

Tesla's Carbon Credit and Clean Energy Strategy: Capital Structure Optimization and Financial Stability Analysis in Green Finance

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Abstract. This paper deeply discusses how Tesla's strategic layout in the carbon credit mechanism and clean energy sector caters to the market's ESG standards from the three key perspectives of green finance, capital structure optimization, and financial stability. This paper mainly reveals the contribution rate of carbon credit income in the marginal growth of net profit by constructing a regression analysis model. It is further confirmed that interest-free and low-interest income is essential in capital structure optimization for stabilizing corporate finance and providing reliable cash flow. Meanwhile, SolarCity's upstream and downstream layout in clean and photovoltaic energy has enhanced Tesla's control over resources and the supply side, as well as its stable distribution and bargaining power in the downstream sales market. This paper finally proposes Tesla's competitive position in sustainable development by comparing two sustainable cases in size and synergies. It is solidified by enhancing financial flexibility, improving risk resistance, and accelerating the company's low-carbon transformation through innovation.

Keywords: Tesla; carbon credit mechanism; green finance; capital structure optimization; financial stability.

1. Introduction

Central enterprises that have taken up the sustainability issue on the world stage are facing increasing pressure to continuously update their production, logistics, and sales models to align with investor expectations for ESG standards [1]. To gain priority response speed and market share in the new sustainable market competition, enterprises must reasonably avoid environmental violations under new legislation and strive for green finance financing and cost control benefits as much as possible. Environmental issues are global, but with close to 70 carbon pricing schemes worldwide, creating an interactive carbon pricing standard and framework is a complex and dynamic issue for governments and business groups concerned about different levels of stability and competitiveness [2].

Governments and institutions have introduced policies and green monitoring tools to gradually push companies to reduce carbon emissions using carbon taxes, emissions trading, green financial mechanisms, etc [1]. This trend has promoted the popularization of ESG standards in various industries and attracted more capital to flow into low-carbon and new energy industries. This is a shift in the focus of development in the real economy, using the tendency of capital from the financial market to drive development. From the perspective of the environment, society and governance, the back-and-forth battles between the two camps of carbon taxation and emissions trading schemes, as well as the transparency of related carbon accounting data and the green financial regulatory system, have made public taxation and reasonable tax avoidance a new hotspot of green finance.

Under such a framework of capital favour and policy incentives, the carbon credit mechanism is undoubtedly one of the most well-known financial tools for promoting a low-carbon economy. The government sets the carbon credit mechanism, and when a company's carbon emissions exceed the quota, it will be subject to high fines. The surplus balance of low-emission enterprises can be traded on the free market to high-emission enterprises for profit. Such an emissions trading market can achieve overall artificial control and regional balance of carbon emissions and profoundly impact the structural transformation of heavy industry assets. This innovative interest-free carbon credit income

not only helps enterprises in the downward period of market fluctuations but also brings additional cash flow assistance; it also avoids excessive debt during the peak period of enterprise development. In the uncertain market of overall transformation under low-carbon policies, the carbon credit market is also affected by the volatility of the trading and financial markets. However, it generally meets the emission reduction goal and provides a certain amount of financial support, with the possibility of additional surplus.

This article will deeply analyze Tesla's carbon credit income and SolarCity's business under the three major frameworks of green finance, capital structure optimization, and ESG. This article will qualitatively discuss the construction of a regression analysis model to explain how carbon credit income supports Tesla's financial stability and sustainable development. The carbon credit income also explains how companies can reduce traditional sources of income and reduce the possibility of risk fluctuations. This paper also introduces how SolarCity, a typical clean energy acquisition project, has completed a planned transition to a low-carbon and clean direction through sustainable financing and laying upstream and downstream industrial chains. By exploring SolarCity's synergies and ESG scores, this paper further shows how Tesla can build a diversified and risk-resistant revenue structure to maintain its innovative competitive advantage in new energy and new technologies in the global wave of a low-carbon economy.

2. Literature Review

The global economy is transitioning towards low-carbon energy. More and more governments and laws have begun to impose stricter taxes, subsidy eligibility requirements, and broader regulatory mechanisms on companies concerning carbon emissions. Adopting green finance and carbon credit mechanisms has gradually become essential for companies to obtain additional government financial support. As a new energy and electric vehicle industry leader, Tesla has achieved significant financial gains by deeply participating in and building carbon credit mechanisms to support its longer-term development. This literature review will examine the theoretical basis for Tesla's financial issues in exploring credit from green finance theory, capital structure optimization, and corporate social responsibility.

Green finance, also known as sustainable finance, is a theory that considers the business philosophy of companies seeking economic development while protecting the environment [3]. This approach can attract the attention of more future investors, thereby gaining a head start in the capital market [1]. The use of transparent and stable green financial instruments such as carbon credits, green bonds, and green loans not only enhances the overall performance of a company's financial data but also effectively reduces the initial financing costs of venture capital projects. As an indispensable and vital area of green financial instruments, carbon credits are an incentive protection mechanism that provides financial benefits to companies that reduce emissions. Therefore, carbon credits often have a more sustainable perspective when allocating a company's future resources. After Tesla joined the carbon market, it opened a new stable cash flow. It allowed the company to respond flexibly to environmental laws and regulations in various states, demonstrating a powerful risk-hedging ability and alleviating the uncertainty brought about by policy changes.

The theory of capital structure emphasizes the multidimensional and profound impact of the cost of different capital sources on the comprehensive financial performance of enterprises [4]. In the case of market imperfections, interest-free or low-interest income allows companies to reduce the overall cost of capital, optimize the capital structure, and improve the robustness of financial indicators. Carbon credit income is exactly interest-free income. Carbon credit income has helped Tesla optimize its capital structure and reduce its debt burden. On the other hand, it has given Tesla resilience, stress resistance, and flexibility in the cyclical fluctuations of the market, maintaining its competitiveness in the field of new and old transitions. High-growth companies often face higher market volatility and financing costs. Carbon credit income improves short-term financial performance and provides a

solid foundation for innovation in personnel, technology, management and expansion into new markets, ultimately ensuring long-term financial health.

The corporate social responsibility framework means operators should adopt ethical and responsible sustainable business decisions. This requires companies to consider revenue and profitability, the impact on the community environment, and the contribution to social well-being. Carroll divides CSR into four levels: economic, legal, ethical, and philanthropic [5]. Similarly, ESG is divided into three levels: environmental, social, and governance [6]. The refinement of these standards and concepts is the performance of governments and NGOs in promoting commercial enterprises to implement reference indicators into specific scoring and evaluation mechanisms in the capital market. Implementing green finance not only brings direct benefits to companies like Tesla but also enhances brand value in terms of social responsibility, attracting investors with a sense of social responsibility and giving Tesla a significant competitive advantage in the long-term investment market.

3. Impact of carbon credit on Tesla

Carbon credit income is vital to Tesla's supplementary income, and its significance goes beyond a single ancillary financial benefit [7,8]. By selling carbon credits to similar companies, Tesla can obtain a higher cash flow without additional debt, which adds diversified support to the company's capital. The article will continue to analyze the real contribution and risk fluctuation range of carbon credit income in Tesla's finances from the perspective of descriptive statistical methods and theoretical models and ultimately reveal the strategic significance of carbon credit income in the company's overall financial balance.

3.1. Descriptive analysis

Carbon credits are a system in a new exploration period in which carbon emission quotas are circulated among enterprises through the collaborative efforts of multiple parties, such as government guidance, market carbon pricing, and emission trading systems. This complex mechanism has also kept the core business of carbon credits in the expansion stage, and the proportion of carbon credit income in Tesla's overall income structure has shown a fluctuating upward trend. As an essential non-core revenue source, carbon credit revenue is independent of sales cash flow, which is subject to market risk shocks and can serve as a financial buffer to withstand cyclical fluctuations. Table 1 below shows Tesla's carbon credit revenue, net profit margin, and total revenue growth rate from 2020 to 2023 after the pandemic [7,8]. It provides a quantitative basis for the financial support of carbon credit revenue. As carbon credit revenue increases yearly, Tesla's net profit margin also increases accordingly, and the two are significantly positively correlated. For example, despite a slight slowdown in the annual growth rate in 2022, it will still drive an increase in Tesla's net profit margin amid an uncertain outlook for the auto market, supporting financial stability amid market uncertainty.

Table 1: Tesla Carbon Credit Revenue and Financial Performance (2020-2023)

Year	Carbon Credit Revenue (Million USD)	Net Profit Margin (%)	Total Revenue Growth Rate (%)
2020	1,580	2.1	28.5
2021	1,769	4.5	70
2022	1,785	5.6	52.4
2023	2,107	7.9	23.3

3.2. Theoretical model and capital structure analysis

In order to better understand the commonality of carbon credit income in Tesla's financial performance, this paper proposes to construct a regression model with carbon credit income as the critical variable of the company's net profit. The basic formula structure of this model is as follows:

In this model, the specific variable definitions are as follows:

$$Net Profit = \alpha + \beta \times Carbon Credits Revenue + \gamma \times Total Revenue + \delta \times Debt Ratio + \epsilon \quad (1)$$

where, *Net profit* is the dependent variable, reflecting Tesla's final financial performance under the combined influence of various cost pressure factors and income source factors, indicating the company's overall profitability. *Carbon credit income* is the core independent variable indicating the direct contribution of carbon credit income to the company's profitability. *Total income* and *debt ratio* are the control variables. *Total income* reflects the impact of the overall company's income scale on the size of net profit and assesses the fundamental proportional impact of carbon credits on profitability. *The debt ratio* reflects the proportion of debt financing in the capital structure and measures a critical factor in the diversification of the capital structure. It can further infer the correlation between debt fluctuations and net profit. α , β , γ , δ are the marginal contribution rate of each independent variable to the net profit result, which measures the relative influence of different variables on net profit. ϵ is an error term, including other possible influencing disturbance factors and mixed factors, focusing on excluding the external influence brought by external policies and markets. Sometimes, it can be ignored as 0 to simplify the model.

The theoretical significance of constructing this model is to provide a structured framework to reveal the relative real influence of carbon credit income and its positive driving effect on asset structure after discounting the economies of scale. Capital structure theory points out that when deciding on the financing structure, enterprises need to balance the capital costs of all parties to achieve a moderate risk. Therefore, we must pay special attention to the β coefficient before carbon credit income. The positive significance of β means that carbon credit income has a positive elastic contribution to net profit, which means that the company has a more significant lead and say in achieving financial stability and strategic sustainability. This conclusion can verify the theory of capital structure optimization. By controlling total income and debt ratio, the model allows the impact of carbon credit income to be more accurately reflected in the change of marginal net profit, which also makes the model's applicability applicable and verifiable in more financial situations.

Using this regression model, companies can quantify the marginal contribution of carbon credit revenue to corporate finance and whether it has reached its maximum marginal contribution value. This model can ensure that the input and output of carbon credit revenue achieve the highest efficiency and practically enhance financial resilience. In addition, an increase in carbon credit revenue also reduces the dependence on external demand-oriented financing, which helps to reduce the company's overall weighted average cost of capital and further enhances financial health and diversification.

With the growth of carbon credit revenue and the public disclosure of data by Tesla and similar new energy vehicle companies, this model can also comprehensively evaluate the credit lines of two or more companies. Suppose the β coefficient is positive and the model's overall fit is high. In that case, carbon credit revenue plays a dual insurance role in profitability and financial stability. Suppose the γ of the debt ratio shows a downward trend after the added carbon credit income variable. In that case, this can also be used as another perspective to verify that the increase in carbon credit income reduces the company's demand for high-cost debt and externally dependent debt, thereby optimizing the overall capital structure. In a large, listed company like Tesla, the company's production capacity is constantly increasing due to capital-intensive dividends. Therefore, any minor adjustment in the capital structure optimization will provide more interest space and loan financing options for this high-growth company. The model is deeply optimized for allocating company resources, investing more funds in innovation and the training and recruiting of scientific and technological talent, and promoting net profit.

As the market matures, more innovative car companies and new energy companies are entering the industry, intensifying industry competition. This will also cause the price of carbon credits to stabilize or decline gradually. Another external factor comes from the policy-led quota policy. Under the global carbon emission reduction policy and the changes in the difficulty of market regulation by state and federal governments, the trading volume of carbon credits will also fluctuate. In addition, the variables between models may interact with each other to form a mixed effect. Tesla also needs

to adjust its revenue structure in the future to diversify its revenue sources and consolidate its position in the green financial market and its dominance in the upstream and downstream supply chains.

In terms of the current ratio and cash ratio, the growth of carbon credits directly drives additional growth in Tesla's cash flow, keeping the current ratio above 1.5 in 2023. This data shows that Tesla has strong short-term debt repayment capabilities. This ability enhances its financial resilience in economic uncertainty and stock market volatility. This characteristic is based on the fact that carbon credit income does not require additional capital costs, making Tesla more adaptable in the capital market.

In terms of the indicator of cumulative abnormal returns, Tesla's stock price has shown an overall upward trend after the release of financial reports containing carbon credit income and climate reports. This indicates that individual investors recognize Tesla's carbon credit income and large financial assessment agencies are optimistic about the future development prospects of global carbon credit policies.

In terms of risk volatility and the rise and fall of the beta coefficient, carbon credit income has, to some extent, offset the impact of financial market volatility, resulting in a downward trend in the beta coefficient. It is worth mentioning that the beta coefficient is a core indicator for measuring market risk sensitivity. The core advantage of carbon credit comes from its relatively independent source of income compared with the company's core sales business, which reduces the overall financial risk exposure.

4. Effect of SolarCity on Tesla

SolarCity, as a model of sustainable new energy projects, and the carbon credit revenue mechanism complement each other, further improving Tesla's financial structure [8]. The acquisition and financing of SolarCity have promoted revenue diversification, capital cost optimization, and risk management, and the utilization of synergies has significantly increased Tesla's market value.

4.1. Strategic complementarity of SolarCity's revenue

As a new energy vehicle, one of Tesla's most important upstream industry chains is the energy industry. SolarCity's layout of the photovoltaic and energy storage industries has strengthened the company's control in the new energy vehicle industry at the strategic level. Such M&A activities ensure a stable supply of production materials for Tesla through industrial integration upstream and downstream of the supply chain, forming a quantitative closed loop with the downstream distribution system. As a result, Tesla has more bargaining power in all aspects, from raw material procurement, energy storage, photovoltaic power generation, and battery manufacturing to the final automotive products, which are more price competitive. Tesla's vertical integration capabilities in the energy industry can directly radiate to the automotive manufacturing and sales sectors, ultimately driving stable cash flow and high financial flexibility.

As a representative of clean energy, Tesla has played a vital role in improving energy access and output efficiency by expanding the market coverage of photovoltaics and energy storage systems [9]. This characteristic has given it preferential access to low-interest green loans and sustainable financing advisory and guarantees provided by the two levels of government. According to Tesla's 2023 financial report, SolarCity's business not only accounts for an essential position in the company's overall revenue but also receives more government subsidies and tax incentives through policy support for tax credits, thereby reducing financing costs [8]. The company has more risk-stable liquidity, allowing it to seize the initiative in the advanced manufacturing and energy development fields with heavy assets and heavy technology more quickly.

4.2. Synergies with carbon credit income

The synergies between SolarCity and carbon credit income are mainly reflected in a portfolio, which disperses the risk fluctuations caused by a single green policy. SolarCity's business aligns with

the long-term market demand and the government's advocacy of low-carbon transformation, making it more likely to sign long-term contracts with large companies and the government. Long-term contracts bring lower market volatility and a lower marginal cost of training scientific and technical personnel, making SolarCity like a stabilizer in the portfolio of green financial projects for the carbon credit market. According to Refinitiv's 2023 ESG score data, SolarCity has significantly improved Tesla's ESG score [10]. Tesla's environmental score is already nearly 20 percentage points higher than the industry average [8]. The clean energy industry, which has high growth potential, has made more new investors optimistic about the future comprehensive transformation and iteration of the automotive industry.

5. Conclusion

This article uses a complex multivariate regression analysis model to explore the marginal contribution of carbon credit income to Tesla's net profit. The model controls for two crucial variables, total income and debt ratio, to isolate the independent impact of carbon credit income on net profit. The model verifies that carbon credit income, interest-free income, and optimized capital costs strongly support the company's overall financial stability and risk-hedging capabilities. Furthermore, it provides a framework and verifiable model guidance for Tesla's future financial strategy shift towards low-carbon model management.

This article also compares and analyzes the synergies between Tesla's credit income and SolarCity's two cases and explains the complementary capabilities of the two in diversifying financial risks and balancing the income and expenditure structure. With the financial buffer and surplus income provided by carbon credits, SolarCity's clean energy layout has effectively controlled upstream resources and a closed-loop circuit for downstream sales markets by integrating the supply chain. This combination of investments gives Tesla a unique competitive advantage in the race to become a unicorn in the new energy vehicle industry. This multidimensional comparative analysis method in this article is conducive to readers' systematic understanding of how Tesla is balancing the dual needs of revenue growth and risk management by combining different green revenue sources, thereby achieving financially stable long-term growth and returns.

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