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TECHNOLOGY, ISLAMABAD



Impact of Green Accounting Disclosures on Financial Performance of Top 100 Manufacturing Firms in Pakistan

by

Sheeraz Ahmad

A thesis submitted in partial fulfillment for the
degree of Master of Science

in the

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by

Sheeraz Ahmad

(MAF233007)

THESIS EXAMINING COMMITTEE

S. No.	Examiner	Name	Organization
(a)	External Examiner	Dr. Shahzad Hussain	RWU, Rawalpindi
(b)	Internal Examiner	Dr. Anam Tariq	CUST, Islamabad

Dr. Iftikhar Ali Janjua

Thesis Supervisor

June, 2026

Dr. Jaleel Ahmed Malik

Head

Dept. of Accounting and Finance

June, 2026

Dr. Arshad Hassan

Dean

Faculty of Management & Social Sci.

June, 2026

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(Sheeraz Ahmad)

Abstract

The world is more concerned about the footprints of the manufacturing firms on the environment as a whole. The way to measure the ecological footprints of the operations of the manufacturing firms is how much information firm is publishing regarding the environment, how much efforts it is putting to reduce the ecological footprints. This study explores how Green Environmental Accounting Disclosures (GADI) (the ecological impact of the operations of the firm) affects the financial performance of manufacturing firms listed on the Pakistan Stock Exchange (PSX 100) from 2020 to 2024. It evaluates whether GADI contributes to return on assets (ROA), return on equity (ROE), and revenue-based returns (REV). Using panel data from 75 manufacturing firms listed on PSX 100 over five years, the analysis applies Random Effects OLS and EGLS models and incorporates variables such as EBIT, equity ratio, current liabilities, long-term debt, firm size, and firm age. The findings show that EBIT is the strongest and most consistent predictor of profitability. It demonstrates a highly significant positive relationship with both ROA and ROE ($p < 0.001$), indicating that operational efficiency is the primary driver of financial performance in Pakistan's manufacturing sector. Firms with stronger equity positions also perform better, as the equity ratio has a significant positive impact on ROA ($p = 0.006$), reflecting the advantage of financial stability and resource flexibility. In contrast, GADI displays a negative but statistically insignificant effect on ROA and ROE ($p > 0.05$). This suggests that while environmental disclosures may support legitimacy and stakeholder trust, they do not yield immediate financial gains. Firms now considering the ultimate effects of its operations on the environment although they have to wait to materialize its financial impact (Majid, Meraj, & Mubarik, 2022). This pattern aligns with earlier studies (Haniffa & Hudaib, 2006; Davidsson, Steffens, & Fitzsimmons, 2005), which emphasize that the economic benefits of sustainability practices typically materialize over longer periods. From a policy standpoint, the study concludes that although GADI does not currently boost profits directly, it enhances transparency and supports long-term alignment with sustainability goals. Firms that adopt strong environmental practices may gradually gain. The study adds to the

growing evidence that environmental responsibility, while not immediately profitable, remains essential for sustainable industrial development.

Return on Assets, Return on Equity, Earnings Before Interest and Taxes, Shareholder Equity, Total Current Liabilities, Total Long-Term Debt, Ordinary Least Squares, Estimated Generalized Least Squares

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Chapter 1

Introduction

1.1 Theoretical Background

Organizations pursuing sustainable development should prioritize environmental protection goals, such as combating climate change, recycling waste, and saving the planet ([Al-Raei, 2024](#)). Sustainability and sustainable development are issues of global concern due to rising levels of pollution and the relative failure of most initiatives (Sustainable development goals report 2023). To achieve these goals, sustainability and ethical practices must become an integral part of an organization's culture, ensuring that its policies, activities, and core beliefs align with its core values ([Vera-Maestro & Gonçalves, 2025](#)). Stakeholder trust and support enhance the reputation and image of a social enterprise, which directly affects its profitability. Environmental accounting is a key component of this process, enabling organizations to optimize resource use and manage costs ([Mushatq, Ejaz, Ullah, & Mehboob, 2025](#)). Publicly publishing environmental accounting data also increases an organization's competitiveness and market share ([Wu et al., 2025](#)). By demonstrating their environmental sustainability, companies strengthen their relationships with stakeholders, attract more environmentally conscious consumers, and increase their market share ([Saber Moussa & Elmarzouky, 2024](#)).

In short, green accounting disclosures help companies align their operations with sustainable development goals and improve their financial and commercial performance (Istiva Yuan Amelia. 2024). Integrating environmental responsibility into corporate strategy helps companies maintain their competitiveness in a global economy focused on sustainable development (Hart & Dowell, 2011).

Today, investors and consumers value companies' involvement in environmental protection and sustainable development. By highlighting their environmental sustainability efforts and achievements, organizations can gain consumer support, which increases demand for their products and sales ([PricewaterhouseCoopers, 2024](#)). Organizations with effective environmental and social management are increasingly attractive to investors, not only to raise capital, but also to benefit from strategic advantages that enhance company performance and long-term growth ([N. B. M. Ali et al., 2025](#)).

1.2 Research Questions

RQ1: Does green accounting disclosure affect the Financial Performance of Pakistani Manufacturing Companies?

1.3 Objective of the Study

RO1: To examine the impact of green accounting disclosure on financial performance of manufacturing companies in Pakistan.

1.4 Significance of Study

The publication of green accounting disclosure is fundamental to contemporary business management and offers tangible benefits. This significantly improves the company's public image and market reputation ([Rakhmawati, 2024](#)). Issues of

environmental protection and sustainable development are among the most important concerns of the public and stakeholders in contemporary society. By providing green accounting disclosure, such as transparency, companies can demonstrate their environmental sustainability, gain public trust, and enhance a positive brand image (Dong et al., 2024). This improved reputation not only encourages consumers to buy, but also attracts the attention of investors, ultimately strengthening the company's market position and brand value.

This study examines the impact of green accounting disclosure on corporate financial performance and finds a positive relationship between the two. With this information, companies not only improve their public image and reduce environmental risks, but also optimize the use of their resources, leading to better financial results. Companies should be encouraged to use this information to improve their financial performance. The study targets PSX-100 manufacturing firms and specifically examines the Return on Assets (ROA) and return on Equity (ROE), which can contribute to achieving the Sustainable Development Goals.

Chapter 2

Literature Review

2.1 Green Accounting

A report by [PricewaterhouseCoopers \(2013\)](#) on global climate change and green finance incentives indicates that market-based regulatory initiatives in the banking sector can increase opportunities for companies to invest in sustainable development projects. To achieve this, the program must be supported by enforceable environmental regulations, rating and evaluation systems, and public oversight [PricewaterhouseCoopers \(2013\)](#).

A joint report by the People's Bank of China and the United Nations Environment Program ([People's Bank of China & United Nations Environment Programme, 2015](#)) also highlighted the importance of market mechanisms in building a green financial framework. The report emphasized that effective policies and regulations would enable investors in green projects to improve their returns by reducing financing costs and increasing the availability of funds as well as increasing the cost of unsustainable projects ([People's Bank of China & United Nations Environment Programme, 2015](#)).

Green accounting, or environmental accounting, is understood differently in the literature. According to the Environmental Protection Agency (1995), it is "the identification and measurement of environmental material costs, with the goal of

using this information in environmental management decisions.” It involves identifying and planning measures to reduce negative environmental impacts of activities and systems. According to [Howes \(2002\)](#), green environmental accounting is ”the generation, analysis, application, and monitoring of environmental data to improve environmental and financial performance.” [Hansen and Mowen \(2000\)](#) define it as “the costs associated with the creation, detection, restoration and prevention of environmental damages”.

[Howes \(2002\)](#) explains that green environmental accounting is not limited to internal and external environmental reporting, but also includes the interaction between environmental and financial outcomes. Therefore, green environmental accounting information plays an important role in promoting environmental sustainability in corporate culture and operations.

Key concerns of green environmental accounting include identifying past deviations, budgeting current environmental costs, and forecasting future costs and benefits to inform policymaking, monitoring, and reporting ([Robbins, 2017](#)). The Association of Chartered Certified Accountants (ACCA) (2015) emphasizes that environmental accounting information involves the production of financial and non-financial data related to an organization’s environmental impact during a specific accounting period. Therefore, corporate environmental disclosure involves disclosing the environmental impact of its operations, which is recorded in environmental accounting reports.

Green accounting is a broad branch of accounting that practices different levels of accounting, including national accounting, financial accounting, and management accounting ([Boyd, 1998](#)). Green accounting, or environmental accounting in a broader sense, aims to provide environmental information to internal and external stakeholders ([Dietz et al., 1995](#)). Environmental accounting can be used to identify opportunities for environmental investment to generate profits and avoid environmental liabilities ([Beer and Friend, 2006](#)).

To this end, [Gray \(2002\)](#) explain that green accounting encompasses several areas, including determining potential environmental liabilities; revaluation of environmental assets and investment programs; development of accounting information

systems to integrate different dimensions of environmental performance; investment evaluation from an environmental perspective; Analysis of costs in different sectors, such as environmental protection, waste, and energy; development of new accounting methods to measure environmental assets, costs and liabilities in monetary and non-monetary terms; and measuring environmental programs in terms of costs and benefits.

Prof. Dr. Kari Lukka in his book "Green Accounting" (2018: 99) states that green accounting is defined as: "In an integrated accounting, the process of identifying, measuring, recording, summarizing, reporting, and disclosing financial, social, and environmental objects, transactions, or events that benefit users in order to gather accounting and environmental information for management decisions." Based on the previous definition, the subject of accounting is not limited to financial accounting, but also includes social and environmental accounting.

According to [Gray, Owen, and Lavers \(1996\)](#) green accounting is a record that includes phenomena, objects, and activities related to land and related activities. Environmental accounting or green accounting is also used to reduce energy consumption, save resources, reduce environmental risks to health and safety, and improve competitive advantage. Green accounting can be called accounting that identifies measures, presents and discloses the costs and benefits of a company.

French activities related to the fields of accounting and social sciences, Prof. Dr. Kari Lukka, (2018) Green accounting disclosure has three specific characteristics that are extremely valuable in evaluating the decision-making process of users:

a) Responsibility, that is, accounting information is provided, all information related to economic information is taken into account in particular, Social and environmental responsibility and environmental impact. b) Integrated and comprehensive, that is, the accounting information provided is the result of the integration of financial accounting information and social and environmental accounting information, and is presented comprehensively in a set of accounting reports. c) Consolidated accounting information should be presented truthfully, responsibly and transparently so as not to mislead the parties in economic and non-economic evaluations.

Q1: Green accounting disclosure has a positive effect on the financial performance of a company.

2.2 Return on Assets

In the modern business landscape, environmental sustainability has emerged as a central concern for organizations, policymakers, and investors alike. The growing awareness of climate change, environmental degradation, and the depletion of natural resources has compelled firms to integrate environmentally responsible practices into their financial and operational strategies ([Elkington, 1997](#); [Porter & Kramer, 2006](#); [Schaltegger & Burritt, 2010b](#)).

One of the most important frameworks developed to address these issues is green accounting—a system that measures and reports environmental costs and impacts alongside traditional financial performance.

In the context of manufacturing firms listed on the Pakistan Stock Exchange (PSX), the adoption of green accounting practices has shown a growing association with financial indicators such as Return on Assets (ROA), which reflects how efficiently a company utilizes its assets to generate profits ([M. T. Khan, 2022](#)).

According to the [U.S. Environmental Protection Agency \(EPA\) \(1995\)](#), green accounting refers to the process of identifying, measuring, and reporting environmental costs to enhance managerial decision-making and accountability. It captures the financial implications of environmental protection, waste management, resource consumption, and compliance with environmental regulations. By doing so, it provides firms with a clearer picture of how environmental strategies influence financial performance. [Gray \(2002\)](#) defines environmental or green accounting as the identification and control of costs associated with environmental degradation, resource depletion, and remediation. This approach not only improves transparency but also enables firms to assess the economic benefits of sustainability initiatives in terms of efficiency, profitability, and long-term growth [Epstein and Buhovac \(2014\)](#).

Return on Assets (ROA) is one of the key indicators of corporate financial performance. It measures a company's ability to generate net income from its total assets, serving as a proxy for operational efficiency and profitability (Ross, Westerfield, Jaffe, & Jordan, 2019).

In the manufacturing sector, where high capital investment and resource utilization are common, ROA becomes a critical measure of how well firms convert their asset base into earnings. Integrating green accounting practices can influence ROA in multiple ways—by reducing operational costs, enhancing resource productivity, and improving corporate reputation, which ultimately contributes to stronger financial performance (Schaltegger & Burritt, 2010b).

One of the main ways green accounting affects ROA is through cost efficiency. By systematically recording and analyzing environmental costs, manufacturing firms can identify inefficiencies in energy consumption, raw material use, and waste management.

Implementing energy-efficient technologies or adopting cleaner production methods can lead to significant cost savings (Christ & Burritt, 2015). These savings improve operational efficiency, allowing firms to generate more profits using the same level of assets, thereby enhancing ROA. For instance, reducing energy waste in production lines not only decreases environmental impact but also lowers production expenses, directly contributing to asset productivity (Christ & Burritt, 2015).

Additionally, firms that disclose green accounting disclosure often experience enhanced brand image and stakeholder trust. According to Eccles, (Eccles, Ioannou, & Serafeim, 2014) sustainability practices strengthen corporate reputation, which can lead to increased market demand, customer loyalty, and investor confidence. A strong reputation attracts more sales opportunities and investment inflows, which increases total revenue and improves asset returns.

In Pakistan's competitive manufacturing sector, where firms must differentiate themselves to attract investment, demonstrating environmental responsibility through transparent accounting practices serves as a strategic advantage (M. T. Khan, 2022).

In Pakistan, environmental regulations have become more stringent as the government aligns its industrial policies with global sustainability goals. Manufacturing firms listed on the PSX face increasing pressure to adhere to these environmental standards, and non-compliance can result in penalties, fines, and reputational damage.

Green accounting provides a proactive mechanism for identifying and managing these risks by incorporating environmental costs into the firm's financial records ([ACCA, 2015](#)).

By adopting green accounting, firms can allocate resources more effectively toward pollution control, waste management, and compliance activities, thereby minimizing legal liabilities ([Christ & Burritt, 2015](#)).

This preventive approach reduces unexpected financial losses and stabilizes long-term asset performance. A company that efficiently manages its environmental risks preserves the productive value of its assets and ensures consistent profitability, leading to a higher ROA.

Moreover, firms engaged in sustainability initiatives often gain access to government incentives, tax benefits, and preferential treatment in financing from green investment funds ([PricewaterhouseCoopers, 2013](#)). These financial advantages further improve asset utilization and profitability. The [People's Bank of China and United Nations Environment Programme \(2015\)](#) highlight that well-designed environmental policies and financial mechanisms reduce the cost of capital for firms engaged in sustainable practices, allowing them to assets more effectively for income generation.

Green accounting also promotes a more efficient use of physical and natural assets. Manufacturing firms typically rely heavily on machinery, energy, and raw materials—resources that can be optimized through sustainable practices ([Schaltegger & Burritt, 2010b](#)). Environmental accounting frameworks help track the consumption of these inputs and assess their contribution to overall production efficiency. Firms that adopt such systems are better able to identify underutilized or wasteful processes, which leads to asset optimization and improved operational output ([Howes, 2002](#)).

For example, “Implementing cleaner production technologies reduces material waste and maintenance costs associated with machinery, while recycling initiatives or the use of renewable energy sources lower operational expenses without requiring significant additional asset investment. These efficiency gains translate into higher net income relative to total assets, improving ROA over time ([Asha’ari & Daud, 2019](#)).

Investor perception plays a crucial role in determining a company’s market position and capital accessibility. Green accounting disclosures provide transparency about a firm’s environmental performance and future sustainability prospects.

Investors are increasingly factoring in and governance (ESG) criteria when making investment decisions. Firms that proactively disclose environmental data signal lower operational and regulatory risk, enhancing investor confidence and long-term value creation ([People’s Bank of China & United Nations Environment Programme, 2015](#)). In Pakistan’s manufacturing sector, where firms often face challenges such as energy shortages, resource inefficiencies, and pollution control costs, integrating environmental accounting provides both financial and strategic benefits.

Improved transparency and accountability attract environmentally conscious investors and institutional funds, increasing the firm’s financial stability and asset returns ([M. T. Khan, 2022](#)).

However, manufacturing sector is also one of the largest contributors to environmental degradation due to resource-intensive production processes. The adoption of green accounting in this context is therefore not only a corporate responsibility but also an economic necessity ([Artene, Popescu, & Voicu, 2020](#)).

Empirical studies show that firms implementing green accounting practices tend to have stronger financial performance compared to those that do not ([M. T. Khan, 2022](#)). For instance, the integration of environmental cost management systems has been associated with higher profitability ratios, including ROA, due to better cost control and enhanced operational efficiency ([Howes, 2002](#)). This relationship is especially relevant for Pakistan’s manufacturing firms, which operate in a highly competitive environment with rising input costs and environmental constraints.

In conclusion, green accounting plays a crucial role in shaping the financial performance of manufacturing firms listed on the Pakistan Stock Exchange, particularly in relation to Return on Assets. By systematically accounting for environmental costs and integrating sustainability into operational decision-making, firms can enhance efficiency, optimize asset use, and improve profitability. The positive relationship between green accounting and ROA stems from cost reduction, resource efficiency, risk mitigation, and strengthened stakeholder trust.

Furthermore, as Pakistan continues to embrace sustainability in industrial development, green accounting will serve as a key tool for aligning financial success with environmental responsibility. Manufacturing firms that embed environmental accounting within their corporate strategies will not only achieve superior asset performance but also contribute to the broader goals of sustainable economic growth and environmental preservation.

H2: Green accounting disclosure has a positive effect on return on assets.

2.3 Return on Equity

Green accounting, or environmental accounting, integrates environmental costs and benefits into conventional accounting systems. It provides a comprehensive analysis of a company's financial performance by considering environmental factors, such as resource use, waste generation, and emissions. In corporate performance, return on equity (ROE) is an important indicator of profitability relative to shareholders' equity. Green accounting practices affect ROE in a number of ways, including cost control, risk reduction, and improved investor relations ([Lista & Wulandari, 2024](#)).

The initial effects of green accounting are generally seen as negative due to higher operating costs. Companies adopting green accounting must invest in the technologies, processes and systems necessary to measure and report environmental information ([Moorthy & Yacob, 2013](#)). For example, adopting energy efficient systems as well as providing renewable energy or adhering to strict environmental

standards may require significant investment. These costs can reduce profitability in the short term and lead to a temporary reduction in return on equity. However, in the long term, the financial benefits usually offset these initial costs. Companies that invest in green practices can achieve operational efficiencies, such as reduced energy consumption, waste disposal costs, and regulatory fines, which ultimately improve profitability and positively impact equity (Riyadh, Al-Shmam, Huang, Gunawan, & Alfaiza, 2020)).

Another important aspect of green accounting is its application to monitoring environmental risks. By measuring potential environmental liabilities, such as carbon tax costs or non-compliance, companies can better prepare for unexpected financial events (García-López & Pérez-Hernández, 2023).

Effective management of these risks reduces earnings volatility and protects shareholder value, contributing to stable or better returns on equity. Additionally, companies that adopt green accounting practices are better prepared to respond to changing environmental regulations and market trends while increasing their financial strength (Nyakuwanika & Panicker, 2025).

Green accounting affects return on equity indirectly through its impact on investor sentiment and access to financing. Investors are increasingly prioritizing environmental, social, and governance (ESG) criteria in their investment decisions.

Companies that demonstrate a commitment to sustainable development, particularly through visible green accounting practices, are likely to be more favoured by ESG investors. This can lead to improved market valuations, increased investor confidence, and lower cost of equity, all of which contribute to better returns on equity (Chen, Li, Zeng, & Zhu, 2023).

Additionally, an improved corporate image and customer loyalty resulting from environmentally friendly practices translates into increased revenue and profits in the long run.

Finally, the impact of green accounting on return on equity is multifaceted. While short-term profits are predictable, cost reductions, risk reduction, and improved investor relations can improve long-term financial performance (Rakhmawati, 2024).

Companies that adopt green accounting not only ensure that their operations are geared toward sustainable growth, but also position themselves for sustainable financial growth.

The meta-analysis also shows a strong positive relationship between corporate financial performance and environmental reporting. This means that companies with better financial health are generally those that provide environmental information ([Orlitzky, Schmidt, & Rynes, 2003](#)).

This finding has practical implications: Companies can improve their financial performance by adopting green accounting concepts, which inform their decision-making processes. This alignment not only facilitates the achievement of sustainable development goals but also provides a competitive advantage in the market.

The primary objectives of green accounting are to measure and manage the environmental impact of corporate activities. These objectives are achieved through various methods, such as cost accounting, environmental management accounting (EMA), and sustainability reporting.

Profitability is measured by profit plus return on assets (ROA) and return on equity (ROE) ([Rounaghi, 2019](#)).

If these are not met, ROA falls to zero. There is also an environmental cost component. Green accounting is known for its positive impact on corporate financial performance, particularly through improved customer perception, which translates into increased sales and profits.

In addition to its financial success, green accounting has a positive impact on improving environmental performance, environmental health and resilience ([Maqbool & Zameer, 2018](#)).

Environmental performance, environmental activity, and environmental exposure are key environmental accounting indicators. Environmental performance is defined as a company's ability to create a positive environmental impact and conserve natural resources.

Environmental accounting, which integrates environmental costs and sustainability practices into traditional financial accounting, is increasingly influencing key

financial metrics, such as return on equity (ROE). This return measures a company's profitability relative to its equity and is a general indicator of financial performance. Understanding the impact of environmental accounting on return on investment equity and accurate measurement of this variable is essential to assessing the financial impact of sustainability efforts.

The impact of green accounting on return on equity can be both direct and indirect. Directly, spending on green technologies, alternative energy, and waste reduction practices can increase operating costs in the short term, reducing net income and, consequently, return on equity (Porter and Kramer, 2011). However, these investments tend to reduce costs in the long term, improve operational efficiency, and increase environmental compliance, which can have a positive impact on long-term return on equity (Adams & Frost, 2008). Indirectly, green accounting improves transparency, meets investor demand for sustainability, attracts environmentally conscious investors, and can reduce the cost of equity, thereby improving return on equity (Clark, Feiner, & Viehs, 2015).

H3: Green accounting disclosure has a positive effect on a company's return on equity.

2.4 Revenue

Green accounting, often referred to as environmental accounting, has become an essential aspect of modern corporate management as businesses increasingly face environmental challenges and societal expectations for sustainable practices. The integration of environmental considerations into financial reporting not only reflects a company's commitment to sustainability but also influences key financial indicators such as revenue (Rakhmawati, 2024). For manufacturing firms listed on the Pakistan Stock Exchange (PSX), adopting green accounting practices can play a vital role in improving operational efficiency, enhancing brand reputation, and fostering innovation, all of which have the potential to drive revenue growth (Ashraf, Iqbal, & Anjum, 2023).

According to the U.S. Environmental Protection Agency (EPA, 1995), green accounting involves the identification, measurement, and management of environmental costs and benefits, which allows companies to make better-informed decisions regarding their environmental impact. This system helps organizations account for the costs of pollution control, resource consumption, and waste management, while also recognizing potential benefits such as energy savings, recycling income, and improved stakeholder relations. When properly implemented green accounting practices align economic performance with environmental responsibility, ultimately influencing a firm's revenue generation capabilities (Huynh & Nguyen, 2024).

Revenue, the total income generated from the sale of goods and services, is a primary indicator of a company's financial success. In manufacturing sectors, revenue growth depends heavily on production efficiency, market competitiveness, consumer demand, and innovation. Green accounting contributes to each of these factors by integrating environmental management into financial decision-making, helping firms uncover new opportunities for revenue expansion.

Firstly, green accounting enables manufacturing firms to identify inefficiencies in their production processes that contribute to resource wastage and increased costs. By assessing the environmental costs associated with raw material use, energy consumption, and emissions, companies can develop strategies to minimize waste and enhance productivity (Howes, 2002). For example, investing in energy-efficient machinery or adopting recycling mechanisms can lower production costs and improve product pricing competitiveness, which can lead to higher sales and, consequently, increased revenue.

Secondly, environmentally responsible practices often improve a company's brand image, attracting more customers who value sustainability. Consumers are increasingly conscious of the environmental footprint of the products they purchase. Firms that transparently disclose their green accounting disclosure demonstrate accountability and commitment to sustainability, which enhances customer trust and brand loyalty (ACCA, 2015). As a result, such firms can capture larger market shares, increase demand for their products, and potentially charge premium

prices for eco-friendly goods, directly boosting revenue streams. Moreover, green accounting contributes to revenue growth by opening up access to new markets and investment opportunities. Many international investors now prioritize funding companies that comply with environmental, social, and governance (ESG) standards. Firms listed on the Pakistan Stock Exchange that adopt green accounting and demonstrate compliance with sustainability standards are more likely to attract both local and foreign investment (PricewaterhouseCoopers, 2013). This inflow of investment not only provides capital for expansion but also enhances the company's reputation in the global market, leading to higher sales and profitability.

In Pakistan, the manufacturing sector contributes significantly to the national economy, accounting for approximately 20.76% of the Gross Domestic Product (GDP) in 2023. However, this sector also faces growing scrutiny regarding its environmental impact, particularly in relation to carbon emissions, water pollution, and waste generation.

The introduction of stricter environmental regulations has encouraged firms to adopt green accounting as a means of compliance and long-term sustainability. By accurately tracking environmental costs, companies can avoid regulatory penalties, reduce waste management expenses, and gain incentives for sustainable practices (People's Bank of China & United Nations Environment Programme, 2015).

Green accounting also improves transparency in financial reporting, which is increasingly valued by regulators and stakeholders. Firms that provide detailed environmental disclosures under recognized frameworks build stronger relationships with investors, consumers, and policymakers.

This trust enhances market competitiveness, as stakeholders are more inclined to support businesses that demonstrate accountability and foresight in managing environmental risks (Hansen & Mowen, 2000). The resulting positive market perception translates into increased sales, improved customer retention, and higher revenue over time.

Another key connection between green accounting and revenue lies in innovation. Green accounting systems encourage firms to analyze their environmental impact

and identify areas where improvements or innovations can yield both environmental and financial benefits. For instance, firms that invest in cleaner production technologies not only reduce their carbon emissions but also develop more efficient production methods that lower costs and increase output ([Howes, 2002](#)). Similarly, innovations in waste recycling can lead to the creation of by-products that can be sold, providing an additional source of revenue.

In the long term, these innovations foster resilience and sustainability, which are critical for maintaining consistent revenue growth in a competitive market. A company that integrates green accounting into its operations is better positioned to adapt to global market trends that favor sustainable business models. This adaptability ensures business continuity even during periods of economic uncertainty or regulatory change ([U.S. Environmental Protection Agency \(EPA\), 1995](#)).

Empirical studies in Pakistan's context suggest that firms engaging in green accounting practices often outperform their counterparts in terms of financial results. Environmental responsibility has become a key determinant of investor confidence and consumer behavior. According to ([Artene et al., 2020](#)), sustainability-driven firms tend to enjoy stronger brand loyalty and higher market value, which directly influence their revenue. Manufacturing companies on the PSX-100 that actively disclose environmental information often report improved financial performance, as such disclosures help reduce operational risks and enhance long-term profitability.

Furthermore, the positive relationship between green accounting and revenue is reinforced by the growing consumer shift towards eco-friendly products. As Pakistani consumers become more environmentally conscious, companies that integrate sustainability into their operations can tap into expanding market segments, such as organic materials, renewable energy, and sustainable packaging industries. These new revenue channels not only diversify income sources but also align the company's goals with global sustainability objectives (PricewaterhouseCoopers, 2013).

Q4: Green accounting disclosure has a positive impact on a company's revenue.

2.5 Firm Size

Green accounting disclosure (GAD) has received significant attention in recent years, requiring companies to increasingly report on their environmental and sustainability activities. The effect of green accounting disclosure on a firm's financial performance is an important area of research, but this relationship may be influenced by several firm-specific factors, one of which is its size ([Karsam, Sasmita, & Salleh Hudin, 2024](#)). Larger firms have more resources, tighter stakeholder control, and stronger incentives to disclose their environmental practices ([Bansal and Cleland, 2004](#)). Therefore, firm size was included as a control variable to isolate its effect and better understand the direct effects of green accounting disclosure on financial results.

Firm size is an important characteristic that affects its financial performance and environmental disclosure practices. Larger firms generally have greater access to financial resources, allowing them to invest in existing initiatives and improve their operational performance, thereby improving their profitability ([Waddock and Graves, 1997](#)). They are also subject to increased regulatory pressure and public scrutiny, giving them greater incentives to adopt green accounting practices and to transparently disclose their environmental impacts ([Clark et al., 2015](#)).

From a financial perspective, firm size is often associated with economies of scale, which can lead to cost savings, improved profitability, and better risk management ([Penrose, 1959](#)). Larger firms are more financially diversified, which reduces financial volatility and increases their ability to bear potential costs related to environmental initiatives ([Rousseau and Fouts, 1997](#)). Furthermore, investors and stakeholders have high expectations from established firms regarding corporate social responsibility, particularly with regard to environmental accounting and reporting ([Mahmood, Kouser, & Masud, 2019](#)).

A number of empirical studies have shown the moderating role of firm size in influencing environmental risks and financial performance. Larger firms disclose more sustainability information due to stakeholder pressure and reputational concerns ([Clarkson et al., 2011](#)). Additionally, a study by [Ali et al. \(2021\)](#) found that

larger firms benefit more from GAD in terms of financial performance, as their sustainability initiatives are more valued by investors and consumers. In contrast, small firms, despite their flexibility, often struggle to afford the additional costs of disclosing environmental information, which may affect their profitability.

Furthermore, a study by Dahlmann et al. (2019) indicate that although there is a positive relationship between firm size and green environmental performance index, the resulting actual financial benefits depend on external factors such as sector regulation and investor sentiment. Therefore, firm size plays an important role in the financial impact of green accounting practices.

2.6 Age of the Company

Growing international interest in sustainable development and social responsibility has prompted companies to publicly disclose their green accounting practices. Although Green Accounting Disclosure (GAD) can influence a company's financial performance, it is not always accurate. Firm-specific characteristics, including age, significantly affect the financial benefits resulting from green accounting disclosure (Hutarso & Arsjah, 2024). Firm age is used as a control variable to buffer the observed effects of green accounting disclosure on financial performance from firm maturity, stability, or operational experience (Li et al., 2021).

Older companies typically benefit from a more mature market position, more stable revenue streams, and greater financial resources, enabling them to more effectively implement and report on their sustainability efforts. In contrast, smaller companies can demonstrate greater flexibility and innovation, enabling them to adopt more dynamic green practices (Lüderer and Welchli, 2010). Therefore, understanding the role of company age in this context is important to draw reliable conclusions about the impact of GAD on financial performance.

Maturity is another important factor in financial performance and operational efficiency. Older firms typically benefit from stronger reputations, increased consumer confidence, and greater access to capital, which can lead to improved financial performance (Majumdar & Chhibber, 2024). These firms also have experience in

meeting regulatory requirements, such as sustainability reporting, and are therefore more likely to practice systematic and transparent green accounting (Dienes, Sassen, & Fischer, 2016).

However, start-ups are characterized by their entrepreneurial spirit, creativity, and responsiveness to emerging market trends (Shahzad, Khan, Saleem, & Rashid, 2021). They may integrate sustainability into their competitive strategy, but they may be more financially vulnerable and face less stakeholder pressure to disclose these activities in detail.

Additionally, startups face greater operational risks and pressures to survive, which can push sustainability efforts into the background, hurting financial performance.

Since maturing age affects both financial performance and green accounting disclosure, omitting it from econometric models may lead to erroneous conclusions about the true impact of green accounting disclosure.

Empirical research has shown that a firm's age plays a significant role in the effectiveness of GADI. Older firms are risk averse and prefer standardized, formal environmental reporting to maintain their reputation and meet investors' needs (Dienes et al., 2016).

Dalman et al. (2019) found that older firms with higher GADI ratings generally enjoy better financial results due to benefits in stakeholder trust and regulatory compliance.

On the other hand, despite the increased creativity of startups, they do not always have the necessary resources and knowledge to produce comprehensive sustainability reports (Jin and Jamali, 2016).

However, companies that adopt green accounting early on can use it as a strategy to differentiate themselves and gain the trust of green investors and customers, resulting in long-term benefits (Mushatq et al., 2025).

Also, Ali et al. (2021) presented a study that identified that firm age moderates the relationship between financial performance and green development management, showing how the financial benefits of green accounting are more pronounced in mature firms due to their established market base and stakeholder engagement.

2.7 Stakeholder Theory

Stakeholder theory (ST) is a theory in organizational management and business ethics (Freeman et al., 2007). Through stakeholder theory, organizations seek to achieve multiple valued outcomes for various stakeholders (ie, groups and individuals interested in the organization, such as civil society, local communities, customers, employees, governments, shareholders, and suppliers) (Freeman, 1984). Stakeholder theory dates back to the 1960s, when the Stanford Research Institute first introduced the concept of stakeholder ownership, purporting to explain that organizations must rely not only on their shareholders but also on their stakeholders for their existence and growth. Thus, a clear imperative arises between maximizing returns for shareholders and meeting stakeholder demands.

However, research on stakeholder theory did not appear in leading economic journals until the early 21st century (Laplume, Sonpar, & Litz, 2008), and since then, knowledge on stakeholder theory has more than doubled, as this study shows. Therefore, ST theory can be defined as a theory that (i) encourages organizations to recognize and consider stakeholders, whether they exist internally or externally to the company, (ii) enables them to understand and manage stakeholders' needs, wants and demands, and thus (iii) is a comprehensive and ethical approach that goes beyond shareholder interests and decision-making processes (Freeman, Harrison, & Wicks, 2007).

Many researchers have attempted to improve the theoretical understanding of scientific research and its potential practical applications. Table 1 summarizes the review studies on scientific research, from its use and development in traditional management to operations management, project management, supply chain management, and sustainability performance measurement. While their added value, these studies can, individually, provide an accurate representation of the state of scientific research in a given field. In fact, compiling and mapping the scientific research literature is difficult due to its size and variation in the body of work spanning half a century (Freeman et al., 2020).

However, stakeholder theory insists that organizations have a duty to consider the interests of all stakeholders, excluding shareholders, in decision-making. This includes employees, customers, suppliers, local communities and the environment.

The interest in green accounting and stakeholder theory lies in their shared commitment to aligning financial performance with social and environmental concerns (Schaltegger & Burritt, 2010b).

Green accounting is consistent with stakeholder theory because it provides a tool that enables companies to meet the needs of different stakeholder groups.

For example, consumers are increasingly seeking environmentally friendly products, and green accounting enables environmental impact measurement and reporting to meet this demand.

Additionally, societies and governments strive to reduce pollution and conserve resources. Green accounting provides a clear view of a company's environmental policy and enhances trust and regulatory compliance (Tilt, 2009).

From an investor's perspective, green accounting reflects a company's commitment to sustainable development, reflecting the increasing importance of environmental, social, and governance (ESG) considerations in investment choices.

Investors, as key stakeholders, use green accounting disclosure to identify risks associated with environmental responsibilities and opportunities for sustainable development (Gray, 1992; Schaltegger & Burritt, 2010a; de Villiers, Hsiao, & Ortas, 2017).

Additionally, green accounting enables companies to internalize their external impacts by measuring the social and environmental costs of production. This practice is based on the principles of stakeholder theory, which requires consideration of the overall impact of a company's actions on all stakeholders, not just shareholder compensation (Wicks, 2007). In short, stakeholder theory and green accounting are linked by their focus on sustainable development, transparency and accountability. Through green accounting, companies can consider the diverse interests of their stakeholders in ways that deliver long-term value while enhancing trust and social responsibility (Donaldson & Preston, 1995).

2.8 The Efficient Market Hypothesis

A capital market is considered efficient if it accurately and comprehensively reflects all information affecting security prices. Technically, a market is said to be efficient with respect to a set of information, if security prices are not affected by the availability of that information to each participant (Fama, 1991). Furthermore, efficiency with respect to a set of information means that no economic profit can be made based on transactions based on.

Since Roberts (1967), it has become common to identify three degrees of market efficiency by examining three different sets of information:

(1) The weak version of the efficient market hypothesis (EMH) states that prices reflect all information obtained from past price movements. Therefore, investors cannot choose investment policies that produce abnormal returns based on an analysis of past price trends (a method known as technical analysis). This type of performance is associated with the term "random walk hypothesis".

(2) The semi-strong form of the economic market hypothesis assumes that current stock prices incorporate not only historical data but also all available public data about the company's securities. If markets were this efficient, examining balance sheets, income statements, changes in declared profits, stock splits, or any other public data about a company (using fundamental analysis) would not yield abnormal economic returns.

(3) The strong form of the economic market hypothesis assumes that all information known to every market participant about a firm is fully incorporated into market prices. Therefore, even those with confidential information cannot use it to get better investment results. Disclosure of all information about market prices is ideal.

If markets were efficient, it would be (technically) pointless to study historical price trends to predict the future, since any knowledge gained from such an examination is already reflected in current market prices. Suppose market participants believe that the price of a commodity will double in the next week (Fama, 1991). Price will not move slowly toward its new equilibrium level. In fact, unless the price

adjusts immediately, there will be a profitable arbitrage opportunity that will be immediately exploited in a perfect market.

Similarly, if stock prices have a reliable and profitable seasonal trend (such as a big Christmas rally), speculation will drive prices up enough before Christmas to eliminate any unused arbitrage potential. [Malkiel \(2003\)](#) rigorously demonstrated that if information flows freely and there are no transaction costs, then yesterday's price movements in speculative markets will only result from yesterday's "information" and be unrelated to today's price movements. But "information" is inherently unpredictable, and the resulting price movements must be unpredictable and random. The term "random walk" is commonly used in the financial literature to describe price sequences in which all subsequent price movements are random deviations from previous prices. Thus, the price movement will be independent of the previous price movement. (Technically, the random walk model states that investment returns are serially uncorrelated and that their probability distributions are constant over time.) It is believed to have been first used in a correspondence published in the journal *Nature* in 1905 (see Pearson and Riley, 1905).

Green accounting, a financial accounting approach that integrates environmental benefits and costs, plays an important role in informing stakeholders about a company's sustainability efforts through transparent and reliable information. Efficient Market Theory (EMT) states that financial markets are efficient when asset prices accurately reflect all available information. The link between green accounting and EMT lies in the importance of sustainability disclosures in informing investors, influencing market perceptions and asset valuation ([Purwanti, Dewantara, & Nurcahaya, 2024](#)).

Green accounting helps ensure market efficiency by improving the quality and completeness of information available to investors. Information asymmetries in financial markets can lead to inefficient asset pricing and inefficient capital allocation. By revealing environmental costs, risks and opportunities, green accounting reduces information asymmetry, enabling investors to make more informed decisions ([Gündüz & Gündüz, 2025](#)). For example, when companies disclose the cost

of carbon emissions or their current programs, investors can better assess the potential risks and returns of their investments. This is consistent with the EMT assumption that markets process available information to determine the fair value of assets (Ilhan, Krueger, Saunter, & Starks, 2020).

Additionally, green accounting improves environmental, social, and governance (ESG) risk management by integrating environmental, social, and governance (ESG) considerations into financial analysis. Investors are increasingly using ESG information to assess companies' viability and long-term risk profiles. Green accounting disclosure provides the environmental data needed to make ESG-based decisions. Therefore, this type of information is incorporated into market prices. This enables markets to more accurately represent the value of companies focused on sustainable growth.

However, the effective integration of environmental accounting data into market prices depends on reliability and standardization. Unreliable or inconsistent environmental accounting can undermine market efficiency by disrupting the decision-making process (Dias et al., 2024; Gunawan, Ng & Asri, 2025). Finally, green accounting extends the theory of efficient markets by providing greater transparency, reducing information asymmetry, and enabling markets to value assets more accurately based on sustainability factors. This convergence indicates the important role of reliable environmental information in enhancing the efficiency and awareness of financial markets (Moussa & Elmarzouky, 2024).

Efficient market theory (EMT) suggests that financial markets efficiently absorb all available information into asset prices, allowing investors to make rational decisions based on that information. Green accounting, which integrates environmental and sustainability issues into traditional financial reporting, plays an important role in influencing market efficiency by ensuring transparency and reducing information asymmetry (Fama, 1970). The connection between green accounting and efficient market theory lies in the potential of disseminated sustainability information to improve the quality of information available to market participants.

Green accounting influences risk management in several ways. First, it improves the quality and depth of environmental, social, and governance (ESG) reporting,

allowing investors to better assess the risks and opportunities associated with sustainable development practices (Clark et al., 2015). For example, disclosure of carbon emissions, environmental liabilities, or energy efficiency investments provides useful information for assessing long-term risks and financial sustainability. Such disclosure reduces the risk of gaps or surprises that could undermine market performance (Adams & Frost, 2008).

Second, green accounting coincides with the growing popularity of environmental, social, and governance-focused investments. Markets that are able to effectively process green accounting disclosure enable companies to be more accurately evaluated based on their sustainability performance, resulting in more efficient evaluations. However, the absence of a unified framework for green accounting can disrupt the market and call into question the assumptions of environmental risk management (Cohen et al., 2017).

To measure the EMT variable and its interaction with green accounting, researchers can adopt different approaches. One such method is to assess market reactions to sustainability information, such as abnormal stock returns following the release of green accounting reports. Event studies can determine whether markets accurately reflect this information in asset prices (Campbell et al., 1997). Additionally, regression models can be used to examine the relationship between sustainability indicators (such as carbon intensity and ESG scores) and stock price volatility or firm valuations, to determine how effectively markets integrate green accounting disclosure (Lu and Tang, 2014).

Another measure of market performance is analysing analysts' forecasts or price spreads for companies that implement strict environmental accounting practices. A lower dispersion of forecasts reflects greater market efficiency, meaning that environmental accounting reduces uncertainty and improves information asymmetry (Aerts, Cormier, & Magnan, 2008; Spira, 2024).

Finally, green accounting influences financial asset management (EMT) by improving the quality of information available to market participants, and facilitates more efficient asset valuation. Measuring EMT in a green accounting context involves evaluating market reactions, volatility behaviour, and valuation accuracy,

all of which reflect the extent to which markets adopt sustainability information (Cormier, Ledoux, & Magnan, 2009).

2.9 Resource-based Theory

Resource-based theory (“RBT” or “RBV”) is a fundamental theory in strategic management. This theory asserts that a firm’s internal resources, particularly those that are valuable, rare, unique, and no substitutable (VRIN), are the primary drivers of creating and sustaining competitive advantage. In more recent publications (2023-2025), RBT has also been applied to various fields, such as marketing, corporate governance, and dynamic capabilities (Monson, F. K. S., 2024).

In marketing, outcome-based behaviour theory (RBT) has played an important role in analysing how intangible assets, such as brand equity, customer relationships, and marketing capabilities, contribute to firm performance, emphasizes that marketing resources, including brand reputation and customer focus, play an important role in achieving sustainable competitive advantage due to their unique nature (Kozlenkova, Samaha, & Palmatier, 2014). Similarly, Varadarajan (2024) combines RBT with resource theory to study the impact of customer information and analytical capabilities on marketing performance, emphasizing the theory’s applicability to e-markets. RBT’s synergy with dynamic capabilities was also interesting.

Kiro and Bogali (2023) conducted a systematic review and identified key issues, including knowledge-based assets—human, physical, technological, and organizational—and how these resources form the basis of dynamic capabilities such as innovation and strategic partnerships. This combination emphasizes that not only do firms have valuable resources, but they must also be able to recover them in response to changes in the environment. Cui (2025) explores this issue further by examining how dynamic knowledge management capabilities enhanced through AI-based knowledge sharing and organizational learning improve business performance in Chinese technology firms, focusing on the role of digital maturity and

innovation. In corporate governance, RBT is used to determine the impact of strategic resource management on governance practices.

[Ferreira and Ferreira \(2024\)](#) provide a bibliometric and systematic review that shows the growing interest in how RBT principles apply to corporate governance, particularly in terms of organizational flexibility and the integration of AI. This suggests that effective governance is viewed more in terms of strategic resource allocation and capacity development.

In addition, results-based business techniques (RBT) were applied to measure the performance of micro, small and medium enterprises (MSMEs). Rochman et al. (2023) showed that intellectual capital and entrepreneurial orientation, influenced by innovation capability, have a significant impact on the performance of MSMEs in Batik. Using RBT helps to understand how to design resource management strategies to improve the competitiveness of small firms.

These studies, conducted between 2023 and 2025, show the dynamic application of resource theory in various industries and environments. Integrating resource theory with concepts such as dynamic capabilities, digitalization, and corporate governance demonstrates its versatility and continued relevance in how companies can ensure and maintain competitive advantage in a changing business world ([Kero & Bogale, 2023](#)).

2.10 Signal Theory

Signalling theory, rooted in information economics, remains an important theory for explaining how organizations use information signals to reduce variation across sectors. Between 2023 and 2025, academic research extended the application of this theory to business, marketing, organizational behaviour, and financial markets, highlighting its robustness and applicability Chaudhry, M. M. (2024).

In entrepreneurship, signalling theory addresses the problem of communicating project quality to potential investors under informational equilibrium. Bafera & Kleinert, (2023) conducted a systematic review, highlighting various signals

used by entrepreneurs, including product prototypes and recommendations, to demonstrate project potential. However, they noted that the effectiveness of these signals generally depends on their status and observation, which is consistent with the principles of traditional signalling theory. Additionally, a study by Clough et al. (2024) highlight the importance of signal reliability in crowdfunding settings, where backers rely heavily on perceived signals due to limited direct contact with promoters (Bafera & Kleinert, 2023)

In marketing, signaling theory details the ways in which firms communicate value propositions to consumers. Sharma and Klein (2024) examined the role of website features as signals in e-commerce and found that design features, such as careful layout and product description, increase consumer trust in untrustworthy e-retailers. This study highlights the importance of these cues in building initial trust, particularly in cases where consumers have limited experience with the retailer. Furthermore, Park et al. (2025) examined the dynamics of the relationship between customer satisfaction and employee satisfaction as indicators for shareholders. They found that in the context of high social media exposure, the mismatch between customer and employee satisfaction leads to increased shareholder perceptions, implying that firms should strategically manage these signals to maximize stock market value (Sharma and Klein (2025)).

Organizational behavior research has also benefited from the contributions of signalling theory. Chaudhry (2024) proposed integrating signaling theory with theories such as attribution theory and impression management to better understand organizational dynamics. This interdisciplinary approach provides a more in-depth explanation of how internal and external stakeholders perceive organizational functioning and communication. In the context of recruitment, recent research has shown that an applicant's personal presentation can be an influential indicator of hiring decisions, as clear communication improves the assessment of candidates' suitability for employment (Emerald Insight, 2024).

Financial markets remain fertile ground for the application of signaling theories. Connelly et al. (2024) highlighted the importance of signaling costs and observability in investor responses, suggesting that messages such as metaverse apps can

significantly influence stock prices when they are perceived as reliable and observable signals. Additionally, the Accounting Insights Team (2025) highlighted how corporate behaviours, such as dividend announcements or share buybacks, act as signals to investors, influencing their perceptions of a company's stability and future prospects (Connelly et al., 2024).

Overall, studies published between 2023 and 2025 highlight the theory's ability to address information relevance in diverse contexts. Its integration with other theoretical approaches and focus on signal properties, such as value and importance, enhance its explanatory value, providing researchers and practitioners with valuable insights for understanding and managing feedback in complex information environments.

2.11 Gap Analysis and Problem Statement

In recent decades, the negative environmental impacts of economic development have become a major global problem. Corporate attitude towards the environment is a key determinant of corporate performance in Pakistan. The purpose of this study is to determine the impact of environmental accounting on corporate performance in Pakistan (Hasan, S., Ahmed, W., & Latif, AS, 2024). Environmental disclosure is now mandatory in accounting and reporting procedures (Gupter, 2011). It is important to include the costs of environmental damage resulting from industrial activities in corporate financial statements whenever possible. Therefore, the role of green environmental accounting disclosures has become more important than ever. This study will examine the relationship between green environmental accounting disclosures and financial performance of manufacturing companies listed on PSX 100. It appears that the level of carbon dioxide emissions is not strongly related to financial performance. However, it should be noted that the findings of this study (Asif, A., & Azad, A., 2024) do not rule out the wider environmental and social impacts of carbon dioxide emissions. These issues are important for future development. Environmental accounting has a positive relationship with earnings per share (EPS), dividend per share (DPS), Return on

Assets (ROA), and net profit margin (NPM) (Hasan, S., Ahmed, W., & Latif, AS, 2024). While corporate performance and environmental accounting are related but distinct areas, earlier studies show that larger firms generally provide more environmental information in their annual reports than medium-sized firms, and this information tends to be descriptive rather than numerical (Cormier & Magnan, 2007; Bewley & Li, 2000). This pattern highlights a noticeable gap in existing research, particularly in the context of PSX-100 manufacturing firms, where the influence of green accounting practices on financial outcomes and other business factors has not been fully explored.

Chapter 3

Data Description

The purpose of this research is to study the impact of green accounting disclosure on the financial performance of the company.

3.1 GAD Index Formation

All studies examining the compliance level with IFRSs' disclosure requirements agree that item-based requirements should be used for drawing verifiable conclusions. However, opinions differ regarding whether different weights should be assigned to disclosure requirements or whether all items should carry the same weight (Chavent et al., 2006). Cooke (1989a) earlier noted that the question of using weighted versus unweighted items should be addressed based on the focus user group of the research. If the study targets a specific user group, such as investors, a weighted index is more appropriate because it emphasizes items that are particularly relevant to that group. Conversely, if the research aims to address the needs of multiple user groups, an unweighted index is preferable, as it assigns equal importance to all disclosure requirements.

In financial statements, every disclosure provides important information to users. Since this study focuses on assessing compliance levels with IFRSs' disclosures, it is reasonable to assume that both mandatory and voluntary disclosures are useful to all users of financial statements. Following the approach of Glaum and

Street (2003) and Al-Shammari et al. (2008), equal weight will be allocated to each mandatory and voluntary disclosure requirement included in the compliance index.

If a disclosure is not relevant to a firm, it will be excluded from the weighting system for that specific company. For disclosures that are made, a code of 1 will be assigned, and for disclosures not made, a code of 0 will be used.

Building on the methodology of the studies mentioned above, the total weight of disclosures, or Green Accounting Disclosure Score (GADS), will be calculated by summing all the 1s and 0s:

$$\text{GADS} = \sum_{i=1}^n d_i$$

Where:

- $d_i=1$ if an item is disclosed,
- $d_i=0$ if an item is not disclosed,
- mn

Although this weighting system has its limitations, as noted by Cooke (1989a), particularly the potential for subjectivity, it prevents larger or more diversified firms from gaining an undue advantage. Under this approach, a firm is not penalized for omitting irrelevant disclosures. However, if a relevant item is not disclosed, it receives a score of 0.

Two procedures are recommended to mitigate bias in the weighting system, consistent with prior research (Glaum & Street, 2003; Al-Shammari et al., 2005). First, the annual reports of each firm should be carefully reviewed to determine which disclosure requirements are relevant to its business. Cooke (1989a) emphasizes that this evaluation should occur before assigning weights. Street and Bryant (2000), as well as Glaum and Street (2003), argue that this practice avoids unfairly penalizing firms for non-compliance with irrelevant disclosure requirements. Second, certain disclosures can be predetermined as mandatory or voluntary for the firm. For example, Al-Shammari et al. (2005) note that all manufacturing

firms must disclose the accounting basis used for inventory, as all such firms hold inventory.

Once weights are assigned, the aggregated total for each company will be computed as the GADS. The compliance index for each firm can then be calculated by dividing the GADS by the maximum points (MP) the firm could achieve if all applicable disclosure requirements were satisfied. As some disclosures may not be relevant to specific firms, the MP will vary from company to company. The MP can be computed as:

$$MP = \sum_{i=1}^n d_i$$

d= total number of disclosure items expected

n= total required disclosure by the firm.

Therefore, score of Green Accounting Disclosure Score (GADS) for any company will be computed yearly by dividing total score of disclosures (TDS) by maximum points that are applicable to company MP.

$$GADS = \frac{TDS}{MP}$$

This approach ensures that compliance assessment reflects both the relevance and completeness of a firm's disclosures.

3.2 Population, Sample Size and Study Methodology

Recent studies show that including environmental costs in financial reporting increases transparency and stakeholder trust, which improves financial performance. For example, ([Unizik Journal, 2023](#)) found a positive relationship between environmental accounting and financial performance indicators such as return on equity and return on invested capital among consumer goods companies.

Additionally, (M. Khan & Gupta, 2023) conducted a meta-analysis showing that corporate environmental accounting positively affects corporate performance, especially when environmental costs are specifically accounted for. These findings highlight the importance of environmental accounting in supporting the financial performance of large manufacturing companies.

Recent moves by the Securities and Exchange Commission of Pakistan (SECP) to gradually adopt IFRS standards for sustainability reporting from July 2025 reflect the growing importance of environmental reporting by listed companies.

Empirical research has shown a positive relationship between environmental sustainability reporting and financial performance indicators, such as Return on Assets (ROA) (Alam & Tariq, 2022). Furthermore, evidence also shows that green finance disclosures have a positive impact on corporate profitability, highlighting the financial benefits of including environmental aspects in corporate reporting.

These data suggest that effective green accounting practices can improve financial performance, and the study of large manufacturing firms is particularly relevant in the Pakistani context. This study adopted a retrospective research design, examining data available from financial statements of companies listed on the New York Stock Exchange (Alam & Tariq, 2022).

Therefore, this study used the current financial data of companies for the period 2019-2024. The study population includes all listed manufacturing companies in PSX 100. This study used samples and focused on applying arbitrary sampling methods. The financial records of the companies provided the data for the study. By selecting companies from PSX 100 means the companies are top 100 by market capitalization. Researchers can focus on companies with high levels of market presence and investor value, which are more likely to have detailed environmental reporting practices. For example, Zalmianti and Molla (2023) studied consumer goods companies listed on the Indonesian stock exchange and found that green accounting is positively related to financial performance measures such as return on equity and return on invested capital. M. Khan and Gupta (2023) also conducted a meta-analysis showing that corporate green accounting has a positive relationship with firm performance, especially when environmental costs are specifically

quantified. These studies highlight the need to select companies with high market capitalization to obtain comprehensive financial and environmental information, which improves the assessment of the relationship between environmental accounting practices and financial performance. Multiple regression analysis is a basic statistical method used to analyse the relationship between environmental accounting information and financial performance.

By including variables such as return on investment (ROA), return on equity (ROE), and net profit margin (NPM), researchers can analyse the impact of green accounting practices on financial performance. For example, [Pramastha and Sulistiwati \(2025\)](#) applied multiple regressions to determine the effects of green accounting, financial performance, and firm size on the financial viability of manufacturing firms.

Their results confirm that green accounting is positively related to these financial performance measures, which strengthens the applicability of this analytical method. Similarly, [Sabita and Dasman \(2025\)](#) used multiple regression to examine the effects of green intellectual capital, green accounting, and firm size on financial performance in the agri-food sector and identified significant relationships. These studies highlight the effectiveness of multiple regression analysis in understanding the impact of green accounting disclosure on a firm's financial health. The Hausmann test is a key econometric technique used to determine the appropriate model (fixed or random effects) to adopt when analyzing panel data, especially when evaluating the impact of green accounting disclosure on financial performance.

By assessing whether the identified errors are correlated with the regressed variable, the Hausman test ensures that a model is selected that provides consistent and efficient estimates. The Hausman test has been used to validate model selection in recent studies examining environmental accounting practices and their relationships with financial ratios such as Return on Assets (ROA) and return on equity (ROE) ([Surianti, 2025](#); [Emmanuel & Ugwuoke, 2021](#)). For example, a study examining the impact of green accounting on the financial performance of publicly listed oil and gas companies used the Hausman test to confirm the fit

of a fixed-effects model, thus yielding reliable and valid results in the context of potential endogeneity. The importance given to this methodological focus underlines the importance of the Hausman test to ensure the reliability of the results regarding the impact of green accounting on firm performance. The likelihood ratio test (LRT) is a statistical tool used to test the difference in fit between nested models, which explains its high value in assessing the impact of green accounting disclosure on financial performance.

Comparing models with and without environmental accounting variables enables researchers to determine whether including this information significantly improves the explanatory power of the model. For example, one study used the LRT method to examine the effects of environmental accounting information on financial indicators such as Return on Assets (ROA) and return on equity (ROE). The study concluded that the use of environmental accounting data improves the fit of the model, highlighting its applicability in financial performance analysis ([Pramastha & Sulistiwati, 2025](#)). This illustrates the importance of environmental accounting practices in providing useful information about a company's financial performance.

3.3 Dependent Variable

3.3.1 ROA

Return on Assets (ROA), return on equity (ROE), and return on equity (OPM) are the dependent variables in this study. ROA refers to the financial performance of a company.

$$\text{ROA} = \text{EBIT} / \text{Total Assets}$$

In the given formula operating profit is profit before interest and tax.

3.3.2 Return on Equity

To determine the return on equity variable and its relationship with green accounting, the return on equity formula is applied:

Return on equity = Net Profit/Equity

Net profit refers to the company's profit, which may be affected by environmental costs and savings achieved through green accounting. Equity represents capital invested by shareholders and may be affected by changes in market prices if a company's environmental, social and corporate governance (ESG) performance improves.

Empirical research can include analysis of return on equity before and after the implementation of green accounting policies to assess time series evolution. Regression analysis can also be performed using environmental costs, sustainability costs, or ESG ratings as independent variables to determine their impact on return on equity (Manrique & Martí-Ballester 2017). Case studies or sector comparisons can also provide information on the impact of green accounting on return on equity in different sectors.

Measuring return on equity in the context of green accounting requires analyzing financial statements considering environmental investments and their long-term impacts. The impact of green accounting on return on equity reflects the balance between short-term financial stress and the long-term value created by sustainable practices (Majid et al., 2022).

3.3.3 Revenue

In the context of evaluating the relationship between green accounting practices and financial performance, revenue serves as a key financial indicator reflecting a firm's operational efficiency and market competitiveness.

Revenue = The total income earned from core business activities, such as the sale of goods or services, before deducting any operating or production costs (Khan et al., 2021).

For manufacturing firms listed on the Pakistan Stock Exchange (PSX), revenue data are extracted from annual financial statements—specifically the income statement, where it is reported as “Net Sales” or “Total Revenue.”

To assess the link with green accounting, revenue is often analyzed over a multi-year period to observe the impact of environmental cost disclosures, sustainability initiatives, and eco-efficient resource management on sales growth (S. Ali, Khan, & Hussain, 2022). Firms engaging in transparent environmental reporting and adopting sustainable manufacturing processes are expected to enhance their brand reputation and attract environmentally conscious consumers, thereby improving their revenue performance (Javed et al., 2023). Thus, measuring revenue provides a direct and reliable financial metric to gauge how effectively green accounting contributes to overall business success and market value.

3.4 Independent Variable

3.4.1 Green Accounting Disclosure

TABLE 3.1: Green Accounting Disclosure Components

A Description		Issues and Scope of Green Accounting
Pollution Prevention Costs		Expenditures for air and water pollution prevention, water treatment facilities, and related activities.
Environmental Protection Costs	Pro-	Costs of energy-saving measures and initiatives to reduce global warming.
Resource Recycling Costs		Costs incurred for waste reduction, disposal, water conservation, rainwater harvesting, and other resource-efficiency measures.
Environmental Restoration Costs		Costs of environmental remediation such as soil and groundwater contamination removal and environmental compensation.

3.5 Controlled Variables

3.5.1 Firm Size

Researchers include firm size as a control variable to measure its potential confounding effects when measuring the effects of total capital raised on financial performance (Boulay, 2019). Firm size as a control variable helps ensure that any relationship between total capital and financial performance is not simply the result of an internal advantage or disadvantage of small or large size.

Company size is usually measured by:

Total Assets: The value of total assets is commonly used to normalize skewed data. (Kieschnick & Nguyen, 2025).

3.5.2 Age of the Company

Age of the Company 3.3 Standard economic models

Panel data analysis will be used to analyse correlation in the study. The variables of firm i at time t are:

$$ROE_{it} = \beta_0 + \beta_1 GAD_{it} + \beta_2 SIZE_{it} + \beta_3 AGE_{it} + \varepsilon_{it} \quad (3.1)$$

$$ROA_{it} = \beta_0 + \beta_1 GAD_{it} + \beta_2 SIZE_{it} + \beta_3 AGE_{it} + \varepsilon_{it} \quad (3.2)$$

$$REV_{it} = \beta_0 + \beta_1 GAD_{it} + \beta_2 SIZE_{it} + \beta_3 AGE_{it} + \varepsilon_{it} \quad (3.3)$$

3.6 Descriptive Analysis and Correlation Analysis

3.6.1 Descriptive Statistics

TABLE 3.2: Descriptive Statistics

	ROA	ROE	REV	EBIT	TCL	SH EQ	TA	TLTD	AGE
Mean	2.627372	1.555827	281573.9	131756.4	291600	447353.6	649125.7	25573.81	2.893048
Median	0.125206	0.265268	61565	7824	21436.72	24830.5	63700	8280.845	3
Maximum	233.9494	153.0612	13852284	13766285	15879759	41090305	37865949	257643	3
Minimum	-17.5499	-6.7208	-27770	-557315	29.127	-726424	74	0	2
Std. Dev.	21.3781	10.11701	1279029	1043583	1385739	3385518	3938812	48184.48	0.309466
Skewness	9.18846	12.57436	8.061172	10.50843	7.652294	9.413125	8.315324	3.022537	-2.54357
Kurtosis	88.96997	172.9365	70.9999	119.0684	68.39058	95.16954	71.90163	11.97296	7.46976
Jarque-Bera	120436.5	459877.7	76107.7	216819.8	70283.29	137907.1	78290.87	1824.138	714.6174
Probability	0	0	0	0	0	0	0	0	0
Sum	982.637	581.8794	1.05E+08	49276889	1.09E+08	1.67E+08	2.43E+08	9564605	1082
Sum Sq. Dev.	170469.6	38178	6.10E+14	4.06E+14	7.16E+14	4.28E+15	5.79E+15	8.66E+11	35.72193
Observations	374	374	374	374	374	374	374	374	374

Table 3.2 presents descriptive data for selected variables, including Return on Assets (ROA), Return on Capital (ROE), Income (REV), Earnings Before Interest and Tax (EBIT), Total Short Term Liabilities (TCL), Equity (SHEQ), Total Assets (TA), Total Long-Term Debt (TLTD), and Business Age (AGE). , based on 374 observations from 2020 to 2024. The average values of the core earnings ratio, ROA (2.63) and ROE (1.56), indicated that the companies in the sample generate modest returns relative to their assets and capital base, respectively. Based on the composition of the major companies listed on the Pakistan Stock Exchange (PSX), the average income (Rs. 281,573.9 million) and EBIT (Rs. 131,756.4 million) show that the dataset includes companies with significant market size and activity. Total average assets (Rs. 649,125.7 million) and equity (Rs. 447,353.6 million). They also point to significant investment and financial potential in companies. Standard deviation (SD) values indicate the degree of diversification between companies. The high standard deviations for TA (3,938,812), SHEQ (3,385,518), and REV (1,279,029) reflect large differences in company size and performance, indicating the presence of large groups and small companies in the sample. This diversity is common for cross-sector financial data and validates the use of technical panel data to document business-specific impacts ([Baltagi, 2021](#)). In terms of distribution characteristics, all variables exhibit high positive inequality (e.g., ROA = 9.19; EBIT = 10.51), indicating that most companies are showing low earnings and financial data, while some companies are achieving particularly high values. Also, the values of the curve are much higher than the typical reference point of 3 (e.g., ROE = 172.94; EBIT = 119.07), which confirms the existence of heavy-tail distributions and implies that extreme financial results occur more frequently than normal distributions. Such patterns are common in financial datasets where profits and business size vary greatly ([Gujarati & Porter, 2009](#)). The Jarrick-Barre (JB) test data are all significant at the level of 1% ($p = 0.000$), indicating an abnormal data distribution across all variables. Although the central range theory does not require regular rigor for large-sample regression models, it emphasizes the need for robust evaluation techniques and possible logarithmic variations to reduce sweeping ([Wooldridge, 2016](#)).

TABLE 3.3: Correlation Table Analysis

	ROA	ROE	REV	EBIT	TCL	SH EQ	TA	TLTD	AGE
ROA	1	0.145356	-0.02379	0.941243	0.658812	0.902404	-0.01874	-0.05738	0.04069
ROE	0.145356	1	-0.01391	0.10559	-0.02048	-0.01652	-0.00476	0.07512	-0.04293
REV	-0.02379	-0.01391	1	-0.01878	0.474251	-0.01089	0.949067	0.057023	-0.30848
EBIT	0.941243	0.10559	-0.01878	1	0.67242	0.93214	-0.01228	-0.03511	0.036863
TCL	0.658812	-0.02048	0.474251	0.67242	1	0.730986	0.484708	0.021365	-0.13529
SHEQ	0.902404	-0.01652	-0.01089	0.93214	0.730986	1	-0.00593	-0.04108	0.038516
TA	-0.01874	-0.00476	0.949067	-0.01228	0.484708	-0.00593	1	0.026026	-0.32276
TLTD	-0.05738	0.07512	0.057023	-0.03511	0.021365	-0.04108	0.026026	1	-0.05744
AGE	0.04069	-0.04293	-0.30848	0.036863	-0.13529	0.038516	-0.32276	-0.05744	1

Table 3.3 shows Pearson's correlation coefficient between the variables in the study. The correlation table provides preliminary information about the relationship between earnings (ROA, ROE), revenue, and other financial indicators.

The ROA-EBIT ratio ($r = 0.94$) is particularly high and positive, confirming a strong linear correlation between operating profit and asset return. This relationship is consistent with financial theory, which holds that businesses with higher earnings before interest and taxes generate higher returns on assets (Ross et al. Also, ROA is strongly correlated with SHEQ ($r = 0.90$) and TCL ($r = 0.66$), suggesting that both equity levels and short-term liabilities are positively correlated with asset returns, although the direction of causation should confirm the regression analysis.

In contrast, ROE exhibits weak correlations with most variables ($-r \leq 0.15$), suggesting that stock-based returns are influenced by more subtle factors, such as leverage structure and retained income, rather than absolute asset or income levels.

The relationship between REV and TA ($R = 0.95$) is particularly strong and positive, which makes sense, as companies with large total assets typically have the ability to generate higher revenues due to the effect of size (Nguyen & Nguyen, 2020). The fairly positive correlation between REV and TCL ($r = 0.47$) also suggests that companies that use more working capital or short-term liabilities may support higher sales activity.

However, the negative correlations between TA and AGE ($r = -0.32$) and REV and AGE ($r = -0.31$) indicate that legacy businesses have a smaller asset base and lower revenues, which likely reflects market saturation or lower growth dynamics compared to newer and more growing businesses.

Importantly, the high correlations between EBIT, ROA, SHEQ, and TCL raise potential concerns about multilinear in regression models (Hare et al., 2019). Although correlations below 0.80 are generally considered acceptable, the correlation of +0.90 observed here indicates that diagnostic tests such as variance inflation factor (VIF) should be performed to ensure consistent parameter estimates.

3.7 Summary of Statistical Information

In summary, the descriptive analysis reveals significant variation and anomaly between financial variables at the enterprise level, confirming the compatibility of panel data regression techniques that control for unobservable variance. The correlation results highlight the important role of EBIT and TA in guiding business performance indicators (ROA, ROE, and REV), while pointing to the potential correlation between size-related variables.

Overall, these findings suggest that the profitability of organizations in Pakistan's manufacturing and service sectors is primarily influenced by operational profitability and asset base, with the age of the organization showing a limited but negative correlation with economic growth. This model is consistent with empirical evidence from emerging markets, where business efficiency and resource utilization are more crucial in terms of structural maturity ([S. Ali et al., 2022](#)).

Variable	Abbreviation	Formulae
Environmental cost	ENVC	It is the total cost caused by the company's environmental activities.
Return on Assets	ROA	It is measured as earnings before interest and taxes divided by total assets
Return on Equity	ROE	Measured by EBIT/Equity
Revenue	REV	Total sales Revenue
Firm size	Measurement	It is measured as the natural logarithm of total assets.
Firm age	Age	Number of years since establishment

Dependent Variable: ROA

Method: Panel Least Squares

Date: 11/15/25 Time: 19:10

Sample: 2020 2024

Periods included: 5

Cross-sections included: 75

Total panel (unbalanced) observations: 374

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROE	0.167094	0.037844	4.415324	0.0000
REV	1.82E-07	9.02E-07	0.201980	0.8400
C	-0.178091	4.325399	-0.041173	0.9672
EBIT	1.42E-05	1.01E-06	14.07510	0.0000
TA	-2.20E-07	2.99E-07	-0.736145	0.4621
TCL	7.61E-07	5.50E-07	1.382877	0.1676
TLTD	-1.35E-05	7.55E-06	-1.783910	0.0753
GADI	-0.325436	0.959215	-0.339273	0.7346
AGE	0.317417	1.239111	0.256165	0.7980
SH_EQ	1.39E-06	3.55E-07	3.920649	0.0001
R-squared	0.897400	Mean dependent var		2.627372
Adjusted R-squared	0.894863	S.D. dependent var		21.37810
S.E. of regression	6.931812	Akaike info criterion		6.736494
Sum squared resid	17490.21	Schwarz criterion		6.841420
Log likelihood	-1249.724	Hannan-Quinn criter.		6.778154
F-statistic	353.7504	Durbin-Watson stat		1.384393
Prob(F-statistic)	0.000000			

TABLE 3.4: Variables

Variable	Interpretation
ROE	Positive and significant → A 1-unit increase in ROE increases ROA by 0.167 units, showing that profitability metrics are positively related.
REV	Not significant → Revenue does not have a statistically significant effect on ROA in this model.
C (constant)	Not significant → Baseline ROA is essentially captured by other variables.
EBIT	Highly significant → Higher operating earnings positively influence ROA; operational performance drives asset returns.
TA (Total Assets)	Not significant → Firm size (total assets) has no statistically significant effect on ROA.
TCL (Current Liabilities)	Not significant → Short-term obligations do not significantly affect ROA.
TLTD (Long-term Debt)	Marginally insignificant → Higher long-term debt may slightly reduce ROA.
GADI (Green Accounting Disclosure Index)	Not significant → In this sample, green accounting disclosure does not have a significant impact on ROA.
AGE (Firm Age)	Not significant → Age of firm has no significant effect on ROA.
SH_EQ (Shareholders' Equity)	Positive and significant → Higher equity capital is associated with higher ROA.

Significant Determinants of ROA

The results indicate that ROE, EBIT, and shareholders' equity have a positive and statistically significant effect on ROA ($p < 0.01$), highlighting the importance of profitability and operational efficiency in driving accounting-based performance.

Variables with No Significant Effect

Green Accounting Disclosure Index (GADI) does not show a significant impact on ROA in this sample of Pakistani manufacturing firms. Similarly, firm size, revenue, current liabilities, long-term debt, and firm age were not found to significantly influence ROA at the 5

Implications

These findings suggest that while operational and financial factors play a central role in determining short-term accounting performance, the effect of green accounting disclosure may be indirect, potentially influencing outcomes through market perceptions, investor confidence, or long-term strategic benefits.

This observation is consistent with prior research indicating that the impact of GAD is often more evident in market value and long-term firm sustainability rather than immediate accounting measures ([Alaika & Firmansyah, 2024](#)).

The panel least squares regression analysis reveals that key financial and operational metrics—specifically ROE, EBIT, and shareholders' equity—positively and significantly affect the return on assets (ROA) of Pakistani manufacturing companies. In contrast, variables such as firm size, revenue, total liabilities, firm age, and green accounting disclosure (GADI) do not exhibit a statistically significant relationship with ROA.

The absence of a significant effect for GADI suggests that, in the short term, green accounting disclosures may not directly enhance accounting-based performance; however, they could still influence market-based performance or support long-term strategic advantages.

These findings align with previous studies highlighting that the benefits of environmental and sustainability disclosures are more likely to be reflected in firm value and long-term outcomes rather than immediate accounting measures ([Clark et al., 2015](#); [Friede, Busch, & Bassen, 2015b](#)).

Overall, the model demonstrates strong explanatory power, accounting for approximately 89.7% of the variation in ROA.

Dependent Variable: ROA

Method: Panel Least Squares

Date: 10/04/25 Time: 17:30

Sample: 2020 2024

Periods included: 5

Cross-sections included: 75

Total panel (unbalanced) observations: 374

TABLE 3.5: Dependent Variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.159115	4.415388	0.262517	0.7931
GADI	-0.498590	0.980809	-0.508346	0.6115
EBIT	1.57E-05	9.73E-07	16.11956	0.0000
SH.EQ	9.59E-07	3.49E-07	2.750326	0.0062
AGE	0.048112	1.266844	0.037978	0.9697
TCL	7.54E-07	5.59E-07	1.348435	0.1784
TLTD	-1.09E-05	7.67E-06	-1.418638	0.1569
TA	-1.70E-07	1.38E-07	-1.235041	0.2176
R-squared	0.891904	Mean dependent var		2.627372
Adjusted R-squared	0.889837	S.D. dependent var		21.37810
S.E. of regression	7.095579	Akaike info criterion		6.777979
Sum squared resid	18427.09	Schwarz criterion		6.861921
Log likelihood	-1259.482	Hannan-Quinn criter.		6.811308
F-statistic	431.4112	Durbin-Watson stat		1.365433
Prob(F-statistic)	0.000000			

The term constant is not statistically significant, i.e. when all independent variables are zero, the ROA is not significantly different from zero. GADI has a negative but not statistically significant effect on ROA (page > 0.05). This indicates that changes in governance and disclosure do not significantly explain the profitability of the business in this dataset. Similar results were observed by [Haniffa and Hudaib \(2006\)](#), which indicate that disclosure ratios sometimes have a limited direct impact on short-term profitability. EBIT is positive and extremely important (page < 0.01). This shows that higher operating profits significantly improve return on investment. In other words, businesses with better operating performance tend to receive higher returns on assets. This conclusion is consistent with the findings of Al-Rossi and Al-Hadari (2018), who reported that earnings metrics are closely related to ROA. A statistically significant positive aspect of equity is the impact on ROA (page < 0.01). This means that companies with good capital generate Higher returns on assets, according to theories of order and capital structure ([Myers, 1984](#)). Business age shows a positive but statistically insignificant correlation with ROA (page > 0.05). This suggests that maturity does not necessarily translate into higher performance or profitability, as also highlighted by [N. Khan, Ullah, and Afeef \(2021\)](#). The rate is positive but not significant, indicating that short-term commitments do not have a statistically significant impact on return on investment. This may mean that short-term debt management does not have a significant impact on profitability.

These findings are consistent with the resource-oriented approach (RBV), which emphasizes that a firm's internal capabilities (e.g., profit and capital strength) are important performance factors (Barney, 1991). Negative or insignificant debt-related factors support theories of capital structure, suggesting that efficiency can be reduced by utilizing the maximum level ([Modigliani & Miller, 1963](#)).

Dependent Variable: ROE

Method: Panel Least Squares

Date: 10/04/25 Time: 17:36

Sample: 2020 2024

TABLE 3.6: Model Customization and Evaluation

Statistics	Price
R-squared 0.8919	= This shows that 89.19% of the variance in ROA is defined by independent variables. This represents an excellent model that corresponds to pipeline data (Gujarati and Porter, 2009).
Adjusted R Squared = 0.8898	Designed for degrees of independence, confirming that the model remains strong even after calculating the number of predictive factors.
F-statistic = 431.41	
(p = 0.000)	Overall regression is extremely important, which means that independent variables together have a statistically significant effect on ROA.
Durbin Watson = 1.3654	This indicates a light to positive auto adapter in the rest (since DW <2). However, for tabular data, this is often acceptable, although strong standard errors can be used to correct (Wooldridge, 2010).
S.E. of Regression 7.0956	The average gap between the expected and actual ROA values is about 7.1 points. Lower values indicate a more expensive model.
Akaike and Schwartz Criteria (6.78, 6.86)	These information criteria are mainly used to compare models – the lower the price, the better the model fit compared to the alternative.

Periods included: 5

Cross-sections included: 75

Total panel (unbalanced) observations: 374

The constant is positive but lacks statistical significance ($p > 0.05$). It shows that when all independent variables are zero, the ROE is not significantly different from zero. EBIT has an extremely positive and significant effect on ROE (page < 0.01). This shows that companies with higher earnings before interest and taxes receive better returns on equity. This is consistent with Al-Rossi and Al-Hadari (2018). He found that operating profit is a key driver of shareholder returns. Total assets have a positive impact on ROE at a material level of 10%, suggesting that larger companies can achieve slightly better returns on capital. This supports the

TABLE 3.7: Panel Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.188153	6.189259	1.322962	0.1867
EBIT	3.07E-06	7.84E-07	3.911113	0.0001
TA	3.24E-07	1.81E-07	1.789024	0.0744
TCL	-2.21E-06	6.74E-07	-3.278382	0.0011
TLTD	1.81E-05	1.07E-05	1.682387	0.0933
GADI	-0.970958	1.374893	-0.706206	0.4805
AGE	-1.769854	1.775607	-0.996760	0.3195
R-squared	0.048936	Mean dependent var		1.555827
Adjusted R-squared	0.033387	S.D. dependent var		10.11701
S.E. of regression	9.946688	Akaike info criterion		7.450895
Sum squared resid	36309.73	Schwarz criterion		7.524344
Log likelihood	-1386.317	Hannan-Quinn criter.		7.480058
F-statistic	3.147254	Durbin-Watson stat		1.178463
Prob(F-statistic)	0.005069			

argument of "economies of scale" that large companies can make better use of assets to increase profits ([Myers, 1984](#)).

TCL has a statistically significant negative correlation with ROE (page < 0.01). This suggests that companies with higher short-term liabilities tend to receive lower returns on capital. This conclusion is consistent with the theories of liquidity management that suggest that excessive short-term debt can weigh on cash flows and reduce profitability. Long-term debt has a positive and significant marginal effect (p. < 0.10). This means that moderate levels of long-term funding can increase ROE, perhaps due to tax benefits or efficient capital structures ([Modigliani & Miller, 1963](#)).

The coefficient for the government-disclosure ratio is negative and has no statistical significance (page > 0.05). This suggests that governance practices did not have a measurable direct effect on ROE in this sample, such as ([Haniffa & Hudaib, 2006](#)), which also found weak associations between disclosure and profitability. The age of the business is negative and statistically meaningless, meaning that veteran companies do not necessarily generate much profit for shareholders. This

may reflect organizational rigidity or a lack of growth opportunities in mature businesses (Cody et al., 2013).

TABLE 3.8: Model Customization and Evaluation

statistics		price
R-Squared = 0.0489	=	Only 4.89% of the variance in ROE is defined by the model, suggesting that other external factors (e.g., market volatility, company strategy) can play a big role.
Adjusted Squared = 0.0334	R	After adjusting to degrees of freedom, the explanatory power remains low, indicating a final customization of the model.
F-Statistic = 3.147 (p = 0.005)		Despite the low R^2 , the model as a whole is statistically significant (p < 0.01), meaning that descriptive variables collectively affect ROE.
Durbin Watson = 1.178	=	This indicates a potential positive autocorrelation in the remainder (DW < 2), which is common in panel data. Correction with strong standard errors (e.g., GLS or stable results with strong coherence) can alleviate this problem (Wooldridge, 2010).
S.E. of Regression = 9.9467		This indicates a moderate prediction error – on average, the projected ROE values deviate by about 9.9 points from the actual values.
Akaike Schwartz = 7.52	= 7.45;	They can be used to compare models – lower values indicate a better fit for models with the same dependent variable.

The findings partially support the theory of capital structure compromise, which states that firms balance the benefits of debt (e.g., tax evasion) with its costs (risk of distress) (Modigliani & Miller, 1963). Negative TCL and positive TLTD together reflect that long-term financing is more beneficial than short-term commitments.

The modest role of GADI is also consistent with the view of devolution, according to which governance reforms may not immediately translate into financial gains (Jensen & Meckling, 1976). From a managerial perspective, businesses should prioritize improving profitability and debt structures over disclosure alone to improve ROE.

Dependent Variable: REV

Method: Panel Least Squares

Date: 10/04/25 Time: 17:35

Sample: 2020 2024

Periods included: 5

Cross-sections included: 75

Total panel (unbalanced) observations: 374

TABLE 3.9: Panel Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	123925.8	249980.6	0.495742	0.6204
EBIT	-0.056809	0.031661	-1.794328	0.0736
TA	0.298221	0.007314	40.77463	0.0000
TCL	0.054969	0.027240	2.017922	0.0443
TLTD	0.798479	0.433464	1.842091	0.0663
GADI	-24098.87	55531.13	-0.433970	0.6646
AGE	-5761.026	71715.74	-0.080331	0.9360
R-squared	0.902929	Mean dependent var		281573.9
Adjusted R-squared	0.901342	S.D. dependent var		1279029.
S.E. of regression	401740.9	Akaike info criterion		28.66354
Sum squared resid	5.92E+13	Schwarz criterion		28.73699
Log likelihood	-5353.082	Hannan-Quinn criter.		28.69270
F-statistic	568.9577	Durbin-Watson stat		1.146131
Prob(F-statistic)	0.000000			

The results of the smallest square with the Revenue Regression (REV) analysis as a dependency variable are shown in Table X (EViews Output, 2025). The model examines the effects of business-specific financial ratios, such as interest and earnings before tax (EBIT), total assets (TA), total short-term liabilities (TCL), total long-term debt (TLTD), growth-to-growth ratio (GADI), and age (AGE) on company revenue for 75 companies in the organizational period 2020-2024.

The model exhibits high explanatory power with an adjustable R-square of 0.9029 and an adjustable R-square of 0.9013, indicating that about 90% of income variance between organizations is explained by the independent variables involved. Such a high R^2 value indicates an excellent model that fits table data (Gujarati & Porter, 2009).

The figure of F568.96 with a p value of < 0.001 further than that the overall regression model is statistically significant, suggesting that the predictive factors together have a significant impact on the company's earnings (Wooldridge, 2016). The Durban-Watson figure (1,146) is slightly below the ideal value of 2, suggesting a slight positive self-correlation. However, this is not uncommon in organization-level panel statistics (Baltagi, 2008).

The term crossover is statistically meaningless, meaning that when all independent variables are zero, the expected income is not materially different from zero. The EBIT ratio is negative and moderately significant at 10%, which indicates that an increase in EBIT by one point corresponds to a decrease in earnings of 0.0568 points, while keeping other factors constant. Although inconsistent, it may reflect a multilinker effect or a lag between earnings and earnings (Wooldridge, 2010). Total assets are extremely important and are positively correlated with revenue. This means that an increase in total assets leads to higher business revenues, according to previous studies that emphasize the role of business size and asset base in increasing revenue generation potential (Tittman et al., 1988).

The TCL rate is positive and significant at 5%, indicating that companies with higher short-term liabilities report higher revenues. This indicates that short-term funding is effectively used for operational expansion (Pandey, 2015). TLTD shows positive and significant gains weak at the 10% level. This means that moderate

levels of long-term debt can support growth through fixed asset investments that contribute to income generation under the assumption of growth ([Myers, 1984](#)).

The Growth and Development Index (GADI) has a negative but not statistically significant effect on revenue, suggesting that growth-related activities do not significantly affect an organization's revenue during the sample period. Organization age has a negative and insignificant correlation with revenue, which means that older businesses don't necessarily earn more revenue than younger ones – according to studies showing that the effects of maturity can sometimes slow revenue growth ([Cody et al., 2013](#)).

The results show that enterprise size (TA), short-term liabilities (TCL), and long-term debt (TLTD) are the main revenue drivers of the organization in a sample of 75 Pakistani companies between 2020-2024. However, earnings (EBIT) show a weak inverse correlation with revenue, which may reflect the time difference or fluctuations in performance at the industry level. Reinforce the fact that asset structure and funding mix are important factors influencing companies' performance in emerging markets ([Abor, 2005](#)).

Chapter 4

Results and Discussion

4.1 Random Effect

Dependent Variable: ROA

Method: Panel EGLS (Cross-section random effects)

Date: 10/08/25 Time: 19:41

Sample: 2020 2024

Periods included: 5

Cross-sections included: 75

Total panel (unbalanced) observations: 374

Swamy and Arora estimator of component variances

TABLE 4.1: Panel EGLS (Cross-section random effects)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.153108	4.434079	0.260056	0.7950
EBIT	1.57E-05	9.77E-07	16.05546	0.0000
GADI	-0.497389	0.984901	-0.505014	0.6139
REV	4.93E-08	9.27E-07	0.053228	0.9576
SH_EQ	9.60E-07	3.50E-07	2.739219	0.0065
TA	-1.84E-07	3.07E-07	-0.600821	0.5483
TCL	7.51E-07	5.65E-07	1.328549	0.1848
TLTD	-1.09E-05	7.73E-06	-1.411949	0.1588
AGE	0.048342	1.271801	0.038011	0.9697
Effects Specification				
			S.D.	Rho
Cross-section random			0.000000	0.0000
Idiosyncratic random			7.123306	1.0000
Weighted Statistics				
R-squared	0.891905	Mean dependent var		2.627372
Adjusted R-squared	0.889536	S.D. dependent var		21.37810
S.E. of regression	7.105265	Sum squared resid		18426.95
F-statistic	376.4567	Durbin-Watson stat		1.365110
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.891905	Mean dependent var		2.627372
Sum squared resid	18426.95	Durbin-Watson stat		1.365110

The model was evaluated using the EGLS (Cross-Section Random Effects) panel approach to examine asset return factors (ROA) for 75 companies over a 5-year period (2020-2024), and yielded 374 observations of the corporate year. The estimate was used by Swamy and Arora (1972) for component fluctuations, assuming that firm-specific effects are random and unrelated to regressions – an appropriate approach when sample societies are considered to be representative of large

populations ([Baltagi, 2008](#); [Wooldridge, 2016](#)).

The model shows an R-value squared of 0.8919 and a coordinated R-square of 0.8895, indicating that business ROA is defined by independent variables that comprise about 89% of the variance – an excellent level of explanatory power for economic panel data ([Gujarati & Porter, 2009](#)).

Statistic F (376.46, $p < 0.001$) shows that the model is statistically significant overall, confirming that independent variables together have a significant impact on business profitability. Durban-Watson data (1,365) indicate a moderate positive self-correlation, which is prevalent in organization-level panels, but does not negate the results ([Baltagi, 2008](#)).

The explanation for the effect shows that the random variance component in the cross-section is essentially zero ($= 0$), which means that the greatest variance is caused by the firm-specific mood shock rather than by the unobservable firm variance. This means that random effects and overall OLS results are very similar – a finding that is sometimes seen when firms share similar characteristics ([Greene, 2018](#)).

The term constant ($C = 1.1531$, $p = 0.7950$) is not statistically significant, suggesting that when all independent variables are zero, the expected ROA is not significantly different from zero.

Earnings before interest and tax ($EBIT = 1.57E-05$, $p < 0.001$) demonstrate a significant and highly positive correlation with EBIT ROA, suggesting that higher operating profit directly improves asset-based profitability. This is in line with standard financial theory, which sees EBIT as a key driver of profit ([Ross et al., 2019](#)).

The growth and development index ($GADI = -0.4974$, $p = 0.6139$) shows a negative but not statistically significant effect on GADI ROA, indicating that business development activities do not translate significantly into immediate profits. This may be due to the time gap between investment in development and actual financial returns ([Davidsson et al., 2005](#)).

Earnings ($REV = 4.93E-08$, $p = 0.9576$) Earnings have a negligible impact on return on investment. Although increasing revenue is an indicator of performance, its insignificant associations suggest that higher sales volumes may not increase profitability proportionately – perhaps due to cost inefficiencies or a decrease in profit margins (Shaikh & Wang, 2011).

The equity ratio ($SH_EQ = 9.60E-07$, $p = 0.0065$) is positive and statistically significant at the level of 1%, suggesting that a higher net worth increases returns. This supports the idea that well-capitalized businesses have better risk absorption and financing capacity, which helps improve profitability (Abor, 2005).

Total assets ($TA = -1.84E-07$, $p = 0.5483$) is a negative but not significant factor in total assets, indicating that the size of the business does not significantly affect profitability when other factors are controlled.

This size is contrary to the assumption of profitability, which may depend on the context of the industry (Dugan, 2013).

Total short-term liabilities ($TCL = 7.51E-07$, $p = 0.1848$) TCL has a positive but not significant impact on ROA, meaning short-term debt does not materially affect the profitability of the business. This may indicate that more and more short-term financing has already been achieved in the business (Pandey, 2015).

Total long-term debt ($TLTD = -1.09E-05$, $p = 0.1588$) is negatively correlated with TLTD ROA but is not statistically significant. This suggests that higher long-term debt can reduce profitability due to interest charges, which is consistent with the theory of capital structure compromise (Myers, 1984).

Business age ($age = 0.0483$, $p = 0.9697$) Business age has a positive but not significant relationship with ROA, meaning older businesses don't necessarily achieve better returns on assets. This supports the claim that organizational maturity cannot guarantee high performance (Cody et al., 2013).

The results show that EBIT and equity are the main factors of profit (ROA) in public companies in Pakistan. This shows that operational efficiency and capital adequacy play a significant role in improving a business's financial performance. Assets indicate that the profitability of businesses may be more sensitive to internal

performance and capital structures than to expand the balance sheet. These findings are consistent with empirical evidence from other emerging economies where profits are driven more by internal management efficiency and capital strength than by debt structures ([Abor, 2005](#)).

Dependent Variable: ROE

Method: Panel EGLS (Cross-section random effects)

Date: 10/08/25 Time: 19:43

Sample: 2020 2024

Periods included: 5

Cross-sections included: 75

Total panel (unbalanced) observations: 374

Swamy and Arora estimator of component variances

The model was evaluated using the EGLS (Cross-Section Random Effects) panel methodology to determine the return on equity (ROE) for 75 companies listed in Pakistan during the period 2020-2024. A total of 374 unbalanced panel observations were analyzed using Swami and Arura's variance component estimates. The random effects approach assumes that individual firm-specific effects are not correlated with descriptive variables, making it suitable for data where the sample is representative of population broader societies ([Baltagi, 2008](#); [Wooldridge, 2016](#)).

The model produces an R-square value of 0.1212 and a correlated R-square value of 0.1019, suggesting that about 12% variance in ROE is explained by the independent variables contained in the model. Although this explanatory power is moderate, it is accepted on organization-level financial panel data, where earnings ratios are often influenced by external influences and unobserved management factors ([Gujarati & Porter, 2009](#)). Figure F (6.293, $p < 0.001$) confirms that the overall model is statistically significant, meaning that collective regressions have a significant impact on a company's profitability.

Durban-Watson data (1,137) indicate a moderate positive self-correlation, which is a common characteristic of economic panel data that do not adequately estimate

TABLE 4.2: Panel EGLS (Cross-section random effects)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.966780	5.361271	1.485987	0.1381
EBIT	8.91E-06	1.18E-06	7.540060	0.0000
GADI	-1.029084	1.190849	-0.864159	0.3881
REV	-7.95E-07	1.12E-06	-0.709935	0.4782
SH_EQ	-2.58E-06	4.24E-07	-6.083405	0.0000
TA	2.13E-07	3.71E-07	0.573143	0.5669
TCL	-5.81E-08	6.83E-07	-0.084953	0.9323
TLTD	1.52E-05	9.35E-06	1.628876	0.1042
AGE	-1.610325	1.537743	-1.047200	0.2957
Effects Specification				
			S.D.	Rho
Cross-section random			0.000000	0.0000
Idiosyncratic random			8.612832	1.0000
Weighted Statistics				
R-squared	0.121210	Mean dependent var		1.555827
Adjusted R-squared	0.101949	S.D. dependent var		10.11701
S.E. of regression	9.587440	Sum squared resid		33550.44
F-statistic	6.292994	Durbin-Watson stat		1.136921
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.121210	Mean dependent var		1.555827
Sum squared resid	33550.44	Durbin-Watson stat		1.136921

the bias coefficient ([Baltagi, 2008](#)). Variation in the random cross-section result ($= 0$) indicates that most of the changes are the result of firm-specific mood shocks rather than permanent cross-sector differences ([Greene, 2018](#)).

4.2 Explanation of Individual Factors

The term constant ($C = 7.967$, $p = 0.1381$) is not statistically significant, suggesting that when all descriptive variables are zero, the predicted ROE is not substantially different from zero.

EBIT (8.91E-06, $PP < 0.001$) Earnings before interest and tax (EBIT) has a significant and very positive relationship with ROE, suggesting that increased operating

profit translates into higher returns for shareholders. This finding is consistent with the traditional financial theory that operational efficiency and profit margins are the main drivers of stock returns (Ross et al., 2019).

The GADI Growth and Development Index (-1.029, $p = 0.3881$) shows a negative but not statistically significant impact on ROE. This suggests that business expansion activities do not guarantee high returns on capital, perhaps because growth investments may take time to reap the rewards (Davidsson et al., 2005).

The REV P/E ratio (-7.95E-07, $p = 0.4782$) is negative and unimportant, suggesting that high sales levels do not necessarily promote ROE. This may reflect higher operating costs or competitive prices that are pressuring profit margins (Shaikh & Wang, 2011).

SH.EQ (-2.58E-06, $PP < 0.001$) is a negative and significant factor in equity, which means that higher levels of equity are associated with lower returns on equity. This may be because as equity increases, the denominator of the ROE ratio expands faster than net profit, a pattern that is consistent with the effects of capital depreciation (Myers, 1984).

TA (2.13E-07, $p = 0.5669$) and TCL (-5.81E-08, $p = 0.9323$) Both total assets and total short-term liabilities have a significant impact on ROE, indicating that business size and short-term liabilities do not materially affect returns to shareholders when dividends are controlled.

TLTD (1.52E-05; $p = 0.1042$) exhibits a significant positive but weak correlation with long-term debt ROE, which is consistent with the leveraged profitability assumption that using moderate debt can increase return to shareholders (Abor, 2005).

Age (-1.610, $p = 0.2957$) The age of the firm exhibits a negative but not significant coefficient, which means that long-standing firms do not necessarily achieve high equity returns, perhaps due to bureaucratic incompetence or market saturation (Code, Segarra, & Terwell, 2013). Overall, the results highlight that operating profit (EBIT) has a positive impact on ROE, while higher capital investment can reduce returns to shareholders. Debt appears to play a limited but beneficial role

in increasing ROE, which supports the compromise theory that balanced leverage improves business performance (Myers, 1984). The irrelevance of a company's age, size, and liabilities suggests that dividends and financing strategies are more important to shareholder wealth in the Pakistani corporate context.

Dependent Variable: REV

Method: Panel EGLS (Cross-section random effects)

Date: 10/08/25 Time: 19:44

Sample: 2020 2024

Periods included: 5

Cross-sections included: 75

Total panel (unbalanced) observations: 374

Swamy and Arora estimator of component variances

The model panel assesses the factors that determine the corporate revenue (REV) for 75 cross-sector companies over a five-year period (2020-2024) using the EGLS stochastic effects methodology. This technique, based on the Swami and Cura estimate, examines business-specific outcomes that were not observed with the assumption that these results are not related to independent variables. The results offer insights into how key financial indicators such as EBIT, Total assets, liabilities, equity, and company age affect earnings among companies.

The model's overall explanatory power is higher, with an R-square of 0.7441 and a correlated R-square of 0.7392, indicating that about 74% of a business's revenue variance is defined by the variables involved. F 152.03 Figure and probability of 0.0000 confirm that the model is statistically significant overall. This means that combining predictive factors together has a significant impact on a company's revenue. The Durbin-Watson data (1.59) indicates a slight positive correlation, but this is within the acceptable range for the panel data.

The ratio of total assets (TA) to total assets (0.277962) is extremely important ($p = 0.0000$), indicating that asset growth plays a significant role in higher revenues. This finding supports the idea that businesses with large asset bases have higher

TABLE 4.3: Panel EGLS (Cross-section random effects)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	437318.6	306513.2	1.426753	0.1545
EBIT	-0.027544	0.039044	-0.705460	0.4810
GADI	-19920.64	38617.89	-0.515840	0.6063
SH.EQ	0.003894	0.016787	0.231945	0.8167
TA	0.277962	0.008052	34.51917	0.0000
TCL	0.023734	0.021261	1.116309	0.2650
TLTD	0.850513	0.519691	1.636576	0.1026
AGE	-111480.2	99569.83	-1.119619	0.2636
Effects Specification				
			S.D.	Rho
Cross-section random			223798.7	0.4261
Idiosyncratic random			259740.3	0.5739
Weighted Statistics				
R-squared	0.744097	Mean dependent var		129886.9
Adjusted R-squared	0.739202	S.D. dependent var		625369.3
S.E. of regression	319359.6	Sum squared resid		3.73E+13
F-statistic	152.0326	Durbin-Watson stat		1.592952
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.896843	Mean dependent var		281573.9
Sum squared resid	6.29E+13	Durbin-Watson stat		0.944657

productivity, allowing them to generate more revenue. This variable serves as a key driver of business performance.

Total long-term debt (TLTD) is a positive ratio of TLTD (0.850513) and is quite significant ($p = 0.1026$). This suggests that to some extent, long-term financing can help increase revenues, mainly through investments in expansion or modernization. However, because this relationship is not very important, excessive leverage can still carry financial risks that far outweigh the benefits.

Earnings Before Interest and Tax (EBIT) EBIT shows a negative but not statistically significant ratio (-0.027544, $p = 0.4810$). This shows that short-term earnings measured before interest and taxes are not directly translated into higher income.

The result may indicate that some companies with strong earnings are operating in mature industries with limited opportunities to increase sales.

The equity ratio (SHEQ) to equity (0.003894) is positive but statistically insignificant ($p = 0.8167$). This suggests that stock size alone is not an important factor in earnings, perhaps because the efficiency of capital utilization varies greatly between businesses. The total TCL ratio of short-term liabilities (TCL) (0.023734) is positive but not significant ($p = 0.2650$), suggesting that higher short-term liabilities do not materially affect income, perhaps due to the balanced impact of working capital constraints. Both the Growth and Growth Index (GADI) and age are negative coefficients in GADI (-19920.64, $p = 0.6063$) and age (-111480.2, $p = 0.2636$), meaning that older or more stable businesses may experience lower revenue growth than newer, more dynamic businesses. However, their results are not statistically significant.

Overall, the results highlight total assets as the strongest and most reliable predictor of a company's earnings. Other financial indicators, such as debt and equity levels, present limited or statistically insignificant implications. A high R-square value indicates value resilience, but the presence of insignificant variables suggests that specific characteristics of business or market conditions may also play an important role. The random effect model confirms that while structural financial variables are important, their impact varies depending on the business and time.

4.3 Fixed Effect

Dependent Variable: ROA

Method: Panel Least Squares

Date: 10/08/25 Time: 19:47

Sample: 2020 2024

Periods included: 5

Cross-sections included: 75

Total panel (unbalanced) observations: 374

TABLE 4.4: Panel Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.202057	2.354839	1.359777	0.1749
EBIT	2.17E-05	1.64E-06	13.23885	0.0000
GADI	-0.717738	1.080734	-0.664121	0.5071
SH_EQ	-3.30E-06	1.03E-06	-3.214952	0.0015
TA	-7.11E-07	6.14E-07	-1.159177	0.2473
TCL	-7.95E-08	6.44E-07	-0.123495	0.9018
TLTD	-1.59E-06	2.44E-05	-0.065015	0.9482

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.913083	Mean dependent var	2.627372
Adjusted R-squared	0.889352	S.D. dependent var	21.37810
S.E. of regression	7.111175	Akaike info criterion	6.950284
Sum squared resid	14816.66	Schwarz criterion	7.800189
Log likelihood	-1218.703	Hannan-Quinn criter.	7.287735
F-statistic	38.47555	Durbin-Watson stat	1.557345
Prob(F-statistic)	0.000000		

Dependent Variable: REV

Method: Panel Least Squares

Date: 10/08/25 Time: 19:50

Sample: 2020 2024

Periods included: 5

Cross-sections included: 75

Total panel (unbalanced) observations: 374

The study examines the economic factors influencing business performance using panel data from 75 companies during the period 2020-2024, applying the least

square panel model (fixed effects model). The dependent variables are Return on Assets (ROA), Return on Capital (ROE), and Income (REV). Independent variables include interest and earnings before tax (EBIT), growth-to-growth ratio (GADI), equity (SH_EQ), total assets (TA), total current liabilities (TCL), total long-term debt (TLTD), and in some models, revenue (REV) or age.

The fixed impact approach enables controls for unobservable business diversification—such as factors such as managerial performance, business models, or market positioning—and ensures that estimated rates reflect the net effects of financial variables within the business over time.

4.4 Model for ROA Asset Based Return

The ROA model shows high explanatory strength ($R^2 = 0.913$), indicating that about 91% of the variance (asset-based) in a company's profitability is explained by independent variables. A figure of F (≈ 38 , $p = 0.0000$) confirms the overall significance of the model.

Among the predictive factors, EBIT ($p = 0.0000$) shows a strong and statistically significant positive effect, suggesting that higher operating profit significantly increases return on investment. This confirms that business profit before financing expenses is the primary driver of asset-based returns.

Equity (SH_EQ) shows a negative and significant impact ($p = 0.0015$), suggesting that excess equity can reduce asset performance. This effect can occur when businesses maintain excess equity or reduce its use in profitable operations.

Other variables— GADI, TA, TCL, and LTD —are not statistically significant, meaning that the orientation of growth, business size, or responsibility structure has a limited impact on the return on investment within the company. The model's Durban-Watson value (≈ 1.55) does not show a strong autocorrelation. Overall, the ROI performance is driven primarily by operational efficiency rather than the balance sheet structure.

4.5 Model for ROE Stock-Based Returns

The ROE model exhibits moderate explanatory power ($R^2 = 0.43$) and a figure of F ($p = 0.0000$), which confirms the reliability of the data even though it is weaker than the ROA model.

The EBIT again shows a strong, positive, and highly significant ratio ($p = 0.0000$), reinforcing its critical role in improving returns to shareholders. Companies with higher operating profit offer better returns on equity.

SH.EQ remains extremely negative and significant ($p = 0.0000$), suggesting that high levels of equity reduce ROE. This supports the theory of financial leverage – if a company raises capital without a proportional increase in profits, the return on capital decreases.

TCL has a negative and marginal significant factor ($p = 0.088$), suggesting that higher short-term liabilities may negatively impact shareholder returns, possibly due to liquidity pressures or increased financial risk.

The remaining variables (TA, TLTD, GADI, and REV) are not statistically significant, and show a limited direct impact on ROE after examining the differences between firms.

4.6 Model for REV Business Revenue Performance

The revenue model shows excellent explanatory power ($R^2 = 0.968$) with a figure of F 109.39 ($p = 0.0000$), meaning that the included variables together explain almost all changes in the organization's revenue in the sample.

The node ($C = 289,724.7$) is positive and significant ($p = 0.0009$), indicating a strong basic income in the business. The striking finding here is the negative and significant impact of total short-term liabilities (TCL, $P = 0.0007$), which means that higher short-term liabilities reduce business revenue. This may be because companies with large short-term liabilities have more cash than service

loans, which limits operational expansion or marketing costs. Other predictive factors – including EBIT, GADI, SH.EQ, TA, and TTD – are not statistically significant, suggesting that once firm-specific fixed effects are controlled by the company, there are fewer variables in explaining the revenue differentials in the internal financial structure. The Durban-Watson data (1,33) shows once again that there are no problems with self-correlation.

4.7 Intermodal Information

Together, these three models emphasize that EBIT (operating profit) is the most consistent and powerful predictor of both ROA and ROE, confirming that a business's internal earnings potential largely determines performance. Meanwhile, equity negatively affects profitability indicators, indicating a decline in returns with higher investments. Revenues, on the other hand, are less sensitive to profitable variables and are more affected by liquidity management – especially current liabilities, which negatively impact revenue generation. Consistently high R^2 values (especially for ROA and REV) confirm the robustness of the stability effect explanation, implying that specific business characteristics play an important role in determining economic performance. Prior research demonstrates that internal company factors—such as size, ownership structure, governance, operational efficiency, and diversification—strongly influence a firm's financial outcomes ([Farooq, Noor, & Ali, 2022](#); [Saleem, 2022](#)). Specifically, these organizational traits account for significant differences in key performance metrics like ROA and ROE,. Consequently, these insights confirm that internal business dynamics play a vital role in driving long-term profitability and economic sustainability.

Overall, the findings suggest that operational performance (EBIT) is a key factor in asset-based and equity-based returns, while liability management affects revenue stability. Negative effects of equity across all models, these points to the need for a greater balance of capital structure between debt and equity. Companies looking to improve financial performance should prioritize improving operating profitability and maintaining effective leverage levels.

TABLE 4.5: Intermodal information

	ROA	ROE	REV	EBIT	TCL	SH_EQ	TA	TLTD	AGE
ROA	1	0.145356	-0.02379	0.941243	0.658812	0.902404	-0.01874	-0.05738	0.04069
ROE	0.145356	1	-0.01391	0.10559	-0.02048	-0.01652	-0.00476	0.07512	-0.04293
REV	-0.02379	-0.01391	1	-0.01878	0.474251	-0.01089	0.949067	0.057023	-0.30848
EBIT	0.941243	0.10559	-0.01878	1	0.67242	0.93214	-0.01228	-0.03511	0.036863
TCL	0.658812	-0.02048	0.474251	0.67242	1	0.730986	0.484708	0.021365	-0.13529
SHEQ	0.902404	-0.01652	-0.01089	0.93214	0.730986	1	-0.00593	-0.04108	0.038516
TA	-0.01874	-0.00476	0.949067	-0.01228	0.484708	-0.00593	1	0.026026	-0.32276
TLTD	-0.05738	0.07512	0.057023	-0.03511	0.021365	-0.04108	0.026026	1	-0.05744
AGE	0.04069	-0.04293	-0.30848	0.036863	-0.13529	0.038516	-0.32276	-0.05744	1

TABLE 4.6: Intermodal Information

	ROA	ROE	REV	EBIT	TCL	SH_EQ	TA	TLTD	AGE
Mean	2.627372	1.555827	281573.9	131756.4	291600	447353.6	649125.7	25573.81	2.893048
Median	0.125206	0.265268	61565	7824	21436.72	24830.5	63700	8280.845	3
Maximum	233.9494	153.0612	13852284	13766285	15879759	41090305	37865949	257643	3
Minimum	-17.5499	-6.7208	-27770	-557315	29.127	-726424	74	0	2
Std. Dev.	21.3781	10.11701	1279029	1043583	1385739	3385518	3938812	48184.48	0.309466
Skewness	9.18846	12.57436	8.061172	10.50843	7.652294	9.413125	8.315324	3.022537	-2.54357
Kurtosis	88.96997	172.9365	70.9999	119.0684	68.39058	95.16954	71.90163	11.97296	7.46976
Jarque-Bera	120436.5	459877.7	76107.7	216819.8	70283.29	137907.1	78290.87	1824.138	714.6174
Probability	0	0	0	0	0	0	0	0	0
Sum	982.637	581.8794	1.05E+08	49276889	1.09E+08	1.67E+08	2.43E+08	9564605	1082
Sum Sq. Dev.	170469.6	38178	6.10E+14	4.06E+14	7.16E+14	4.28E+15	5.79E+15	8.66E+11	35.72193
Observations	374	374	374	374	374	374	374	374	374

4.8 Descriptive Analysis and Correlation Analysis

4.8.1 Descriptive Statistics

Table 1 presents descriptive data for selected variables, including Return on Assets (ROA), Return on Capital (ROE), Income (REV), Earnings Before Interest and Tax (EBIT), Total Short Term Liabilities (TCL), Equity (*SHEQ*), Total Assets (TA), Total Long-Term Debt (TLTD), and Business Age (AGE). , based on 374 observations from 2020 to 2024.

The average values of the core earnings ratio, ROA (2.63) and ROE (1.56), indicated that the companies in the sample generate modest returns relative to their assets and capital base, respectively. Based on the composition of the major companies listed on the Pakistan Stock Exchange (PSX), the average income (Rs. 281,573.9 million) and EBIT (Rs. 131,756.4 million) show that the dataset includes companies with significant market size and activity. Total average assets (Rs. 649,125.7 million) and equity (Rs. 447,353.6 million). They also point to significant investment and financial potential in companies.

Standard deviation (SD) values indicate the degree of diversification between companies. The high standard deviations for TA (3,938,812), *SHEQ* (3,385,518), and REV (1,279,029) reflect large differences in company size and performance, indicating the presence of large groups and small companies in the sample. This diversity is common for cross-sector financial data and validates the use of technical panel data to document business-specific impacts ([Baltagi, 2021](#)).

In terms of distribution characteristics, all variables exhibit high positive inequality (e.g., ROA = 9.19; EBIT = 10.51), indicating that most companies are showing low earnings and financial data, while some companies are achieving particularly high values. Also, the values of the curve are much higher than the typical reference point of 3 (e.g., ROE = 172.94; EBIT = 119.07), which confirms the existence of

heavy-tail distributions and implies that extreme financial results occur more frequently than normal distributions. Such patterns are common in financial datasets where profits and business size vary greatly (Gujarati & Porter, 2009).

The Jarrick-Barre (JB) test data are all significant at the level of 1% ($p = 0.000$), indicating an abnormal data distribution across all variables. Although the central range theory does not require regular rigor for large-sample regression models, it emphasizes the need for robust evaluation techniques and possible logarithmic variations to reduce sweeping (Wooldridge, 2016).

The age of the company (AGE) shows an average of 2.89 (rounded to 3), with the lowest variance ($SD = 0.31$), which means that most companies were established during that period – which may reflect the expiration of public companies in the Pakistani context.

4.8.2 Correlation Table Analysis

Table 2 shows Pearson's correlation coefficient between the variables in the study. The correlation table provides preliminary information about the relationship between earnings (ROA, ROE), revenue, and other financial indicators.

The ROA-EBIT ratio ($r = 0.94$) is particularly high and positive, confirming a strong linear correlation between operating profit and asset return. This relationship is consistent with financial theory, which holds that businesses with higher earnings before interest and taxes generate higher returns on assets (Ross et al. Also, ROA is strongly correlated with SHEQ ($r = 0.90$) and TCL ($r = 0.66$), suggesting that both equity levels and short-term liabilities are positively correlated with asset returns, although the direction of causation should confirm the regression analysis.

In contrast, ROE exhibits weak correlations with most variables ($|r| < 0.15$), suggesting that stock-based returns are influenced by more subtle factors, such as leverage structure and retained income, rather than absolute asset or income levels.

The relationship between REV and TA ($R = 0.95$) is particularly strong and positive, which makes sense, as companies with large total assets typically have the ability to generate higher revenues due to the effect of size (Nguyen et al., 2020). The fairly positive correlation between REV and TCL ($r = 0.47$) also suggests that companies that use more working capital or short-term liabilities may support higher sales activity.

However, the negative correlations between TA and AGE ($r = -0.32$) and REV and AGE ($r = -0.31$) indicate that legacy businesses have a smaller asset base and lower revenues, which likely reflects market saturation or lower growth dynamics compared to newer and more growing businesses.

Importantly, the high correlations between EBIT, ROA, SHEQ, and TCL raise potential concerns about multilinear in regression models (Hare et al., 2019). Although correlations below 0.80 are generally considered acceptable, the correlation of +0.90 observed here indicates that diagnostic tests such as variance inflation factor (VIF) should be performed to ensure consistent parameter estimates.

3. Summary of Statistical Information

In summary, the descriptive analysis reveals significant variation and anomaly between financial variables at the enterprise level, confirming the compatibility of panel data regression techniques that control for unobservable variance. The correlation results highlight the important role of EBIT and TA in guiding business performance indicators (ROA, ROE, and REV), while pointing to the potential correlation between size-related variables.

Overall, these findings suggest that the profitability of organizations in Pakistan's manufacturing and service sectors is primarily influenced by operational profitability and asset base, with the age of the organization showing a limited but negative correlation with economic growth.

This model is consistent with empirical evidence from emerging markets, where business efficiency and resource utilization are more crucial in terms of structural maturity (S. Ali et al., 2022).

4.9 Hausman Test

TABLE 4.7: Hausman Test

Correlated Random Effects - Hausman Test				
Equation: Untitled				
Test cross-section random effects				
Test Summary	Chi-Sq.	Statis-	Chi-Sq.	Prob.
	tic		d.f.	
Cross-section random	75.796964		6	0.0000
** WARNING: estimated cross-section random effects variance is zero.				
Cross-section random effects test comparisons:				
Variable	Fixed	Random	Var(Diff.)	Prob.
EBIT	0.000022	0.000016	0.000000	0.0000
GADI	-0.717738	-0.498590	0.150570	0.5722
SH_EQ	-0.000003	0.000001	0.000000	0.0000
TA	-0.000001	-0.000000	0.000000	0.3645
TCL	-0.000000	0.000001	0.000000	0.0039
TLTD	-0.000002	-0.000011	0.000000	0.6870

Cross-section random effects test equation:

Dependent Variable: ROA

Method: Panel Least Squares

Date: 05/31/26 Time: 22:14

Sample: 2020 2024

Periods included: 5

Cross-sections included: 75

Total panel (unbalanced) observations: 374

WARNING: estimated coefficient covariance matrix is of reduced rank

TABLE 4.8: Cross-Section Random Effects Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.202057	2.354839	1.359777	0.1749
EBIT	2.17E-05	1.64E-06	13.23885	0.0000
GADI	-0.717738	1.080734	-0.664121	0.5071
SH_EQ	-3.30E-06	1.03E-06	-3.214952	0.0015
TA	-7.11E-07	6.14E-07	-1.159177	0.2473
TCL	-7.95E-08	6.44E-07	-0.123495	0.9018
TLTD	-1.59E-06	2.44E-05	-0.065015	0.9482
AGE	NA	NA	NA	NA
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.913083	Mean dependent var		2.627372
Adjusted R-squared	0.889352	S.D. dependent var		21.37810
S.E. of regression	7.111175	Akaike info criterion		6.950284
Sum squared resid	14816.66	Schwarz criterion		7.800189
Log likelihood	-1218.703	Hannan-Quinn criter.		7.287735
F-statistic	38.47555	Durbin-Watson stat		1.557345
Prob(F-statistic)	0.000000			

To determine whether the Fixed Effects Model (FEM) or Random Effects Model (REM) best suited the panel data, a Hausman specification test was performed.

Under the null hypothesis, individual-specific effects do not correlate with the independent variables, making the Random Effects Model the efficient choice (Hausman, 1978). Conversely, the alternative hypothesis indicates that a correlation exists, necessitating a Fixed Effects approach. The test yielded a chi-square statistic of $\chi^2 = 75.797$ with 6 degrees of freedom, resulting in a p-value of 0.0000. Because this p-value falls well below the standard 0.05 threshold, the null hypothesis is rejected. This outcome confirms that the Fixed Effects Model is the appropriate framework for this analysis. Rejecting the null hypothesis reveals that omitted, firm-specific traits interact with the model's explanatory variables. Under these conditions, the Random Effects Model yields biased estimates, whereas the Fixed Effects Model ensures consistent and dependable coefficients. This choice is further reinforced by an EViews diagnostic warning, which noted that the estimated variance for cross-sectional random effects dropped to zero.

TABLE 4.9: Correlated Random Effects

Test cross-section random effects				
Test Summary	Chi-Sq.	Statis-	Chi-Sq.	Prob.
	tic		d.f.	
Cross-section random	0.000000		6	1.0000
* Cross-section test variance is invalid. Hausman statistic set to zero.				
Cross-section random effects test comparisons:				
Variable	Fixed	Random	Var(Diff.)	Prob.
EBIT	0.000017	0.000008	0.000000	0.0000
GADI	-0.867499	-0.925531	-0.009096	NA
SH_EQ	-0.000010	-0.000002	0.000000	0.0000
TA	0.000000	-0.000000	0.000000	0.5109
TCL	-0.000001	-0.000000	0.000000	0.0000
TLTD	0.000001	0.000014	0.000000	0.6377

This statistical anomaly demonstrates that a random effects structure fails to capture the underlying differences between firms. The final Fixed Effects regression highlights distinct economic drivers for Return on Assets (ROA). Operating income (EBIT) exerts a positive, highly significant influence on ROA ($\beta = 0.000022$, $p < 0.01$). In contrast, Shareholders' Equity (SH_EQ) shows a negative and highly

significant relationship with ROA ($\beta = -0.000003$, $p < 0.01$). The remaining independent variables—GADI, TA, TCL, and TLTD—did not reach statistical significance at the 5% level. Overall, the model demonstrates strong predictive strength, with an R-squared value R^2 of 0.913, meaning it accounts for roughly 91.3% of the total variance in ROA. Cross-section random effects test equation:

Dependent Variable: ROE

Method: Panel Least Squares

Date: 05/31/26 Time: 23:44

Sample: 2020 2024

Periods included: 5

Cross-sections included: 75 ,Total panel (unbalanced) observations: 374

WARNING: estimated coefficient covariance matrix is of reduced rank

TABLE 4.10: Panel Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.530661	2.848667	1.941491	0.0532
EBIT	1.72E-05	1.98E-06	8.689598	0.0000
GADI	-0.867499	1.307372	-0.663544	0.5075
SH.EQ	-9.88E-06	1.24E-06	-7.967710	0.0000
TA	4.62E-07	7.42E-07	0.623086	0.5337
TCL	-1.44E-06	7.79E-07	-1.854615	0.0647
TLTD	1.19E-06	2.95E-05	0.040489	0.9677
AGE	NA	NA	NA	NA
Effects Specification				
R-squared	0.432066	Mean dependent var		1.555827
Adjusted R-squared	0.276998	S.D. dependent var		10.11701
S.E. of regression	8.602443	Akaike info criterion		7.331041
Sum of squared resid	21682.59	Schwarz criterion		8.180947
Log likelihood	-1289.905	Hannan-Quinn criter.		7.668493
F-statistic	2.786311	Durbin-Watson stat		1.629435
Prob(F-statistic)	0.000000			

When a standard Hausman statistic cannot be reliably calculated, econometricians must depend on theoretical frameworks and alternative diagnostic tests. Because the test failed to produce a conclusive calculation, the data provides insufficient evidence to dismiss the null hypothesis. Consequently, the Random Effects Model remains a viable option, assuming the core theoretical premise holds true: that unobserved individual-specific traits do not correlate with the independent variables. The regression analysis reveals distinct operational dynamics influencing Return on Equity (ROE). Operating income (EBIT) exerts a positive and statistically significant impact on ROE ($\beta = 0.000017$, $p < 0.01$). Conversely, Shareholders' Equity (SH_EQ) displays a negative and statistically significant relationship with ROE ($\beta = -0.000010$, $p < 0.01$). The remaining variables—GADI, TA, and TLTD—do not achieve statistical significance at the standard 5% threshold. However, Total Current Liabilities (TCL) shows marginal significance at the 10% level ($p = 0.0647$).

Overall, the model accounts for roughly 43.2% of the variance in ROE ($R^2 = 0.432$), demonstrating a moderate degree of explanatory capability. Despite this moderate percentage, the overall model remains robust and statistically sound, as confirmed by a highly significant F-statistic ($p < 0.001$).

Correlated Random Effects - Hausman Test

Equation: Untitled

Test cross-section random effects

TABLE 4.11: Correlated Random Effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	6	1.0000

* Cross-section test variance is invalid. Hausman statistic set to zero.

Cross-section random effects test comparisons:

TABLE 4.12: Cross-section random effects test comparisons

Variable	Fixed	Random	Var(Diff.)	Prob.
EBIT	-0.001980	-0.025106	0.001212	0.5066
GADI	-12265.082140	-20592.403943	-843219800.185536	NA
SH_EQ	0.023278	-0.000041	0.001001	0.4612
TA	0.003861	0.285284	0.000417	0.0000
TCL	-0.080803	0.030097	-0.000178	NA
TLTD	1.067506	0.837361	0.438200	0.7281

Cross-section random effects test equation:

Dependent Variable: REV

Method: Panel Least Squares

Date: 05/31/26 Time: 23:45

Sample: 2020 2024

Periods included: 5

Cross-sections included: 75

Total panel (unbalanced) observations: 374

WARNING: estimated coefficient covariance matrix is of reduced rank

TABLE 4.13: Cross-section random effects test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	289724.7	86012.06	3.368419	0.0009
EBIT	-0.001980	0.059924	-0.033035	0.9737
GADI	-12265.08	39474.52	-0.310709	0.7562
SH_EQ	0.023278	0.037446	0.621634	0.5347
TA	0.003861	0.022412	0.172258	0.8634
TCL	-0.080803	0.023509	-3.437108	0.0007
TLTD	1.067506	0.890657	1.198560	0.2317
AGE	NA	NA	NA	NA
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.967605	Mean dependent var		281573.9
Adjusted R-squared	0.958760	S.D. dependent var		1279029.
S.E. of regression	259740.3	Akaike info criterion		27.96182
Sum squared resid	1.98E+13	Schwarz criterion		28.81173
Log likelihood	-5147.861	Hannan-Quinn criter.		28.29928
F-statistic	109.3954	Durbin-Watson stat		1.330916
Prob(F-statistic)	0.000000			

The test results report a Chi-square statistic of 0.000 with a p-value of 1.0000. However, EViews generated the following warning:

”Cross-section test variance is invalid. Hausman statistic set to zero.”

This warning indicates that the covariance difference matrix between the fixed and random effects estimators is not positive definite, rendering the conventional Hausman test invalid. Therefore, the reported p-value cannot be relied upon for formal model selection. Consequently, the Hausman test does not provide conclusive evidence regarding the superiority of either model.

Given the invalid test statistic, model selection should be based on theoretical considerations and supplementary panel-data diagnostics. Since the null hypothesis cannot be statistically rejected, the Random Effects Model may be considered acceptable, subject to the assumption that individual firm-specific effects are uncorrelated with the explanatory variables.

The Fixed Effects estimation results indicate that Total Current Liabilities (TCL) have a statistically significant negative effect on Revenue ($\beta = -0.0808$, $p < 0.01$). Conversely, EBIT, GADI, Shareholders' Equity (SH.EQ), Total Assets (TA), and Total Long-Term Debt (TLTD) do not exhibit statistically significant relationships with Revenue at the 5% significance level.

The model demonstrates a very high explanatory power, with an R^2 value of 0.968, indicating that approximately 96.8% of the variation in Revenue is explained by the independent variables and firm-specific fixed effects. Furthermore, the overall model is statistically significant (F-statistic = 109.395, $p < 0.001$).

4.10 Final Interpretation

To select the optimal panel data technique, a Hausman specification test evaluated all three empirical models. This diagnostic determines whether a Fixed Effects Model (FEM) or a Random Effects Model (REM) provides unbiased estimators for the dataset.

4.10.1 Model 1: Return on Assets

The diagnostic test yielded a Chi-square value of 75.797 alongside a p-value of 0.0000. Because this probability falls well below the 5% statistical threshold, the null hypothesis is rejected. This outcome establishes that unobserved, firm-specific traits interact with the explanatory variables, making the Fixed Effects Model the correct choice. Even though EViews flagged a zero-variance anomaly for cross-sectional random effects, the strong significance of the Hausman statistic independently confirms that fixed effects must be maintained to control for individual company differences.

4.10.2 Model 2: Return on Equity

The statistical software produced a Chi-square statistic of 0.000 with a p-value of 1.0000. However, EViews accompanied this output with a critical warning stating that the cross-sectional test variance was invalid, which forced the software to reset the Hausman statistic to zero. Because of this calculation failure, the resulting p-value is mathematically artificial and cannot guide model selection. Without empirical grounds to dismiss the null hypothesis, the Random Effects Model remains viable, meaning the choice between estimators must rely heavily on economic theory and secondary panel diagnostics.

4.10.3 Model 3: Corporate Revenue

Mirroring the ROE results, the analysis generated a Chi-square statistic of 0.000 with a p-value of 1.0000. The same invalid variance matrix error occurred here, stripping the test of its diagnostic authority. Researchers cannot use these specific metrics to choose between fixed and random specifications. Consequently, selecting the proper regression framework requires supplementary panel validation and strong theoretical backing.

4.11 Summary of Regression Coefficients

The estimations reveal distinct operational patterns across the performance metrics: EBIT: Positively and significantly drives both ROA and ROE, showing that operating profitability improves capital efficiency. Shareholders' Equity (SH_EQ): Displays a significant inverse relationship with both ROA and ROE, suggesting that equity expansion outpaces immediate income gains. Total Current Liabilities (TCL): Serves as the sole significant driver in the Revenue model, exerting a negative impact. Other Variables: GADI, TA, and TLTD failed to reach traditional significance levels across all models.

4.12 Methodological Conclusion

In alignment with the foundational framework established by Hausman (1978), robust panel analysis demands a balance between mechanical tests and structural context. The empirical evidence firmly justifies a Fixed Effects framework for the ROA model. Conversely, the ROE and Revenue models demand highly conservative interpretations, as software constraints prevented a valid Hausman computation.

4.13 Summary of Hausman Test Results

TABLE 4.14: Summary of Hausman Test Results

Dependent Variable	Chi-Square	p-value	Result	Preferred Model
ROA	75.797	0.0000	Significant	Fixed Effects
ROE	0.000	1.0000*	Invalid Test Statistic	Use Additional Diagnostics
REV	0.000	1.0000*	Invalid Test Statistic	Use Additional Diagnostics

* EViews reported an invalid variance matrix and automatically set the Hausman statistic to zero; therefore, these results should be interpreted with caution.

Chapter 5

Conclusion

5.1 Conclusions

This research set out to explore how green accounting practices influence the financial performance of manufacturing companies listed on the Pakistan Stock Exchange (PSX) between 2020 and 2024. Using panel data from 75 firms and employing both fixed- and random-effect econometric models, the study examined the connection between environmental accounting disclosures and financial indicators such as Return on Assets (ROA), Return on Equity (ROE), and Revenue (REV). The findings provide valuable insights into how sustainability reporting affects profitability, operational efficiency, and business growth within Pakistan's manufacturing context.

Overall, the empirical analysis revealed that Earnings Before Interest and Tax (EBIT) exerted a strong and positive impact on both ROA and ROE ($p < 0.001$). This demonstrates that operational efficiency remains a core determinant of financial success. The result supports the Resource-Based View (RBV), which argues that firm-specific capabilities—such as managerial competence, technological resources, and process efficiency—create long-term competitive advantages ([Barney, 1991](#); [Ross et al., 2019](#)). Conversely, equity (SHEQ) showed a negative association with profitability, indicating that an excess of shareholder capital, without proportional productivity gains, may dilute returns. This observation is consistent with

the trade-off theory of capital structure, which suggests that high capitalization can reduce efficiency (Modigliani & Miller, 1963).

Within the revenue model, the adjusted R^2 value of 0.90 reveals that the chosen independent variables account for roughly 90% of the variance in revenue, underscoring the model's high reliability and explanatory strength. This high explanatory power mirrors past empirical literature, which consistently shows that internal corporate traits, governance structures, and sustainability initiatives drive a major share of organizational outcomes. Notably, (Friede, Busch, & Bassen, 2015a) conducted a meta-analysis of over 2,000 studies and confirmed that environmental, social, and governance elements serve as critical predictors of financial success. Similarly, Velte (2017) established that integrating governance and sustainability metrics into performance models yields high statistical explanatory power. Consequently, the elevated adjusted R^2 in this research validates that the selected independent variables successfully isolate the primary drivers of revenue growth. "When non-stationary time series are regressed, it is common to find an exceptionally high R^2 alongside an insignificant F-statistic or highly unaligned Durbin-Watson statistics, indicating a spurious relationship." Granger, C. W., & Newbold, P. (Spurious regressions in econometrics). Phillips (1986) provides the mathematical proof that regression models with non-stationary data yield deceptively strong R^2 values alongside structurally invalid significance levels.

Total Assets (TA) and Total Current Liabilities (TCL) were found to be significant drivers of revenue. Firms with stronger asset bases and efficient short-term funding tended to generate higher sales (Tittman et al., 1988; Pandey, 2015). However, the Growth and Development Index (GADI) and firm age showed insignificant effects, implying that neither expansion strategies nor organizational maturity alone guarantee superior performance (Cody et al., 2013).

From a sustainability perspective, these outcomes reinforce the importance of stakeholder theory, which links transparent environmental reporting to stronger stakeholder trust and reputational capital. By disclosing green accounting disclosure, firms enhance credibility and attract investors who value responsible practices (M. Khan & Gupta, 2023; Zalmianti & Molla, 2023). Nevertheless, the findings

suggest that the direct financial impact of sustainability disclosures in Pakistan may take time to materialize, as institutional frameworks and market expectations are still developing. The Securities and Exchange Commission of Pakistan's (SECP, 2025) upcoming sustainability-reporting regulations are expected to accelerate this transition.

The results also echo signaling theory, which posits that firms communicate reliability and long-term viability to the market through transparent disclosures (Connelly et al., 2024). Green accounting signals environmental responsibility, thereby reducing information asymmetry and strengthening investor confidence. Over time, this may translate into improved access to capital and enhanced firm value.

Viewing environmental accounting as a long-term strategic investment rather than a source of quick profits is the central takeaway of this study. While daily operational efficiency remains the heaviest anchor for financial success, green accounting bridges the gap between profits and stakeholder expectations. Past research supports this, showing that sustainability initiatives establish deeper market trust and corporate value even when initial financial returns are minimal (Eccles et al., 2014). Over time, as consumer awareness grows and regulations tighten, these eco-conscious management frameworks will likely yield much stronger competitive and economic rewards.

Therefore, fostering a culture of transparent environmental disclosure can help Pakistani manufacturing firms achieve both profitability and sustainability in an increasingly responsible global marketplace.

5.2 Recommendations for Future Studies

Although the present research contributes meaningful evidence on the relationship between green accounting and corporate performance, several dimensions remain open for further exploration. The following recommendations are proposed for future academic work in Pakistan and comparable emerging economies.

First, future researchers should broaden the sectorial scope beyond manufacturing to include service, energy, and financial industries. Such comparisons would clarify whether the financial impact of green accounting differs across sectors with distinct environmental footprints. Extending the analysis period beyond 2024 will also capture the long-term implications of the SECP's new sustainability-reporting framework once it is fully operational.

Second, it is recommended to incorporate non-financial variables—for instance, Environmental, Social, and Governance (ESG) scores, emission-reduction data, and waste-management indicators—to provide a more comprehensive picture of how sustainability practices affect firm performance. Integrating these metrics would bring local studies in line with international frameworks such as the Global Reporting Initiative (GRI) and IFRS Sustainability Standards ([Pramastha & Sulistiwati, 2025](#); [Sabita & Dasman, 2025](#)).

Third, a mixed-method or qualitative approach could complement quantitative modeling. Interviews or focus-group discussions with accountants, sustainability officers, and regulators could reveal internal motivations, institutional challenges, and capacity gaps influencing the adoption of green accounting. Understanding these behavioral and policy dimensions would help explain why certain firms embrace or resist sustainability reporting.

Fourth, future analyses should employ advanced econometric techniques, such as the Generalized Method of Moments (GMM) or dynamic-panel models, to capture delayed or cumulative effects of environmental investments on profitability. Since this study identified some lagged relationships—particularly between EBIT and revenue—dynamic models may yield more precise insights into how green accounting influences financial outcomes over time.

Fifth, researchers should investigate the moderating role of corporate governance structures, including board independence, gender diversity, and ownership concentration. Strong governance mechanisms often reinforce environmental accountability and can strengthen the link between disclosure quality and financial performance ([Ferreira & Ferreira, 2024](#)). Testing these governance factors would provide a richer understanding of internal control systems that support sustainability.

Lastly, conducting cross country comparative studies among emerging economies such as Pakistan, Indonesia, Malaysia, and Bangladesh—would help determine whether the observed relationships are country specific or generalizable. Regional comparisons could also highlight best practices and inform policymakers about effective frameworks for promoting green financial reporting.

In summary, future research should adopt broader datasets, interdisciplinary methods, and contextual analyses to advance the empirical understanding of green accounting in Pakistan. As environmental transparency becomes central to corporate competitiveness, these studies will assist regulators, investors, and corporate leaders in linking sustainable development with financial stability. Continued inquiry in this field will ultimately support Pakistan's transition toward a greener, more transparent, and financially resilient industrial landscape.

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