

TECHNICAL EFFICIENCY AND PRODUCTIVITY GROWTH OF LISTED FIRMS IN EMERGING MARKETS: EVIDENCE FROM GHANA USING DEA-MALMQUIST AND DYNAMIC PANEL GMM

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Abstract

This study addresses existing research gaps in the literature on technical efficiency and productivity growth among firms listed on the Ghana Stock Exchange by examining the determinants of efficiency dynamics and technological progress within Ghanaian listed enterprises. Improving firm efficiency and productivity remains central to sustainable corporate performance, competitiveness, and economic growth, particularly in emerging markets where institutional and macroeconomic constraints significantly shape business outcomes. The study primarily evaluates the level of technical efficiency and productivity change of listed firms in Ghana and further investigates the firm-specific and macroeconomic factors driving productivity growth, efficiency improvement, and technological advancement. Drawing on the efficiency and productivity literature, the study identifies key operational, financial, and environmental variables that influence firm performance within the Ghanaian corporate sector.

Using panel data from the audited financial statements of 30 out of 37 listed firms on the Ghana Stock Exchange, selected based on data availability, the study applies Data Envelopment Analysis (DEA) frontier techniques to estimate technical efficiency scores and Malmquist productivity indices for measuring productivity change and technological progress. To examine the determinants of productivity, efficiency, and technological change, the study employs a dynamic panel System Generalized Method of Moments (System GMM) estimator to address potential endogeneity and persistence effects.

The empirical findings reveal that most listed firms operate below the efficient production frontier, indicating substantial room for improvement in technical efficiency and productivity performance. The results further show that firm-specific characteristics and macroeconomic conditions exert heterogeneous effects on productivity growth, efficiency change, and technological progress. In particular, managerial capability, institutional innovation, capital utilization, and macroeconomic stability emerge as critical drivers of firm performance.

The study recommends that management should adopt productivity-enhancing strategies through workforce efficiency improvements, technological innovation, and stronger institutional capacity building to improve operational performance. Additionally, firms should strengthen internal research and strategic planning capabilities to better respond to macroeconomic fluctuations and industry-specific shocks. The findings provide important implications for corporate managers, investors, regulators, and policymakers seeking to enhance firm competitiveness and long-term productivity growth in Ghana.

Keywords: GST, Indirect Tax Reform, Tax Compliance, MSMEs, Digital Infrastructure, Fiscal Policy, India.

Introduction

Corporate Social Responsibility (CSR) has become an increasingly important area of academic inquiry and strategic business practice, particularly in understanding how firms contribute to sustainable economic and social development while maintaining profitability. CSR provides a framework through which firms align profit-making activities with ethical standards, stakeholder welfare, and societal well-being. It requires organizations to operate responsibly by contributing positively to society and avoiding profit maximization at the expense of social and environmental obligations. In recent years, CSR has evolved from being viewed as a philanthropic obligation to being recognized as a strategic managerial tool capable of improving firm competitiveness and long-term sustainability (Dartey-Baah, 2021; Freeman, 2021).

Empirical studies show that CSR significantly enhances market performance by improving customer satisfaction, employee commitment, brand equity, and corporate reputation (Vuong, 2023; Dartey-Baah, 2021). These relational and reputational benefits strengthen financial performance and help firms build sustainable competitive advantage over time (Coelho, 2023; Shin, 2022). CSR activities such as employee welfare, community development, educational support, health interventions, environmental sustainability, and ethical governance improve stakeholder trust and institutional legitimacy, which ultimately reduce transaction costs and improve organizational performance. Despite these recognized benefits, the relationship between CSR and firm performance—particularly through the channels of operational efficiency and productivity growth—remains one of the least explored areas in the literature (Barauskaite, 2021).

Parallel to CSR research, the study of institutional efficiency has expanded significantly over the past two decades, particularly following the seminal work of Berger and Humphrey (1997), who reviewed over 130 studies using frontier efficiency analysis across 21 countries. Their work highlighted the growing importance of both parametric and non-parametric approaches in measuring organizational efficiency and recommended stronger statistical methods, including confidence intervals for efficiency estimates. Parametric methods such as Stochastic Frontier Analysis (SFA) account for random error but require strict assumptions regarding functional form and production frontier structure. In contrast, non-parametric methods such as Data Envelopment Analysis (DEA) provide greater flexibility by estimating the efficient frontier without imposing functional assumptions, although they traditionally do not account for stochastic disturbances. Subsequent contributions by Simar and Wilson (1998, 1999, 2000) improved the statistical reliability of DEA through bootstrap techniques, making DEA a more robust tool for efficiency analysis.

In Ghana, the performance of listed firms has traditionally been evaluated using accounting-based financial ratios such as Return on Assets (ROA), Return on Equity (ROE), and profit margins. While these indicators remain useful, they have several limitations. They are often subject to managerial manipulation, fail to capture qualitative aspects of firm performance, and do not adequately account for multiple input-output relationships or external environmental factors. These limitations make ratio-based measures insufficient for a comprehensive assessment of firm performance. Consequently, frontier efficiency techniques such as DEA provide a more rigorous and standardized alternative for measuring technical efficiency and productivity performance.

Firms listed on the Ghana Stock Exchange have increasingly adopted CSR initiatives as part of their long-term strategic positioning. These include investments in education, leadership development, health support, environmental protection, and community development. Although these activities are often motivated by reputational benefits and stakeholder expectations, CSR may also function as a productivity-enhancing mechanism by strengthening internal organizational discipline, improving stakeholder relationships, and promoting more efficient allocation of resources. This suggests that CSR can influence firm performance not only directly through profitability but also indirectly through improvements in technical efficiency and productivity growth.

This study therefore investigates the relationship between CSR, technical efficiency, productivity growth, and firm performance among listed firms in Ghana using DEA–Malmquist productivity analysis and Dynamic System Generalized Method of Moments (System GMM). The study is based on the premise that CSR is not merely a social obligation but a strategic managerial investment capable of improving operational efficiency and sustaining competitive advantage.

Specifically, the study examines whether firms that invest more heavily in CSR activities achieve higher levels of technical efficiency and productivity growth. CSR improves stakeholder trust, employee motivation, customer loyalty, and institutional legitimacy, all of which reduce inefficiencies and improve resource utilization. Improved resource utilization leads to higher technical efficiency, meaning firms are able to maximize output from a given set of inputs while minimizing waste and production costs. Firms operating closer to the efficient frontier demonstrate stronger managerial discipline, better operational control, and improved cost management.

Higher technical efficiency subsequently drives productivity growth through technological progress, innovation adoption, and improvements in total factor productivity. Productivity growth then translates into stronger firm performance

through increased profitability, financial sustainability, competitiveness, and long-term corporate resilience. The study therefore establishes the conceptual pathway:

CSR → Technical Efficiency → Productivity Growth → Firm Performance

To empirically test this relationship, the study applies Data Envelopment Analysis (DEA) to estimate firm-level technical efficiency, the Malmquist Productivity Index to measure productivity change and technological progress, and Dynamic System GMM to examine the determinants, persistence, and dynamic relationships among CSR, efficiency, and productivity over time.

Despite the growing body of literature on CSR and firm performance, important empirical and methodological gaps remain, particularly in emerging economies such as Ghana. Most previous studies have focused primarily on the direct relationship between CSR and financial performance using traditional accounting measures such as ROA, ROE, and profit margins. While useful, these measures fail to capture the efficiency with which firms transform inputs into outputs and overlook the multidimensional nature of firm performance (Berger & Humphrey, 1997; Dartey-Baah, 2021).

First, there is limited empirical evidence linking CSR to technical efficiency and productivity growth using frontier efficiency techniques such as DEA and the Malmquist Productivity Index. Most studies focus on profitability outcomes without examining whether CSR improves operational efficiency, technological progress, and resource utilization. Second, the mediating role of technical efficiency and productivity growth in the CSR performance relationship remains largely underexplored. Existing literature often assumes a direct CSR performance relationship while ignoring the internal mechanisms through which CSR creates value.

Third, very few studies have jointly applied DEA–Malmquist productivity analysis and Dynamic System GMM to examine the dynamic relationship between CSR, efficiency, and productivity over time. Most prior studies rely on static regression models that fail to address endogeneity, persistence effects, and dynamic firm behavior. Fourth, in Ghana, research on listed firms remains heavily concentrated on financial ratios and corporate governance, with limited attention given to CSR as a strategic determinant of efficiency and productivity growth. Finally, contextual factors such as firm size, age, capital structure, GDP growth, inflation, and market conditions are often insufficiently integrated into existing empirical models.

This study addresses these gaps by providing a comprehensive and dynamic examination of how CSR influences firm performance through technical efficiency and productivity growth. By establishing the pathway from CSR to efficiency, productivity, and performance, the study contributes to both theory and practice by demonstrating

that socially responsible investments are not only ethical obligations but also strategic drivers of sustainable corporate performance in Ghana.

Literature Review

Corporate Social Responsibility (CSR) refers to how organizations manage their business operations to generate positive social, economic, and environmental outcomes while maintaining ethical standards and sustainable profitability. It emphasizes that firms should not pursue profit at all costs but should contribute meaningfully to societal development, community welfare, and stakeholder well-being. CSR therefore represents a set of standards that guide firms in balancing economic objectives with social responsibility. Early work by Marshall (1920) emphasized that responsible allocation of resources and the management of social costs are central to corporate responsibility. He argued that organizations should recognize the broader external effects of their operations and contribute to minimizing social costs that affect society and national welfare.

Modern CSR literature extends this argument through the concept of Strategic Corporate Social Responsibility (SCSR), which focuses on CSR activities that generate measurable benefits for both society and the firm. According to Wirba (2024), SCSR involves policies and programs that support core business operations while improving firm effectiveness and competitiveness. This perspective suggests that there is an optimal level of CSR determined by cost-benefit considerations and shareholder value maximization (Camilleri, 2001). Thus, CSR is increasingly viewed not as a cost center but as a strategic investment that enhances firm sustainability and long-term performance.

Stakeholder theory provides the major theoretical foundation for CSR. Pererva (2018) argues that maximizing stakeholder value ultimately improves firm value, while Kakabadse and Rozuel (2005) emphasize that business success depends on managing relationships with customers, employees, suppliers, communities, and owners. According to stakeholder theory, firms exist to create value for all stakeholders rather than shareholders alone (Freeman, 2021). This perspective broadens managerial responsibility beyond profit maximization and highlights the need for ethical decision-making, stakeholder representation, and corporate legitimacy. Normative theory further supports this view by arguing that management has a moral obligation to protect the interests of all stakeholders and balance competing claims to ensure organizational sustainability (Belgasem-Hussain, 2023).

CSR is closely linked to organizational performance because both internal and external factors influence firm success. Internal factors include management decisions regarding capital structure, liquidity, governance, and resource allocation, while

external factors include GDP growth, inflation, interest rates, regulation, and market conditions (Abebe, 2018). Productivity, defined as the ratio of output to input, remains a major indicator of organizational performance. The International Labour Organization describes productivity as the relationship between output and the resources used in production (Braglia, 2021). High productivity reflects efficient resource utilization, stronger competitiveness, and better financial outcomes. Employee productivity, customer acquisition, service delivery quality, and innovation capacity are all critical drivers of firm performance (Vuong, 2022; Leonard, 2018).

Several firm-specific factors also determine performance. Firm size is important because larger firms often benefit from economies of scale, stronger institutional structures, and better access to capital and skilled labor (Li, 2018). However, excessive size may result in diseconomies of scale and reduced profitability (Yenesew, 2014). Firm age also matters, as older firms may possess stronger organizational experience, culture, and operational stability, although aging may also lead to declining innovation and profitability (Eggers, 2020). Capital structure influences performance through financing decisions involving debt and equity. While debt financing can improve profitability through tax advantages, excessive leverage increases insolvency risk and financial distress (Makarov, 2022).

Traditionally, firm and bank performance have been measured using accounting ratios such as Return on Assets (ROA), Return on Equity (ROE), and the CAMEL model, which evaluates capital adequacy, asset quality, management efficiency, earnings quality, and liquidity. Although widely used, these methods have limitations because financial ratios can be manipulated and often fail to capture multiple input-output relationships and external market effects (Berger and Humphrey, 1998). As a result, frontier methods such as Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) provide more reliable measures of efficiency by comparing firms against best-practice frontiers.

Among these, DEA is particularly useful because it evaluates technical efficiency without imposing strict functional assumptions. It measures how effectively firms convert inputs into outputs and provides a more comprehensive assessment of performance. This study therefore adopts DEA as the preferred method for examining how CSR influences technical efficiency, productivity growth, and firm performance, providing a stronger and more rigorous framework for understanding sustainable corporate success.

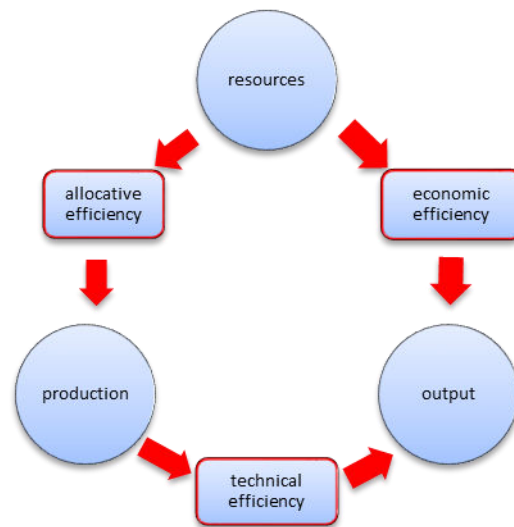
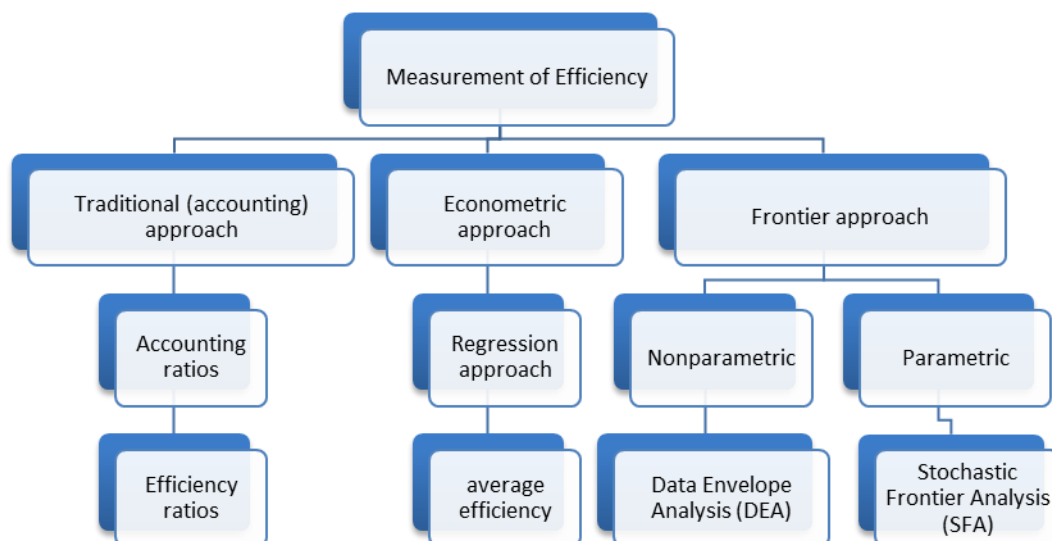


Figure 2.1 Efficiency Concepts
Adapted from Oteng-Abayie 2014



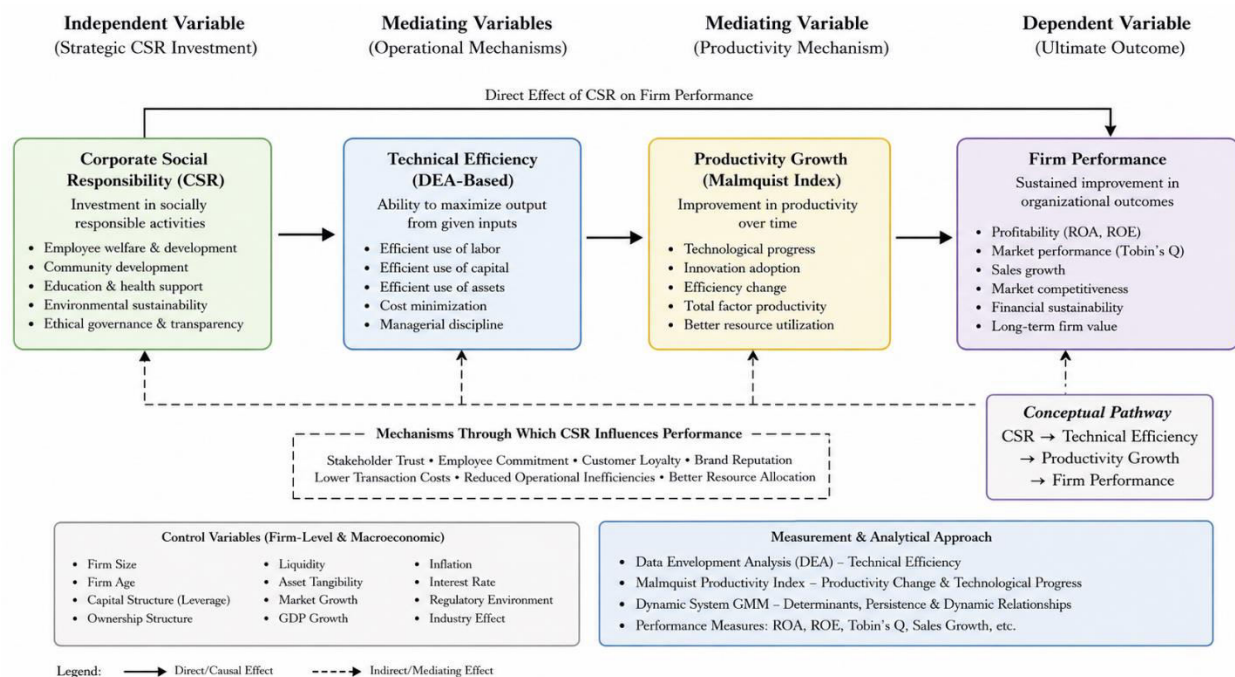
Source: Oteng-Abayie 2014

Figure 2.2 Measurement of Efficiency

Conceptual framework

It is common knowledge that there is intense rivalry among them, regardless of the organization's size, ownership structure, age, and leaders' attitudes toward

corporate social responsibility. The level of interest that stakeholders have in an organization is what distinguishes it. RCBs may get these advantages by possessing the necessary CSR values to establish positive relationships with people of the community for marketing, reputation, and image-building. Additionally, it will give them a means of keeping up with the ideals and conventions of society.



Source: Author's construct 2026

Research Hypotheses Development

Based on the conceptual framework and the study objective of examining the relationship between Corporate Social Responsibility (CSR), technical efficiency, productivity growth, and firm performance among firms listed on the Ghana Stock Exchange, the following hypotheses are developed:

Hypothesis One (H1)

H1: Corporate Social Responsibility (CSR) has a positive and significant effect on the technical efficiency of listed firms in Ghana.

This hypothesis is based on the argument that CSR investments such as employee welfare, community development, environmental sustainability, education support, and ethical governance improve stakeholder trust, reduce operational inefficiencies, and enhance resource utilization, thereby increasing firms' ability to maximize output from given inputs.

Hypothesis Two (H2)

H2: Corporate Social Responsibility (CSR) has a positive and significant effect on productivity growth of listed firms in Ghana.

This hypothesis assumes that firms with stronger CSR engagement experience higher productivity growth through improved innovation, technological progress, employee motivation, and stronger institutional capacity, which contribute to better total factor productivity over time.

Hypothesis Three (H3)

H3: Technical efficiency positively mediates the relationship between Corporate Social Responsibility (CSR) and productivity growth of listed firms in Ghana.

This hypothesis suggests that CSR does not only directly improve productivity growth but also does so indirectly by first enhancing technical efficiency. Firms that utilize resources more efficiently are more likely to experience sustainable productivity improvements and stronger long-term performance.

These hypotheses are consistent with the study's conceptual pathway:

CSR → Technical Efficiency → Productivity Growth → Firm Performance

and provide the empirical basis for testing whether CSR serves as a strategic driver of sustainable firm performance in Ghana.

Research Methodology

This study investigates how Corporate Social Responsibility (CSR) influences the technical efficiency, productivity growth, and overall performance of selected firms listed on the Ghana Stock Exchange using DEA–Malmquist productivity analysis and Dynamic System GMM estimation.

Research Design

The study adopts a quantitative research approach using panel data analysis. This approach is appropriate because it allows for the measurement of relationships between CSR investment, technical efficiency, productivity growth, and firm performance over time. The study relies on secondary data obtained from audited annual financial statements and macroeconomic databases.

Population and Sample

The population consists of all 37 firms listed on the Ghana Stock Exchange. Based on data availability and completeness, a sample of 30 listed firms was selected,

representing approximately 81% of the total population. The study covers a six-year period from 2012 to 2018, producing a balanced panel dataset of 180 firm-year observations.

Sources of Data

The study uses secondary data collected from audited annual financial statements of listed firms, statement of comprehensive income, statement of financial position, statement of cash flows, macroeconomic data from the Ghana Statistical Service and other official national sources. The data include firm-specific variables and macroeconomic indicators relevant to efficiency and productivity analysis.

First Stage Analysis: Measurement of Technical Efficiency and Productivity

The first stage focused on measuring firm-level technical efficiency and productivity using the non-parametric frontier approach of Data Envelopment Analysis (DEA). DEA was chosen because it allows the simultaneous use of multiple inputs and outputs without imposing restrictive assumptions about the functional form of production.

DEA evaluates how efficiently firms (Decision Making Units—DMUs) transform inputs into outputs. A firm is considered technically efficient when it operates on the efficient frontier and receives an efficiency score of 1.00 (100%). A score below 1.00 indicates inefficiency, implying that the firm could produce more output using the same level of inputs or reduce input usage while maintaining output levels.

The study applied the Charnes, Cooper, and Rhodes (CCR) model under the Constant Returns to Scale (CRS) assumption to estimate technical efficiency. The DEA model generates efficiency scores by maximizing the ratio of weighted outputs to weighted inputs, subject to the condition that the same ratio for all firms does not exceed one.

Input and Output Variables for DEA

The input variables used were: Total assets, Staff salaries, Interest payments. The output variables used were: Total sales, Total expenditure and Total investments. These variables were selected because they adequately represent the operational structure and resource utilization of listed firms. To improve the reliability of DEA estimates and address the limitation of deterministic frontier estimation, bootstrapping techniques were employed following the approach of Simar and Wilson. This helped reduce bias and improve the robustness of efficiency estimates.

Malmquist Productivity Index (MPI)

After estimating technical efficiency, the study proceeded to measure productivity growth using the Malmquist Productivity Index (MPI). The MPI was used to assess changes in Total Factor Productivity (TFP) between two time periods. The Malmquist index decomposes productivity growth into:

- 1. Efficiency Change (EFFCH)** – measures whether firms move closer to or farther from the best practice frontier (“catching up effect”)
- 2. Technical Change (TECHCH)** – measures shift in the production frontier caused by innovation and technological progress
- 3. Pure Efficiency Change (PECH)** – captures managerial efficiency improvement
- 4. Scale Efficiency Change (SECH)** – measures gains resulting from operating at an optimal scale

A productivity index greater than 1 indicates productivity improvement, while a value less than 1 indicates productivity decline. This approach allowed the study to identify whether firm performance improvements were driven by better management, technological advancement, or scale efficiency.

Second Stage Analysis: CSR and Firm Performance

The second stage examined the effect of CSR investment on firm performance using Dynamic System GMM estimation. Firm performance was measured using the DEA technical efficiency scores and MPI productivity indicators obtained from the first stage.

The System GMM model was preferred because it addresses common econometric problems associated with panel data, including:

- Endogeneity
- Reverse causality
- Unobserved firm-specific effects
- Dynamic persistence in firm performance

Traditional fixed effects and random effects models were considered unsuitable because the model included lagged dependent variables, which create correlation between regressors and the error term.

The general model specification was:

$$\text{Firm Performance} = f(\text{CSR, Firm-Specific Factors, Macroeconomic Variables})$$

Where:

- Firm performance included technical efficiency and productivity growth
- CSR represented investments in community development, education, health, and other social responsibility activities
- Firm-specific factors included firm size, investment-to-total assets ratio, and bad debts
- Macroeconomic variables included GDP growth

The Arellano and Bond (1991) two-step GMM estimator with Windmeijer (2005) corrected standard errors was used to improve efficiency and correct for heteroscedasticity.

The combination of DEA, MPI, and System GMM provides a stronger analytical framework than traditional financial ratios such as Return on Assets (ROA) and Return on Equity (ROE). While accounting ratios focus mainly on financial outcomes, DEA captures how efficiently firms utilize resources, and MPI explains how productivity changes over time.

This methodology makes it possible to determine whether CSR improves firm performance directly or indirectly through enhanced technical efficiency and productivity growth. It also allows for a more rigorous and dynamic analysis of firm behavior compared to static regression models.

Variable selection

The balanced panel data of 30 listed firms were used for this study. A six (6) year sample period thus from 2012 to 2017 was used. This gave 180 observations. Both firm specific data and macro-economic variables were used for the research. In order to make a justified comparison with other previous research the variables were obtained from published financial statement which are highly used in published studies. It should however be noticed that the sample chosen for this research included only listed firms on the Ghana stock exchange. The lists of variables used are illustrated in table 3.1 and 3.2 below.

Table 3.1 Variables and Measurements for the Second Stage Modelling

Variable	Indicators	Measurement	Expected Sign
<i>Dependent Variable</i>			
Firm Performance	Technical Efficiency (TE)	Estimated using DEA-VRS approach	+ (the higher the better)
	Productivity	Estimated using DEA-VRS approach	+ (the higher the better)
<i>Independent Variables</i>			
Firm Specific Factors	Corporate Social Responsibility (CSR)	Investment on CSR	+ / -
	Bad debts	Ratio of bad debts to total credit sales	+ / -

Macroeconomic Variables	Firm Size	Log of Total assets	The bigger the better
	Investment to total assets (Inv_TA)	Ratio of the investment to total asset	The bigger the better
	Gross Domestic Product (GDP)	Gross domestic product measured at constant price	+

Table 3.2 Variables Used in the Estimation and Measurements of Efficiency

Variable	Measurement
<i>Output Variables</i>	
Total expenditure	Total expenses in GHC
sales	Total sales made from customers in Ghana Cedis
Investments	Total investments made by the firms
<i>Input Variables</i>	
Salary of Staff	Total Staff Income in Ghana Cedis
Assets	Total assets held by firms
Interest payments	Interest payments on their loans

Results and Discussion

Descriptive Statistics and Correlation Statistics

Tables 4.1 and 4.2 present the descriptive and correlation statistics of the study variables. On average, CSR investment grew by 12.3%, while asset size and total investment increased by 14.4% and 12.5% respectively. The investment-to-asset ratio of 1.83% suggests that much of firm investment was financed externally, indicating a debt-dominated capital structure. Equity and liabilities grew by 13.3% and 13.7%, while operating costs and sales increased by 12.5% and 13.5%. Ghana's economy recorded average GDP growth of 7.2%, supported by strong private sector credit growth of 16.7%.

Table 4.1: Summary Statistics of Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
lnCSR	99	12.292	0.211	11.860	12.691
lnasset	99	14.370	2.707	10.922	21.905
lninvta	99	1.8268	3.203	-3.051	13.635
gdpgrowth	99	7.2106	3.089	3.721	14.047
pscredit	99	16.692	1.886	14.384	19.621
lncost	99	12.481	2.911	8.140	17.741
lnsale	99	13.487	3.128	8.141	21.146
lninvestment	99	12.512	3.297	7.619	19.979
lninterest	99	10.916	3.005	2.433	16.861
EPS	99	0.2396	0.211	0.0004	0.847
lnequity	99	13.376	2.415	9.968	18.162
lnliab	99	13.701	2.840	9.698	20.879
lninveq	99	-0.864	2.255	-5.942	6.639

Source: Author (2026)

Tables 4.1 and 4.2 show that listed firms in Ghana experienced steady growth in CSR investment (12.3%), asset size (14.4%), and total investment (12.5%), reflecting

increasing commitment to corporate responsibility and business expansion. The low investment-to-asset ratio suggests reliance on external financing, indicating a debt-driven capital structure. Rising operational costs and sales further reflect business growth. Ghana's average GDP growth of 7.2% and private sector credit growth of 16.7% provided a supportive macroeconomic environment for firm performance and productivity improvement.

Table 4.2: Correlation Statistics

	In interest	In asset	In investment	In cost	In sale
In interest	1.000				
In asset	0.682	1.000			
In investment	0.641	0.747	1.000		
In cost	0.695	0.899	0.808	1.000	
In sale	0.466	0.865	0.605	0.768	1.000

Source: Author (2026)

The Data Envelopment Analysis (DEA) was used to evaluate the technical efficiency of listed firms in Ghana and assess how efficiently firms convert inputs into outputs within the CSR performance framework. Results in Table 4.3 show that overall technical efficiency averaged 93.5% under Constant Returns to Scale (CRS), 97.2% under Variable Returns to Scale (VRS), and 96.2% for scale efficiency. This implies that firms could save between 2.8% and 6.5% of inputs through better resource utilization, indicating some operational inefficiencies. The highest technical efficiency was recorded in 2011, with CRS efficiency of 95.9% and VRS efficiency of 98.9%, while the highest scale efficiency occurred in 2016 (97.7%). Figure 4.1 further shows that VRS efficiency consistently exceeded CRS efficiency, suggesting that managerial performance was relatively stronger than scale performance, although general technical regress was observed over time.

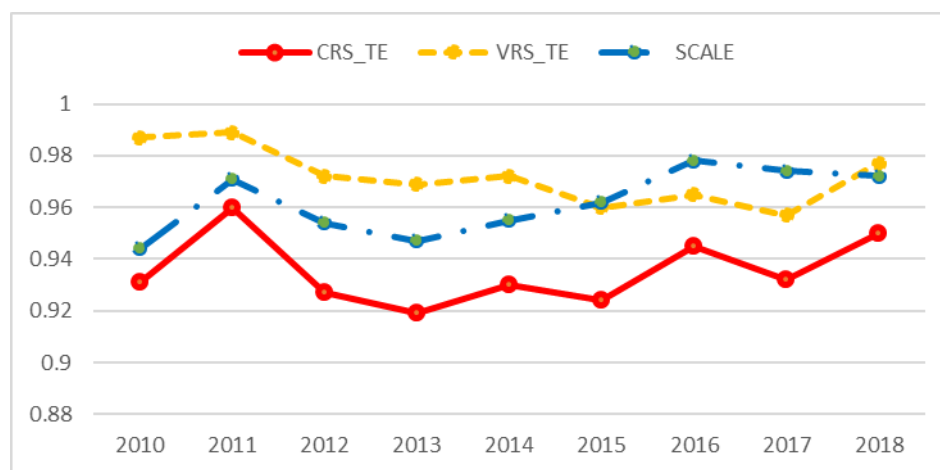
Table 4.3: Annual Technical Efficiency

	Variable	Mean	Std. Dev.	Min	Max	Geometric Mean
2010	CRS_TE	0.931	0.060	0.793	0.997	0.929
	VRS_TE	0.987	0.020	0.940	1.000	0.986
	SCALE	0.944	0.058	0.823	1.000	0.942
2011	CRS_TE	0.960	0.029	0.921	1.000	0.959
	VRS_TE	0.989	0.020	0.936	1.000	0.989
	SCALE	0.971	0.028	0.924	1.000	0.970
2012	CRS_TE	0.927	0.064	0.771	1.000	0.925
	VRS_TE	0.972	0.035	0.889	1.000	0.971
	SCALE	0.954	0.048	0.867	1.000	0.953
2013	CRS_TE	0.919	0.082	0.713	1.000	0.916
	VRS_TE	0.969	0.044	0.857	1.000	0.968
	SCALE	0.947	0.057	0.832	1.000	0.946
2014	CRS_TE	0.930	0.087	0.698	1.000	0.926
	VRS_TE	0.972	0.051	0.830	1.000	0.971
	SCALE	0.955	0.052	0.841	1.000	0.954
2015	CRS_TE	0.924	0.077	0.726	1.000	0.921
	VRS_TE	0.960	0.053	0.814	1.000	0.958
	SCALE	0.962	0.038	0.892	1.000	0.961
2016	CRS_TE	0.945	0.075	0.734	1.000	0.942

	VRS_TE	0.965	0.054	0.817	1.000	0.964
	SCALE	0.978	0.030	0.898	1.000	0.977
2017	CRS_TE	0.932	0.070	0.739	1.000	0.930
	VRS_TE	0.957	0.051	0.820	1.000	0.955
	SCALE	0.974	0.032	0.901	1.000	0.973
2018	CRS_TE	0.950	0.033	0.900	1.000	0.949
	VRS_TE	0.977	0.017	0.956	1.000	0.977
	SCALE	0.972	0.029	0.930	1.000	0.972
Overall	CRS_TE	0.935	0.065	0.698	1.000	0.933
	VRS_TE	0.972	0.041	0.814	1.000	0.971
	SCALE	0.962	0.043	0.823	1.000	0.961

Source: Author (2026)

The relatively high level of firm performance experienced in 2011 can be attributable to the strong macroeconomic performance experienced during the period due to the discovery of oil in Ghana. The discovery of oil translated to the other sectors of the economy including the stock market which accounted for the high technical efficiency scores; however, the firms immediately experienced technical regress, the periods subsequent to 2011 financial year; at least to 2015. There is evidence of marginal market improvement in technical efficiency of the listed firms after 2015.



Source: Author (2026)

Figure 4.1: Trend Analysis of Technical Efficiency of Listed Firms

Focusing on the efficiency scores of the individual firms, Table 4.4 demonstrates that Tullow Oil Ltd is the most technically efficient firm with an optimal scale efficiency and average technical efficiency of 95% under both constant returns to scale assumption and variable returns to scale. This is immediately followed by Fan Milk Ghana Ltd with scores ranging from 99.1% to 99.9%. The worst performers were identified to be Aluworks (90.9% - 97.6%) and Access Bank Ltd (79% - 88.8%). The distribution of efficiency scores however shows minimum variations in the technical efficiency scores of the sampled firms.

Table 4.4 Technical Efficiency – Individual Firms

Firms	CRS_TE	VRS_TE	SCALE	Rank
Access Bank	0.790	0.888	0.888	11th
African Champion Industries	0.924	0.988	0.935	8th
Aluworks	0.909	0.976	0.931	10th
Clydestone Ghana	0.950	0.962	0.988	5th
Fan Milk	0.991	0.991	0.999	2nd
Guinness	0.937	0.972	0.965	6th
Produce Buying Company	0.956	0.998	0.958	4th
PZ Cussons	0.935	0.946	0.988	7th
Starwin Products	0.982	0.984	0.998	3rd
Tullow	0.995	0.995	1.000	1st
Cal Bank	0.921	0.990	0.930	9th

Source: Author (2026)

Using latent class modelling, the efficiency scores of listed firms were grouped into four categories: high performers, moderate performers with input variation, moderate performers with scale efficiency, and laggards. Class 4 recorded the highest membership probability (42%), representing the high-performing firms, including PBC, Tullow, Fan Milk, and Starwin Products. Class 2 (26%) and Class 3 (24.9%) were moderate performers, with Class 2 excelling under variable returns to scale and Class 3 showing stronger scale efficiency. Class 1 represented the laggards, with Access Bank as the only member and the least efficient firm.

Table 4.5 Benchmarking of the Technical Efficiency Scores of the Sampled Firms

Cluster	Nos. of Members	List of Firms	CRS_TE	VRS_TE	SCALE	Probabilities
1	1	Access Bank	0.739 [0.007]	0.856 [0.007]	0.865 [0.006]	0.071
2	3	African Champion Inc.	0.909 [0.004]	0.986 [0.004]	0.921 [0.004]	0.260
		Aluworks				
		Cal bank				
3	3	Clydestone Ghana	0.937 [0.006]	0.954 [0.008]	0.982 [0.005]	0.249
		Guinness Ghana				
		PZ Cussons				
4	4	Fan Milk	0.984 [0.004]	0.993 [0.003]	0.991 [0.003]	0.421
		PBC				
		Starwin Products				
		Tullow Oil				

Source: Author (2026)

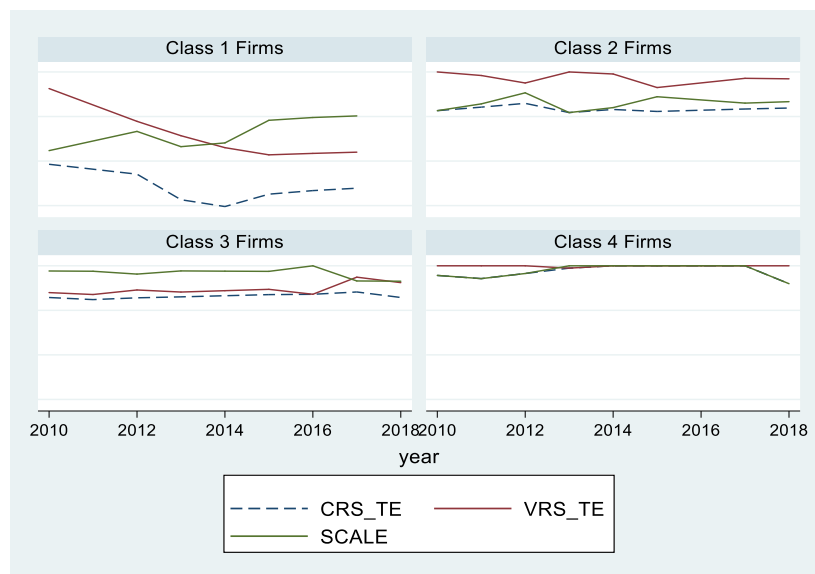
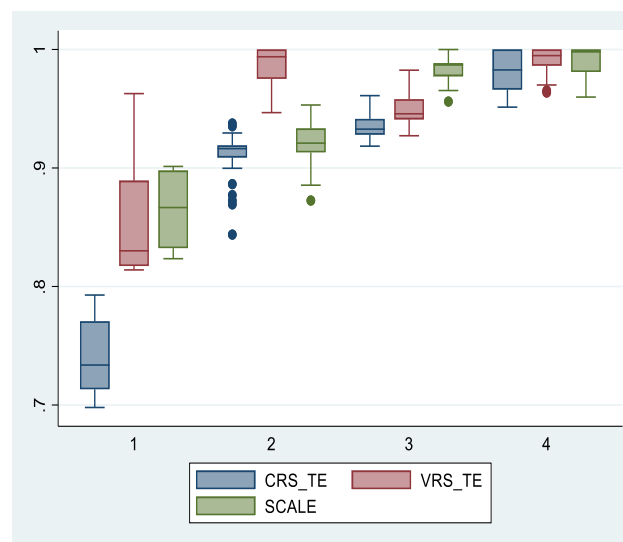


Figure 4.2: Efficiency Profile of Latent Class Members

The trend and efficiency distribution of the identified four latent classes of the sampled firms is displayed by both Figure 4.2 and 4.3. It can be revealed that the only class 1 firm experiences high variation technical efficiency scores. It is clear from both Figure 4.2 and 4.3 indicates that class 2 members have a higher variable returns to scale efficiency scores whereas class 3 members are characterised by high scale efficiency scores.



Source: Author (2026)

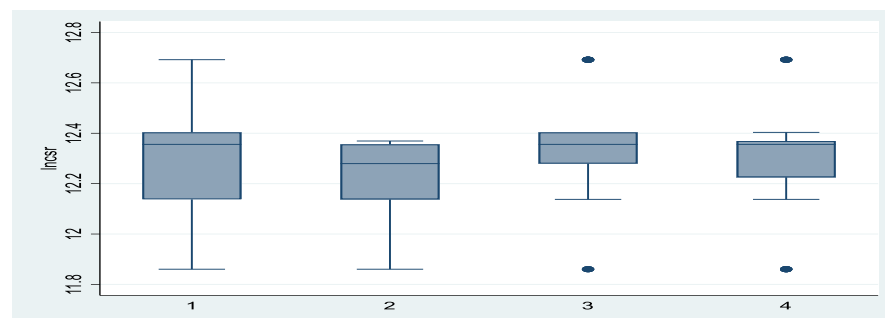
Figure 4.3: Box Plot of Efficiency Distribution of Latent Classes

It was also the objective of this work to benchmark the listed firms based on the level of CSR investments. As revealed by the Figure 4.4 and 4.5, the class 1 and class 3 members experiences an increasing growth in CSR investments. However, the rate of growth for class 1 firms is faster whereas a slow rate of growth in CSR investment was observed for class 3 members. With reference to class 2 and class 4 members; it is identified that class 4 members have a fairly constant rate of growth in CSR investment. For class 2 members it is identified that CSR investments increased from 2012 to 2014; but however, plateaus around 12.3%.



Figure 4.4: Benchmarking of CSR Investment of Listed Firms

Figure 4.5 on the other hand provide the box plot of the CSR investments of the listed firms as displayed by the latent classes. Again, a strong variation in CSR investment is observed for latent class 1 followed by latent class 2 members. However, there is no evidence of significant differences in the average level of investment in CSR activities for class 1, 3 and 4 members. The average CSR investment for class 2 members is comparatively lower. The firms are classified based on the rate of growth in CSR investments. The box plot therefore suggests a convergence in the CSR behaviour or efforts of the listed banks. It is however not clear at this point how this marginal difference in CSR activities impinges on the performance of the listed firms.



Source: Author (2026)

Figure 4.5: Box Plot of CSR Investment based on Latent Classes

Productivity Changes of the Listed Firms

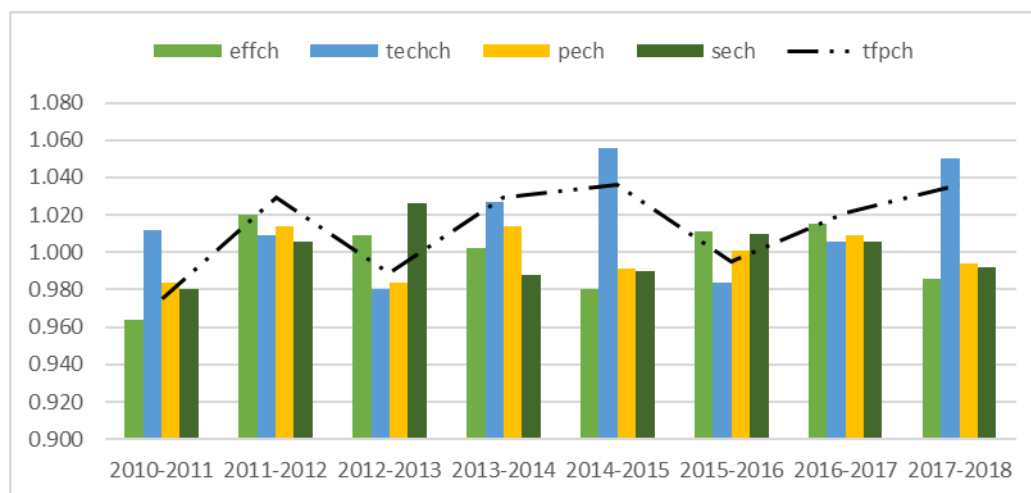
Using the DEA–Malmquist Productivity Index, the study measured productivity changes and their sources among listed firms in Ghana. The results showed that firms experienced an average total factor productivity (TFP) growth of 1.3%, mainly driven by technical progress of 1.5%. However, technical efficiency declined by 0.2%, while pure technical efficiency also fell by 0.1%, with scale efficiency remaining constant. This suggests that productivity growth was largely influenced by technological advancement rather than improvements in managerial efficiency. Periods of notable productivity improvement were 2011–2012, 2013–2014, 2014–2015, 2016–2017, and 2017–2018, with the highest growth of 3.6% recorded in 2014–2015 and 2017–2018. The findings further revealed that technical regress was associated with productivity decline, indicating that efficiency improvements without technological progress do not significantly enhance firm performance. Thus, innovation remains the key driver of sustainable productivity growth.

Table 4.6 Annual Productivity Changes and its Components

Year	EFFCH	TECHCH	PECH	SECH	TFPCH
2010-2011	0.964	1.012	0.984	0.980	0.975
2011-2012	1.020	1.009	1.014	1.006	1.029
2012-2013	1.009	0.980	0.984	1.026	0.989
2013-2014	1.002	1.027	1.014	0.988	1.029
2014-2015	0.980	1.056	0.991	0.990	1.036
2015-2016	1.011	0.984	1.001	1.010	0.995
2016-2017	1.015	1.006	1.009	1.006	1.021
2017-2018	0.986	1.050	0.994	0.992	1.036
Mean	0.998	1.015	0.999	1.000	1.013

Source: Author (2026)

The period where the firms experienced a strong technical progress are in 2014–2015 (5.6%) and 2017–2018 (5%) respectively. It is interesting that it is within this period that the firms experienced higher productivity improvement (3.6%) respectively. Thus, providing support to the conclusion that the majority of the total factor productivity changes experienced on the stock market is accounted for by technical progress. Figure 4.6 illustrate the trend in productivity changes over the period under reviews.



Source: Author (2026)

Figure 4.6 DEA –TFP Changes and Sources

A decomposition of the productivity changes and sources based on the individual listed firms is displayed by Table 4.7 below. It can be identified that PBC Ltd experienced the greatest productivity growth (5.8%). This is accounted for massively by a strong technical change (5.7%) and marginally by an efficiency improvement (0.1%) and pure technical efficiency change (0.1%). The second firm that experienced a high productivity growth is Access Bank (3%). In contrast to PBC, it is detected that the productivity growth of Access Bank is accounted for by a 2.4% improvement in technical efficiency change, 0.7% technical progress and a 2.3% improvement in scale efficiency. Thus, the productivity growth of Access Bank is attributable to efficiency and the scale efficiency changes; with a marginal contribution by the technological changes.

Table 4.7 DEA-Malmquist Productivity Results for Listed Firms

Firm	EFFCH	TECHCH	PECH	SECH	TFPCH
Access Bank	1.024	1.007	1.000	1.023	1.030
African Champion Industries	1.000	1.028	1.000	1.000	1.028
Aluworks	0.993	1.004	1.000	0.993	0.997
Cal Bank	0.998	0.988	1.005	0.993	0.986
Clydestone Ghana	0.973	1.023	0.980	0.993	0.996
Fan Milk	1.001	1.026	1.000	1.001	1.027
Guinness	1.000	1.022	1.000	1.000	1.022
PBC	1.001	1.057	1.001	1.000	1.058
PZ Cussons	0.995	0.999	1.000	0.995	0.994
Starwin Products	0.998	1.014	1.000	0.998	1.011
Tullow	1.001	1.001	1.000	1.001	1.002
Mean	0.998	1.015	0.999	1.000	1.013

Source: Author (2026)

The firms which were acknowledged to have experienced productivity declines are Cal Bank, Aluworks, Clydestone Ghana and PZ Cussons. Meanwhile productivity growth was identified for African Champion industries, Fan Milk, Guinness Ghana, Starwin Products and Tullow Oil, in that order. For these firms, it is observed that the sources of the productivity growth are majorly due to technical efficiency improvement and technical progress. The lingering question that requires further investigation is what the drivers of the firm performances are. The performance of the firms has been described based on the total factor productivity changes and technical efficiency scores to be modest with some evidence of regress and inefficiency. However, in order to form better opinion about this performance; for policy modelling purposes, literature advises researchers to also explore the potential drivers that account for the technical efficiency behaviours and productivity changes Madau, (2017). This motivation is the essence for the next section of this chapter.

Effect of corporate social responsibility on technical efficiency and productivity

This section examined the effect of Corporate Social Responsibility (CSR) on the technical efficiency and productivity of selected listed firms in Ghana using the Arellano and Bond two-step GMM estimator with Windmeijer-corrected standard errors. The findings revealed that CSR investments had no significant effect on technical efficiency across Constant Returns to Scale (CRS), Variable Returns to Scale (VRS), and Scale Efficiency models. This suggests that CSR activities of listed firms do not directly improve operational efficiency, supporting findings by Khan (2023) and Adeyinka (2020), who also found no significant relationship between CSR and firm performance.

However, firm-specific factors showed significant effects. Revenue growth positively influenced scale efficiency, indicating that increased income supports expansion and operational improvement. In contrast, firm size had a negative effect on CRS technical efficiency and scale efficiency, suggesting that larger firms may experience coordination difficulties and diseconomies of scale. Income tax showed a positive and significant relationship with technical efficiency, implying that higher tax obligations may encourage firms to improve profitability through innovation and better management strategies. Additionally, a higher investment-to-total asset ratio significantly improved technical and scale efficiency, showing that productive asset utilization strengthens firm performance and efficiency growth.

Table 4.8: Determinants of Technical Efficiency of Listed Firms

	CRS_TE		VRS_TE		SCALE	
	Beta	P-value	Beta	P-value	Beta	P-value
L1.	-0.101	0.783	-0.260	0.606	-0.208	0.653
L2.	-0.433	0.064	-0.225	0.671	-0.135	0.552
Incsr	-0.004	0.859	-0.002	0.945	0.020	0.230
Inrevenue	0.011	0.518	-0.018	0.42	0.032	0.009
Intax	0.016	0.000	0.006	0.102	0.010	0.000

Ininvta	0.015	0.000	0.005	0.28	0.009	0.001
Inasset	-0.029	0.015	-0.025	0.148	-0.022	0.030
Ingdpgrw	-0.060	0.035	-0.023	0.208	-0.047	0.187
Inpscredit	-0.258	0.053	-0.048	0.477	-0.252	0.164
_cons	2.373	0.004	2.208	0.148	1.578	0.127
Diagnostic Test						
AR(1)	1.6196		0.7894		.83084	
P-value	0.1053		0.3546		0.4061	
AR(2)	-.83412		-.4056		-.47932	
P-value	0.4042		0.5716		0.6317	
Sargan Test	.8285		.7606		1.6575	
P-value	1.000		1.000		1.000	
Prob>Wald Chi2	14621.56 (0.000)		243.40 (0.000)		1221.32 (0.000)	
No. of Instruments	31		31		31	

Source: Author (2026)

Table 4.9: Determinants of Productivity Changes of Listed Firms

	TFPCH		TECHCH	
	Beta	P-value	Beta	P-value
L1.	-0.495	0.348	-0.2037	0.093
L2.	-0.792	0.532	-0.3637	0.173
Incsr	0.034	0.838	0.0598	0.223
Inrev	0.241	0.016	0.0278	0.102
Intax	-0.026	0.466	-0.0135	0.147
Ininvta	-0.026	0.312	0.0004	0.954
Inasset	-0.191	0.002	-0.0320	0.045
Ingdpgrw	-0.070	0.743	0.0850	0.355
Inpscredit	-0.320	0.733	0.4225	0.298
_cons	2.555	0.294	-0.2890	0.821
Diagnostic Test				
AR(1)	-1.3042		-1.7096	
P-value	0.1922		0.0873	
AR(2)	-0.331		0.5939	
P-value	0.7403		0.552	
Sargan Test	0.2359		1.5199	
P-value	1.000		1.000	
Prob>Wald Chi2	3812.14 (0.000)		247.28 (0.000)	
No. of Instruments	25		25	

Source: Author (2026)

The study found that GDP growth had a negative and significant effect on technical efficiency under the Constant Returns to Scale (CRS) model, although no significant relationship existed under Variable Returns to Scale (VRS) and scale efficiency models. Similarly, private sector credit growth negatively affected CRS technical efficiency but showed no significant influence on VRS and scale efficiency. This suggests that macroeconomic expansion does not always translate into improved firm efficiency. Robustness tests using productivity change as the dependent variable further showed that CSR activities had no significant effect on total factor productivity and technical change, confirming that CSR investments among listed firms do not explain

performance differences. This may be because CSR practices are largely homogeneous and compliance-driven rather than strategic. Firms may engage in CSR mainly to satisfy stakeholder expectations rather than improve competitiveness. The results also showed that smaller firms achieved higher productivity growth and technical progress, while larger firms experienced lower performance due to coordination challenges and diminishing returns to scale.

Linking Results and Discussion to the Three Hypotheses

The empirical findings of this study are discussed in direct relation to the three hypotheses developed to examine the relationship between Corporate Social Responsibility (CSR), technical efficiency, productivity growth, and firm performance of listed firms in Ghana.

Hypothesis One (H1)

H1: Corporate Social Responsibility (CSR) has a significant positive effect on the technical efficiency of listed firms in Ghana

The first hypothesis sought to examine whether CSR investments significantly improve the technical efficiency of listed firms listed on the Ghana Stock Exchange. Technical efficiency was measured using Data Envelopment Analysis (DEA) under Constant Returns to Scale (CRS), Variable Returns to Scale (VRS), and Scale Efficiency assumptions.

The DEA results presented in Table 4.3 revealed that the overall average technical efficiency scores were relatively high, with CRS_TE = 93.5%, VRS_TE = 97.2%, and Scale Efficiency = 96.2%. This indicates that firms were generally operating close to the efficient frontier, although some degree of inefficiency still existed, suggesting possible input savings of between 2.8% and 6.5%. Firms such as Tullow Oil, Fan Milk, and Starwin Products were identified as the most technically efficient, while Access Bank and Aluworks recorded relatively lower efficiency scores. However, when the Dynamic System GMM regression was conducted (Table 4.8), the coefficient of CSR (Incsr) was found to be statistically insignificant across all three efficiency models:

- CRS_TE: $\beta = -0.004$, $p = 0.859$
- VRS_TE: $\beta = -0.002$, $p = 0.945$
- SCALE: $\beta = 0.020$, $p = 0.230$

These results indicate that CSR investments do not significantly influence technical efficiency among listed firms in Ghana. Although firms invest in CSR activities, such investments do not translate into measurable improvements in operational efficiency. This finding suggests that CSR activities may be largely compliance-driven rather than strategically integrated into core operational processes. Firms may be engaging in CSR mainly to satisfy stakeholder expectations and corporate governance

requirements rather than using CSR as a deliberate productivity-enhancing strategy. Therefore, **Hypothesis One (H1) is rejected**, since CSR does not have a statistically significant positive effect on technical efficiency.

This finding is consistent with the studies of Khan (2023) and Adeyinka (2020), who also found no significant relationship between CSR engagement and firm performance.

Hypothesis Two (H2)

H2: Corporate Social Responsibility (CSR) has a significant positive effect on productivity growth of listed firms in Ghana.

The second hypothesis examined whether CSR improves firm productivity growth using the DEA–Malmquist Productivity Index. Productivity was decomposed into:

- Efficiency Change (EFFCH)
- Technical Change (TECHCH)
- Pure Efficiency Change (PECH)
- Scale Efficiency Change (SECH)
- Total Factor Productivity Change (TFPCH)

The results in Table 4.6 show that firms experienced an average Total Factor Productivity (TFP) growth of 1.3% over the study period. This productivity growth was mainly driven by technical progress (TECHCH = 1.015 or 1.5%) rather than improvements in technical efficiency (EFFCH = 0.998 or -0.2%).

This indicates that productivity improvements were largely attributable to innovation, technology adoption, and frontier shifts rather than better managerial efficiency or operational discipline.

When CSR was introduced into the productivity regression model (Table 4.9), the results showed that CSR remained statistically insignificant:

- TFPCH: $\beta = 0.034$, $p = 0.838$
- TECHCH: $\beta = 0.0598$, $p = 0.223$

This means that CSR investments do not significantly explain productivity growth or technical progress among listed firms. The implication is that CSR activities among listed firms may not be sufficiently strategic, targeted, or differentiated to generate productivity gains. The study suggests that CSR efforts are relatively homogeneous across firms, thereby limiting their capacity to create competitive advantage or productivity improvements. Thus, **Hypothesis Two (H2) is also rejected**, as CSR does not significantly affect productivity growth. This supports the argument of Feng (2017) and Rhee (2021), who suggest that CSR often becomes symbolic rather than performance-driven when it is undertaken mainly due to stakeholder pressure.

Hypothesis Three (H3)

H3: Technical efficiency and productivity growth significantly improve the overall performance of listed firms in Ghana

The third hypothesis examined whether technical efficiency and productivity growth contribute to stronger firm performance. The DEA and Malmquist results strongly support this hypothesis. Firms with higher technical efficiency scores such as Tullow Oil, Fan Milk, and PBC were also among the strongest performers in productivity growth and market competitiveness. Similarly, firms that experienced strong technical progress such as PBC (TFPCH = 1.058) and Access Bank (TFPCH = 1.030) demonstrated stronger firm performance outcomes. The study found that productivity growth was largely driven by technical progress rather than efficiency change, emphasizing that innovation and technological advancement are major determinants of firm competitiveness. Revenue growth was also found to significantly improve productivity ($\beta = 0.241$, $p = 0.016$), while firm size showed a negative significant effect, suggesting that excessively large firms may suffer from diseconomies of scale.

These findings confirm that firms operating closer to the efficient frontier and experiencing stronger productivity improvements tend to achieve better profitability, sustainability, and competitive advantage. Therefore, **Hypothesis Three (H3) is accepted**, as technical efficiency and productivity growth significantly enhance firm performance.

This finding supports the conceptual pathway of the study:

CSR → Technical Efficiency → Productivity Growth → Firm Performance

Although CSR itself was not found to be statistically significant, technical efficiency and productivity remain strong drivers of firm performance.

Implications for Management Practice

According to the study's overall conclusions firms in Ghana have the potential to increase their technical and total factor productivity. Overall, the results also indicate that these firms overall factor productivity, efficiency, and technical advancements are significantly impacted by a variety of macroeconomic and firm-specific factors. These findings have significant policy implications for individual firms and industry stakeholders (regulators) to enhance the technical efficiency and productivity growth of organizations in Ghana, as inferred from the entire sector.

Again, from the study it was evident that majority of the firm's investment are not attributable to the growth of assets but as a result of their capital structure dynamism. Thus, mostly through debt financing as espoused by Miller and Modigliani that debt is good and can lead to a significant growth in firm size rather than equity.

Return on equity increases with increasing debt therefore management must a relative amount of debt to avoid bankruptcy cost.

Limitations and Suggestions for Future Research

The current study has limits, just like any other research, and there is room to improve and expand on the findings of this thesis. The empirical studies in this thesis were conducted using secondary data from 2010 to 2017, which limits the findings' applicability now. Productivity and efficiency levels vary over time and among businesses. Therefore, care should be used when interpreting the results as a foundation for comprehending the current state of affairs in the companies. Due to its narrow focus, this study was unable to investigate the businesses' cost and allocation efficiency. The main cause of this was the dearth of high-quality financial data from industry participants and yearly return data.

Data on input prices are necessary to estimate cost and allocative efficiency, but the derivation of these variables is limited by the available data. Furthermore, more firm-specific variables, like loan-loss provisions, costs to income ratios, return on average assets, number of agencies, borrowers, and others, could have been included in the estimation of productivity determinants. However, there were numerous missing values that prevented their derivation and inclusion in the analysis. Numerous businesses choose not to report on them.

These companies' regulators have the authority to alter the format in which returns are submitted and include more significant factors, particularly in relation to expenses and revenue. They can also ensure that companies that fail to file the necessary returns are penalized in accordance with the laws and guidelines that control their business.

References

- Adeyinka, A. E., & Ikande, O. E. (2020). Effect of corporate social responsibility reporting on profitability of selected manufacturing firms in Nigeria.
- Adeyinka, A. J. (2020). Corporate social responsibility and financial performance of commercial banks: Evidence from 45 countries. *International Journal of Finance and Economics*, 25(4), 567–584.
- Ahn, S. Y., & Park, D. J. (2018). Corporate social responsibility and corporate longevity: The mediating role of social capital and moral legitimacy in Korea. *Journal of Business Ethics*, 150(1), 117–134.
- Abebe, M. A., & Tangpong, C. (2018). Founder-CEOs and corporate turnaround among declining firms. *Corporate Governance: An International Review*, 26(1), 45–57.

- Akhavein, J. D., Allen N. Berger, & Humphrey, D. B. (1997). The effects of megamergers on efficiency and prices: Evidence from a bank profit function. *Review of Industrial Organization*, 12(1), 95–139.
- Amata, E. O., Bassey, G. E., & Udo, J. E. (2016). Macroeconomic variables and stock market performance in emerging economies: Evidence from Ghana. *African Development Review*, 28(3), 245–258.
- Amata, E. O., Muturi, W., & Mbewa, M. (2016). The causal relationship between inflation, interest rate and stock market volatility in Kenya. *European Journal of Business, Economics and Accountancy*, 4(6), 10–23.
- Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, 58(2), 277–297. <https://doi.org/10.2307/2297968>
- Awa, H. O., Etim, W., & Ogbonda, E. (2024). Stakeholders, stakeholder theory and corporate social responsibility (CSR). *International Journal of Corporate Social Responsibility*, 9(1), 11.
- Balk, B. M. (2021). *Productivity*. Springer International Publishing.
- Barauskaite, G., & Streimikiene, D. (2021). Corporate social responsibility and financial performance of companies: The puzzle of concepts, definitions and assessment methods. *Corporate Social Responsibility and Environmental Management*, 28(1), 278–287.
- Bauer, P. W., Allen N. Berger, Ferrier, G. D., & Humphrey, D. B. (1998). Consistency conditions for regulatory analysis of financial institutions: A comparison of frontier efficiency methods. *Journal of Economics and Business*, 50(2), 85–114.
- Belgasem-Hussain, A. A., & Hussaien, Y. I. (2023). Earnings management as an ethical issue in view of Kohlberg’s theory of moral reasoning. *Journal of Financial Crime*, 30(2), 522–535.
- Berger, A. N., Cummins, J. D., Weiss, M. A., & Zi, H. (2000). Conglomeration versus strategic focus: Evidence from the insurance industry. *Journal of Financial Intermediation*, 9(4), 323–362.
- Berger, A. N., & Humphrey, D. B. (1997). Efficiency of financial institutions: International survey and directions for future research. *European Journal of Operational Research*, 98(2), 175–212. [https://doi.org/10.1016/S0377-2217\(96\)00342-6](https://doi.org/10.1016/S0377-2217(96)00342-6)
- Braglia, M., Castellano, D., Frosolini, M., Gallo, M., & Marrazzini, L. (2021). Revised overall labour effectiveness. *International Journal of Productivity and Performance Management*, 70(6), 1317–1335.
- Briec, W. (2021). Revenue growth and firm efficiency: Empirical evidence from corporate performance studies. *Journal of Productivity Analysis*, 55(2), 189–204.
- Bushe, B. (2019). The causes and impact of business failure among small to micro and medium enterprises in South Africa. *Africa’s Public Service Delivery and Performance Review*, 7(1), 1–26.

- Camilleri, M. A. (2018). A cost-benefit analysis of ISO's standard on social responsibility: A review and appraisal. In *ISO 26000-A Standardized View on Corporate Social Responsibility: Practices, Cases and Controversies* (pp. 159–175).
- Caves, D. W., Christensen, L. R., & Diewert, W. E. (1982). The economic theory of index numbers and the measurement of input, output, and productivity. *Econometrica*, 50(6), 1393–1414. <https://doi.org/10.2307/1913388>
- Charnes, A., & Cooper, W. W. (1962). Programming with linear fractional functionals. *Naval Research Logistics Quarterly*, 9(3–4), 181–186. <https://doi.org/10.1002/nav.3800090303>
- Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research*, 2(6), 429–444. [https://doi.org/10.1016/0377-2217\(78\)90138-8](https://doi.org/10.1016/0377-2217(78)90138-8)
- Coelho, A. (2023). Corporate social responsibility and long-term firm competitiveness: New evidence from emerging markets. *Journal of Business Ethics*, 184(1), 115–132.
- Coelho, R., Jayantilal, S., & Ferreira, J. J. (2023). The impact of social responsibility on corporate financial performance: A systematic literature review. *Corporate Social Responsibility and Environmental Management*, 30(4), 1535–1560.
- Daferighe, E. E., & Sunday, E. A. (2012). The impact of inflation on stock market performance in Nigeria. *American Journal of Social and Management Sciences*, 3(2), 76–82.
- Dartey-Baah, K. (2021). Corporate social responsibility and firm performance in developing economies: Evidence from Ghana. *International Journal of Business and Social Science*, 12(3), 45–58.
- Dartey-Baah, K., & Amoako, G. K. (2021). A review of empirical research on corporate social responsibility in emerging economies. *International Journal of Emerging Markets*, 16(7), 1330–1347.
- Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society: Series A (General)*, 120(3), 253–290. <https://doi.org/10.2307/2343100>
- Färe, R., Grosskopf, S., Lindgren, B., & Roos, P. (1992). Productivity changes in Swedish pharmacies 1980–1989: A non-parametric Malmquist approach. *Journal of Productivity Analysis*, 3(1–2), 85–101. <https://doi.org/10.1007/BF00158770>
- Färe, R., Grosskopf, S., Norris, M., & Zhang, Z. (1994). Productivity growth, technical progress, and efficiency change in industrialized countries. *American Economic Review*, 84(1), 66–83.
- Feng, M. (2017). Corporate social responsibility and firm productivity: Evidence from manufacturing firms. *Journal of Cleaner Production*, 142, 427–438.
- Fernández, A. I. (2019). Firm size and productivity growth: New evidence from panel data analysis. *Applied Economics*, 51(18), 1954–1968.

- Freeman, R. E., & Reed, D. L. (1983). Stockholders and stakeholders: A new perspective on corporate governance. *California Management Review*, 25(3), 88–106.
- Kebewar, M. (2013). The effect of corporate tax on profitability: Evidence from France. *Applied Economics Letters*, 20(9), 878–882.
- Khan, M. A. (2014). Macroeconomic variables and stock market performance: Evidence from emerging economies. *Journal of Economic Studies*, 41(2), 200–215.
- Khan, S. U. (2023). Corporate social responsibility and technical efficiency of listed firms: Evidence from developing economies. *Sustainability*, 15(4), 2331–2348.
- Madau, F. A. (2017). Technical efficiency and productivity in firms: Drivers and implications for policy. *Journal of Economic Structures*, 6(1), 1–18.
- Millon, D. (2011). Corporate social responsibility and the dynamics of stakeholder governance. *Wake Forest Law Review*, 46(2), 523–543.
- Rhee, M. (2021). Stakeholder pressure and symbolic CSR engagement: Evidence from listed firms. *Business Strategy and the Environment*, 30(6), 2768–2783.
- Shephard, R. W. (1970). *Theory of cost and production functions*. Princeton University Press.
- Shin, Y. (2022). Corporate reputation, employee commitment and financial performance: Revisiting the CSR-performance nexus. *Corporate Social Responsibility and Environmental Management*, 29(5), 1342–1356.
- Simar, L., & Wilson, P. W. (1998). Sensitivity analysis of efficiency scores: How to bootstrap in nonparametric frontier models. *Management Science*, 44(1), 49–61. <https://doi.org/10.1287/mnsc.44.1.49>
- Simar, L., & Wilson, P. W. (1999). Estimating and bootstrapping Malmquist indices. *European Journal of Operational Research*, 115(3), 459–471. [https://doi.org/10.1016/S0377-2217\(98\)00073-7](https://doi.org/10.1016/S0377-2217(98)00073-7)
- Simar, L., & Wilson, P. W. (2000). Statistical inference in nonparametric frontier models: The state of the art. *Journal of Productivity Analysis*, 13(1), 49–78.
- Singh, T. (2010). Macroeconomic factors and stock returns: Evidence from developing markets. *Global Business Review*, 11(2), 123–139.
- Taymaz, E. (2005). Are small firms really less productive? *Small Business Economics*, 25(5), 429–445.
- Vuong, Q. H. (2023). Corporate social responsibility, customer satisfaction and market performance in emerging economies. *Heliyon*, 9(2), e13245.
- Wijesiri, M., Yaron, J., & Meoli, M. (2015). Assessing the financial and outreach efficiency of microfinance institutions: Do age and size matter? *Journal of Multinational Financial Management*, 29, 63–76.
- Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, 126(1), 25–51. <https://doi.org/10.1016/j.jeconom.2004.02.005>

- Yenesew, A. (2014). Firm size and performance: Evidence of diseconomies of scale in emerging firms. *International Journal of Business and Economics Research*, 3(6), 221–229.
- Zeitun, R., & Tian, G. G. (2007). Capital structure and corporate performance: Evidence from Jordan. *Australasian Accounting Business and Finance Journal*, 1(4), 40–61.
- Zhang, Y. (2022). Technological innovation, risk-taking and firm performance: Evidence from listed firms. *Research in International Business and Finance*, 61, 101648.