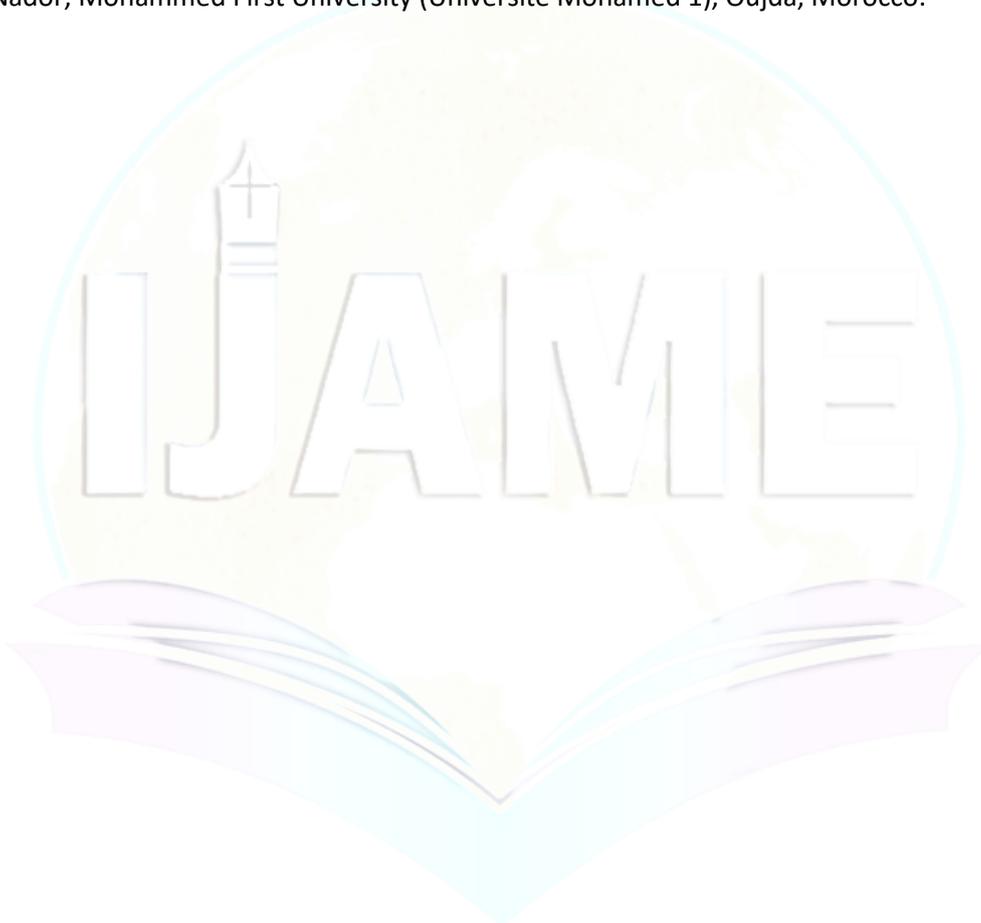# Carbon footprint and stock market performance in an emerging context: Evidence from Moroccan listed companies.

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Abstract

Purpose: This paper examines whether improvements in environmental performance, measured through reductions in carbon dioxide emissions, are associated with stock market performance in an emerging economy context.

Design and methodology: The study adopts an exploratory quantitative approach using secondary data extracted from corporate annual reports and market information for three Moroccan listed companies over the period 2020 to 2023. Environmental performance is captured by changes in carbon dioxide emissions, and stock market performance is captured by annual share price variation. The analysis combines correlation analysis and an association test to evaluate the relationship between the two variables.

Findings: The empirical results do not show a statistically significant association between reductions in carbon dioxide emissions and stock market performance in the studied sample. The observed relationships vary across firms and remain unstable when tested at the pooled level.

Practical implications: These results suggest that, in this context, investors may not systematically incorporate environmental performance signals into pricing decisions, and stock price movements may be driven more strongly by financial and market factors.

Originality and contribution: The paper provides exploratory evidence from Morocco, a setting that remains underrepresented in empirical research on environmental performance and capital markets, and highlights the need for broader samples and longer time horizons to strengthen inference.

Keywords: Environmental performance; Carbon dioxide emissions; Stock market performance; Emerging markets; Morocco; Investor reaction

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1   Introduction

Climate change has become a global priority and refers to the lasting alteration of atmospheric conditions worldwide, mainly due to increasing concentrations of greenhouse gases (GHGs) in the atmosphere. Human activities such as the burning of fossil fuels, deforestation and intensive agriculture are contributing to its acceleration. Global warming, changes in precipitation patterns and an increase in the frequency of extreme meteorological events are all part of the picture, making it even more important to reduce GHG emissions.

The question we wish to answer in this paper is whether environmental performance, in particular CO_2 emission reduction policies and programs, impacts stock market performance? To answer this question this scientific paper is divided into two main parts, the first focuses on a review of existing literature in relation to the concept of carbon footprint while the second deals with a statistical study to answer our problematic question.

Literature review

Carbon footprint Concept

The carbon footprint is a tool for calculating CO_2 emissions that has been popularized as part of sustainable development policies and particularly in the fight against climate change, with the aim of quantifying greenhouse gas emissions associated with human activities. The concept aims to account for the total quantity of these emissions, expressed in CO_2 equivalent, thus enabling an understanding of the scale of a given entity's environmental impact (Matthews et al., 2008). The adoption of this tool has been stimulated by international initiatives such as the Kyoto Protocol and the Paris Agreement, which have emphasized the need to reduce global GHG emissions.

The term "carbon footprint" generally refers to the total amount of greenhouse gas emissions produced directly and indirectly by an individual, organization, product, or activity, expressed in carbon dioxide equivalent (CO_2e). According to Wiedmann and Minx (2008), the carbon footprint represents "the total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event, or product."

Similarly, Pandey et al. (2011) define carbon footprint as a measure of the environmental impact related to energy consumption, transportation, industrial processes, and waste management. The concept extends beyond carbon dioxide to include other greenhouse gases such as methane (CH_4), nitrous oxide (N_2O), and fluorinated gases, converted into CO_2 equivalents using global warming potential coefficients.

Thus, the carbon footprint serves as an integrated indicator of climate-related environmental pressure generated by economic and social activities.

In corporate studies, carbon footprint is considered a key indicator of environmental performance. Firms with lower emissions are often perceived as more environmentally responsible and better aligned with sustainability objectives.

According to Clarkson et al. (2011), companies with superior environmental performance tend to disclose more extensive environmental information. Carbon footprint reporting reflects managerial commitment to transparency and environmental accountability.

Moreover, carbon management practices, such as emission reduction targets and carbon offsetting, are closely linked to corporate governance and strategic orientation. Firms operating in environmentally sensitive industries face stronger pressure to monitor and disclose their carbon footprint.

Thus, carbon footprint measurement supports internal decision-making and external communication with stakeholders.

An increasing body of literature examines the relationship between carbon footprint and financial performance. Two main perspectives dominate this debate.

The first perspective argues that reducing emissions improves operational efficiency and lowers regulatory and reputational risks. According to Porter and Van der Linde (1995), environmental innovation can enhance competitiveness. Several studies find a negative relationship between carbon emissions and firm value, suggesting that lower carbon footprints are associated with better financial outcomes.

The second perspective emphasizes the costs of environmental investments. Compliance with environmental standards and emission reduction technologies may increase operating expenses and reduce short-term profitability.

Empirical findings remain mixed, particularly in emerging economies, where institutional frameworks and environmental regulations are less developed.

The carbon footprint is a fundamental indicator for measuring and managing greenhouse gas emissions. It provides valuable information for policymakers, investors, and corporate managers. The literature highlights its multidimensional nature, encompassing measurement methodologies, disclosure practices, and economic implications.

While significant progress has been made in standardizing carbon accounting, challenges

remain, particularly regarding data availability and Scope 3 emissions. Moreover, empirical evidence on the financial impact of carbon footprint remains inconclusive, especially in emerging economies.

Future research should focus on improving measurement techniques, analyzing long-term financial effects, and exploring institutional factors influencing carbon disclosure in developing countries.

Calculation methodologies

The most widely used calculation method, among many others that have been developed for carbon footprinting, is the GHG Protocol (Greenhouse Gas Protocol) and ISO 14064 standards. The GHG Protocol is divided into three scopes, covering direct emissions (Scope 1), indirect energy-related emissions (Scope 2), and all other indirect emissions (Scope 3). Each scope is used to categorize emissions sources and facilitate accounting (WRI, WBCSD, 2004).

ISO 14064 is an international standard that provides a normative framework for quantifying, managing, and verifying GHG emissions. This standard is widely used in environmental certification and reporting approaches (ISO, 2018). The work of Zhang et al. (2017) has shown that rigorous application of these methodologies not only enables accurate assessment of emissions, but also enables comparison between different entities and better management of climate risks.

For companies and governments, establishing a carbon footprint is a strategic step towards identifying the main sources of emissions, implementing reduction actions, and complying with environmental regulations. It should be noted that several studies show that carbon footprinting can be a lever for innovation to improve energy efficiency and reduce operating costs (Carvalho et al., 2011; Kolk and Pinkse, 2007).

Relationship between CO_2 emissions reduction and share price.

According to the study by Trumpp and Guenther (2017) environmental performance, measured by reductions in CO2 emissions, is associated with better corporate financial performance, including higher share prices. The authors explain that companies that engage in sustainable practices can improve their reputation, reduce costs, and attract responsible investors. In the same vein, other researchers have found that companies that reduce their CO2 emissions and are transparent about their environmental practices have higher stock market valuations (Clarkson et al. 2015). This suggests that the market rewards sustainability efforts, especially

in industries where environmental concerns are stronger.

According to stakeholder theory (Freeman, 1984), firms are expected to respond to the environmental expectations of stakeholders, including investors, regulators, customers, and civil society. Reducing CO_2 emissions enhances corporate legitimacy and reputation, which may translate into increased investor confidence and higher share prices.

From this perspective, emission reduction reflects responsible management and long-term value creation, encouraging positive market reactions.

Results and discussion

Aim of the study

In this study, we seek to examine the impact of companies' environmental performance, measured by their CO2 emissions, on their stock market performance. The aim is to determine whether a reduction in CO2 emissions is associated with a positive variation in share prices for companies listed in Morocco.

Study sample

The choice of companies in this sample was motivated primarily by the relevance of their profile for studying the impact of environmental performance on stock market performance. Indeed, these three companies - MARSA MAROC, HIKMA and CMT - are major players in industrial sectors traditionally considered to have a significant environmental impact in Morocco.

In addition, these companies stand out for their formal communication on their environmental practices, which makes it possible to analyze in depth how their sustainability performance is perceived by investors and potentially reflected on the stock market.

Data and methodology

The empirical analysis is based on secondary data collected from the annual reports of three Moroccan listed companies: HIKMA/PROMOPHARM, MARSA MAROC, and Compagnie Minière Touissit (CMT). The observation period covers 2020 to 2023. CO_2 emissions are measured in tonnes, while stock market performance is captured through annual changes in share prices expressed in Moroccan dirhams (MAD).

The study adopts an exploratory quantitative approach to examine whether reductions in CO_2 emissions are associated with positive stock price variations. First, Pearson's correlation coefficient is used for each company to assess the direction and strength of the linear association

between the two variables. Second, the data are restructured into categorical variables in order to test the association between environmental performance and stock market performance using Fisher's exact test and the chi-square test.

The variables are defined as follows:

- Environmental performance: reduction in CO_2 emissions (positive reduction = performance; negative reduction = counter-performance).
- Stock market performance: annual variation in share price (positive variation; negative variation).

The study tests the following hypotheses:

- **H0**: There is no statistically significant relationship between CO_2 emissions reduction and stock market performance.
- **H1**: There is a statistically significant relationship between CO_2 emissions reduction and stock market performance.

Because the final dataset includes only 9 observations (3 companies over 3 yearly intervals), the empirical results must be interpreted with caution. The very small sample size limits the statistical power of the tests and the generalizability of the findings. Therefore, the results should be considered exploratory.

Discussion of results

The empirical results do not reveal a statistically significant relationship between CO_2 emissions reduction and stock market performance in the selected sample of Moroccan listed companies.

At the company level, Pearson correlation coefficients suggest heterogeneous associations between environmental performance and stock price variation. However, none of these relationships can be considered statistically robust given the limited number of observations available for each firm. The results therefore do not support the existence of a stable linear relationship between the two variables in the studied sample.

To complement this analysis, the data were restructured into categorical variables and tested using Fisher's exact test and the chi-square test. The results indicate no statistically significant association between environmental performance and stock market performance in the pooled sample of 9 observations. Accordingly, the null hypothesis (**H0**) cannot be rejected.

These findings should be interpreted with caution. First, the sample size is extremely small, which reduces statistical power and increases the probability of non-detection of an existing

effect. Second, stock prices are influenced by many other factors, including firm profitability, investor expectations, macroeconomic conditions, sector-specific dynamics, and broader market sentiment. As a result, CO_2 emissions reduction alone may not be sufficient to explain annual stock price movements.

In the Moroccan context, the results may also reflect the relatively limited weight of environmental information in investors' decision-making. In the absence of strong regulatory pressure or mature ESG-sensitive capital markets, improvements in carbon performance may not yet generate a clear and immediate stock market response. Therefore, while the results do not show a significant relationship, they should not be interpreted as evidence that environmental performance is irrelevant, but rather as an indication that the relationship remains difficult to detect in this exploratory setting.

The correlation was calculated for each company independently, but the data from the three companies covering the three years of analysis were restructured and categorized:

- CO2 emissions reduction (Performance if greater than 0%; Counter-performance if less than 0%)

- Change in share price (Positive change if above 0%; Negative change if below 0%)

the chi-square and Fisher test were applied to the 9 obervations (3 companies over three years)

Tableau 1. Summary of correlation results by company

Company	Sector	Statistical test	Coefficient / statistic	Significance	Interpretation
HIKMA	Pharmaceutical	Pearson correlation	0.857	Not statistically significant	Positive association, but not robust
MARSA MAROC	Trade and transport	Pearson correlation	0.810	Not statistically significant	Positive association, but not robust
CMT	Mining	Pearson correlation	0.696	Not statistically significant	Moderate positive association, but not robust

Source: Authors.

Tableau 2. Association test on pooled sample

Test	Sample size	p-value	Decision at 10%	Decision at 5%	Decision at 1%
Fisher's exact test	9	0.206	Do not reject H0	Do not reject H0	Do not reject H0

Source: Authors.

The final sample includes only 9 observations, which substantially limits the power of statistical inference. For this reason, the results are reported as exploratory and should be interpreted with caution.

- Case 1: HIKMA/Pharmaceutical sector

The results of this regression analysis indicate that there is no statistically significant relationship between CO_2 emissions reduction and stock price variation in our data sample. Model fit is poor, with an R-squared of just 0.050, and the overall model is not significant ($p > 0.05$).

- Case 2: MARSA MAROC/Trade and transport sector

The results of this analysis show that the reduction in CO_2 emissions has no statistically significant impact on the variation in share prices in our data sample. The low R-squared and high p-value indicate that the model fails to capture a significant relationship between the variables.

- Case 3: CMT/Mining sector

The results indicate a moderate correlation between CO_2 emissions reduction and share price variation, but this relationship is not statistically significant ($p > 0.05$). The model does not sufficiently explain the variation in share price, suggesting that other factors not included in the analysis may be more decisive.

The results of Fisher's exact test and the Chi-square test, applied to restructured data, show no statistically significant association between the variable ReductionEmissionsCO2 "Environmental performance" and VarPrixAction "Stock market performance" in our sample of 9 observations.

By way of conclusion, it should be noted that these results could indicate that other factors influence share prices more than CO2 emission reductions, or that the relationship is more complex and requires a more elaborate model or additional data to be properly assessed.

In the Moroccan context, these results can be explained by the absence of binding regulations: on the one hand, companies may not be sufficiently incentivized to invest in CO2 emission reduction programs, and on the other hand, investors may not perceive these efforts as significant without a clear regulatory framework.

CONCLUSION

The analysis carried out on the sample did not reveal a statistically significant link between CO_2 emissions reduction and the stock market performance of the companies studied in Morocco. Otherwise, in the context of an emerging country like Morocco these results show that other factors play a more impactful role on stock prices.

In addition, the absence of strict environmental regulations could limit the impact of sustainability initiatives on stock market valuation.

List of abbreviations

GHG: Greenhouse gas

CO_2: Carbon dioxide

CH_4: Methane

N_2O: Nitrous oxide

GHG Protocol: Greenhouse Gas Protocol

ISO: International Organization for Standardization

GWP: Global Warming Potential

WRI: World Resources Institute

WBCSD: World Business Council for Sustainable Development

ESG: Environment, Social, Governance

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