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Research Article

Corporate Investment Dynamics: The Effect of Operating Efficiency and Financial Leverage on Capital Expenditure

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Abstract
This study investigates the effects of operating efficiency and financial leverage on the investment decisions of non-financial listed firms on the Dhaka Stock Exchange, while accounting for factors such as firm age, size, profitability, economic growth, and the impacts of COVID-19. Utilizing a comprehensive dataset that encompasses a wide range of non-financial firms, the analysis applied both the Random Effects model and the Panel-Corrected Standard Errors (PCSE) model to ensure robustness in the results. The findings indicate that both operating efficiency, as measured by asset turnover, and financial leverage significantly influence corporate investment decisions across both models. Notably, firms demonstrating higher operating efficiency are more likely to elevate their capital expenditures, whereas financial leverage tends to have a detrimental effect on corporate investment. Additionally, the analysis of control variables offers further insights into how these factors shape investment behavior. The results highlight the critical role of effective resource management and cautious financial strategies in steering corporate investment decisions. This study enhances our understanding of investment behavior in non-financial firms and points to potential avenues for future research, including the investigation of additional variables and sector-specific analyses.

Keywords: Capital expenditure, operating efficiency, leverage, age, size, profitability

JEL Classification: D22, G31, L60, C23, E22, E32, C52

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1. Introduction
Investment decisions represent a critical component of corporate finance, involving the allocation of funds with the anticipation of generating future returns. In the context of manufacturing firms, investing in real assets is essential for enhancing profitability and operational efficiency. Real assets encompass tangible resources such as land, machinery, buildings, and other fixed capital items vital for production. Since manufacturing firms are often capital-intensive, making informed capital expenditure (capex) decisions is crucial for achieving desired productivity levels and ensuring long-term sustainability.

Since capital investment affects both short-term performance and long-term viability, a significant body of literature has examined the determinants of capital expenditure (Warrad & Omari, 2015; Patin, Rahman & Mustafa, 2020; Nguyen & Nguyen, 2020; Amado, 2003). Fixed asset investment not only enhances a firm's productive capacity but also strengthens its financial position by serving as collateral in credit arrangements. Therefore, investment in long-term assets is regarded as one of the most strategic and consequential decisions in business management.

Despite extensive research, existing studies have not sufficiently explored the combined influence of operating efficiency and financial leverage on capital expenditure decisions, especially in the context of emerging economies. Operating efficiency, often represented by asset turnover, indicates how effectively a firm utilizes its resources to generate revenue. A higher level of efficiency may facilitate internal financing, reducing dependence on external sources. In contrast, financial leverage reflects a firm's reliance on debt financing, which can either support investment by providing necessary funds or hinder it by increasing financial risk and repayment obligations.

The research problem addressed in this study lies in the limited empirical evidence on how these two variables operating efficiency and financial leverage jointly shape capital investment behavior among firms in developing markets. In particular, for listed manufacturing firms in Bangladesh, regulatory pressure, operational diversity, and market visibility make investment behavior a compelling area for investigation.

The novelty of this study lies in its simultaneous examination of efficiency and leverage as determinants of capital expenditures (Capex) within a single empirical framework, focusing on a developing country setting. Prior studies have often treated these factors in isolation or within the context of developed markets.

Accordingly, the purpose of this study is to empirically investigate whether operating efficiency and financial leverage have a significant influence on capital expenditure decisions among non-financial listed firms in Bangladesh. By doing so, the study contributes to the literature by offering context-specific insights into corporate investment dynamics in emerging markets, where financial constraints and governance practices may differ markedly from those in advanced economies.

This study contributes to both academic understanding and managerial practice. For academics, it provides a nuanced perspective on investment behavior in capital-intensive industries within developing markets. For practitioners and policymakers, the findings can inform more informed decision-making regarding capital budgeting, financing strategies, and resource allocation.

2. Literature Review and Hypothesis

Operating efficiency

Makgata and Ngwakwe (2017) identified a significant positive relationship between human capital expenditure and asset turnover. In contrast, Purba et. al., (2020) determined that asset turnover, return on assets, and total asset turnover did not have a significant effect on the capital structure of Indonesian manufacturing firms; however, they found a negative and significant impact from the current ratio. Purnama et. al., (2022) demonstrated that digital marketing enhanced asset turnover for culinary micro and small enterprises (MSMEs) during the COVID-19 pandemic. Additionally, Warrad and Omari (2015) investigated turnover ratios in Jordanian service sectors, while Patin et. al., (2020) emphasized the importance of asset turnover in improving equity returns through enhanced operating efficiency. Zakaria and Sonjaya (2023) reported that while working capital and asset turnover did not significantly affect ROI for Indonesian manufacturers, capital structure emerged as the most influential factor. Utami (2017) showed that profit growth was significantly influenced by changes in the current ratio, debt-to-asset ratio, total asset turnover, return on assets, and price-earnings ratio.

In the context of Bangladesh's ceramic firms, Azim et. al., (2015) found that profitability was positively impacted by fixed asset turnover, return on equity, and return on assets. Moreover, Utami and Muslih (2022) revealed that the Investment Opportunity Set was influenced by dividend policy and return on assets, but not significantly by total asset turnover. Based on the findings from the literature, we can formulate the following hypothesis:

H1.a: Operating efficiency, as measured by the Asset Turnover Ratio, has a significant positive impact on a firm's corporate investment decision.

Financial leverage

A business can secure more funding without relinquishing control by utilizing debt finance. With this, the corporation could embark on more ambitious capital initiatives than it could have done with equity finance alone. Cheema, Ahmed, Saleem, Abideen, and Jabeen (2021) studied the performance of Pakistani pharmaceutical firms, which is influenced by the intersection of cash flow, capital expenditures, and financial leverage. The findings reveal a strong correlation between capital expenditures, cash flow, financial leverage, and the performance of pharmaceutical firms. Yuliani and Hadi (2021) examined the variables influencing firm value in the real estate and property subsectors listed on the Indonesia Stock Exchange between 2014 and 2019. The analysis's findings indicate that while variable leverage and profitability have an impact on the firm's value, variable capital expenditure does not. Chen (2020) conducted a study on the impact of financial leverage on firm performance and concluded that there is a notably unfavorable relationship between financial leverage and corporate performance.

Aivazian, Ge and Qui (2005) identified the impact of leverage on firm investment. The study found that leverage has a negative correlation with investment, and the effect is far more pronounced for businesses with low growth prospects than for those with great growth prospects. Odit and Chittoo (2008) investigated whether financial leverage affects the investment decisions of Mauritian firms. The findings show a strong inverse link between investment and leverage. Vo (2019) investigated the relationship between leverage and investment in an emerging market. Consistent with the existing literature, the study found a negative effect of leverage on corporate investment. Haque (2014) conducted a study on the impact of financial leverage on corporate investment in Pakistani firms. The study concluded that leverage has a significant and negative impact on a firm's corporate investment decision. The study highlighted that greater leverage enables managers to play a more disciplined role and prevents them from overinvesting in capital expenditures. Umutlu (2009) analyzed the effect of leverage on investment for Turkish non-financial firms. The study concluded that leverage has a negative impact on investment.

H1.b: Financial leverage affects negatively on a firm's corporate investment decision.

Firms' age

Abedin, Sen, and Akter (2017) found that prior capital expenditure, age, size, and the presence of independent directors positively influence net capital expenditure in Bangladesh's pharmaceutical sector. Berchtold (2014) noted that well-established firms invest less in high-growth segments but found no inefficiencies. Chay, Kim, and Suh (2015) observed a decline in profitability and capital expenditure as firms age. Nunes, Serrasqueiro, and Matos (2017) highlighted that debt encourages, while age limits, investment in high-tech firms. Kalusova and Badura (2022) identified firm age as a key factor influencing fixed asset allocation in Slovak firms.

H1.c: Firms' age impacts on firm's corporate investment decision in both directions.

Firm size

Several studies examined determinants of capital expenditure. Nguyen and Nguyen (2020) found that business size and free cash flow have a positive impact on capital spending in Vietnam, while working capital, depreciation, dividends, and interest costs have a negative effect. Amado (2003) identified revenue growth as a significant factor in corporate investment, with debt-to-equity ratio and firm size being insignificant. Sheikh and Siddiqui (2020) highlighted that cash flow, fixed capital intensity, leverage, and firm size influence corporate investment in Pakistan, with

borrowing costs and tax rates having negative effects. Gesti (2022) found that operating cash flow and firm size have a significant influence on fixed asset investments in Indonesia.
H1.d: Firms' size impacts on firm's corporate investment decision in both directions

Profitability
Olatunji and Adegbite (2014) found that fixed asset investments have a positive and significant impact on profitability in Nigeria's banking industry. Pandya (2017) observed that a significant influence on spending improves financial performance in infrastructure firms. Kwistianus et. al., (2022) concluded that capital expenditure influences long-term profitability for Indonesian firms. Islam Mer and Usman (2020) also noted that capital investments have a positive impact on long-term performance but a negative impact on short-term performance, a finding supported by (Grozdic et. al., 2020).
H1.e: Firms' profitability affects firm's corporate investment decision in both directions

Capital expenditure of earlier period
Subrahmanyam, Indudeepchhhachhi and Brown (2013) analyzed the determinants of capital expenditures across the nation. The study found that the historical growth and leverage of the firm have a significant impact on the capital spending of U.S. firms, whereas free cash flows and firm size are the dominant determinants of Indian firms. Nguyen and Dong (2013) found the determinants of corporate investment decisions in Vietnam. The study revealed that cash flow, business risk, leverage and size have a significant impact on corporate investment decisions. The study further noted that the firm's past investment also affects its corporate investment decision.
H1.f: Firm's past capital expenditure affects firm's corporate investment decision

Economic growth and Covid
Farooq et. al., (2023) found that foreign direct investment, economic growth, Financial Development, Inflation Rate, Profitability, Firm Size, and Leverage impact investment decisions in GCC countries. Petunin (2015) highlighted that Russian GDP, exports, the Reserve Fund, and firm performance metrics, such as sales, return on assets (ROA), cash flow, and debt, affect capital expenditures in Russian mining firms. Jiang and Dalbor (2017) demonstrated that firm earnings, size, cash flow, and economic conditions have a significant influence on capital expenditures. Ishak (2022) found that the COVID-19 pandemic negatively impacted capital spending in Indonesian provinces, as funds were reallocated for social and economic recovery efforts.
H1.g: Economic growth affects a firm's corporate investment decision in both directions.
H1.h: The presence of COVID affects a firm's corporate investment decision negatively.

Although a number of studies have been conducted to observe the impact of operating efficiency and leverage on financial performance or capital structure, no studies, to the best of the authors' knowledge, have been conducted to investigate the impact of operating efficiency and leverage on firms' corporate investment decisions. Therefore, this study aims to address the existing gap in the literature.

3. Data and Method

Composition of the study
The study includes sixty-three (63) DSE-listed non-financial firms from fourteen (14) sectors of Bangladesh. A convenient sampling technique was chosen when selecting firms for the study. Altogether, there are approximately 819 observations spanning the years 2010 to 2022. Data has been collected on a yearly basis. A list of firm names is presented in the appendices section. However, the sector-wise number of the firm's list has been depicted below:

Table 1. Sector-wise firm list

Sector Name	Number of Firms	% of Total
Cement	06	9.52%
Ceramics Sector	05	7.94%
Engineering	04	6.35%
Food & Allied	08	12.70%
Fuel & Power	04	6.35%
IT Sector	02	3.17%
Jute	01	1.59%
Miscellaneous	03	4.76%
Paper and Printing	02	3.17%
Pharmacy and Chemical	09	14.29%
Service & Real Estate	01	1.59%
Tannery	03	4.76%
Telecommunications	01	1.59%
Textile	14	22.22%
Total	**63**	**100.00%**

Sources of data

Secondary sources have been used for this study. The variables chosen, both dependent and independent, have been sourced from the annual reports of the respective firms. In addition, the World Bank Indicator's data has been used as another source for the macroeconomic data of this study. The detailed names and sources of the variables are presented in the following section. To enrich the study and increase its depth, contemporary articles and literature relevant to this research have been reviewed and aligned.

Research type

The research is quantitative. Panel data has been used in this study, which is a type of dataset that combines characteristics of both cross-sectional data and time-series data. Each entity, in our case, a firm, is observed at multiple points in time, creating a panel or matrix structure. For empirical analysis, the research employed a Random Effects Model and Panel-Corrected Standard Errors (PCSE). The presence of non-normality, heteroskedasticity, and autocorrelation necessitates the use of the PCSE model. It is customary when working with panel data to consider the possibility of correlation between observations made over time within the same entity. The standard errors of regression coefficients are adjusted for probable heteroscedasticity and serial correlation within panels using the Panel-Corrected Standard Errors (PCSE) function.

Variables

Dependent variable

The amount of money spent on capital expenditure, as a proportion of total assets, during the research period has been considered a dependent variable in the study. The investment in capital expenditure reflets investment in three types of capital assets, including property, plant and equipment. The firm acquires such assets for long run sustainability of the firm and is regarded as a vital part of the investment. However, such an investment demonstrates a slow payback period, for which investment in these types of assets does not yield immediate returns.

Independent variables

The two main independent variables are efficiency and leverage. The asset turnover ratio has been considered a proxy for efficiency, while the debt-to-total assets ratio has been viewed as a proxy for leverage. Additionally, the study controls for six variables that may influence the dependent variable. Since the firm's size may impact capital expenditure, the study considers the natural logarithm of total sales as a proxy for firm size. Likewise, the study used a logarithm of age to see the effect of a firm's age on capital expenditure. As a proxy for profitability, return on assets has been used as a measure. The previous year's capital expenditure may have an impact on the capital

expenditure in the following year. For this reason, the lag of the previous year's capital expenditure has been considered. Additionally, to control for the effects of COVID-19 and the country's economic growth, the study considers the impact of COVID-19 and the GDP growth rate during that period.

Definition of variables

The definition of variables, along with measurement, has been depicted in the following tables:

Table 2. Definition of the variables

Variable Definition	Acronym	Variable Type	Measurement	References	Expected Sign
Investment in Capital Expenditure	Capexta	Dependent	Investment in Property, Plant and Equipment to Total Assets	Farooq et. al., (2020)	
Efficiency	Salesta	Independent	Sales to total assets	Patin et. al., (2020)	(+)
Financial Leverage	DTA	Independent	Debt to total asset	Haque (2014)	(-)
Age of the firm	Ln Age	Control	The logarithm of the number of years since the firm's establishment till the observation date	Nunes et. al. (2017)	(+/-)
Size of the firm	Ln turnover	Control	Logarithm of turnover/sales	Gesti (2022)	(+)
Profitability	ROA	Control	Net income divided by total assets	Pandya (2017); Grozdic et. al., (2020)	(+/-)
Previous year's capital expenditure	capextalag	Control	One period lag of capital expenditure to total assets	Nguyen & Dong (2013)	(+/-)
Presence of Covid	Cov	Control	The presence of COVID marks 1 and absence marks 0	Ishak (2022)	(-)
Economic growth	GDPgr	Control	GDP growth rate of the respective year	Petunin (2015)	(+)

Model of the study

The equation aims to model the proportion of capital expenditure to total assets as a function of various firm-specific and macroeconomic factors. By analyzing this model, the study can identify how operating efficiency (asset turnover) financial leverage impacts the corporate investment decision of the firm (as measured by investment in capital expenditure) while controlling the effect of firm size, age, profitability, past investment behavior, and external economic conditions (including the impact of COVID-19 and GDP growth).

$$\textbf{Capexta}_{i,t} = \beta 0 + \beta 1\ \textbf{Salesta}_{i,t} + \beta 2\ \textbf{DTA}_{i,t} + \beta 3\ \textbf{Ln Age}_{i,t} + \beta 4 \textbf{ln Turnover}_{i,t} + \beta 5\ \textbf{ROA}_{i,t} + \beta 6\ \textbf{Capexta}_{i,t-1} + \beta 7\ \textbf{Cov}_{i,t} + \beta 8\ \textbf{GDPgr}_{i,t} + \varepsilon_{i,t} \quad (1)$$

The coefficient β_0 represents the intercept, indicating the expected value of the dependent variable when all predictors are set to zero. β_1, associated with sales to total assets (operational efficiency), indicates how efficiency impacts the dependent variable positive if increased efficiency improves the outcome, negative otherwise. β_2, tied to debt to total assets (financial leverage), reflects the effect of leverage on the outcome, with a positive sign suggesting leverage benefits the dependent variable. β_3 measures the impact of firm age (ln age) on the dependent variable, capturing how maturity influences the result. β_4 represents the logarithm of turnover (firm size), indicating

whether larger firms are more or less likely to affect the outcome. β_5 relates to return on assets (ROA), highlighting the role of profitability in determining the dependent variable. β_6, the lagged capital expenditure to total assets ratio, accounts for the influence of prior investment decisions. β_7 captures the effect of COVID-19, while β_8, tied to GDP growth, reflects the broader economic context's influence on the dependent variable.

This model helps to understand the dynamic interactions between these factors and how they collectively determine a firm's investment strategy in capital assets.

Diagnostic tests

The study conducted several diagnostic tests and ultimately determined the most appropriate model to satisfy the assumptions of the underlying Panel Data Analysis. The results and tests are explained in the following section.

Normality Test: To check whether the chosen variables follow a normal distribution, the study incorporated the Shapiro-Wilk Test for normality. Based on the P-value, which is less than 0.05, the test indicates that none of the variables in the study follow a normal distribution.

Table 3. Normality test using Shapiro-Wilk

Variable Name	z value	Prob > z	Decision
Capexta	3.821	0.000700	Deviates from Normal Distribution
Salesta	12.223	0.000000	Deviates from Normal Distribution
Dta	11.867	0.000000	Deviates from Normal Distribution
Age	2.635	0.004210	Deviates from Normal Distribution
Turnover	3.191	0.000710	Deviates from Normal Distribution
Roa	12.932	0.000000	Deviates from Normal Distribution
capextalag	5.159	0.000000	Deviates from Normal Distribution
Gdpgr	9.879	0.000000	Deviates from Normal Distribution
Cov	2.831	0.002320	Deviates from Normal Distribution

Source: Data Processed by Authors (2024)

Multicollinearity test: To check the multicollinearity, the study further used the Variance Inflation Factor (VIF). Based on the test, the mean VIF is 1.12. As it is less than 10, it indicates that the model does not have multicollinearity.

Table 4. Result of the VIF test

Variable	VIF	1/VIF
Cov	1.23	0.81301
Gdpgr	1.16	0.86207
Salesta	1.13	0.88496
ln turnover	1.12	0.89286
Dta	1.10	0.90909
Roa	1.09	0.91743
Lnage	1.08	0.92593
Capexlag	1.06	0.94340
Mean	**1.12**	

Source: Author's analysis using STATA (Version 14.2)

Heteroskedasticity Test: To check for heteroskedasticity, the research adopted the Breusch-Pagan /Cook-Weisberg test. Based on the P-value, which is close to 0.00, where the chi-square value is 96.88, the model indicates the presence of heteroscedasticity.

Table 5. Result of Heteroskedasticity test

Breusch-Pagan / Cook-Weisberg test for Heteroskedasticity			
Model	**chi2**	**Prob>chi2**	**Presence of Heteroscedasticity**
1	96.88	0.0000	Yes

Source: Data Processed by Authors (2024)

Autocorrelation test: For this model, the Wooldridge test has been used to examine the autocorrelation. Based on a 5% significance threshold, the test indicates that the dataset contains autocorrelation.

Table 6. Result of Autocorrelation test

Wooldridge test for autocorrelation in panel data			
Model	**F value**	**Prob>F**	**Presence of Autocorrelation**
1	51.853	0.0000	Yes

Source: Data Processed by Authors (2024)

Cross-sectional dependency: To verify the cross-sectional dependence within the panel data set, the model employed Pesaran's test. There is insufficient data to reject the null hypothesis because the p-value (0.7311) is above the threshold. These findings indicate that there is no discernible cross-sectional dependence in the data.

Table 7. Result of Pesaran's test of Cross-sectional independence

Pesaran's test of Cross-sectional Independence			
Model	**Pesaran's Value**	**Prob. Value**	**Presence of Cross-Sectional Dependence**
1	0.344	0.7311	No

Source: Data Processed by Authors (2024)

Hausman Test: To determine whether to use a Fixed Effects Model or a Random Effects Model, the study has considered the Hausman test. Based on the above table, the null hypothesis that is, the idea that the coefficients from the random effects model are efficient and consistent cannot be rejected since the chi-square value is nearly zero. This implies that both the fixed effects and random effects estimators may be consistent and effective, but the random effects model may be marginally more efficient. Based on the Hausman test, the null hypothesis that is, the idea that the coefficients from the random effects model are efficient and consistent cannot be rejected since the chi-square value is nearly. Therefore, the study employs the Random Effect Model.

Table 8. Result of Hausman test

Model	**Chi2**	**Prob > Chi2**	**Decision**
1	0.000	Not positive definite	Random Effect Model

Source: Data Processed by Authors (2024)

Additionally, the study incorporates the Panel-Corrected Standard Errors (PCSE) model. Given that the data set displays autocorrelation and heteroskedasticity without cross-sectional dependency, the Panel-Corrected Standard Errors (PCSE) model may be a suitable choice. Panel data problems, including serial correlation and heteroskedasticity, are addressed by the PCSE model. It offers robust standard errors that account for these problems, thereby enhancing the reliability of statistical inference.

4. Results

Descriptive statistics

This research includes 819 observations from 63 non-financial firms. The minimum, maximum, standard deviation, and mean of the observations are displayed in the following table.

Table 9. Descriptive statistics of the variables

Variables	Observations	Mean	Standard Deviation	Minimum	Maximum
capexta	717.00	0.41	0.20	0.00	0.98
salesta	711.00	0.53	0.53	0.00	0.58
dta	706.00	0.51	0.33	0.03	0.42
age	819.00	32	19.48	2.00	112.00
turnover (million)	712.00	7270.00	17600.00	40697.00	1500.00
roa	717.00	0.05	0.18	-4.05	0.54
capextalag	659.00	0.41	0.20	0.00	0.98
gdpgr	819.00	6.43	1.04	3.45	7.88
cov	819.00	0.15	0.36	0.00	1.00

Source: Data Processed by Authors (2024)

Based on the above data, the average propensity of firms to invest in capital expenditure is 0.41, which means that for every Tk. 01 of total assets, Tk. 0.41 is allocated to capital expenditure on average. The average asset turnover, a measure of efficiency, is approximately 0.53, indicating that firms can generate Tk. 0.53 for every Tk. 1.00 of assets deployed. The average debt to total assets of the firms is 0.51, whereas the average age of the firms studied is around 32 years. The mean turnover of the firms is around Tk. 7,270 million, whereas the average profitability, based on return on assets, is around 5%. The average economic growth as measured by GDP growth rate throughout the time period was around 6.43%.

Results of models

Based on the Hausman test results, the study employs a Random Effects Model. However, since the variables in the study exhibit heteroskedasticity and autocorrelation, Panel-Corrected Standard Errors (PCSE) are specifically made to address this problem. Based on both models, the following table highlights the results:

Table 10. Results of PCSE and RE Model

	PCSE		RE	
Variables	**Coef.**	**Standard Error**	**Coef.**	**Standard Error**
Salesta	0.035***	0.009	0.041***	0.010
Dta	-0.104***	0.044	-0.057***	0.020
Lnage	0.013	0.012	-0.016**	0.009
Lnturnover	-0.002	0.003	0.000	0.003
Roa	0.034***	0.013	-0.005	0.031
Capextalag	0.404***	0.073	0.609***	0.026

Gdpgr	-0.005***	0.001	-0.005	0.005
Cov	-0.018***	0.006	-0.020	0.015
Constant	0.346	0.053	0.260	0.079
R-Sq	64.09%		49.01%	
Prob > F	0.0000		0.0000	

N.B: *** means significance at 1%, ** means significance at 5% and * means significance at 10%

Source: Data Processed by Authors (2024)

The two variables of the study (asset turnover and leverage) are statistically significant at a 1% significance level in both models. The direction of the coefficients is also the same for both models of the variables in question.

Interpretation of results based on the PCSE model

The coefficient of asset turnover for PCSE is 0.035. This indicates that for every 1-unit increase in asset turnover, capital expenditure is expected to increase by 0.035 units, holding all other variables constant. The coefficient of financial leverage, measured as debt to total assets, is -0.104, which indicates that for every 1-unit increase in financial leverage, capital expenditure is expected to decrease by 0.104 units, holding all other variables constant. Among the six control variables, profitability, GDP growth rate, Covid and capital expenditure of the previous year are found to be statistically significant in the PCSE model. Return on Assets, a measure of profitability, has a 0.034 coefficient, which means that when the firm's profitability increases by 1 unit, the tendency to invest in capital expenditure increases by 0.034. The previous year's capital expenditure has a strong influence on the subsequent year's capital expenditure. Based on the result, this indicates that for every 1-unit increase in the previous year's capital expenditure, the current year's capital expenditure is expected to increase by 0.404 units, holding all other variables constant. The coefficient of economic growth, as measured by the GDP growth rate, is -0.005, which means that when the country experiences a 1-unit increase in GDP growth, the firm's tendency to invest in capital expenditure decreases by 0.005 units. The presence of COVID-19 also negatively affects investment in capital expenditure. Overall, the R-squared value of the PCSE model is 64.09%, which means that the model explains 64.09% of the variability in capital expenditure. The P-value for the model is 0.0000, which means the overall model is statistically significant.

Interpretation of results based on the Random Effect model

The coefficient of asset turnover is 0.041, which means that if asset turnover increases by 1 unit, the propensity to invest in capital expenditure increases by 0.041 unit, other things remaining constant. The coefficient of leverage is -0.057, which means that when a firm incorporates leverage into its capital structure by 1 unit, capital expenditure is expected to decrease by 0.057 units, holding all other variables constant. Age and previous year capital expenditure are statistically significant. However, age negatively influences capital expenditure, which means that as the firm grows older, its tendency to invest in capital expenditure decreases further. The R-squared value of the model is 49.01%, indicating that the model explains 49.01% of the variability in capital expenditure. The P-value of the model is 0.0000, which means the model is statistically significant. *Therefore, based on the p-values of both models, we can reject the null hypothesis and conclude that efficiency, as measured by asset turnover and financial leverage, has an impact on corporate investment decisions, as indicated by investment in capital expenditures.*

5. Discussion

The following discussion section is organized based on the results and existing literature.

Operating efficiency

The operating efficiency of firms positively influences corporate investment (Warrad & Omari, 2015; Patin et. al., 2020; Zakaria & Zonjaya, 2023). The findings of the study support this assertion. A firm that effectively leverages its assets to generate revenue typically exhibits a high asset turnover ratio, which is often viewed as a sign of sound management and efficient operations. This effective

resource management enhances a firm's ability to generate profits from new investments, thereby encouraging increased capital expenditures. As a result of this confidence, firms are motivated to allocate more funds towards new projects. A high asset turnover ratio fosters consistent and reliable cash flow, which facilitates ongoing investment. According to both models examined in the study, operational efficiency, indicated by asset turnover, significantly positively impacts firms' decisions regarding capital expenditures.

Financial leverage

According to the literature, the effect of leverage on corporate investment decisions is largely negative (Aivazian et. al., 2005; Odit & Chittoo, 2008; Vo, 2019; Haque, 2014). This study has similarly found that as a firm's financial leverage increases, its propensity to invest in capital expenditures declines. A negative coefficient for leverage suggests that higher levels of debt are associated with reduced capital investment. This finding aligns with earlier research and agency theories of corporate finance, which propose that leverage acts as a discouraging factor for managers considering capital expenditures.

While financial leverage is theoretically intended to provide firms with greater funding for investments, other significant factors likely influence capital expenditure decisions. Firms may prioritize alternative opportunities such as research and development, mergers and acquisitions, or working capital management over capital investments, regardless of their leverage levels. Additionally, firms might be hesitant to increase their debt burden, particularly if they foresee future economic volatility or if their existing debt loads are already considerable. Consequently, they may adopt more conservative investment approaches.

Age of the firm

The relationship between firms' age and corporate investment decision is both directional (Abedit et. al., 2017; Berchtold, 2014; Chay et. al., 2015; Nunes et. al., 2017) When examining how a firm's age, as indicated by the natural logarithm of the firm's age since founding, affects its capital expenditure, a noteworthy relationship deserving of further examination is revealed by the statistically significant coefficient of -0.016 in case of random effect model. A negative coefficient means that the firm's capital expenditure tends to decrease with increasing age. This result suggests that, over time, older businesses allocate comparatively fewer resources to capital investment activities than their younger counterparts. Businesses that have matured may have previously invested a substantial amount of money in technology, infrastructure, and operational capabilities when they were younger. As a result, they may need to make fewer capital expenditure investments compared to younger firms, which are typically still growing and laying the groundwork for their operations. Additionally, older firms may prioritize other strategic initiatives such as share buybacks, dividend payments, or diversification over capital expenditures. These firms may also have stronger networks, a stronger market presence, and a more recognizable brand, all of which reduce the need for significant capital expenditure to remain competitive.

Size of the firm

Literature evidenced that there is an impactful relationship between a firm's size and capital spending (Nguyen & Nguyen, 2020; Amado, 2003; Sheukh & Siddiqui, 2020). When examining the relationship between a firm's capital expenditure and its size, as measured by the natural logarithm of turnover, this study has found that there is no statistically significant relationship between firms' age and corporate investment decisions. Both of the models demonstrated the same. The size of the firm may not have as significant an impact on capital expenditures (Capex) as strategic factors, such as industry demands, market prospects, or technological requirements. Larger firms may have steady capital expenditures (Capex) due to their established operations, whereas smaller firms may have high Capex due to their aggressive expansion ambitions.

Profitability

Previous studies regarding the impact of profitability on a firm's corporate investment have found results in both directions and neutral (Olatunji & Adegbite, 2014; Kwistianus et. al., 2022; Islam et. al., 2020; Grozdic et. al., 2020). Analyzing the effect of profitability on a firm's capital spending

using return on assets (ROA) yields some interesting findings, especially when considering the statistically significant coefficient of 0.0345. A positive coefficient suggests that capital spending tends to increase when firms experience higher profitability. Higher profitability generates more internal funds, which can be reinvested into the business without the need for external financing. Firms with greater profits have more cash flow available to finance capital projects, such as expanding production capacity, upgrading technology, or entering new markets.

Capital expenditure of earlier period

Investment in earlier periods affects the corporate investment in the following period (Subrahmanyam et. al., 2013; Nguyen & Dong, 2013). The correlation coefficient, which is positive in both models, indicates a robust and direct relationship between capital expenditure from the previous year and capital asset investment during the current year. When a firm makes a large capital investment commitment at one time, it frequently starts a sequence of follow-up investment operations. These could be finishing off unfinished business, maintaining recently purchased equipment, or expanding operations to maximize the use of already-existing infrastructure. There is a positive relationship between the two variables, resulting from the momentum created by previous capital expenditures influencing the firm's investment decisions in the current period.

Economic growth

Apart from studies that found that economic growth has a significant impact on firms' corporate investment decisions (Etnia, 2015), this study reveals that economic growth has a negative impact on firms' corporate investment decisions. However, the relationship is statistically significant only in the case of the PCSE model. In an economy that is expanding rapidly, inflationary forces may drive up the prices of labor, raw materials, and other inputs. Increased expenses may lower profit margins, making businesses less willing to take on new ventures.

Presence of COVID

The presence of COVID-19 has a negative impact on corporate investment decisions (Ishak, 2022). This study has also found that the presence of COVID-19 affects capital spending by firms. However, such a relationship is not statistically significant.

6. Conclusion

This study sought to assess the influence of operating efficiency and financial leverage on the corporate investment decisions of non-financial firms. The findings indicate that both factors significantly impact investment choices. Specifically, higher operating efficiency, measured by asset turnover, is positively correlated with increased investment, suggesting that firms adept at utilizing their resources are more inclined to reinvest in growth opportunities. Additionally, financial leverage plays a crucial role, indicating that firms strategically employ debt to fund their investments, thereby balancing the associated risks and rewards of leveraging capital. These results imply that businesses should focus on enhancing operational efficiency and managing leverage effectively to support their investment strategies. For practitioners, these insights underscore the importance of maintaining efficient operations and sound financial management to foster sustainable growth. Policymakers may also want to consider these elements when developing regulations aimed at encouraging corporate investment and economic development.

Limitations and avenue for future research

Further research could delve into the influence of additional variables, such as market conditions, corporate governance, and innovation, on corporate investment decisions. Investigating these dynamics across various industries, geographic regions, and economic cycles could yield a more nuanced understanding of how firms approach investment choices. Moreover, longitudinal studies that assess the long-term effects of operating efficiency and financial leverage on investment outcomes would be quite valuable. Research that takes into account the impact of macroeconomic factors, such as interest rates and economic stability, would also contribute significantly to this field of study.

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Appendices

Table A1: List of firms

No	Name	No.	Name
1	ACI Limited	33	Meghna Cement Mills Ltd.
2	Agricultural Marketing Firm Ltd.	34	Monno Ceramic Industries Ltd.
3	Al-Haj Textile Mills Limited	35	Olympic Industries Ltd.
4	Apex Foods Limited	36	Premier Cement Mills PLC
5	Apex Footwear Limited.	37	R.N. Spinning Mills Limited
6	Apex Spinning & Knitting Mills Limited	38	Rahim Textile Mills Ltd.
7	Apex Tannery Limited	39	RAK Ceramics (Bangladesh) Limited
8	Bata Shoe Firm (Bangladesh) Limited	40	Renata Ltd.
9	Beacon Pharmaceuticals Limited	41	Saiham Textile Mills Ltd.
10	Beximco Pharmaceuticals Ltd.	42	Shinepukur Ceramics Limited
11	British American Tobacco Bangladesh Firm Limited	43	Sonali Aansh Industries Limited
12	Crown Cement PLC.	44	Sonali Paper & Board Mills Ltd.
13	Fu Wang Food Ltd.	45	Square Pharmaceuticals Ltd.
14	Fu-Wang Ceramic Industries Ltd.	46	Square Textiles Ltd.
15	Golden Harvest Agro Industries Ltd.	47	Standard Ceramic Industries Ltd.
16	Hakkani Pulp & Paper Mills Ltd.	48	The IBN SINA Pharmaceutical Industry PLC
17	Heidelberg Cement Bangladesh Ltd.	49	Zahintex Industries Limited
18	JMI Syringes & Medical Devices Ltd.	50	Envoy Textiles Limited
19	LafargeHolcim Bangladesh Limited	51	Generation Next Fashions Limited
20	Malek Spinning Mills Ltd.	52	Maksons Spinning Mills Limited
21	Marico Bangladesh Limited	53	Berger Paints Bangladesh Limited
22	Beximco Limited	54	Bangladesh Submarine Cables PLC
23	Bangladesh Steel Re-Rolling Mills Limited	55	Beximco Synthetics Ltd.
24	Confidence Cement PLC	56	Chittagong Vegetable Oil Industries Ltd
25	Daffodil Computers Limited	57	Desh Garments Ltd
26	Deshbandhu Polymer Limited	58	Dhaka Electric Supply Firm Limited

27	Dulamia Cotton Spinning Mills Limited	59	Eastern Cables Limited
28	Eastern Housing Limited	60	Fine Foods Ltd
29	GBB Power Limited	61	Gemini Sea Food Ltd
30	GlaxoSmithKline plc	62	Golden Son Limited
31	GPH Ispat Limited	63	GQ Ball Pen Industries Limited
32	Grameenphone Limited		