

Analysis of the IIGF Listed Companies' Green and Brown Revenue Database for Listed Companies and Its Practical Applications



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As the "dual carbon" objectives and sustainable development goals advance, the movement towards economic and social greening, low-carbon development, and high-quality growth has become increasingly significant. Within this context, a critical issue has arisen: how to not only advance the rapid expansion of "green" sectors—such as energy efficiency, environmental protection, clean production, and renewable energy—but also to further enable the low-carbon transformation and upgrading of traditional industries while harnessing their intrinsic potential. Finance, as the lifeblood of the real economy, plays an essential role in the effective allocation of resources and risk management, thereby supporting the green and sustainable development of industries and facilitating a comprehensive economic and societal transformation. This paper will examine the IIGF Green and Brown Revenue Database for listed companies, an innovative tool developed by the International Institute of Green Finance (IIGF) at Central University of Finance and Economics. It will analyze the database's applications in theoretical research and market practice, offering valuable insights for academic studies, financial instrument development, and financial product innovation.

PRIMARY CHALLENGES ADDRESSED BY THE GREEN AND BROWN REVENUE DATABASE FOR LISTED COMPANIES

Comprehensive fulfillment of the risk identification requirements for "greenwashing" within financial institutions

The green and brown revenue data for listed companies is an essential metric for financial institutions in detecting "greenwashing" risks. It facilitates a rigorous and quantitative evaluation of the green performance of investment and financing assets, supporting both scientific and objective disclosure of environmental information and serving as foundational data for climate and environmental risk stress testing. As the "dual carbon" targets advance, the global framework for identifying climate-related financial risks and opportunities is becoming more sophisticated. Sustainable legislation, exemplified by the European Green Deal and the Green Transition Directive, is accelerating the market-driven efforts to counteract greenwashing. Concurrently, national green finance policy frameworks are being reinforced, increasing the demand for financial institutions to quantify

	Green and Brown Revenue Database	Traditional Industry Classification Methods
Update Frequency	Currently updated annually, with potential future inclusion of semi-annual reports. The update frequency is relatively high, allowing for timely reflection of changes and trends in companies' green and brown revenues.	Updates occur less frequently, and for many large listed companies, industry classifications tend to be quite generalized.
Labeling Framework	Allows a primary revenue activity to have multiple green or brown revenue labels, enabling the identification of both green and brown attributes for companies with limited disclosure.	In a standardized industry classification framework, a company is restricted to a single industry category, thereby ensuring the exclusivity of green and brown revenue labels.
Data Sources	Directly identifies green and brown revenues through primary revenue composition fields, using data disclosed directly by companies and verified for increased reliability.	Relying predominantly on criteria set by the China Securities Regulatory Commission (CSRC), the Securities Association of China (SAC), and national economic sectors carries a risk of misclassification in the identification of a company's green and brown revenues.
Evaluating Corporate Green Transition	The trend in the ratio of green to brown revenue provides a direct measure of the degree to which a company's core business activities are transitioning to green practices.	It is not feasible to evaluate the degree of a company's transformation.
Green Sector-Related Companies	This approach enables the development of a benchmark pool of comparable companies, which allows for focused analysis of industry performance based on fixed green and brown revenue attributes.	The categorization and comparative analysis of companies using green or brown labels are not feasible.

Table 1. Comparative Advantages of the Listed Companies' Green and Brown Revenue Database Relative to Conventional Classification Approaches

Source: IIGF, CUF

their carbon attributes and mitigate greenwashing risks. Additionally, local regulatory bodies are advancing requirements for environmental information disclosure by financial institutions. For instance, the "Shenzhen Guidelines for Financial Institutions on Environmental Information Disclosure" require comprehensive and accurate disclosure of the green revenue information of assets by banks, insurance firms, and securities institutions. This data also serves as a valuable supplement to carbon emission databases, addressing existing information gaps. The expansion in the temporal scope and coverage of listed companies' green and brown revenue data will further support the development of practical low-carbon transition strategies for financial institutions.

Addressing the inherent biases in conventional green revenue identification systems

Traditionally, revenue classification for listed companies has relied predominantly on industry affiliation, lacking in-depth analysis of a company's core operations and business units. Such conventional green identification systems are often rigid, imposing a binary classification of revenues as either green or brown based on industry norms. For instance, the entire environmental sector might be broadly categorized as green, while the oil and chemical sectors are typically deemed brown.

This approach renders the accuracy of green and brown revenue classification highly dependent on the granularity of industry categorization, which inadequately reflects the dynamic nature of companies. Especially for firms undergoing a green transition, their actual green revenues often surpass those identified by traditional industry-based methods. As demonstrated in Table 1, the Listed Companies' Green and Brown Revenue Database rectifies these inherent biases by enhancing timeliness, precision, traceability, and contextual relevance.

Offering a sophisticated, dynamic, and systematic data aggregation tool

The Listed Companies' Green and Brown Revenue Database facilitates the effective integration of fragmented data, providing a foundation for comprehensive data analysis. It addresses the unique characteristics of companies within diverse industries by utilizing detailed classification and labeling methodologies, ensuring both accuracy and relevance. With regard to information transparency, the database offers a standardized framework that enables more straightforward horizontal and vertical comparisons of corporate data for financial institutions.

The approach to data collection and classification accounts for potential changes in companies' operational practices, thereby offering a dynamic representation of their status. Furthermore, the database incorporates financial technology elements, employing a combined "system intelligence + expert judgment" labeling system. This system integrates various corporate characteristics and restructures data attributes based on national economic sector classifications and green versus brown industry modules, thereby maximizing the precision and consistency of green and brown revenue data across multiple years.

Diverse applicability of the database facilitates a seamless integration of theoretical research with practical market applications

One of the fundamental attributes of the Listed Companies' Green and Brown Revenue Database is its versatility in application, facilitating a seamless integration of theoretical research with practical market analysis across several dimensions, including industry assessment, product development, and risk evaluation. For investors, the database offers comprehensive data to evaluate companies' environmental performance and potential for green transformation, thus supporting the development of scientifically robust sustainable investment strategies. Financial institutions benefit from the database's precise and detailed information, which underpins the creation of innovative and adaptable sustainable financial products. Researchers can leverage the database for systematic analysis to identify green and brown revenue streams within industries and evaluate the extent of industry-wide green transitions, thereby providing a solid foundation for policy formulation and industry advancement. Additionally, the database aids companies in pinpointing sources of green and brown revenue, thereby reflecting their current status and potential in green transformation and guiding the development of more scientifically informed and sustainable transition strategies.

THE GREEN AND BROWN REVENUE DATABASE FOR LISTED COMPANIES DEVELOPED BY THE INTERNATIONAL INSTITUTE OF GREEN FINANCE (IIGF) AT CENTRAL UNIVERSITY OF FINANCE AND ECONOMICS

The IIGF Green and Brown Revenue Database for Listed Companies advances beyond the conventional method of categorizing entire industries as either green or brown by offering a nuanced analysis of green and brown revenues at a granular level for different industries and firms. This approach enables investors to detect potential greenwashing risks and facilitates the monitoring of companies' progress in green transitions, providing a robust basis for evaluating sustainable practices.

To address industry-specific variations, the database categorizes companies' primary revenues into three distinct classes: "brown," "green," and "non-green-brown." Additionally, it employs a combination of "systematic intelligence and expert judgment" to further refine the revenue labels, enhancing the precision of the assessment of companies' core activities and overcoming the limitations of traditional single-label classifications.

The IIGF Green and Brown Revenue Database comprises six primary categories, 27 secondary categories, and 100 detailed subcategories of green revenue labels, as well as eight primary categories and 38 secondary categories of brown revenue labels. The criteria for identifying green revenue are derived from the "Green Industry Guidance Catalogue (2019 Edition)" and the "Green and Low-Carbon Transition Industry Guidance Catalogue (2024 Edition)," whereas brown revenue is categorized according to China's eight high-emission sectors: petrochemical, chemical, building materials, steel, non-ferrous metals, paper, power, and aviation. As depicted in the database system interface (Figure 1), the database employs key fields such as "Main Revenue Name," "Green Revenue Label," "Green Revenue Proportion," "Brown Revenue Label," and "Brown Revenue Proportion" to systematically categorize revenues as green or brown. This methodology facilitates a precise classification of company revenues based on the detailed analysis of disclosed main activities in annual reports, thereby offering a comprehensive overview of an enterprise's green and brown revenue proportions. The database currently encompasses over 5,300 A-share listed companies and includes more than 300,000 data records spanning from 2010 to 2022.

As detailed in the table below, the IIGF Green and Brown Revenue Database is characterized by six key strengths: extensive data coverage, frequent updates, diverse labeling schemes, label reliability, the capability to identify greenwashing risks, and an interactive query interface. These attributes are instrumental in financial product analysis, industry research, portfolio management, and the assessment of corporate green transitions. They enable financial institutions to evaluate the green development status of companies and offer more tailored financial services, thereby mitigating related risks.

报告期	主营收入名称	绿色收入标签	绿色收入 (万元)	棕色收入标签	棕色收入 (万元)
2021	电力-水电	水力发电和抽水蓄能装备制造	77,526.44	—	—
2021	电力-光伏	太阳能发电装备制造	125,980.47	—	—
2021	电力-风电	风力发电装备制造	245,500.41	—	—
2021	生态环保	节能环保产业	654,129.37	—	—
2021	电力-燃煤	—	—	火力发电	976,510.17
2021	电力-燃机	—	—	火力发电	615,043.12

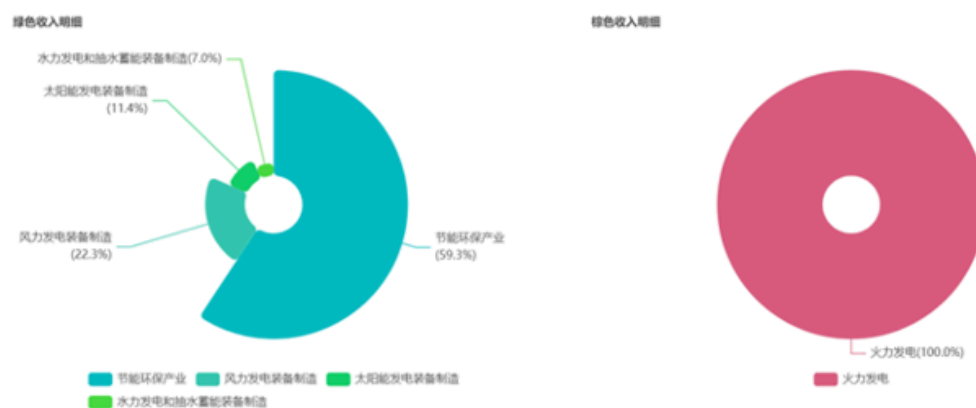


Figure 1. Interface Display of the IIGF Listed Companies' Green and Brown Revenue Database (Partial View)
Source: IIGF, CUFE

Database Characteristics	Main Content
Comprehensive Data Coverage	<ul style="list-style-type: none"> Revenue data for over 5,300 A-share listed companies covering fiscal years 2010-2022. This dataset offers a refined window for comparative analysis, facilitating more precise and effective insights into market trends and dynamics.
Timely Data Updates	<ul style="list-style-type: none"> Provides timely updates on companies' green and brown revenue metrics, offering current and primary data. Serves as a more effective platform for investment decision-making. Delivers substantial data support for corporate initiatives towards green transformation.
Diverse Label Classification	<ul style="list-style-type: none"> Refines labels and stores and manages data based on various dimensions and characteristics. Employs multi-label classification to assess the main activities of companies, addressing the issue of singular labels in traditional industry classifications.
Label Reliability	<ul style="list-style-type: none"> The "System Intelligence + Expert Manual Judgment" approach to labeling provides a dual safeguard of both "automated processing at scale" and "quality assurance." The modular approach to data updates ensures both the timeliness and sustainability of the information, thereby maintaining consistency in labeling.
Greenwashing Risk Assessment	<ul style="list-style-type: none"> Evaluates the allocation of green and brown revenues by dissecting the distribution of these revenues across industry sectors and specific business activities, based on the core operational activities of the company. Assesses the revenue structure to delineate corporate environmental initiatives, thereby facilitating the identification and analysis of potential greenwashing practices among companies and financial assets.
Interactive Query System	<ul style="list-style-type: none"> The system enables users to adjust query parameters according to their specific requirements, allowing for targeted searches within designated parameters. Data is presented through comprehensive visualizations, including charts, graphs, and maps, facilitating an in-depth analysis of revenue, identifying trends, and uncovering potential relationships.

Table 2. Key Features of the IIGF Listed Companies' Green and Brown Revenue Database
Source: IIGF, CUFE

Theoretical Research: In-Depth Industry Analysis and Factor Model Development

Industry Research: Case Study of Green and Brown Revenues in the Power Generation Sector

From an industrial analytical perspective, the scale and proportion of green and brown revenues among listed companies provide a clear indicator of the industry's progress towards green transformation, offering a quantifiable basis for evaluating corporate shifts towards sustainability. Using "power generation companies" as a case study, the research team utilized the IIGF Green and Brown Revenue Database to perform a detailed examination of the industry's green revenue composition. Figure 2 illustrates the evolution of green and brown revenues in the power sector from 2010 to 2022. During the period from 2010 to 2014, the sector was predominantly characterized by brown revenues, with green revenues growing at a slow pace. Between 2015 and 2020, the increase in both green and brown revenues was synchronized, although brown revenues continued to dominate the sector. Post-2020, green revenues experienced substantial growth, surpassing brown revenues by 2022, which aligns with overarching macroeconomic policies and market trends. Furthermore, the database allows for nuanced analysis of primary units with ambiguous boundaries. For instance, approximately 50% of revenues with dual green and brown attributes are linked to "power," nearly 20% to "power products," and over 10% to "power sales."

A critical aspect of industry analysis is assessing the progress of green transformation and the associated performance metrics, which constitutes a primary application of the database. Utilizing the power industry as a case study, the research team categorized companies into 10 distinct groups based on their green to brown revenue ratios. Group G1 exhibits the lowest green to brown revenue ratio, whereas Group G10 exhibits the highest. The data was observed over a three-year interval. Figure 3 illustrates the utility of the database in analyzing and depicting the low-carbon transition of power industry companies. A comparative analysis of data from 2010 and 2022 reveals a notable increase in the number of companies within the higher green revenue groups, alongside a substantial decrease in the number of companies in Group G1, which has the highest brown revenue ratio. This trend indicates a significant industry-wide shift towards more environmentally sustainable practices, highlighting substantial advancements in the green transformation of companies within the power sector.

The "green minus brown revenue ratio" serves as a foundational metric for assessing the "green minus brown factor" of publicly listed companies, providing a key basis for quantitatively evaluating corporate sustainability levels. Analyzing this "green minus brown factor" can substantiate its effectiveness within the A-share market, offering novel perspectives for developing sustainable investment portfolios and supporting the theoretical framework for database product development and financial instrument innovation.

Accordingly, the research team has extended the methodology of Fama and French (2015) by constructing a green-brown factor based on the green minus brown revenue ratio of firms [5], and conducting an empirical analysis of stock returns in the A-share market from 2013 to 2023.

Grouping stocks by market capitalization, book-to-market ratio, and green minus brown revenue ratio generates a stock pool, designated as $S1|BM1|G1$, with the returns of this pool

noted as $r_{S1|BM1|G1}$. Based on the distribution within the green-brown database, the research team explored two classification schemes for companies according to their "green minus brown revenue ratio," identified as GMB005 and GMB010 [6]. Figure 4 depicts the cumulative returns of the green-brown factor across various groupings.

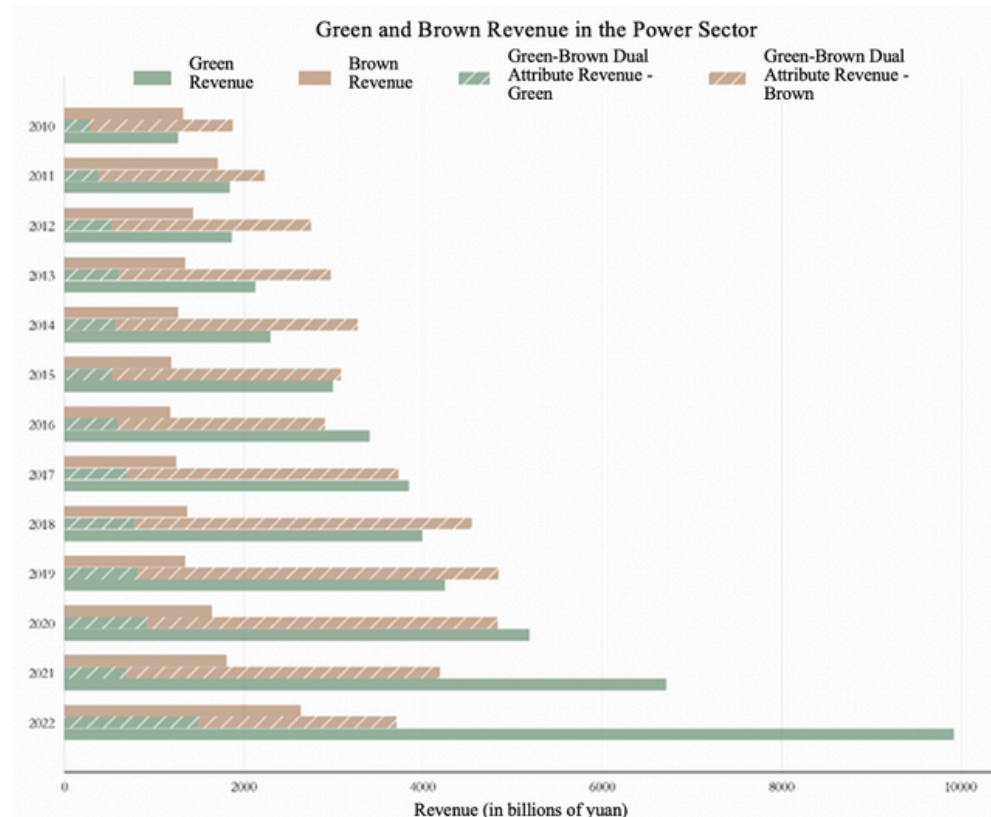


Figure 2. Green and Brown Revenue in the Power Sector (2010 to 2022) (in 100 million yuan)
Source: IIGF, CUFE

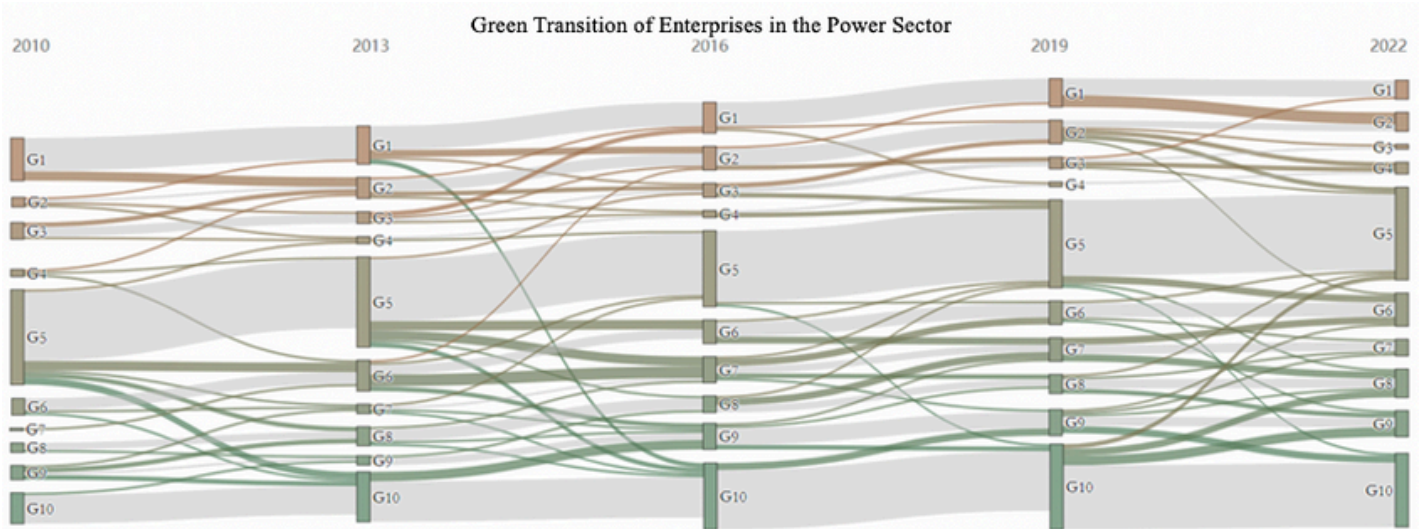


Figure 3. Green Transformation of Power Industry Companies (2010 to 2022)
Source: IIGF, CUFE

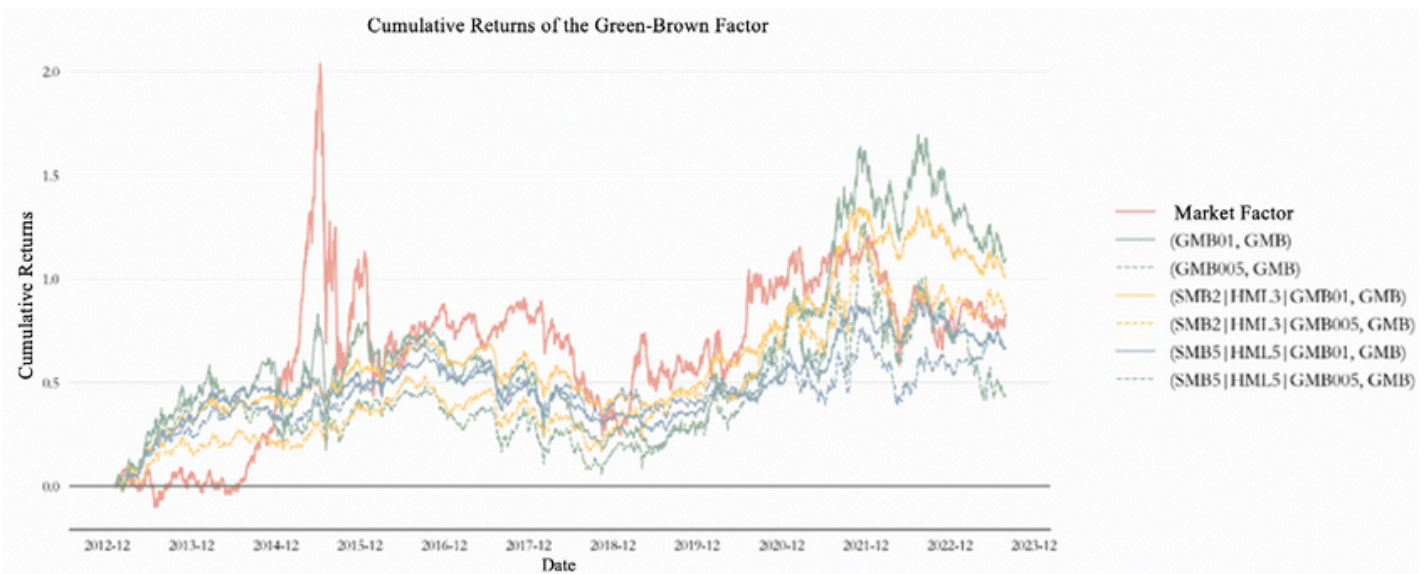


Figure 4. Cumulative Returns of the Green-Brown Factor
Source: IIGF, CUFE

The market factor returns ($R_m - R_f$) are represented by a red solid line, the cumulative returns for the GMB010 green-brown factor by a green solid line, and the cumulative returns for GMB005 by a green dashed line. Across all grouping methods, the cumulative returns of GMB010 consistently surpass those of GMB005. During the volatile period from late 2014 to late 2015, the green-brown factor exhibited relatively stable fluctuations, suggesting that the green-brown factor offers greater stability and resilience against risk during periods of significant market volatility.

Market Practices: Financial Product Innovation and Index Construction

Financial Product Innovation: Beijing Bank's Loan Products Tied to Green-Brown Revenue Metrics

The credit risk level of a company is directly reflected in its probability of default, which subsequently impacts the company's financing costs. As depicted below, the research team categorized publicly listed companies into ten

distinct groups based on their green minus brown revenue ratio [7]. The analysis reveals a clear monotonic relationship between a company's creditworthiness (as indicated by default distance and probability) and its green minus brown revenue ratio. Specifically, companies with a higher green minus brown revenue ratio (i.e., net green revenue) are found to have a lower risk of default. From a financial market application perspective, the IIGF green-brown revenue database can be employed for purposes such as identifying green-themed credit risks, assessing interest rates, constructing carbon risk models, and determining green attribute factors.

In June 2024, with the support of IIGF, Bank of Beijing introduced the nation's inaugural green-brown revenue-linked loan product. This financial instrument capitalizes on the advantages inherent in green financing by offering preferential interest rates contingent upon the borrower's green-brown revenue ratio. The product employs a spread-ratchet mechanism to determine these preferential rates, appropriately adjusting them in accordance with the borrower's green-brown revenue ratio.

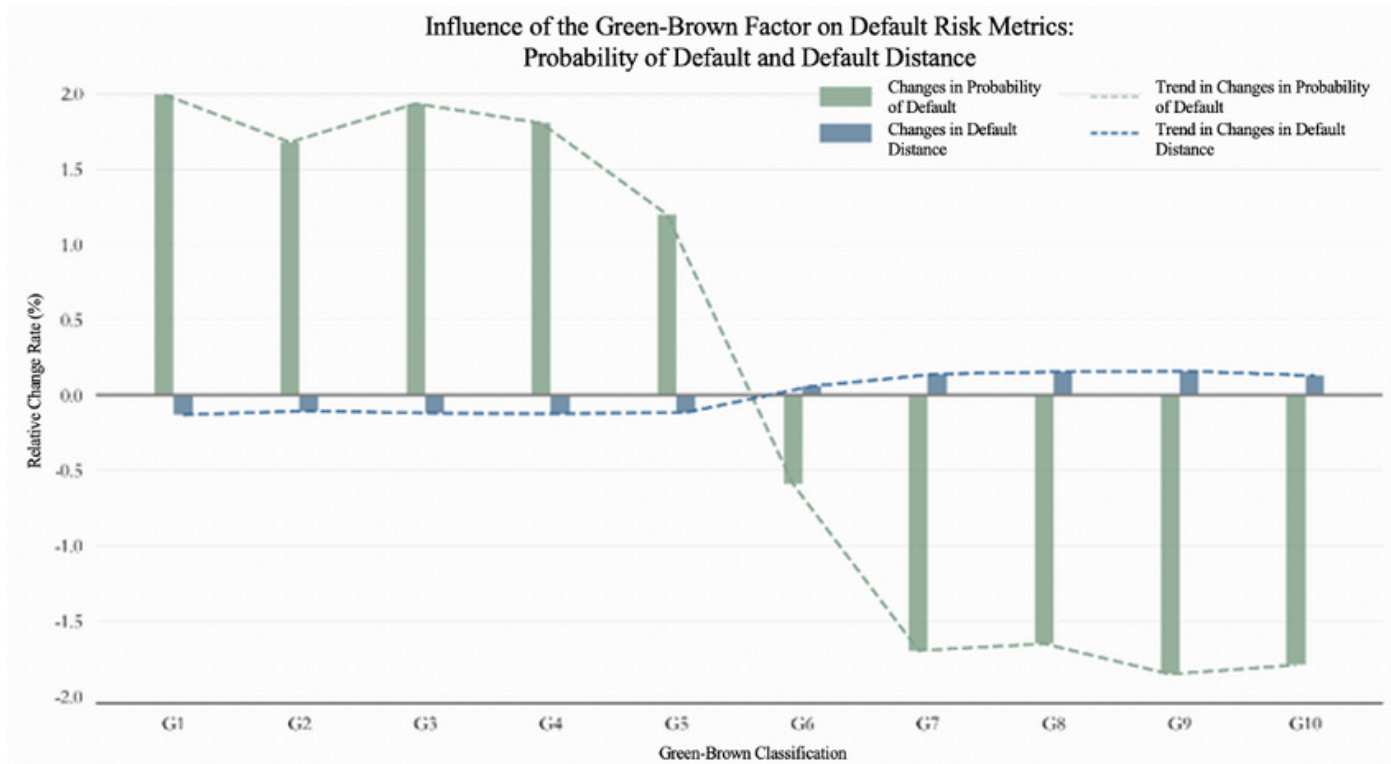


Figure 5. Influence of the Green-Brown Factor on Default Risk Metrics: Probability of Default and Default Distance
Source: IIGF, CUFE

A notable aspect of this loan product is its incorporation of the green-brown revenue ratio as a primary Key Performance Indicator (KPI). It utilizes a one-way incentive structure to provide reduced interest rates to clients who achieve Sustainability Performance Targets (SPTs), thereby mitigating the costs associated with green financing. This initiative not only supports the enterprises' green development efforts but also incentivizes them to prioritize the green transformation of their core operations alongside their economic objectives.

Development of the "Green and Low-Carbon" Themed Index: The Carbon Neutrality 50 Index

Utilizing the IIGF green-brown revenue database as a fundamental resource enables the development of a range of index construction methodologies. These methodologies facilitate the identification of investment candidates that are actively engaged in transformation and exhibit significant growth potential.

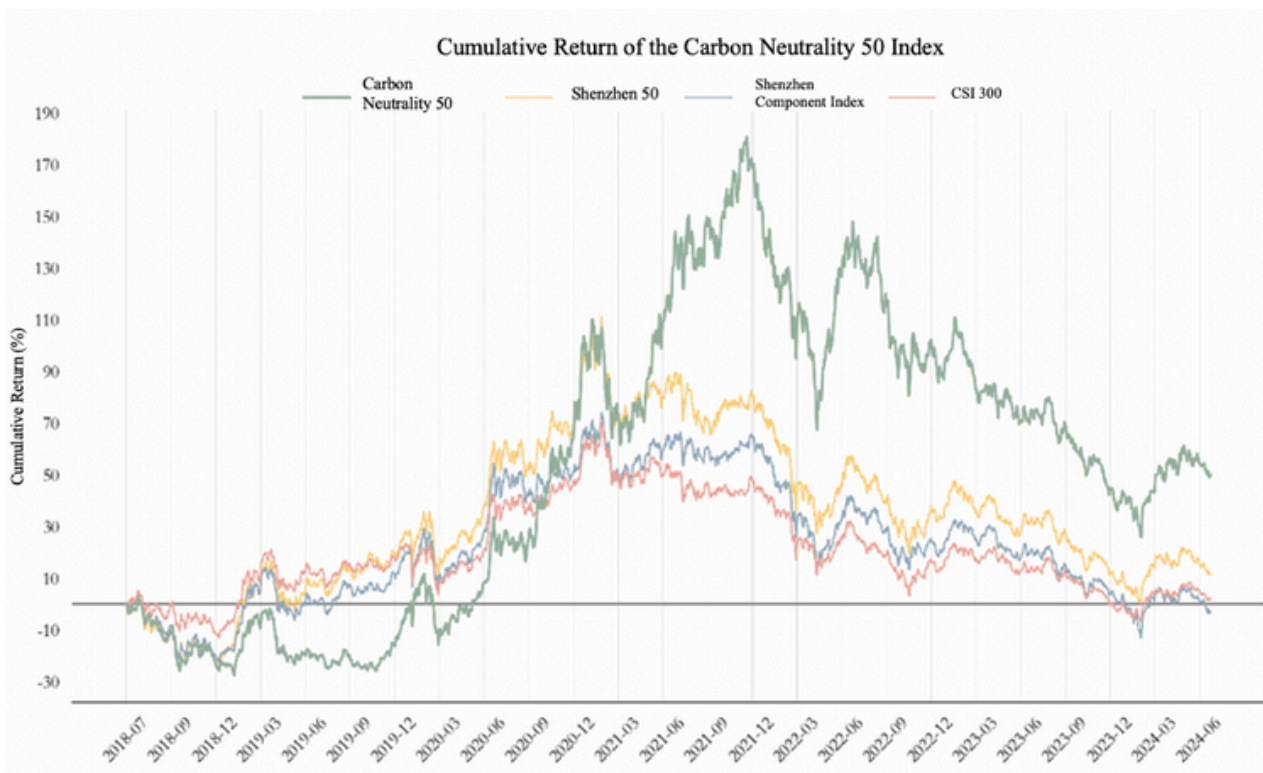


Figure 6. Impact of the Green-Brown Factor on Default Risk Indicators: Probability of Default and Default Distance
Source: IIGF, CUFE

By providing investors with evidence-based, objective, and forward-looking benchmarks, this approach aims to assist in achieving long-term sustainable investment outcomes.

In April 2022, IIGF in collaboration with the China Securities Index Co., Ltd., introduced the Carbon Neutrality 50 Index, which is grounded in the green-brown revenue database [8]. This index is designed to capture the stock price movements of publicly listed companies engaged in carbon neutrality-related sectors and to enhance the spectrum of green investment options. The index utilizes A-share companies listed on the Shenzhen Stock Exchange that meet specific eligibility criteria [9] as its candidate pool. During the component stock selection process, significant attention is given to both the "green and low-carbon theme" and the "green transformation theme." For companies under the "green transformation theme," the IIGF green-brown revenue database is extensively employed, focusing on metrics such as the growth in the proportion of green revenue over the past three years and the reduction in the proportion of brown revenue. These indicators are used to evaluate the extent of corporate green transformation and to establish the sample pool for the index. As of early July 2024, the Carbon Neutrality 50 Index has recorded a cumulative return of 49% (as illustrated below), markedly surpassing the performance of market indices over the same period, equivalent to four times the cumulative return of the Shenzhen 50 Index and 23 times that of the Shenzhen Component Index.

Footnotes

[1] Currently, the database uses the 2019 version of the Green Industry Guideline Directory as the basis for green revenue.

[2] Proportion of Green Revenue for a Company

$$= \frac{\sum_{i=1}^n G_i}{R}$$

where G_i represents the i -th item of green revenue from the company's main operations, and R is the total revenue from the company's core business.

[3] Proportion of Brown Revenue for a Company

$$= \frac{\sum_{i=1}^n B_i}{R}$$

where B_i represents the i -th item of brown revenue from the company's main operations, and R is the total revenue from the company's core business.

[4] The green-minus-brown revenue ratio, also known as the net green revenue ratio, ranges from [-1, 1]. Values closer to 1 indicate a higher absolute level of green revenue for the company, while values closer to -1 signify a higher absolute level of brown revenue.

A green-minus-brown revenue ratio of 0 indicates that the company either does not engage in green or brown revenue or that the levels of green and brown revenue are equal.

[5] The regression equation incorporating the green-minus-brown factor is as follows:

$$R_A - R_f = \alpha + \beta_m(R_m - R_f) + \beta_{GMB} \times R_{GMB} + \beta_{SMB} \times R_{SMB} + \beta_{HML} \times R_{HML} + \epsilon$$

In this equation, R_A denotes the return on the asset, R_f represents the risk-free rate, and R_m is the market return. $R_m - R_f$ indicates the risk premium. The variables R_{SMB} and R_{HML} correspond to the simulated returns of the size factor and the book-to-market factor, respectively. R_{GMB} represents the simulated return of the green-minus-brown factor. The coefficients β are the parameters to be estimated, and ϵ denotes the residual.

[6] In the GMB005 framework, stocks are categorized into three groups based on their green-minus-brown revenue ratios: the lowest 5% are assigned to the first group, the middle 90% to the second group, and the highest 5% to the third group. Similarly, under the GMB010 framework, the bottom 10% of stocks with the lowest green-minus-brown revenue ratios are designated as the first group, the middle 80% as the second group, and the top 10% as the third group.

[7] G1 represents the group with the lowest green-minus-brown revenue ratio, while G10 represents the group with the highest ratio.

[8] Index code: 980021, hereinafter referred to as the Carbon Neutrality 50 Index.

[9] The component stocks of the index must meet the following screening criteria: they should not be ST or *ST stocks; they must have been listed for more than six months; the company should not have had significant violations or major issues with financial reporting in the past year; the company should not have experienced abnormal operations or significant losses in the past year; and there should be no unusual stock price fluctuations during the observation period.



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[Link to the original: https://mp.weixin.qq.com/s/ih-TV06utsPfrWH4YP-Spg](https://mp.weixin.qq.com/s/ih-TV06utsPfrWH4YP-Spg)

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