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Research on the Impact Mechanism of Carbon Tariffs on Corporate Value and Valuation Methods

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Abstract. With the advancement of global climate governance and carbon reduction policies, carbon tariffs, as a critical regulatory tool in international trade, are increasingly influencing companies' cost structures, market competitiveness, and supply chain arrangements. This paper investigates the impact mechanism of carbon tariffs on corporate value and related valuation methods. In the context of reshaping global low-carbon trade rules, it explores the profound influences of carbon tariffs on corporate value through cost transmission, market competition, and supply chain restructuring. In addition, it also analyzes the limitations of traditional valuation methods, which overlook carbon costs and green assets, and provides relevant research suggestions. The study reveals that under carbon constraints, changes in corporate value drivers occur, and that carbon tariffs increase cost pressures on companies while creating long-term value through low-carbon transformation and green innovation.

Keywords: CBAM, Corporate Value, Impact Mechanism, Valuation Methods

1. Introduction

Against the backdrop of global climate change governance, the European Union (EU) proposed the Carbon Border Adjustment Mechanism (CBAM) in 2019, with full implementation scheduled for 2026. The mechanism covers six high-carbon industries and imposes additional costs on companies from high-carbon-exporting countries, markedly affecting Chinese steel and aluminum exports [1]. The CBAM triggers a corporate-level chain reaction, including cost transmission, profit fluctuations, and ultimately value restructuring. Thus, traditional corporate valuation systems, like the discounted cash flow (DCF) model, struggle to adapt to these changes. Existing research lacks a systematic framework for carbon tariff impacts and does not fully include new variables in valuation methods. Specifically, scholars have examined the effects of CBAM on corporate value from the perspectives of cost transmission, market competition, and supply chain restructuring, while also highlighting the limitations of traditional valuation methods and testing new models [1-3]. However, the dynamic effects of carbon tariffs and the cross-industry applicability of differentiated valuation tools require further study. This study aims to clarify the multi-dimensional impact of CBAM on corporate value and measure its cross-industry differences, while exploring corporate response strategies and value restoration, and integrating new variables to build adapted valuation tools. Through case analysis and quantitative modeling, it develops an adapted valuation method to reveal the multi-dimensional impact of carbon policies on corporate value and corresponding response strategies.

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2. Multidimensional effects of carbon tariffs on firm value: a study of midea group

2.1. Cost pressure and cash flow risk

The primary impact of carbon tariffs on Midea Group lies in the continuous rise of export costs and the increased volatility of cash flows. This is especially pronounced when carbon emissions remain high and the company's exports to the EU are heavily dependent on stable demand. These pressures threaten corporate value stability [4,5]. The formation of carbon tariffs can be understood through their calculation method, as shown in Equation 1.

$$Carbon\ Tariff = (Embedded\ Emissions\ of\ Goods - Free\ Allocation) \times (EU\ Carbon\ Price - Deduction\ for\ Home\ Carbon\ Price) \quad (1)$$

For Midea's main products exported to the EU, like air conditioners, compressors, and motors, the free emission allowance is zero. Based on an EU carbon price of €67.2/ton and a domestic price of €12.29/ton in 2024, carbon tariff estimates are shown in Table 1 [6-8].

Table 1. Carbon tariff cost calculation

Item	2024	2023	2022	2021	2020
Total Carbon Emissions (10^4 t CO_2e)	220.35	229.83	150.59	171.28	156.44
Estimated EU Revenue Proportion	15.80%	15.80%	14.70%	13.50%	11.50%
Carbon Tariff Cost (10k EUR)	1,911.68	1,993.96	1,215.51	1,269.65	987.87

Based on total carbon emissions data, Midea Group's emissions indicated a fluctuating upward trend from 2020 to 2023, while the EU revenue share remained stable, resulting in a significant increase in carbon tariff costs. In 2023, the carbon tariff cost approached €20 million, more than double that of 2020. Figure 1 shows that the trends of total carbon emissions and carbon tariff costs are highly consistent, reflecting the direct impact of emissions on the company's tax burden. This rising cost directly strains cash flow, significantly increasing CBAM's share in export cash flow, tying up operating funds, raising short-term debt pressure, and limiting investment capacity.

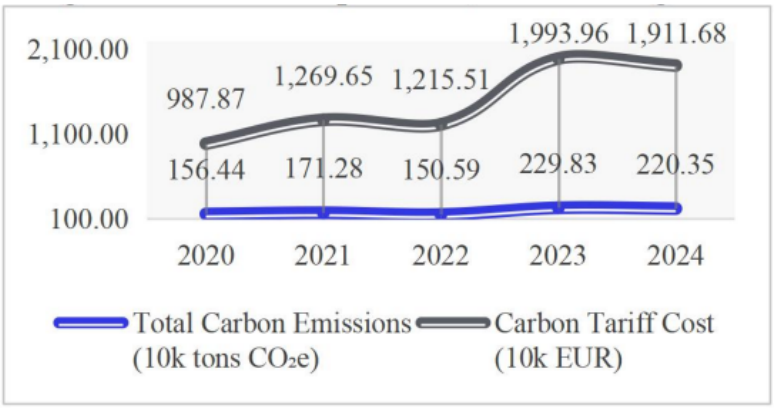

Figure 1. Trend of carbon emissions and carbon tariff costs

Besides, the carbon price is market-driven and subject to fluctuations [9]. The current estimates are based on a static carbon price model, and if the EU carbon price continues to rise, Midea will face greater uncertainty and risk regarding CBAM. Meanwhile, to adhere to carbon tariff regulatory

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requirements, Midea must invest significantly in emission monitors, data systems, and production upgrades. In 2023, as CBAM-related expenses surged, its carbon data management system began centralized construction, raising operating costs and financial pressure.

2.2. Profitability and financial robustness

The CBAM has raised Midea's cost burden, directly affecting its profitability and financial stability [10]. The data from 2020 to 2024 show that after factoring in CBAM-related costs, its net profit margin dropped by an average of 0.03 percentage points. While the decline is modest, it markedly impacts overall profits due to its large export scale and ongoing capital expenditures, as shown in Figure 2.

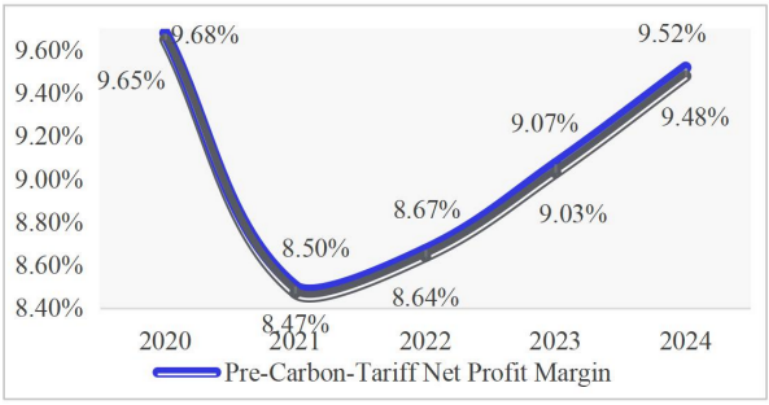

Figure 2. Schematic diagram of carbon tariff impact on net profit margin

The core mechanism through which CBAM affects profits is that its additional costs raise the tax burden and cut profits via higher operating and capital costs [11]. Increased capital expenditures, especially for carbon emission monitoring and mitigation equipment upgrades, while also providing long-term value, have tightened short-term cash flow and reduced financial flexibility. In addition, the fluctuation of carbon tariff costs increases uncertainty in profits and threatens financial stability. As carbon prices rise, it faces higher costs, tighter margins, and potential drops in risk resilience and market confidence. Thus, carbon tariffs reduce current profit levels and impact the stability of the financial structure, posing challenges to sustained profitability.

2.3. Competitive landscape and long-term value expectations

The implementation of CBAM profoundly alters the global home appliance industry's competitive landscape, particularly significantly impacting Midea Group's core export market, the EU [8]. By raising market access barriers for high-carbon products and boosting low-carbon products' price advantage, it directly affects corporate market share. The data from 2023-2024 show that companies actively pursuing low-carbon transformation increased their EU market share by an average of 3-5 percentage points, while traditional high-carbon brands saw their shares fall. Consequently, Midea boosted R&D investment to erect tech barriers, with total investment surpassing 40 billion RMB over five years. This has led to 2,890 Chinese invention patents and 570 overseas patents, placing the company among industry leaders. In key areas like R290 refrigerants, Midea holds 200+ patents for energy-efficient breakthroughs. For example, since 2014, R290 air conditioners have sold over 1 million units in Europe and won the UNIDO "Outstanding Contribution to Energy Conservation and Environmental Protection Award" in 2020 [12]. Concurrently, Midea advanced green supply chain

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management, using a supplier cloud platform to monitor environmental data from 50,000 global suppliers in real time, thus achieving a reduction of 1,890 tons of hazardous waste by 2020. The CBAM presents both a challenge and an opportunity, hence prompting Midea to shift from scale expansion to value creation and reshaping its core competitiveness globally.

3. Strategies for firms to respond to carbon tariffs and value restoration mechanisms

3.1. Carbon emission management and cost control

Facing global carbon tariff compliance pressures, Midea implements a comprehensive value-chain carbon management system and precise cost-control measures to reduce emissions while optimizing operational costs, building a replicable model for green transition [8]. Technological innovation underpins its strategy. The adoption of inverter technology in small refrigerators reduced annual emissions by 324,000 tons in 2022, while advancements in R290 technology further cut per-unit emissions by 0.447 tons CO_2e in 2023. And broad energy-saving measures across manufacturing facilities yielded significant water and emission savings. In addition, collaboration within the supply chain and circular economy measures further reduce costs and emissions. By 2022, Midea had screened 4,324 suppliers for carbon emissions, with nine key suppliers disclosing data by 2023, and partnerships on high-strength steel and reusable packaging further cut emissions. By leveraging digital tools, it has enhanced management precision. The energy management platform now covers over 30 factories, while the iBUILDING carbon system enables product life-cycle carbon tracing. Consequently, emission intensity fell to 0.0436 tCO_2/10k RMB revenue in 2022, and Scope 1 & 2 emissions stabilized around 0.061 tCO_2/10k RMB in 2023, thus showing sustained progress toward cost-efficient decarbonization.

3.2. Supply chain restructuring and low-carbon transition

Midea addresses carbon tariffs through the comprehensive decarbonization of its supply chain [8]. In 2022, it established a supplier social responsibility review system based on “green procurement” across five dimensions, conducting full reviews for new suppliers and self-assessment reviews for 4,324 historical suppliers, investigating carbon emissions in industries such as steel, and organizing green training for over a thousand suppliers. For low-carbon materials, collaboration with Covestro launched low-carbon refrigerators using materials with 60% biomass content, achieving a 60% carbon reduction and obtaining green certification; logistics optimized routes through intelligent vehicle scheduling, achieved a 70% usage rate of new energy vehicles, and reduced annual carbon emissions by 1,098 tons through reusable packaging. In 2023, it explored PCR recycled materials, with pool heat pump products containing over 50% such material receiving certification; set red lines for supplier responsibility, incorporated environmental protection into agreements, established support teams to guide low-carbon transformation, promoted core suppliers to obtain national green certifications, traced through the GSC platform achieving 100% compliance among 279 high-risk suppliers; developed compostable packaging, reducing paper use in washing machine packaging by 32.9%. These full-chain initiatives enhance carbon efficiency and compliance capabilities.

3.3. ESG strategy and green financing

Beyond operational changes, Midea leverages strategic ESG integration and sustainable finance to mitigate CBAM risks and create value. The company integrates ESG principles into its corporate governance framework, issuing annual ESG reports that boost transparency and bolster stakeholder

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trust. This commitment is reflected in its AA-level ESG rating, and a key financial response has been the strategic use of green financing instruments [8]. In 2022, Midea issued USD 450 million in green bonds. The proceeds were exclusively allocated to eligible green projects, such as energy efficiency upgrades and renewable energy installations. This issuance was priced at a coupon rate 120 basis points lower than comparable conventional bonds, hence reflecting investor appetite for sustainable assets and resulting in annual interest savings of approximately USD 5.4 million. This directly reduces the company's cost of capital and improves its weighted average cost of capital (WACC), a key input in valuation models. The funded projects, like rooftop photovoltaics, reduce carbon emissions and generate operational cost savings, creating a virtuous cycle that enhances cash flows and corporate value. This approach demonstrates ESG performance converting into financial benefits and stronger risk resilience amid regulatory shocks such as CBAM.

4. Applicability and evolution of valuation methods under carbon tariff scenarios

4.1. Traditional valuation methods and their limitations

The implementation of carbon tariffs poses challenges to traditional corporate valuation methods, making it difficult for them to accurately reflect value changes during the low-carbon transition [13]. The DCF model relies on forecasts of future cash flows and the WACC. However, cost volatility and policy uncertainty induced by carbon tariffs increase forecasting difficulty and reduce valuation accuracy. For instance, the deviation between predicted and actual carbon tariff costs for Midea reached 28% in 2023. Furthermore, its assumption of linear cost changes struggles with volatility; when WACC is below 3%, valuation highly depends on long-term cash flows, and the long-term uncertainty of carbon tariffs further undermines the reliability of these cash flows. The Economic Value Added (EVA) model overlooks carbon costs and green assets, excludes carbon tariffs from operational expenses, resulting in inflated profits and ignoring the value of low-carbon assets such as patents. Relative valuation methods are also distorted, as carbon costs cause intra-sector value divergence and historical metrics miss transition potential. Asset-based approaches similarly ignore the market value of carbon assets and liabilities, such as EU allowance prices (averaging €67/ton CO_2 in 2024), thereby limiting their relevance [6].

4.2. Model integration of carbon costs and green premiums

Incorporating carbon tariffs into traditional valuation models requires restructuring variables and expanding dimensions to quantify the fixed impact of carbon costs and green premiums. In the DCF model, carbon tariffs and low-carbon capital expenditures should be subtracted from operating cash flows, while green subsidies and carbon asset income should be added. To mitigate the impacts of carbon price volatility, scenario analysis should compute weighted expected values, and separate cash flows should be flagged for sensitivity. The discount rate should reflect carbon risk premiums. Accordingly, for enterprises with more than 15% of exports to the EU, the WACC may be increased by 1-2 percentage points, thus representing a pragmatic adjustment aligned with practices in other policy-sensitive sectors. In Midea’s case, with an export share of 15.8%, this implies adjusting the discount rate from 7% to 8.5%, as shown in Table 2.

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Table 2. Scenario analysis of carbon price fluctuations (EUR)

Year	2024	2025	2026	2027	2028	2029	2030
Domestic Carbon Price (+3% p.a.)	12.29	12.66	13.04	13.43	13.83	14.25	14.67
Baseline (+5% p.a.)	67.20	70.56	74.09	77.79	81.68	85.77	90.05
Optimistic (+10% p.a.)	67.20	73.92	81.31	89.44	98.39	108.23	119.05
Pessimistic (+2% p.a.)	67.20	68.54	69.91	71.31	72.74	74.19	75.68
Weighted Expected Value (4:3:3 ratio)	67.20	70.96	75.00	79.34	84.01	89.03	94.44

The EVA model should deduct net carbon tariffs and capitalize low-carbon assets, amortizing them over their useful life. For instance, amortizing Midea's 2.5 billion RMB low-carbon patents over 10 years would raise its EVA by 3.2%. In relative valuation, low-carbon peer selection should use metrics like emission intensity and green patents. A green premium of 10%-15% should then be applied to multiples. Consequently, Midea's price-to-earnings ratio could increase from 12 times to 13.5 times, reflecting the value of its green transition.

4.3. Expansion of valuation through ESG and sustainable finance

Under the context of carbon tariffs, ESG strategy and sustainable finance instruments provide new perspectives for corporate valuation, driving the evolution of valuation logic towards sustainable value [8]. ESG performance influences valuation through risk mitigation and value enhancement: high ESG ratings reduce exposure to carbon policy risks. For instance, Midea's AA ESG rating in 2023 resulted in 12% lower value volatility compared to A-rated peers and a 0.5-percentage-point reduction in carbon risk premium. Strong ESG performance also enhances green premiums. For example, 75% of Midea's air conditioner sales were Grade 1 energy-efficient models, adding 2.3% to gross margin. Furthermore,the digital carbon management platform reduced the deviation rate in cash flow forecasts from 15% to 8%. Besides, sustainable finance instruments, such as green bonds, lower the cost of capital and reduce WACC. Funded projects, like photovoltaic facilities producing 220 million kWh yearly, cut carbon emissions and save about RMB 11 million per year. These cash flows should be included in valuation. As such, an ESG-Carbon Cost-Value transmission model can translate ESG scores into valuation parameters, like adjusted WACC and green premium multiples, thereby achieving a dynamic balance between risk and value. As a result, this approach captures the long-term value of the low-carbon transition and supports scientifically informed decision-making.

5. Conclusion

This study shows that carbon tariffs alter corporate value in multiple ways, including cost pressures from tariffs and low-carbon investments, market barriers favoring energy-efficient products, and supply chain transitions toward low-carbon regions. Through technological innovation, low-carbon patents, supply chain collaboration, and ESG integration with green financing, corporations can restore value and establish a positive cycle. Traditional valuation methods require adjustment, with DCF, EVA, and relative valuation models incorporating carbon costs, low-carbon assets, and green premiums of 10-15%. These findings provide practical guidance for companies and investors, while highlighting the need for future research on cross-industry heterogeneity.

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