Carbon Emissions and Firm Performance

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: This paper examines the effects of carbon emissions on the accounting and market-based performance of financial and non-financial firms in emerging economies. Data for 104 financial and 328 non-financial firms constituting 2591 observations operating in 22 emerging economies were collected from the Datastream database for the period 2011–2020. We applied OLS and 2SLS regression techniques to analyze the data. The results show that financial firms emit less carbon than their non-financial counterparts. The results further show that carbon emissions reduce firms' return on equity, Tobin's Q, Z-score, and credit rating. Our findings remain robust in different estimation techniques and alternative proxies of performance. Our results have some important policy implications for emerging economies.

Keywords: environmental performance ; carbon emission ; emerging economies ; firm performance

1. Introduction

This research aims to investigate the effect of firms' carbon emissions on performance for a large sample of financial and non-financial firms in emerging economies. More specifically, the research examines if firms' direct and indirect carbon emissions affect the return on assets, Tobin's' Q, Z-score, and credit rating, and if the results differ between financial and non-financial firms across regions. Further, this research attempts to examine if the effects of firms' carbon emissions vary between state-owned, rent seeking, and environment project financing firms.

Although developed countries are mostly responsible for the mounting carbon stock in the atmosphere, emerging countries are gradually evolving as leading emitters. Recently, emerging economies including Brazil, Russia, India, and China (BRICs) have experienced a rapid rise in GDP growth rate resulting from higher productivity as well as increased economic activities, which require a huge energy input to keep the nascent pace of economic growth stable. On the other hand, structural changes in economic activities accompanied by the augmented GDP growth rate have resulted in rapid urbanization. These effects combined lead to higher carbon emissions in the atmosphere [1][2][3]. A report published by the International Energy Agency [4] shows that the decline in emissions in advanced economies accounted for 10% in 2020 compared to 2019, mainly due to the disruptive economic activities caused by the COVID-19 pandemic. However, emissions from emerging economies declined on average only by 4% during the same period. China, the largest carbon emitter at present, experienced an increase in emissions in 2020 and in the first two quarters of 2021 [5][6]. This implies that achieving the target level of emission cut depends decisively on carbon reduction strategies in emerging countries.

Despite widespread importance, the impact of carbon emissions on the accounting and market-based performance of firms in emerging economies and the varying impact on financial and non-financial firms remain largely unexplored. Our paper aims to fill this important research gap. It is argued that carbon-intensive firms suffer financially due to various reasons. For example, carbon emissions increase firms' cost of capital, regulatory compliance, and litigation costs. Moreover, firms with a high carbon profile are required to pay a larger carbon premium under the ETS. On the other hand, customers hesitate to use products and services that are not environmentally friendly [7]. Furthermore, carbon emissions ruin firms' reputation, which results in a lower financial and market-based performance of high-carbon-emitting firms.

2. Literature Review and Hypothesis Development

Prior literature investigates the impact of carbon emissions on various attributes of firms [8][9][10]. For instance, Jung et al. [11], Kim et al. [9], and Li et al. [12] examined the impact of firms' carbon emissions on the cost of bank debt financing for Australian firms and found a positive association between them. In a similar fashion, Du et al. [13] for Chinese private-owned firms, El Ghoul et al. [14] for a sample of manufacturing firms in 30 countries, Kleimeier and Viehs [10] drawing evidence from 58 countries, and Nandy and Lodh [15] for US firms found consistent evidence that higher carbon emissions have a positive and significant effect on the cost of bank debt financing. Similarly, Chapple et al. [16] for a sample of 58 Australian listed firms, Griffin et al. [17] and Matsumura et al. [18] for S&P 500 firms, Johnston et al. [19] in the context of US electric firms, Lee et al. [20] using a sample of 362 firms, and Wen et al. [6] for Chinese corporate entities show that firms'

carbon emissions reduce equity value. Kabir et al. [8] provide evidence that carbon emissions increase firms' credit risk, which, in turn, lowers the credit rating of carbon-intensive firms [21].

Firms' carbon reduction also helps boost their financial return. Former vice president of the United States Al Gore [22] (p. 342) stated "3M, in its Pollution Prevention Pays program, has reported significant profit improvement as a direct result of its increased attention to shutting off all the causes of pollution it could find." This example clearly hints that firms can benefit from carbon mitigation strategies. The literature also provides supporting evidence. Busch and Hoffmann [23] examine the relationship between carbon mitigation and performance of the largest companies of the Dow Jones Global Index and report a positive association between them. Ganda and Milondzo [24] using a sample of 63 South African firms and Busch and Lewandowski [25] through a metadata analysis of 34 studies show a negative impact of carbon emissions on firms' financial performance. Similarly, Cucchiella et al. [26] found that appropriate control of emissions led to a higher profit for Italian firms by increasing demand and productivity. Dechezleprêtre et al. [27] show that the European Union Emission Trading Scheme (ETS) has helped reduce firms' carbon emissions, which, in turn, has led to an increase in firms' revenues. Lewandowski [28] illustrates that performance improvement is pronounced for firms with superior carbon performance but not for companies with inferior carbon performance. Alvarez [29] found evidence of a positive impact of carbon emissions on ROA but not on ROE.

The impact of firms' carbon emissions on performance has been argued from two interrelated perspectives. The first line of argument in the literature argues that firms' carbon emissions involve increased costs of compliance, litigation, and cleaning up, etc. which results in a decline in performance. Bauer and Hann [30] show that litigation risk is higher for firms that fail to mitigate emissions. Companies with a clean environmental profile are likely to face fewer regulatory burdens because of the lower probability of being punished for environmental delinquency. Palmer, Oates, and Portney [31] argue that costs imposed by some environment regulations can be so high that firms may face bankruptcy. Similarly, Chan, Li, and Zhang [32] report that the increased cost of complying with the European Union Emissions Trading System accounts for five to eight percent of the total material cost of carbon-intensive firms. Similarly, Pasurka [33], analyzing nine countries in Europe, North America, and Asia, reports that pollution abatement costs in 2000 ranged from one percent in Taiwan to five percent in Canada.

Increased production costs imposed by environmental regulations may result in a loss of firms' national and international competitiveness, primarily if countries differ in terms of stringency of environmental regulations. Porter and Linde [34] and Huang, Zhao, and Cao [35] provide evidence that stringent enforcement of environmental regulations accelerates the innovation of low-carbon technologies that require comparatively less energy inputs per unit, which, in turn, helps firms gain production efficiency. Moreover, firms with a low carbon profile are flexible and well prepared to adopt any regulatory changes that aim to restrict their carbon footprint.

Emissions are a negative externality. Hence, high-carbon-emitting firms are increasingly liable for internalizing negative externalities. Firms that fail to sufficiently commit to this social requirement face adverse social consequences. Frooman [36] argues that stakeholders possess a resource- 'withholding' capacity. For example, suppliers of funds can restrict the flow of finance, whereas regulatory authorities can deny the license or permit for an entity that fails to comply with certain environmental regulations. These events may require high-carbon firms to commit resources for compliance, environmental disaster management, and litigation settlement [37]. Ferris and McGartland [38] report that high-emitting industries including the pulp and paper, oil refinery, and steelmaking industries in the USA incurred regulatory compliance costs equivalent to one percent of their annual turnover in 2005, whereas the corresponding figure for all manufacturing plants was only 0.4 percent.

While the above stream of literature emphasizes on the additional costs incurred by carbon-intensive firms, the second line of argument regards the view that firms' carbon emissions reduce cash flows. Reputation and brand image positively impact firms' sales [39]. Owing to extensive media coverage and increased public awareness, firms' carbon profiles are known to a wider group of stakeholders who can significantly affect firms' reputation and revenue. For example, firms that fail to furnish sufficient tools to control emission and are reluctant to put adequate measures to decarbonizing the environment are not well perceived by stakeholders [20][40][41]. Society punishes such firms by withdrawing support, which may result in serious setbacks including a decline in sales, funding opportunities, and market competitiveness. Sanjuán et al. [42] in the context of Spanish buyers, and Sakagami et al. [43] analyzing the buying behavior of Japanese consumers show that customers are willing to pay a premium for green products. Furthermore, reputational risk also leads partner firms to severe business ties with the polluters. This could seriously disrupt the existing supply chain, leading to a substantial financial loss.

Compliance costs and reputational risks increase the credit risk of carbon-intensive firms by creating contingent liabilities. Credit rating agencies thus incorporate environmental elements in assessing firms' credit risk [21][44][45]. For example, S&P [46] reports that between 2015 and 2017, environmental and climate concerns affected corporate ratings in 717 cases, 10 percent of corporate rating assessments. Similarly, Thompson and Cowton [47] document that 60 percent of banks in the UK have incorporated environmental dimensions in their formal corporate lending policy. Since the debt market holds a significant share of corporate finance, it is highly likely that creditors provide benefit to low-emitting firms by charging low-carbon premiums and punishing high-carbon emitting firms by asking for higher default premiums. This indicates that firms with high carbon emissions, inter alia, suffer financially compared to their low-emitting counterparts. The above discussion leads to the following hypothesis

Hypothesis 1 (H1).s

Firms' carbon emissions are negatively related to financial and market performance.

3. Carbon Emissions and Firm Performance

The impact of firms' carbon emissions on performance has gained renewed interest from academia and policymakers, partly due to the rise in increased shareholder activism but mainly due to the unprecedented upsurge of carbon stock in the atmosphere. The increasing trend of anthropogenic emissions owing mainly to the rising activities of corporate firms and the resulting adverse economic and social consequences on human ecology have prompted stakeholders to scrutinize firms' carbon emissions and their impact on the firms' financial health. In this pursuit, this paper has attempted to examine the effects of firms' direct and indirect carbon emissions on their accounting and market-based performance. In so doing, we collected data from 22 emerging economies across six continents. An unbalanced panel of 2591 observations for the period 2011–2020 was analyzed applying the OLS and 2SLS regression methods. To dilute the firm- and country-level effects, we included firm-specific and macroeconomic variables in the model. In addition, the robustness of the results was checked using propensity score matching and applying alternative proxies for performance.

The results reveal that non-financial firms emit more carbon than their financial peers. The difference is more pronounced for direct carbon emissions than the indirect carbon emissions and for Middle Eastern countries compared to other regions. However, carbon emissions reduce return on assets and Tobin's Q for both types of firms, although the magnitude of the effect is higher for non-financial firms than their financial counterparts. Similarly, the effect of carbon emissions on stability is negative for both types of entities, but the stability of financial firms is affected more by carbon emissions than non-financial firms. Our results remain valid even if we apply alternative proxies for performance and estimation techniques.

These findings offer several policy implications for policymakers, managers, and investors. First, in most cases, financial firms are not equally disciplined compared to their non-financial peers. This conclusion is derived from the fact that the magnitude of negative impact of carbon emissions is more pronounced for non-financial firms than their financial counterparts. This can mainly be attributed to the lack of awareness of people regarding the carbon emitted by financial firms, which are considered clean and low polluters. However, our point of view is that emissions are emissions regardless of their sources of origin. Hence, financial firms are to be equally scrutinized for the greater interest of carbon mitigation plans. Emissions from financial firms are both direct and indirect. For the mitigation of direct emissions, financial institutions can consider constructing physical facilities that are energy efficient. For instance, branches can use solar power and equipment can be devised in such a fashion to consume less energy. For tackling indirect emission, financial institutions can finance eco-friendly firms at a discounted rate. Regulatory authorities can formulate suitable policies to achieve this objective. For example, a portion of the national climate fund can subsidize loans that are aimed at environmental projects and green firms. Moreover, carbon emissions are positively associated with financial instability. Hence, regulators can support financial stability by providing more incentives for investment in low-carbon-emitting technologies.

Second, firms' managers should consider carbon mitigation strategies seriously because carbon emissions negatively affect shareholder value. This means that managers can enhance shareholders' value by undertaking emission abatement policies to boost their financial and market performance. Managers are expected to be aware of their company's carbon emission strategies to protect them from a decline in profitability. They can strategize long-, medium-, and short-term carbon reduction targets commensurate with national and international goals. Moreover, carbon-cutting strategies help firms increase their credit score and financial stability, which may facilitate boosting investors' confidence in low-emitting firms. This may provide opportunities for firms to fund them at a lower cost.

Third, Research findings have important implications for investors. Firms profiled as having high carbon emissions receive lower credit ratings, which indicates an elevated default probability. Hence, investors are expected to follow the required precautions before investing in such firms. Moreover, the market value and profitability of firms decline with the increase in carbon emissions. As a result, investors should take firms' carbon emissions into their investment decisions. Research results also confirm that rent-seeking firms, firms that have higher general and administrative expenses, have higher emissions. Research have argued that firms with higher administrative expenses may suffer from a shortage of resources required for adopting carbon abatement technologies. Hence, investors should carefully consider such firms as a place for their valuable investments.

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