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Article

Sustainable Blueprint: Do Stock Investors Increase Emissions?

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Abstract: The lack of agreement on climate policies among stock-market investors has raised significant concerns about GHG-emission levels, likely reflected in asset pricing. This study uses annual data sourced from the World Bank from 1980 to 2019 to examine whether stock-market investments increase GHG emissions in Organization for Economic Co-operation and Development (OECD) countries. The study employs the panel-standard fixed effects and the Arellano-Bover and Blundell–Bond dynamic methods and shows that stock-investor confidence is critical for emissions reduction in OECD countries. Additionally, the results highlight the potential mechanism through which the stock market can influence emissions in the OECD countries. We recommend that investors re-evaluate the emissions criteria before selecting long stock portfolios. Additionally, there is a need for policy-makers to promote the preservation of environmental quality by carefully redesigning policies for stock-market investments.

Keywords: stock investors; carbon efficiency; stock price; dynamic panel analysis



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1. Introduction

It is not uncommon to see empirical studies suggesting that increases in income are associated with a decrease in carbon emissions. Perception is often cited as the hypothesis of the environmental Kuznets curve (EKC). However, the evidence for the EKC hypothesis is not only debatable but also warrants further investigation, as most studies on the EKC hypothesis have reported mixed evidence with various shapes being identified. These include (a) the U-shaped pattern (Gyamfi et al. 2021; Bibi and Jamil 2021), (b) the S-shaped pattern (Xie and Wu 2021; Shobande and Asongu 2021a; Guo et al. 2021), and (c) patterns with unknown shapes. Moreover, a review of these empirical studies highlights that some of them overlooked the possibility that stock-market development can critically affect climate policy, help to reduce carbon emissions, and improve environmental quality. The efficient market hypothesis (EMH) is another theory that explains how information included in stock prices reflects carbon disclosure. While the theoretical model and, more particularly, empirical tests of EMH have been equivocal, some studies have revealed evidence of a positive impact of carbon efficiency on asset returns (Jensen and Meckling 1976; Busch and Lewandowski 2018; Trinks et al. 2020; Shobande and Ogbeifun 2021; Shobande and Shodipe 2021). Busch and Lewandowski (2018) observed that economic mechanisms could have a positive relationship between carbon efficiency and market value. Dyck et al. (2019) presented a causal link between institutional shareholders and environmental and social costs. Trinks et al. (2020) looked at the effects of carbon efficiency on several financial performance indicators and found evidence that financial performance enhances carbon efficiency. Thus, bridging this knowledge gap is critical for environmental policy improvement and to boost investor confidence and stock management.

This study considers the case of the Organization for Economic Co-operation and Development (OECD) countries. Several factors warrant this inquiry. First, understanding how the stock market influences emissions is not only essential to build investor trust

but also to aid the OECD countries in successfully managing the variables associated with carbon-emission reduction. Second, the increasing stock-market instability in OECD countries can be attributed to the increase in the perceived importance of environmental, social, and governance (ESG) policies. Thus, investors need a better understanding of how the ESG approach affects investments before deciding whether to increase or decrease their portfolios. Third, the recent increase in energy consumption can be attributed to the paradigm shift to online stock transactions through information on communication technology and will likely increase emissions if not controlled. For example, the consistent use of information and communications technology is linked to the increased energy consumption, resulting in higher carbon emissions and the deterioration of environmental quality.

Studies show that stock-market developments can have both direct and indirect effects on emissions. Two direct effects can be explored between the stock-investment–emission nexus. (a) An increase in investment can increase productivity, which can further increase energy use and emissions (Alessi et al. 2021; Safi et al. 2021; Shobande 2021). Similarly, increased carbon emissions can pose a physical risk due to the increased potential for climate-related events, resulting in the irreversible loss of infrastructure assets. Such losses can induce market failure as businesses are exposed to risks affecting their market equity, having significant consequences for investors. (b) An increase in stock investment can help to promote technological innovation, aiding the realization of a sustainable environment without rising emissions (Shobande and Asongu 2021b, 2022). For indirect effects, investments could increase emissions, resulting in more stringent environmental regulations and higher emission costs, weakening market equity, and delaying investment (Hong et al. 2020; Shobande and Enemona 2021).

This study builds on the existing literature and makes the following contributions. It investigates the possible mechanism through which stock investors could elevate carbon emissions in OECD countries. By controlling for confounders, this study infers the causation link among the factors. The study addresses the potential endogeneity that is likely to arise due to sampling bias, simultaneity, and measurement error by employing an instrumental-variable approach based on the Arellano-Bover and Blundell–Bond dynamic methodologies. It finds that stock-investor confidence is critical for reducing emissions in the OECD countries. Additionally, it sheds light on the potential mechanism through which stock investors can affect emissions among OECD countries.

The remainder of this paper is organized as follows. Section 2 presents a concise literature review and the study’s hypotheses. Section 3 describes the data and methodology used in this study. Section 4 presents the results, and Section 5 concludes the paper with potential policy implications.

2. Literature Review

An overview of the evidence of the relationship between the stock market and emissions as a structure is presented below.

2.1. Theoretical Framework

The theoretical foundation of this study is based on the augmented EKC hypothesis. Three reasons motivated this consideration. First, the EKC hypothesis provides a means of assessing the implication of financial variables on emissions (Byrd and Cooperman 2018; Shobande and Ogebeifun 2022). Second, the hypothesis can help in analyzing the effect of other confounding variables that could have an impact on carbon emissions. For example, the level of economic activities that can be captured with income growth, market size and trading activities can be re-examined along with the financial variables of interest (Shobande and Enemona 2021; Gök 2020; Byrd and Cooperman 2018).

2.2. Related Work

2.2.1. Stock Investors and Emissions

The research into whether stock investors influence emissions is still in its early stages. Only a few studies have investigated this link. However, their results have been relatively mixed. A noteworthy example is a study by [Jaggi et al. \(2018\)](#), who empirically tested the importance of carbon information for investors in the Italian economy. They reported that the market reacts positively to carbon disclosures by firms. Similarly, studies in the United States and the United Kingdom also observed a positive relationship between stock investments, carbon disclosure and emissions ([Plumlee et al. 2015](#); [Matsumura et al. 2014](#); [Middleton 2015](#)). [Clarkson et al. \(2013\)](#), suggest that investors need more accurate details on a company's GHG-emissions results to refine their carbon-liability estimates.

Conversely, some studies have reported a negative effect of carbon disclosure on firm investment. [Lee et al. \(2015\)](#) suggested that investors question the reliability of carbon disclosure because they cast doubt on investment decisions and stock evaluations. [Bolton and Kacperczyk \(2021\)](#) suggested that institutional investors use exclusionary screening in a few key industries based on the direct emission rate. However, [Byrd and Cooperman \(2018\)](#) argued that investors and assets can be exposed to potential risks if carbon emissions are not considered in investment decisions. [Zafar et al. \(2019\)](#) used the panel-bootstrap-co-integration approach to examine the role of the stock market, banking-sector development, and renewable energy in carbon emissions in the G-7 and N-11 countries. They reported that the stock-market-development index positively affects carbon emissions in the G-7 and negatively in the N-11 countries.

2.2.2. Financial Development and Emissions

Several studies have also examined the role of financial development in emissions and have reported mixed evidence. [Zhang \(2011\)](#) examined the role of financial development in carbon emissions in China using the Granger causality test and variance decomposition. The author reported that financial development acts as an important driver of carbon emissions in the Chinese economy. [Zaidi et al. \(2019\)](#) studied the dynamic linkage between globalization, financial development, and carbon emissions within the Asian Pacific economic co-operation countries and reported that financial development reduced carbon emissions in both the short and long term. In Africa, [Tsaourai \(2019\)](#) discovered that financial development positively affects carbon emissions. [Jiang and Ma \(2019\)](#) reported that financial development positively affects carbon emissions based on their study on the role of financial development in carbon emissions in 155 developed, emerging, and developing countries. [Acheampong et al. \(2020\)](#) compared financial-market developments and carbon-emission intensity in 83 countries using a generalized method of moments (GMM). They reported that the impact of financial-market development on carbon-emission intensity differed across countries at different stages of financial development. [Shobande and Asongu \(2021a\)](#) assessed the causal link between financial development, human-capital development and climate change in eastern and southern Africa and reported that financial development negatively impacts carbon emissions. [Shen et al. \(2021\)](#) reported that financial development positively impacts carbon emissions in the Chinese economy based on their study on the role of natural resource rent, green investment, financial development, and energy consumption in mitigating carbon emissions in 30 Chinese provinces using a cross-sectionally augmented, autoregressive-distributed-lag model. [Li and Wei \(2021\)](#) consistently reported a positive relationship between financial development and carbon emissions in China. [Nguyen et al. \(2021\)](#) reported that stock-market capitalization and foreign direct investment could contribute to carbon emissions in G6 countries. [Khan et al. \(2021\)](#) discovered that financial development could help to reduce carbon emissions by studying the impact of financial development and energy consumption on environmental degradation in a panel of 184 countries using dynamic-panel analysis and a GMM estimator. [Xiong et al. \(2017\)](#) discovered that financial development could improve the environment in their study using regional panel data from 1997 to 2011. Using a meta-analysis, [Gök \(2020\)](#) reported that

financial development leads to environmental degradation. [Acheampong \(2019\)](#) observed that financial development helps firms to access the cheaper loans needed to provide environmentally friendly technology.

2.2.3. Stock Pricing and Emissions

Most studies examining the relationship between stock prices and emissions have reported mixed results. A prominent example is the study by [Griffin et al. \(2015\)](#), which reported that stock price positively responds to carbon emissions. [Kumar et al. \(2012\)](#) assessed the impact of the stock prices of clean-energy firms and oil and carbon markets using a vector-autoregressive analysis. They reported that stock prices have no meaningful impact on the carbon prices of the firms. [Farzin \(1996\)](#) reported that optimal pricing affects carbon control by determining the optimal pricing of environmental- and natural-resource use with stock externalities using a simple dynamic model. [Torre et al. \(2020\)](#) discovered that ESG positively affects the environment by analyzing the effects of the ESG index and stock returns. [Lorraine et al. \(2004\)](#) reported that the stock market in the United States responds positively to environmental-performance news. [Topcu et al. \(2020\)](#), investigated whether environmental degradation reacted to stock-market development in 60 developing countries from 1990 to 2014 and discovered that stock-market development decreased environmental degradation in these countries. [Paramati et al. \(2017\)](#) observed a negative relationship between stock-market development and emissions in G-20 countries. [Tamazian et al. \(2009\)](#) also reported a similar result in Brazil, Russia, Indonesia, and China.

2.2.4. Mediating Role of Energy—Emissions Nexus

Several studies that have examined whether energy use increases carbon emissions have yielded conflicting results. For example, [Zhang and Cheng \(2009\)](#) assessed the link between energy consumption, carbon emissions, and economic growth in China from 1960 to 2007 and discovered unidirectional causality flows from energy consumption to emissions. [Soytas et al. \(2007\)](#) investigated the effect of energy consumption and output on emissions in the United States and reported Granger causality from energy consumption to carbon emissions. [Dogan and Seker \(2016\)](#) observed that energy consumption contributed to emissions in OECD countries from 1975 to 2011. [Gozgor \(2017\)](#) reported a positive link between energy consumption and carbon emissions in a panel of 35 OECD countries between 1960 and 2013. [Zafar et al. \(2020\)](#) showed that energy consumption contributed to carbon emissions in OECD countries from 1990 to 2015. [Ozcan et al. \(2020\)](#) explored the dynamics of energy consumption, economic growth, and environmental degradation in a panel of 35 OECD countries from 2000 to 2014. They reported that economic growth and energy consumption could contribute to emissions. [Li et al.'s \(2021\)](#) examination of the effect of economic growth and energy, social, and trade structural changes on carbon emissions in 147 countries from 1990 to 2015 and highlighted that reducing energy intensity by increasing the share of renewable energy can help to reduce emissions.

2.2.5. Mediating Role of Income—Emissions Nexus

Several studies that have attempted to confirm the EKC hypothesis on the link between income and emissions have found mixed evidence. [Lau et al. \(2014\)](#) investigated the EKC hypothesis in a panel of 18 OECD countries from 1995 to 2015. They reported that an increase in income reduces carbon emissions. [Churchill et al. \(2018\)](#) reported evidence on the relationship between income and emissions by investigating the EKC hypothesis in OECD countries from 1870 to 2014. [Zaim and Taskin \(2000\)](#) showed that an increase in income can improve environmental quality in OECD countries. [Sommer and Kratena \(2017\)](#) discovered that non-linear income elasticity is associated with direct and indirect emissions by estimating the carbon footprint of European households and the income distribution in 59 countries. [Song \(2021\)](#) assessed the link between economic growth and carbon emissions using a panel-threshold estimator and reported carbon emissions in China reduces because of economic growth. [Baloch et al. \(2021\)](#) reported that emissions responded negatively to an

increase in economic growth in Pakistan from 1971 to 2018. [Burke et al. \(2015\)](#) investigated the short-term effect of economic growth on carbon emissions in 189 countries from 1961 to 2010 and found no evidence of an association between emissions and income elasticity.

2.2.6. Mediating Role of Trade–Emissions Nexus

Major studies on the pollution-haven hypothesis, which suggests a potential link between trade and emissions, have yielded mixed results. [Wang and Zhang's \(2021\)](#) investigation on the effects of trade openness on decoupling carbon emissions from economic growth in 182 countries from 1990 to 2015 showed that trade openness decreased carbon emissions. [López et al. \(2018\)](#) investigated whether trade from resource-rich countries from 1995 to 2009 avoided the existence of a global pollution-haven hypothesis and reported that international trade explains carbon saving.

2.3. Research Questions

In light of the above literature review, the purpose of this study is to examine whether investors' confidence, stock price and financial market impact the pressure on emissions. This study seeks to answer the following research questions.

Question 1

Does stock-market investors' confidence raise emissions?

This question is motivated by several factors. First, recent evidence has shown that environmental, social, and governance factors are becoming an important factor in stock investment. Second, there is concern that when stock investors perceive carbon risk, their investment behavior will change.

Question 2

Do stock prices affect emissions?

The efficient-market hypothesis states that stock price reflects all of the information needed in making investment decisions. [Mirzaee Ghazani and Jafari \(2021\)](#) suggested that stock price may not reflect carbon emissions, hence an emission-trading system can help to detect the capacity to produce certainty in emissions reduction. Similarly, it is necessary to analyze whether carbon-emission efficiency is genuinely represented in stock price.

Question 3

What role does the financial development index play in emissions?

Addressing the above questions can help the OECD in several ways. Firstly, investors' confidence a key motivating factor for raising capital and driving economic growth, but to know whether capital can trigger emissions is important for OECD countries. Moreover, the investors' confidence indicates whether to take more or less risk when investing in the stock market. It not only instils trust in investors, but it also poses a risk to the environment as businesses have access to funds to boost production, which results in increased emissions. Secondly, a proper understanding of the link between stock price and emissions can help policymakers in the formulation of the strategy needed to improve environmental quality in the OECD countries. Thirdly, the answers to the hypotheses could provide the evidence required to improve the position of financial institutions in credit-risk management, which will likely have an impact on environmental policy.

3. Data and Methodology

3.1. Data

The present study used a dataset that covers the period of 1980 to 2019 for 23 OECD countries, i.e., Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Mexico, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Turkey, the United Kingdom, and the United States. Following [Shobande and Ogbeifun \(2021\)](#) CO₂-emission data were obtained from the OECD statistics database.¹ The study uses the financial-development index (FD) developed by the International Monetary Fund (IMF) to capture the role of financial development in carbon

emissions. Stock-price proxy by share-price index and investor-confidence index was sourced from the OECD statistics. Trade openness, market size (proxy by GDP), inflation rate, and energy consumption were obtained from the WDI. The human-development index (HDI) was sourced from the UNESCO Institute for Statistics, whereas foreign-direct-investment inflows were collected from the United Nations Conference on Trade and Development (UNCTAD) statistics.

3.2. Methodology

3.2.1. Motivation

This study examines the role of stock investors in carbon emissions among the OECD countries. In doing so, three plausible hypotheses were formulated based on the argument in the existing literature. The empirical strategy is based on the standard-fixed-effects estimators, which help in controlling for the state fixed effects. However, this study addresses the potential problem of endogeneity by implementing the Arellano-Bover and Blundell-Bond dynamic methodologies. The dynamic-panel approach helps to settle the potential issue of reverse causality and measurement errors that are likely to affect the outcome of the study.

3.2.2. The Model

Our model is specified as follows.

$$CO_2 = . f(IC, FD, SP, MS, X)$$

where CO_2 is carbon emissions, IC is investor-confidence index, SP is stock pricing, FD is financial-development index, MS is market size X is vector of control variates (*inflation, energy consumption, human-development index, trade openness, and foreign direct investment*), see Appendix A.2.

Econometrically, this can be respecified:

$$CO_{2it} = \phi_0 + \sigma_1 IC_{i,t} + \sigma_2 SP_{i,t} + \sigma_3 FD_{i,t} + \sigma_4 MS_{i,t} + \alpha X_{i,t} + \mu_{i,t}$$

where i is index of country, t is time, and $\mu_{i,t}$ are the stochastic terms.

$$CO_{2it} = \phi_i + \sigma_1 CO_{2it} + \sigma_2 IC_{i,t} + \sigma_3 SP_{i,t} + \sigma_4 FD_{i,t} + \sigma_5 MS_{i,t} + \alpha X_{i,t} + \mu_{i,t}$$

where ϕ_i is a vector of individual effects, $\mu_{i,t}$ is the error term, and σ_{1-5} are parameters of the variable.

3.2.3. Empirical Strategy

The analysis of the study begins with the panel of the standard-fixed-effects (FE) estimator. The FE is a first-differencing transformation which helps to removed unobserved effects. While the FE can partially eliminate the unobserved fixed effect, the potential problem of endogeneity remains. To address the endogeneity issue, we implemented the Arellano-Bover/Blundell-Bond dynamic-panel approach. The dynamic-panel approach helps to resolve issues concerning endogeneity and measurement-related problems in the analysis.

4. Empirical Results

4.1. Summary Statistics

Table 1 reports a summary of the statistics indicating the mean values and their corresponding standard deviations. According to the descriptive statistics, the mean and standard deviation of the market size, investors' confidence, stock price, and financial-development index stood at 26,505.4 (14,480.3), 100.1 (1.62), 64.5 (60.3), and 0.59 (0.199) respectively.

Table 1. Descriptive Statistics.

Variable	Mean	Std. Dev.	Min	Max	Obs
CO2	8.545	3.982	1.6	20.3	920
IC	100.056	1.617	91.922	105.566	822
FD	0.59	0.199	0	0.958	897
SP	64.454	60.248	0	657.822	880
MS	26,505.424	14,480.279	2401.517	92,232.234	920
FDI	19,820.255	43,994.254	31,689.3	471,792	920
INF	6.238	13.096	−4.478	131.827	920
TO	66.247	34.096	16.014	239.215	920
EC	3987.388	1782.038	704.791	8455.547	828
HDI	0.861	0.067	0.583	0.957	690

4.2. Main Results

The purpose of this study was to examine whether investors’ confidence, stock price, and the financial-market index impact pressure on emissions. A two-panel approach was used. The first was the standard-fixed-effects estimator that helped to control for confounder and assumed country-fixed effects. The second was the Arellano-Bover/Blundell–Bond dynamic-panel estimator that helped in addressing the potential endogeneity problem.

Table 2 displays the typical fixed-effect results of the main variables of carbon emission while controlling for confounders. In column (1) the results indicate that investors’ confidence has a negative and statistical impact on carbon emissions. Similarly, a negative and statistical relationship exists between the market size and carbon emissions, such that a 10% increase in the market size will decrease carbon emissions by about 14.6 units. This result implies that a large market size makes it possible for firms to enjoy economies of scale when switching to environmentally friendly technology.

Table 2. Fixed-effect-panel-data estimations for 23 OECD countries, yearly data (1980–2019).

	Basic Model	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	29.04 *** (0.000)	30.24 *** (0.000)	27.36 *** (0.000)	29.53 *** (0.000)	−58.03 *** (0.000)	34.39 *** (0.000)	−58.12 *** (0.004)
IC_t	−0.0821 *** (0.001)	−0.0781 *** (0.002)	−0.0673 *** (0.008)	−0.0766 *** (0.002)	−0.0109 (0.433)	−0.0827 *** (0.001)	−0.0114 (0.939)
FD_t	−4.072 *** (0.000)	−3.855 *** (0.000)	−4.196 *** (0.000)	−4.163 *** (0.000)	−1.224 *** (0.000)	−4.404 *** (0.000)	−1.197 *** (0.002)
SP_t	0.109 * (0.062)	0.101 ** (0.024)	0.0464 (0.632)	0.104 (0.182)	0.278 *** (0.000)	0.273 *** (0.001)	0.186 *** (0.001)
MS_t	−1.455 *** (0.000)	−1.746 *** (0.000)	−1.385 *** (0.000)	−1.207 *** (0.000)	−1.149 *** (0.000)	−2.029 *** (0.000)	−0.341 (0.162)
FDI_t		0.158 *** (0.001)					0.0345 (0.205)
INF_t			−0.0208 *** (0.007)				−0.0023 (0.621)
TO_t				−0.902 *** (0.008)			0.479 * (0.052)

Table 2. Cont.

	Basic Model	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
EC_t					9.455 *** (0.000)		9.462 *** (0.000)
HDI_t						−0.636 (0.851)	−11.54 *** (0.000)
Obs.	787	748	787	787	718	648	550
F	21.53	18.82	18.81	18.79	310.6	24.62	152.6

Note: IC stands for investor-confidence index; FD stands for financial-development index; SP stands for stock price; FDI stands for foreign-direct-investment inflows; MS stands for market size; INF stands for inflation rate; TO stands for trade openness; EC stands for energy consumption; HDI stands for human-development index. The table presents the coefficient estimates and their *p*-values in the parentheses for the period of 1980–2019. *, **, *** denote levels of significance of 10%, 5% and 1%, respectively.

Furthermore, the financial-development index indicates a negative and statistically significant effect on carbon emissions such that a unit increase in the index will bring about a 4.07-unit decrease in carbon emissions. The plausible explanation for these findings can be attributed to the improved financial institutions and financial markets in OECD countries in the mid-1990s and early 2000s, as well as non-financial enterprises attempting to make their products and production more environmentally friendly.

However, the stock price shows a positive and significant impact on carbon emissions. This means that investors should be willing to pay lower prices for stocks in companies that face higher expenses and policy risks because of their carbon inefficiency.

In the subsequent columns, we included the control variables from our basic model. The estimates of critical variables maintain their sign and significance with slight changes in the magnitudes of the coefficients.

While the fixed effect helped in controlling for confounders, the potential problem of endogeneity remains. In the literature, there are three sources of endogeneity, notably: (a) sampling bias, (b) reverse causality, and (c) measurement error. We implement the Arellano-Bover/Blundell–Bond dynamic-panel statistical procedure to address this problem, and the results are reported in Table 3.

Table 3. Arellano-Bover/Blundell–Bond dynamic-panel-data estimations for 23 OECD countries, yearly data (1980–2019).

	Basic Model	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	−0.432 (0.731)	−0.968 (0.490)	−0.363 (0.773)	−0.936 (0.460)	−12.01 *** (0.000)	1.591 (0.273)	−16.60 *** (0.000)
$CO2_{t-1}$	0.950 *** (0.000)	0.940 *** (0.000)	0.946 *** (0.000)	0.941 *** (0.000)	0.752 *** (0.000)	0.926 *** (0.000)	0.621 *** (0.000)
IC_t	−0.0414 *** (0.000)	−0.0365 *** (0.001)	−0.0447 *** (0.000)	−0.0470 *** (0.000)	0.0343 *** (0.000)	−0.0319 *** (0.004)	−0.0226 ** (0.033)
FD_t	−0.214 *** (0.007)	−0.0359 (0.909)	−0.305 ** (0.047)	−0.262 ** (0.011)	−0.826 *** (0.001)	−0.552 * (0.067)	−1.631 *** (0.000)
SP_t	0.0870 ** (0.023)	0.0826 * (0.052)	0.0613 ** (0.033)	0.0580 ** (0.038)	0.0907 ** (0.010)	0.0275 ** (0.018)	0.00495 (0.912)
MS_t	−0.371 *** (0.000)	−0.232 ** (0.020)	−0.400 *** (0.000)	−0.206 ** (0.030)	−0.899 *** (0.000)	−0.531 *** (0.008)	−0.333 (0.102)
FDI_t		0.0128 (0.528)					0.0345 (0.205)

Table 3. Cont.

	Basic Model	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
INF_t			−0.0071 * (0.078)				−0.0023 (0.621)
TO_t				−0.382 *** (0.001)			0.479 * (0.052)
EC_t					2.307 *** (0.000)		9.462 *** (0.000)
HDI_t						0.932 (0.546)	−5.666 *** (0.001)
Obs.	776	737	776	776	707	648	550
Wald chi2	7789.7	6404.3	7820.4	7829.2	8591.1	5096.3	4964.7

Note: IC stands for investors’ confidence index; FD stands for financial development index; SP stands for stock price; FDI stands for foreign direct investment inflows; MS stands for market size; INF stands for inflation rate; TO stands for trade openness; EC stands for energy consumption; HDI stands for human development index. The table presents the coefficient estimates and their *p*-values in the parentheses for the period of 1980–2019. *, **, *** denote levels of significance of 10%, 5% and 1%, respectively.

After correction for potential issues of endogeneity, the results indicate that the lagged value of the carbon emission shows potential divergence to equilibrium as it was found to be positive and statistically significant. Notably, the sign and significance of the main variables are similar to the results from the fixed-effect estimation, with a substantial decline in size and magnitude.

4.2.1. Theoretical Implications

A rising body of research on physical and transition hazards is attempting to determine if markets can price and absorb climate concerns. The roadblocks to pricing transition risk are carbon exposure and the difficulties in detecting and quantifying the climate risk of investment. Moreover, the transition to net-zero carbon emissions could have an influence on financial risks, investment shifts, financial stability, and macroeconomic performance. Our findings reveal that the transition to a net-zero-carbon economy creates long-term value by allowing the financial system to distribute previously unheard-of quantities of cash to sustainable businesses that use green processes and technology. It also allows stock investors to change their behavior based on the level of carbon disclosure and the perceived risk of climate change in the stock market.

4.2.2. Practical Implications

Our findings have several practical implications. First, investors who consider carbon emissions in their investment plans may be able to utilize their power as shareholders to encourage corporate action on environmental issues. Second, improved regulatory quality can help the financial markets to move in the direction of net-zero carbon investments. Third, the stock market can be used by international communities and policymakers to monitor carbon disclosure and sanction emitters.

5. Conclusions and Policy Implications

The debate among stock-market investors to reconsider the impacts of market development on emissions has continued to trigger conflicts among stakeholders. This study examines whether stock-market investors increase emissions in OECD countries. The study employs the panel-standard fixed effects and Arellano-Bover and Blundell–Bond dynamic methods and finds that stock investor confidence plays a critical role in reducing carbon emissions in OECD countries. Additionally, it highlights the potential mechanism through which the stock market can influence emissions through energy consumption, technological innovation, and governance effectiveness. The findings are consistent with earlier study by (Kumar et al. 2012; Jiang and Ma 2019; Byrd and Cooperman 2018; Shobande 2021). The

analysis of the study has a number of implications for OECD countries, notably: Firstly, the evidence presented above strongly supports the hypothesis that a rise in the stock-investor-confidence index will help in the reduction in emissions. This means that stock-investors' confidence can be used to control emissions by effectively tracking demand growth and anticipating economic turning points. Secondly, our analysis indicates that the financial-development index negatively influences emission. This means that a strong financial sector will assist in the provision of capital through efficient intermediation between lenders and borrowers, as well as the development of innovative products to reduce carbon emissions. Thirdly, evidence indicates that stock price influences emissions. It is obvious that rising stock prices result in rising emissions. Future studies can consider the responses of the consumer-confidence index to carbon emissions.

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Appendix A

Appendix A.1. Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) CO ₂	1.000									
(1) CO ₂	−0.032	1.000								
(1) CO ₂	0.455	−0.010	1.000							
(4) SPI	−0.032	0.142	0.133	1.000						
(5) GDP	0.295	−0.004	0.661	0.159	1.000					
(6) FDI	0.388	0.027	0.386	0.020	0.350	1.000				
(7) INF	−0.264	0.150	−0.399	−0.153	−0.345	−0.091	1.000			
(8) TO	−0.061	0.062	0.095	−0.017	0.336	−0.058	−0.147	1.000		
(9) EC	0.786	−0.021	0.437	−0.128	0.467	0.325	−0.328	0.036	1.000	
(10) HDI	0.461	−0.058	0.704	0.135	0.832	0.239	−0.634	0.297	0.621	1.000

Appendix A.2. Definition and Source of Variables

Variables	Signs	Definition	Source
Foreign direct investment	FDI	Foreign direct investment inflows (US dollars at current prices in millions)	UNCTAD
Market size	MS	Gross domestic product: Total and per capita, current and constant (2015) prices, annual	UNCTAD
Trade openness	TO	Trade (% GDP)	WDI

Variables	Signs	Definition	Source
Investors' confidence	IC	Business confidence index	OECD
Inflation	INF	Inflation, GDP deflator (annual %)	WDI
Human development index	HDI	Human development index	UNESCO
Carbon emission	CO ₂	CO ₂ emissions (metric tons per capita)	OECD
Energy consumption	EC	Energy use (kg of oil equivalent per capita)	WDI
Financial development	FD	Financial development index	IMF
Stock price	SP	Share price index	OECD

Note

¹ We omitted Iceland from the study due to a lack of data for investors' confidence.

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