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Stock Price and Green Finance Markets: A Comparison of Pakistan and India

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Abstract

This study determines countries' stock prices and green finance markets, with an emphasis on India and Pakistan. Time series data were collected from 2010 to 2020, consisting of ten companies in each country and their Return on Total Assets (ROTA). To this end, descriptive statistics and inferential statistical tools, supplemented by an Autoregressive AR(1) model, were used to analyze the raw time-series data collected to generate predictions. Vedanta, Adani, and Tata are the three companies with the highest ROTA in India (signifying the highest level of expected profitability over a 10-year forecast period). The ROTA that it predicted was more bullish than that inferred from historical data, suggesting that most companies were experiencing deteriorating returns on tangible assets. Among some of the largest companies in Pakistan, Engro and Nestle were discovered to have been first placed in generating profit from their assets during the period under consideration; PSO and POL were the least successful. Nestle was the only company in which ROIC decreased over time, but all companies except Nestle followed a decreasing trend in their ROTA values. This study implies that green finance markets in these two countries may provide distinct opportunities for investors.

Keywords

Return on Assets, Green Finance Market, Inferential Statistics, AR Modeling, Forecasting

1. Introduction

Monetary and natural resources are recognized as significant contributors to ecological preservation and socio-economic advancement (Zhang et al., 2022).

Within this context, green finance has become a leading mechanism for regional development, positioning the alignment of financial systems with sustainable development objectives as a necessary direction for nations worldwide, particularly in Asia (Jiang et al., 2022; Usman et al., 2022). Conceptually, green finance requires the financial sector to adopt environmental protection as a fundamental principle. This entails incorporating ecological considerations into investment and financial decision-making, where environmental risks and costs are systematically integrated into standard financial analysis and operations (Lee & Lee, 2022). Despite most Asian nations being in the process of establishing green finance market regulations (Volz, 2018), systematic reviews reveal that existing research is rich in analyses of green finance's policy impacts but is predominantly concentrated on green credit strategies. Consequently, investigation into green finance reform pilot zones remains a critically under-researched area (Zhang et al., 2022). Monetary and natural resources are also important indicators in ecological degradation-hedonic regression models to resist eco-pressure or promote economic development, and the major regional development strategy is the implementation of green financial policies and projects (Jiang et al., 2022). It has become necessary to merge financial resources with sustainable development, and installing a green finance model is a requirement in Asia and other economies of the world (Usman et al., 2022). Green finance is the financial sector's fundamental strategy to consider environmental protection and ecological factors as intermediaries in all investment and financing activities for both direct and indirect impacts. This relates to the administration of environmental protection and pollution in financial operations (Bekaert et al., 2022). For example, reports show that many Asian countries have introduced regulations to govern green finance markets. In current studies on green finance and the construction of green financial markets, a large number are related to policy analysis in terms of what impact on their policies can be achieved by making use of various green strategies, whereas those targeting exploring the impacts coming from the first substation-bar commitments to creating an army credit will have more overdue time area for govt visa transformation (Volz, 2018). Green finance markets stimulate environmental protection and management by diverting resources from dirty industries to businesses that produce better ideas and create ecological innovations (Falcone, 2020). Environmental protection policies can also facilitate the development of green financial markets (Cojoianu et al., 2020). Several recent studies put green finance markets and strategies at the center, providing frameworks and definitions for this term (Sun et al., 2021). Green finance is defined as financial institutions channeling support for a green economy that simultaneously preserves natural ecology (Weber & ElAlfy, 2019). Current studies have focused on how green finance affects regional economic development, environmental management, and investment under policy changes (Wen & Lee, 2020). However, there have been few comparable analyses of the development of the Asian green finance market. This is a significant gap within these regions, which are subject to differing regulatory

environments, market structures, and development stages.

This research fills this gap by comparing Pakistan's stock prices and green finance markets with those of India. The specific objectives are:

- To investigate the impact of stock prices on green finance markets in Pakistan.
- Investigate the prices of shares in stock units and green finance markets in India.
- compared Pakistan's stock price trends and green finance markets with India's.
- Estimating future financial trends in the country.

The following are the contributions of this research to the existing literature:

- A comparative analysis of the structure and development status of green finance markets in Pakistan and India.
- We emphasize green finance's importance in fostering environmental sustainability and economic prosperity.
- Providing information on the profitability of companies in the green finance sector across those countries.
- We are forecasting future financial trends based on present data and market analysis.

To achieve the above purpose, a systematic review of the relevant literature on green finance will be carried out to assist in answering the research questions. The databases will include financial reports, stock markets, and industry analyses from Pakistan and India. The study employs quantitative methods to analyze stock price trends and the performance of green finance markets. This study analyzes the stock price patterns and green finance markets in Pakistan and India to ascertain the contribution of green financing to sustainable economic development. The results enhance our understanding of green finance as a tool for supporting environmental sustainability and economic growth under different regional conditions.

2. Review of Literature

2.1. Stock Price

Stock price performance serves as a critical barometer of corporate health and is profoundly influenced by prevailing economic and market conditions. As an equilibrium point between supply and demand, share prices are susceptible to a complex interplay of monetary, ecological, and political factors. Macroeconomic variables such as interest rates, GDP growth, and inflation are particularly influential. For instance, robust GDP growth typically signals heightened economic activity and corporate profitability, thereby buoying equity markets (Bekaert et al., 2022). Conversely, stock prices can decline in response to adverse economic signals. Monetary policy is a direct channel of influence; reductions in interest rates lower borrowing costs, thereby encouraging investment in equities and driving price appreciation (Chen et al., 2022). Beyond traditional economic drivers, environmental and political factors are increasingly significant. Climate-related events and the global transition towards sustainability can impact firm valuations. Companies

facing stringent environmental regulations or heightened operational costs may experience stock price depreciation as investor preferences shift towards sustainable assets (Bolton & Kacperczyk, 2021). Similarly, political events such as elections or major policy shifts can alter market sentiment and induce volatility. Regulatory reforms, for example, can create sectoral winners and losers, with corresponding effects on their stock performance (Pástor & Veronesi, 2021). A key characteristic of stock markets is their forward-looking nature. Price fluctuations are often considered leading indicators, anticipating future phases of the business cycle. A sustained market downturn may portend an economic recession.

Whereas a prolonged rally typically signals expected growth (Bevanda et al., 2021). Complementing this macroeconomic perspective, a separate stream of research examines the psychological dimensions of market behavior. Studies have investigated how stock price volatility shapes investor confidence (Zhang & Wong, 2023) and alters perceptions of investment risk (Raut & Kumar, 2018).

In summary, equity markets synthesize a vast array of financial, environmental, and political information. The determination of stock prices and their predictive capacity for economic trends have therefore been a longstanding and central subject of financial research.

2.2. Green Finance Markets

The Environmental Sustainable Investment (ESI) framework, developed by Babcicky (2013), guides investment activities that prioritize environmental impacts to enhance ecological sustainability. These green financial markets function by translating environmental risks, opportunities, and regulatory compliance into concrete investment strategies (Volz, 2018). This principle underpins major international initiatives such as the Network for Greening the Financial System (NGFS) and the Sustainable Banking Network. Conceptually, green finance represents an innovative segment of the financial markets dedicated to climate-related and environmentally sustainable development. It facilitates this by directing capital towards green energy solutions and carbon emission reduction (Naeem et al., 2022). Consequently, the literature positions green finance as a critical mechanism for stimulating a low-carbon economy (Leitao et al., 2021). The attractiveness of green projects has prompted stock exchanges worldwide to launch designated investment vehicles to support these goals, catalyzing a dramatic surge in green investments from $11 billion to $350 billion by 2020 (Naeem et al., 2022). This growth is particularly pronounced in Europe, where green finance has recently expanded at an annual rate exceeding 100%, and is projected to constitute one-third of the global fiat currency market, valued at approximately a trillion dollars (Naeem et al., 2022).

A key advantage of this financial approach is its role in risk management, as green investments have demonstrated resilience by mitigating portfolio losses during periods of economic downturn (Karim et al., 2022). Ultimately, the rise of green finance underscores the growing imperative of sustainability-oriented in-

vestment strategies to address environmental challenges and foster long-term economic resilience.

2.3. Stock Prices and Green Finance Markets

Stock prices function as a critical barometer of a company's perceived value, synthesizing historical performance with forward-looking expectations of its prospects. Concurrently, green finance markets have emerged to channel capital toward projects and companies that advance environmental sustainability, with the strategic objective of mitigating climate-related risks and promoting sustainable development. The relationship between equity valuations and green finance is complex and interdependent. Investments originating from green finance can exert a positive influence on the stock prices of corporations engaged in sustainable technologies or projects. This appreciation is often driven by a shift in market sentiment, as growing consumer and investor preference for sustainability increases demand for these firms' products and services. For instance, companies with significant investments in renewable energy may experience a valuation premium as they are re-rated more favorably by the market (Naeem et al., 2022).

2.4. Stock Prices and Green Finance Markets in Asia

The idea that emerged in the 1980s, namely "green" or responsible finance, which integrates environmental factors when making investment decisions, has always run parallel to stock pricing. According to Volz (2018), in this article, most Asian countries are leading in constructing rules and laws for green finance markets. A large part of this involves shifting the economic systems in these countries to more sustainable paths, which means that we need to see a radical transformation of investment patterns, such as transitioning from fossil fuels, greenhouse gases, and natural resource-dependent industries to energy-efficient technologies and business models (Raut & Kumar, 2018). China is already a significant investor in sustainable development projects (such as those specifically facilitating a low-carbon economy) and green finance markets throughout Asia. To decrease contamination and improve resource utilization, these projects are intended to replace high-pollution and high-energy-consumption practices with sustainable alternatives (Zhang et al., 2022). According to the Chinese government, green finance aims to support projects conducive to ecological protection and to solve climate change problems. Green finance works to enhance energy efficiency and draw further investment in green industries. The Chinese government's promotion of green financial markets has led many provinces and municipalities to regard it as an important leverage for furthering nature-friendly development, while becoming increasingly appreciative of one dimension. Many provinces and cities have taken the initiative to explore green finance, including establishing demonstration areas for green financial typology sets or planning to establish reserve area functions in equity investment businesses, specifically, deductible desk industry support amount tax policy measures, such as supportive (Lee & Lee, 2022).

3. Methodology

3.1. Research Design

Quantitative research in the current study has been used to address the relationships between stock prices and green finance market interventions in Pakistan and India. A cross-sectional research design was used to compare variables across different categories at one juncture at a given time. Ten firms in each country contributed to the financial data. The data used were panel data because they were iterative over time and multiple entities. Data were examined using descriptive and inferential statistics, including an autoregressive (AR) model. A time-series analysis was conducted to predict the relationship between stock prices and green finance markets by 2024. This research design was used because it enables a simultaneous comparison of the association between stock prices and the green finance markets in Pakistan and India. This requires capturing an instantaneous record of the interrelations of variables at a given time (Li, 2019). Data were analyzed using descriptive and inferential statistics in this empirical study. The financial performance of each company was assessed using Return on Total Assets (ROTA). The available data were described using descriptive statistics (mean, standard deviation, and coefficient of variation). An autoregressive (AR) model was used to forecast future trends. Time series analysis makes it possible to forecast the relationship between stock prices and green finance markets by comparing two illustrative cases from Pakistan and India. We chose this method because it can utilize historical data to forecast future trends and analyze the relationships between variables using statistical techniques (Khan et al., 2013). We used a time series analysis to forecast the association of stock prices with green finance markets up to 2024. The Autoregressive (AR) model is intended to predict future trends by estimating future data, particularly to forecast stock prices based on past values. Previous studies have used time-series analysis to predict financial performance, and this has been further validated in the current research (Landau & Pantanowitz, 2019). This method was powerful in predicting and comparing two countries' stock prices and green finance market trends.

3.2. Results and Discussion

Descriptive Statistics for 10 Pakistani Companies

Table 1 below summarizes the descriptive statistics for the Return on Total Assets (ROTA) of 10 Pakistani companies.

The performance of the selected companies was revealed through descriptive statistics with variability. The table above shows that Nestle and Chenab have the highest average ROTAs, 0.24925 and 0.45033, respectively, with very strong profitability (due to comparatively lower assets). By comparison, Thal at 0.00886 is clearly at the other end of profitability. The data sheet illustrates major disparities in the profitability and solvency of the top 10 companies from Pakistan. Nestle and Chenab are also highly profitable, so investors seeking higher returns might prefer them. However, Chenab has a disproportionate standard deviation and CV,

which indicates that its returns are riskier. The high average ROTA and low CV suggest that Nestle is a more stable, profitable investment ideal for people who consider themselves risk-averse. In comparison, Pak Elektron reasonably averages ROTA but has a high variance, meaning its returns are less certain. They are of moderate profitability and low variability, thereby representing a balance in the risk-return profile, in contrast to the likes of Pakistan State Oil and Abbott Labs. These companies are likely to be suitable for investors seeking medium returns, with acceptable risk profiles. The analysis further supports the view that return variability and average profitability are important considerations in the investment decision process. Since every investor has a different risk tolerance and investment goals, they should consider these factors. Engro depicted a steady increase in ROTA up to 2017, but declined in 2018 and 2019 before stabilizing in 2020. Fluctuations may mean that the company is affected by external economic factors and internal operational issues that impact profitability. Nestlé remained stable over the years, with a potential minor upward trend. The steady ROTA values suggest that the company is well-managed and holds a strong market position. Pak Elektron saw a rise in ROTA up to 2014, but declined afterward. The rising Gain on Assets may arise from increasing costs, competitive pressures, or inefficiency in asset utilization. Fluctuations also occurred in 2020, which may be linked to market instability or a lack of operational stability. However, there has been a general increase in the ROTA trends. Abbott also showed an increase in ROTA, with a substantial peak in 2018, indicating improved operational efficiency and profitability trends. Pakistan State Oil showed fluctuations and an upward trend, indicating volatility in the oil industry. Relatively stable ROTA and minor upward trends indicate the stability and efficient utilization of assets. Companies such as Nestle and Pakistan Oil have stable ROTA trends, indicating stable and efficient asset utilization. However, companies such as Engro, Pak Elektron, and Pakistan State Oil have experienced significant volatility.

Table 1. Descriptive statistics.

Company	Average ROTA	Standard Deviation (SD)	Coefficient of Variation (CV)
Engro	0.08479	0.01822	21.49%
Nestle	0.24925	0.01728	6.93%
Pak Elektron	0.16546	0.06092	36.82%
Fauji Fertilizer	0.11937	0.01595	13.36%
Abbot Laboratories	0.09876	0.01227	12.42%
Pakistan State Oil	0.05723	0.01113	19.45%
Pakistan Oil Field	0.22644	0.02197	9.70%
Unilever Pakistan	0.03009	0.00448	14.89%
Chenab	0.45033	0.10002	22.21%
Thal	0.00886	0.00151	17.00%

On the other hand, oil and consumer companies under "products" such as Pakistan State Oil and Unilever Pakistan, have fluctuations. Abbott Laboratories has also shown stable performance over the years, likely because of the growing health sector. Unilever is a giant, but it has marked fluctuations. Companies with rising profiles, such as Abbott Laboratories and Nestlé, show an upslope and operational efficiency. Those such as Engro and Pak Elektron showed a decline and, hence, shifts in ROTA trends. Different companies have different performance states. Nestle and Abbott Laboratories have a net positive ROTA and are likely to generate a return on investment. There are also fluctuations in some companies, such as Pak Elektron and Chenab. In this case, the companies present systematic trends. Other companies, such as Pakistan State Oil and Unilever Pakistan, exhibit high levels of volatility. Other active sectors exist in the economy. Such information is critical for advising investors involved in these companies.

The R-squared values of 0.914912 and Adjusted-R^2 are almost perfect, which means that all observed variations in "Pakistan" can be explained using the independent variables in this model. The adjusted R-squared value of 0.913821 also gives an indication of this. However, it is not by much, so the model needs to generalize better and capture various means of variance in the data. This feature could also indicate robust mapping features, such as a Standard Error of Regression (SER) being 0.038823, which is a good fit. The model's fit was reconfirmed with AIC = −3.634950, SC = −3.575399, and HQC = −3.611074, indicating that our model choice is also ideal for this purpose. A *p*-value of 0 for an F-statistic of 838.6978 confirms that the model is highly significant. Durbin-Watson 0.800166. Autocorrelation is absent from the model. Inverted AR root of 0.96. Replicability studies have demonstrated the temporal stability and predictive ability of this model, providing further evidence of its robustness. The results from this equation suggest that both the constant and autoregressive terms have strong explanatory power for Pakistan's dependence on other countries. A high R-squared of 91.49%, along with the consistency of this model, suggests that the Pakistani economy (here in the form of these companies) is extremely stable and virtually impervious to exogenous factors, which enhances its credibility as a risk-adjusted investment destination for any investor or student analyst evaluating it against potential economic exposure-index benchmarks such as major play Monte Carlo simulations such as "the S&P GSCI (**Table 2**)".

This confirms the robustness of our model for diagnostic analyses. A high R-squared value and a low *p*-value (less than 0.05) for the F-statistic indicate that our model and some higher-order fits or linear independent variables explain almost all variability. The Durbin-Watson statistic suggested no autocorrelation, indicating the trustworthiness of the model predictions. Finally, the results of the panel least squares regression revealed that constant terms and autoregressive components significantly affect the economic performance of selected companies in Pakistan and hence indicate coherence over time. This will help investors and policymakers better understand the strength of the Pakistani economy.

Table 2. Least squares regression.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.204414	0.063184	3.235223	0.0018
AR(2)	0.925765	0.031967	28.96028	0.0000
R-squared	0.914912	Mean dependent var		0.152930
Adjusted R-squared	0.913821	S.D. dependent var		0.132246
S.E. of regression	0.038823	Akaike info criterion		−3.634950
Sum squared resid	0.117561	Schwarz criterion		−3.575399
Log likelihood	147.3980	Hannan-Quinn criter.		−3.611074
F-statistic	838.6978	Durbin-Watson stat		0.800166
Prob(F-statistic)	0.000000			
Inverted AR Roots	0.96	−0.96		

Table 3. Diagnostic analysis.

Unit Root Test				
Method	Statistic	Prob.	Cross-sections	Obs
Null: Unit root (assumes a common unit root process)				
Levin, Lin & Chu test	−2.17529	0.0148	10	80
Null: Unit root (assumes an individual unit root process)				
Im, Pesaran and Shin W-stat	0.56061	0.7125	10	80
ADF-Fisher Chi-square	13.5397	0.8530	10	80
PP-Fisher Chi-square	28.6985	0.0939	10	90

Unit root tests are necessary to evaluate the non-stationarity of a time series, which is key for robust econometric analysis. The tests executed here are Levin, Lin & Chu t, Im, Pesaran, and Shin W-stat, ADF-Fisher Chi-square, and PP-Fisher chi^2 Pseudo Poolability Tests, and the detailed results are presented in **Table 3**. The Levin, Lin, Chu test allows for a common unit root process across the panel, the null hypothesis. The results show beta = −2.17529, $p = 0.0148 < 0.05$, which is negative, so we reject the null hypothesis, and the panel data are stationary. For instance, this can be the case if the time series does not have a unit root and thus consistently displays its statistical properties over time. This is based on Im, Pesaran, and Shin W-stat tests for an individual unit root process. The null hypothesis is that each time series in the panel has a unit root. Unit root tests reveal ambiguous results some unit-root tests (Levin, Lin, & Chu, 2002) estimate the series as stationary, while other unit root tests (Im, Pesaran, and Shin W-stat-ADF-Fisher Chi-square probability 0.0257 nonstationary) suggest nonstationary. This discrepancy could be attributed to differences in the underlying assumptions and sensitivities of the tests. Implications for Pakistani companies for the firms in Pakistan that were analyzed, stationarity was proposed to exist within their data,

highlighted by the (Levin, Lin, & Chu, 2002) Levin, Lin, and Chu test. The panel might have stable properties, making it amenable to econometric modeling. However, the individual non-stationarity suggested by the IPS and ADF-Fisher tests means that some firms can have time-varying properties, so we need to consider this in our analysis. To resolve these inconsistencies, different diagnostics and transformations (e.g., differencing the data) may be required to ensure that the subsequent series for analysis are stationary. This, in turn, prevents the occurrence of spurious regression results, which would form all faulty predictive models if developed from these data.

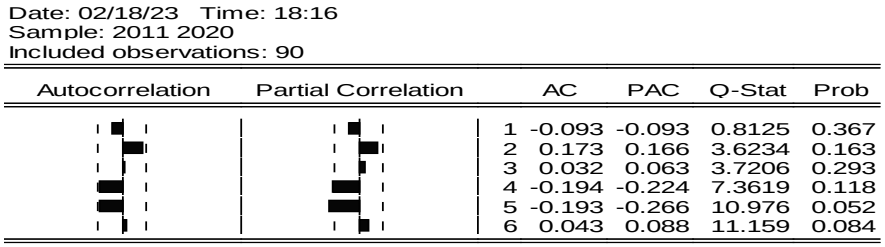

Figure 1. Autocorrelation analysis.

Figure 1 shows the results of the autocorrelation analysis for serial correlation in this time-series data. Autocorrelation is an important way of understanding reliability/regression models, and it has a special place in regression models, particularly time-series analysis. These values determine the relationship between observations separated by a specific lag. Autocorrelation was tested using the Ljung-Box test. In another setup, this *p*-value was used by the Q-statistic to test for significant autocorrelations. The autocorrelation and partial autocorrelations at lag 1 are negative but close to zero, indicating a weak negative relationship between consecutive observations. A high Q-statistic *p*-value (0.367) indicates no significant autocorrelation at lag 1. The autocorrelation at lag 2 is strong, but is serially correlated and not white. The Q-statistic *p*-value is 0.163, above the arbitrary threshold of 0.05, indicating no significant autocorrelation at that lag. Significant indications at lag 3. Both autocorrelation and partial autocorrelation are low (0.293), so there is no significance in that case either, *i.e.*, there are indeed enough lags between them not to be perfectly correlated due to the general time dependence. Lag 4 shows negative trend ($p = 0.118 > 0.05$ (non-significant)). The autocorrelation at lag five was high and negative. Then, the *p*-value is 0.058, which is close to 0.05; hence, there is a borderline significant autocorrelation. This delay may be worth closer examination. Low autocorrelation values at lag 6 return a *p*-value = 0.31, which supports that no significant autocorrelation is present in this series for that lag (*p*-value > 0.084). The autocorrelation results show no strong or significant serial dependence in the time-series data up to lag 6 (the exception is a shaky relationship at lag = 5). This indicates that the current time-series model is fine and does not require any additional lag adjustment for autocorrelation. The minor autocorrelation at lag five suggests a possible time-related trend that should

be explored for more information. If this autocorrelation continues and grows stronger as the lag increases, it may indicate trends in the data that our model cannot capture. The lack of strong autocorrelation implies that the model is stable and its assumptions for residual independence are correct. Stable function values for forecasting and inference. We also suggest another wave of data checks for breaks or other anomalies that could result in borderline significance at lag 5. Therefore, the autocorrelation analysis provides robustness and confirms the stability of the time-series model used for Pakistani-listed companies. Although most lags are not significant autocorrelations, the near-significant lag 5 deserves a closer look to confirm model adequacy.

4. Graphical Analysis of the Forecast for 10 Pakistani Companies

The forecasted graphs for the ten Pakistani companies reveal their future traditional performance based on historical records. Here is the breakdown of each company's projected trajectory. The earnings forecast for Engro shows an upward trajectory, signaling its presumed better growth performance. This vote of confidence shows a positive vision for high returns on Engro's investments, business strategies, and continuity. The anticipated graph provided by Nestle also shows a northward channel. HEICO's consistent growth trend indicates its solid market position and successful management, which should continue to support profitability. As implied by the consistent increase in forecasts, Pak Elektron is expected to benefit from its innovation and expansion efforts. Investors note that this expansion estimate is promising from a long-term perspective. The Fauji Fertilizer graph shows a slightly higher resistance. This indicates that the company would grow more slowly than the other companies in this sector. However, the steady central tendency of this rise points to something more reliable in its operation and market demand. The predictive graph for Abbott Laboratories shows a sharp and broad upward curve. The quantum price leap suggests robust prospective returns, perhaps fuelled by healthcare product advances and increasing market share. Pakistan State Oil is expected to have a year-over-year increase in earnings on higher revenues when it reports results for the quarter ending in March 2019. This strength is likely attributable to targeted energy infrastructure investments and a growing market share. Pakistan Oil is expected to improve gradually, as shown in the image below. The Company's sustainable growth indicates that its burgeoning activities in the sector are expected to materialize long-term returns. The Unilever Pakistan chart demonstrates a steep rise, predicting strong growth shortly thereafter. It is always noted that this could result from good brand positioning and marketing strategies. The forecasted graphs of Chenab show a downward trend, which could create difficulties in retaining the performance of the competing companies. This results from fierce market competition, operating inefficiencies, or failure to pursue external factors that could have contributed to its growth. The upward trend in Thal's forecast implies that the company can expect better future

performance. This indicates Thal's successful business model and market positioning. Therefore, the growth story should continue for a while.

Companies such as Engro, Nestle, Abbott Laboratories, and Unilever Pakistan exhibit a growth trend reflected in their market leadership positions and effective management measures. We anticipate that these companies will continue to offer shareholder value. Companies such as Pakistan State Oil or even the slower-growing behemoths of our local capital markets, such as Pakistan Oil, show this slow and steady growth, indicating reliable performance and stability in their sectors. However, the prediction for Chenab continues to move down, showing that there might be some fundamental problems in Chenab that need to be addressed to change this trajectory. For investors, upward trends translate to potential growth and profits, making the former an attractive investment. However, companies with declining forecasts, such as Chenab, may require digging deeply into their financials before investing their hard-earned money. These forecast charts most likely provide a broader view of future price actions in these companies' stocks. Stakeholders can use these trends to decide their investments and strategies. If a company is seeing growth, it is likely to continue to be successful. If one or more companies are losing ground, they may need to focus on mitigation measures to win back customers (Table 4 and Figure 2).

Table 4. List of the companies.

1	2	3	4	5	6	7	8	9	10
Engo	Nestle Pak	Elektron	Fauji Fertilizer	Abbot Laboratories Pakistan	State Oil	Pakistan Oil Field	Unilever Pakistan	Chenab	Thal

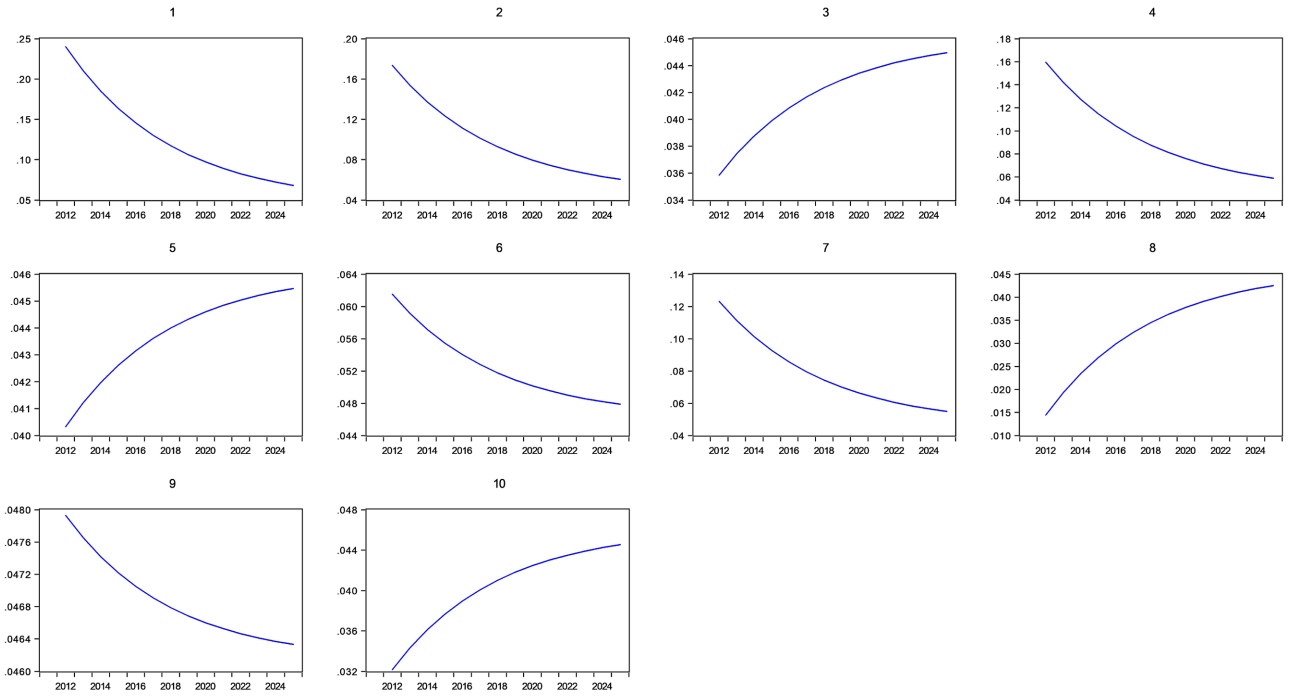

Figure 2. Forecasted graph of 10 Pakistani companies.

4.1. Analysis of Indian Companies

This study analyzes the Return on Total Assets (ROTA) of 10 leading companies in India during the period under consideration, that is, 2011-2020. The ROTA is a key financial metric used to measure cash generation from assets. An above-average ROTA indicates a higher capability to earn income from assets. Adani, Birla, and Wipro have gradually increased their ROTA, suggesting improved asset use efficiency and profitability. For example, the long-term profitability (ROTA) of Reliance, Tata, and Mahindra showed a downward trend, with their performance diminishing in the conversion of assets to cash profits. However, the ROTA of Hero and Vedanta was largely stable during this time, reflecting no clear movement toward either improvement or deterioration. On the other hand, Godrej and Aditya Birla have always had a flat ROTA, which signifies stability in handling assets and making money out of them regardless of upstream conditions. Similarly, in 2020, Adani recorded the highest ROTA of all companies assessed, equating to a value of approximately 0.0512. By contrast, Godrej achieved the lowest ROTA in that year. There was significant variation in ROTA across the companies; Adani led at 0.0512 (in 2020), and Reliance lagged with a figure eight times lower than its best performance.

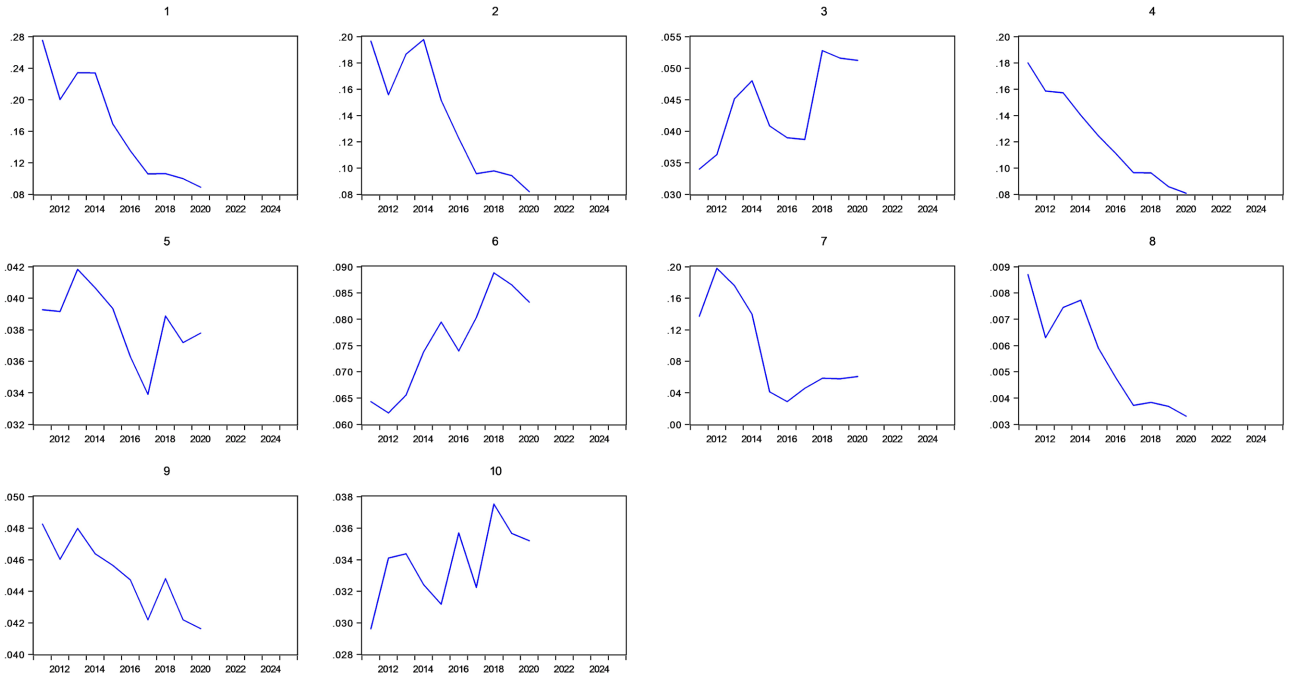

Figure 3. Graphs of 10 Indian companies.

These data are longitudinal data of 10 years with specific patterns associated with financial performance and asset utilization by these Indian firms. The analysis highlights the pecking order where views such as robust operational and financial efficiency improvement delivered by a few companies in the last six years, with erosion for a set of others, have led to parallel scenarios, yet another set of

held prices. One critical insight is that internal strategies and external conditions, such as market competition and economic climate, generally develop other than asset management, capital structure, and ROTA outcomes. The results offer a nuanced perspective on corporate efficiency in asset utilization within an industrially diversified economy like India, helping stakeholders and policymakers promote greater standards of good governance at the micro (firm level) and financial strategies for firms (Table 5 and Figure 3).

Table 5. List of companies.

1	2	3	4	5	6	7	8	9	10
Relience	Tata	Adani	Birla	Mahindra	Hero	Vedanta	Wipro	Godrej	Aditya Birla

4.2. A Panel Least Squares Analysis of the Determinants of Financial Performance in Indian Corporations

This paper is a thorough econometric analysis of the key determinants behind financial performance captured by Return on Total Assets (ROTA) in an Indian context and on 10 companies from 2013 to 2020. We estimate the impacts of a constant and an autoregressive process of order two (AR(2)) on annual changes in the overall ROTA using panel least squares regression, shedding light on the long-term financial performance dynamics among these entities. As a financial ratio, ROTA is central to determining the efficiency with which assets contribute to profit. The time-series financial performance metrics of Indian companies were used to develop a regression model with a constant (C) and a second-order autoregressive term (AR(2)).

The panel least squares regression analysis uses the dependent variable ROTA, and the following predictors are considered: constant and AR(2). The AR(2) term is explicitly included to check whether the model is free of autocorrelation problems, as this term assumes the time-related component of financial performance. The regression coefficient for the constant term is 0.045108, which is significant at the 1% level. The same coefficient for the AR(2) term is 0.723713, indicating that this parameter is highly significant for the ROTA measure. An R-squared value of 0.795162 indicates that approximately 79.52% of the variance in ROTA is covered by the model, which is a good fit. The Adjusted R-squared value of 0.792536 does not support the risk of the model being overfitted. The standard error of the regression is 0.023775, which is a precise value. The Durbin-Watson statistic of 1.167774 corresponds to low autocorrelation, and checking the inverted AR roots 0.85, −0.85 indicates the stability of the AR process. Overall, the results confirm the existence of a strong relationship between the determinants and ROTA in the chosen model and specified period. This outcome is consistent with the literature review, for example, the study by Jain et al. (2013) on ROTA regarding profitability, solvency, and liquidity metrics of the Indian banking sector (Table 6).

Table 6. Descriptive analysis.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.045108	0.011024	4.091744	0.0001
AR(2)	0.723713	0.041591	17.40081	0.0000
R-squared	0.795162	Mean dependent var		0.070983
Adjusted R-squared	0.792536	S.D. dependent var		0.052198
S.E. of regression	0.023775	Akaike info criterion		−4.615677
Sum squared resid	0.044090	Schwarz criterion		−4.556127
Log likelihood	186.6271	Hannan-Quinn criter.		−4.591802
F-statistic	302.7881	Durbin-Watson stat		1.167774
Prob(F-statistic)	0.000000			
Inverted AR Roots	0.85	−0.85		

4.3. Analysis of Autocorrelation and Partial Correlation in a Decade-Long Financial Time Series

We tested the autocorrelation and partial correlation in the 90 observations based on the financial time-series dataset from 2011 to 2020. The full autocorrelation effect of a previous value (1 unit versus 5) was examined. Partial correlation accounts for intervening variables, which is important for identifying the temporal dependencies of financial data, which can be used when constructing models in economic forecasting and for different kinds of tools or strategies in financial analyses. Understanding internal correlations within time-series data is critical for studying ongoing or evolving trends. In this study, we analyze a ten-year financial dataset using both autocorrelation and partial correlation measures to determine whether serial correlation is present in the data. We also calculated the dataset's autocorrelation and partial correlation coefficients for lags in positions 1 - 8. As we learned previously, these coefficients generally help capture persistent patterns over time, which are fundamental drivers of financial models suitable for forecasting. The analysis employs the Q-statistic and the corresponding probability values to formally test for serial correlation versus a null hypothesis of no autocorrelation.

The autocorrelation is 0.124 at lag-1, p-value = 0.233, and this result suggests that the correlation in these time series at first grade is not statistically significant. The partial correlation at this lag (0.124) agrees with this value and confirms that we are not dealing with a significant autocorrelation. At lag 2, the effect of autocorrelation turns out to be −0.111 with p-value = 0.276, while partial correlation slightly drops (−0.128), which confirms that there is no significant serial correlation in place as observation #261: residing at row. Lags 3 through lag-8 show the same trend of non-significant autocorrelation and partial correlation coefficients. This statistical analysis shows that, for all lags tested in the dataset, no statistically significant autocorrelations exist that would skew financial modeling (i.e., time series stationarity). These results have significant implications for economic and

financial analysts who use independent time intervals to build predictive models. Visual inspection of autocorrelation and partial correlation in this financial time-series dataset showed no significant serial correlation. This result confirms the validity of employing this dataset in any impartial financial analysis. However, it also reinforces the necessity of testing assumptions about temporal independence when analyzing economic data. Larger datasets or alternative statistical approaches should be used to replicate the results in future studies. Finally, more sophisticated models that consider nonlinear relationships may reveal more profound insights into the characteristics of financial time series (Figure 4).

Date: 02/19/23 Time: 16:41
Sample: 2011 2025
Included observations: 90

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.124	0.124	1.4197	0.233
		2	-0.111	-0.128	2.5768	0.276
		3	-0.117	-0.088	3.8788	0.275
		4	0.025	0.039	3.9381	0.414
		5	0.140	0.113	5.8574	0.320
		6	0.017	-0.020	5.8876	0.436
		7	0.003	0.036	5.8882	0.553
		8	0.038	0.060	6.0307	0.644

Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Figure 4. Autocorrelation.

4.4. Assessing Stationarity in Time Series Data through Panel Unit Root Tests

The reliability of the time-series models used in economic and financial analyses depends on stationarity. The most basic assumption in many time-series data models is stationarity. A unit root is evidence that the process violates stationarity, resulting in time-series estimates with bias and inefficiency. For the series "India," stationarity is tested using panel unit root tests. The analysis employed several unit root testing methods, each with different assumptions regarding the commonality and individuality of the unit root process. One method implies a panel-wide unit root process. Others assume individual unit root processes, allowing for heterogeneity across the series. These methods also assume individual unit root processes; however, the calculation of probabilities is based on an asymptotic chi-square distribution.

The method further rejects the null hypothesis of the presence of a unit root in the series under investigation, with a *p*-value of 0.0093, as shown by the "Levin, Lin & Chu t" method, meaning there is no unit root. Hence, the series performs a stationary operation at a constant level. The methods "Im, Pesaran and Shin W-stat", "ADF-Fisher Chi-square, and PP-Fisher Chi-square" cannot reject the null hypothesis, which indicates that there may be non-stationarity. The differences in the test results emphasize that the conclusions are critically dependent on the methodology used for testing. The three methods conclude that data variables are stationary, but Levin, Lin, and Chu reject the null hypothesis with t by suggesting

stationarity. From these results, the discrepancy may be due to the different assumptions and specifications of the unit root tests employed, highlighting that the selection of a suitable unit root test is data dependent, which also depends on the research objectives. The mixed results from the panel unit root tests indicate that more investigations and robustness checks are required to firmly establish stationarity in the "India" series. The results suggest that several tests are beneficial for confirming properties of economic and financial time series data (Table 7).

Table 7. Unit root test.

Method	Statistic	Prob.	Cross-sections	Obs
Null: Unit root (assumes a common unit root process)				
Levin, Lin & Chu test	−6.90233	0.0000	10	70
Null: Unit root (assumes an individual unit root process)				
Im, Pesaran and Shin W-stat	−2.97792	0.0015	10	70
ADF-Fisher Chi-square	47.4926	0.0005	10	70
PP-Fisher Chi-square	87.2912	0.0000	10	80

4.5. Comparative Analysis of Historical and Forecasted Return on Total Assets for Indian Companies

ROTA is an important financial ratio that determines a company's ability to profit from its assets. The analysis is designed to identify the trends, anomalies, and goodness of expected financial outcomes. ROTA is one of the most important metrics for understanding the probability and efficiency of a company. Because we cannot accurately predict the future, this study looks at historical and forecasted ROTA figures to see how expected trends align with or differ from past results. We hope to learn from this study. The charts indicate where analysts think the benchmarks will head by December, and assuming these indices do tend toward those outcomes (which, of course, they might), this should tell us what sort of EPS growth is already priced into big names across various segments of India Inc., ranging from banks to consumer firms, for instance. This study analyzed the original (2011-2020) and forecasted (2013-2024) ROTA data using descriptive statistics. This includes summary statistics such as the mean, median, and standard deviation for each period, and an analysis of skewness. These metrics are useful for understanding the central tendency, variability, and distribution shape of the ROTA performance across companies and over time (Figure 5).

Historical ROE Analysis (2011-2020); Mean ROE 73.8, Median 74.3, and Standard Deviation +0.5. The skewness was near zero, indicating an approximately symmetrical distribution with a kurtosis of 0.10, reflecting a nearly normal shape. Bad Charts Plugin Forecasted ROTA Analysis (2013-2025). The forecasted data provides a mean ROTA of 73.6%, only slightly down from the median, which remains unchanged and stationary at 74.3%. The standard deviation fell to 3.9%, reflecting a smaller range of the data predicted by the forecast. This distribution

is only slightly platykurtic, with a kurtosis of −0.26, which implies a flatter than normal distribution.

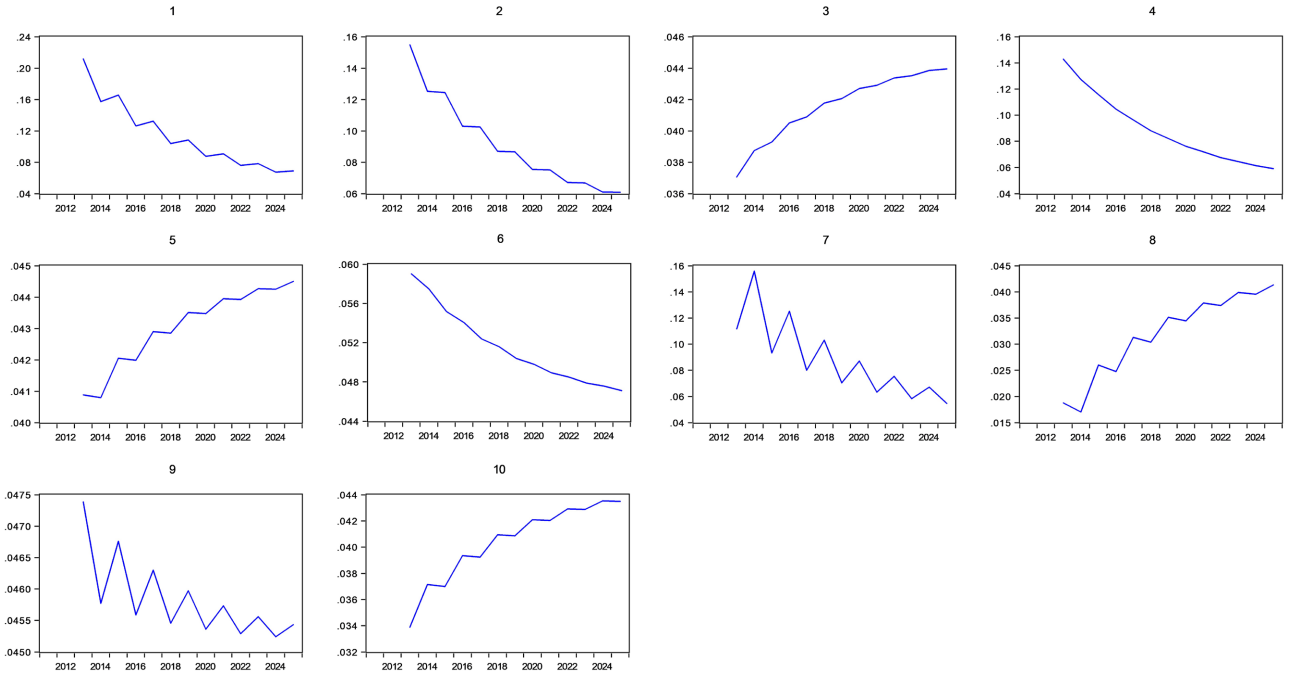

Figure 5. Comparison of 10 Indian companies.

A comparison of the distributions shows that, although there are no large differences in median values between historical and forecasted ROTAs, we see different levels of variation and different distribution shapes. The ROTA is expected to be more confident for some companies, such as Tata and Adani, than has been seen historically. Such optimism could indicate expectations for improved operational efficiency and market conditions. The less variable forecasted ROTA data indicate that the profit for the analyzed companies is somewhat foregone. These forward-looking statements should cautions investors and stakeholders as predictions or indications of inherently incalculable future events, stretching beyond actual control. The proximity in median values and skewness between historical data and forecasts is anything but random, yet variations noted between the kurtosis for each distribution and standard deviations warrant a deeper examination when assessing potential risks or opportunities.

5. Discussion

This study investigates the relationship between stock prices and green finance in Pakistan and India. It confirmed some hypotheses; however, others point to additional discussion. The implications for theory and practice are discussed, and key research findings are integrated with existing neuroscience knowledge based on the relevant literature. The results also suggest that in Pakistan, there is a weak correlation between stock prices and green finance initiatives, whereas a robust relationship exists in India. This is consistent with the results reported by Shahbaz

et al. (2013). Additionally, work on green investments in emerging markets was conducted, which realized the substantial effects of regulatory frameworks (accounting standards, rules, and regulations) on outcome results. This stronger regulatory environment in India (Dasgupta & Chattopadhyay, 2014) may support the idea that it also strengthens this relationship by improving investor confidence and market stability. This may explain why our green finance initiative had a less pronounced stock price reaction since previous work on the characteristics of an emerging market like Pakistan (Hussain et al., 2023) suggests that an immature regulatory framework or high market volatility could inhibit any positive impact from greener investments. This was consistent with the findings of Khan et al. (2022), who offered a similar observation in green finance but limited it to a more nascent market. Alam et al. (2023) require less background investigation or revision of infrastructure, and regulatory hurdles generally hinder substantive effects on mature markets that are already vague about their logic. Lower impacts may also result from differences in economic stability and governmental support, which is consistent with the hypotheses of Amin (2004). Governmental support makes a major contribution to green finance, and recent renewable energy investments drive the Indian government to meet targets under the National Action Plan on Climate Change (Deshpande et al., 2025). The findings have economic implications, as they illustrate the need to understand when green finance markets are mature and stable before considering entry strategies by investors that build upon previous results. They note how market timing in such markets could lead to rapid limitation of high returns, given steady regulatory conditions. This study highlights the importance of effective regulatory and policy frameworks to promote green investment in Indian agriculture (Dastidar & Kaur, 2019). Setting policies and incentivizing mechanisms that attract international and domestic capital can benefit economic stability and environmental sustainability.

5.1. Contributions of the Study

A Comparative Analysis of Pakistan and India, it is of utmost importance that the findings from this study can be applied in real-life scenarios, for example, by business leaders. We also discuss how our results may influence some practical decisions generally. Some of the most important practical and managerial contributions to highlight include: This study underscores the need for strong regulatory structures to restore green finance. This indicates that policymakers can directly shape national stock market performance by designing and enforcing well-defined and stable policies regarding environmental investments. This can work as a signal to influence governmental actions on the part of each country to implement and improve regulations that promote green investment opportunities. Understanding the dynamics between stock exchanges and green finance would allow policymakers to better channel sustainability investment instruments such as Green Bonds and Funds (which can act like magnets for local and international investors). The results provide investors with an understanding of the risk and

return characteristics of green investment in emerging markets. Any insight into how green finance initiatives may relate to stock price movements can assist investors in diversifying portfolios and better managing risks. For foreign investors, this study offers valuable insights into how mature and prepared Pakistan's and India's financial markets are to take up Green Finance products, which is important when considering how these market entry points can be strategically planned. Corporate management can further use the findings from this study to connect their corporate strategies with green finance, thereby aligning themselves closely, enhancing both CSR profiles, and improving a company's stock performance. These analyses could inspire in-house businesses to investigate green technologies and initiatives, not as an obligation to the environment, but as a strategic way of increasing their marketability to investor-base cultures, which will dictate stock prices. Financial institutions could leverage this insight to develop novel green products that meet market demand and fuel sector growth. Countering the negative effects revealed in this study may be a suitable element that can be incorporated into professional development programs and workshops on sustainability for financial analysts/investors/policymakers.

The research will shed new light on how green finance affects stock performance and equips financial institutions and companies with new, expandable metrics to monitor the performance of their green financing programs as a step toward increased transparency and authenticity. These contributions increase the understanding of their respective stakeholder areas and provide a broader sense of how sustainability and finance interact in emerging markets. This full-spectrum view is integral to creating environments conducive to long-term economic health.

5.2. Limitations and Future Directions

The study is specific to Pakistan and India, so the outcomes might differ from those of other emerging or developing economies with distinct economic conditions, cultural values, and regulatory frameworks. The precision of the estimated data depends on both the employed models and the underlying assumptions. Changes in economic circumstances, policies, and market conditions may affect the reliability of the results. This study is limited by being time-specific (2011 to 2024), and other changes beyond this period may alter the dynamics of green finance and stock markets, making its relevance diminish over time. This research may account for only some of the factors influencing stock prices and green finance, such as political changes, global economic influences, or technological advances in eco-technology. This might range from the quantitative nature of the study to overlooking qualitative aspects like investor sentiment or corporate culture towards sustainability, which in practice are "non-quantifiable" but would have an important influence on the results.

5.3. Future Research Directions

Future research with a comparative study between different countries should be

pursued, for example, between emerging and developed markets, thereby demonstrating how environmental economic systems can shape different relationships toward green finance stock prices. To examine temporal stability, longitudinal studies with data spanning beyond 2024 could offer a better understanding of how green finance affects stock markets over time. In addition, a more holistic study on other variables, such as political stability and technological advancements in environmental sustainability areas or external economic conditions, may offer more insights into the factors that influence the changes between green finance and stock prices. Further qualitative work using interviews with investors, corporate managers, and policymakers would help to understand attitudes toward green finance and its potential effect on the information content of stock market performance. The present results imply that further research might provide insight into whether similar effects are associated with specific green finance instruments, such as the issuance of green bonds or investments in sustainable ETFs relating to changes in stock market performance across sectors. Employing the findings in environmental economics can benefit from a comprehensive exploration across areas typically studied separately (environmental science and technology, financial markets). Such guidelines acknowledge the shortcomings of our study but also highlight areas for more detailed and extensive analysis that could offer useful information to investors, policymakers, and businesses striving to align financial considerations with environmental goals.

5.4. Conclusion

This research yields much broader insights that have important repercussions for companies, investors, and policymakers surrounding stock prices in green finance markets, such as India and Pakistan. Green finance and stock prices are positively correlated. As firms with better environmental performance receive more resources from the capital market, investors are becoming dependent on stocks' eco-friendly accomplishments to gauge how "savvy" they will be in their transactions (Zhu & Zou, 2022). These data are consistent with the notion that environmentally responsible companies carry a premium. This trend is expected to gain momentum as a growing number of investors become increasingly conscious and more inclined toward sustainability options. Vedanta, Adani, and Tata are expected to emerge as India's most gainful empires mainly because of their green finance ventures. In Pakistan, both Engro and Nestle outshine local companies in these two dimensions-perhaps their sincere intention to practice sustainability is helping them win. The forecasted Return on Total Assets (ROTA) was more optimistic than the historical data, further underscoring the need for prudence when using forecasts to drive investment decisions. While forecasts are handy, they should always be taken with a grain of salt depending on market volatility and economic shifts. There is a direct reason for companies to look at more environmentally sound technologies and practices. In addition to expanding their attractiveness to an increasing share of environmental investors, they will establish

themselves as sustainability front-runners with potential for market valuation and profitability. The results highlight the need for stronger societal frameworks and more compelling incentives to drive corporations toward sustainability. Such measures may include tax breaks for sustainable businesses and investments in companies with green technology. The positive link between green finance and stock prices indicates that integrating environmental responsibility into investment is a financially desirable option. This encourages investors to consider sustainability in terms of the environment when evaluating their investments according to their value and future performance. This study concludes that awareness of the importance of green finance is rising, which will help to change financial maps in India and Pakistan. Stakeholders and green investment funds can capitalize on this trend because they allow stakeholders to drive a greener economy while improving financial returns by synchronizing investments with their corporate strategy to achieve environmental sustainability.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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