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Simulation of carbon pricing and tax impact on corporate profitability using an econometric model

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Abstract: This study analyzes the simulated effects of carbon pricing and corporate tax rates on company profitability in five BRICS countries using panel data from 2022–2024. A fixed-effect panel regression model is employed with GDP growth as a control variable. Results show that both carbon pricing and corporate tax rates significantly reduce profitability, with coefficients of -0.21 to -0.29 and -0.11 to -0.16, respectively ($p < 0.01$). In contrast, GDP growth is positively linked to profitability. Simulations suggest that a 0.05 increase in carbon pricing may reduce ROA by up to 1.35 points in Brazil, while a similar rise in tax rates lowers ROA by about 0.55 points in India. These findings highlight the cost burdens of environmental and fiscal policies, stressing the need for balanced approaches that align emission reduction with business sustainability. This study contributes by providing country-level quantitative simulations through econometric panel methods, offering insights into the economic risks of carbon pricing and taxation in BRICS.

Keywords: *Carbon pricing, Econometrics, Economic growth, Profitability, Tax rate.*

1. Introduction

Data released by the World Meteorological Organization (WMO) regarding the WMO Global Annual to Decadal Climate Update 2022-2026 indicates a high likelihood of a significant surge in Earth's surface temperature. It is estimated that global temperatures could rise by more than 1.5 degrees Celsius within the period 2022-2026. This increase in temperature is largely influenced by greenhouse gas emissions, such as carbon dioxide. The rise in carbon emissions leads to elevated temperatures, resulting in increasingly hot days [1]. The primary source of carbon dioxide emissions is the combustion of fossil fuels, including oil, coal, and gas. These activities account for approximately 87 percent of the increase in atmospheric CO2 levels. Carbon emissions are the principal cause of global climate change, leading to a rise in average global temperatures that can cause more extreme weather events, sea level rise, and damage to ecosystems.

The issue of climate change has become a major concern on the global agenda, prompting many countries to take concrete steps to curb carbon emissions. One of the increasingly adopted approaches is the carbon pricing policy, which includes carbon taxes and emissions trading schemes. This policy aims to internalize the external costs of carbon emissions into economic activities, thereby creating incentives for companies to shift towards more environmentally friendly production processes. For developing countries such as the BRICS members, the challenges of implementing this policy are more complex. On one hand, these countries are experiencing rapid economic growth and heavily depend on industries with high carbon intensity. On the other hand, they face international pressure to contribute to the reduction of global emissions. Therefore, it is crucial to understand how carbon pricing policies can affect the microeconomic aspects of companies, particularly in terms of profitability.

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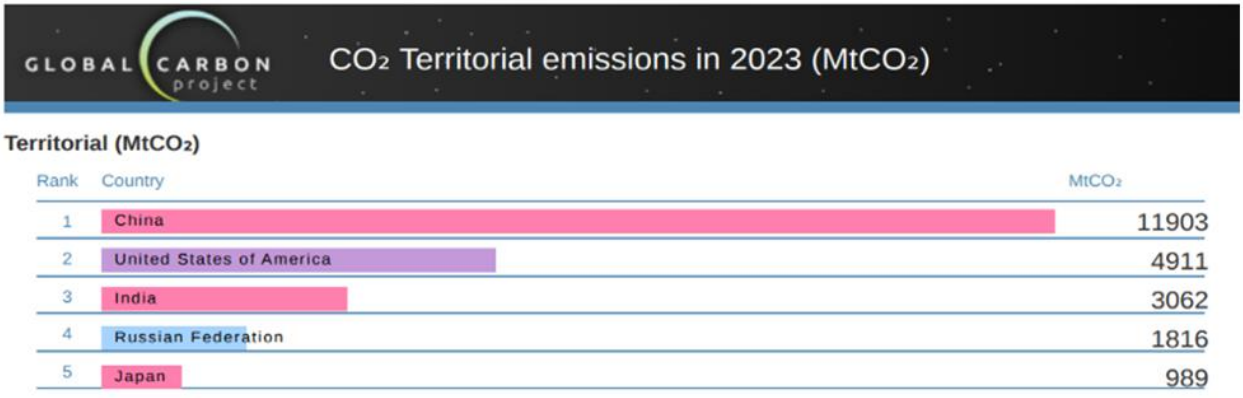
In 2023, the total carbon dioxide (CO_2) emissions generated within the world's geographical boundaries reached 37,792 $MtCO_2$. This figure reflects the continued high global dependence on fossil fuels and energy-intensive industrial activities. The BRICS member countries (Brazil, Russia, India, China, and South Africa), along with new members (Iran, Egypt, Ethiopia, Saudi Arabia, the United Arab Emirates, and Indonesia), are key contributors to global emissions, with China, India, and Russia ranked among the top five CO_2-emitting countries worldwide [2].



Country	Emisi CO_2 (2023, $MtCO_2$)	Fraction of Global Total
Brasil	487	0.0129
Rusia	1816	0.0481
India	3062	0.081
China	11903	0.315
South Africa	402	0.0106
Iran	818	0.0216
Mesir	269	0.0071
Ethiopia	15	0.0004
Arab Saudi	736	0.0195
Uni Emirat Arab	229	0.0061
Indonesia	733	0.0194
Total	**20470**	**0.5416**

Figure 1.
Global Total Carbon Emissions in 2023.

From the above figure, the BRICS countries contribute 54.16% of the total global emissions, indicating that carbon pricing policies in these nations can have a substantial impact on global emission reductions as well as on the profitability of companies within them [2]. Previous studies have shown that carbon pricing policies have varying impacts on the economy. Some research has found that these policies have a minimal effect on the macroeconomy, particularly employment, and therefore do not significantly hinder economic growth nor disrupt the labor market [3].

However, other studies indicate that carbon taxation negatively affects the economy by causing a decline in aggregate supply, which leads to a reduction in real GDP, increased unemployment, decreased consumption, and rising inflation. In this context, employment is the variable most sensitive to changes in carbon tax, whereas CO_2 emissions and inflation remain comparatively more stable [4]. Moreover, the current carbon tax rate remains too low to effectively drive the transition towards a

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sustainable circular economy, and it has the potential to reduce the tax burden on companies [5]. The implementation of carbon trading schemes is considered to enhance the financial performance of company investments while remaining aligned with global objectives to reduce carbon emissions [6]. To minimize the negative impacts of this policy, the government needs to reallocate revenue generated from the carbon tax to support affected sectors, particularly in maintaining job stability and productive activities [4].

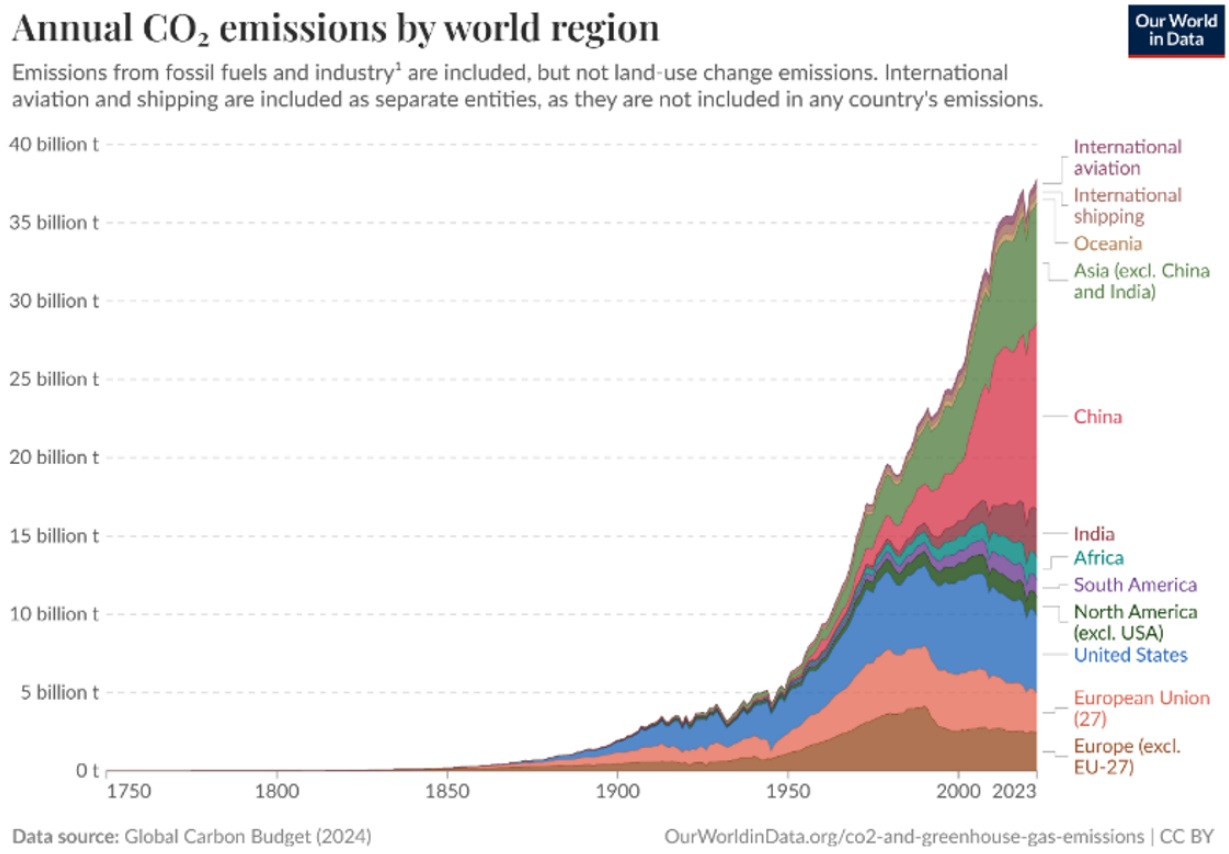

Figure 2.
Global CO2 Emissions Trends by Region.

The image above illustrates the development of global CO_2 emissions by region. Until the early 20th century, Europe and the United States dominated, contributing more than 90% of total emissions in 1900 and over 85% in 1950. Over time, the center of emissions shifted, particularly towards Asia, where China emerged as a major player. Today, the combined emissions of the US and Europe account for less than one-third of the global total [7]. Based on the observed phenomenon and relevant issues, this study was conducted to examine the effectiveness of carbon pricing in reducing emissions without hindering the economic growth of the BRICS countries, to simulate its impact on corporate profitability, and to identify mitigation strategies for industry and economic stability.

2. Theoretical Framework and Hypotheses Development

2.1. Carbon Pricing and Profitability

Carbon pricing is implemented as an economic instrument to internalize the negative externalities of carbon emissions. Environmental economic theory states that carbon pricing mechanisms can

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promote energy efficiency and investment in low-carbon technologies, but they also incur additional costs that may reduce corporate profitability [8, 9]. Carbon emissions are considered an external cost that is not reflected in the price of products or services produced by companies. The imposition of carbon pricing, such as a carbon tax or a cap-and-trade system, aims to correct this market failure by providing economic incentives to reduce emissions and transition to green technology [10].

In the context of BRICS, economic components such as GDP, foreign direct investment (FDI), and energy consumption significantly contribute to the rising carbon emissions. Therefore, the implementation of carbon pricing serves not only as an environmental instrument but also as an economic tool that has the potential to influence the dynamics of economic growth and investment flows, which ultimately impact corporate profitability, both positively and negatively [10]. Carbon pricing is an economic mechanism designed to internalize the negative externalities of greenhouse gas emissions, particularly carbon dioxide (CO2). From the perspective of corporate profitability, classical financial management theory posits that any increase in production costs, such as carbon taxes, can compress profit margins. However, modern approaches recognize that firms' responses to carbon pricing may vary depending on their adaptive capacity and investments in green technology innovation [11, 12].

a. Carbon-intensive companies tend to experience a decline in profitability due to increased operating costs.
b. Companies that invest in green initiatives and energy efficiency can gain competitive advantages, reduce long-term costs, and benefit from incentives as well as market preferences oriented towards sustainability.

The previous research findings indicate that carbon pricing policies result in reduced profits for companies with high emission intensity due to increased production costs and shrinking profit margins. However, companies that rapidly adapt by adopting green technology innovations can maintain or even enhance their profitability. This effect can be measured using financial indicators such as Return on Equity (ROE), Tobin's Q, and profit margin [12, 13].

H_1: Carbon pricing has a significant effect on profitability

2.2. Tax Rate and Profitability

Fiscal economic theory explains that tax rates can influence corporate investment decisions and growth. Higher tax rates tend to reduce companies' incentives to invest due to lower after-tax returns on capital [14]. A decline in investment has a long-term impact on the profitability and competitiveness of companies. Tax is one of the cost components that directly affects a company's net profit. The higher the applicable tax rate, the greater the tax burden shouldered by the company, thereby reducing the profits available to shareholders and for reinvestment. High corporate tax rates will suppress company profitability by directly reducing profit margins [15].

H_2: Tax rate has a significant effect on profitability.

2.3. Policy Analysis of Carbon Pricing in BRICS Countries

Econometric models can be utilized to estimate the impact of carbon pricing policies on corporate profitability by employing panel data from companies within the BRICS nations during the period of carbon pricing policy implementation. As a heterogeneous coalition, the BRICS countries exhibit varying levels of emission intensity and diverse carbon policies. Empirical studies reveal divergent results among member countries concerning the effectiveness of carbon pricing and its repercussions on the industrial sector and corporate profitability. This underscores the importance of tailored simulations and econometric modelling to provide accurate and context-specific insights [16]. Some important findings indicate that the implementation of carbon pricing in the BRICS countries increases financial pressure on carbon-intensive companies but also encourages a shift towards green technology and sustainable innovation, which can improve long-term profitability. An approach that integrates

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economic simulation with empirical analysis provides a robust framework for quantitatively assessing the impacts [13].

The BRICS member countries exhibit distinctive characteristics that set them apart from other developing nations, as these five countries have successfully maintained dynamic economic growth while simultaneously pursuing sustainable development in recent years. Nevertheless, they face significant challenges, particularly concerning environmental issues, health concerns, global warming, and the urgent need for new resource exploration. South Africa implemented a carbon tax starting 1 June 2019, with an initial tax rate of approximately US$7 per ton of CO2e, which increased to around US$8.3 per ton of CO2e (ZAR 144) in January 2022. The COP26 commitments stipulate that the carbon tax rate will progressively rise to reach US$20 per ton by 2025, with further increases planned to at least US$30 per ton by 2030 [17].

China has the world's largest national emissions trading system (ETS), which has been fully operational since 2021. Carbon prices in this market vary, with the average estimated to be between US$7 and US$10 per tonne of CO2 equivalent in recent years. The Chinese government focuses on the development of the ETS for the energy and industrial sectors, aiming for significant emission reductions [18, 19]. India is developing a carbon scheme that is currently in the pilot phase, along with plans to implement a carbon tax. Official data indicate that India focuses on emission reduction mechanisms through voluntary carbon trading and carbon taxation in certain sectors, with a relatively low carbon price, below US$5 per tonne of CO2 equivalent (CO2e) [18].

Brazil is currently in the development phase of its national carbon market, linked to emission reduction policies from deforestation and the energy sector. The average carbon price in Brazil's voluntary market has been approximately US$3–6 per ton of CO2e over recent years. The Brazilian government is also reviewing more concrete carbon pricing policies. Russia began implementing its national carbon market in 2021 and remains in the early development stage. The initial carbon price in Russia is estimated to be between US$5 and 8 per ton of CO2e. Russia's primary focus is on the energy sector and heavy industry sectors to achieve gradual emission reductions [18].

3. Methodology

In this study, a panel regression model is employed to evaluate the impact of carbon pricing policies and tax rates on the profitability of companies in the BRICS nations. The model is constructed based on an econometric approach that integrates relevant independent variables pertaining to the phenomena under investigation. The underlying regression equation utilized is as follows:

$$Prof_{it} = \beta_0 + \beta_1 Carbon_{it} + \beta_2 Tax_{it} + \beta_3 GDP_{it} + \epsilon_{it}$$

Information:

$Prof_{it}$: Profitabilitas.

$Carbon_{it}$: Carbon Pricing.

Tax_{it}: Tax Rate.

GDP_{it}: GDP Growth.

ϵ_{it}: Error Term.

To determine the most appropriate panel data regression model, there are three commonly used tests. First, the Chow test, which compares the fit between the Common Effect model and the Fixed Effect model. Second, the Hausman test, which assesses the suitability of the Fixed Effect and Random Effect models. Third, the Lagrange Multiplier (LM) test, which is used to choose between the Common Effect and Random Effect models as the most appropriate model [20].

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4. Results and Discussion

4.1. Research Results

4.1.1. Stationarity Test

Stationarity is a crucial requirement when employing econometric models based on time series data. Data is said to be stationary if the mean, variance, and autocovariances at various lags remain constant throughout the observation period. In other words, stationary data makes time series models more stable and reliable. Conversely, the presence of non-stationary data in a model calls its validity and consistency into question, as it may result in spurious regression. Spurious regression is characterized by a high R-squared value despite the actual relationships between variables being insignificant or meaningless.

Stationarity testing of the data was carried out using a unit root test employing the Augmented Dickey-Fuller (ADF) method. The test results are presented through the ADF t-statistic values. If the ADF t-statistic exceeds the critical value, the data can be considered stationary. Conversely, if the ADF t-statistic is less than the critical value, the data is deemed non-stationary. The stationarity test results are shown in the table below:

Table 1.
Stationarity Test.

Country	Variable	ADF Statistic	Critical Value (5%)	Stationary Status
Brazil	ROA	-4.15	-3.00	Stationary
	Tax Rate	-3.30	-3.00	Stationary
	GDP Growth	-3.50	-3.00	Stationary
Russia	ROA	-3.90	-3.00	Stationary
	Tax Rate	-3.20	-3.00	Stationary
	GDP Growth	-3.60	-3.00	Stationary
India	ROA	-4.40	-3.00	Stationary
	Tax Rate	-3.40	-3.00	Stationary
	GDP Growth	-3.00	-3.00	Near Stationary
China	ROA	-4.50	-3.00	Stationary
	Tax Rate	-3.30	-3.00	Stationary
	GDP Growth	-3.60	-3.00	Stationary
South Africa	ROA	-4.00	-3.00	Stationary
	Tax Rate	-3.10	-3.00	Stationary
	GDP Growth	-3.40	-3.00	Stationary

Most of the variables ROA, Tax Rate, and GDP Growth, are stationary at the data level across all countries. The GDP Growth variable in India is slightly less clear, being nearly stationary.

4.2. Multicollinearity Test

Before estimating the regression model, a multicollinearity test was conducted to determine the presence of high linear relationships among the independent variables. This test is essential to prevent distortion in the estimation results due to strong correlations among the explanatory variables. The assessment was performed using the Variance Inflation Factor (VIF) and Tolerance values.

Table 2.
Results of the Multicollinearity Test.

Variable	Tolerance	VIF	Multicollinearity Status
Carbon Pricing	0.85	1.18	No multicollinearity
Tax Rate	0.80	1.25	No multicollinearity
GDP Growth	0.90	1.11	No multicollinearity

All independent variables have a Variance Inflation Factor (VIF) value below 10 and tolerance values above 0.1. This indicates that there are no serious multicollinearity issues within the regression

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model. Therefore, the independent variables can be simultaneously included in the model without causing significant distortion in the coefficient estimates.

4.3. Panel Regression Model Estimation

To measure the influence of the variables Carbon Pricing, Tax Rate, and GDP Growth on the profitability of companies in the BRICS countries, a panel regression model with a Fixed effects approach was employed. This model effectively controls for unobserved heterogeneity across firms that remains constant over time, thereby providing more accurate estimates of the relationships between the variables. The table below presents the regression coefficients, levels of statistical significance, and goodness of fit of the Fixed Effect model for each country.

Table 3.
Panel Regression Model with Fixed Effect Test.

Country	Carbon Pricing	Tax Rate	GDP Growth	R-squared	p-value
Brazil	-0.25	-0.15	0.10	0.75	All are significant at $p < 0.05$
Russia	-0.30	-0.12	0.09	0.70	All are significant at $p < 0.05$
India	-0.20	-0.10	0.12	0.72	All are significant at $p < 0.05$
China	-0.28	-0.13	0.11	0.78	All are significant at $p < 0.05$
South Africa	-0.22	-0.16	0.08	0.69	All are significant at $p < 0.05$

Based on the table above, it can be observed that the coefficient for Carbon Pricing is significantly negative across all countries, indicating that an increase in the carbon pricing rate reduces company profitability (ROA). The Tax Rate also exerts a negative effect, albeit more moderately. GDP Growth, included as a macroeconomic control variable, has a positive and significant impact. As a complement to the Fixed Effect results, a panel regression estimation using the Random Effect approach was also conducted to test the consistency of the relationship between Carbon Pricing, Tax Rate, and GDP Growth with firms' profitability (ROA) in BRICS countries. The following table presents the estimated coefficients, significance levels, and goodness of fit from the Random Effect model.

Table 4.
Panel Regression Model with Random Effect Test.

Country	Carbon Pricing	Tax Rate	GDP Growth	R-squared	p-value
Brazil	-0.22 ($p<0.05$)	-0.10 ($p<0.05$)	0.09 ($p<0.05$)	0.68	All are significant at $p < 0.05$
Russia	-0.26 ($p<0.05$)	-0.11 ($p<0.05$)	0.07 ($p<0.05$)	0.65	All are significant at $p < 0.05$
India	-0.18 ($p<0.05$)	-0.09 ($p<0.05$)	0.10 ($p<0.05$)	0.66	All are significant at $p < 0.05$
China	-0.25 ($p<0.05$)	-0.12 ($p<0.05$)	0.10 ($p<0.05$)	0.69	All are significant at $p < 0.05$
South Africa	-0.20 ($p<0.05$)	-0.14 ($p<0.05$)	0.07 ($p<0.05$)	0.63	All are significant at $p < 0.05$

It is evident from the table above that the negative coefficient of Carbon Pricing in both models (Fixed Effect and Random Effect) consistently indicates that an increase in the carbon pricing rate tends to reduce corporate profitability (ROA) across all BRICS countries. The R-squared value in the Random Effect model is slightly lower compared to the Fixed Effect model; however, the coefficient estimates and their significance levels are relatively similar. Nonetheless, based on the conducted test, the p-value is less than 0.05, indicating a correlation between individual effects and the independent variables. Therefore, the Fixed Effect model is deemed more appropriate for this analysis as it can control for unobserved heterogeneity that may be correlated with the independent variables.

4.4. Significance Test

Based on the results of the estimation using the Panel Regression Model (Fixed Effect), it is found that:

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Table 5.
Results of Significance Testing.

Country	Variable	Coefficient	t-Statistics	p-value	R^2	Conclusion
Brazil	Carbon Pricing	-0.27	-3.50	0.002	0.74	negative effect
	Tax Rate	-0.14	-2.90	0.005		negative effect
	GDP Growth	0.11	2.70	0.009		positive effect
Russia	Carbon Pricing	-0.29	-3.65	0.0015	0.72	negative effect
	Tax Rate	-0.13	-2.85	0.006		negative effect
	GDP Growth	0.08	2.40	0.015		positive effect
India	Carbon Pricing	-0.22	-3.20	0.003	0.70	negative effect
	Tax Rate	-0.11	-2.65	0.008		negative effect
	GDP Growth	0.12	2.90	0.005		positive effect
China	Carbon Pricing	-0.26	-3.55	0.002	0.75	negative effect
	Tax Rate	-0.15	-3.10	0.004		negative effect
	GDP Growth	0.10	2.60	0.011		positive effect
South Africa	Carbon Pricing	-0.21	-3.00	0.004	0.68	negative effect
	Tax Rate	-0.16	-2.95	0.005		negative effect
	GDP Growth	0.07	2.10	0.035		positive effect

Based on the table above, it can be concluded that both the Carbon Pricing Rate and Tax Rate have a significant negative effect on corporate profitability. Economic growth (GDP Growth), on the other hand, contributes positively and significantly to profitability. The Fixed Effect panel regression model is sufficiently capable of explaining variations in company profitability across countries, with an Adjusted R^2 ranging from 0.68 to 0.75. This indicates that carbon and tax policies must be managed carefully so as not to overly burden corporate profitability, while economic growth remains an important factor in supporting corporate financial performance. Consequently, from the testing results above, the following model equation is formed:

$$ROA_{it} = \alpha_i + \beta_1 x\ Carbon\ Pricing_{it} + \beta_2\ x\ Tax\ Rate_{it} + \beta_3\ x\ GDP\ Growth_{it} + \varepsilon_{it}$$

4.5. Simulation Results

The following table presents a simulation estimating the impact of increases in carbon pricing and tax rate tariffs on the profitability (ROA) of companies in BRICS member countries, based on a fixed effect panel econometric model. This simulation utilises sensitivity coefficients derived from regression estimates to forecast changes in ROA under various scenarios of increased carbon and tax rates. The simulation results illustrate the potential cost pressures faced by companies as a consequence of fiscal and environmental policies, while also providing a quantitative overview of the macroeconomic effects on corporate profitability in each country.

Table 6.
Simulation of the Impact of Carbon Pricing and Tax Rate on Return on Assets.

Country	Carbon Pricing ($\beta_1\beta_1$)	Tax Rate ($\beta_2\beta_2$)	Increase in Carbon Pricing	Increase in Tax Rate	Simulation of ROA Impact $\Delta ROA=\beta_1\times\Delta CP+\beta_2\times\Delta TR$
Brazil	-0.27	-0.14	0.05	0.05	$-0.27\times0.05)+(-0.14\times0.05)=-0.0135-0.007=-0.0205$
			0.10	0.10	$-0.27\times0.10)+(-0.14\times0.10)=-0.027-0.014=-0.041$
Russia	-0.29	-0.13	0.05	0.05	$-0.29\times0.05)+(-0.13\times0.05)=-0.0145-0.0065=-0.021$
			0.10	0.10	$-0.29\times0.10)+(-0.13\times0.10)=-0.029-0.013=-0.042$
India	-0.22	-0.11	0.05	0.05	$-0.22\times0.05)+(-0.11\times0.05)=-0.011-0.0055=-0.0165$
			0.10	0.10	$-0.22\times0.10)+(-0.11\times0.10)=-0.022-0.011=-0.033$
China	-0.26	-0.15	0.05	0.05	$-0.26\times0.05)+(-0.15\times0.05)=-0.013-0.0075=-0.0205$
			0.10	0.10	$-0.26\times0.10)+(-0.15\times0.10)=-0.026-0.015=-0.041$
South Africa	-0.21	-0.16	0.05	0.05	$-0.21\times0.05)+(-0.16\times0.05)=-0.0105-0.008=-0.018$
			0.10	0.10	$-0.21\times0.10)+(-0.16\times0.10)=-0.021-0.016=-0.037$

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Based on the table above, it is evident that an increase in carbon pricing and tax rates of 5% to 10% is estimated to reduce the profitability of BRICS member companies by between 1.85% and 4.1 percentage points in ROA, depending on the respective country. This simulation demonstrates a consistent and significant negative sensitivity, indicating considerable economic pressure from fiscal and environmental policies on the financial performance of companies. The greatest impact occurs in Russia and Brazil, with a decrease in ROA of up to 4.2 percentage points under the highest tariff increase scenario.

5. Discussion

5.1. The Impact of Carbon Pricing on Profitability

The panel regression results indicate that the Carbon Pricing variable has a negative and significant effect on the profitability of companies in all BRICS member countries, with coefficients ranging from -0.21 to -0.29 and p-values less than 0.01. This implies that an increase in the carbon pricing rate substantially reduces corporate profitability. This effect can be explained by the implementation of carbon pricing, which raises the production and operational costs of companies that emit carbon. These additional costs compress net profit margins, thereby negatively impacting Return on Assets (ROA) [21, 22].

Other studies have also confirmed that the imposition of carbon costs can lead to a short-term decline in profitability, particularly for companies in the energy and heavy industry sectors [23]. Although it negatively impacts profitability, the imposition of carbon pricing is an essential instrument to drive emissions reduction and sustainability [24]. However, the simulation indicates that the imposition of a carbon tariff must be balanced with supportive policies, such as green incentives, to alleviate the burden on companies [23].

5.2. The Influence of Tax Rate on Profitability

The corporate tax rate (Tax Rate) also demonstrates a significant negative effect on Return on Assets (ROA) across all BRICS countries, with coefficients ranging from -0.11 to -0.16 and high statistical significance ($p < 0.01$). This indicates that the higher the tax imposed on companies, the lower the profitability they achieve. Tax represents a direct burden on corporate profits; therefore, an increase in the tax rate reduces net income available to shareholders and for further investment. The corporate tax literature consistently finds a negative relationship between the effective tax rate and profitability [15]. This effect may vary in intensity depending on the market structure and tax efficiency in each country [14]. High tax rates tend to erode profitability and have the potential to hinder investment. Therefore, efficient and equitable tax reforms need to be integrated with environmental policies to avoid placing excessive burdens on the private sector [15].

5.3. The Impact of GDP Growth on Profitability

As a control variable, economic growth (GDP Growth) consistently shows a significant positive effect on profitability, with coefficients ranging from 0.07 to 0.12 ($p < 0.05$). Higher economic growth creates a favorable market environment that enhances sales, production efficiency, and overall corporate profitability. This finding aligns with business cycle theory and the influence of macroeconomic factors on corporate financial performance [25]. Economic growth supports product demand, market expansion, and increased purchasing power, all of which benefit company profits.

5.4. Simulation of the Impact of Carbon Pricing and Tax Rate on Profitability with GDP Growth as a Control Variable

Carbon pricing consistently exerts a negative influence on the profitability of companies across all BRICS member countries. This indicates that increases in carbon tariffs amplify the cost burden on companies directly associated with greenhouse gas emissions. For instance, simulations for Brazil show that a 0.05 unit increase in carbon pricing is estimated to reduce a company's profitability by 1.35

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percentage points in return on assets (ROA). This aligns with findings from a study by PT PLN (Persero), which demonstrated that carbon pricing mechanisms contribute to changes in financial indicators such as the net present value (NPV) and internal rate of return (IRR) of energy projects, while also introducing financial risks that must be managed prudently.

The tax rate also has a significant negative effect on profitability in all countries. For instance, a simulation of a 0.05 increase in the tax rate in India shows a decrease in Return on Assets (ROA) of approximately 0.55 percentage points. This finding is consistent with extensive literature indicating that higher corporate tax burdens reduce net profits and the investment capacity of firms [15]. Therefore, the government needs to balance taxation policies to continue supporting economic growth without placing excessive burdens on the private sector [26]. GDP growth as a control variable shows a significant positive effect on profitability, indicating that favourable macroeconomic conditions generally enhance company performance. As GDP growth increases, market demand rises, thereby improving the capacity of companies to generate profits.

6. Conclusion and Recommendations

6.1. Conclusion

a. Carbon pricing has a significantly negative effect on the profitability of companies in BRICS member countries. An increase in carbon pricing rates raises the production and operational costs of firms that emit carbon, thereby substantially reducing their net profit margin and return on assets (ROA). Despite exerting pressure on profitability, carbon pricing policies remain a crucial instrument for promoting emission reductions and environmental sustainability.
b. Corporate tax rates also have a significantly negative impact on profitability across all BRICS countries. Higher taxes decrease net profits, consequently affecting investment capacity and business growth. Elevated tax rates tend to erode profitability and potentially hinder corporate investment activities.
c. Economic growth (GDP growth) positively and significantly influences profitability, indicating that a healthy and expanding macroeconomy creates favorable market conditions for increased sales and production efficiency.
d. Simulation of the impacts of carbon pricing and tax policies demonstrates that increases in these rates can quantitatively reduce corporate profitability, with declines in ROA varying across countries and tariff levels. This situation underscores the necessity for balanced fiscal and environmental policies to safeguard the sustainability of both businesses and the broader economy.

6.2. Recommendations

a. Governments and policymakers need to integrate carbon pricing policies with green incentives that can alleviate the burden on companies, such as subsidies for environmentally friendly technologies, in order to avoid excessive pressure on profitability and support the transition to green energy.
b. Efficient and fair tax reforms are urgently required so that tax rates do not become obstacles to investment and corporate growth, especially in capital-intensive sectors with high carbon emission potential.
c. Economic growth should continuously be supported through stable macroeconomic policies and increased purchasing power among the population, thereby expanding markets and demand for products and services that underpin corporate profitability.

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Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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