

Asset Classification as a Hidden Liability: Carbon Accounting and Corporate Valuation Bias in China's ETS

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Abstract. Despite the rapid growth of carbon markets, accounting standards remain silent on whether emission allowances should be classified as intangible assets or financial instruments. China's prevailing requirement to record allowances as intangible assets at historical cost prevents balance sheets from reflecting market prices, systematically biasing equity valuation downward. Using a comparative case design featuring leading power and steel producers, combined with valuation-model decomposition, this study demonstrates how the intangible-asset classification inflates price-to-book ratios and disrupts the logic of the EV/EBITDA framework. Research shows that introducing a dual classification model based on management intent—distinguishing between self-use and trading carbon emission rights and using historical cost and fair value measurement, respectively—can significantly improve the relevance of accounting information. Based on this, the paper proposes policy recommendations to revise accounting standards, adjust valuation models, and strengthen carbon finance regulation, aiming to improve the quality of carbon accounting information, help the capital market accurately price green assets, and promote high-quality economic development under the "dual carbon" goal.

Keywords: Carbon Emission Allowances, Asset Classification, Fair Value Accounting, Corporate Valuation Bias, Dual Classification Model

1. Introduction

1.1. Institutional context: carbon allowances as new balance sheet items

Amid accelerating global climate change governance and the stringent requirements of the "dual carbon" goals, carbon emission rights have transitioned from environmental regulatory indicators to scarce production factors with both commodity and financial attributes. China's national carbon emissions trading system has conducted two rounds of compliance trading, with a total amount of traded carbon exceeding 400 million tonnes and a turnover of over 20 billion yuan; thus, it has extended the influence of carbon price signals on resource allocation. However, the Accounting Classification of Carbon Emission Allowances is still unclear. According to the Provisional Regulations on Accounting Treatment of Carbon Emission Rights Trading issued by the Chinese Ministry of Finance in 2019, the enterprise responsible for the large-scale emissions shall recognise the purchased carbon emission allowances as "intangible assets" and measure them at historical cost.

In practice, however, carbon emission rights have active price quotations, are freely traded on the secondary market, and can be used as collateral for financing; they more closely resemble the characteristics of "financial assets measured at fair value through profit or loss". Therefore, there is a mismatch between the financial statements and the underlying economic reality due to this classification discrepancy of assets. As an example, Huaneng Power International had more than 50 million tons of carbon emission allowances in 2023, and at the year-end average market price, their potential market value exceeded RMB 3 billion. However, the historical cost method does not reflect this appreciation, and thus the price-to-book (PB) ratio is artificially high [1]. With the spread of ESG investment ideas, these accounting distortions no longer reflect the actual value of a company's green assets and hinder investors' assessment of intrinsic value. Therefore, analysis of the recognition logic for carbon emission rights under different asset classification standards and quantification of their impact on valuation models are required to improve green accounting standards, enhance pricing efficiency in capital markets, and guide green and low-carbon investment.



Figure 1. Market-wide trading dynamics

As shown in Figure 1, the transaction volume, transaction value and closing price in the second compliance cycle were about 46.9%, 125.3% and 46.5% higher, respectively, than in the first compliance cycle [2, 3]. The expansion of the carbon market has increased the financial-reporting and valuation relevance of carbon emission allowances.

1.2. Previous research on carbon accounting classification

Many scholars have studied the accounting treatment for carbon emission rights. Kim et al. believe that, because carbon emission rights do not have a physical form and grant exclusive use rights, classifying them as intangible assets aligns with the definition in Accounting Standards for Business Enterprises No. 6 and supports practical application [4]. Clermont et al. believe that, when held for the purpose of earning profits from price differences, carbon emission rights are economically similar to financial products. They believe that since active market quotes are available, these rights should be classified as "financial assets for trading" and reflected in the risk calculation more promptly according to changes in the carbon price [5]. Steindl and others have conducted an empirical study of companies in the EU ETS to examine the economic effects of accounting policies; they found that stock price information content for firms disclosing carbon emission rights

under the fair value model is significantly higher than that for firms using the historical cost measurement method. Therefore, according to the above analysis, the fair value model can help reduce information asymmetry [6]. N'gatta and others believe that the recognition mechanism modifies the motivation to reduce pollution in terms of contract theory. The historical cost model may lead management to hold back allowances at a time of low carbon prices; a fair value model would be more transparent about the carbon cost and thus encourage the enterprise to reduce energy consumption and emissions [7]. Although the previous studies have provided a theoretical basis for this paper, most of them are single-indicator. Few studies have systematically examined whether the main reason for asset classification (intangible assets versus financial instruments) affects the parameters in valuation models, such as EV/EBITDA and P/B ratios.

1.3. Gaps in valuation-relevant accounting research

Most studies consider allowance accounting a measurement problem and assume a fixed-asset category. The intangible-asset convention fails to recognise that allowances can be monetised or hedged. Few studies have designated these as financial instruments and analysed their effect on net debt and enterprise value. In addition, research on carbon accounting has generally been static in nature and has not addressed the problem of high volatility in China's carbon market dynamically. According to the new standards released by the International Sustainability Standards Board (ISSB), there is now a discrepancy between the theory and the application of integrating climate-related financial risks into the main valuation system. At present, no research has been conducted on the transmission path among asset classification, financial statement presentation and valuation parameters that this paper intends to address.

1.4. Research objectives and structure

A total of four steps exist. First, compare the regulatory requirements in China with the classification system abroad. Second, it applies valuation theory to quantify the effect of the alternative treatment on ROE, leverage and multiples. Third, it also has a dual-classification model for management intent. The residual income model will determine the different impacts of the two recognition policies on core financial indicators of the company (e.g., ROE and debt-to-asset ratio) and valuation multiples (e.g., P/B and P/E ratio). Finally, considering the deficiencies in the current standards, this paper puts forward modifications to carbon accounting rules and adjusts ESG valuation models to offer a reference for regulatory optimisation of disclosure requirements and help investors revise their valuation methods.

2. Empirical illustration: carbon accounting practice at Baoshan Iron & Steel

Baoshan Iron & Steel Co., Ltd. (Baosteel) is a large steel company in China and one of the first to join the national ETS; it holds material carbon allowances for both its asset base and financing structure. By the end of 2023, Baosteel had accumulated more than 5 million tonnes of carbon emission allowances (CEAs) and, according to the average market price in that year, they were worth over 300 million RMB. In line with the 2019 MoF interim rules, Baosteel recognises allowances as intangible assets at historical cost and does not recognise fair value changes until disposal or impairment. However, in response to the EU's Carbon Border Adjustment Mechanism (CBAM) and in preparation for ISSB disclosure, the company's management has been under considerable pressure to adjust its financial statements [8]. Due to the supply-demand imbalance of

the carbon market in 2023, CEA increased by more than 40% year-on-year. If recognised as financial instruments, the unrealised holding gain would increase the company's book profit significantly. Baosteel also engages in innovation in carbon finance and offers carbon-emission right-backed loans and carbon trading. The Cash Flow Characteristics of these enterprises differ significantly from those of traditional intangible assets. Disclosures only report the gross carrying amount in the notes, and there is no line-item reconciliation of fair value changes. Thus, the information set for investors on a company's low-carbon transition is reduced.

3. Economic consequences of carbon allowance classification

Although it is convenient in terms of operation to treat carbon emission rights as intangible assets, the rationale for this classification does not meet the economic attributes of assets, and several structural inconsistencies have arisen at the microeconomic level. Based on accounting theory, information economics and corporate finance theory, the following will be examined in this section: positive market signals and the deep-seated problems caused by this classification model.

3.1. Benefits of the status quo: stability and low compliance friction

3.1.1. Earnings smoothing under historical cost

Recognising carbon emission rights as intangible assets and applying historical cost accounting have thus provided some support for smoothing corporate earnings. In the event of a significant drop in carbon prices, this model will not be directly affected by fair value changes and thus has reduced volatility in net profit. Asset-heavy, long-cycle steel and power companies can show the market that they are operating normally through this stability, reduce stock price fluctuations caused by short-term carbon price speculation, and meet management's desire to avoid short-term performance pressure. Foreign studies have also found evidence supporting the aforementioned association [9].

3.1.2. Auditability and reduced measurement uncertainty

The present model of intangible asset recognition is highly compatible with China's existing corporate accounting standards system, and large-scale restructuring of accounting items will not be required. Therefore, the company's compliance costs in terms of personnel training, system upgrades and financial report preparation will be reduced. At the same time, historical cost is easily verifiable; therefore, management cannot inflate profits through fair value, and certified public accountants can issue an unqualified audit report based on the reliability of the accounting information [10].

3.2. Valuation and financial reporting costs

3.2.1. Hidden assets and book-value bias

Forcibly classifying carbon emission rights in active trading markets as intangible assets, and not accounting for them promptly at fair value in the financial assets fails to reflect their actual value in the corporate balance sheet. In a period of rising carbon prices, a large number of allowances held by companies are recorded at historical cost as "hidden assets", resulting in an artificially high price-to-book (PB) ratio and an understatement of the company's true value. This information asymmetry inhibits capital flow to low-carbon, high-efficiency enterprises, and at the same time, high-carbon enterprises are granted excessive credit based on inflated asset book values; thus, green financial

resources are misallocated. From a macro perspective, this is equivalent to creating an invisible financial barrier to low-carbon transition and obstructing the realisation of the "dual-carbon" goals. Research abroad has found that carbon disclosure is correlated with firm-specific risk [11].

3.2.2. Mis-specification in EV/EBITDA valuation

Historically, the enterprise value (EV) in a company valuation model has included interest-bearing debt. If carbon emission rights are treated as intangible assets, changes in their fair value will not affect EV; however, if they are considered "trading financial assets", their liquidity should be regarded as cash equivalents or deducted in the calculation of net debt. Current accounting classifications introduce biases in the EV/EBITDA model for analysts: EBITDA includes carbon trading costs, but EV does not exclude the value of carbon assets; thus, valuation multiples are distorted. Therefore, it is difficult for investors to distinguish between a company's "operating profitability" and its "carbon asset management capabilities", and as a result, financial information will be less relevant to investment decisions, and a "green bubble" in the capital market may occur.

3.2.3. Carbon finance and hedging complexity

As carbon emission rights have not been recognised as financial instruments, the related carbon financial derivatives (such as carbon forwards and carbon options) cannot be reasonably matched with hedging accounting. When a company carries out a carbon buyback or pledging, it is not feasible to recognise corresponding financial liabilities or asset transfers in the balance sheet. This increases the accounting complexity for companies using hedging tools to mitigate carbon price risk and also lacks unified standards for auditors in assessing the credit risk of related financial instruments [12]. Furthermore, due to the absence of recognised fair value, when carbon prices fall suddenly, a one-time provision will have to be made under "asset impairment loss" rather than releasing the risk in advance through "fair value change gains or losses"; thus, there will be a delay in financial statement recognition and an increase in financial system vulnerability.

In short, the above frictions suggest that the choice of classification is not just a technical accounting issue but also affects the first-level determination of carbon exposure pricing and management.

4. Policy implications and practical recommendations

4.1. A dual-classification model for allowance accounting

Given the problem of asset underrecognition due to misclassification, it is proposed that the Ministry of Finance strengthen the relevant standard and introduce a "dual-classification" system. Carbon emission rights primarily for self-use should continue to be recognised as intangible assets; allowances intended for active trading or use in carbon finance operations may be classified as "financial assets measured at fair value through profit or loss". At the same time, the classification criteria and fair value changes of both classes of assets need to be disclosed in the balance sheet. This will meet the management needs of all companies and make implicit assets explicit; thus, investors can better assess the green asset reserves of these companies and correct PB valuation bias. In addition, alignment with ISSB standards should be promoted in parallel, and companies need to disclose the valuation methods and input parameters for carbon emissions rights in the notes to the financial statements to enhance the comparability and transparency of the data.

4.2. Valuation adjustments for carbon-aware investment analysis

Industry organisations and equity analysts should introduce carbon-adjusted valuations to account for allowance accounting in the valuation of enterprises. When calculating enterprise value, a "carbon asset adjustment mechanism" should be introduced: the fair value of carbon emission rights recognised as financial assets is deducted from the denominator in the calculation of enterprise value (EV), and carbon trading gains and losses should be listed separately in the calculation of EBITDA. In addition, it is proposed to introduce a "carbon-adjusted price-to-earnings ratio" based on the P/E ratio analysis, that is; by deducting the effect of changes in the fair value of carbon assets from net profit, one can restore the true profitability of the enterprise's main business and eliminate the interference of fluctuations in the carbon price on valuation. Alter the valuation model so that, in light of the company's core competitiveness, investors focus less on short-term speculation in carbon prices.

4.3. Accounting rules for carbon finance and macro-prudential supervision

To address the financial risk caused by the absence of fair value accounting, Accounting Standard No. 22—Recognition and Measurement of Financial Instruments—should be referenced to establish specific and detailed rules for carbon finance accounting. Clarify the recognition timing and measurement attributes of carbon emission rights pledging, repurchase and derivative transactions to enable eligible hedging transactions to use hedging accounting methods for profit and loss smoothing over time. At the same time, the company needs to build an internal control system for carbon assets, regularly conduct stress tests on them, and disclose the results of carbon price sensitivity analysis in the annual report [11]. The regulatory office will add carbon assets to the range of the macro-prudential assessment (MPA) and monitor concentration risk in carbon assets among financial institutions. Strengthen accounting standards to require listed companies to improve their carbon asset management capacity and prevent liquidity risk and other financial risks caused by sudden changes in carbon prices.

5. Conclusion

5.1. Main findings

Therefore, China's mandatory recognition of allowances as intangible assets has failed to reflect the balance sheet situation of the active carbon market. Research shows that although the current main recognition model for intangible assets ensures accounting stability, it fails to reflect the actual economic value of carbon allowances in the financial statements promptly and accurately, resulting in significant understatement and information asymmetry. This misclassification will change the basic valuation indicators, such as the Price-to-Book ratio (PB), and thus result in a logical inconsistency of applying the traditional valuation model (EV/EBITDA); as a result, it will be impossible to distinguish between the company's operating performance and the return on its carbon asset management. Although the historical cost model reduces the compliance burden, the resulting fragmentation of financial statements increases the accounting complexity of carbon finance and may be subject to systemic risk.

5.2. Contributions and valuation practice

Therefore, the following specific recommendations are proposed: develop a "dual-classification" accounting system, strengthen the ESG valuation model by adding a carbon-asset-adjustment factor, and improve standards for carbon-finance accounting. The above measures aim to solve the problem of the mismatch between accounting classification and economic reality, and promote the deep integration of carbon accounting data into financial management. Based on the above results, this paper may provide relevant theoretical support for the regulatory authorities in raising the standard of green accounting; offer some references for investors in adjusting valuation models and identifying "green value"; and guide enterprises to strengthen the management of carbon assets and improve the quality of information disclosure. By promoting the reform of accounting recognition models, this study helps to improve the pricing efficiency of the carbon market, directs social capital for efficient allocation in the low-carbon sector, and thus serves the smooth implementation of the national "dual carbon" strategy.

5.3. Limitations and prospects for future research

This study will only use the information in the public financial reports and policy documents for qualitative analysis. Due to a lack of data, specific internal records of carbon asset management and first-hand data on management intentions were not obtained, and thus, in-depth research into the implementation details of the dual classification model has been limited. In the future, semi-structured interviews will be conducted with chief accountants and certified public accountants to learn more about the classification of carbon assets. Additionally, panel data models can be employed to study the particular effects of different accounting recognition models on the risk of stock price collapse and financing costs empirically, thereby extending the results of this study.

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