Does Total Factor Productivity Be an Issue on Corporate Earnings? Evidence from the DSE Listed Pharmaceutical Companies in Bangladesh

Kawsar Jahan[1]
Israt Jabin[2]

Abstract:

This study explores whether total factor productivity matters to change the corporate earnings of manufacturing companies in an emerging economy, Bangladesh. To do this, researchers captured relevant data from the annual reports of 27 DSE-listed pharmaceutical and chemical companies over the period 2012–2021. The key variable, total factor productivity, is estimated by using the Cobb-Douglas production function, which takes into account the contribution of research, development, and technological improvement of pharmaceutical companies to total output rather than the benefit of the number of employees and the company's asset size. The study uses return on assets (ROA) and return on equity (ROE) as the dependent variable to assess corporate earnings (CE). The panel analysis finds that total factor productivity has a significant positive influence on ROA and ROE in both the random effect model and the GMM analysis. The findings announce that pharmaceutical companies with more technological progress are generating a higher profit. In addition, we found that long-term debt ratio, growth, liquidity, firm age and firm size have a significant impact on corporate profitability. This evidence motivates the stakeholders to increase the amount of investment in research and technology, which ultimately develops the innovation of various medicines, vaccines, etc., thereby decreasing imports and finally heightening the economy of Bangladesh by saving valuable foreign currency.

Keywords: Total factor productivity (TFP), Corporate Earnings (CE), Return on Assets (ROA), Return on Equity (ROE).

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1.0 Introduction

Corporate earnings (CE) are an evaluation of a company's capacity to generate cash flow and make good use of the resources in its primary line of business. It is also a

[1] Associate Professor, Department of Accounting and Information Systems, Faculty of Business Studies, University of Dhaka, Dhaka, Bangladesh, Email: kjshumi@yahoo.com
[2] Lecturer, School of Business and Economics, United International University, Dhaka, Bangladesh, Email: israt@bus.uiu.ac.bd

general predictor of a company's long-term financial health, providing a quick picture of the company's fiscal climate and managerial performance. A corporation is considered performing if it is both efficient and effective (Siminica, 2008). 'Performance' is a generic term that denotes a variety of ideas, including growth, profitability, return, productivity, efficiency, and competitiveness (Colase, 2009). Measuring performance has the potential to provide incredibly valuable data that management can use for a variety of purposes, including but not limited to tracking performance, reporting progress, boosting morale, and communicating (Waggoner et al., 1999).

Solow (1957), Kendrick (1961), Dension (1962), Jogerson & Griliches (1967), and Grililiches (1966) provided the foundations of total factor productivity (TFP) that are used to capture the technological improvement of firms. Then Griliches (1966) reviews this intellectual history, focusing on the creation of Solow residuals. Although Solow's (1957) publication is often credited as the starting point for total production factor analysis, there has been a rise in both theoretical and empirical research on the topic in recent years (TFP). Several methodological developments in the literature since the mid-1990s have sparked this fresh interest, and the increasing availability of firm-level data calculates TFP at the level of the individual organization possible (Bartelsman & Doms, 2000; Ackerberg et al., 2007).

This study collected the required information from the annual reports of pharmaceutical companies in Bangladesh. With a market value of around $3 billion, Bangladesh's pharmaceutical business now provides 1.83 percent of the GDP. Bangladesh's pharmaceutical industry meets 98% of the nation's overall medical demand and also exports pharmaceuticals. Bangladesh is in the 71st position out of 134 countries that export pharmaceuticals. According to a survey from the Dublin-based market intelligence and analysis firm's research and markets, the pharmaceutical industry in Bangladesh is predicted to reach $6 billion by 2025, growing by an incredible 114 percent from current levels. Research and development (R&D) expenses are the main motivating force behind any successful new production (Wanget et al., 2013). Thus, huge investment in R&D is quite natural to produce new medicines, vaccines, and other pharmaceutical-related products. The pharmaceutical industry has been deemed the industry that spends a high volume of money to boost its level of production, which increases corporate earnings. That is the broader impulse behind collecting evidence from the pharmaceutical industry.

Among several financial ratios to assess corporate earnings, this paper employed ROA (return on assets) and ROE (return on equity) to explore the relationship between total factor productivity and corporate earnings. Very few studies have explored this relationship. So, we can say that this research will provide very new experimental findings regarding the relationship between firms' corporate earnings

and total factor productivity. The research was able to collect data from 27 DSE-listed companies in the pharmaceutical industry for the consecutive ten years (2012–2021) to examine the impact of TFP on corporate earnings. There are a lot of theoretical and empirical studies on TFP in a global economic environment, but relatively few empirical studies have been done on finding the link between business performance and TFP at the firm level, both at home and abroad. This study will provide empirical evidence to find a significant relationship between the TFP and firm performance.

The rest of the paper is organized as follows: Section 2 provides a literature review; Section 3 formulates hypotheses and specifies models; Section 4 explains data analysis; Section 5 gives insights into the discussion of results; Section 6 provides the concluding remarks; and finally, Section 7 discusses the scope for further studies.

2.0 Literature review

Corporate earnings (CE) depend on a variety of factors, and they differ between nations. However, some studies analyze many countries. For instance, Glancey (1998) employed company characteristics such as size, age, location, inter-industry variations, and growth for Scottish enterprises. Whereas MaçsNunes et al. (2009) looked at size, growth, liquidity, and tangibility in Portugal. At the same time, Yazdanfar (2013) examined the factors that influence the present profitability of Swedish small businesses, including size, age, growth, productivity, delayed profitability, and industry affiliation. Lee (2009) also examined the size, market dominance, capital intensity, promotion, research and development intensities, bad debt proportion, and inventory for 7,000 US public businesses over 20 years.

Total factor productivity (TFP) is important for understanding economic turbulence, economic expansion, and cross-country variations in per capita income. TFP is positively and significantly related to output and labor input over the whole range of business cycle frequencies (Kydland & Prescott, 1982). In light of this discovery, they established the real business cycle (RBC) literature. In the traditional business cycle model, pro-cyclical labor supply and investment spread shocks to the TFP, resulting in output and labor productivity swings at business cycle frequencies with an amplitude similar to the US data. By including unmeasured labor hoarding and/or capacity utilization in the conventional paradigm, further work has included pro-cyclical swings in measured TFP (Burnside et al., 1995; Basu, 1996; King & Rebelo, 1999). In an economy with an overall neoclassical production function, Robert Solow's seminal work from 1956 demonstrated that long-run growth in income per capita must be fueled by increases in TFP.

Solow (1956) showed how significant income-per-capita variations might result from technological differences across nations. According to Klenow & Rodriguez-Clare (1997) and Hall & Jones (1999), large cross-country disparities in the total production

factor have been linked to the majority of the income per capita gap between rich and poor nations. TFP discrepancies across nations may result from disparities in the physical technology utilized by those nations or in the effectiveness of those technologies. Direct estimates of technology adoption for around 75 distinct technologies were compiled by Comin et al. (2006), who demonstrated that cross-country disparities in technology are roughly four times higher than cross-country differences in income per capita.

According to Fiordelisi & Molyneux (2010), the variations in shareholder value within the banking sector are most effectively explained by changes in Total Factor Productivity (TFP). They observed that technological change emerges as the most significant component of TFP influencing the creation of shareholder value in European banking. Kim and Shafi'i (2009) examined the Malaysian manufacturing sector from 2000–2004 and concluded that total factor productivity was mostly driven by technological developments, with decreased technical efficiency acting as a hindrance. Total factor productivity was also found to be affected by scale efficiency and allocative efficiency in their study. Technical efficiency was mostly determined by the quality and level of workers, whereas technical development was linked to elements including foreign ownership, imports, and employee competence.

We found limited theoretical and empirical research on the total production factor (TFP) in a global economic context. There is a dearth of empirical studies examining the relationship between firm performance and TFP at the firm level. According to the study conducted by Dvouletý & Blažková (2022) on 267 Czech high-tech companies over the years 2002–2018, there exists a significant relationship between firm performance and total factor productivity. Their findings also suggest that a successful firm has to achieve a high level of technical progress, be of sufficient size due to the capital intensity in these sectors, and have adequate equity since high indebtedness appears to be an obstacle to achieving higher sales and profits in the Czech high-tech industry. The study also observed that as the industry gets older, it can generate higher sales and profits, which highlights the importance of learning processes in gaining capabilities to succeed in the high-tech market.

Byun et al. (2012) conducted a study to find the impact of total factor productivity on manufacturing companies and observed that TFP contributes to the economic cooperation among Korea, China, and Japan by analyzing their productivity growth and evaluating their relative competitiveness, therefore being useful in establishing promotional strategies.

A few pieces of literature have been found to predict the relationship between TFP and firm performance, and this issue isn't well established yet in Bangladesh. To mitigate this research gap, this study tries to make an effort to find a verifiable relationship between TFP and firm performance. Other than the total factor

productivity of a firm, a firm's performance is affected by a variety of internal and external variables. Therefore, this study aims to explore the impact of some other variables crucial in determining a firm's profitability, such as long-term debt ratio, liquidity, firm age, tangibility, sales growth, NDTS, and firm size. Previous literature provides strong evidence that these factors have mixed impacts on a firm's overall profitability and performance.

3.0 Methodology of the Study

3.1 Data Collection

The empirical data for the study has been derived from DSE-listed pharmaceutical and chemical companies in Bangladesh. Out of 33 pharmaceutical companies, the study was able to collect data from 27 companies spanning ten years from 2012 to 2021 to form a balanced panel data size of 270 firm years. The required information was gathered from each company's annual report and audited financial statements. We used the statistical software STATA and Excel to properly prepare and analyze the data file. To analyze the impact of total factor productivity (TFP) on corporate earnings (CR), this research involved the profitability indicators return on assets (ROA) and return on equity (ROE). The objective of this study is to demonstrate the relationship between TFP and corporate earnings (CR). Hence, TFP is our main explanatory variable. We obtain TFP from the Cobb Douglas production function by dividing the total production by the total input. Total input captures the contribution of the logarithm of the number of employees and the amount of the logarithm of asset size. To enhance the results of the model, the study uses seven other control variables related to firm characteristics, which are: leverage ratio, firm age, growth, liquidity, firm size, tangibility, and non-debt tax shield.

3.2 Explanation of Dependent Variables

Corporate earnings (CE) can be assessed through different metrics or numerical ratios. This research employs accounting-based metrics: return on assets (ROA) and return on equity (ROE). Samad (2022) contends that return on assets (ROA) serves as a prevalent metric for comparing the earnings of corporate enterprises across diverse geographical regions and economic sectors. In our study, ROA is calculated by dividing net income by total assets. It is a metric that illustrates the efficiency of capital invested in an entire asset to generate profits for all investors, including bondholders and stockholders. It demonstrates how efficiently or inefficiently a business uses all its assets, including equipment, cars, and intellectual property, to generate its maximum earnings.

Return on equity (ROE) is another profitability indicator that is mostly useful from shareholders' perspective. It is a financial metric that assesses a company's profitability by comparing its net income to the average shareholder equity employed. It reveals how much money a business makes off of its shareholders' capital. In this

study, ROE is measured by dividing net income by shareholder's equity. Net income rises through profitable sales and service revenue transactions. A higher growth rate achieved through profitable products and prudent expense management leads to an increase in ROE. Scholars such as Chiang and Lin (2011), and Lim and Rokhim (2021) frequently employ ROE as an effective assessment tool to measure CR.

3.3 Discussion of Explanatory Variables and Hypothesis Development

3.3.1 Total factor productivity (Key Explanatory Variable)

In economics, total factor productivity (TFP) serves as a constant to evaluate the impact of worker knowledge changes, technological advancements, and other factors on production. Therefore, a variety of factors influence the increase in output. This research is mainly focused on examining the growth in production attributed to technological progress. Various techniques are available for assessing Total Factor Productivity (TFP), with the Solow residual method, commonly estimated using Ordinary Least Squares (OLS), being one of the simplest. John W. Kendrick initially proposed the Cobb-Douglas production framework, which conceptualizes Total Factor Productivity (TFP) as a weighted average of capital, labor, and raw material efficiency. This research computes TFP by dividing the total output by the average cost of production (cost of capital and labor). The percentage of increased output that is not attributable to a corresponding increase in inputs is known as TFP. Assuming that an economy's entire real output is created by an aggregate production function that, in turn, depends on the total quantity of labor and capital utilized in the economy is the standard starting point for growth accounting. Total production is measured by total sales, and the inputs are the amount of total assets and the number of employees. The Cobb-Douglas production function used in this research is,

$$Y_t = A_t K^{\alpha}_t L^{\beta}_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where Yt denotes total output measured by the quantities of the firm's sales; Kt and Lt are the quantities of input variables total capital and the number of employees, respectively. All three quantities are measured at time t. α and β are the output elasticity of the input variables labor and capital, and At is the constant. The value At is called here TFP and captures the contribution of research and development, technological advancement, and others.

Organizations may boost output without increasing inputs by focusing on increasing At. Gains in At are typically referred to as "technological development" by macroeconomists. Therefore, it is reasonable to assume that rising levels of At are linked to the development of advanced technologies that boost business efficiency. It is only a measure of production efficiency, and it may move up or down due to a variety of factors, such as more or less stringent government rules. TFP is the term most usually used in empirical literature to describe the phenomenon where an

increase in At raises the productivity of all other factors (Whelan, 2021). Accumulating changes in TFP that affect the business's earnings is a superb technique for assessing productivity at the firm level. Dvouletý & Blažková (2022) did their study on 267 Czech high-tech business firms and considered TFP as their prime variable as a determinant of firm earnings. Hence, the key hypothesis of the research is,

H1: There is no significant relationship between total factor productivity and corporate earnings.

3.3.2 Other Control Variables

Long-term Debt Ratio (LTD)

This is a financial measure that looks at how much of a company's funding comes from debt (loans) or how well it can meet its financial obligations. One can gauge a company's ability to repay its debts when they come due by examining its leverage ratio. Since most businesses use a mix of equity and debt to fund their operations, this category of ratios is essential. Many scholars, such as Margaritis & Psillaki's (2010), Cai & Zhang's (2011), Giroud et al. (2012), and Jahan & Tumpa (2020), have utilized the leverage ratio as a significant indicator of company success, with varying results.

Firm age

This paper defined firm age as the number of years of incorporation of the company, even though some believe that listing age should define the age of the company. According to various researchers like Loderer & Waelchli (2010) and Dvouletý & Blažková (2022), firm age significantly impacts company performance.

Growth rate

The term "growth rate" reflects a company's capacity to increase its sales over a certain period. We determine the revenue change by dividing the increase or decrease in sales from the current period by the total sales revenue from the preceding period. Different researchers have used the growth rate to signify its impact on corporate earnings. This includes Lazar (2016), who studied Romanian listed companies over the years 2000–2011 and found that the growth rate has a notable impact on a firm's earnings; Jahan & Tumpa (2020) also discover similar findings about the growth rate.

Tangibility

A tangible asset is related to fixed assets that have a physical form, for instance, a structure, rolling stock, piece of manufacturing machinery, office furniture, and inventory. This paper calculates tangibility as a ratio of net fixed assets to total assets. Distinguished researchers like Lazar in 2016 and Jahan & Tumpa (2020) have demonstrated the significant impact of tangibility on firm success.

Liquidity

Liquidity is used to describe a business's ability to meet its financial obligations when they come due, in line with the conditions of the loans themselves. Having a lot of

liquid assets, including cash and short-term investments, on hand is a sign of high liquidity. The decision about the optimal level of liquid assets involves the trade-off between profitability and risk. To come up with the impact of liquidity on profitability, researchers use different types of liquidity ratios, but the current ratio is the most commonly used. Different practitioners, such as Qasim & Rehman (2011), Chukwunweike (2014), and Hossain & Rashed (2019), use this ratio as a key independent variable.

Firm size

This study uses the logarithm of total sales revenue to denote firm size. Many researchers found a significant relationship between firm size and firm earnings (Opeyemi, 2019; Pervan & Višić, 2012; Jahan & Tumpa, 2021).

Non-Debt Tax Shield

The term 'tax shield' refers to the economic advantage that arises from deducting taxes on a company's net borrowings, leading to tax savings. In this research, Net Debt Tax Shield (NDTS) specifically refers to the financial benefit that arises from the ability to deduct depreciation charges on net fixed assets, leading to tax savings. Deitiana & Robin (2016) discovered that NDTS has a substantial influence on a company's profitability.

Table-1: Explanation of the Dependent and Independent Variables

Functional Variable	Proxy Variables & Symbol	Applied Research	The Empirical Relationship between Dependent and Independent variables
Dependent variable: Profitability	Net income/total assets = (ROA)	Samad, (2022) ; Ahmed Sheikh et al. (2013)	
	Net income/total equity = (ROE)	Lim and Rokhim (2021); Chiang and Lin (2011)	
Independent variable:			
Total factor productivity	Total production/ total input= TFP	Dvouletý &Blažková (2022)	Positive
Long-term Debt Ratio	long term debt/ total assets= (LTD/TA)	Margaritis and Psillaki's (2010);	Positive
		Jahan & Tumpa (2020); , Giroud et al. (2012)	Negative
Firm Age	Ln(current year- year of incorporation)= (LogAge)	Loderer & Waelchli (2010)	Negative
		Dvouletý &Blažková (2022)	Positive

Growth	[Sales(t)-sales(t-1)]/sales(t-1)= (Growth)	Lazar (2016)	Positive
		Jahan, Khasnobish & Bhuiyah (2021)	Positive
Tangibility	Net fixed assets/total assets = (Tangibility)	Lazar(2016)	Negative
		Jahan & Tumpa (2020)	Insignificant
Liquidity	Current Assets/ Current liability = (Liquidity)	khalid, Hossain, and Rashed (2019)	Insignificant
		Qasim, Rehman(2011); chukwunweike, (2014)	Positive
Firm size	ln(Total Assets) = (FSize)	Pervan and Višić, (2012); Opeyemi (2019)	Positive
		Jahan, Khasnobish & Bhuiyah (2021)	Negative
Non-debt tax shield	Depreciation/Total Assets = (NDTS)	TitaDeitiana & Robin (2016)	Positive

Source: Prepared by the authors

3.4 Model Specification

This research introduces a macroeconomic variable in the model to determine the profit earnings of pharmaceutical companies. This new variable, total factor productivity, makes the study unique in capturing technological progress and gives it a new height as research from the perspective of Bangladesh. The main purpose of the model is to investigate the interplay between indicators of corporate earnings and TFP. The study uses a multiple regression model.

$$Y_{it} = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + ... + \beta_k X_{ki} + e_i$$

In this model, Yit is used as the explained variable; α is the regression constant, which describes the average change of Y (the explained variable) considering X1, X2, ..., Xk (all independent variables) at zero; β1, β2, ..., βk denotes the average change of dependent variable Y due to per unit change in explanatory variable X1, X2, ..., Xk; and ei is the random error term. Since the study uses two proxy variables (ROA and ROE), we have two regression models used in this study.

Model 1:

$$(ROA)_{it} = \beta_0 + \beta_1(LTD)_{it} + \beta_2(LogAge)_{it} + \beta_3(Growth)_{it} + \beta_4(Tangibility)_{it} + \beta_5(liquidity)_{it} + \beta_6(FSize)_{it} + \beta_7(NDTS)_{it} + \beta_8(TFP)_{it} + \epsilon_{it} \quad \ldots\ldots(2)$$

Model 2:

$$(ROE)_{it} = \beta_0 + \beta_1(LTD)_{it} + \beta_2(LogAge)_{it} + \beta_3(Growth)_{it} + \beta_4(Tangibility)_{it} + \beta_5(liquidity)_{it} + \beta_6(FSize)_{it} + \beta_7(NDTS)_{it} + \beta_8(TFP)_{it} + \epsilon_{it} \quad \ldots\ldots(3)$$

4.0 Data Analysis

4.1 Results of Summary Statistics

Table-2 displays the summary statistics for proxies of endogenous and exogenous variables. The table shows the mean, standard deviation, minimum, and maximum values of the controlled and control variables during the period 2012–2021 for 270 firm years. The summary statistics of different proxy variables show that the average value of TFP is roughly 1.57 for pharmaceutical firms in Bangladesh. Average profitability is around 6%, as depicted by ROA, and 18% measured by ROE. The average value of the other control variables: long-term debt ratio (leverage ratio), firm age, growth, tangibility, liquidity, NDTS, and firm size is 13%, 3.21, 11.15, 54%, 1.98, 3%, and 21.91, respectively. The long-term debt ratio indicates that pharmaceutical companies on average use 12.6 percent of their total assets as debt in their capital structure. The growth result explains that, on average, sales are growing by 17.15 times higher than the previous year, which is a very positive sign. As measured by the mean tangibility value, pharmaceutical firms typically hold 54% of their assets in tangible form. Companies have a current ratio of 1.98, indicating that they possess adequate liquid assets to cover their current liabilities, aligning closely with the standard value.

Table-2 : Summary Statistics of the Dependent and Independent Variables

Variable	Observation	Mean	Std. Dev.	Min	Max
ROA	270	0.0626	0.1193	-0.8167	0.5365
ROE	270	0.1759	0.5926	-4.9302	6.5873
TFP	270	1.5723	2.4010	0.0389	14.0901
LTD	270	0.1261	0.1292	0.0027	0.6764
Tangibility	270	0.5427	0.2154	0.1024	0.9337
Growth	270	11.524	28.3503	-91.2721	201.673
LogAge	270	3.2090	0.7122	0.6931	4.2047
Liquidity	270	1.9842	1.9768	0.1025	17.6678
NDTS	270	0.0308	0.0246	0.0011	0.1250
FSize	270	21.9068	1.5340	18.2006	25.1846

Source: Calculated by the authors

4.2 Detection of Multicollinearity

We evaluated the data using regression analysis and checked all of its assumptions for accuracy. Some assumptions may be checked beforehand, while others, especially those related to the error term, need to be checked only after the regression model

has been implemented. Multicollinearity occurs when two explanatory variables have a strong correlation (0.80), which is one of the key assumptions (Gujrati, 2004). Table-3 displays the pairwise correlation between variables, from which we can easily identify whether there is any multicollinearity. The results show that TFP and tangibility have the highest negative correlation (-0.602). And the highest positive correlation exists between TFP and ROA, which is 0.591. That means all the pairwise correlation values remain within the range of these two values. TFP has a positive relationship with ROA, ROE, firm age, and NDTS (0.591, 0.389, 0.123, and 0.036, respectively) and a negative relationship with long-term debt ratio, tangibility, growth, firm size, and liquidity (-0.193, -0.602, -0.027, -0.014, and -0.058). The correlation values between independent variables are small enough (far less than 0.80) at both ends (positive and negative) to conclude that there is no multicollinearity concern.

Table-3 : Pairwise Correlation between Explanatory Variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) ROA	1.0000									
(2) ROE	0.3069	1.0000								
(3) TFP	0.5907	0.3887	1.0000							
(4) LTD	-0.2715	-0.0105	-0.1925	1.0000						
(5) Tangibility	-0.2368	-0.1899	-0.6016	0.0978	1.0000					
(6) Growth	-0.0006	0.2826	-0.0266	0.1024	0.0468	1.0000				
(7) LogAge	-0.0233	0.0401	0.1234	-0.2383	-0.2757	-0.1018	1.0000			
(8) Liquidity	0.1123	-0.0489	-0.0582	0.0087	-0.0819	0.0461	-0.0553	1.0000		
(9) NDTS	0.1063	0.0276	0.0355	-0.0983	0.2262	0.0004	-0.3599	-0.0951	1.0000	
(10) FSize	0.1310	-0.0584	-0.0142	-0.1118	-0.1119	0.0607	0.4004	0.3006	-0.3326	1.0000

Source: Calculated by the authors

4.3 Regression Analysis

We conduct a pooled regression at the outset of the econometric analysis for the panel dataset to assess the influence of the key term Total Factor Productivity (TFP) on a firm's value enhancement. The effect of TFP on firm performance, measured by return on assets (ROA), and return on equity is predicted in Table-5 and Table-6 below. Subsequently, the robustness of the pooled regression model against fixed and random effect models is examined through the Wald test and the Breusch-Pagan Lagrange Multiplier test (LM). This study employs ordinary least squares regression to investigate the impact of TFP on business performance. The regression analysis

confirms a significant connection between firm profits and TFP, thereby rejecting the null hypothesis.

The study employs both fixed and random effect models to examine the relationship between individual effects and explanatory factors. The research concludes by selecting the most suitable model between fixed and random effect estimates using the Hausman test. The Hausman test accepts the null hypothesis in the regression model, with a p-value of P(chi2) = 0.4561. This indicates that the random effect is the most acceptable choice since the individual effects (alpha) do not correlate with the independent variables (Brooks, 2002). The variance inflation factor yields a result of 1.58, suggesting a lack of correlation between the independent variables. However, the study also conducts post-estimation tests and finds the value of the modified Wald test as a cross-check of group-wise heteroscedasticity in the error variables. The value of Wald chi-square for return on assets (ROA) and the return on equity (ROE) were found to be (106.18) and (49.44), with a probability value of (0.0000) for both the dependent variable, indicating significant heteroscedasticity. Additionally, the study applies the Wooldridge test to investigate serial correlation in the panel data, and the probability value of the F-statistic suggests the presence of serial correlation. Moreover, applying the Dickey-Fuller test, the study observes the presence of a unit root in most variables, indicating that the regressions were not co-integrated.

Thus, the econometric analysis observed potential issues such as heteroscedasticity, autocorrelation, contemporaneous correlation, and nonstationary problems in the regression model. To address these issues and the endogeneity problem in the explanatory variables with respect to firm performance, the study employs the Two System Generalized Method of Moments (GMM) techniques developed by Arellano and Bond (1991) and Blundell and Bond (1998). This method utilizes instrumental variables to control for endogeneity, with the first-order lagged dependent variable serving as one of the instrumental variables to address autocorrelation, as suggested by Chen and Guariglia (2013). In the context of a dynamic panel, the lagged dependent variable by construction data is correlated with the unobserved cross-section fixed effect and therefore two step System GMM estimation technique has been used to analyze the dynamic panel model. All regressors, including Total Factor Productivity (TFP), Long-Term Debt (LTD), Non-Debt Tax Shields (NDTS), Growth, Tangibility, Firm Size (FSize), Logarithm of Firm Age (LogAge), and Liquidity, are considered endogenous and instrumented using their lagged levels in the equation. The research noted a significant relationship between the data and the lagged dependent variable, indicating autocorrelation in the model. Additionally, the analysis revealed first-order autocorrelation with the dependent variable ROA. Consequently, first-order lagged variables were utilized as instrumental variables to estimate the total earnings (ROA) and (ROE) in two different models.

Table-4 : Test Statistic Value for the validity of Instrument Variable (ROA)

Test Statistic	Value of z	Probability Value
Arellano-Bond test for AR(1) in first differences	z = - 1.44	Pr > z = 0.049
Arellano-Bond test for AR(2) in first differences	z = - 0.57	Pr > z = 0.570
Hansen test of overid. Restrictions	chi2(28) = 17.82	Pr > chi2 = 0.995

Source: Calculated by the authors

The study employed a two-step system GMM analysis, and the validity of the instrumental variable was assessed using the Hansen test statistic. The findings indicated that the instrumental variables of the two-step System GMM were valid, as the study observed that the p-value of AR(1) was significant (<0.05), suggesting first-order serial correlation, while the p-value of AR(2) was insignificant (>0.05), indicating no second-order serial correlation for both regression models considering dependent variables ROA and ROE. To justify the validity of the instrument variable in the two-step GMM system, the study used the Hensen test statistic value. The insignificant value of the test statistic (Hansen test > 0.05) disclosed the overidentification restrictions of the excluded instruments for both the corporate earning proxies ROA and ROE.

Table-5 : Test Statistic Value for the validity of Instrument Variable (ROE)

Test Statistic	Value of z	Probability Value
Arellano-Bond test for AR(1) in first differences	z = -1.83	Pr > z = 0.067
Arellano-Bond test for AR(2) in first differences	z = -0.45	Pr > z = 0.651
Hansen test of overid. Restrictions	chi2(36) = 16.77	Pr > chi2 = 0.997

Source: Calculated by the authors

4.3.1. Regression Results in Estimating Firm's Earnings (ROA)

The following Table-6 demonstrates the regression results in estimating the firm's return on assets. In the pooled regression analysis, seven out of the eight variables were found to have a significant influence on the corporate earnings return on assets (ROA). The table indicates that the long-term debt ratio, growth rate, and firm age have a significant negative impact on firm performance in both pooled regression and random effect models at the 1% and 5% levels of significance, respectively. Additionally, the table shows that total factor productivity (TFP), tangibility, and firm size have significant positive effects on ROA in both pooled and random effect models. The non-debt tax shield is significant only in the pooled regression and liquidity is significant only in the random effect model.

The regression results of the Generalized Method of Moments (GMM) demonstrate the robustness of the analysis, revealing that TFP, growth rate, and liquidity are significant factors for enhancing the return on assets. Total factor productivity has a significant positive association with ROA at the 10% significance level. GMM estimation did not find non-debt tax shields (NDTS), tangibility, long-term debt ratio, and firm age to be significant factors in enhancing firm performance. Importantly, all types of regression analysis consistently observed TFP as a significant factor in increasing ROA.

Table-6 : Different Regression Results in Estimating Firm's Earnings (ROA)

	ROA		
Variables	**Pooled OLS**	**Random Effect Model**	**GMM**
ROA Ll.			-0.024061 (0.0288)
LTD	-0.0188*** (0.0008)	-0.0121*** (0.0036)	-0.085909 (0.004)
TFP	0.0929*** (0.0005)	0.0851*** (0.0109)	0.056391* (0.011)
NDTS	-0.4596* (0.0796)	-0.454 (0.153)	0.9871951 (0.239)
Growth	-0.00032*** (0.00007)	-0.00031*** (0.00044)	0.000933*** (0.00008)
Tangibility	0.2259*** (0.0002)	0.1664** (0.0546)	0.147379 (0.152)
FSize	0.0104*** (0.0131)	0.0136** (0.00085)	-0.0211555 (0.004)
LogAge	-0.0225*** (0.011)	-0.032** (0.062)	-0.0007452 (0.962)
Liquidity	0.0044 (0.121)	0.0029*** (0.0032)	0.025838*** (0.001)
Constant	-0.2399 (0.0861)	-0.2346 (0.119)	0.163855 (0.3561)
Observation	270	270	270
Adjusted R^2	0.505	0.495	
Hausman test		chi2(9)= 0.4913	

*Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1),*

Source: Calculated by the authors

4.3.2. Regression Results in Estimating Firm's Earnings (ROE)

Table-7 below exhibits the regression results in calculating the firm's return on equity.

Table-7 : Different Regression Results in estimating a firm's Earnings (ROE)

ROE			
VARIABLES	**POOLED OLS**	**RANDOM EFFECT MODEL**	**GMM**
ROE L1			-0.0518571 0.000
LTD	-0.00472 (0.876)	0.01296 (0.729)	-0.114123*** (0.003)
TFP	0.192*** (0.000)	0.19577** (0.004)	0.1111201* (0.018)
NDTS	-0.92766 (0.567)	0.0760613 (0.969)	-1.07869 (0.744)
Growth	0.00555*** (0.000)	-0.0057499 (0.0002)	-0.215549*** (0.00001)
Tangibility	0.1437012 (0.552)	0.1313737 (0.689)	-0.4347662 (0.911)
FSize	0.0450662* (0.0831)	0.059221 (0.108)	-0.1467552** (0.04)
LogAge	-0.0533842 (0.338)	-0.0904716 (0.302)	0.03324374** (0.043)
Liquidity	0.005961 (0.744)	-0.00393 (0.944)	-0.0431448 (0.423)
Constant	0.911036* (0.092)	1.125986 (0.138)	1.873755 (0.342)
Observation	270	270	270
Hausman test		chi2(7)= 0.4763	
Adjusted R2	0.524	0.475	

*Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1),*

Source: Calculated by the authors

From the estimates of the Generalized Method of Moments (GMM) for the Return on Equity (ROE) model, it was observed that total factor productivity exerts a significant positive influence on ROE at a 10% significance level. Additionally, among the control variables, firm age demonstrates a significant positive correlation at a 5% significance level, while long-term debt ratio, firm size, and growth exhibit significant negative associations with corporate earnings as measured by ROE. Furthermore, both pooled and random effect models find that total factor productivity, the primary explanatory variable, significantly impacts ROE.

5.0 Discussion of the Results

The key variable in our study, total factor productivity, upon which this research focuses, has a significant positive link with firm performance (ROA and ROE) at the 10% significance threshold. Thus, the study is in line with the results of Devoulety & Blažková's (2022) research on 267 Czech high-tech businesses from 2002–2018. This outcome reveals that if firms enrich their technology and spend more on research and development, their asset size as well as performance also increase. Fiordelisi & Molyneux (2010) observed that technological advancement emerges as the most significant component of TFP, influencing the creation of shareholder value in European banking.

With a long-term debt ratio, ROE exhibits a significant negative relationship in GMM analysis. When pharmaceutical firms use more debt in their capital structure, a large amount of interest is charged as a direct cost against their net profit, which ultimately reduces the profitability rate and returns on assets as well. This finding is consistent with the pecking order theory (Myers & Majluf, 1984), which implies that to compensate for information asymmetry, external users demand a higher return to counter the risk they are taking, therefore reducing firm performance. It indicates that pharmaceutical companies prioritize sound financial management and resort to issuing debt when obtaining external funding is promising. An inverse link between leverage and profits was also discovered in many empirical studies (Rajan &Zingales, 1995; Giroud et al., 2012; Booth et al., 2001; Zou & Xiao, 2006; Jahan & Tumpa, 2020). In contrast, Margaritis & Psillaki (2010) found that leverage enhances the performance of businesses through improved efficiency. They interpreted efficiency as a proxy for lower agency costs resulting from debt holders vs. shareholders' conflict. It suggests that with the increase in debt in the capital structure, several restrictions have been put on the operations of management as debt covenants by lenders. These sets of rules ultimately reduce the manipulation of earnings and misappropriation of assets by management, enhance the efficiency of operations, and improve the performance of businesses.

In our analysis, growth manifests a significant positive relationship with return on assets (ROA) and a significant negative association with return on equity (ROE). The

link between ROA and growth is consistent with the finding of Lazar (2010), who also identified a significant positive relationship between sales growth and firm performance in the context of a Romanian-listed company. The additional earnings from increased sales represent an important factor in improving firm performance. Jahan et al. (2021) found similar results in their study of the Bangladeshi textile industry. Afinindy et al. (2021) found no significant impact of sales growth on firm performance in their analysis of food and beverage companies listed on the Indonesia Stock Exchange. The negative association between growth and ROE can be the reason for aggressive pricing strategies aimed at boosting sales volume, which erode profit margins, ultimately decreasing overall firm profitability. Again, rapid sales growth can strain a company's capacity to meet demand, causing operational inefficiencies and increased costs.

Liquidity presents a significant positive relationship with return on assets. This result is in line with the findings of several researchers (Qasim & Rehman, 2011; Chukwunweike, 2014; Jahan & Tumpa, 2020) and matches the trade-off theory. To achieve optimum profitability, the company must manage its current assets and current liabilities effectively.

According to a study conducted by Dvouletý & Blažková (2022), as companies operating in the Czech high-tech industry get older, they are able to generate higher sales and profits, which refers to the importance of learning processes in gaining capabilities to succeed in the high-tech market. In alignment with this finding, our analysis of the ROE model also finds significant positive results. But it is contradictory with the study of Loderer, & Waelchli (2010), who came to the conclusion that a negative relationship exists between firm age and profitability; when a firm grows older, profitability declines.

Again, this study reveals that firm size has a significant negative relationship with firm performance (ROE). Our finding is compatible with Jahan et al., 2021, where in their study of the Bangladesh textile industry, they found a significant negative relationship between size and performance. However, this relationship is not aligned with the findings of Opeyemi (2019), who discovered that both business size and duration of operation had a significant positive effect on performance. Similar findings have been made by other researchers, such as Pervan and Višić (2012).

Table-8 : Review of Findings

Dependent variable	Explanatory variables	Significant Relationship	Comparison with Previous Studies
ROA & ROE	Total factor productivity (TFP)	Positive	Consistent with Devoulety & Blažková's (2022); Fiordelisi & Molyneux (2010)
ROA	Growth	Positive	Consistent with Afinindy et al. (2021); Lazar (2010); Jahan et al. (2021)
	Liquidity	Positive	Consistent with Qasim and Rehman, (2011); Chukwunweike, (2014); Jahan &Tumpa, (2020)
ROE	Firm Size	Negative	Consistent with Jahan et al., 2021
			Contradict with Opeyemi (2019); Pervan and Višić (2012)
	Long-term debt ratio (LTD)	Negative	Congruent with Giroud et al., 2012; Zou & Xiao, 2006; Jahan &Tumpa, 2020
			Contradict with Margaritis & Psillaki (2010)
	Growth	Negative	Contradict Afinindy et al. (2021); Lazar (2010); Jahan et al. (2021)
	Firm age	Positive	Compatible with the result of Dvouletý and Blažková (2022)
			Contradict with Loderer & Waelchli (2010)

Source: Calculated by the authors

6.0 Concluding Remarks

This study attempted to determine the impact of total factor productivity on corporate earnings from the pharmaceutical industry in Bangladesh, considering ten years from 2012 to 2021. The empirical analysis of the relationship between TFP and firm performance is entirely new in the context of Bangladesh. Only a handful of studies have explored this field globally. So, this study strived to provide empirical validation of the relationship between TFP and profitability. We also aimed to find out the impact of other firm characteristics on firm performance and whether they are consistent with or contradict the findings of previous literature in this field. Here we use profitability measures (ROA and ROE) as the proxy variables for firm performance. To test the association of the explanatory variables with the explained variables, we perform pooled and random effect analyses on both models. With the application of random effect analysis, the research finds that long-term debt ratio, growth, tangibility, firm age, total factor productivity, firm size, and liquidity have significant impacts on firm performance as assessed by ROA. In the random effect analysis of the ROE model, only total factor productivity was found to have a

significant positive impact on ROE. We conduct GMM estimates for both models because of the presence of heteroscedasticity and autocorrelation in the models. This estimate also showed that TFP has a major positive effect on ROA and ROE. In this advanced analysis, among the control variables, growth and liquidity remain to have a significant positive impact on ROA, and long-term debt ratio, growth, and firm size have a significant negative association with ROE. The important point is that our key variable, total factor productivity (TFP), was found to be significant in both the random effect model and the GMM at the 1% significance level. It implies that the first empirical work on the relationship between firm performance and total production factor from the perspective of the Bangladesh pharmaceutical industry reveals a significant positive relationship. This evidence will encourage management to invest more in research and development (R&D) and technological improvements, recognizing technology as a strategic asset. Stakeholders and investors will also gain a better understanding of the importance of TFP to the company's bottom-line performance. This insight will be helpful for future researchers to conduct more vigorous studies in this field. The study underscores the significance of total factor productivity (TFP) growth as a pivotal indicator for guiding long-term decision-making among economists, policymakers, and business managers. By leveraging TFP growth, stakeholders can effectively enhance sustainable economic productivity, foster growth, and improve efficiency within firms, thereby contributing to overall economic advancement. Embracing technological advancements offers numerous benefits, such as fostering innovation and bolstering market competitiveness, which is the key to succeeding in this advanced world of technology and automation. These outcomes, in turn, facilitate sustained economic growth for companies operating in the pharmaceutical and chemical industry of Bangladesh. By prioritizing technology-driven initiatives, firms can capitalize on emerging opportunities and position themselves for enduring success in the ever-evolving business landscape.

7.0 Scope for Further Study

Expanding the scope of research on firm earnings within the pharmaceutical sector in Bangladesh offers a promising avenue for deeper understanding by integrating additional proxy variables such as return on earnings per share, return on capital employed, Tobin-Q, and market value added. Moreover, there's potential to enhance this understanding further by introducing control variables like the standard deviation of cash flow, the standard deviation of sales, and measures of bankruptcy risk. Additionally, incorporating various corporate governance indicators, such as CEO duality, ownership structure, board size, non-executive composition, gender diversity, and audit committee effectiveness, could provide valuable insights into the dynamics of firm performance. Employing advanced econometric techniques can refine the measurement of firm performance, offering a more nuanced perspective. This comprehensive approach not only contributes to the understanding of pharmaceutical companies but also presents an opportunity to replicate the methodology across other

industries in Bangladesh. Textile, fuel, tannery, and engineering sectors, among others, stand to gain from adopting similar analytical frameworks. Incorporating industry-specific factors will be duly considered as a potential area for further investigation. Further research can be done by conducting a cross-country comparison to find a more comprehensive outlook. Applying sensitivity analysis can identify the most suitable model specification, which is an important avenue for future research. Employing stochastic frontier analysis can directly capture technical efficiency and address endogeneity concerns more accurately, making it a promising avenue for future investigation. This would not only enrich our understanding of firm performance but also shed light on the broader dynamics of total factor productivity in the country.

References

Ackerberg, D. C., Lanier B., Steven B., & Ariel P., (2007). "Econometric tools for analyzing market outcomes," in James Heckman and Edward Leamer, eds., *Handbook of Econometrics,* Vol. 6(1), Amsterdam: North-Holland, pp. 4171–4276.

Afinindy, I., Salim, U. & Ratnawati, K., (2021). The effect of profitability, firm size, liquidity, sales growth on firm value mediated capital structure. *International Journal of Business*, Economics and Law, 24(4), pp.15-22.

Bartelsman, E. J. & Mark D., (2000). "Understanding productivity: Lessons from longitudinal microdata*," Journal of Economic Literature*, 38 (3), 569–594.

Basu, S. (1996). Procyclical productivity: increasing returns or cyclical utilization? Quarterly *Journal of Economics 111*, 719–51.

Booth, L., Aivazian, V., Demirguc-kunt, V. & Maksimovic, V. (2001). Capital structure in developing countries. *Journal of Finance*, 56, 87-130.

Brooks, C. (2002). *Introductory Econometrics for Finance*. Cambridge University Press.

Burnside, C., Eichenbaum, M. and Rebelo, S. (1995). Capital utilization and returns to scale In NBER Macroeconomics Annual, ed. B.S. Bernanke and J.J. Rotemberg. Cambridge, MA:MIT Press.

BYUN, T., KIM, K. and CHOI, H. (2012). Comparative Analysis of the Total Factor Productivity of Manufacturing in Northeast Asian Metropolitan Areas. Growth and Change, 43(1), pp.167–177.

Cai, J., Zhang, Z., 2011. Leverage change, debt overhang, and stock prices. *Journal of Corporate Finance 17*, 391-402.

Comin, D., Hobijn, B. and Rovito, E. (2006). Five facts you need to know about technology diffusion. Working Paper No. 11928. Cambridge, MA: NBER.

Chukwunweike, V., (2014). The Impact of Liquidity on Profitability of Some Selected Companies: The Financial Statement Analysis (FSA) Approach. *Research Journal of Finance and Accounting,* Vol. 5, No. 5

Denison, Edward F. (1962). The Sources of Economic Growth in the United States and the Alternatives Before Us, Washington DC, Committee for Economic Development.

Dvouletý, O. and Blažková, I. (2022). Relationship between Firm Total Factor Productivity and Performance: Case of the Czech High-Tech Industry. *International Journal of Entrepreneurial Venturing,* 14(4), p.1. doi:10.1504/ijev.2022.10047629.

Fiordelisi, F., & Molyneux, P. (2010). Total factor productivity and shareholder returns in banking. Omega, 38(5), 241-253.

Giroud, X., Mueller, H.M., Stomper, A., Westerkamp, A., 2012. Snow and leverage. Ivana Blažková Ondřej Dvouletý Ondřej Dvouletý, *Review of Financial Studies*, 2012, Vol. 25, Issue 3, 680-710

Glancey, K. (1998) - Determinants of Growth and Profitability in Small Entrepreneurial Firms, *International Journal of Behaviour and Research,* Vol. 4, No. 1: 18-27

Hall, R. and Jones, C. 1999. Why do some countries produce so much more output per worker than others? *Quarterly Journal of Economics 114*, 83–116.

Jahan, K. & Tumpa, K., (2020). An assessment of financial leverage for listed pharmaceutical firms of Bangladesh. *Daffodil International University Journal of Business and Entrepreneurship,* Vol. 13, No. 2, PP. 19-35.

Jahan, K., Bhuiyah, S. & Khasnobish, T. (2021). Working capital management and Firm's Performance: A Study on Listed Textile Companies in Bangladesh. *The Cost and Management,* ISSN 1817-5090, Vol. 49, No. 5.

Jensen, M., Meckling, W., (1976). Theory of the firm: Managerial behavior, agency costs and capital structure. *Journal of Financial Economics 3*, 305–360.

Kendrick, J. W., (1961). Productivity Trends in the United States, Princeton NJ, Princeton University Press.

Kim, S., & Shafi'i, M., (2009). Factor determinants of total factor productivity growth in Malaysian manufacturing industries: a decomposition analysis. *Asian-Pacific Economic Literature,* 23(1), 48-65.

Khalid, S., Rashed, M. and Hossain, A., (2013). The Impact of Liquidity Risk on Banking Performance: Evidence from the Emerging Market. *Global Journal of Management and Business Research: C Finance*, Vol. 19, issue 4 version 1.

Klenow, P. and Rodriguez C., A. (1997). The neoclassical revival in growth economics: has it gone too far. In NBER Macroeconomics Annual, ed. B. Bernanke and J. Rotemberg. Cambridge, MA: MIT Press.

Kydland, F. and Prescott, E. (1982). Time to build and aggregate fluctuations. *Econometrica 50*, 1345–70.

Lazar, S., (2016). Determinants of Firm Performance: Evidence from Romanian Listed Companies. *Review of Economic & Business Studies*, Vol. 9, Issue 1, PP. 53-69.

Lee, J. (2009). "Does Size Matter in Firm Performance? Evidence from US Public Firms", *International Journal of the Economics of Business,* 16 (2): 189-203.

Lim, H. & Rokhim, R. (2021). "Factors affecting profitability of pharmaceutical company: an Indonesian evidence", *Journal of Economic Studies*, Vol. 48, No. 5, pp. 981-995.

Loderer, C. & Waelchli, U., (2010). Firm age and performance. Munich personal RePEC Archive (MPRA), Paper No. 26450, Posted, 07 Nov 2010.

Margaritis, D., Psillaki, M., (2010). Capital structure, equity ownership and firm performance. *Journal of Banking & Finance 34*, 621-632.

McQuinn, K., Whelan, K., (2006). Prospects for Growth in the Euro Area. Central Bank Research Technical Paper; 12/RT/06, Ireland.

Muritala, T.A., (2012). An empirical analysis of capital structure on firms' performance in Nigeria. *International Journal of Advances in Management and Economics,* 1(5), pp.116-124.

Nunes, P.J.M., Z. M. Serrasqueiro, T.N., (2009). "Profitability in Portuguese Service Industries: A Panel Data Approach", *The Service Industries Journal,* Vol. 29 No. 5: 693-707.

Opeyemi, A., (2019). The Impact of Firm Size On Firms Performance in Nigeria: A Comparative Study of Selected Firms in The Building Industry In Nigeria. Asian Development Policy Review, Vol. 7, No. 1, PP. 1-11.

Orgenson, D. W. & ZviGriliches, (1967). The Explanation of Productivity Change, *Review of Economic Studies*, 34 (July), 249-280.

Pervan, M. & Višić, J. (2012). Influence of Firm Size on Its Business Success. *Croatian Operational Research Review (CRORR),* Vol. 3.

Qasim, S., & Rehman, R., (2011). Impacts of liquidity ratios on profitability. *Interdisciplinary Journal of Research in Business,* Vol. 1 (pp.95-98).

Rajan, R. G. & Zingales, L, (1995). What do we know about capital structure? Some evidence from international data. *Journal of finance, 50(5),* 1421-1460.

Rachagan, S., Terpstra-Tong, J., Terpesta, R. & Mahenthiran, S., (2013). Intangible Factors Influencing Firm Performance in Developing Countries: Malaysia Evidence. American Accounting Association (AAA) Conference 2013 - Anaheim, United States of America.

Rehman, M. & Khidmat, W., (2013). Impact of liquidity and solvency on profitability: chemical sector of Pakistan. *Economika Management Inovace*, Vol. 6, issue 3, 2014

Samad, S., (2022). Unravelling Factors Influencing Firm Performance: Evidence from the SMEs in Tourism Industry. *International Journal of Financial Studies*, 10(3), p.77.

Solow, R. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics 70(1),* 65–94.

Solow, R., (1957). Technical change and the aggregate production function. *Review of Economics and Statistics 39,* 312–20.

Deitiana, T., M; Robin, (2016). The Effect of Firm Size, Profitability, Tangibility, Non-Debt Tax Shield and Growth to Capital Structure on Banking Firms Listed in Indonesia Stock Exchange from 2007 – 2012. *South East Asia Journal of Contemporary Business, Economics & Law,* Vol. 10, Issue 1 (Aug.) ISSN 2289-1560.

Waggoner, D., Neely, A., & Kennerley, M., (1999). The forces that shape organizational performance measurement systems. An interdisciplinary review. *International Journal of Production Economics,* Volumes 60–61, (pp. 53-60).

Dodge, Y., (2008). The Concise Encyclopedia of Statistics (Springer Reference), 2010th edition.

Yazdanfar, D., (2013), "Profitability determinants among micro firms: evidence from Swedish data", *International Journal of Managerial Finance,* Vol. 9, No. 2: 150-160.

Zou, H. & Xiao, J. Z. (2006). The financing behavior of listed Chinese firms. *The British Accounting Review,* 38(3), 239-258.

Appendix

Table-9 : Results of Hausman test

Chi – Sq. Statistic	Value of Chi – Sq. Statistic	Prob>chi2	Appropriate Model
chi2(7) (ROA)	6.71	0.4596	Random effect Model
chi2(7) (ROE)	6.84	0.4452	Random effect Model

Table-10 : VIF index for the model ROA & ROE

Variable	VIF	1/VIF
Tangibility	2.49	0.402097
TFP	2.41	0.414861
NDTS	1.45	0.687336
FSize	1.45	0688090
LogAge	1.44	0.693227
Liquidity	1.18	0.850132
LTD	1.13	0.881770
Growth	1.08	0.928726
Mean VIF	1.58	