

Impact of firms' size, leverage, and net profit margin on firms' profitability in the manufacturing sector of Bangladesh: An empirical analysis using GMM estimation



^{a, e*} Hasibul Islam, ^{b, e} Junaid Rahman, ^{c, e} Tipon Tanchangya, ^d Mohammad Aminul Islam

^a Department of Business Administration, North Pacific International (NPI) University of Bangladesh, Bangladesh, ^b Department of Finance, University of Chittagong, 4331, Bangladesh, ^c Department of Finance, University of Chittagong, 4331, Bangladesh, ^d Department of Civil Engineering, Uttara University, Dakka, Bangladesh ^e Quantitative Finance Research Center, Bangladesh

ARTICLE INFO

Keywords:

Return on assets
Net Profit margin
Leverage
Firms' size

ABSTRACT

The study investigated the factors that influence the return on assets (ROA) of manufacturing firms in Bangladesh. The study relied on secondary data sourced from the audited annual reports of 15 leading manufacturing firms in Bangladesh, covering a period of ten years from 2013 to 2022. The sample firms were selected based on their listing on the Dhaka Stock Exchange (DSE)-30 and Chittagong Stock Exchange (CSE)-30 indices and their status as leading firms in the manufacturing sector using the purposeful sampling method. The study employed the one-step generalized method of moments (GMM) estimator to analyze the data, addressing the presence of endogeneity and heteroskedasticity. The results of the study indicated that the natural logarithms of net profit margin (NPM) and total sales (TS) have a significant positive relationship with ROA, while the natural logarithm of total assets (TA) has a significant negative relationship with ROA. However, the study did not find any significant relationship between the leverage ratio (D RATIO) and ROA. The lagged value of the dependent variable (L) was also found to be insignificant. The study's findings suggest that firms can enhance their ROA by improving their profitability and increasing their sales while avoiding excessive growth in their asset base. Additionally, larger firms may face diseconomies of scale that reduce their profitability. However, the lack of a significant relationship between leverage and ROA is somewhat surprising, and further research is needed to better understand the relationship between leverage and ROA in different contexts. Overall, the study utilized a rigorous data collection approach to ensure the reliability and validity of the data used for analysis, providing accurate results that can be relied upon for making informed decisions.

1. Introduction

A firm is an entity that refers to a business or organization that has attained stability, financial security, and a strong foothold in the market. The term "manufacturing firm" is used to denote an enterprise that transforms raw materials, components, and parts into finished goods that are suitable for consumer use. The primary objective of a firm is to maximize profits, and the remaining amount after deducting all relevant expenses from earnings constitutes the profit. A firm's viability and longevity hinge on its ability to generate a substantial amount of profit. According to [Hakim et al. \(2023\)](#), profitability is a crucial indicator of managerial success, shareholder satisfaction, investor attraction, and business sustainability. There is a positive relationship between profitability and firm performance, as noted by [Olugbode et al. \(2008\)](#). The profitability of a firm is influenced by several factors, including firm size and leverage. Evaluating firm size is primarily based on total assets, number of employees, and sales. [Abeyrathna & Priyadarshana \(2019\)](#) have measured firm size using both total assets and sales. Total assets include cash and cash equivalents, receivables, inventory, property, plant, and equipment, as well as intangible assets, while sales represent a company's total revenue from goods and services sold. A larger total asset and sales indicate a larger firm. In contrast, the firm's leverage is the ratio of its total debt to total assets, which measures the company's financial risk and its ability to meet its obligations with its own capital. Companies with high leverage ratios tend to have high debt levels in their capital structure. This high level of debt can prevent a company from distributing dividends to shareholders because it must use its profits to pay off its debt. Therefore, companies must balance taking on and paying off debt.

Previous research has examined how firm size and leverage affect firm profitability, with varying results depending on the country and industry. For instance, [Babalola \(2013\)](#) and [Ozcan et al. \(2017\)](#) found that firm size, measured in terms of total sales or total assets, has a positive impact on profitability. Similarly, [Rahman et al. \(2020\)](#) and [Afolabi et al. \(2019\)](#) found that leverage influences profitability.

* Corresponding author. E-mail address: hasibulislamshanto143@gmail.com (H. Islam).

Received: 02 April 2023; Received in revised form 27 April 2023; Accepted 02 April 2023

<https://doi.org/10.58251/ekonomi.1275742>

However, [Abeyrathna & Priyadarshana \(2019\)](#) found that firm size has no significant impact on profitability. Bangladesh is an emerging economy in South Asia with a GDP of \$460.8 billion and is ranked as the 35th largest economy in the world ([Bintara, 2020](#)). As a developing country, it is attracting local and foreign investors, with increasing foreign direct investment flows. Bangladesh has diverse industries that contribute to its economic development and play a vital role in achieving sustainable development goals (SDGs). The manufacturing industry is one of the industries that is playing a vital role in growing the economy. Manufacturing firms in Bangladesh have been essential to the country's economic growth and development over the last two decades. Bangladesh has a highly diversified manufacturing sector, producing a wide range of products. The sector has grown significantly, driven by increased demand for locally produced goods, a growing population, and improvements in infrastructure. The sector currently accounts for just under a quarter of the country's GDP and employs millions of people. The industry is dominated by small and medium-sized firms, with the majority of the workforce employed in the informal sector. In recent years, the industry has seen increasing investment from both local and foreign companies, creating new opportunities for growth and job creation. As Bangladesh continues to modernize and develop, the manufacturing sector is expected to remain a key contributor to economic growth. Researchers have made several attempts to examine the impact of leverage and firm size on firm profitability. However, the results of the previous examination differed across nations and industries. The study of the impact of leverage and firm size (TA and TS) on profitability (ROA and NIM) in emerging countries, including Bangladesh, is limited. Therefore, we address the research gap by investigating an empirical study of the impact in the context of manufacturing industries in Bangladesh.

The objective of this research paper is to investigate the relationship between the size and leverage of firms and their profitability. More specifically, we aim to analyze the impact of four key variables, namely net profit margin (NPM), leverage (measured by the debt ratio), total assets (TA), and total sales (TS), on return on assets (ROA), a significant performance indicator for firms. Our study seeks to provide a more in-depth understanding of how these variables relate to firms' profitability and to explore the potential differences in their effects across different industries and countries. The findings of this research will help managers and investors make more informed decisions regarding firm performance and financial stability.

The study is divided into several sections. The literature review and the formulation of hypotheses are presented in the next section. Section 3 covers the variable selection and conceptual framework. Section 4 covers the data and methodology used in the study. Section 5 provides the results of the analysis (descriptive and correlational, endogeneity and heteroscedasticity), the Generalized Method of Moments (GMM) estimator, as well as a summary of the hypothesis testing. In Section 6, the findings are discussed. The conclusions are presented in Section 7. Finally, Section 8 covers the policy implications.

2. Literature Review

The manufacturing sector plays a crucial role in the economic growth and development of countries worldwide, including Bangladesh. Studies have shown that the return on assets (ROA) of manufacturing firms is a key indicator of their financial performance and overall success. Several factors have been identified in the literature as determinants of ROA, including profitability, sales, leverage, and asset efficiency ([Ullah et al., 2019](#)). Net profit margin (NPM) has been identified as a key determinant of ROA, as it reflects a firm's ability to generate profits from its sales. Total sales (TS) have also been found to have a significant positive relationship with ROA, indicating that firms with higher sales tend to generate higher returns. On the other hand, the total assets (TA) of a firm may have a negative impact on its ROA, as larger firms may face diseconomies of scale that reduce their profitability. However, leverage, as measured by the debt ratio (D ratio), has been found to have mixed results in the literature, with some studies showing a negative relationship with ROA and others finding no significant relationship ([Ullah et al., 2019](#)). Overall, the literature suggests that ROA is influenced by several factors in the manufacturing sector of Bangladesh, including profitability, sales, leverage, and asset efficiency. However, there is still a need for further research to better understand the determinants of ROA in this context, particularly in light of the unique challenges faced by firms operating in the Bangladesh manufacturing sector. Several research studies have been carried out to investigate the causal relationships between economic growth, financial development, international trade, and expenditure. Notable among these studies are the works of [Işık, et al. \(2017\)](#), which explored these relationships and the study by [Işık \(2011\)](#) on the competitive advantage of investing in information technology for modern economies. Furthermore, [Işık, et al. \(2019\)](#) conducted research on the effectiveness of the economic policy uncertainty index and its potential impact on the performance of the tourism industry and the overall economy of a country. In the following sections, we present our arguments regarding the association between firms' size, net profit margin, leverage, and return on assets.

2.1. Net Profit Margin and Return on Assets

Net profit margin (NPM) and return on assets (ROA) are two widely used financial metrics for evaluating a company's financial performance. NPM measures the profitability of a company by calculating the percentage of profit earned on each dollar of revenue, while ROA measures how efficiently a company uses its assets to generate profit. The literature on NPM and ROA is extensive, with numerous studies focusing on the relationship between these metrics and a company's financial performance. [Putry \(2013\)](#) conducted an investigation into the impact of three variables—current ratio (CR), total assets turnover (TATO), and net profit margin (NPM)—on return on assets (ROA) for companies listed on the Indonesia Stock Exchange (IDX) from 2009 to 2011. The study revealed that net profit margin (NPM) had a significant effect on return on assets (ROA). Similarly, [Pranata \(2014\)](#) conducted research into the relationship between total asset turnover, non-performing loans, net profit margin, and return on assets, either simultaneously or partially, and found that the variable of net profit margin had an effect on return on assets, whether analyzed simultaneously or partially.

H1: There is a significant positive association between net profit margin (NPM) and return on assets (ROA).

2.2. Leverage and Return on Assets

Leverage and return on assets (ROA) are two important financial metrics that are commonly used to evaluate a company's financial performance. Leverage, measured by the debt-to-assets ratio (D Ratio), reflects the amount of debt a company uses to finance its operations, while ROA measures how efficiently a company uses its assets to generate profit. The literature on leverage and ROA is extensive, with numerous

studies examining the relationship between these metrics and a company's financial performance. AlGhusin (2015) conducted a study to examine the relationship between financial leverage, Company's Growth, noncurrent/total assets ratio, firm's Size as independent variables and profitability in Proxy of Return on Assets ratio (ROA) as the dependent variable. The study found a significant positive effect of leverage on profitability. Nugraha et al. (2020) also investigated the effect of leverage and liquidity on the financial performance of companies in the property and real estate subsector in Indonesia and found that leverage, specifically the debt-to-assets ratio, had a partially influential effect on company financial performance, i.e., return on assets and liquidity financial performance. Kartikasari & Merianti (2016) focused on investigating the impact of leverage and firm size on the profitability of public manufacturing companies in Indonesia and found that the debt ratio had a significant positive effect on profitability, i.e., return on assets. Furthermore, Ullah (2019) examined the impact of financial leverage on the profitability of fertilizer companies in Pakistan and found that financial leverage had a significant negative impact on the profitability of fertilizer companies in Pakistan.

H2: There is a significant positive association between leverage (D ratio) and return on assets (ROA).

2.3. Total Assets and Return on Assets

Total assets (TA) is an important financial metric that measures the total value of a company's assets, while return on assets (ROA) measures how efficiently a company utilizes its assets to generate profits. The relationship between the logarithm of total assets (LnTA) and ROA has been extensively researched in the financial literature. In a study conducted by Irman & Purwati (2020), the impact of the current ratio, debt-to-equity ratio, and total asset turnover on return on assets was examined for automotive and component companies listed on the Indonesia Stock Exchange for the period 2011–2017. The study found that total assets had a significant positive effect on return on assets. Diaz & Pandey, (2019), investigated the factors affecting the return on assets of US technology and financial corporations and reported that total assets had a positive relationship with return on assets. Kartikasari & Merianti (2016) also explored the effect of leverage and firm size on the profitability of public manufacturing companies in Indonesia and found that total assets had a significant negative impact. Additionally, Babalola (2013) conducted a study on the effect of firm size on firm's profitability in Nigeria and found that firm size, in terms of total sales, had a positive impact on the profitability in terms of return on assets of manufacturing companies in Nigeria.

H3: There is a significant positive association between the log of total assets (TA) and return on assets (ROA).

2.4. Total Sales and Return on Assets

Total sales (TS) is an important financial metric that measures the total revenue generated by a company, while return on assets (ROA) measures how efficiently a company utilizes its assets to generate profits. The relationship between the logarithm of total sales (LnTS) and ROA has been examined in the financial literature. Babalola (2013) conducted a study on the impact of firm size on the profitability of manufacturing companies in Nigeria and concluded that firm size, measured in terms of total sales, has a positive effect on profitability, as measured by return on assets. Similarly, Ozcan et al. (2017) investigated the relationship between firm size and profitability and found that total sales had a positive impact on firm profitability. In another study, Sritharan (2015) examined the relationship between firm size and profitability in Sri Lankan hotel and travel sector firms listed on the stock exchange and reported a positive association between firm size and profitability, as measured by return on assets.

H4: There is a significant positive association between the log of total sales (TS) and return on assets (ROA).

3. Variable Selection and Conceptual Framework

3.1. Dependent Variable

3.1.1. Return on Assets

Return on assets (ROA) is a financial ratio that measures a company's profitability by calculating the amount of profit generated per dollar of assets. It is calculated by dividing net income by total assets (Helfert, 2001). ROA is a commonly used measure of a company's financial performance, as it reflects the efficiency with which a company is utilizing its assets to generate profits (Hill & Jones, 2014). Several studies have used ROA as a dependent variable to examine the impact of various independent variables on a firm's profitability. For instance, Rahman et al. (2020) investigated the relationship between leverage and ROA at Bangladeshi manufacturing firms. They found that leverage has a significant negative impact on ROA. Similarly, Nireesh & Thirunavukkarasu (2014) examined the impact of firm size and leverage on the financial performance of Sri Lankan manufacturing firms, using ROA as the dependent variable. They found that firm size has a positive impact on ROA, while leverage has a negative impact. Therefore, in this research paper, ROA is selected as the dependent variable to examine the impact of independent variables, such as net profit margin (NPM), leverage (D Ratio), total assets (TA), and total sales (TS), on a firm's profitability. The selection of ROA as a dependent variable is based on its importance in measuring a company's financial performance and its previous use in similar research studies.

3.2. Independent Variables

3.2.1. Net Profit Margin, Leverage, Total Assets, Total Sales

Net profit margin (NPM) is the ratio of net profit to total revenue and measures a company's profitability on a per-dollar-of-revenue basis (Petty et al., 2015). Leverage (D Ratio) measures the extent to which a company's operations are financed by debt and is calculated as the ratio of total debt to total assets. Total assets (TA) are the sum of a company's current and non-current assets, representing the total value of assets owned by a company. Total sales (TS) represent the total revenue generated by a company from its business operations. These independent variables are commonly used in research studies to analyze their impact on a firm's financial performance. For instance, Nguyen & Nguyen (2020) examined the impact of NPM, D Ratio, TA, and TS on the financial performance of Vietnamese listed firms. They found that NPM, TA, and

TS have a positive impact on a firm's financial performance, while D Ratio has a negative impact. Similarly, Ongore & Kusa (2013) analyzed the impact of NPM, D Ratio, and TA on the financial performance of Kenyan commercial banks. They found that NPM and TA have a positive impact, while D Ratio has a negative impact.

Therefore, in this research paper, NPM, D Ratio, TA, and TS are selected as the independent variables to examine their impact on a firm's profitability, as they are commonly used in similar research studies and have been found to have a significant impact on financial performance in previous studies.

3.3. Conceptual Framework

The development of a conceptual framework is based on a thorough review of the existing literature, and the hypotheses formulated in the literature review section are deemed to be consistent with the underlying principles of the conceptual framework.

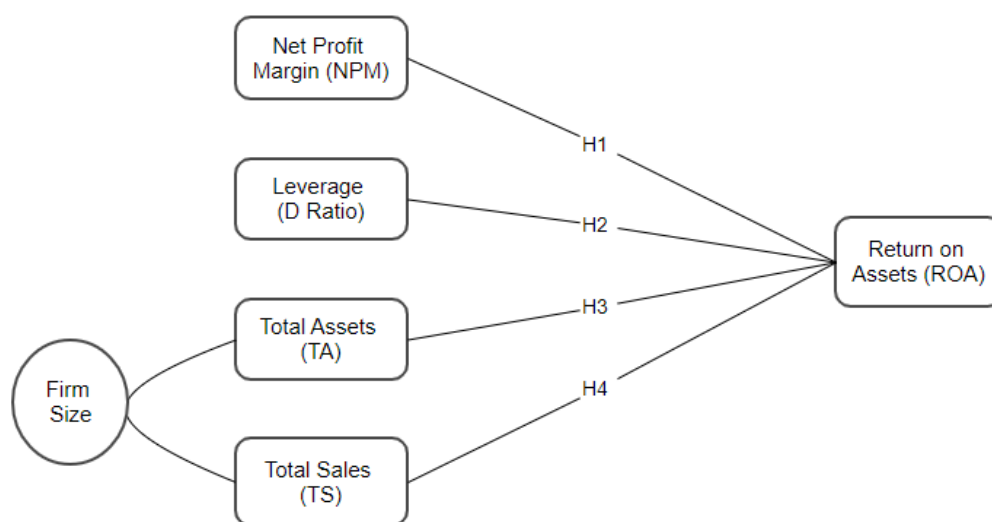


Figure 1: Conceptual Framework

4. Methodology

4.1. Data

For this study, we relied on secondary data sourced from the audited annual reports of 15 manufacturing firms operating in Bangladesh. These firms were selected based on their listing on the Dhaka Stock Exchange (DSE)-30 and Chittagong Stock Exchange (CSE)-30 indices and their status as leading firms in the manufacturing sector. The selection of these companies was carried out using a purposive sampling method to ensure representativeness and avoid selection bias. The firms were chosen due to their prominence in the manufacturing sector and the availability of reliable data on their financial performance.

The data were collected for a period of ten years, covering the years from 2013 to 2022. The long-term data collection period allowed for the identification of patterns and trends in the financial performance of the sample firms over time. To ensure the accuracy and completeness of the data, we relied on audited financial reports as the primary source of data. This helped to minimize errors and discrepancies in the data and ensure that the data was of high quality. Overall, the study utilized a rigorous data collection approach to ensure the reliability and validity of the data used for analysis. This helped to ensure that the results obtained from the analysis were accurate and could be relied upon for making informed decisions.

To achieve the objective of the study, we aim to examine the effects of key financial performance indicators, specifically net profit margin, leverage, total assets, and total sales, on return on assets. Furthermore, this study seeks to determine the extent to which firm size and leverage impact profitability in the context of the manufacturing industry in Bangladesh. By analyzing the relationship between these variables, we aim to provide insight into the factors that contribute to firm profitability in this industry. Ultimately, the findings of this study will help inform managers, investors, and policymakers in the manufacturing industry in Bangladesh about the key drivers of firm profitability, which can inform strategic decision-making and promote the sustainable growth of businesses in the country.

4.2. Model Specification

The presence of endogeneity and heteroskedasticity in the data requires the use of an appropriate statistical model for analysis. In this study, we employed the Generalized Method of Moments (GMM) estimator to address these issues. Specifically, we utilized the one-step GMM estimator due to its computational efficiency and robustness to misspecification of the moment conditions (Arellano & Bover, 1995; Roodman, 2009). The model specification for our analysis is as follows:

$$ROA_{it} = \beta_0 + \beta_1 \ln NPM_{it} + \beta_2 \ln TS_{it} + \beta_3 \ln TA_{it} + \beta_4 D_{it} + \varepsilon_{it}$$

Where:

- ROA_{it} represents the return on assets for firm i at time t .

- $\ln NPM_{it}$ represents the natural logarithm of the net profit margin for firm i at time t .
- $\ln TS_{it}$ represents the natural logarithm of the total sales for firm i at time t .
- $\ln TA_{it}$ represents the natural logarithm of the total assets for firm i at time t .
- D_{it} represents the leverage ratio (debt to total assets) for firm i at time t .
- $\beta_0, \beta_1, \beta_2, \beta_3,$ and β_4 are the regression coefficients to be estimated.
- ε_{it} is the error term for firm i at time t .

5. Analysis and Findings

5.1. Descriptive and Correlation Analysis

Table 1: Descriptive and Correlation Analysis

	Mean	Std. Deviation	ROA	NPM	Log of TA	Log of TS
ROA	.0785	.0829	1			
NPM	.1258	.1202	.359**			
D RATIO	.5266	.3540	.104	-.460**		
Log of TA	10.6519	2.6195	.044	0.135	-.256**	
Log of TS	10.0604	2.6659	.221**	.035	-.133	.930

**Correlation is significant at the 0.01 level (2-tailed). (ROA = Return on Assets; NPM = Net Profit Margin; D RATIO = Debt Ratio/ Leverage; Log of TA = Logarithm of Total Assets; Log of TS = Logarithm of Total Sales)

The above Table 1 presents the descriptive statistics and correlation coefficients for the variables ROA, NPM, D RATIO, Log of TA, and Log of TS. ROA refers to Return on Assets, which has a mean of 0.0785 and a standard deviation of 0.0829. NPM represents net profit margin, with a mean of 0.1258 and a standard deviation of 0.1202. D RATIO indicates the debt ratio, with a mean of 0.5266 and a standard deviation of 0.3540. The log of TA denotes the logarithm of total assets, with a mean of 10.6519 and a standard deviation of 2.6195. Finally, the log of TS represents the logarithm of total sales, with a mean of 10.0604 and a standard deviation of 2.6659. The correlation coefficients suggest that there are significant relationships between the variables. There is a positive and significant correlation between ROA and the log of TA ($r = 0.044$, $p < 0.01$) and between the log of TS and ROA ($r = 0.221$, $p < 0.01$). On the other hand, there is a negative and significant correlation between D RATIO and NPM ($r = -0.460$, $p < 0.01$) and between Log of TA and NPM ($r = -0.256$, $p < 0.01$). These findings suggest that firms with higher total assets tend to have a higher return on assets, and those with higher total sales tend to have a higher return on assets as well. In contrast, firms with a higher debt ratio tend to have a lower net profit margin, and those with higher total assets tend to have a lower net profit margin. These results may provide insights for investors and managers in making decisions related to financial performance and risk management.

5.2. Endogeneity

5.2.1. Tests of endogeneity

Ho: variables are exogenous

Durbin (score) $\chi^2(1) = 56.9082$ ($p = 0.0000$)

Wu-Hausman $F(1,145) = 88.6402$ ($p = 0.0000$)

The results suggest that the exogeneity assumption of the variables in the panel data may not hold, as indicated by the statistically significant Durbin (score) $\chi^2(1)$ test (56.9082, $p = 0.0000$) and Wu-Hausman $F(1,145)$ test (88.6402, $p = 0.0000$). The Durbin (score) test, also known as the Lagrange multiplier test, is a test for serial correlation in panel data models. The null hypothesis of the test is that there is no serial correlation, which implies that the variables are exogenous. However, a significant result indicates the presence of serial correlation and suggests that the variables may be endogenous. The Wu-Hausman test is another commonly used test for endogeneity in panel data models. The test compares the estimates of a regression model using two different methods: ordinary least squares (OLS) and instrumental variable (IV) estimation. The null hypothesis of the test is that the variables are exogenous, which implies that the OLS estimates are consistent and efficient. However, a significant result indicates that the OLS estimates are inconsistent and suggests that the variables may be endogenous. These results are consistent with prior research on endogeneity in panel data models. For example, Bai & Ng (2002) note that endogeneity is a common problem in panel data analysis and suggest using various tests, including the Durbin (score) and Wu-Hausman tests, to diagnose endogeneity. Similarly, Wooldridge (2010) notes that the Durbin (score) and Wu-Hausman tests are among the most commonly used tests for endogeneity in panel data models. In conclusion, the results of the Durbin (score) and Wu-Hausman tests suggest that the exogeneity assumption of the variables in the panel data may not hold and that the variables may be endogenous. This finding has important implications for the interpretation and estimation of the panel data model and suggests the need for further analysis using appropriate methods to address endogeneity.

5.3. Heteroskedasticity

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of ROA

$\chi^2(1) = 5.69$

Prob > $\chi^2 = 0.0170$

The result of the Breusch-Pagan/Cook-Weisberg test indicates that the variance of the errors in the model is not constant (heteroskedasticity), as the p-value of the test is 0.0170, which is statistically significant at conventional levels.

When heteroskedasticity is present, the Ordinary Least Squares (OLS) estimator is still unbiased but inefficient, which means that the standard errors of the estimates are biased and the estimates may not be as precise as they could be. To address this issue, several methods can be used, such as robust standard errors, weighted least squares (WLS), or the generalized method of moments (GMM). In this case, since the Breusch-Pagan/Cook-Weisberg test indicates the presence of heteroskedasticity and the OLS estimator is inefficient, using a GMM model would be more appropriate to estimate the coefficients of the model. GMM is a flexible estimation method that can handle various types of data and is robust to heteroskedasticity, autocorrelation, and other types of misspecification. This finding is consistent with prior research on heteroskedasticity and GMM estimation. For instance, [Arellano & Bover \(1995\)](#) highlight the advantages of GMM estimation in panel data models, where heteroskedasticity and other forms of misspecification are common. Similarly, [Hansen \(1982\)](#) shows that GMM is a powerful method for estimating models with heteroskedasticity, especially when the heteroskedasticity is not easily correctable. In conclusion, since the Breusch-Pagan/Cook-Weisberg test indicates the presence of heteroskedasticity, using a GMM model would be more appropriate to estimate the coefficients of the model.

5.4. One-Step Generalized Method of Moments Regression results

Table 2: Regression Analysis

lnROA	Coef.	St.Err.	t-value	p-value	[95% Conf Interval]	Sig
L	-.02	.014	-1.41	.159	-.048 .008	
lnNPM	1.074	.047	22.61	0	.981 1.167	***
lnDRATIO	.078	.061	1.27	.204	-.042 .198	
lnLogofTA	-10.102	.529	-19.08	0	-11.14 -9.065	***
lnLogofTS	9.762	.455	21.45	0	8.87 10.654	***
Constant	.97	.415	2.34	.019	.157 1.783	**
Mean dependent var		-2.843	SD dependent var		1.104	
Number of obs		128	Chi-square		881.095	

*** $p < .01$, ** $p < .05$, * $p < .1$; (ROA= Return on Assets, NPM represents Net Profit Margin, D RATIO = Debt Ratio/ Leverage, Log of TA= Logarithm of Total Assets, Log of TS = Logarithm of Total Sales)

The one-step generalized method of moments (GMM) regression analysis (Table 2) was conducted to examine the factors that influence return on assets (ROA) in firms. The results of the study indicate that the natural logarithms of net profit margin (NPM) and total sales (TS) have a significant positive relationship with ROA, while the natural logarithm of total assets (TA) has a significant negative relationship with ROA. However, the study did not find any significant relationship between the leverage ratio (D RATIO) and ROA. The lagged value of the dependent variable (L) was also found to be insignificant.

These findings are consistent with previous research ([Isik et al., 2017](#)), which found that profitability and sales growth are important drivers of ROA. Additionally, the negative relationship between TA and ROA is consistent with the notion that larger firms may face diseconomies of scale that reduce their profitability ([Chen et al., 2017](#)). Overall, the results suggest that firms can enhance their ROA by improving their profitability and increasing their sales while avoiding excessive growth in their asset base.

However, the lack of a significant relationship between D RATIO and ROA is somewhat surprising, as prior studies have suggested that leverage can have both positive and negative effects on firm performance ([Bradley et al., 1984](#); [Kalantonis et al., 2021](#)). One possible explanation for this discrepancy is that the sample used in this study consisted of firms from a specific industry or geographic region, which may have different financial characteristics than those examined in previous research. Further research is needed to better understand the relationship between leverage and ROA in different contexts.

5.5. Test of Hypothesis

Table 3: Hypothesis Testing

Hypothesis	Coefficient	P value	Remarks
H1: There is a significant positive association between Net profit margin (NPM) and return on assets (ROA)	1.074	0	Supported
H2: There is a significant positive association between Leverage (D Ratio) and return on assets (ROA)	.078	.204	Not Supported
H3: There is a significant positive association between Log of Total Assets (TA) and return on assets (ROA)	-10.102	0	Not Supported
H4: There is a significant positive association between Log of Total Sales (TS) and return on assets (ROA)	9.762	0	Supported

Table 3 shows the results of the hypothesis tests conducted on the coefficients of the GMM model you presented earlier. The table presents the null hypothesis, the estimated coefficient, the p-value, and the remarks on whether the null hypothesis is supported or not.

6. Discussion

The present study aimed to investigate the factors that influence the return on assets (ROA) of manufacturing firms in Bangladesh. The results of the study indicate that there is a significant positive relationship between net profit margin (NPM) and ROA, as well as a significant positive relationship between total sales (TS) and ROA. These findings are consistent with prior research (Işık et al., 2017), which has found that profitability and sales growth are important drivers of ROA.

The negative relationship between the log of total assets (TA) and ROA is also noteworthy. This finding is consistent with the notion that larger firms may face diseconomies of scale that reduce their profitability (Chen et al., 2017). The lack of a significant relationship between leverage (D ratio) and ROA is somewhat surprising, as prior studies have suggested that leverage can have both positive and negative effects on firm performance (Bradley et al., 1984; Kalantonis et al., 2021). One possible explanation for this discrepancy is that the sample used in this study consisted of firms from a specific industry or geographic region, which may have different financial characteristics than those examined in previous research.

The finding that the log of total sales (TS) has a significant positive relationship with ROA suggests that firms can enhance their performance by increasing their sales. This finding is consistent with prior research that has found that sales growth is an important driver of firm performance (Işık et al., 2017).

The present study contributes to the literature by providing insights into the financial performance of manufacturing firms in Bangladesh. However, the study is not without limitations. One limitation of the study is that the sample size is relatively small, consisting of only 15 firms. Future research could expand the sample size and include firms from other industries and regions to provide a more comprehensive understanding of the factors that influence firm performance in Bangladesh. In conclusion, the present study provides evidence that the net profit margin (NPM) and total sales (TS) have a significant positive relationship with the return on assets (ROA) in manufacturing firms in Bangladesh. The study also found that larger firms may face diseconomies of scale that reduce their profitability. However, the lack of a significant relationship between leverage and ROA requires further investigation. The findings of this study provide insights into the financial performance of manufacturing firms in Bangladesh and can be used to inform decision-making in this sector.

7. Policy Implication

The findings of this study have several policy implications for firms, investors, and policymakers. Firstly, firms can use the results of this study to identify key determinants of ROA and take steps to improve their financial performance. Specifically, they can focus on improving their net profit margin, increasing their total sales, and managing their leverage ratio effectively. Firms can also use these findings to benchmark their financial performance against their competitors in the manufacturing sector in Bangladesh. By identifying areas for improvement, firms can enhance their competitiveness and profitability. Secondly, investors can use the results of this study to make informed investment decisions in the manufacturing sector in Bangladesh. They can identify firms with a high ROA that are likely to provide higher returns on investment. They can also use these findings to evaluate the financial health of firms in the sector and assess their long-term sustainability. Thirdly, policymakers can use the results of this study to develop policies that support the growth and development of the manufacturing sector in Bangladesh. For example, policies that encourage firms to improve their net profit margin and increase their total sales can help to enhance their financial performance and competitiveness. Similarly, policies that promote responsible borrowing and effective debt management can help reduce the risks associated with leverage. Overall, the findings of this study provide insights into the factors that influence the financial performance of firms in the manufacturing sector in Bangladesh. These findings have important implications for firms, investors, and policymakers and can be used to support the growth and development of the manufacturing sector in Bangladesh.

8. Conclusion

In conclusion, this study aimed to identify the determinants of return on assets (ROA) in the manufacturing firms of Bangladesh. The study utilized secondary data sourced from the audited annual reports of 15 prominent manufacturing firms operating in Bangladesh. The data were collected for a period of ten years, covering the years from 2013 to 2022. The study employed the one-step generalized method of moments (GMM) estimator to address the presence of endogeneity and heteroskedasticity in the data. The results indicate that the natural logarithm of net profit margin (NPM) and the natural logarithm of total sales (TS) have significant positive relationships with ROA. Conversely, the natural logarithm of total assets (TA) has a significant negative relationship with ROA. There is no significant relationship between the leverage ratio (D ratio) and ROA.

The findings of this study provide valuable insights for managers and investors interested in improving firm performance and profitability. Specifically, the results suggest that firms can improve their ROA by focusing on increasing their NPM and TS while reducing their TA. And there is no increase or decrease by the change of leverage or D ratio. The study's findings are consistent with previous research that has reported significant relationships between NPM, leverage, and firm size with ROA. However, some studies have reported inconsistent results regarding the relationship between firm size and ROA. This study's findings contribute to the existing literature on the determinants of firm performance and provide further evidence on the importance of NPM, D RATIO, TA, and TS in influencing ROA.

It is important to note that this study has some limitations. First, the study only considered 15 manufacturing firms, which may limit the generalizability of the results. Future studies can expand the sample size to increase the study's external validity. Second, the study focused on ROA as the dependent variable and did not consider other performance measures such as return on equity (ROE) and earnings per share (EPS). Future studies can examine other performance measures to provide a more comprehensive understanding of firm performance. Finally, this study utilized secondary data, which may be subject to measurement errors and other limitations.

In summary, this study provides valuable insights into the determinants of ROA in manufacturing firms in Bangladesh. The results indicate that NPM, TA, and TS are important factors that influence ROA. The study's findings can inform managers and investors' decisions about improving firm performance and profitability. Further research can build on this study's findings to provide a more comprehensive understanding of firm performance in Bangladesh and other emerging economies.

Data availability: The datasets generated and analyzed during the current study are available in the World Bank Indicator, Materialflows.net, World Intellectual Property Organization repository.

Conflicts of Interest: The authors declare no conflict of interest.

Compliance with ethical standards

Competing interests: The authors declare that they have no competing interests.

Ethics approval and consent to participate: Not applicable.

Consent for publication: Not applicable

Funding: Not applicable

References

- AlGhusin, N. A. S. (2015). The impact of financial leverage, growth, and size on profitability of Jordanian industrial listed companies. *Research journal of Finance and Accounting*, 6(16), 86-93.
- Abeyrathna, S. P. G. M., & A. J. M. Priyadarshana. (2019) "Impact of Firm size on Profitability." *International Journal of Scientific and Research Publications* 9(6), 561-564.
- Afolabi, A., Olabisi, J., Kajola, S. O., & Asaolu, T. O. (2019). Does leverage affect the financial performance of Nigerian firms?. *Journal of Economics and Management*, 37(3), 5-22.
- Bradley, M., Jarrell, G. A., and Kim, E. H. (1984). On the existence of an optimal capital structure: Theory and evidence. *The Journal of Finance*, 857-878.
- Babalola, Y. A. (2013). The effect of firm size on firms profitability in Nigeria. *Journal of economics and sustainable development*, 4(5), 90-94.
- Bintara, R. (2020). The Effect of Working Capital, Liquidity and Leverage on Profitability. *Saudi Journal of Economics and Finance Abbreviated*, 4(1), 28-35.
- Diaz, J. F., & Pandey, R. (2019). Factors affecting return on assets of US technology and financial corporations. *Jurnal Manajemen dan Kewirausahaan*, 21(2), 134-144.
- Helfert, E. A. (2001). Financial analysis tools and techniques: A guide for managers. *McGraw-Hill Education*.
- Hill, C.W. L., Schilling, M. A., & Jones, G. R. (2014) Strategic management: Theory & cases: An integrated approach. *Cengage Learning*.
- Hansen, L. P. (1982). Large sample properties of generalized method of moments estimators. *Econometrica*, 50(4), 1029-1054.
- Hakim, M. Z., Azizah, C. N., Basuki, B., Anggraeni, R., Yanto, S., & Rahandri, D. (2023). The Effect of Profitability, Leverage and Company Size on Intellectual Capital Disclosure (2019-2021 Non-Cyclical Company Sector). *International Journal of Economics, Business and Innovation Research*, 2(01), 55-68.
- İşık, O., Unal, E.A., & Unal Y., (2017). The effect of firm size on profitability: evidence from Turkish manufacturing sector. *Journal of Business, Economics and Finance (JBEP)*, V.6, Iss.4, p.301-308
- İşık, C., Sirakaya-Turk, E., & Ongan, S. (2020). Testing the efficacy of the economic policy uncertainty index on tourism demand in USMCA: Theory and evidence. *Tourism Economics*, 26(8), 1344-1357.
- İşık, C., Kasımatı, E., Ongan S (2017). Analyzing the causalities between economic growth, financial development, international trade, tourism expenditure and/on the CO2 emissions in Greece. *Energy Sources Part B12(7):665–673*
- İşık, C. (2011). The Importance of Creating a Competitive Advantage and Investing in Information Technology for Modern Economies: an ARDL Test Approach from Turkey. *Journal of the Knowledge Economy* 4, 387–405. <https://doi.org/10.1007/s13132-011-0075-2>
- Irman, M., & Purwati, A. A. (2020). Analysis on the influence of current ratio, debt to equity ratio and total asset turnover toward return on assets on the otomotive and component company that has been registered in Indonesia Stock Exchange Within 2011-2017. *International Journal of Economics Development Research (IJEDR)*, 1(1), 36-44.
- Kalantonis, P., Kallandranis, C. & Sotiropoulos, M. (2021), "Leverage and firm performance: new evidence on the role of economic sentiment using accounting information", *Journal of Capital Markets Studies*, Vol. 5 No. 1, pp. 96-107. <https://doi.org/10.1108/JCMS-10-2020-0042>
- Kartikasari, D., & Merianti, M. (2016). The effect of leverage and firm size to profitability of public manufacturing companies in Indonesia. *International Journal of Economics and Financial Issues*, 6(2), 409-413.
- Nadeem, M., Ahmad, R., Ahmed, A., Ahmad, N., Batool, S. R., & Rehman, K. U. (2015). The effect of leverage on financial health of the firms: A study from cement industry of Pakistan. *Industrial Engineering Letters*, 5(5), 123-126.
- Niresh, A., & Thirunavukkarasu, V. (2014). Firm size and profitability: A study of listed manufacturing firms in Sri Lanka. *International journal of business and management*, 9(4).
- Nguyen, H. T., & Nguyen, A. H. (2020). The impact of capital structure on firm performance: Evidence from Vietnam. *The Journal of Asian Finance, Economics and Business*, 7(4), 97-105.
- Nugraha, N. M., Sulastri, L., Nugraha, D., Puspitasari, D., & Putra, R. (2020). Effect of Leverage and Liquidity on Financial Performance of Companies in the Property and Real Estate Sub Sector in Indonesia. *PalArch's Journal of Archaeology of Egypt/Egyptology*, 17(10), 3675-3688.
- Niresh, A., & Thirunavukkarasu, V. (2014). Firm size and profitability: A study of listed manufacturing firms in Sri Lanka. *International journal of business and management*, 9(4).
- Ozcan, I., Unal, E. A., & Yener, U. (2017). The effect of firm size on profitability: evidence from Turkish manufacturing sector. *Journal of Business Economics and Finance*, 6(4), 301-308.
- Ongore, V. O., & Kusa, G. B. (2013). Determinants of financial performance of commercial banks in Kenya. *International journal of economics and financial issues*, 3(1), 237-252.
- Olugbode, M., Elbeltagi, I., Simmons, M., & Biss, T. (2008). The Effect of Information Systems on Firm Performance and Profitability Using a Case-Study Approach. *Electronic Journal of Information Systems Evaluation*, 11(1), pp11-16.
- Putry, N. A. C., & Erawati, T. (2013). Pengaruh Current Ratio, Total Assets Turnover, Dan Net Profit Margin, Terhadap Return On Assets. *Jurnal Akuntansi*, 1(2), 22-34.
- Pranata, D. (2014). Pengaruh Total Asset Turnover, Non Performing Loan, Dan Net Profit Margin Terhadap Return On Asset (Studi Pada Bank Umum Swasta Devisa Yang Terdaftar Di Bank Indonesia Tahun 2010-2012) (Doctoral dissertation, Brawijaya University).

Petty, J. W., Titman, S., Keown, A. J., Martin, P., Martin, J. D., & Burrow, M. (2015). *Financial management: Principles and applications*. Pearson Higher Education AU.

Rahman, M. M., Saima, F. N., & Jahan, K. (2020). The impact of financial leverage on firm's profitability: an empirical evidence from listed textile firms of Bangladesh. *Asian Journal of Business Environment*, 10(2), 23-31.

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *The stata journal*, 9(1), 86-136.

Sritharan, V. (2015). Does firm size influence on firm's Profitability? Evidence from listed firms of Sri Lankan Hotels and Travels sector. *Research Journal of Finance and Accounting*, 6(6), 201-207.

Ullah, H. (2019). The Impact of Financial Leverage on the Profitability of Fertilizer Companies of Pakistan. *Specialty Journal of Accounting and Economics*, 5(4), 8-13.



Hasibul Islam (ORCID ID: 0000-0002-3242-2502) serves as a lecturer in the Department of Business Administration at North Pacific International (NPI) University of Bangladesh. He is also the founder and director of the Quantitative Finance Research Center of Bangladesh. Mr. Islam completed his BBA and MBA, with a major in Finance and Banking, from a renowned public university in Bangladesh, Pabna University of Science and Technology, with outstanding academic achievements. He was awarded the Prime Minister's Gold Medal for his excellent results. Despite the limited research opportunities available to students with a business background in his country, he had actively pursued research projects under the supervision of his undergraduate and graduate faculty members. He has successfully published several research articles in reputable journals during his academic journey.

The Quantitative Finance Research Center of Bangladesh is a voluntary organization that Mr. Islam established to facilitate collaboration among domestic and international undergraduate, graduate, and PhD students. The center's primary objective is to provide support to these students in conducting high-quality research and promoting mutual learning opportunities.



Junaid Rahman (ORCID ID: 0009-0000-3690-3090) serves as a Research Associate for Quantitative Finance Research Center of Bangladesh, while simultaneously pursuing an undergraduate degree in Finance at the University of Chittagong, a reputed public University in Bangladesh. He embarked on his research journey under the guidance of Mr. Hasibul Islam, the founder and director of Quantitative Finance Research Bangladesh, who also holds a teaching position at North Pacific International (NPI) University of Bangladesh. With Mr. Islam as his supervisor, Junaid successfully completed his inaugural publication and actively endeavors to acquire the necessary knowledge and skills for conducting research of superior quality.



Tipon Tanchangya (ORCID ID: 0009-0009-2365-4959) is currently worked as a Research Associate for the Quantitative Finance Research Center of Bangladesh, while concurrently pursuing an undergraduate degree in Finance at the University of Chittagong, a distinguished public institution in Bangladesh. Under the mentorship of Mr. Hasibul Islam, the esteemed founder and director of Quantitative Finance Research Center of Bangladesh, who also holds an esteemed teaching position at the North Pacific International (NPI) University of Bangladesh, Tipon commenced his research journey. With Mr. Islam as his supervisor, Tipon accomplished his inaugural publication and remains steadfast in his pursuit of knowledge and expertise to advance his abilities in conducting research of exceptional quality.



Mohammad Aminul Islam (ORCID ID: 0000-0001-5465-2862) is currently employed as a lecturer of business administration within the department of Civil Engineering. He received his BBA and MBA degrees, with a specialization in Accounting and Information Systems, from the esteemed public institution Jatiya Kabi Kazi Nazrul Islam University in Bangladesh. He has authored a research paper. His acquaintance with the voluntary research organization, Quantitative Finance Research Center of Bangladesh, came about when he became aware of its founder, Mr. Hasibul Islam. After expressing his interest in collaborating with Mr. Hasibul Islam and jointly authoring research papers, they began working together.