

By rearranging the equation (1), Färe et al. (1989) proposed the Malmquist productivity index as a product of efficiency change and technical change as equation (2).

$$MPI_0^{t,\ t+1}(y^t, y^{t+1}, x^t, x^{t+1}) = \frac{D^{t+1}(y^{t+1},x^{t+1})}{D^t(y^t,x^t)} \sqrt{\left[\frac{D^t(y^t,x^t)}{D^{t+1}(y^t,x^t)} \times \frac{D^t(y^{t+1},x^{t+1})}{D^{t+1}(y^{t+1},x^{t+1})}\right]} \quad (2)$$

In equation (2), the first term in front of the square root is the ratio of the two distance functions measures Farrell (1957) technical efficiency change (Effch) from the period t to the period (t+1). The second term measures technological progress (Techch) from the period t to the period (t+1). In other words, the second term, TC, measures the shift in the frontier. The term Farrell technical efficiency is greater than, equal to, or less than one (Effch (>1, =1, <1)) indicates that the firm is closer to frontier, no change, decline in productivity. The second term, Techch, is greater than, equal to, or less than one (Techch (>1, =1, <1)) indicates that the technological best practice has increased, unchanged, declined.

The Malmquist productivity index of firm-A is illustrated by using the following figure-5, considering one input one output case, assuming constant returns to scale and the equation (2). Grifell-Tatje and Lovell (1997) argued to assume constant returns to scale while estimating Malmquist productivity index as Malmquist productivity index may not capture the resulting gains or losses from scale effect while variable returns to scale is assumed. The hidden reasons are the nature of firm level and the aggregate data.

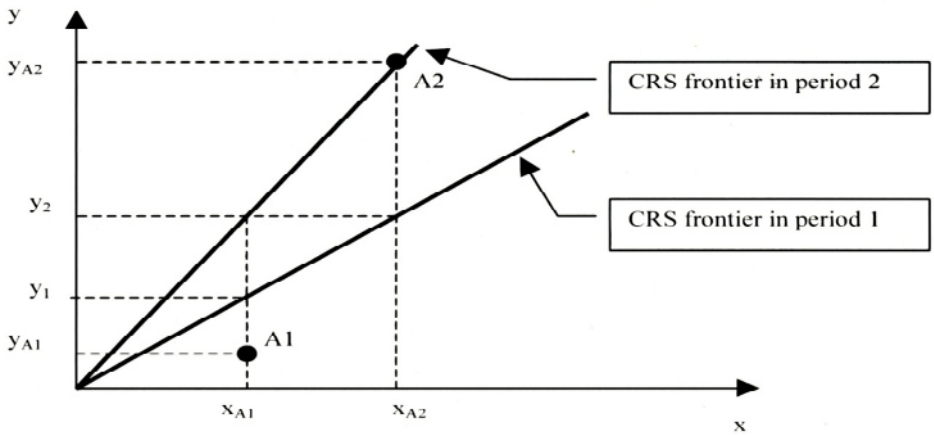

Figure 5. Malmquist productivity index

Source: Kirikal (2005), Kirikal Modified from Coelli, Rao, and Battese (1998).

In the Figure 5, the firm A produces output y by using input x. The firm produces at A1 at time period t and at A2 at time period (t+1). Firm A is inefficient at time t, as the firm is producing at A1, under the frontier line-CRS1. However, the firm A is efficient at time (t+1)

and producing at A2, on the frontier-CRS2. The frontier is shifted upward indicates technical advancement/progress. The technical progress includes two components: a time component and a technological component. By using the Figure 5 and the equation (2), the Malmquist productivity index is as equation (3).

$$M_{1,2}(y_{A1}, y_{A2}, x_{A1}, x_{A2}) = \frac{y_{A2}/y_{A2}}{y_{A1}/y_1}\left[\frac{y_{A1}/y_1}{y_{A1}/y_2} x \frac{y_{A2}/y_2}{y_{A2}/y_{A2}}\right]^{1/2} \quad (3)$$

The Figure 5 shows that Malmquist productivity index of firm A is greater than 1 (MPI>1) which means growth in productivity. The sources and their magnitude to the Malmquist productivity index reflected in the efficiency change (Effch) ratio and technical progress (Techch) ratio. The efficiency change in firm A also greater than 1 (Effch > 1) which indicates increase in efficiency. The technical change is also greater than 1 (Techch > 1), upward ship, indicates technological progress.

A Malmquist Productivity index is calculated for the adjacent period by using the four distance functions: $D^t(y^t, x^t), D^t(y^{t+1}, x^{t+1}), D^{t+1}(y^{t+1}, x^{t+1}),$ *and* $D^{t+1}(y^t, x^t)$. There are many techniques to calculate the value of a distance function. The techniques available for calculating the values of the distance functions can be grouped in two broad categories: mathematical programming and econometric analysis. However, most widely used technique is the linear programming problem. Färe et al. (1994) developed DEA-friendly Malmquist productivity index. This study applies DEA-like distance functions to estimate the Malmquist productivity index.

The relationship among the Malmquist productivity change index, efficiency change, technical change, pure efficiency change, and scale efficiency change are described in the equation (4).

$$\textbf{MI} = \textit{Effch} * \textit{Techch} = \textbf{Pech} * \textbf{Sech} * \textit{Techch} \quad \textbf{(4)}$$

Where, MI or Tfpch stands for Malmquist Productivity Index;

Effch **stands for efficiency change;**

Techch stands for technical change;

Pech stands for pure efficiency change;

Sech stands for scale efficiency change.

Malmquist productivity index is also known as Malmquist productivity change index, Malmquist total factor productivity change index.

4.1.5 Constant and Variable Returns to Scale

An important issue in productivity analysis is returns to scale properties of the production technology. The two most frequently returns to scale properties assumed in productivity analysis are constant returns to scale (Charnes, Cooper, & Rhodes, 1978) and variable returns to scale (Banker, Charnes, & Cooper, 1984). According to constant returns to scale, output will increase according to the increase in the input. For instance, if input is increased by 100 per cent then output will also increase by 100 per cent. On the other hand, in the case of variable returns to scale, when input increases, output increases at first and then decreases according to scale size. In figure-6, according to constant returns to scale, only the decision making unit B is efficient. However, according to variable returns to scale, all the points: A, B, C, and D, are efficient.

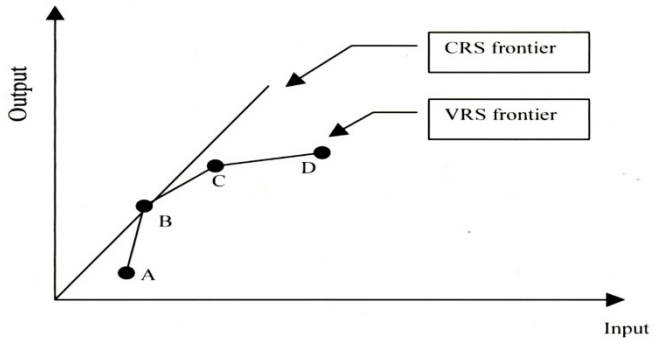

Figure 6. Constant and variable returns to scale

Source: Kirikal (2005), Kirikal Modified from Färe, Grosskopf, and Lovell (1994).

Malmquist productivity analysis can be conducted based on the assumption-production technology follows constant returns to scale or variables returns to scale. However, this study is based on the assumption that production technology follows constant returns to scale. By using one-input, one-output example, Grifell-Tatje and Lovell (1997) showed that total factor productivity is not measured correctly when it is assumed that production technology follows variable returns to scale. This happens because of nature of firm level and aggregate data. Consequently, Malmquist productivity analysis is conducted assuming production technology follows constant return to scale.

4.1.6 Data Envelopment Analysis

Data envelopment analysis is a linear program based program developed and proposed by Charnes, Cooper, and Rhodes (1978) to measure the efficiency of the DMUs those use the similar type of inputs and produce the similar type of outputs. The proposed model is based on the assumption of constant returns to scale and input orientation. The model forms a pair-wise non-linear efficient frontier and DMUs are compared with the frontier to determine the efficiency of the DMUs. However, model based on the various types of returns to scale and orientations are also developed later. Among the models developed later, Banker, Charnes, & Cooper (1984) is the most popular model. However, this study is based on the assumption that production technology follows constant returns because of practible-ness of firm-level and aggregate data.

A Malmquist productivity index for a fair of adjacent period is constructed based on a set of the four distance functions: $D^t(y^t, x^t), D^t(y^{t+1}, x^{t+1}), D^{t+1}(y^{t+1}, x^{t+1}), and\ D^{t+1}(y^t, x^t)$. We should solve total n sets for n sample DMUS. There are many econometric and mathematical methods to estimate the values of the distance functions. However, DEA-Like linear programming problems are used to estimate the values of the distance functions in this study. The following a set of four linear programming problems-output-oriented CRS envelopment model (equation 5-8) are formulated and solved to construct the Malmquist productivity index.

(a) By comparing y^t with the frontier at time t, i. e., determining D^t (y^t, x^t).

$$[D^t(y^t, x^t)]^{-1} = Max\ D \tag{5}$$

subject to

$$\sum_{j=1}^{n} \lambda_j\, x_j^t \leq x^t$$

$$\sum_{j=1}^{n} \lambda_j\, y_j^t \geq Dy^t$$

$$\lambda_j \geq 0, j = 1, \ldots \ldots n$$

(b) By comparing y^{t+1} with the frontier at time t, i. e., determining D^{t+1} (y^{t+1}, x^{t+1}).

$$[D^t(y^{t+1}, x^{t+1})]^{-1} = Max\ D \tag{6}$$

subject to

$$\sum_{j=1}^{n} \lambda_j\, x_j^t \leq x^{t+1}$$

$$\sum_{j=1}^{n} \lambda_j\, y_j^t \geq Dy^{t+1}$$

$$\lambda_j \geq 0, j = 1, \ldots \ldots n$$

(c) By comparing y^{t+1} with the frontier at time t+1, i. e., determining D^{t+1} (y^{t+1}, x^{t+1}).

$$[D^{t+1}(y^{t+1}, x^{t+1})]^{-1} = Max\ D \tag{7}$$

subject to

$$\sum_{j=1}^{n} \lambda_j\, x_j^{t+1} \leq x^{t+1}$$

$$\sum_{j=1}^{n} \lambda_j\, y_j^{t+1} \geq Dy^{t+1}$$

$$\lambda_j \geq 0, j = 1, \ldots \ldots n$$

(d) By comparing y^t with the frontier at time t+1, i. e., determining D^{t+1} (y^{t+1}, x^{t+1}).

$$[D^{t+1}(y^t, x^t)]^{-1} = Max\ D \tag{8}$$

subject to

$$\sum_{j=1}^{n} \lambda_j\, x_j^{t+1} \leq x^t$$

$$\sum_{j=1}^{n} \lambda_j\, y_j^{t+1} \geq Dy^t$$

$$\lambda_j \geq 0, j = 1, \ldots \ldots n$$

Where, $x_j^t = (x_{1j}^t, \ldots., x_{mj}^t)$ is the inputs vector, $y_j^t = \left(y_{1j}^t, \ldots., y_{sj}^t\right)$ is the output vector and t = 1,…..T. Where superscript denotes time period and subscript denotes DMU identity. λ_j is the weight given to the DMU, $1 \leq D \leq \infty$ is proportional increase in the outputs keeping the inputs constant. $0 \leq 1/D\ (=\delta) \leq 1$ is a technical efficiency score.

4.2 The Empirical Models

Two models are formed to check the affect of changes in leverage on the changes in firm productivity/performance which is termed as performance model, the equation (9) and the affect of productivity/performance change index on changes in leverage which is termed as leverage model, the equation (10). In other words, the objective of the performance model is to check the affect of changes in leverage on the Malmquist productivity change index & its components and the objective of the leverage model is to check the affect of the Malmquist productivity change index & its components on the changes in leverage.

4.2.1 Performance Model

The productivity/performance model is formulated as follows:

$$\Delta EFF_{it} = \propto_0 + \propto_1 \Delta LEV_{it-1} + \propto_2 \Delta Z_{1it-1} + u_{it} \quad (9)$$

Where, Δ *EFF* is the productivity/its component change index, Δ *LEV* is the changes in leverage ratio, ΔZ_1 is the changes in vector of the control variables, *it* is the observation value of firm i at time t. *u* is the stochastic error term. The control variables are used from Uddin (2015a).

A term ΔLEV_{it-1}^2 is considered to include in the equation (9) on the understanding that, in the beginning stage when the firm is all equity firm or leverage is lower than optimum, if leverage increases, productivity increases. If the leverage increases, at a point, productivity reaches at the highest level, after the highest level, if the leverage is increases, the productivity is decreases simultaneously. However, the variables ΔLEV_{it-1} and ΔLEV_{it-1}^2 are strongly positively correlated (0.95) and hence ΔLEV_{it-1}^2 not included in the equation.

4.2.2 Leverage Model

The leverage model is formulated as follows:

$$\Delta LEV_{it} = \beta_0 + \beta_1 \Delta EFF_{it-1} + \beta_2 \Delta Z_{2it-1} + \vartheta_{it} \quad (10)$$

Where, $\Delta\ LEV$ is the changes in leverage ratio, $\Delta\ EFF$ is the productivity/its component change index, $\Delta Z_2$is the changes in the vector of the control variables, *it* is the observation value of firm i at time t. ϑ is the stochastic error term. The control variables are used from Uddin (2015a).

In the both model, at the time of estimation, the productivity/its component change index is replaced be the Malmquist productivity change index, technical efficiency change, technological change, scale efficiency change and pure technical change one after another. In the both model, at the time of estimation, financial leverage is replaced by leverage defined in terms of short-term debt, long-term debts and total debts one after another.

5. The Empirical Results

5.1 Correlation Coefficients between the Financial Leverage Ratios (Uddin, 2015a)

Leverage can be defined in many ways based on the objective of the study. Table 5 shows the correlation coefficients of all possible pairs. The table shows that total-debt is strongly positively related with short-term debt (0.82) and moderately positively related with long-term debt (0.54). In addition, EBIT/I and EBITD/I are perfectly correlated (1.00) but EBIT/I and EBITD/I are not correlated with other financial leverage ratios. Thus EBIT/I and EBITD/I and other financial leverage ratios represent different aspects of financing. Total liabilities ratio is not related with any other leverage ratio. Hence should not be a candidate for the financial leverage ratio. Thus based on the correlation coefficients, the leverage ratios can be summarized.

Table 5. Correlation between the leverage ratios

Debt Ratios	*STD/TA*	*LTD/TA*	*TD/TA*	*TL/TA*	*TD/(TS+TE)*	*LD/(LD+TE)*	*EBIT/I*	*EBITD/I*
STD/TA	1.00							
LTD/TA	0.02	1.00						
TD/TA	**0.82**	**0.54**	1.00					
TL/TA	-0.06	-0.07	-0.08	1.00				
TD/(TS+TE)	**0.62**	**0.57**	**0.83**	-0.08	1.00			
LD/(LD+TE)	0.03	**0.91**	**0.50**	-0.06	**0.69**	1.00		
EBIT/I	-0.06	-0.19	-0.16	-0.03	-0.17	-0.17	1.00	
EBITD/I	-0.06	-0.19	-0.15	-0.03	-0.16	-0.17	**1.00**	1.00

Source: Author's Calculations.

5.2 Affects of Changes in Leverage on Malmquist Productivity Change Index and Its Components

Table 6 shows the effect of changes in leverage on Malmquist productivity change index and its components (equation 9 : performance model). The table is based on the 15 OLS regression results. The results of the study show that there is no significant affect of any kind of changes in leverage on the Malmquist productivity change index and its components. So, we can conclude that the changes in leverage do not affect significantly the Malmquist productivity change index & its components.

Table 6. Affects of changes in leverage on malmquist productivity change index and its components

MI/ its Components	ΔLeverage Ratio	P-value	Affect of ΔLeverage Ratio on MI/ its Components
Malmquist TFP Index (Tfpch)	ΔSTD/TA	63.36%	No significant affect of changes in leverage on Tfpch
	ΔLTD/TA	70.01%	
	ΔTD/TA	78.18%	
Technical Efficiency Change (Effch)	ΔSTD/TA	34.51%	No significant affect of changes in leverage on Effch
	ΔLTD/TA	52.80%	
	ΔTD/TA	54.53%	
Technological Change (Techch)	ΔSTD/TA	36.16%	No significant affect of changes in leverage on Techch
	ΔLTD/TA	90.13%	
	ΔTD/TA	69.46%	
Pure Efficiency Change (Pech)	ΔSTD/TA	21.93%	No significant affect of changes in leverage on Pech
	ΔLTD/TA	74.09%	
	ΔTD/TA	31.57%	
Scale Efficiency Change (Sech)	ΔSTD/TA	83.05%	No significant affect of changes in leverage on Sech
	ΔLTD/TA	65.83%	
	ΔTD/TA	69.15%	

Source: Author's Calculations using equation (9) (Performance Model). Control variables are not reported.

5.3 Affects of Malmquist Productivity Change Index and Its Components on Changes in Leverage

Table 7 shows the results of the reverse causality tests- the affect of Malmquist productivity change index & its components on the changes in leverage (equation 10: leverage model). The financial leverage is defined in terms of the short-term debts, long-term debts, and total debts. The affects of the Malmquist productivity change index & its components are checked on the changes in each financial leverage ratio. There are one OLS regression to check the affect of the Malmquist productivity change index or one of its components on one of the financial leverage ratio. Hence, the table-7 is the summary of the 15 OLS regressions. As per the results of the analyses, the Malmquist productivity change index & its components: efficiency change, technical change, pure technical change, and scale efficiency change do not affect financial leverage defined in terms of short-term debts, long-term debts or total debts of the industry.

Table 7. Affects of malmquist productivity change index and its components on changes in leverage

Changes in Leverage Ratio	MI/ its Components	P-value	Affect of MI/its Components on leverage
ΔSTD/TA	TFPCH	36.40%	Changes in MI or its components does not significantly affect changes in short-term debt
	EFFCH	81.40%	
	TECHCH	38.30%	
	PECH	60.40%	
	SECH	67.00%	
ΔLTD/TA	TFPCH	88.80%	Changes in MI or its components does not significantly affect changes in long-term debt
	EFFCH	67.80%	
	TECHCH	86.70%	
	PECH	76.90%	
	SECH	76.80%	
ΔTD/TA	TFPCH	44.40%	Changes in MI or its components does not significantly affect changes in total debt
	EFFCH	35.60%	
	TECHCH	74.10%	
	PECH	19.80%	
	SECH	76.60%	

Source: Author's Calculations using equation (10) (Leverage Model). Control variables are not reported.

6. Conclusion and Future Research Directions

This study identified the reasons of the discrepancies in the previous studies about the affect of the leverage on the firm performance. Moreover, this study tested the affect of the changes in the leverage on the Malmquist productivity change index & its components and the affect of the Malmquist productivity change index & its components on the changes in the leverage. The study also determined the relationship between the changes in the leverage ratios and their squares. The study reveals that the reasons for the discrepancies are the differences in the corporate environments, leverage measures, data analysis techniques, uncommon control variables, performance measures, data issues, market type-bank or market-based economy, and market locations. The study also reveals that the changes in the leverage do not affect the Malmquist productivity change index & its components. In addition, there is no significant reverse causality- the Malmquist productivity change index & its components do not affect the changes in the leverage. Thus capital structure of the pharmaceutical sector of Bangladesh is irrelevant.

This research design should be applied on the data from the other industrial sectors : textile, food & allied products, engineering, pharmaceuticals & chemiacals, tannery & leather, information technology, fuel & energy, ceramic and cement in Bangladesh in order to check the affect of changes in the financial leverage on the Malmquist productivity change index & its components and the affect of the Malmquist productivity change & its components on the changes in the financial leverage. In addition, the future researchers should conduct research on different industrial sectors from the different parts of the world so that the unified understanding in the affect of the changes in the leverage on the Malmquist productivity change index & its components and the affect of the Malmquist productivity change index & its components on the changes in the leverage can be developed.

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Chapter 5: Conclusion and Future Research Direction

This research report is the end result of the three studies on the three related areas of the capital structure. In the short titles, the studies are the corporate capital structure behaviors analysis, the corporate capital structure productivity analysis and the performance relevance of the corporate capital structure choices. The research questions, results, academic contribution, managerial implications of the studies and future research directions are presented as follows.

The first part of the research (research report chapter-2) has reviewed all of the important theories and concepts developed in the corporate capital structures until till date in an aggregate manner. The empirical part has answered important questions like: Can leverage ratios defined by short-term debts, long-term debts, total-debts, debt/(debt+equity), earnings before interest & taxes over interest and earnings before interest, taxes & depreciation over interest be summarized? What is the relationship between book-value based and market-value based leverage? What is the attitude of the companies toward tax payment and research & development expenses? What is the proportion of the short-term debts and long-term debts to the total debts? Can size of the company be represented either by natural log of the sale or natural by log of the assets? Do human capital affects the financial leverage of a company? What are the determinants of the corporate capital structure? etc.

The empirical part of the study reveals that the leverage ratios defined by short-term debts, long-term debts, total debts and book value of assets are correlated. Similarly, the leverage ratios defined by short-term debts, long-term debts, total debts and market value of assets are correlated. However, book value based and market value based leverage ratios are not correlated. The leverage ratios defined by earnings before interest & taxes over interest and earnings before interest, taxes & depreciation over interest are positively perfectly correlated. Besides, short-term loans are three times more compare to long term debts, firms are reluctant in paying tax, allotment in research and development expenses are insufficient, total sales &

total assets can be alternative to be the proxy of the size of the firm and human capital cost do not have effect on any kind of leverage. These empirical evidences are original, significant and deserve to appear in the text book of the corporate finance.

In addition, industry median average, non-debts tax shield, uniqueness (R&D) positively significantly affects financial leverage and size, tangibility, tax rate, dividend pay-out, agency cost, business risk, GDP growth, and money growth negatively significantly affects financial leverage. The selling, general and administrative expenses positively affect short-term debts, negatively affects long-term debts and have no significant effects on total debts.

The second part of the thesis (research report chapter-3) has studied the productivity of the corporate sector in Bangladesh. More specifically, has estimated the Malmquist productivity change index for the corporate sector in Bangladesh, has investigated the reasons of the Malmquist productivity change index, has checked whether the leverage ratios of the productivity growth & the productivity declined industry are the same or different and has determined the relationship between the traditional measures of the corporate performance & the Malmquist productivity change index & its components.

The study shows that productivity is increased by 1.3 percent per year over the period 2006-2012. This growth is due to increase in the efficiency by 4.1 per cent per year and decline in the catching up by 2.7 per cent per year. In another way, the productivity of the seven industries out of the fourteen industries is increased and the productivity of the seven industries out of the fourteen industries is decreased over the sample period. Similarly, the productivity is decreased during the 50 per cent of the sample periods. A study of the leverage ratios of the productivity growth and the productivity declined industries shows that there is a mismatch between the leverage ratios of the two groups. Moreover, a relationship study shows that the Malmquist productivity change index & its components and the traditional measures of the corporate performance present different aspects of the corporate performance.

The last part of the thesis (research report chapter-4) has identified the reasons behind the discrepancies in the result from the past empirical studies about the affect of the leverage on the firm performance. Most importantly, by using the Malmquist productivity change index & its components as the proxy for the corporate performance, the effect of changes in the leverage on the corporate performance and the affect of the corporate performance on the changes in the leverage have identified. The study also has estimated the relationship between the changes in the leverage ratios and their squares.

The study reveals that the reasons for the discrepancies are the differences in the corporate environments, leverage measures; data analysis techniques, uncommon control variables, performance measures, data issues, market type-bank or market-based economy, and market locations. Besides, the study shows that the changes in leverage and the square of the changes in leverage are very strongly positively correlated; the changes in the leverage do not affect the Malmquist productivity change index and its components. The reserve causality tests show that the Malmquist productivity change index & its component do not affect the changes in the leverage. Hence, it is proved that the change in the leverage does not improve the corporate performance and the corporate performance does not affect the leverage. Thus, the thesis achieved its objectives.

The studies provided significant academic and managerial contributions. The academic contributions are: the theoretical integration in the first part; the design for productivity analysis and improvement in second part, and the two new models to test the affect of the changes in leverage on the firm performance & the affect of firm performance on the changes in leverage. The managerial contributions are: the empirical evidences of the first part, the empirical information of the second part and the empirical evidences of the final parts including the leverage irrelevance**.** The academic contributions and the empirical findings of the study deserve to appear in the text book of the corporate finance.

This thesis is the basis for the many researches in the future. Future researchers should retest the empirical findings presented in this research report. In addition, they can conduct the researches by applying the research design of this study to the other sectors: textile, food & allied products, engineering, pharmaceuticals & chemicals, tannery & leather, information technology, fuel & energy, ceramic cement and other sectors of the economy and different parts of the world. The researcher can conduct sensitivity analysis by using the different methods of the analyses for the better understandings. For making the better decisions and for improving the productivity, decision makers should conduct the productivity analysis by using this research design.

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