



2024 REPORT ON GLOBAL SUSTAINABLE FINANCE AND LOW CARBON DEVELOPMENT

**CEIBS Lujiazui International Institute of Finance
CEIBS Finance MBA (FMBA) Programme**

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About CEIBS Lujiazui International Institute of Finance

The CEIBS Lujiazui International Institute of Finance (CLIIF) was initiated by the China Europe International Business School (CEIBS) and the Shanghai Lujiazui (Group) Co., Ltd. in October 2007. The purpose of CLIIF is to carry out social influence research and facilitate the construction of Shanghai International Financial Center, for China's macro-economic control and financial stability. Based in Shanghai, CLIIF shall serve as an open and international platform for academic exchange while focusing on studying the opportunities and path to the financial opening-up and development of the service industry under the new development pattern. CLIIF is committed to providing first-class research, consulting and training services to financial institutions, financial regulation agencies, financial investors, and consumers, as it fulfils its role as an influential think tank for the development of Shanghai as an international financial center and promotes a "going-out strategy" for China's financial institutions and enterprises.

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About FMBA

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Beyond the classroom, the practice-driven "F4" series of activities provide students with diverse perspectives, deep insights into the forefront of business, and a comprehensive enhancement of practical skills and business acumen. Since its inception in 2011, the CEIBS FMBA has cultivated over a thousand senior management talents who are active in various industries, becoming the backbone of promoting the synergy between industry and finance.



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Preamble

Since the Industrial Revolution of the 19th century, technological advancements have fueled unprecedented prosperity for human society. However, the reliance on fossil fuel consumption has led to significant industrial pollution, environmental degradation, and an escalating climate crisis. In response, the concept of sustainable development began to take shape in the 1970s and has since become a globally recognized and pursued model for economic growth. The rising demand for financial services aligned with sustainable development objectives has catalyzed the growth of sustainable finance. In essence, Sustainable Finance integrates the objectives of environmental protection, social responsibility, and governance (ESG) into traditional financial activities and investment decisions.

Among the various sustainable development objectives, addressing climate change caused by greenhouse gas emissions is one of the most urgent challenges. In September 2020, China's President Xi Jinping announced at the United Nations General Assembly that China aims to peak its carbon emissions by 2030 and achieve carbon neutrality by 2060, establishing the country's overarching climate action goals. On August 11, 2024, the Central Committee of the Communist Party of China and the State Council issued the "Opinions on Accelerating the Comprehensive Green Transition of Economic and Social Development," marking the first national-level strategy for accelerating a comprehensive green transition. The goal is to establish a green, low-carbon, and circular economic system by 2035. Throughout this process, enterprises will undoubtedly play a pivotal role as both key practitioners and core drivers in the "comprehensive, collaborative, innovative, and secure" transformation of China's economy and society.

While businesses are motivated to align with sustainable development trends, significant financial support is required for their transformation efforts. Furthermore, the transition involves rising costs, policy uncertainties, and technological risks. As a result, although half of global publicly listed companies have committed to net-zero

emissions,¹ there remains a substantial gap between aspirational visions and actual actions. Sustainable finance should help bridge this gap by establishing financial market mechanisms that align with climate action goals, it means to lower the cost of low-carbon investments, mitigating risks associated with these assets, and increasing the cost of holding carbon-intensive assets. This would direct more "smart" capital toward low-carbon transition projects.

This report, jointly produced by the China Europe International Business School (CEIBS) Lujiazui International Institute of Finance (CLIIF) and the CEIBS Finance MBA (FMBA) Programme, aims to track and analyze the progress of sustainable finance and corporate decarbonization, with a particular focus on the development of green initiatives in Chinese enterprises. The goal is to track and provide first-hand, reliable, and relevant data reviews and analyses to international and domestic, public and private, corporate and investment institutes, to serve China's "dual carbon" goals and broader sustainable development strategies.

The report was led by Professor Xinge ZHAO, Executive Deputy Director of CLIIF, and Professor Fang YU, Director of the CEIBS FMBA Program, with coordination from Liu Gongrun, Deputy Director of CLIIF, and Ma Ning, Administrative Director of the CEIBS FMBA Program. The 2024 report consists of three main chapters: the first two chapters were written by CLIIF researchers Xi CHEN and Ju QIU, while the third chapter, "CEIBS Alumni Insights," features research projects by CEIBS FMBA 2022 alumni, Jingchang ZOU, Zhuojun KONG, Jin LI, Shoupeng XU, and Jiancheng ZHANG.

¹ MSCI, The MSCI Net-Zero Tracker, May 2023.

Executive Summary

✧ The Development and Practices of Sustainable Finance

Over the past eight years, the global sustainable bond and loan markets have exhibited a three-phase development pattern. In the first phase (2016–2019), the sustainable bond and loan markets maintained relatively low annual issuance volumes and numbers, with the market size remaining stable. The second phase (2020–2021) witnessed significant expansion in these markets, especially driven by the pandemic, with global issuance volumes reaching historic highs in 2021, particularly for green bonds and social bonds. In the third phase (2022 to the present), the global sustainable bond and loan markets experienced a notable decline due to factors such as global economic downturns and worsening geopolitical conditions. However, by 2023, the markets began to recover and showed strong signs of a rebound by early 2024.

The global sustainable bond market is becoming increasingly diverse, exhibiting distinct development trends. Firstly, green bonds have consistently been the primary driving force in the market, with their issuance volume and quantity far surpassing the other three types of bonds, despite some fluctuations. Secondly, as global efforts to address social and economic challenges have intensified, the significance of social bonds and sustainability bonds has rapidly grown. Notably, during the pandemic in 2020, social bond issuance saw a breakthrough, reaching ten times the volume of the previous year.

Regionally, Europe has long been the dominant player in the global sustainable bond market, consistently accounting for around 50% of global issuance. From 2022 to 2023, the Asia-Pacific region surpassed the Americas in sustainable bond issuance, becoming the second-largest issuing region globally. This rise is mainly attributed to the rapid growth of China's green finance market.

In contrast to its dominant position in the sustainable bond market, ***Europe's sustainable loan issuance has been more volatile over the past four years, with the Americas emerging as a strong competitor.*** In the first half of 2024, Europe's sustainable loan market expanded to \$160.2 billion, accounting for 42.4% of the global total, slightly ahead of the Americas' 37.4% share.

The construction of the EU sustainable finance framework primarily revolves around three core pillars: the EU Taxonomy, the disclosure system for financial institutions and companies, and sustainable investment tools aimed at promoting sustainable development. So far, significant progress has been made in the legislation and implementation of these three pillars, providing a relatively comprehensive regulatory environment for sustainable investment within the EU.

China's sustainable finance market has formed a diversified development pattern led by green finance, with emerging sectors such as transition finance and social responsibility finance as complementary. Between 2018 and 2023, China's green loans achieved an average annual growth rate of 26.62%. In 2022 and 2023, the issuance of green bonds in both domestic and overseas markets reached record highs of ¥ 980 billion and ¥ 1.08 trillion, respectively, with year-on-year growth rates of 60.66% and 10.20%. In the field of emerging finance, China issued 53 Sustainability-Linked Bonds (SLBs) in 2023, with a total volume of ¥ 40.6 billion, maintaining its global leadership.

However, compared to developed countries and regions in the sustainable finance market, China is still in a catch-up phase. Areas such as the development of information disclosure systems, expansion of sustainable finance standards, and alignment with international practices remain underdeveloped. For instance, disclosure requirements are still primarily encouraged rather than mandatory, the scope of mandatory disclosure indicators for companies remains limited, and the proportion of listed companies disclosing sustainability information is still relatively low.

✧ Sustainable finance and the low-carbon development progress

To achieve the 1.5 °C target set for the end of this century while minimizing the economic and social costs of a low-carbon transition, it is essential to scale up climate

investment as soon as possible. ***Recent global investment flows suggest that potential funds to combat climate change could be sufficient, however, the key issue lies in the lack of incentives.***

Consider "green premium" or "carbon premium" as metrics for assessing the capital market's support for low-carbon economic activities, as well as its penalization of high-carbon projects, so far, there is no solid evidence that suggest the common existence of such premiums. A comparison of the returns on different types of financial assets reveals that green financial assets exhibit greater volatility compared to traditional financial assets. Although green assets may generate higher returns during market upswings, they also experience sharper declines during market downturns. This high-risk characteristic indirectly indicates that the capital market has not yet established a reward to green and low-carbon investments, implying a lack of incentives strong enough to drive large-scale capital flows into low-carbon sectors.

In terms of financial institutions' carbon reduction progress, among the world's 54 largest lending banks, 48 have set net-zero emissions targets, with 23 of them committing to halting financial support for coal-related assets. Compared to 2017, 37 banks with continuous data disclosure reduced their total loan exposure to five carbon-intensive industries—oil and gas, coal, power, steel, and cement—by 24%, with loan-associated carbon emissions dropping by more than 40%.

Regional trends indicate that European banks have seen the largest reductions in both loan volume to these carbon-intensive sectors and associated carbon emissions, followed by North American banks. In contrast, banks in the Asia-Pacific region have significantly increased both their lending to these industries and the associated carbon emissions.

Preliminary analysis suggests that the notable decline in banks' loan-related carbon exposure may be attributed to several factors: the reduction in the industries' carbon emissions, a cleaner carbon mix, and changes in bank lending strategies towards high-carbon sectors.

On the corporate side, data of 432 companies in carbon-intensive industries globally shows that 68% of these companies have set net-zero emissions targets. Regionally, over 80% of companies in both Europe and South Latin America have committed to net-zero goals, the highest among regions in comparison. The vast majority (75%) of companies' net-zero targets cover Scope 1 and

2 emissions, while only 17% aim for full net-zero across Scope 1, 2, and 3 emissions. In terms of emission reduction pathways, 60% of companies plan to achieve carbon neutrality through market-based mechanisms such as purchasing carbon credits or investing in carbon offsets. The remaining 40% of companies aim to reach net-zero entirely through location-based decarbonization.

Analyses on a larger group of listed companies from 62 countries and across 32 industries indicate that, ***in the decade since 2014, companies have halved their average carbon emissions and reduced their emissions intensity by almost a third, with average energy consumption falling by 45 % and energy intensity decreasing by 40 %.***

Sub-industry analysis reveals that most sectors have shown varying degrees of decline across these four indicators, with only a few exceptions. However, ***regional differences are substantial.*** North American companies had the highest average carbon emissions across all regions, and between 2014 and 2019, they experienced the most significant reduction. However, since 2020, emissions reduction has plateaued.

European companies had the second-highest average emissions before 2019, but their emissions have steadily declined, with ***the median emissions of European companies becoming the lowest among all regions by 2021.*** Over the past ten years, European companies' emissions have fallen by 68%. In addition, their carbon intensity and energy intensity have shown steady annual declines, contrasting with the fluctuations observed in other regions. This reflects the effectiveness of climate legislation and the green transition efforts in European countries.

Asia-Pacific companies have seen a steady decline in average carbon emissions since 2019, signaling a gradual shift towards lower emissions in the region.

In general, fluctuations have been observed for changes in both carbon emissions and energy consumption. Before the pandemic, an increasing proportion of companies were reducing their emissions and energy consumption. However, during the post-pandemic recovery phase, this trend was reversed until 2022, in which relevant indicators approached those seen before the pandemic.

For example, in 2015, about half of the companies experienced a year-on-year decline in carbon emissions. By 2020, this proportion increased to 70%. However, in 2021, the percentage of companies reducing their emissions fell to 44%, and by 2022,

it had recovered to levels similar to 2019, with approximately 50% of companies showing a year-on-year decrease in carbon emissions.

For Chinese companies, significant sectoral differences in carbon emissions and energy consumption are found. The Consumer Goods and Services sector performs better in terms of emissions reductions, with the median corporate emissions and emission intensity decreasing by 16% and 29%, respectively, compared to 2016. However, in the other three sectors---Energy & Power, Manufacturing & Technology, and Metals & Chemicals---average carbon emission have continued to increase year by year. Despite this, companies in these sectors have achieved substantial reductions in both emission intensity and energy intensity since 2015.

✧ China's ESG Products

China's ESG regulatory practices are becoming increasingly standardized, and company disclosure are becoming more routine. As of May 2, 2024, a total of 2,124 listed companies had independently prepared and released their 2023 ESG reports, accounting for approximately 39.8% of all A-share companies. Notably, 95% of companies listed in the CSI 300 Index released ESG reports in 2024. The Shanghai Stock Exchange (SSE) has the highest ESG report publication rate at 49.9%, followed by the Shenzhen Stock Exchange (SZSE) at 33.2%. The top three sectors in terms of ESG report release rate in 2024 were the financial industry (91.3%), utilities (64.4%), and energy (58.7%). By contrast, industries such as ICT, consumer goods, pharmaceuticals, and industrials had the lowest disclosure rates, at 31%, 35.1%, and 36.4%, respectively.

As the world's second-largest asset management market, China introduced ESG-related products in 2019. Currently, ***nearly all ESG-related asset management products in the domestic market are public funds and wealth management products offered by banks,*** with only a small number of primary equity private funds adopting the ESG label. ESG investment and secondary private equity funds are almost non-existent.

From 2018 to 2024, the proportion of ESG products issuance relative to the total product issuance in the market has remained stable in the 35-40% range, peaking at 38.8% in mid-2022. In terms of total assets under

management (AUM), the share of public ESG products as a percentage of total public fund products rose steadily from 14% in 2018 to 27% by mid-2022, before declining slightly. The issuance of bank wealth management ESG products followed a similar trajectory to that of public ESG products.

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Chapter I

- The Development and Practices of Sustainable Finance

With technological advancements and productivity improvements, human society and the economy have rapidly developed, but this progress has also led to issues such as resource depletion, ecological degradation, climate change, and social inequality. These problems not only harm the environment but also threaten the stability of the economy and society, becoming obstacles to sustainable development. Over the past half-century, various stakeholders have gradually recognized that traditional business models, which ignore ecological and social responsibilities, may result in unsustainable outcomes, ultimately jeopardizing future economic prosperity.

In this context, the concept of sustainable development emerged. Sustainable development emphasizes that economic growth must be combined with environmental protection and social equity to ensure the sustainable use of resources and the well-being of future generations. However, achieving this goal requires transforming traditional development models and directing capital to support environmentally friendly and socially responsible economic activities. Sustainable finance is a key practical tool for implementing this concept. Its main approach is to integrate environmental (E), social (S), and governance (G) factors into financial decision-making and investment processes, aiming to achieve a harmonious balance of economic, social, and environmental benefits.

This chapter will explore the development and practice of sustainable finance, aiming to provide an overview of global progress, analyze the experience of the European Union as a model for sustainable finance systems, and delve into the opportunities and future development of China in this field.

Section 1

Global Progress in Sustainable Finance

By incorporating environmental, social, and governance (ESG) factors into financial decision-making processes, sustainable finance can achieve financial returns while promoting environmental protection and social progress, driving long-term sustainable economic growth. Currently, the international influence of sustainable finance is steadily expanding, becoming a cutting-edge trend in the financial sector. Governments, international organizations, and major financial institutions worldwide are committed to introducing and formulating policies and regulations that promote the development of sustainable finance. These efforts aim to encourage and guide financial markets to focus more on sustainability, contributing to global sustainable development. Against this backdrop, this section will provide a global perspective on the rise of sustainable finance, the formation of its concepts, and an overview of its practices.

1. The Rise of Sustainable Finance

With the rise of the concept of sustainable development, sustainable finance has emerged accordingly. International organizations and supranational institutions such as the United Nations, the World Bank, the G20, and the European Union have been the driving forces behind the development of sustainable finance policy frameworks. The United Nations Conference on the Human Environment, held in Stockholm in June 1972, marked a significant turning point in global environmental policy and became a key milestone in promoting sustainable finance. In May 1992, just before the Rio Earth Summit, 13 banks, including Deutsche Bank and HSBC, jointly issued the "Banking Sector Statement on Environment and Sustainable Development," which signaled the official launch of the United Nations Environment Programme Finance Initiative (UNEP FI).¹ Since then, this initiative has developed several frameworks aimed at integrating sustainable development into financial market practices, such as the Principles for Responsible Investment (PRI)² in 2006, the Principles for Sustainable Insurance (PSI)³ in 2012, and the Principles for Responsible Banking (PRB)⁴ in 2019. With the gradual

¹ For more information, please refer to the official website of the United Nations Environment Programme (UNEP): <https://www.unepfi.org/about/about-us/history/>.

² In April 2006, the UNEP launched the Principles for Responsible Investment (PRI). Currently, more than 4,000 financial institutions from over 50 countries have signed the agreement. For more information, please refer to the official website of the United Nations Environment Programme (UNEP): <https://www.unepfi.org/about/about-us/history/>.

³ In 2012, the UNEP together with a group of insurance institutions, launched the Principles for Sustainable Insurance (PSI), the first global framework in the insurance industry to address environmental, social, and governance (ESG) risks and opportunities. Over 200 organizations worldwide have adopted its four guiding principles, including insurance companies representing more than 25% of global premium volume and managing assets totaling \$14 trillion. For more information, please refer to the official website of the United Nations Environment Programme (UNEP): <https://www.unepfi.org/about/about-us/history/>.

⁴ In 2019, under the leadership of the United Nations Environment Programme Finance Initiative (UNEP FI), a coalition of 132 banks launched the first global sustainability framework for the banking industry—the Principles for Responsible Banking. These six guiding principles help signatory banks ensure that their strategies and practices

introduction of these principles, the United Nations' sustainability blueprint has now covered the core sectors of the financial industry.

In addition to the United Nations, various international institutions and organizations have also played a collaborative role in promoting the development of global sustainable finance through funding, setting standards, conducting research, and providing technical support. These efforts have facilitated the global transition toward a sustainable economy. For example, the International Finance Corporation (IFC) introduced the widely recognized Equator Principles (EPs) ¹ in 2003, and since 2016, the G20 has released several Comprehensive Reports on Sustainable Finance and the G20 Sustainable Finance Roadmap. Additionally, in 2016, the European Union established the High-Level Expert Group on Sustainable Finance (HLEG) to conduct in-depth research on sustainable finance strategies. ²

Overall, while discussions on sustainable finance have been ongoing for some time, its true global momentum was achieved after the adoption of the United Nations' 2030 Agenda for Sustainable Development in 2015 and the entry into force of the Paris Agreement in 2016. Notably, the Paris Agreement set forth the requirement to "make financial flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development," emphasizing the dual focus on funding targets, emission reduction, and climate adaptation. ³ This marked a significant advancement in global climate finance.

2. The Formation of the Concept of Sustainable Finance

Sustainability is a complex and evolving issue, and neither academia nor industry has yet reached a unified definition of sustainable finance. However, as the role of finance in addressing environmental challenges and promoting sustainable development becomes increasingly significant, the international community's understanding of sustainable finance has been expanding and deepening. The United Nations considers sustainable finance to encompass four key areas: environmental, social, economic, and governance aspects. These areas, in order of scope from broadest to narrowest, include social environmental finance, green finance, climate finance, and low-carbon finance. Climate finance is closely tied to the United Nations Framework Convention on Climate Change (UNFCCC) and focuses on emission reduction and climate change adaptation. Green finance, with a broader definition, not only addresses

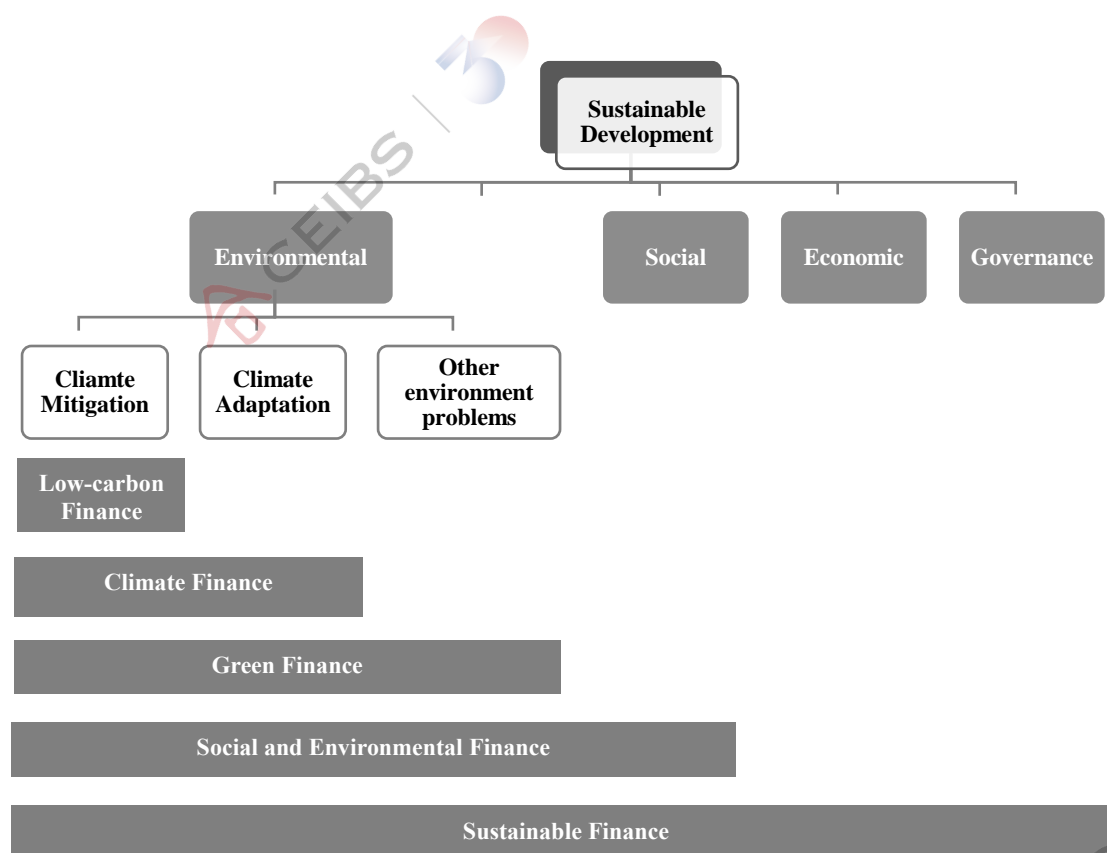
align with society's vision for the future as outlined in the Sustainable Development Goals (SDGs) and the Paris Agreement. The framework brings purpose, vision, and ambition to sustainable finance, with signatories committing to embedding these principles into all areas of their business, from strategy to portfolios and transactions. For more information, please refer to the official website of the United Nations Environment Programme (UNEP) : <https://www.unepfi.org/about/about-us/history/>.

¹ The Equator Principles provide financial institutions with a framework and standards for managing environmental and social risks in project financing across industries such as mining, oil, gas, and forestry. These principles are designed to identify, assess, and manage environmental and social risks in project finance, offering minimum due diligence standards for making responsible risk decisions. As of June 2023, the Equator Principles have been adopted by 139 financial institutions across 39 countries, establishing themselves as the global industry standard for managing environmental and social risks in project financing. For more information, please refer to the following website: <https://www.ifc.org/content/dam/ifc/doc/2023/ifc-annual-report-2023-building-a-better-future-cn.pdf>.

² Based on the recommendations of the High-Level Expert Group on Sustainable Finance, the European Commission launched the "Action Plan on Financing Sustainable Growth" in March 2018, aimed at reforming the EU's financial system. Since then, the EU's sustainable finance sector has entered a fast-track phase of development. At present, the EU has largely established a sustainable finance framework composed of three main pillars, setting a leading example for global sustainable finance development.

³ The three main goals are outlined in Article 2 of the Paris Agreement. For more information, please refer to the official United Nations website: <https://www.un.org/zh/documents/treaty/FCCC-CP-2015-L.9-Rev.1>.

environmental issues but also covers a wider range of environmental goals and risks.¹ (See Figure 1-1)



Source: United Nations Environment Programme (UNEP)

Figure 1-1 Conceptual Framework of Sustainable Finance by the UN

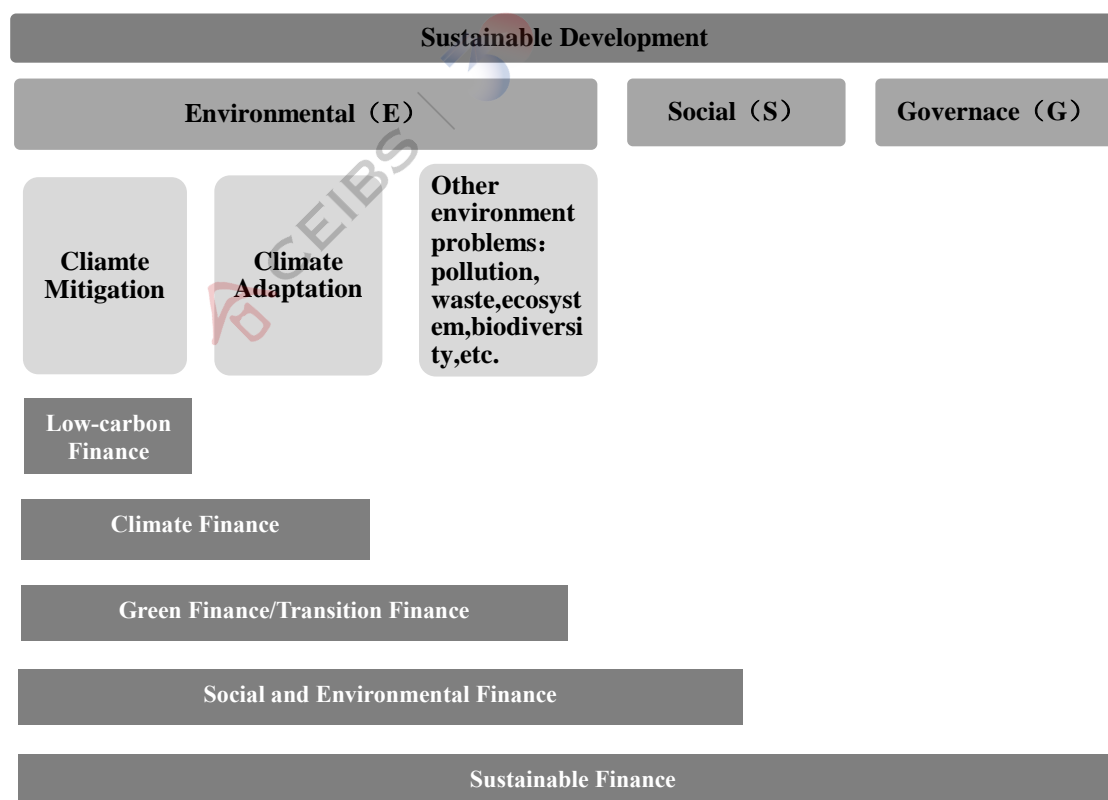
The European Commission views sustainable finance as the process by which the financial sector incorporates Environmental, Social, and Governance (ESG) factors into investment decisions to support long-term investments in sustainable economic activities and projects (see Figure 1-2). In the environmental domain, the EU mandates that financial decisions address not only climate change but also biodiversity and the circular economy. In the social sphere, the focus is on inequality, inclusiveness, labor relations, and human rights. Governance emphasizes institutional management structures, employee relations, and executive compensation, ensuring that social and environmental concerns are fully integrated into investment decisions.

While the EU's sustainable finance framework is similar to the United Nations', it has distinctive elements. In addition to supporting environmentally friendly economic activities (green finance), the EU also promotes the transition of high-carbon industries, such as coal power, steel, and cement, toward environmental sustainability (transition finance).² Transition finance, therefore, plays a key role in the EU's sustainable finance framework, extending and

¹ UNEP, DEFINITION AND CONCEPTS, INQUIRY WORKING PAPER 16/13, September 2016.

² For more information, please refer to the following website: https://finance.ec.europa.eu/sustainable-finance/overview-sustainable-finance_en#what.

complementing green finance by enabling the shift of the overall economy towards low-carbon and environmentally-friendly development.



Source: Compiled by the author based on information from the official website of the European Commission

Figure 1-2 Conceptual Framework of Sustainable Finance by the EU

Overall, the scope of sustainable finance has expanded from its initial focus on environmental issues to encompass broader areas, including social, economic, and governance factors. It now covers fields such as low-carbon finance, climate finance, green finance, social responsibility finance, and transition finance. Domestically, green finance is a more familiar concept, often divided into broad and narrow definitions. Broad green finance refers to sustainable financial activities related to supporting green development, while the narrow definition is more specific, based on clear guidelines in policy documents¹. In this report, we will primarily adopt the sustainable finance framework defined by the United Nations and the European Commission.

3. Global Practices of Sustainable Finance

As mentioned earlier, sustainable finance is a complex and evolving concept that covers a wide range of financial instruments, making it challenging to systematically measure the overall market size. This complexity leads to varying statistical approaches and focuses across major financial institutions. In this section, we refer to financial data from Refinitiv², part of the

¹ This policy document mainly refers to the "Green Industry Guideline Catalogue (2023 Edition)."

² Refinitiv, a subsidiary of the London Stock Exchange Group (LSEG), is one of the world's largest providers of

London Stock Exchange Group, to provide an overview of the recent global development and practices related to sustainable bonds and loans.

3.1 Global Scale and Development Stages of Sustainable Bonds and Loans

Following the adoption of the United Nations' 2030 Agenda for Sustainable Development and the Paris Agreement, the sustainable bond market experienced its first global growth surge. The sustainable bond market can be divided into three development stages based on issuance volume: the initial stage (2016–2019), the rapid expansion stage (2020–2021), and the adjustment stage (2022–present) (see Figure 1-3).

Before 2020, the sustainable bond market maintained relatively low annual issuance volumes and numbers, with the total annual issuance generally remaining below \$300 billion. Among these, the issuance of social bonds, sustainability bonds, and bonds issued by sustainable companies was significantly smaller than green bonds (see Figure 1-4).

The second stage witnessed substantial growth in the sustainable bond market, especially with the pandemic driving demand. In 2021, global issuance reached a historic high, with green bonds and social bonds seeing particularly significant issuance. The global issuance of sustainable bonds surpassed \$1 trillion for the first time in 2021, marking a 45% year-on-year increase and setting a new record. Green bond issuance totaled \$488 billion, more than double that of 2020, while social and sustainability bonds also reached record highs in 2021.¹

In the third stage, the global sustainable bond market experienced a notable decline in 2022 due to factors such as economic downturns, worsening geopolitical conditions, and stricter global ESG regulations². The market began to recover in 2023 and showed signs of revival in early 2024.

After a year of adjustment, the sustainable bond market had its strongest start in the first quarter of 2024 since 2021. In Q1 2024, global sustainable bond issuance totaled \$259 billion, a 9% year-on-year increase, with over 500 bonds issued, representing a 14% increase.³ However, issuance in Q2 declined by 24% compared to Q1, resulting in a total of \$455.8 billion in the first half of 2024, a 2% year-on-year decrease⁴. This indicates that while the global sustainable bond market is recovering, it remains in an adjustment phase (see Figure 1-3).

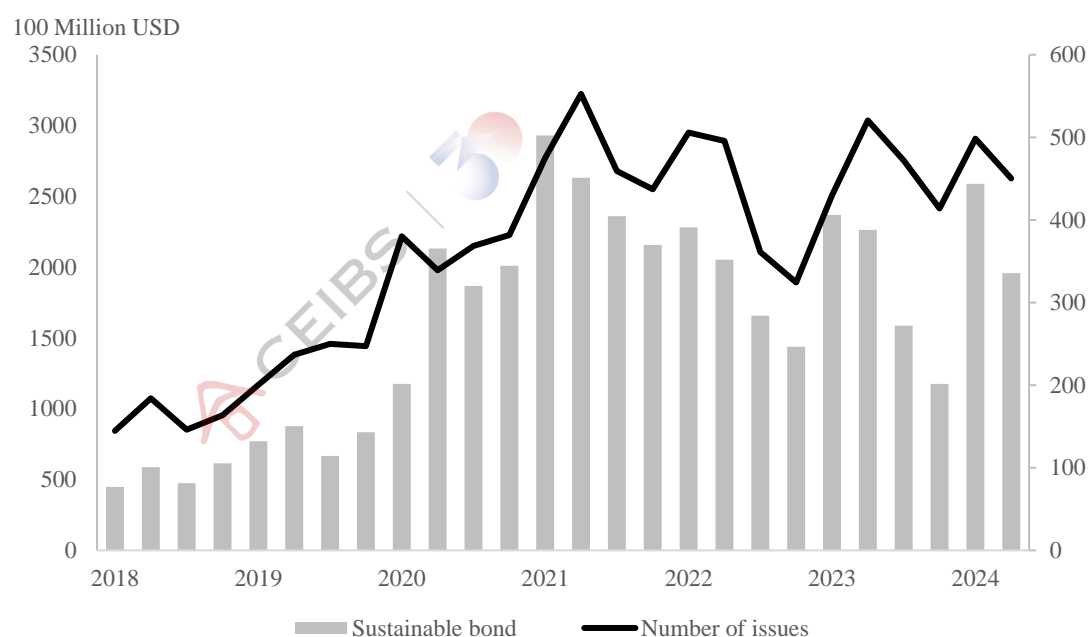
financial market data and infrastructure. The organization regularly publishes updates on global sustainable financial products and the trading and activities of sustainable companies. For more information, please refer to the following website: <https://www.refinitiv.com/en/products/deals-intelligence/sustainable-finance#>.

1 Refinitiv Deals Intelligence, Sustainable Finance Review Full Year 2021, January 2022.

2 In 2022, the total global issuance of sustainable bonds amounted to \$744.3 billion, a 26% decrease year-on-year, marking the first annual decline since records began. By 2023, the total global issuance of sustainable bonds had reached \$740.8 billion, remaining largely stable compared to 2022. For more information, please refer to the following website: Refinitiv Deals Intelligence, Sustainable Finance Review Full Year 2022, January 2023.

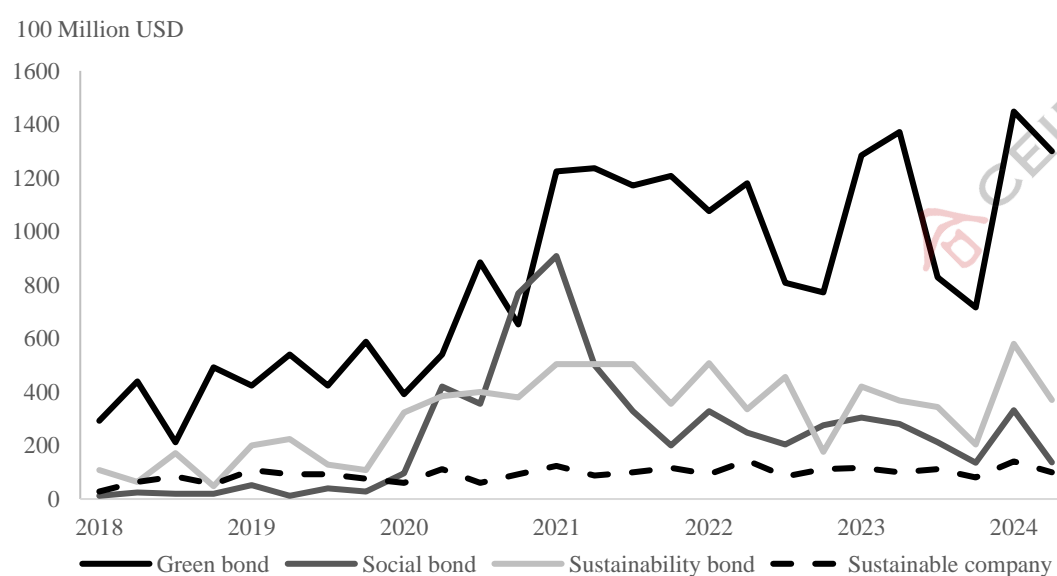
3 Refinitiv Deals Intelligence, Sustainable Finance Review First Quarter 2024, April 2024.

4 Refinitiv Deals Intelligence, Sustainable Finance Review First Half 2024, July 2024.



Source: Refinitiv

Figure 1-3 2018—2024 H1 Global quarterly issuance volume and quantity of sustainable bonds



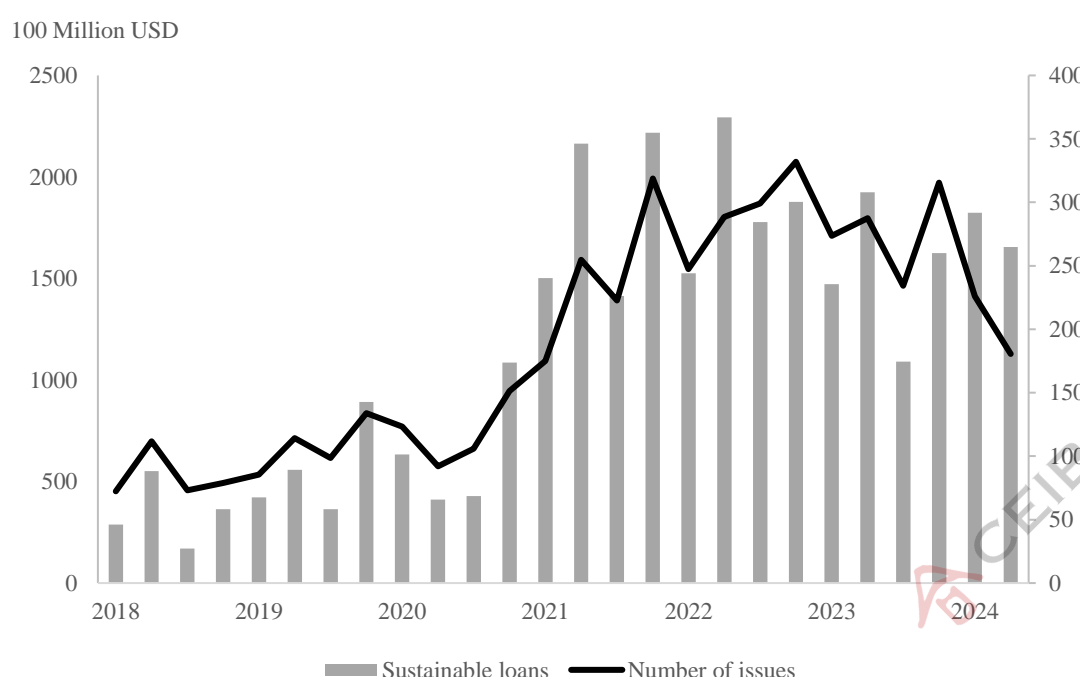
Source: Refinitiv

Figure 1-4 2018—2024 H1 Global quarterly issuance volume of sustainable bonds by type

From the perspective of sustainable loans, the global sustainable loan market followed a similar trend to the sustainable bond market during the first stage (2016–2019), with low annual issuance volumes and fewer loans. In the second stage, the two markets developed somewhat

differently. Sustainable bonds saw an explosive growth at the beginning of 2020, while sustainable loans only experienced a significant upward trend toward the end of 2020. In 2021, global sustainable loan issuance surged to \$716.6 billion, more than three times the amount in 2020, setting a record high.

However, due to factors such as the Russia-Ukraine conflict and increased global economic pressure, the sustainable loan market showed a marked decline in 2022. Unlike the sustainable bond market, sustainable loans continued their downward trend in 2023, with the total loan issuance amounting to only \$576.1 billion, a 24% year-on-year decrease, marking the slowest growth since 2020. Nevertheless, in the first half of 2024, the sustainable loan market showed signs of a strong recovery. From January to June 2024, global sustainable loan issuance totaled \$377.7 billion, with a year-on-year growth rate of 11%.¹ (see Figure 1-5).



Source: Refinitiv

Figure 1-5 2018—2024 H1 Global quarterly issuance volume and quantity of sustainable loans

By reviewing the global sustainable bond and loan markets, in addition to the three distinct stages mentioned earlier, we have observed the following two development characteristics.

First, the global sustainable bond market has diversified, showing distinct growth trends. Green bonds have consistently been the primary driving force, with both issuance volume and number far surpassing the other three types of bonds, despite some fluctuations. Moreover, as global efforts to address social and economic challenges have intensified, the significance of social bonds and sustainability bonds has rapidly increased. Notably, during the pandemic in

¹ Refinitiv Deals Intelligence, Sustainable Finance Review First Half 2024, July 2024.

2020, the issuance of social bonds saw a breakthrough, growing tenfold compared to the previous year. This contributed to the total global sustainable bond market exceeding \$1 trillion for the first time in 2021, reflecting the market's diverse demands.

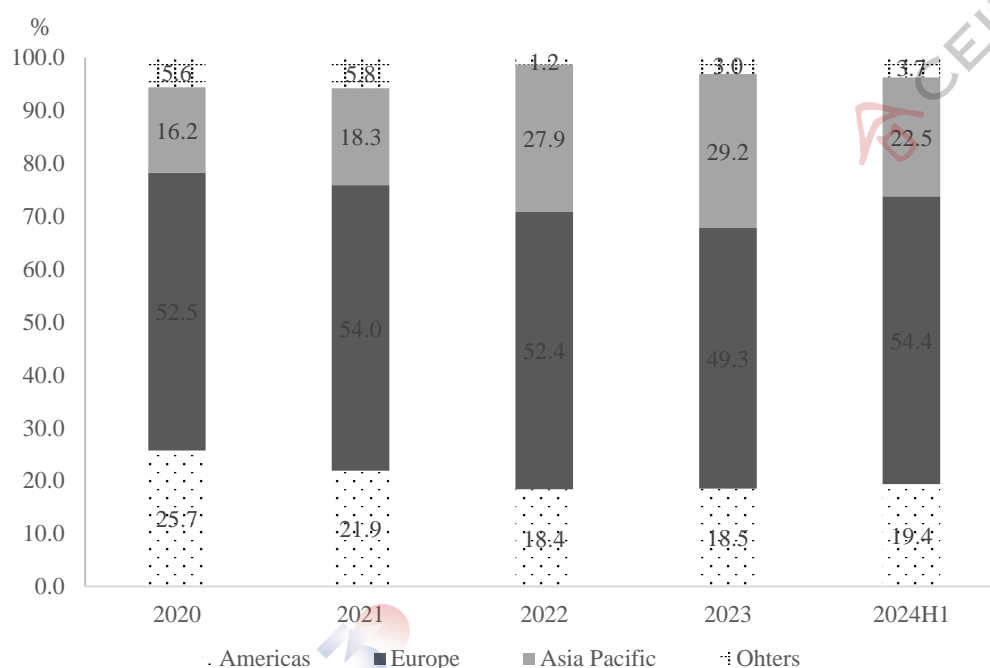
Second, both the sustainable bond and loan markets have exhibited high volatility but also strong resilience. The sustainable finance market experienced rapid growth between 2020 and 2021. Although the sustainable bond and loan markets saw their first annual decline in 2022 due to global macroeconomic and geopolitical factors, signs of recovery emerged in early 2024 following more than a year of market adjustment.

3.2 Regional Development Characteristics of Sustainable Finance

3.2.1 Sustainable Bond

Europe has consistently been the leading region for sustainable bond issuance, maintaining approximately 50% of the global market share, securing its top position. During 2020 and 2021, the Americas ranked second in issuance volume, followed by the Asia-Pacific region in third. However, in 2022 and 2023, the total sustainable bond issuance from the Asia-Pacific region surpassed that of the Americas for two consecutive years, making it the second-largest region for sustainable bond issuance globally (see Figure 1-6).

The rise of the Asia-Pacific sustainable bond market is primarily attributed to the rapid development of China's green finance market. In 2023, seven of the top ten global issuers of sustainable bonds were Chinese companies, accounting for 86.8% of the total issuance by the top ten. Among them, Shanghai Pudong Development Bank ranked first, issuing green bonds worth \$4.36 billion.

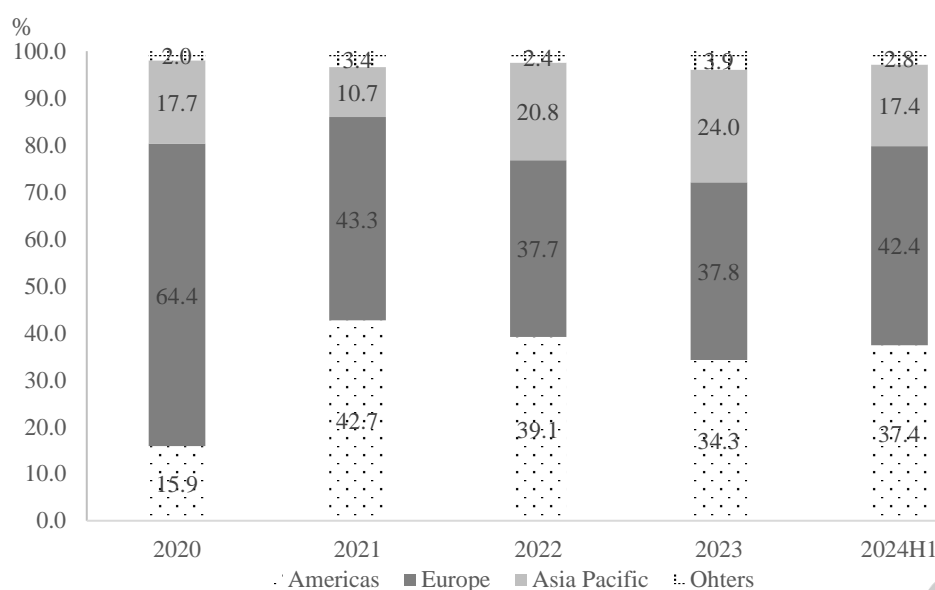


Source: Refinitiv

Figure 1-6 2020—2024 H1 Share of Sustainable Bond Issuance in Major Global Regions

3.2.2 Sustainable Loan

In contrast to Europe's dominant position in the sustainable bond market, the issuance of sustainable loans in Europe has shown significant fluctuations over the past four years, creating a competitive landscape with the Americas. In 2020, 64.4% of sustainable loan borrowers were from Europe. By 2023, Europe's share of the global sustainable loan market had dropped to 37.8%, while companies from the Americas became increasingly active, raising the region's share to 34.3%. In the first half of 2024, Europe's sustainable loan volume expanded again, reaching \$160.2 billion, a year-on-year increase of 56.1%, accounting for 42.4% of the global total, slightly surpassing the Americas' 37.4% share (see Figure 1-7).



Source: Refinitiv

Figure 1-7 2020—2024 H1 Share of Sustainable Loan Issuance in Major Global Regions

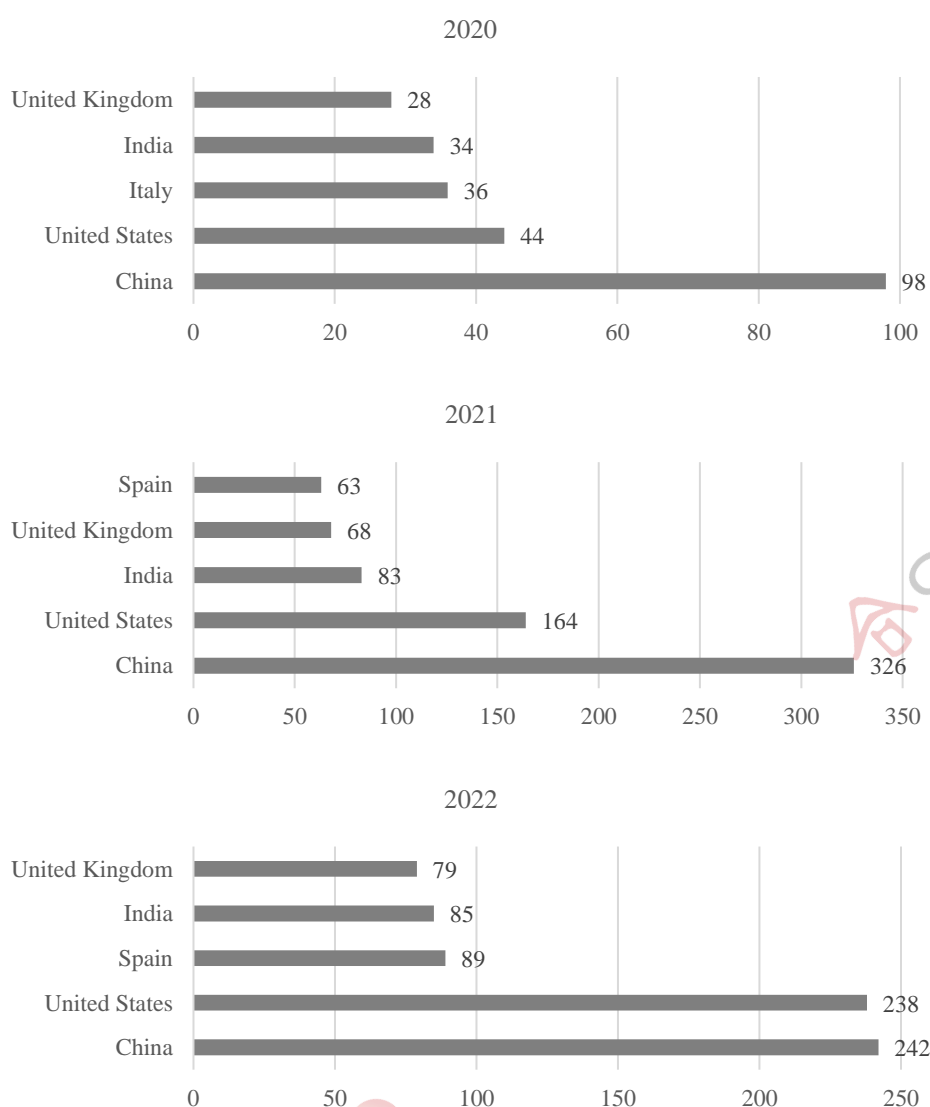
3.3 Equity Capital Market Activities and M&A Transactions of Sustainable Companies

In recent years, the equity capital market (ECM) activities of sustainable companies have shifted from being primarily dominated by the Americas to a dual dominance by both China and the U.S. In 2020 and 2021, the Americas accounted for 62% and 56% of global ECM activities, respectively, maintaining a leading position. However, driven by the equity capital market transactions in South Korea and China, the Asia-Pacific region surpassed the Americas in sustainable financing in 2022, accounting for 65% of the global total. By 2023, sustainable ECM activities were largely concentrated in the U.S. and China, with the two countries contributing to over 57% of global sustainable ECM activities. Among the top 10 global transactions, three U.S. companies raised a total of \$4.42 billion, while four Chinese companies raised \$2.46 billion, representing 43.1% and 24% of the top 10 transactions, respectively.¹

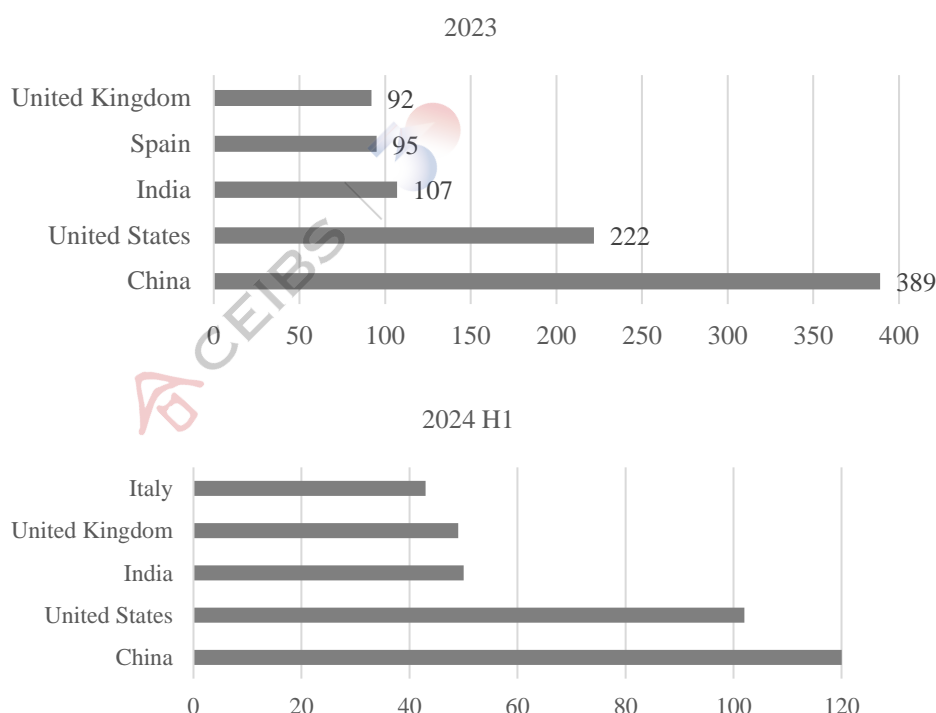
¹ Refinitiv Deals Intelligence, Sustainable Finance Review Full Year 2023, January 2024.

In the first half of 2024, the U.S. and China continued to dominate sustainable ECM activities, with a combined share of 68% of global ECM activities. Together, companies from these two countries raised \$4.37 billion in the top 10 transactions, accounting for 72.9% of the total.¹

Due to the ongoing macroeconomic downturn and deteriorating geopolitical environment, the global M&A market for sustainable companies has also underperformed in recent years. However, in terms of activity, China stands out as a leader in the global M&A market. From 2020 to 2023, China ranked first in the number of sustainable M&A transactions for four consecutive years, and it continued to hold this position in the first half of 2024, with the number of Chinese M&A deals far exceeding those of other countries except for the U.S. (See Figure 1-8).



¹ Refinitiv Deals Intelligence, Sustainable Finance Review First Half 2024, July 2024.



Source: Refinitiv

Figure 1-8 2020—2024 H1 Top Five Countries for Global Sustainable Company M&A Activities (by Number of Transactions)

Overall, the regional development of the sustainable finance market in recent years has shown a diverse trend. Although Europe has maintained its dominant position in the global sustainable finance market, the importance of the U.S. and China in certain segments has been gradually increasing. For example, since 2020, the U.S. sustainable loan market has been highly active, with its market share growing year by year, reaching a scale comparable to that of Europe. Additionally, China has made significant strides in the sustainable bond market, equity capital market, and M&A transactions. Driven by China's green finance market, the Asia-Pacific region has surpassed the Americas in sustainable bond market share for two consecutive years in 2022 and 2023, becoming a key driver of the global sustainable bond market. China's equity capital market activities have remained consistently vibrant, with sustainable companies' financing capabilities approaching those of the U.S. Moreover, Chinese companies have led the global sustainable M&A market in terms of the number of transactions for several consecutive years, underscoring China's growing importance and influence in the global sustainable finance landscape.¹

¹ For more analysis on the Chinese sustainable finance market, please refer to Section 3 of this report.

Section 2

The EU Sustainable Finance Framework as a Global Model

Since the 1970s, the EU has gradually developed a green transition model that is guided by a sustainable development policy framework, driven by green research and innovation and the carbon emissions trading system, and supported by EU public finance and a sustainable financial framework. However, achieving the EU's sustainable development goals requires more than just public funds; a stable and efficient sustainable finance framework is essential to mobilize additional capital to bridge the gap between the goals and the necessary funding.

Therefore, integrating sustainable risks, opportunities, and objectives into the EU's financial regulatory framework and reforming the existing financial system to steer investments toward sustainable directions is key to achieving the EU's sustainable development goals. Currently, the EU has essentially established a sustainable financial framework based on three main pillars and leads globally in areas such as top-level policy design, the EU Taxonomy for classification standards, disclosure frameworks, and sustainable investment tools.

1. The Launch and Structure of the EU Sustainable Finance Framework

To tackle the challenges of green transition and enhance the sustainable growth efficiency of financial services, the European Commission established the High-Level Expert Group on Sustainable Finance (HLEG) in 2016. This group initiated an in-depth study on the development strategy for sustainable finance within the EU. In March 2018, the EU introduced the "Action Plan on Financing Sustainable Growth," which aimed to reform the financial system. This plan divided the EU's future sustainable finance actions into three categories with ten key action points, marking a significant step toward the EU's transition to a sustainable economy (see Figure 1-9).¹ Since then, the EU has entered a fast-paced development phase in the field of sustainable finance.

The EU Action Plan covers a series of key legislative initiatives. By the end of 2023, over half of the legislative tasks related to the ten action points had progressed. These include the EU Environmental Taxonomy, the EU Green Bond Standard, EU Sustainable Finance Disclosure, and Corporate Sustainability Reporting. Legislative processes in areas like ESG ratings, retail and insurance investment products, and corporate sustainability due diligence are

¹ For more information, please refer to the following website: https://finance.ec.europa.eu/publications/renewed-sustainable-finance-strategy-and-implementation-action-plan-financing-sustainable-growth_en#action-plan.

ongoing, while the development of the EU Social Taxonomy and EU Ecolabel has been temporarily put on hold.¹



Source: European Commission

Figure 1-9 The Ten Key Actions of the EU Action Plan on Financing Sustainable Growth

As mentioned above, the construction of the EU's sustainable finance framework has primarily progressed around three core pillars: the EU Taxonomy, the disclosure framework for financial institutions and corporations, and sustainable investment tools aimed at promoting sustainable development. At present, significant progress has been made in the legislation and implementation of these three pillars, providing a comprehensive regulatory environment for sustainable investment within the EU.²

The First Pillar-the EU Taxonomy has undergone several important legislative stages. It began with the EU Taxonomy Regulation coming into effect in July 2020, followed by the implementation of the Climate Delegated Act in 2022 and the Supplementary Climate Delegated Act in 2023, culminating in the full enforcement of the Environmental Delegated Act in July 2024.

The Second Pillar-the Disclosure Framework started with the implementation of ESG disclosure requirements in April 2020, the entry into force of the Sustainable Finance Disclosure Regulation (SFDR) in March 2021, and the subsequent adoption of the Disclosure

¹ Vincent Vandeloise, A guide to the next sustainable finance agenda, Finance Watch 2024, January 2024.

² European Commission, Enhancing the usability of the EU Taxonomy and the overall EU sustainable finance framework, Commission Staff Working Document, COM(2023)317, Strasbourg, June 2023. For more information, please refer to the following website:
<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023SC0209>.

Delegated Act and Corporate Sustainability Reporting Directive (CSRD) in 2022 and 2023, respectively.

The Third Pillar-sustainable Investment Tools includes the Benchmark Regulation (BMR), which was implemented in December 2020, and the EU Green Bond Standard Regulation (EUGBS), which came into effect in December 2023.

Next, we will focus on a detailed review and analysis of the EU Taxonomy and the disclosure framework, which are currently the most discussed topics in financial markets based on the outlined framework.

2. The EU Taxonomy and Its Characteristics

In March 2018, the European Commission introduced the EU Taxonomy in its Sustainable Finance Action Plan. After about a year of preparation, the Technical Expert Group (TEG) of the European Commission published the technical report of the EU Taxonomy Regulation in June 2019, establishing technical screening criteria for 67 economic activities and providing initial usage guidelines for the taxonomy. In March 2020, the TEG submitted its final report and policy recommendations on the EU Taxonomy to the European Commission. The regulation was approved by the European Parliament and the European Council and officially came into effect in July 2020.

The EU Taxonomy has several key characteristics. First, the EU Taxonomy Regulation provides a comprehensive classification list for sustainable activities within the EU, making it highly operational. The regulation defines technical screening criteria for hundreds of economic activities, aligning not only with the EU's industrial classification system but also with international statistical frameworks, covering a wide range of economic sectors and activities.

Second, although the EU Taxonomy Regulation has established a general framework for sustainable economic activities, including specific activity lists and technical screening criteria, these lists and standards are not fixed. They are continuously updated and adjusted in line with advancements in scientific knowledge and market practices to address emerging environmental challenges and economic activities. Between 2020 and 2023, the EU passed four climate and environment-related delegated acts to update/revise the list of sustainable economic activities and technical screening criteria under the EU Taxonomy Regulation.

Third, the EU Taxonomy Regulation works in strong coordination with other EU policies. For example, the EU Green Bond Standard (EuGB) specifies that the funds raised through compliant green bonds must be allocated to activities that align with the sustainable economic activities defined in the EU Taxonomy. In essence, if a green bond meets the criteria set forth in the EU Green Bond Standard and the Taxonomy, it can be awarded the "EU Green Bond" label (EuGB).

3. The EU Sustainable Disclosure Framework

As another crucial pillar of the EU's sustainable finance framework, the sustainable disclosure framework not only provides comprehensive reporting standards for both financial and non-financial institutions but also offers critical information for investors to make sustainable investment decisions. The EU has established an extensive disclosure framework,

with key components including the Sustainable Finance Disclosure Regulation (SFDR), the Corporate Sustainability Reporting Directive (CSRD), the EU Taxonomy Delegated Act on Disclosures (Disclosure Delegated Act), and other supporting regulations such as the EU Benchmarks Regulation, the European Single Access Point Regulation, and the ESG Ratings Transparency and Integrity Regulation. In the following paragraph, we will focus on the SFDR and CSRD.

3.1 The Sustainable Finance Disclosure Regulation

The Sustainable Finance Disclosure Regulation (SFDR), which came into effect in March 2021, is one of the key regulatory rules introduced by the European Commission to fulfill its commitment to the United Nations' Sustainable Development Goals. The SFDR aims to standardize the sustainability-related disclosure requirements for financial institutions at the governance, financial services, and product levels, with the goal of increasing transparency in financial markets regarding sustainability.

Firstly, from the perspective of institutional entities, the SFDR mandates that financial market participants (FMPs) disclose the sustainability risks and impacts of their financial products, business activities, and processes to end investors. FMPs include not only the legal entities of financial institutions but also product providers and investment advisory firms. Notably, although the SFDR is an EU regulation, the entities required to comply with its disclosure obligations are not limited to those within the EU. For example, FMPs under EU jurisdiction, those headquartered outside the EU but with subsidiaries or offices operating in the EU, and even non-EU FMPs that raise funds or issue financial products within the EU market must also provide sustainability disclosure reports.¹

Secondly, in terms of financial products, the SFDR imposes sustainability disclosure obligations on seven types of financial products: investment portfolios, alternative investment funds (AIFs), insurance-based investment products (IBIPs), pension products, pension schemes, undertakings for collective investment in transferable securities (UCITS), and pan-European personal pension products (PEPPs). These financial products, according to SFDR standards, are classified into three main categories: Article 9, Article 8, and Article 6 products. SFDR "Article 9" products typically refer to those that have sustainability as their primary investment objective. "Article 8" products are those that promote environmental or social factors in their investment strategies. Meanwhile, "Article 6" products are standard financial products that do not have sustainability as a core focus of their investment objectives.²

Since the implementation of the SFDR in March 2021, the EU has gradually increased the standardization of sustainability disclosures at the asset level for various SFDR funds. This has allowed stakeholders to more objectively assess whether the sustainability objectives of SFDR "Article 9" funds are being achieved as promised. Stricter regulatory requirements have led to significant structural changes in sustainable funds within the EU. For instance, a Morningstar report shows that in the fourth quarter of 2022, a total of 307 funds were downgraded from

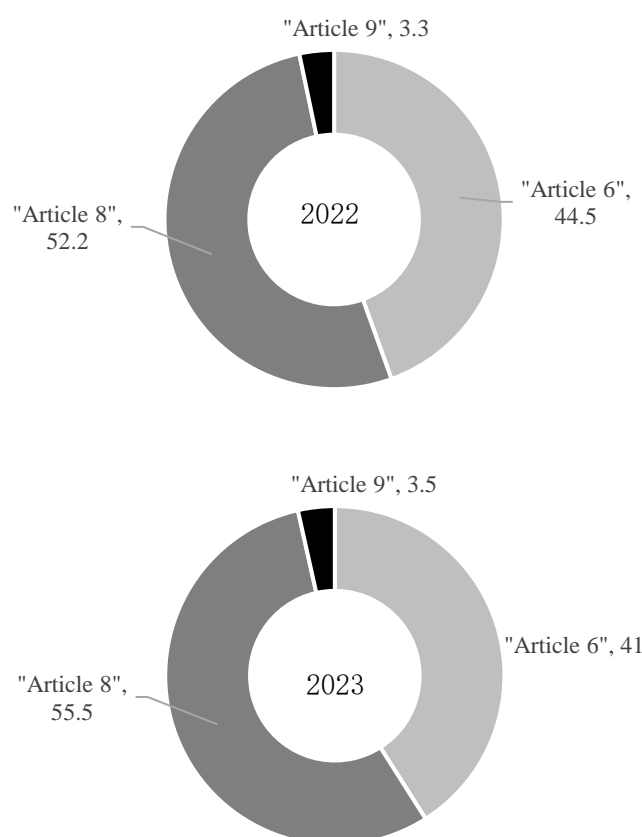
¹ For more information, please refer to the following website:
<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019R2088>.

² "Article 9" products can be understood as "dark green," "Article 8" products as "light green," and "Article 6" products as "other". For more information, please refer to the following website: Morningstar, EU Sustainable Finance Disclosure Regulation Explained, 2023.

"Article 9" to "Article 8," involving assets worth €175 billion, which accounted for 40% of the total assets of "Article 9" funds.¹

By the fourth quarter of 2023, facing continued macroeconomic pressures and weakening demand for ESG and sustainable products, investors withdrew €26.7 billion and €4.7 billion from "Article 8" and "Article 9" funds, respectively. Meanwhile, "Article 6" funds absorbed €93 billion in the last quarter of 2023. Despite this, by the end of December 2023, the market share of "Article 8" funds remained at 55.5%, and "Article 9" funds at 3.5%, both showing an increase compared to the same period in 2022. On the other hand, the market share of "Article 6" fund products dropped by 3.5 percentage points to 41% compared to the same period in 2022.

² (See Figure 1-10)



Note: The data in the figure is expressed in "%".

Source: Morningstar

Figure 1-10 2022—2023 Market Share of the Three Types of Funds under the SFDR

3.2 The Corporate Sustainability Reporting Directive

For a long time, the EU has placed significant emphasis on legislation and policy planning related to corporate sustainability disclosures. In order to more effectively measure, monitor,

¹ Morningstar, SFDR Article 8 and Article 9 Funds: Q4 2022 in Review, January 2023.

² Morningstar, SFDR Article 8 and Article 9 Funds: Q4 2023 in Review, January 2024.

and manage corporate performance and its social and environmental impacts, and to further enhance access to non-financial information, the EU adopted the Non-Financial Reporting Directive (NFRD) in October 2014. The introduction of this directive marked an important step in advancing the EU's "Corporate Social Responsibility" agenda and laid the foundation for subsequent legislation on corporate sustainability reporting.

In 2019, the EU announced in its latest growth strategy, the European Green Deal, that it would review the NFRD as part of its broader strategy to strengthen the foundation for sustainable investment. After two years of research, the European Commission adopted the CSRD proposal in April 2021, and the directive officially came into effect in January 2023, replacing the NFRD¹. Overall, compared to the previous NFRD, the CSRD requires companies to provide more comprehensive, detailed, stringent, and scientifically based disclosures on sustainability-related issues. This is reflected in the following six areas.

First, double Materiality Assessment: The CSRD introduces the concept of “Double Materiality Assessment” (DMA), which requires companies to evaluate both their impact on the environment and society (“outside-in” perspective) and how these issues affect the company’s own development (“inside-out” perspective).

Second, expanded Disclosure Scope and Content: The CSRD expands the mandatory disclosure scope to approximately 50,000 companies within the EU. This includes large enterprises, listed companies, and third-country companies established in the EU.

Third, phased Implementation: To accommodate companies' ability to adapt to the new regulations, the CSRD will be implemented in phases from 2024 to 2028. For example, starting January 1, 2024, the CSRD will apply to large enterprises already subject to the NFRD with more than 500 employees, which must publish their sustainability disclosure reports by 2025. The final group of third-country companies meeting the CSRD standards will be required to publish CSRD-compliant reports by 2028, with their subsidiaries or branches responsible for the reports.

Forth, standardization of Disclosure Reports: To address inconsistencies in reporting formats and standards under the NFRD framework, the CSRD requires constrained companies to use the unified European Sustainability Reporting Standards (ESRS). The first set of 12 ESRS standards was released in July 2023.

Fifth, introduction of Independent Verification Mechanisms: To ensure the reliability of disclosed information and elevate the quality of sustainability information to the level of financial information, the CSRD mandates that sustainability disclosure reports must be verified by statutory auditors or independent auditing firms.

Sixth, digitalization of Sustainability Disclosure Information: The CSRD requires constrained companies to prepare their sustainability disclosure information in Extensible Hypertext Markup Language (XHTML) format and to employ “digital tagging”.

¹ For more information, please refer to the following website: https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en#legislation.

In summary, the EU's overall framework for sustainability disclosure provides an important institutional and regulatory foundation for promoting sustainable development in the EU financial market. By integrating multiple regulations and directives, the framework offers a comprehensive and unified disclosure system, effectively reducing information asymmetry and enhancing market transparency and comparability. Furthermore, the EU's sustainability disclosure framework achieves innovative breakthroughs in several areas, such as the use of digital technology and “digital tagging” by companies and financial institutions to improve the readability and searchability of information, thus enhancing investors' access to and utilization of sustainability information.

Section 3

The Development and Opportunities of Sustainable Finance in China

Sustainable development has become a guiding principle for countries addressing global challenges, and China is no exception. Amidst multiple pressures such as climate change, geopolitical tensions, and economic downturns, low-carbon development not only helps mitigate the impacts of the energy crisis and environmental issues but also fosters greater cooperation among major world economies in sustainable development, countering the trend of deglobalization.

In recent years, as China's "dual carbon" goals (carbon peaking and carbon neutrality) have steadily advanced, the country's sustainable finance market has flourished. The top-level policy framework has been initially established, standard systems and disclosure frameworks are aligning with international markets, and innovative incentive mechanisms are continuously emerging. Sustainable financial instruments are becoming increasingly diversified. Currently, China's sustainable finance market has largely taken shape with green finance as the core, supplemented by emerging areas such as transition finance and social responsibility finance, forming a diversified development landscape. Based on an analysis of China's sustainable finance policy blueprint and market practices, this section will explore the future direction of sustainable finance in China.

1. China's Sustainable Finance Policy Blueprint and Infrastructure Development

Considering that China's sustainable finance market is dominated by green finance, supplemented by emerging areas such as transition finance and social responsibility finance, we will focus on the policy development trajectory in the field of green finance.

Compared to the global landscape, China's green finance began relatively early, particularly in the areas of green financing (loans and bonds), where it now leads internationally. This progress is closely tied to China's well-established "top-down" policy framework. For instance, in the field of green bonds, as early as 1995, the People's Bank of China issued the "Notice on Implementing Credit Policy and Environmental Protection," marking the inception of China's green finance policy. Although the central government had not yet explicitly proposed the concept of green credit at that time and the policy lacked corresponding regulatory

and incentive mechanisms, it signaled the initial establishment of a direction for China's green credit policy framework.¹

In 2020, with the announcement of the "dual carbon" goals, China's green finance experienced a new wave of policy support. At the central level, in October 2020, the Ministry of Ecology and Environment and four other ministries jointly issued the "Guiding Opinions on Promoting Climate Change Investment and Financing," defining climate investment and financing as an important component of green finance, aiming to direct and encourage more capital towards addressing climate change. At the local level, in November 2020, the Standing Committee of the Shenzhen Municipal People's Congress issued China's first green finance regulation—the "Shenzhen Special Economic Zone Green Finance Regulations" (referred to as the "Regulations"). The Regulations implement ecological civilization construction through seven aspects, including systems and standards, products and services, investment evaluation, and environmental information disclosure, serving as an innovative local practice of central policies and setting a national example.

Following this, the central government successively issued documents such as the "Evaluation Plan for Green Banks in China's Banking Industry" and the "14th Five-Year Development Plan for Financial Standards." The issuance of these policies and regulations marks a new stage in China's policy support and institutional development in the field of green finance, providing strong support for promoting China's green economic transition and achieving sustainable development goals.

China's progress in building information disclosure systems started relatively early. In 2016, the "Guiding Opinions on Building a Green Finance System" required green bond issuers to disclose environmental information and recommended gradually expanding this practice to all listed companies and bond-issuing enterprises. In July 2021, the People's Bank of China, under the Financial Standards Committee, issued the "Guidelines for Financial Institutions on Environmental Information Disclosure." This marked the first time that environmental disclosure requirements were introduced in the form of national standards. The guidelines incorporated the widely used Task Force on Climate-related Financial Disclosures (TCFD) framework, and they have been widely adopted, particularly by financial institutions in pilot regions for green finance reform and innovation.²

In terms of aligning with international green finance standards, China places great emphasis on comparability with global standards and actively participates in their development. For instance, in June 2022, China and the European Union co-led a comparison of China-EU green and sustainable finance standards, resulting in the publication of the "Common Ground Taxonomy—Climate Change Mitigation" (referred to as the "Common Taxonomy"). In May 2023, China and the EU officially launched the second phase of work on the Common Taxonomy, focusing on gradually expanding its international basis by incorporating green taxonomies from countries and regions like Singapore.

Moreover, to further enhance the competitiveness of Chinese enterprises and financial institutions in international capital markets, the unification of disclosure standards has become

¹ For more information, please refer to the following report: KPMG, "Rising Sun, Promising Future: Insights into the Development of Sustainable Finance in China" (in Chinese), May 2023.

² China Construction Bank Corporation, Beijing Green Finance and Sustainable Development Research Institute, "China Green Capital Market Green Book (2022 Edition)" (in Chinese), April 2023.

a key focus in the field of sustainable finance over the past two years. In May 2024, the Ministry of Finance, along with the Ministry of Foreign Affairs, the National Development and Reform Commission (NDRC), and nine other departments, developed a national unified sustainable disclosure standard—the "Corporate Sustainability Disclosure Standards—Basic Standards (Draft for Comments)" (referred to as the "Basic Standards"). This was based on an evaluation of the applicability of the International Sustainability Standards Board (ISSB) guidelines and reflects both international best practices and China's unique circumstances, providing a unified blueprint for China's sustainability efforts.¹

In conclusion, China has made significant strides in sustainable finance policy, information disclosure, and international standards alignment in recent years. Through proactive policy support, transparent disclosure requirements, and efforts to align with global standards, China has not only fostered the growth of sustainable finance domestically but also played a pivotal role in the global sustainable finance market. This showcases China's positive attitude and leadership in advancing global sustainability goals.

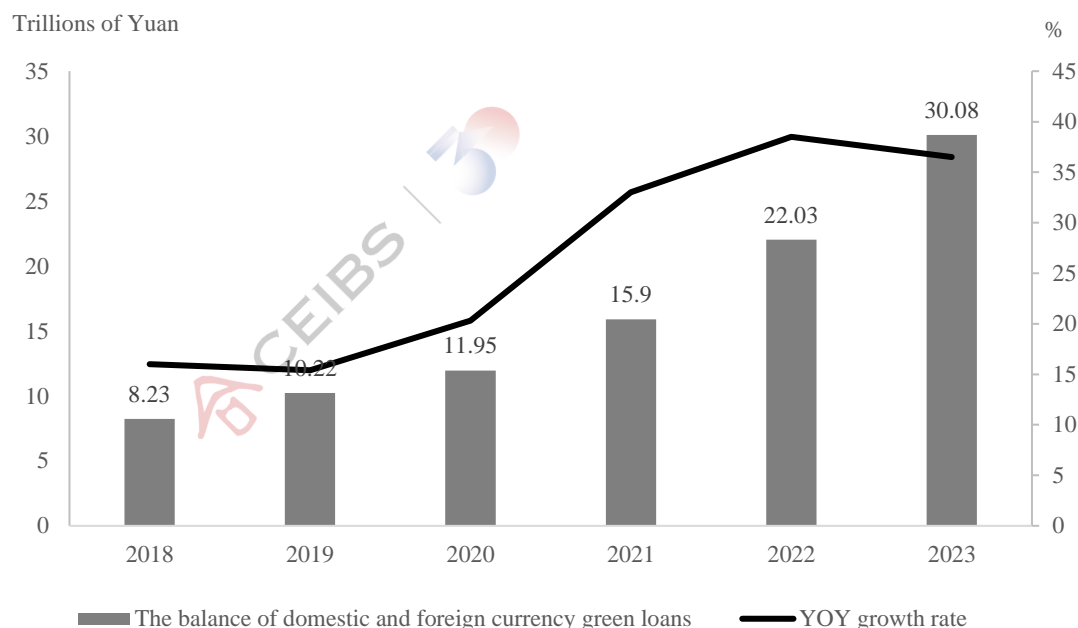
2. China's Sustainable Finance Market Practices

With the gradual refinement of China's top-level sustainable finance policy framework, the practice of sustainable finance has entered a rapid development phase. Green financial instruments, such as green bonds and green loans, dominate China's sustainable finance market, serving as the primary force driving the development of a low-carbon economy. At the same time, emerging financial instruments like social responsibility bonds, sustainability bonds, and sustainability-linked bonds have rapidly gained prominence in recent years, becoming rising stars in the market. These new instruments not only diversify China's sustainable finance offerings but also strengthen capital market support for social responsibility and sustainability, further promoting China's transition to a green economy.

2.1 Green Financing Tools

In the area of green loans, China's balance of domestic and foreign currency green loans has grown steadily in recent years, with growth rates significantly outpacing those of total loan balances. According to data from the People's Bank of China, from 2018 to 2023, the average annual growth rate of green loans was 26.62%, approximately 14.97 percentage points faster than the average growth rate of all loans (see Figure 1-11). By the end of 2023, the balance of domestic and foreign currency green loans in China reached ¥30.08 trillion, a year-on-year increase of 36.5%, surpassing the growth rate of all loans by 26.4 percentage points.

¹ Global Zero Carbon Research Center, "National Unified ESG Standards Introduced, Disclosure Business Expected to Grow Exponentially" (in Chinese), May 2024.

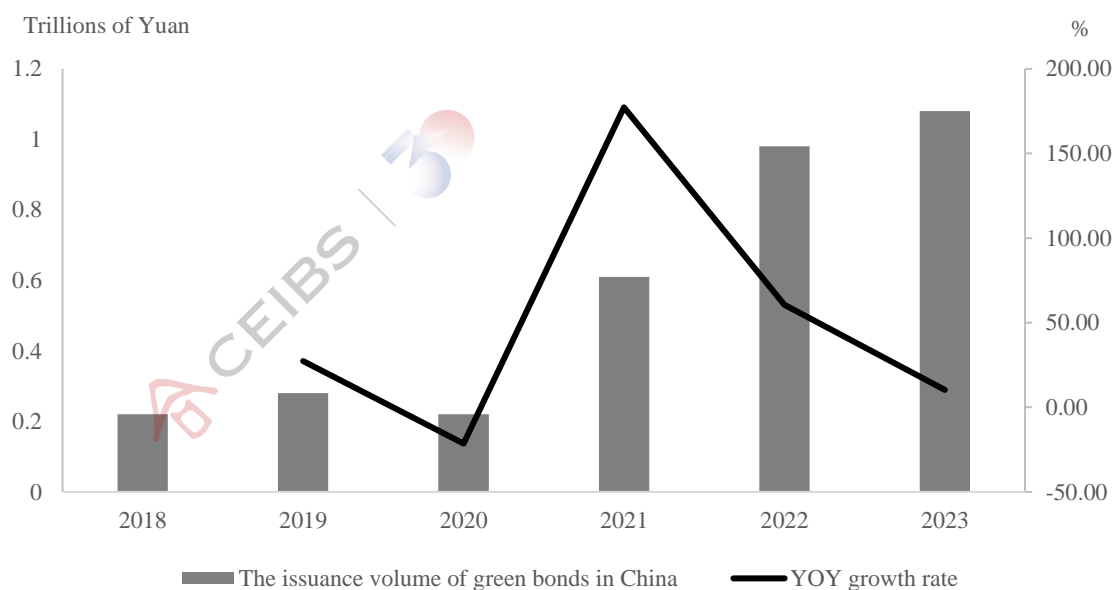


Source: Monetary Policy Analysis Group of the People's Bank of China

Figure 1-11 2018—2023 Balance and YOY Growth of China's Domestic and Foreign Currency Green Loans

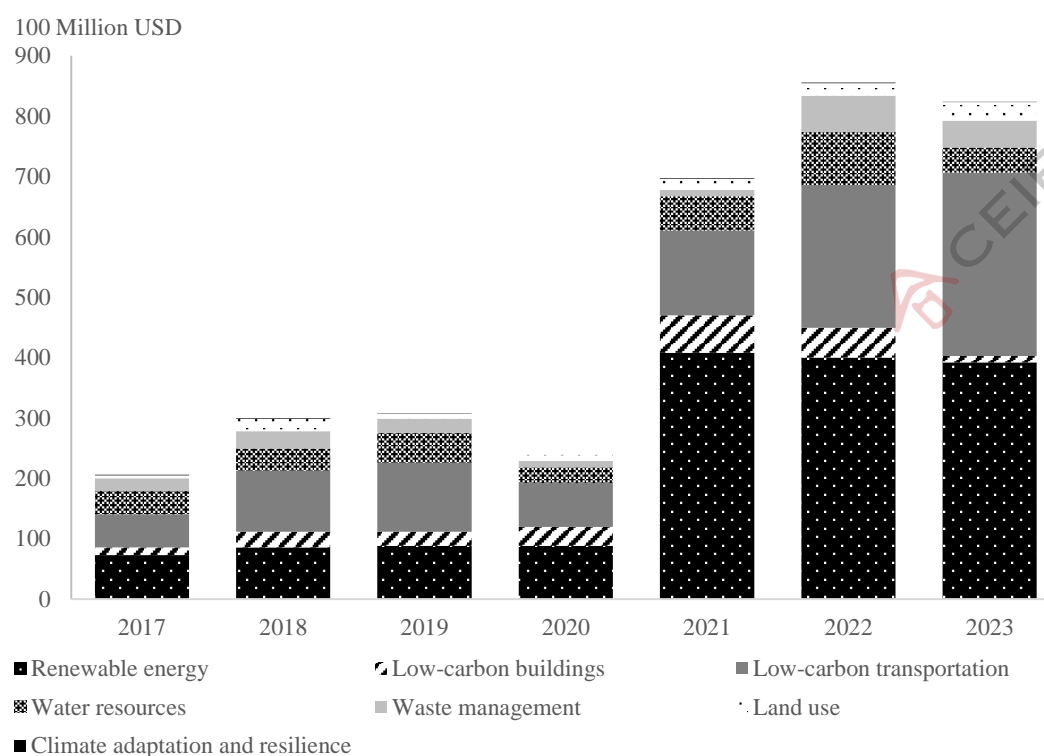
In the area of green bonds, the issuance of green bonds in both domestic and international markets in China remained at relatively low levels between 2018 and 2020, with an average annual issuance of only ¥240 billion. However, with the introduction of China's "dual carbon" goals, green finance entered a new phase of supportive policies, driving rapid market growth. In 2021, the issuance of green bonds in China's domestic and international markets reached its first peak, totaling ¥610 billion, a year-on-year growth of 177.27%. The continuous innovation of green bond products further expanded the issuance scale during 2022 and 2023 (see Figure 1-12). In 2022 and 2023, the issuance of new green bonds in both domestic and international markets in China hit record highs, reaching ¥980 billion and ¥1.08 trillion, with year-on-year growth rates of 60.66% and 10.20%, respectively.¹

¹ Central University of Finance and Economics Green Finance Research Institute, "2023 China Green Bond Annual Report" (in Chinese), February 2024.



Source: Central University of Finance and Economics Green Finance Institute Data

Figure 1-12 2018—2023 Issuance Scale and YOY Growth of Green Bonds in China's Domestic Market



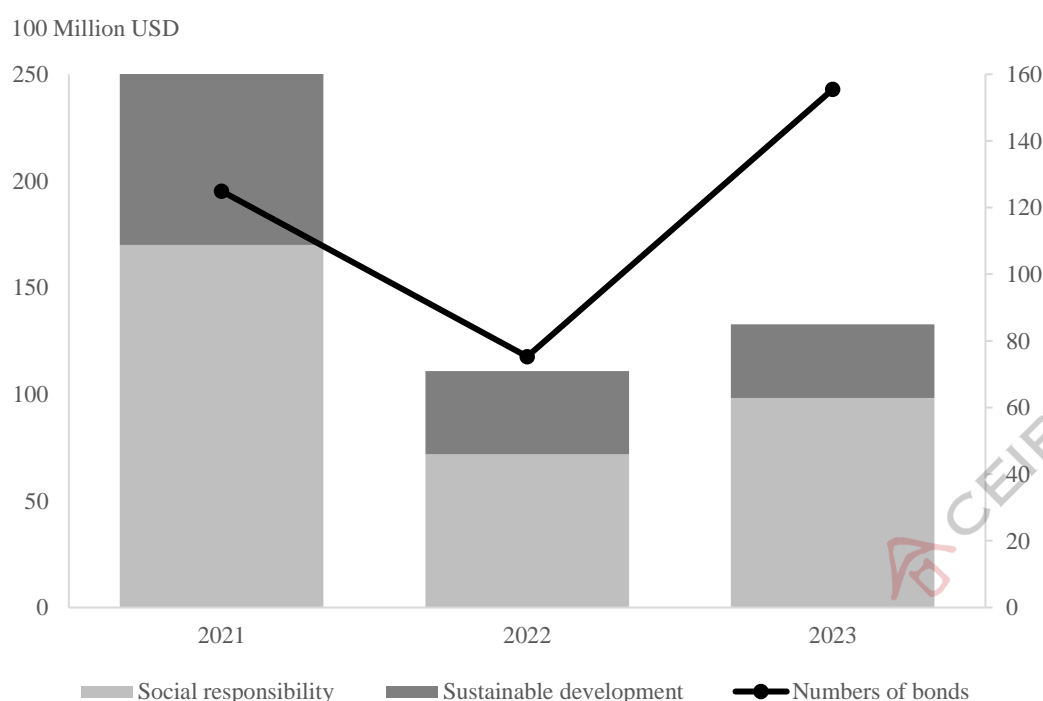
Source: Climate Bonds Initiative

Figure 1-13 2017—2023 Sectors Targeted by China's Domestic Green Bond Issuance

In terms of the allocation of funds raised, renewable energy has consistently been the primary focus, followed by low-carbon transportation. In 2023, financing related to energy and transportation accounted for 84% of the total funds raised by onshore green bonds, an increase of over 10% compared to 2022. Although funds allocated to the energy sector slightly decreased, they remained at similar levels as in 2022, while financing directed toward the transportation sector saw a significant increase, with year-on-year growth exceeding 33%¹ (see Figure 1-13).

2.2 New Emerging Sustainable Financial Instruments

Apart from green financial products, in recent years, China has also begun to explore the development of emerging sustainable financial products such as social responsibility finance and transition finance, yielding significant results. In 2020, to support pandemic control efforts, China issued ¥1 trillion in special anti-pandemic government bonds. This led to pandemic control bonds becoming a major component of China's social responsibility bonds that year.



Source: Climate Bonds Initiative

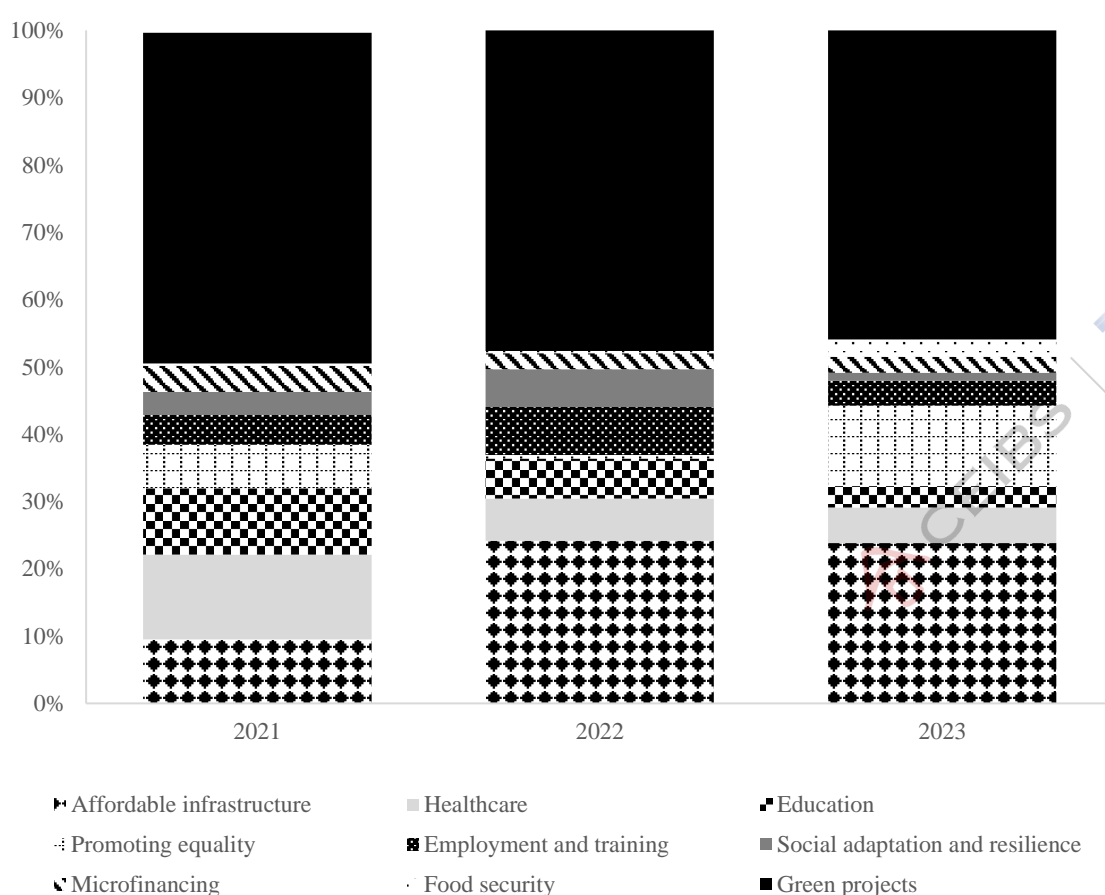
Figure 1-14 2021—2023 Scale and Issuance of China's Social and Sustainability Bonds

Since 2021, the issuance of pandemic control bonds has decreased, but the issuance of other social responsibility and sustainable development bonds has significantly increased, rising 1.8 times year-on-year to ¥193.8 billion. This brought the total scale of China's social and sustainable development bonds to a six-year peak of ¥270.3 billion. Subsequently, due to the easing of pandemic measures and global interest rate hikes, the issuance of social and sustainable development bonds in China declined to ¥125.2 billion in 2022, a year-on-year

¹ Climate Bonds Initiative, Central Government Securities Registration and Settlement Co., Ltd. (ChinaBond), and Industrial Bank Economic Research and Consulting, "2022 China Sustainable Bond Market Report" (in Chinese), June 2023.

decrease of 35.4%. However, driven by both the public and private sectors, the total issuance of social and sustainability bonds rebounded in 2023 to approximately ¥140 billion, with the number of bonds issued increasing to 154, surpassing the previous peak of 124 in 2021¹ (see Figure 1-14).

In 2023, the largest share of funding from China's social and sustainability bonds was directed toward affordable infrastructure and equality-promoting projects under social responsibility initiatives. Affordable infrastructure projects received \$1.58 billion in investments², accounting for 24% of the total bond issuance. Bonds issued for these projects represented 61.9% of the total bond count dedicated to social responsibility initiatives. Meanwhile, equality-promoting projects, which aim to foster gender or income equality, accounted for 11.6% of the total issuance volume and 42.8% of the bond count. (See Figure 1-15)



Source: Climate Bonds Initiative

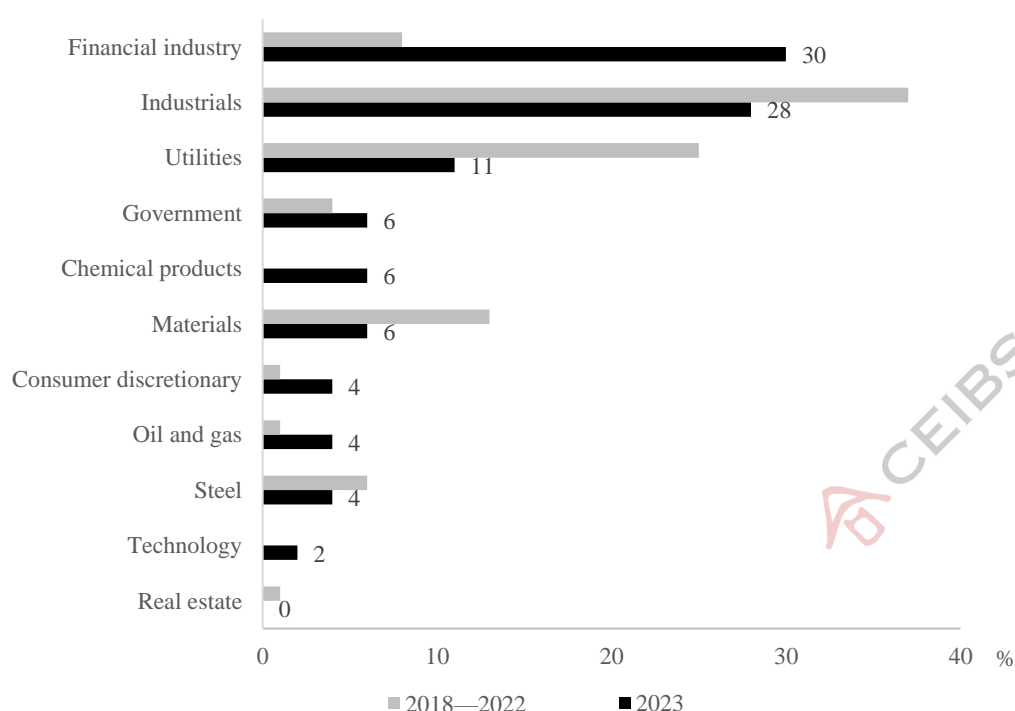
Figure 1-15 2021—2023 Sectors Targeted by China's Social and Sustainability Bond Issuance

¹ Climate Bonds Initiative, Central Government Securities Registration and Settlement Co., Ltd. (ChinaBond), and Industrial Bank Economic Research and Consulting, "2022 China Sustainable Bond Market Report" (in Chinese), June 2023.

² Affordable infrastructure in China typically includes projects such as social security housing or large public facilities. For more information, please refer to: Climate Bonds Initiative and Industrial Bank Economic Research and Consulting, "2023 China Sustainable Bond Market Report" (in Chinese), May 2024.

In the field of transition finance, China has gradually introduced various types of financial instruments since 2021, including sustainability-linked bonds (SLBs) and transition bonds. After launching the pilot program for SLB issuance in April 2021, China began piloting transition bonds in June 2022, covering eight major industries such as power, building materials, and steel. By the end of 2022, China had issued a total of 83 SLBs and 16 transition bonds in domestic and international markets, with a combined issuance volume of ¥131.9 billion, of which 92% were SLBs and 8% were transition bonds. Heavy industries such as power, building materials, steel, cement, and chemicals were actively involved in issuance.¹

In 2023, China's SLB issuance continued to maintain a global leading position. According to data from the Climate Bonds Initiative, China issued 53 SLBs in 2023, with a total scale of ¥40.6 billion.² The financial sector replaced industrial companies as the leading issuer, accounting for 30% of total SLB issuance in 2023, followed by industrial companies (28%) and utilities (11%). The chemicals and technology sectors in China participated in SLB issuance for the first time, accounting for 6% of total issuance (see Figure 1-16).



Source: Climate Bonds Initiative

Figure 1-16 2018—2023 Industry Breakdown of China's Sustainability-Linked Bond Issuance

Overall, China has promoted the rapid development of sustainable finance through policy support, financial innovation, and enhanced market transparency and accountability. Both

¹ Climate Bonds Initiative, Central Government Securities Registration and Settlement Co., Ltd. (ChinaBond), and Industrial Bank Economic Research and Consulting, "2022 China Sustainable Bond Market Report" (in Chinese), June 2023.

² According to the screening rules established by the Climate Bonds Initiative for the SLB database, the organization also tracks and compiles data on SLB issuance in major global countries to showcase the scale and credibility of the global SLB market.

mainstream sustainable finance tools (such as green finance) and emerging ones (such as social responsibility and transition finance) have played important roles in this process. The widespread application of these financial tools has not only fostered sustainable finance domestically but also elevated China's leadership position in the global sustainable finance market, making significant contributions to global sustainable development.

3. The Prospects and Opportunities for Sustainable Finance in China

Currently, China has gradually developed a policy system centered on guiding principles, incentive mechanisms, and information disclosure, covering both real enterprises and financial institutions, and has made significant progress in market practices. However, compared to developed countries and regions with advanced sustainable finance markets, China is still in a catching-up phase, and relevant policies, standards, and mechanisms need further improvement.

In terms of building an information disclosure system, there are still some shortcomings in China. First, information disclosure requirements are still primarily encouraged rather than mandated, focusing on the environmental risk management of financial institutions and the potential environmental impact of invested assets. In contrast, developed regions like the EU have introduced more specific and mandatory requirements for financial institutions through the SFDR. Secondly, the mandatory disclosure indicators for Chinese companies are still limited, mainly focusing on environmental management and pollution control, whereas the requirements in developed regions cover a broader range of social responsibility indicators, such as corruption, proxy voting transparency, and employee human rights.¹ Lastly, although the proportion of listed companies in China disclosing sustainability information has increased in recent years, it remains relatively low, and newly released guidelines have not fully mandated information disclosure. In 2010, 23.8% of A-share companies in China disclosed sustainability information reports, and by 2023, this proportion had only risen to about 33%. On February 8, 2024, the Shanghai Stock Exchange, Shenzhen Stock Exchange, and Beijing Stock Exchange simultaneously released a significant guideline—the “Self-Regulatory Guidelines for Listed Companies—Sustainability Reporting (Trial) (Draft for Comments),” but these documents also do not fully mandate sustainability information disclosure for listed companies².

Despite this, these issues are not unique to China. Globally, the regulation of sustainable finance markets is undergoing continuous transformation and improvement, and the advent of a new era of stringent information disclosure regulation is driving China to accelerate its policy reforms. To ensure that China's information disclosure system transformation is both suited to national conditions and aligned with international standards, the following two points should be prioritized in the future.

First, although China officially released the national unified sustainable disclosure standard—the “Corporate Sustainability Disclosure Guidelines—Basic Principles (Draft for Comments)” —on May 27, 2024, its implementation will be gradual. Given that this process

¹ Central Government Securities Registration and Settlement Co., Ltd. (ChinaBond) and International Capital Market Association, “China ESG Practices White Paper”(in Chinese), December 2022.

² The Shanghai and Shenzhen Stock Exchanges have adopted a combination of mandatory and voluntary disclosure. Companies continuously included in the Shanghai Stock Exchange 180 Index, the STAR 50 Index, the Shenzhen 100 Index, the ChiNext Index, and companies listed both domestically and internationally should disclose a “Sustainable Development Report” during the reporting period. Other listed companies are encouraged to disclose voluntarily.

may take a considerable amount of time, the standardization of disclosure reports during this period is also crucial for advancing the information disclosure system.

Second, China can learn from the EU's experience by gradually introducing verification mechanisms, employing third-party reviews to enhance the reliability and transparency of information disclosure, and promoting the regulated development of financial markets.

In addition to improving the information disclosure system, we must also focus on expanding standards in the sustainable finance sector and aligning with international norms. In recent years, China's market regulatory authorities have continuously advanced the integration of sustainable finance market rules, achieving significant results. On one hand, the establishment of new green bond standards has led to the preliminary unification of domestic standards. On the other hand, China has actively participated in international cooperation, gradually realizing the internationalization of standards.

In the future, as domestic and international sustainable finance markets continue to expand, the unification of standards and international cooperation will play increasingly important roles. By participating in and leading the development and revision of international standards, emerging market economies such as China can exert greater influence and voice in the global sustainable finance system. For instance, following the release of the “Common Taxonomy” by China and the EU in 2022, the two parties launched Phase II work in 2023, focusing on gradually expanding the national basis of the “Common Taxonomy” and building capacities in more countries and regions. On May 3, 2024, the Hong Kong Monetary Authority, based on the China-EU “Common Taxonomy,” the EU Taxonomy Regulation and its supplementary acts, and China's “Green Bond Support Project Catalog (2021 Edition),” established the Hong Kong Sustainable Finance Taxonomy, serving as a successful example of regional application of the China-EU “Common Taxonomy.”

Overall, due to the transnational nature of issues like climate change, environmental pollution, and resource shortages, joint efforts by countries are essential to achieve common goals through coordinated financial tools and policies. Accelerating the expansion of standards and international alignment will not only enhance the standardization and transparency of domestic sustainable finance market operations but also improve the effectiveness and efficiency in addressing global challenges, ultimately achieving comprehensive economic, social, and environmental benefits.



Chapter II

- Sustainable Finance and the Low-Carbon Development Progress

As a rapidly evolving field, sustainable finance inevitably faces many controversies and challenges today and in the future, most notably the huge gap between vision and real-world actions. On the one hand, demand for investment under the Sustainable Development Goals (SDGs) continues to grow. On the other hand, global subsidies for fossil fuels amounted to \$7 trillion in 2022, in stark contrast to the embarrassingly low level of sustainable investment. Given this reality, it is particularly important to focus on incentives and constraints faced by real-world actors. Therefore, this chapter turns its attention to the carbon reduction practices and related incentives for micro-actors, including financial institutions and corporations. The aim is to provide a data-driven foundation to further explore how to bridge the gap between the visionary goals of a sustainable finance and real-world actions.

Section I

Sustainable Finance and Carbon Premium

Addressing the climate crisis and achieving SDGs require mobilizing substantial financial resources. Given the strong budgetary and debt constraints on public investment growth, the private sector is expected to become the primary source of sustainable investment in the future. From an economic perspective, tilting private sector investments toward low-carbon development hinges on the role of carbon premiums or green premiums.

The core function of sustainable finance policy tools is to enable companies with different environmental characteristics to access differentiated financing services. These tools either raise the carbon premium or reduce the green premium, thereby reshaping the incentive mechanisms of capital markets to favor green and low-carbon projects. To this end, this report will, through literature review and market data analysis, continue to monitor the formation and scale of carbon or green premiums in capital markets.

1. Sustainable Investment Growth Target under SDGs

According to the United Nations(UN), the annual funding gap for achieving the goals outlined in the “2030 Agenda for Sustainable Development” has widened to \$4 trillion in 2023.

¹ In terms of climate mitigation and adaptation alone, an estimated \$3 to \$10 trillion in annual investments will be required globally by 2050 to meet the 1.5°C temperature control target set for the end of this century. ² Recent data shows that global climate investment remains significantly below the level needed to meet these targets. In 2022, global climate investment totaled \$1.4 trillion, accounting for approximately 1% of global GDP.

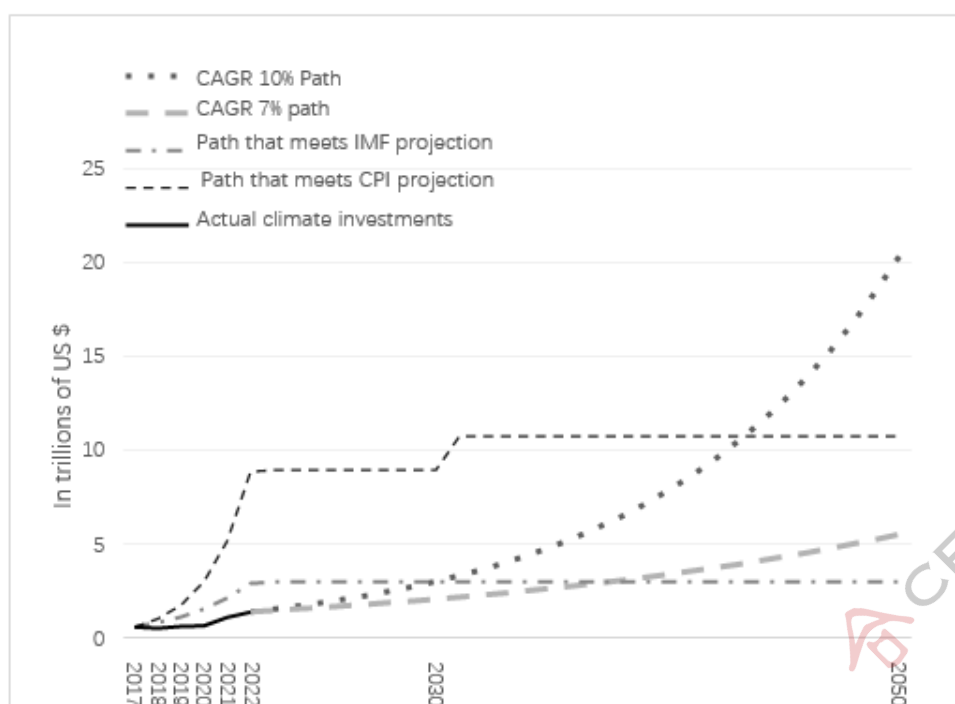
Figure 2-1 compares various possible growth trajectories of climate investment. It shows that even with a compound annual growth rate (CAGR) of 10%, by the time climate investment reaches a meaningful scale, it would likely be too late. This would result in either catastrophic consequences from climate warming or a rapid and abrupt shift to a low-carbon economy, leading to immense economic and social transition costs.

1 UNCTAD, *SDG Investment Trends Monitor* (Issue 4), Sep 14, 2023.

2 According to the International Monetary Fund (IMF) 2022 report, in order to meet the Paris Agreement's temperature control goals, including climate change mitigation and adaptation, between \$3 and \$6 trillion per year will be needed by 2050, as detailed in IMF Staff Climate Note, "Mobilizing Private Climate Financing in Emerging Markets and Developing Economies", 2022/007, International Monetary Fund. Also according to the Climate Policy Initiative (CPI) 2023 report, the 1.5°C target would require an average of \$9 trillion per year until 2030 and \$10 trillion per year between 2031 and 2050, see Strinati, C., C. Alberti, B. Melling and C. Baudry, "Top-down Climate Finance Needs to be Invested", 2022/007, International Monetary Fund. "Top-down Climate Finance Needs", 2024-05-31, Climate Policy Initiative.

To achieve a smooth transition to a low-carbon economy, it is essential to rapidly scale up climate investment. According to our estimates, based on the IMF's projected funding needs, the compound annual growth rate (CAGR) of climate investment over the next few years must reach 38%. If we aim to meet the annual \$9 trillion target under the 1.5°C warming scenario, as estimated by the Climate Policy Initiative(CPI), the required CAGR would need to rise swiftly to 71%.

Fortunately, achieving this growth target is not out of reach. In 2020, global emergency fiscal spending in response to the COVID-19 pandemic reached \$11.7 trillion. Additionally, in 2022, \$7 trillion in subsidies flowed into the fossil fuel sector. This highlights that the core issue is not the availability of sufficient funds, but rather whether there are adequate incentives to direct these funds towards climate and sustainable investment projects.



Note: The solid black line in the figure shows the size of global climate investments in the year as tallied by the Climate Institute, and all dashed lines are projections.

Data sources: IMF (2022), Climate Policy Initiative (CPI,2023), by author's calculations

Figure 2-1 Climate Investment Growth Targets and Trajectories

In terms of funding sources, public and private sectors have each contributed approximately 50% to cumulative climate investment since 2017.¹ Given the growing challenges of public debt crisis, the potential for future growth in climate and sustainable investment will primarily come from the private sector. This is especially critical in developing and low-income countries, where sustainable investment from the private sector remains severely underfunded. Increasing private sector participation will be essential for achieving future climate targets.

¹ According to the Climate Policy Initiative, the public sector accounts for 51% of cumulative climate investments from 2017 to 2022, and the private sector accounts for 49%. For details, see Strinati, C., C. Alberti, B. Melling and C. Baudry, "Top-down Climate Finance Needs", 2024-05-31, Climate Policy Initiative.

2. Carbon Premium and Sustainable Investment Incentives

We can use the concept of premiums to understand the incentives for sustainable investment in the private sector. A price premium is a neutral concept in economic definitions, indicating either an additional gain or an extra loss compared to a benchmark (e.g., the average market price). The concept of green premium has gained widespread attention through Bill Gates' book "How to Avoid a Climate Disaster". In the book, the green premium represents the additional cost required to replace traditional, carbon-emitting products with carbon-neutral solutions, for example, using biofuels instead of traditional jet fuel in airplanes or replacing coal power with renewable energy. Clearly, an excessively high green premium could hinder economic decarbonization.

In this sense, green technological innovation, the selection of technological innovation pathways, and policy decisions should surround reducing the green premium. The objective is to make green solutions not only economically viable but potentially more profitable options.

In capital market, premiums are often closely linked to risk. The green premium generally refers to the additional return investors gain from investing in green, low-carbon assets, that compensates for uncertainties related to future technological developments and the transition process.

In contrast, the carbon premium represents the excess returns investors earn by holding high-carbon-emitting assets. Under the influence of climate risks, these high-carbon assets may face significant price volatility in the future, and they may even become "stranded assets." In this sense, the carbon premium serves as compensation for investors exposed to such transition risks.

From the demand side of the capital market, a higher risk premium for capital also translates into higher financing costs, which can, in turn, suppress financing demand and hinder the development of related projects.

The key role of sustainable financial policy tools is to provide differentiated financing services for firms with different environmental characteristics. Their main function is reflected in raising carbon premium and lower green premium of capital, thereby subverting the original capital market incentive, and making the supply of capital tilted towards green and low-carbon projects

For example, green loan strategies of banks provide preferential interest rates to environmentally friendly firms or impose punitive interest rates for high-emission lenders. Green bonds attract investors who pursue a balance between economic and social returns and provide low-cost capital to green projects. These financial tools affect the premiums in financing and eventually regulate the direction of capital flows. In the meanwhile, we can also test the effectiveness of these financial tools by examining whether a premium exists.

Literature in recent years have provided conflicting evidence regarding the existence of a carbon or green premium. Although in general, good environmental performance is correlated with a lower cost of financing, but whether there is effect coming from GHG emissions is not clear. Some analyses tend to support the existence of a carbon premium (e.g. Bolton and Kacperczyk, 2021; Palea and Drogo, 2020; Trinks et.al., 2022), but others argue that the

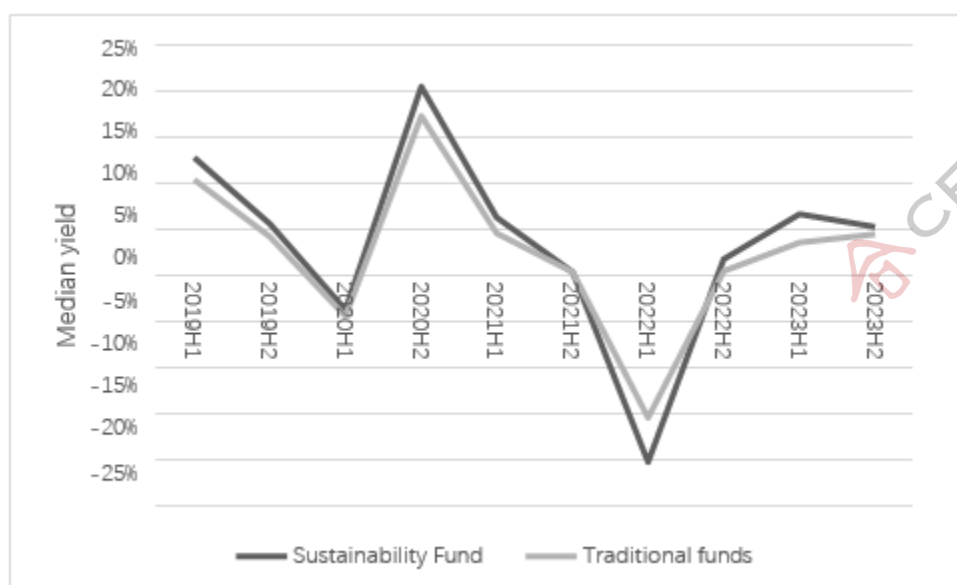
correlation between asset returns and carbon emissions is not statistically significant (e.g. Aswani, et.al., 2023). In the next subsection, we will examine whether and how capital markets process carbon-related risks indirectly by comparing the returns of different financial assets.

3. Performance of Sustainable or Green Assets

3.1 Sustainable Fund Returns

A recent analysis by Morgan Stanley shows that the median return of sustainable funds in 2023 was 12.6%, significantly higher than 8.6% of traditional funds. Moreover, sustainable funds outperformed traditional funds across all regions and asset types. As illustrated in Figure 2-2, sustainable funds consistently delivered superior performance in terms of median returns between 2019 and 2021. However, from the second half of 2021 to the second half of 2022, sustainable funds experienced a sharper decline in returns compared to traditional funds, a period that coincided with rising inflation in the United States.

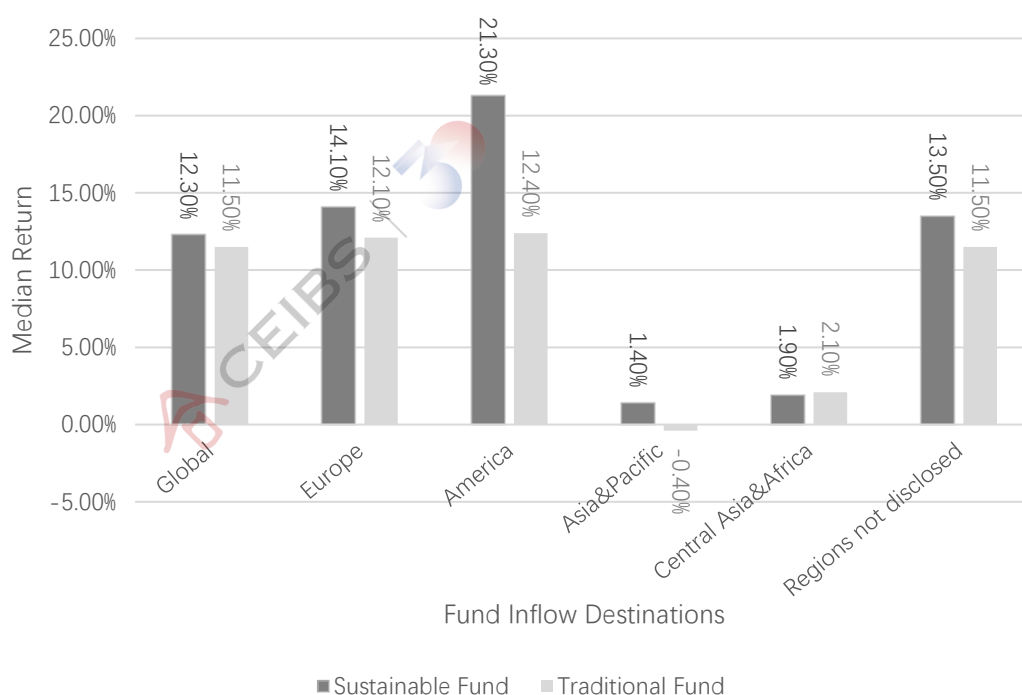
Morgan Stanley's research also identified significant regional differences in sustainable investment yields. The Americas posted the highest returns, followed by Europe, while sustainable investment returns in Asia, Africa, and Oceania were less than one-tenth of those in the Americas (see Figure 2-3).



Note: H1 and H2 represent the first and second half of the year, respectively.

Data Source: Morgan Stanley

Figure 2-2 Comparison of Sustainable and Traditional Funds



Data Source: Morgan Stanley

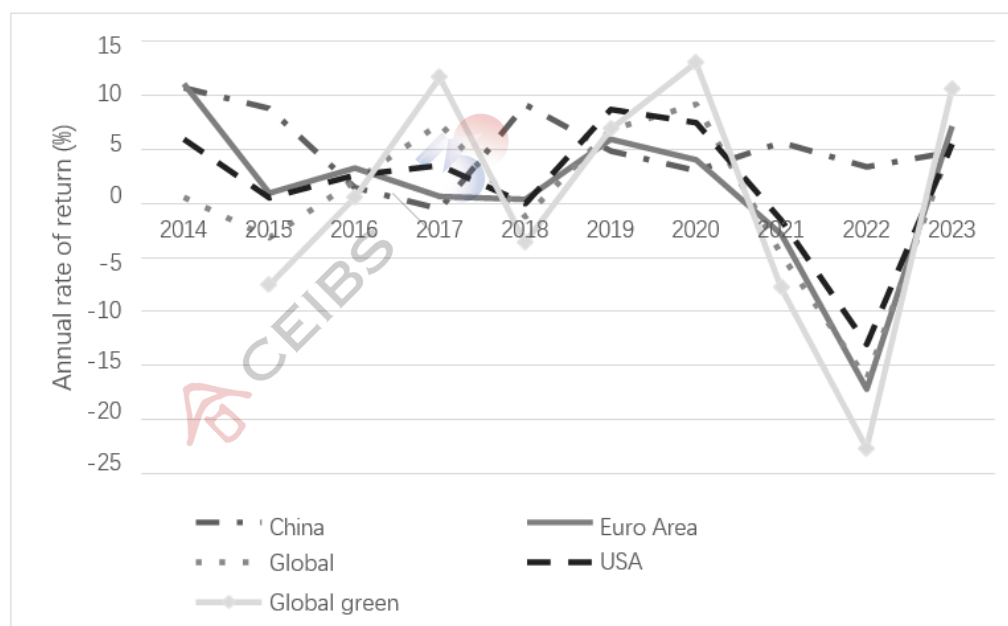
Figure 2-3 Return of Funds by Investment Destination

3.2 Returns of Green Fixed Income Indices

Figure 2-4 compares the annual returns of the Bloomberg Global Aggregate Bond Index with the Global Green Bond Aggregate Index, as well as fixed income indices from China, the United States, and Europe. Figure 2-5 focuses on comparing the annual returns of green bond indices, green-tilted bond indices,¹ and traditional bond indices.

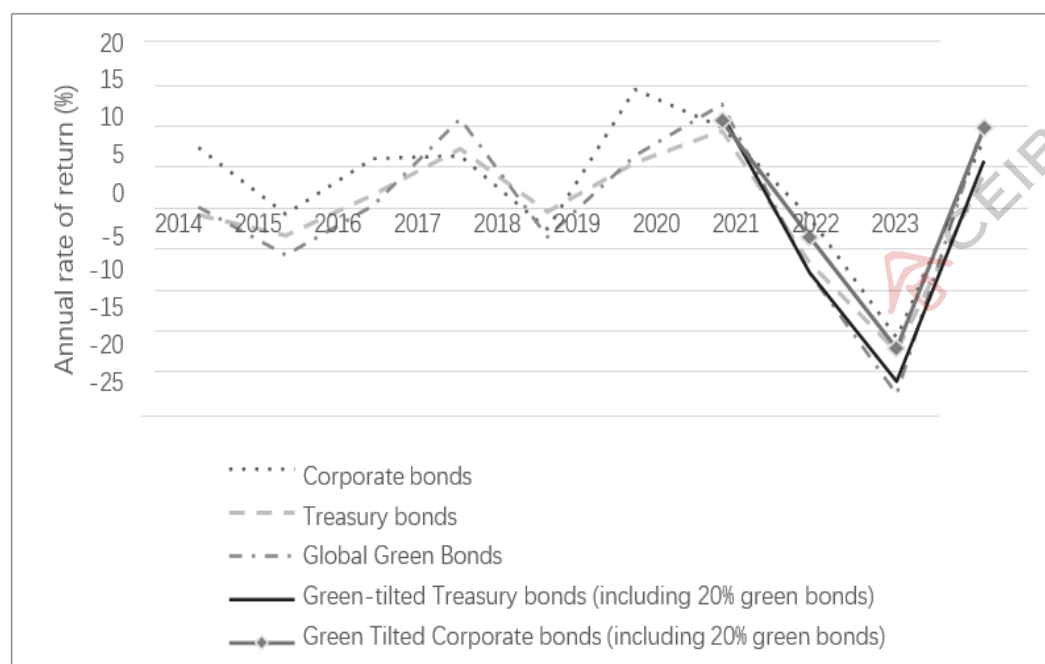
Overall, compared to traditional fixed income indices, green bond indices exhibit greater volatility. During periods when fixed income indices generally rise, green bond indices tend to generate higher excess returns, but during down cycles, they also tend to experience more significant pullbacks.

¹ Although green bonds have maintained a relatively high growth rate in recent years, their market share within the overall bond market remains relatively small. For example, according to European Environment Agency, the market value of green bonds in the European Union accounted for just 8.9% of the total EU bond market. In traditional fixed income index funds, the share of green bonds is even lower, typically below 2%. However, in the Bloomberg Green-tilted Sovereign and Corporate Bond Index shown in Figure 2-5, the share of green bonds is amplified to 20%.



Note: Returns are for the 12-month period prior to the last trading day of the year
Data source: Bloomberg, compiled by author

Figure 2-4 Annual Returns of Fixed Income Indices by Region



Note: Returns are for the 12-month period prior to the last trading day of the year
Data source: Bloomberg, compiled by author

Figure 2-5 Annual Returns of Fixed Income Indices by Category

3.3 Returns of Climate-Linked Equity Indices

We selected the MSCI World Climate Action Index (USD) and the MSCI World Climate Paris Aligned Index (USD), comparing them to their parent index, the MSCI World Index (USD). The Climate Action and Paris Aligned indices have different criteria in constituent selection and weight assignment, but both indices address the risks and opportunities associated with a low-carbon transition. As a result, there is significant overlap in the composition of the two indices, leading to similar trends in their cumulative returns.

In Figure 4-10, we plotted the differences between the Paris Aligned Index and the parent index as shaded area, and the returns of each individual index using solid or dashed lines. The comparison reveals three main points as follows.

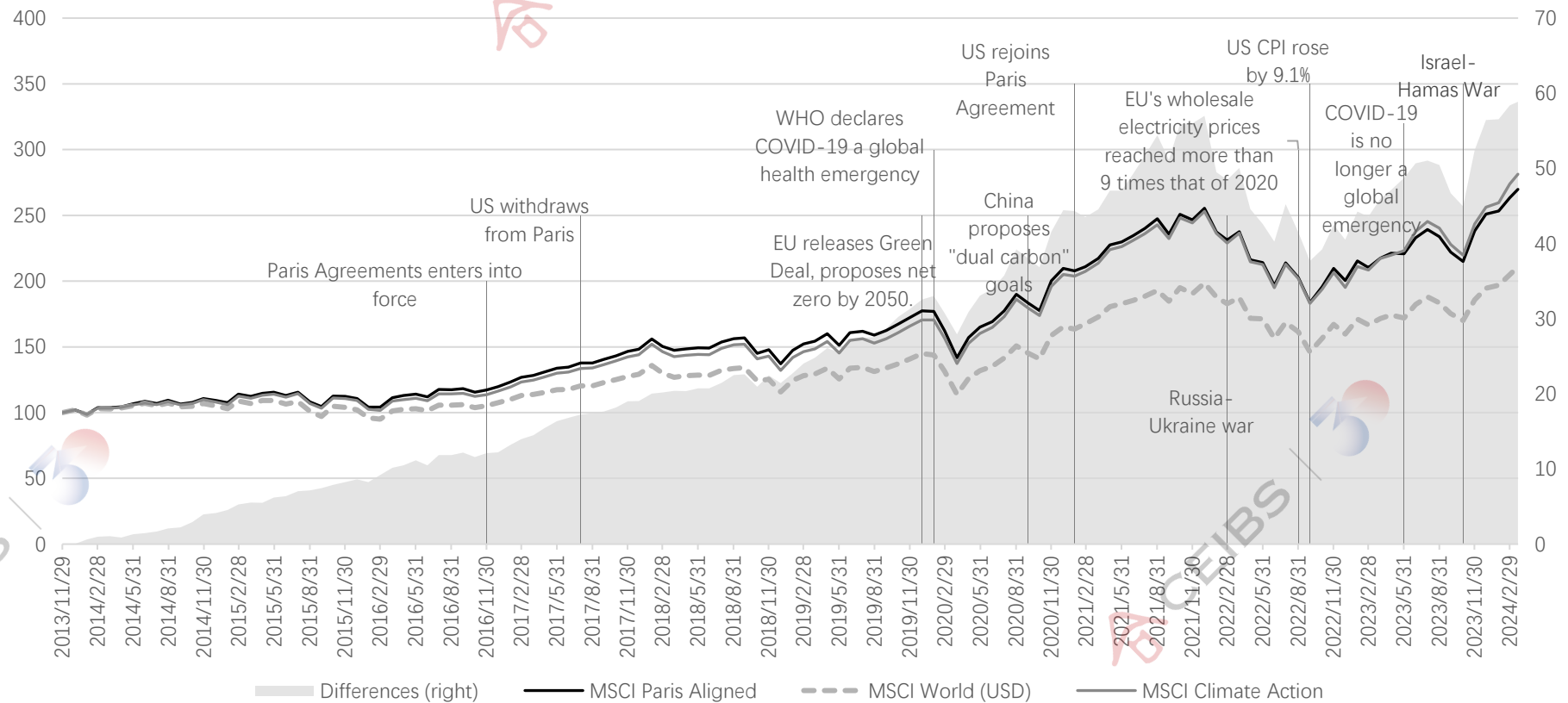
First, the performance of the climate indices follows the same general trends as the MSCI World Index, with both indices rising and falling in sync.

Second, the climate indices generally outperform the MSCI World Index in terms of returns.

Third, the climate indices exhibit greater volatility, as reflected by the widening of the difference between the climate indices and the parent Index during upward market cycles and the narrowing of the difference during downward cycles.

In summary, comparisons across different asset types consistently reveal a similar pattern: green financial assets tend to outperform traditional assets during market upswings but experience steeper declines during downturns. This indicates the high risk nature of green assets.

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Note: The MSCI World Index USD covers 1,464 large- and mid-cap stocks in 23 developed economies, which account for approximately 85% of the total market capitalization of companies listed in each country. The MSCI Paris-Aligned are based on the MSCI World Indexes selecting companies that are committed to reducing carbon emissions and are active in the low-carbon transition in alignment with the Paris Agreement's global temperature control goals. Similarly, the MSCI Climate Action Index is based on the MSCI World Index and takes into account the opportunities and risks associated with the transition to a low-carbon economy in its construction. The shaded area of the chart represents the differences between the MSCI Paris aligned minus the MSCI World Index. Data Source: Bloomberg Terminal, compiled by author

Figure 2-6 Cumulative Returns of MSCI World Equity Indices (Nov. 2013-Mar. 2024)

Section II

Carbon Reduction Progress of Financial Institutions

Financial institutions holding carbon-intensive assets are exposed to a range of uncertainties, including stranded assets, asset devaluation, losses from climate disasters, policy shifts, reputational risks and etc., under climate risks. These factors may even threaten the stability of the global financial system. Following the signing of the Paris Agreement, regulators in many countries began requiring financial institutions to assess and disclose the carbon exposure risks and to make an effort to steer capital flows toward low-carbon, sustainable development sectors.

Since then, the voluntary disclosure framework for climate-related financial information has gained traction internationally, with some countries and regions even beginning to mandate climate information disclosure. Against this backdrop, an increasing number of global financial institutions have committed to reducing or halting investments in high-carbon industries such as coal, oil, and gas. This section will focus on the climate action commitments made by financial institutions.

We selected 54 banks which are the largest lenders worldwide, with climate action information and historical loan-related carbon emissions data provided by the Bloomberg Terminal. In 2022, these 54 banks held total assets of approximately US\$78.2 trillion, accounting for 43% of global bank assets.¹ This group includes most of the banks listed by the Financial Stability Board (FSB)² as Global Systemically Important Banks (G-SIBs).³

These banks cover regions including Asia-Pacific, Europe, North America, and the Middle East. Moreover, the selection encompasses various banking sectors such as retail, investment,

¹ Source: Statista

² The Financial Stability Board, or FSB for short, is an international organization established in 2009 and is part of Group of Twenty (G20). Its member countries include the central banks, ministries of finance and financial regulators of a number of G20 and partner countries, as well as the major international financial institutions and professional committees

³ It refers to the list of Global Systemically Important Banks, which is updated annually by the Financial Stability Board (FSB) and the Basel Committee on Banking Supervision (BCBS). The safety of the banks in the list is considered to be of global importance. A failure of one of them would not only affect one country but could shake financial markets around the world. In order to safeguard the global financial system, these banks need to be regulated to a higher standard. For more information: <https://www.fsb.org/2023/11/2023-list-of-global-systemically-important-banks-g-sibs/>

commercial, and specialized financial services, offering a globally and industry-representative sample.

1. Status of Climate Action Targets

Among the 54 banks, 48 (89%) have set net-zero emissions targets. However, there are significant regional differences in the setting of these targets. All European banks in the sample, along with 90% of North American banks, have established net-zero goals. In contrast, only 8 out of the 12 Asia-Pacific banks (67%) have set similar targets.

According to Table 2-1, of the 48 banks that have set net-zero targets, 41 banks (approximately 76%) plan to cover Scope 1, 2, and 3 emissions,¹ aiming for full carbon neutrality. The remaining six banks have targets that only cover Scope 1 and 2 emissions, with two North American banks having already achieved net-zero emissions in Scope 1 and 2 by 2022. Besides, 80% of the banks plan to achieve carbon neutrality by 2050, while another 6% aim to reach this goal by 2030 or 2035. In terms of the pathways chosen, 43 banks intend to use market-based mechanisms, such as purchasing carbon credits, to achieve carbon neutrality.

Table 2-1 Banks' Climate Action Targets by Region

Region	Number of Banks	Has a net-zero target	Use carbon offsets	Target covers Scope 1、2、3	Continue lending to coal
European	21	21	19	20	1
North America	20	18	15	13	10
Aisa-Pacific	12	8	8	7	1
Middle East	1	1	1	1	0
Total	54	48	43	41	12

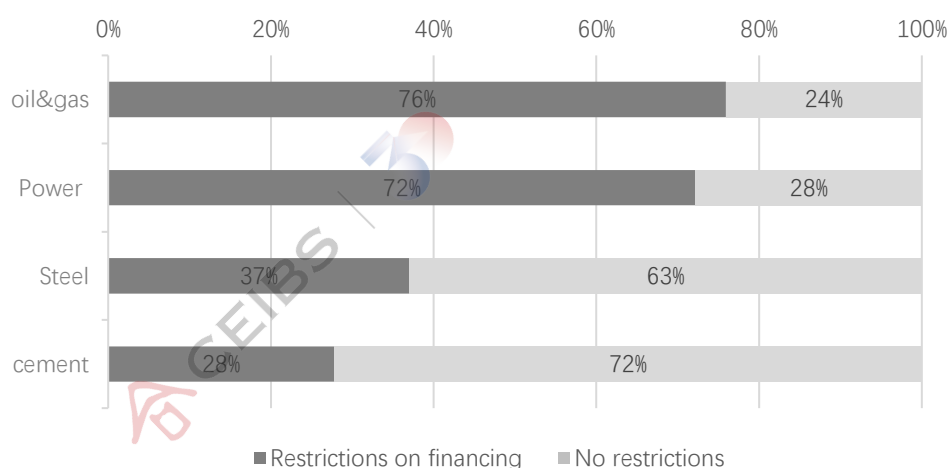
Note: Summarized from the latest disclosed data (2021 or 2022)

Source: Bloomberg Terminal

In addition, 41 out of the 54 banks (76%) have committed to reducing financial support for high-carbon industries such as oil, gas, and power. Some banks have also included carbon-intensive industries like steel and cement in their reduction plans (see Figure 2-7). Among these, 23 banks (43%) have pledged to stop supporting coal-related projects.

In fact, only 12 banks out of the 54 are still investing in coal companies (both private and publicly listed), including ten North American banks, one Chinese bank, and one European bank.

¹ Scope 1, 2, and 3 is a way to categorize the different ranges of carbon emissions that a company generates within its own operations and the broader value chain. Scope 1 emissions cover GHG emissions directly generated by the company. This includes the operation of the company's machinery, use of vehicles, etc.; Scope 2 is the emissions generated indirectly by the company, which mainly include emissions from energy and electricity purchased by the company; and Scope 3 is the emissions generated by the company's upstream and downstream value chain, which are not directly related to the company's operations but can be affected by them, such as emissions from the production of purchased intermediates and emissions from the use of its products by its customers.



Note: Summarized from the latest disclosed data (2021 or 2022)

Data source: Bloomberg Terminal, created by the author based on relevant data

Figure 2-7 Industry strategies in Banks' Climate Targets

2. Sectoral Composition of Banks' Financed Emissions

Financed emissions, as calculated by the Bloomberg Terminal, are based on the methodology of the Partnership for Carbon Accounting Financials (PCAF). Using historical lending data from the sample banks, the emissions calculations cover loans extended to five carbon-intensive industries: oil and gas, coal, power, cement, and steel.¹

PCAF provides a globally accepted standard and guidance for financial institutions to assess and disclose the greenhouse gas emissions associated with their loans and investments.²

In 2022, 37 banks that have consistently disclosed data since 2017 provided a total of US\$4.87 trillion in loans to the five carbon-intensive industries, representing a 24% decrease compared to 2017. The associated greenhouse gas emissions totaled 326 million tons, marking a 40% reduction compared to 2017 (see Table 2-2).³

¹ Relevant statistics show that 90% of global GHG emissions originate from energy-related fossil fuel combustion, mainly for power generation, heating and transportation, with coal combustion contributing 40% of global GHG emissions in 2022, and oil and natural gas contributing 32% and 21%, respectively. In addition, the cement industry contributes 5%. See for details: [https://www.csiro.au/en/research/environmental-impacts/climate-change/Climate-change QA/Sources-of-CO2](https://www.csiro.au/en/research/environmental-impacts/climate-change/Climate-change%20QA/Sources-of-CO2).

² For more details: <https://carbonaccountingfinancials.com/standard>

³ Only 37 of the 54 banks have complete emissions data for each year; the others have missing data for different years. In order to exclude the effect of missing data on changes in emissions, we only take these 37 bank loans into account when calculating total emissions.

Table 2-2 Bank Financed Emissions (2022)

Sector	Loan (Trillions of US\$)	% change since 2017	Financed emissions (Millions of tons CO ₂ e)	% change since 2017
Oil & Gas	1.43	-17.9%	260.74	22.3%
Coal	0	-100%	0	-100%
Power	1.33	10.7%	54.79	-59.4%
Steel	0.90	-17.8%	1.81	-67.2%
Cement	1.21	-8.7%	8.42	-2.4%
Region				
North America	3.05	-22.2%	200.86	-48%
Europe	1.06	-44.9%	77.00	-42.1%
Asia & Pacific	0.76	35.7%	47.91	81.4%
Total	4.87	-24%	325.76	-40.3%

Note: Data in the table are based on data from 37 continuously observed banks. Loan values are denominated in 2016 dollars.

Source: Bloomberg Terminal, created by the author based on relevant data

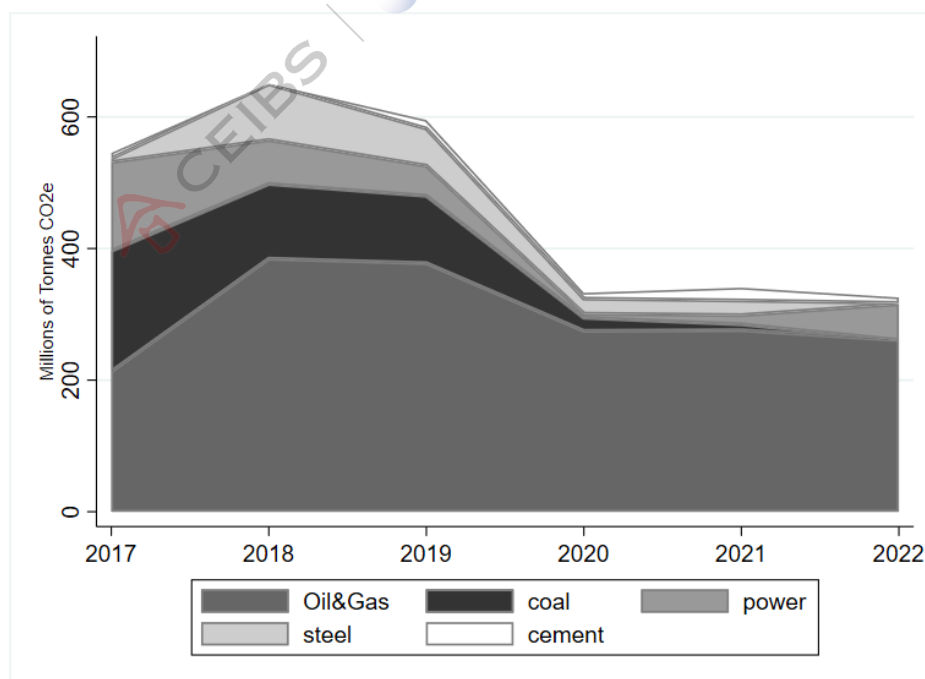
Figure 2-8 illustrates the composition changes in financed emissions from banks to the five industries between 2017 and 2022. The overall emissions saw a significant decline in 2020, but remained relatively stable over the next two years, with only a slight increase in 2021. In terms of sector composition, finance emissions from the power sector saw a notable increase in 2023, while emissions from the cement sector remained relatively unchanged. In contrast, emissions linked to loans in the oil and gas, coal, and steel sectors have significantly declined since 2019.

Changes in loan provision largely explain the variation in emissions. Figure 2-9 shows that loan amounts across all industries saw a sharp decline in 2020, likely due to the contraction in economic activities caused by the COVID-19 pandemic. Loan volumes rebounded in 2021, surpassing 2019 levels in total. However, it is noteworthy that the growth in loan volumes did not result in a proportional increase in carbon emissions.

The main reason behind is that, the emission intensity associated with loans is also a key factor influencing total carbon emission levels. Figure 2-9 highlights that in 2021, the composition of loans by industry shifted, with a significant decrease in the share of loans going to the coal industry. The share previously allocated to coal was redistributed to other sectors. The emission intensity of the coal industry is in general more than twice that of the oil and gas sector and over six times that of the power sector. Thus, the reduction in coal-related loans partially explains why the total financed emissions did not rise significantly in 2021.

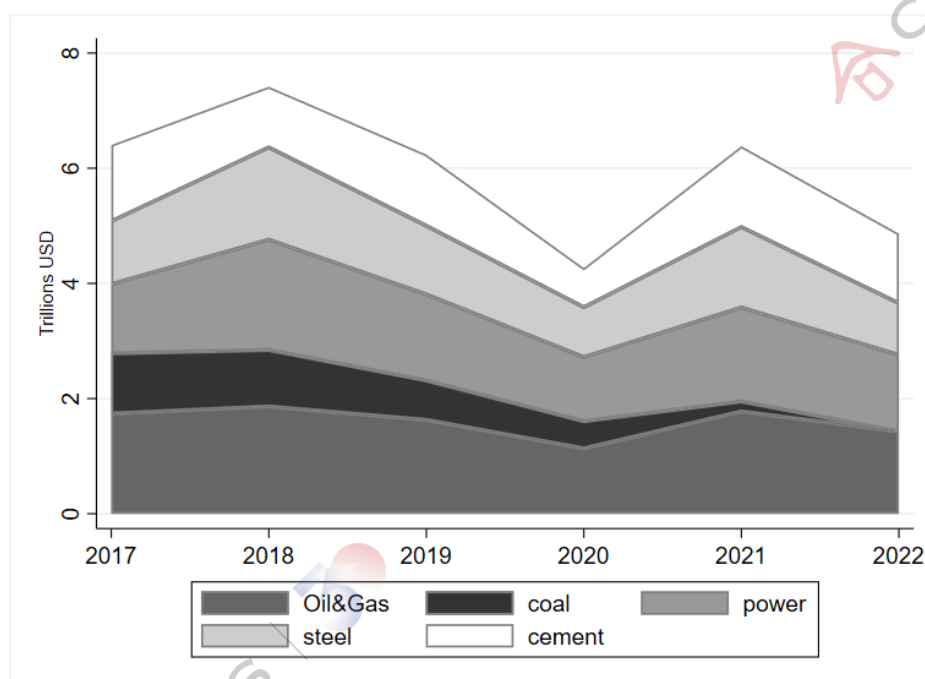
Additionally, compared to 2019, the loan volumes for the oil and gas, steel, and cement industries expanded in 2021 and 2022. However, financed emissions for these sectors did not increase during the same period. This may be attributed to the industries' efforts in emission reduction. For instance, oil and gas companies likely invested more in renewable energy projects, reduced high-emission activities, or installed carbon capture and carbon sequestration (CCS) technologies.

Another possible explanation is that banks adjusted their lending strategies, implementing stricter screening for high-carbon projects. As a result, they were able to increase lending while effectively managing carbon exposure.



Data source: Bloomberg Terminal BI Intelligence, plotted by author's calculations

Figure 2-8 2017—2022 Sector Composition of Banks' Financed Emissions



Data source: Bloomberg Terminal BI Intelligence, plotted by author's calculations

Figure 2-9 Sector Composition of Bank Loans

3. Regional Differences in Financed Emissions

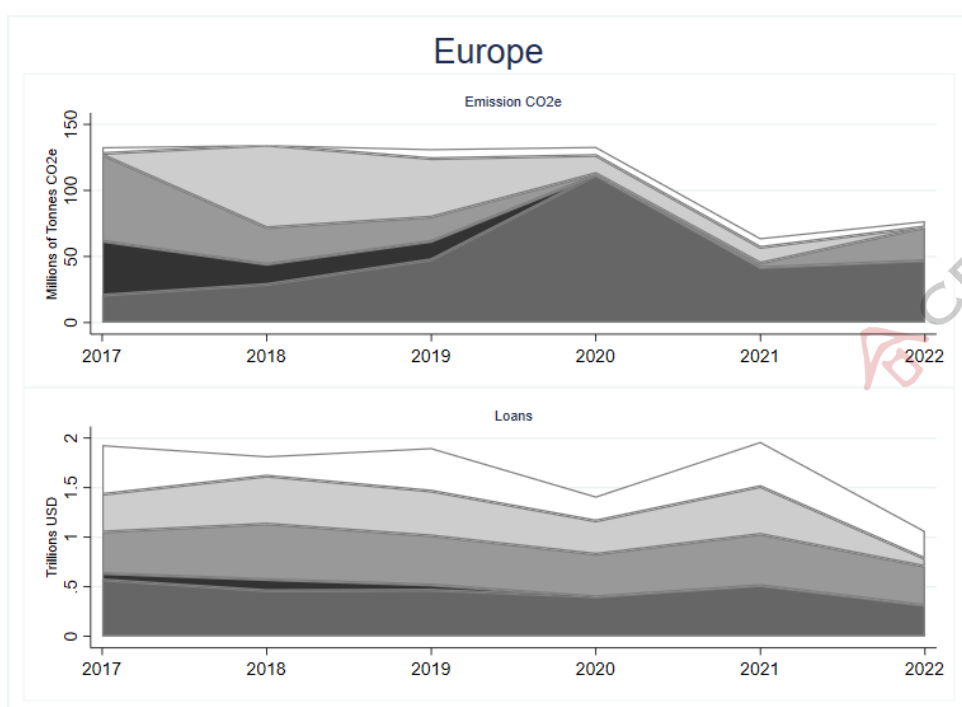
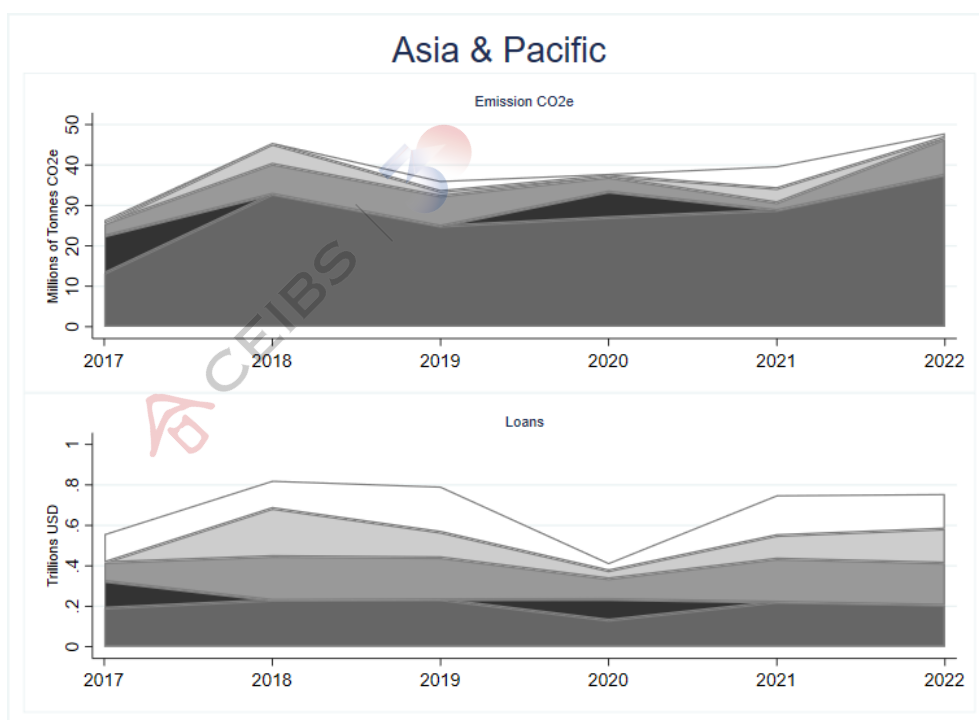
North American banks have the largest volume of loans, reaching US\$3.05 trillion in 2022, accounting for 63% of the total of the 37 banks. Their total financed emissions account for 62% of the overall carbon emissions of the sample. As a result, the trend of the overall sample is largely dominated by changes in North American banks. However, Figure 2-10 shows that the trends in Europe and Asia-Pacific differ significantly from those in North America.

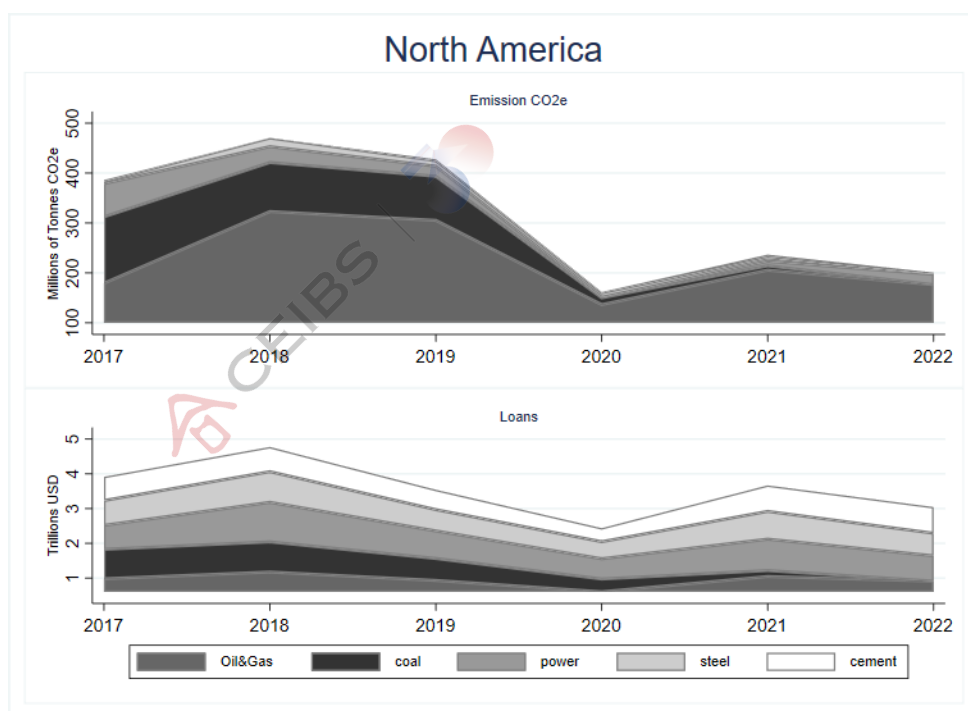
First, Europe and North America banks differ significantly in the changes related to the Oil & Gas sector. From 2017 to 2020, the size of European banks' loans to the Oil & Gas sectors remains largely stable, while the associated emissions continue to rise. In contrast, when North American banks saw a major decline in the Oil & Gas related emissions in 2020, European banks' financed emissions were growing rapidly. The growth trend continued until the outbreak of the energy crisis in 2021 when European banks' lending to the Oil & Gas industry declined substantially.

Second, another notable difference between the two regions is reflected in the power sector. In 2022, financed emissions from the power sector for European banks surged from 3 million tons to 25 million tons. However, during the same period, European banks' loan provision to the same sector decreased from US\$516.9 billion in 2021 to US\$392.8 billion. In comparison, both the loan volume and associated emissions for the North American banks to the power sector remained relatively stable.

Compared to banks in Europe and North America, banks in the Asia-Pacific region generally have smaller loan volumes and associated carbon emissions. Due to the relatively small number of banks in the Asia-Pacific sample, the results of our analysis may underestimate the actual figures in the overall region. Nevertheless, the observed trends in the data still provide valuable insights.

Unlike the trends in North America and Europe, the financed emissions of Asia-Pacific banks have shown an upward trend since 2019, primarily driven by increases in emissions linked to the Oil & Gas and Power sectors. However, aside from a decline in 2020, possibly driven by the pandemic, the overall changes in loan volumes have been relatively stable for the region.





Data source: Bloomberg Terminal BI Intelligence, plotted by author's calculations

Figure 2-10 Sectoral Composition of Financed Emissions by Region

Section III

Low-Carbon Development Progress of Enterprises

Enterprises are not only key drivers of low-carbon technology innovation but also critical implementors in achieving climate targets. Sustainable finance policies ultimately need to mobilize, incentivize, and constrain corporate behavior. Thus, in this section, we will focus on carbon reduction targets and actions of enterprises, aiming to provide data and information benchmark to the formulation of sustainable finance policies.

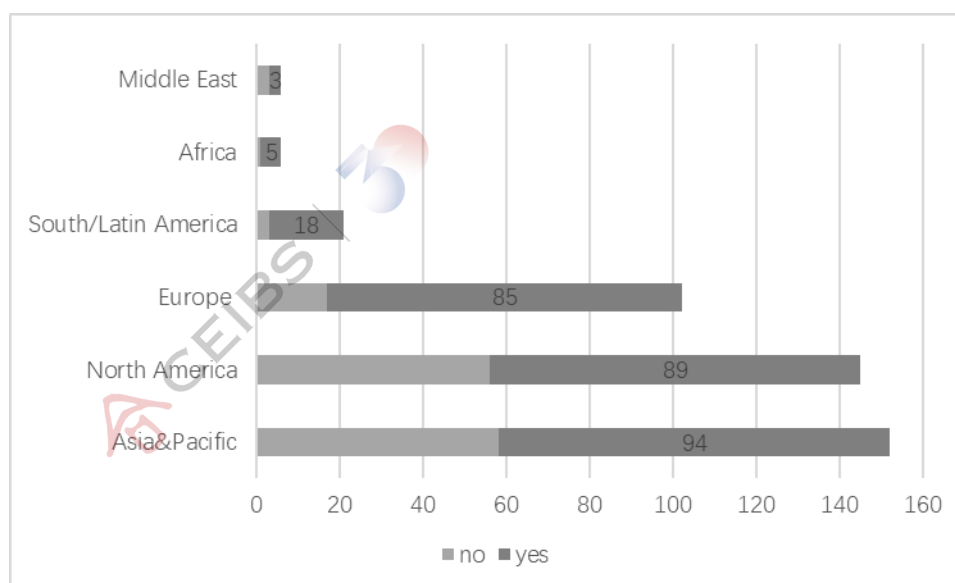
The first part of this section will summarize and describe the climate commitments made by companies in major high-carbon industries. The second part will track the actual carbon reduction progress of 1,080 publicly listed companies from various countries and industries. Finally, the section will focus on the carbon reduction of Chinese enterprises.

1. Corporate Climate Action Pledge

Statistics from 432 companies in high-emission sectors globally, including energy, transportation, chemicals, cement, and steel, indicate that 68% of these enterprises have set net-zero emissions targets. Companies from Europe, North America, and the Asia-Pacific region each account for about 30% of those with net-zero targets, while companies from South Latin America, Africa, and the Middle East collectively make up 10%.

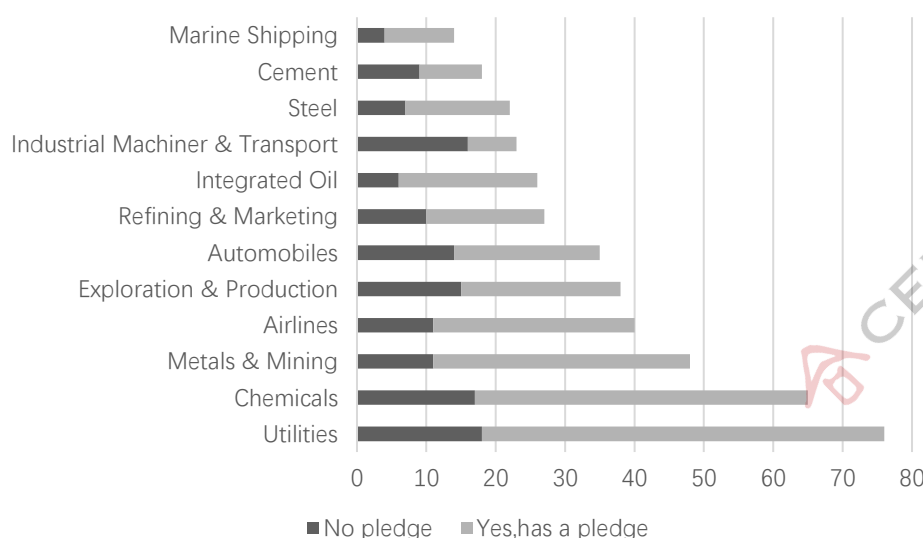
However, in terms of climate pledge within each region, Europe and South Latin America stand out, each with over 80% of companies having set net-zero targets. In contrast, approximately 60% of companies in North America and the Asia-Pacific region have established such targets. Even in the Middle East, where the proportion of net-zero companies is relatively low, this figure has reached 50% (see Figure 2-11).

Most sectors have more than 60% or 70% of companies setting net-zero targets. However, the proportions are relatively lower in the cement and industrial machinery & transportation equipment sectors, which are 50% and 30% respectively (see Figure 2-12).



Data source: Bloomberg Terminal, plotted by author's calculations

Figure 2-11 Corporate Climate Action Pledge by Region



Data source: Bloomberg Terminal, plotted by author's calculations

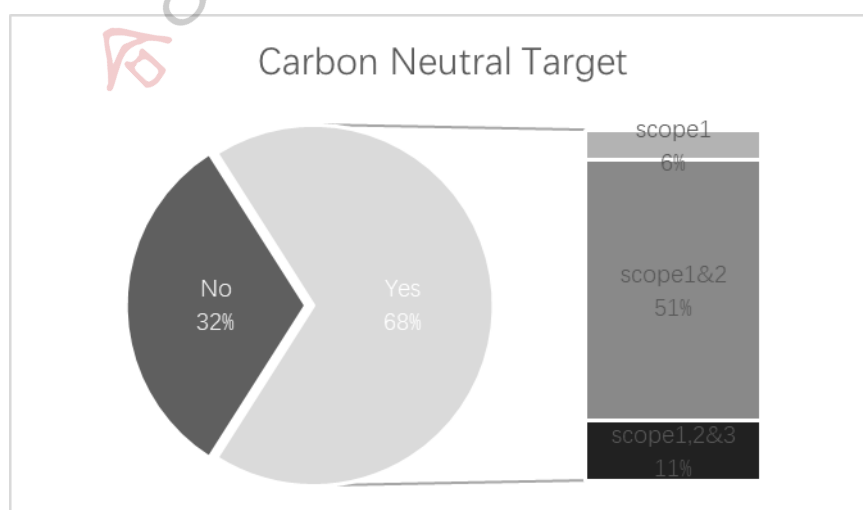
Figure 2-12 Corporate Climate Action Pledge by Industry

Among the companies that have set net-zero emissions targets, approximately 75% plan to achieve net-zero emissions for Scope 1 and 2, while 17% aim for full carbon neutrality covering Scope 1, 2, and 3 emissions. Additionally, around 9% of companies have set targets that focus solely on direct emissions within Scope 1.

Around 69% of companies plan to achieve carbon neutrality by 2050. As of now, three U.S. energy companies have already achieved net-zero emissions in 2021. Additionally, five energy companies plan to reach net-zero by 2025, including two U.S. Oil & Gas companies, two Latin American companies, and one African energy company. Furthermore, five companies

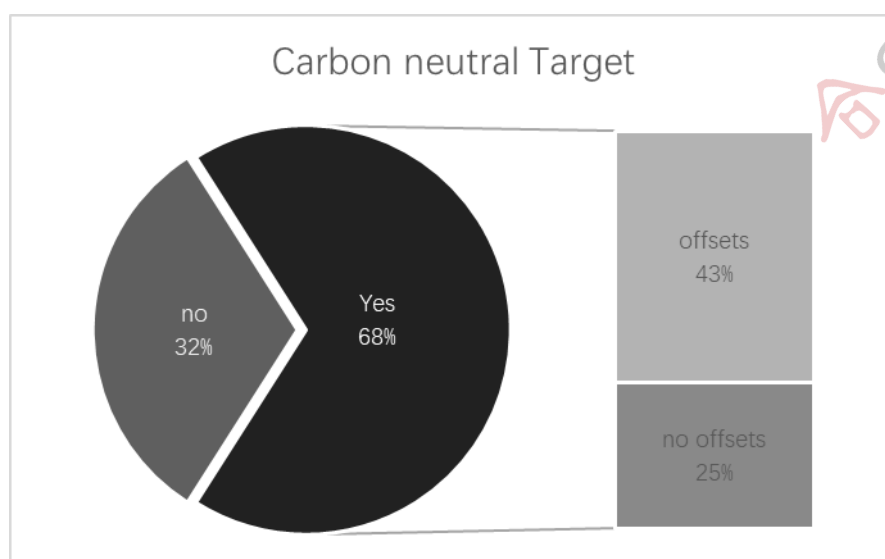
have set their net-zero targets for 2060 or 2070. The remaining 15 companies aim to achieve carbon neutrality between 2030 and 2050 (see Figure 2-13).

Nearly 40% of companies have committed to achieving carbon neutrality through location-based decarbonization, meaning they plan to fully decarbonize their own production and office processes. Meanwhile, 60% of companies aim to achieve net-zero through market-based mechanisms, such as purchasing carbon credits or investing in carbon offset products (see Figure 2-14).



Data source: Bloomberg Terminal, plotted by author's calculations

Figure 2-13 Scope of Corporate Carbon Neutral Target



Data source: Bloomberg Terminal, plotted by author's calculations

Figure 2-14 Pathways to Achieve Carbon Neutral Targets

2. Corporate Carbon Reduction Progress

2.1 Carbon Emission and Energy Consumption Levels

This analysis is based on a sample of 1,080 listed companies registered in 62 countries. These companies belong to 32 sub-industries across 8 industrial sectors, with a focus on carbon-intensive sectors such as oil and gas, energy, chemicals, steel, and transportation, and moreover, with a coverage of a wide range of sectors from manufacturing to retailing. The sample includes large, medium, and small firms, with market capitalizations ranging from US\$14.05 million to US\$209 billion.

The data includes Scope 1, 2, and 3 greenhouse gas emissions (measured in carbon dioxide equivalents, hereafter referred to as carbon emissions or CO₂e), emission intensity (carbon emissions per unit of sales revenue), energy consumption (measured in terawatt-hours), and energy intensity (energy consumption per unit of sales revenue).

Table 2-3 presents the median carbon emissions and energy consumption for companies across different industries in 2023, as well as the change rates compared to 2014. The data is arranged top down by the increase in emissions, from lowest to highest. To minimize the impact of extreme values, the key variables are winsorized by 5%, with statistics in the table representing 90% of the companies in the sample.

Overall, industries with high energy consumption typically exhibit higher emission levels, but there are exceptions, as emissions also depend on energy intensity. In some energy-intensive industries, the emission levels are relatively low because their energy consumption per unit of output is lower than other energy intensive industries. Additionally, the energy mix plays an important role. As the share of renewable energy increases, the correlation between energy consumption and emission levels diminishes.

Over the decade since 2014, average corporate carbon emissions, measured by the sample median, have been reduced by half, emission intensity has decreased by nearly one-third, energy consumption has dropped by 45%, and energy intensity has fallen by 40%. Industry-level analysis shows that, with few exceptions, most sectors have seen varying degrees of reduction across these four indicators.

Table 2-3 Carbon Emission and Energy Consumption by Industry (2023)

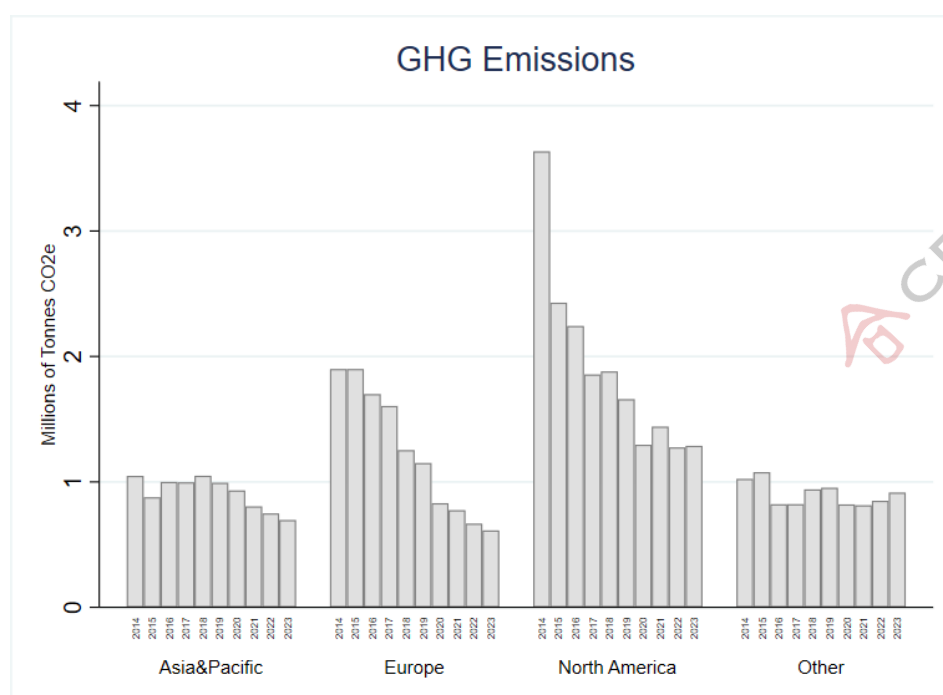
	Emissions		Emission Intensity		Energy Consumption*		Energy Intensity*	
	Millions of tons CO2e	% change since 2014	Tons CO2e/US\$ million	% change since 2014	GWh	% change since 2014*	GWh/US\$ billion	% change since 2014*
Electric Utilities	19.10	-46%	2523.23	-45%	51.66	-26%	8038.05	-39%
Building Materials	18.86	-41%	3116.15	-25%	26.16	-58%	4560.36	-3%
Power Generation	7.66	-59%	834.80	-62%	26.83	-68%	3701.90	-41%
Aluminum	16.79	-31%	2470.55	37%	53.61	-30%	6517.08	21%
Natural Gas Production	0.57	-89%	201.19	-60%	1.61	-67%	260.62	-43%
Electricity & Gas Transmission	1.46	-74%	198.45	-59%	15.41	45%	1471.57	46%
Crude Oil Production	2.06	-56%	474.86	-16%	9.31	5%	1210.99	25%
Steel	1.27	-63%	309.87	-57%	2.18	-45%	618.79	-55%
Gold	1.63	-46%	321.69	-50%	6.32	2%	1403.39	-13%
Transportation	4.97	-21%	714.59	-12%	25.92	-30%	2615.19	-14%
Telecom Carriers	0.46	-67%	43.54	6%	3.23	137%	113.13	-10%
Iron	0.97	-48%	206.95	-25%	2.77	-47%	1497.01	92%
Lodging	0.87	-48%	252.50	0%	1.65	-58%	775.11	22%
Mobile Handset Manufacturers	0.52	-60%	30.36	64%	0.96	-78%	78.80	36%
Auto OEMs	0.68	-50%	19.66	-37%	2.07	-62%	72.80	-30%
Diversified Industrials	0.23	-70%	25.01	-60%	0.75	-49%	75.72	-26%
Agricultural Chemicals	1.70	-23%	425.08	-26%	3.00	-66%	750.59	-75%
Personal Computer	0.22	-65%	8.92	-59%	0.54	-70%	17.16	-57%
Aerospace & Defense	0.34	-54%	16.71	-27%	1.31	-15%	72.27	1%
Auto Parts	0.47	-36%	68.46	0%	1.77	-30%	239.24	-11%
Servers	0.25	-41%	8.29	-31%	0.64	-33%	31.60	-5%
Silver	0.12	-45%	215.75	-48%	0.48	-71%	683.92	-54%
Courier Services	0.30	-23%	37.27	-33%	1.42	-37%	179.46	-8%
Machinery	0.14	-28%	20.43	-21%	0.39	-52%	86.67	-23%
Food	0.39	1%	73.19	-6%	1.51	17%	286.29	-6%
Food and Drug Stores	0.55	6%	41.12	-11%	1.23	-32%	99.32	10%
Beverages	0.35	19%	46.09	-16%	1.35	13%	192.72	-12%
Copper	3.36	23%	358.51	-14%	7.26	-28%	1018.99	-12%
Platinum	4.02	20%	872.36	-36%	3.69	-17%	803.02	-63%
Basic & Diversified Chemicals	4.31	21%	566.20	26%	13.67	4%	1724.73	2%
Integrated Oils	25.60	36%	333.70	-5%	103.67	38%	902.98	5%
Industrial Gases	37.72	50%	1283.71	-32%	71.67	-31%	2408.17	-69%
Total	0.87	-52%	103.39	-27%	2.65	-45%	288.86	-40%
Total number of firms	870	391	869	392	785	353	782	352

Note: The data in the table are the median value of the sample firms in 2023. The samples are winsorized by 5%. The rates of change marked with a star represented approximated values. As an important part of the data on energy consumption and energy intensity for 2023 are still missing, we used the values of 2022 instead. Data source: Bloomberg Terminal.

Figure 2-15 shows that North American companies had the highest average carbon emissions among all regions, but also experienced the most significant reduction over the past decade. In 2015, the median carbon emissions of North American companies were approximately 2.43 million tons, a 30% reduction from 3.63 million tons in just one year. This decline was likely driven primarily by the shale oil revolution in the United States, which led to a shift in the energy mix, particularly in the power sector, where natural gas largely replaced coal. However, since 2020, the decline in carbon emissions in North America has plateaued, marking the end of the previous rapid downward trend.

Before 2019, European companies had the second-highest average carbon emissions, following North America. However, due to a steady decline in emissions, the median emissions of European companies became the lowest among the four regions by 2021, with a 68% reduction over the past decade. This reflects the effectiveness of the EU and other European countries' efforts in advancing climate legislation and driving the green transition.

Companies in the Asia-Pacific region have seen a steady decline in emissions since 2019. In contrast, the "Other Regions" category in Figure 2-15, of which half is from South America and the other half from the Middle East and Africa,¹ has not shown a clear downward trend in average emissions.



Note: The figure plots the region-year median of Scopes 1, 2 & 3 carbon emissions of enterprise.
Data source: Bloomberg Terminal, plotted by author's calculations

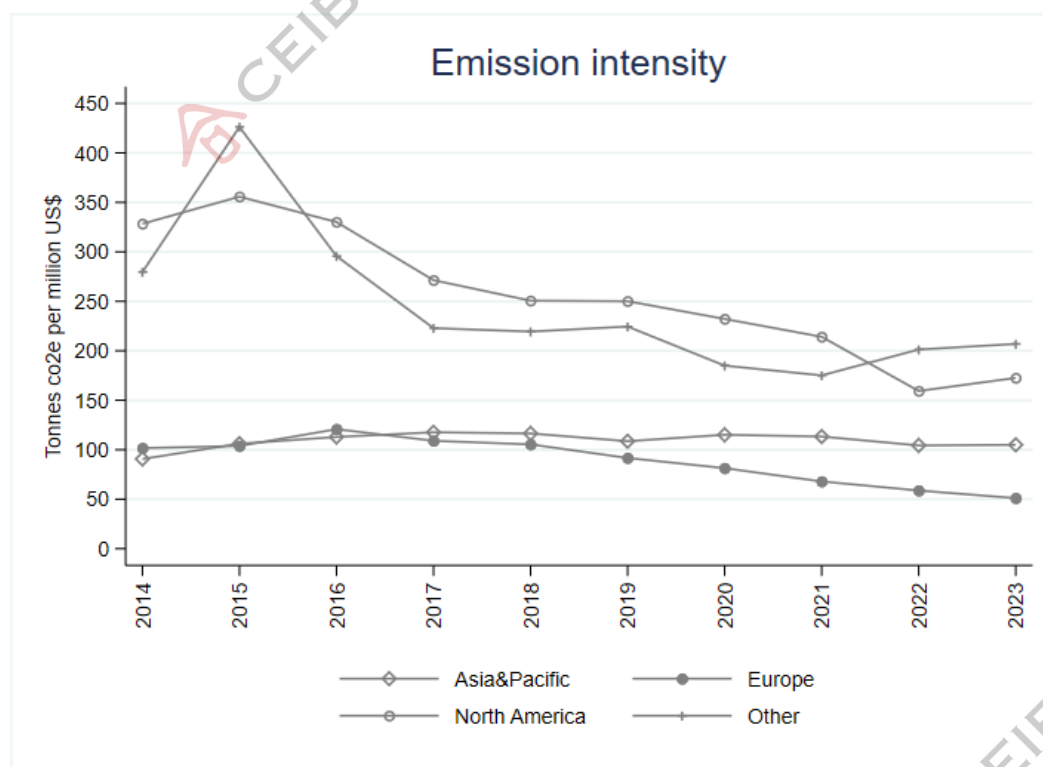
Figure 2-15 2014—2023 Corporate Carbon Emissions by Region

In terms of emission intensity by region, Figure 2-16 shows that, the median emission intensity of companies in all regions except the Asia-Pacific, has significantly declined over the

¹ Due to the relatively smaller number of companies in these regions, they were combined for comparison.

past decade. North American companies consistently had the highest median emission intensity for most of the years, but starting in 2022, the median for companies in South America, the Middle East, and Africa surpassed that of North America.

The average emission intensity of European and Asia-Pacific companies began to diverge after 2019, primarily due to the faster decline in emission intensity among European companies.



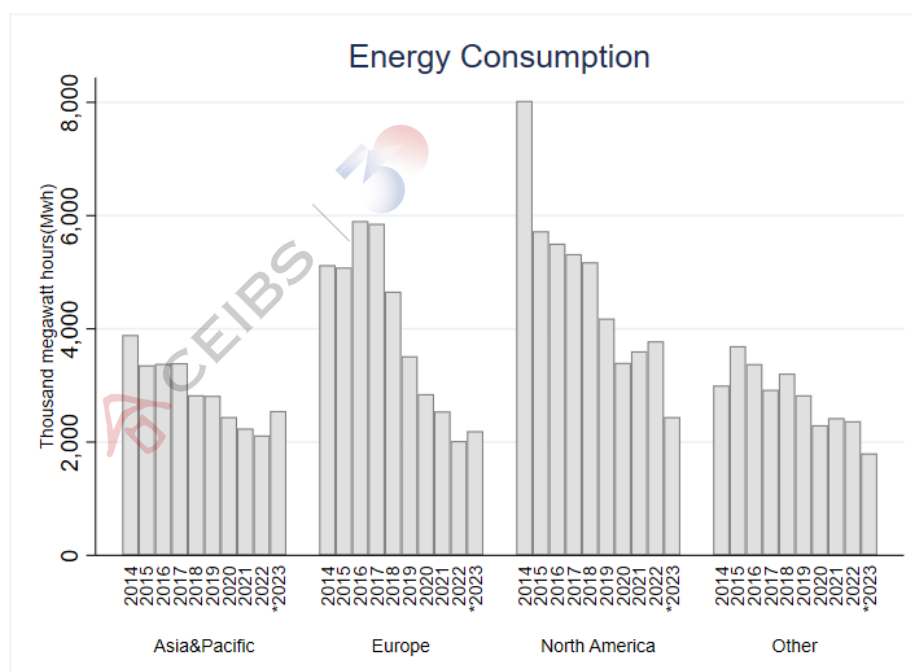
Note: The figure plots the region-year median value of carbon emissions per million dollars of sales revenue for firms.

Data source: Bloomberg Terminal, plotted by author's calculations

Figure 2-16 2014—2023 Carbon Emission Intensity by Region

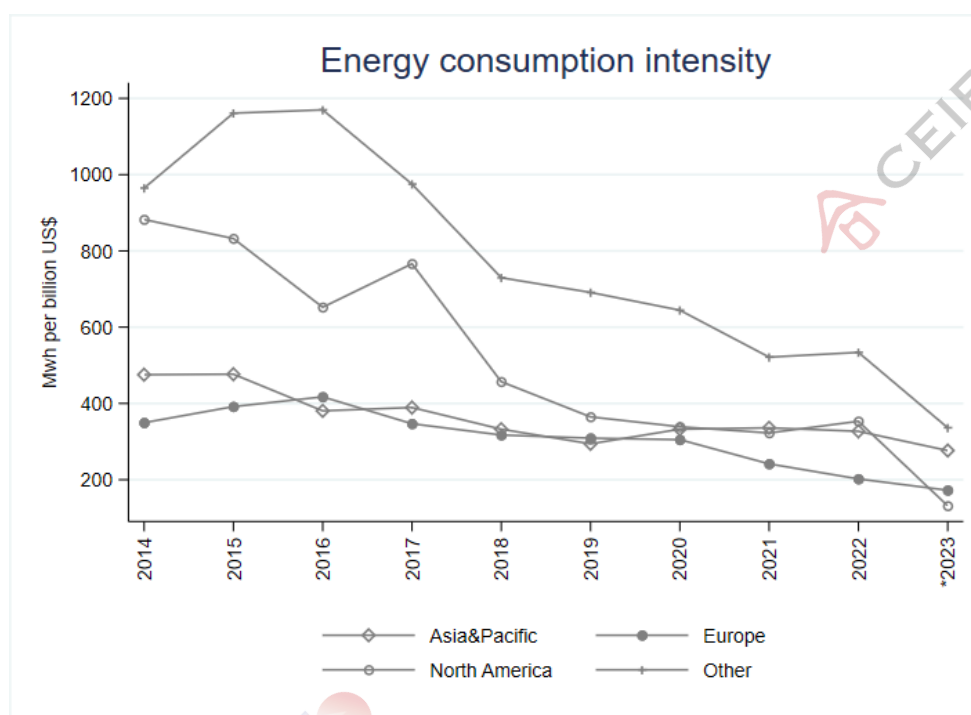
In terms of energy consumption, Figure 2-16 indicates that the median energy consumption of companies across various regions has significantly declined over the past decade. However, there has been some volatility post-pandemic, notably in North America, where energy consumption has risen for three consecutive years from 2020 to 2023.

Figure 2-17 compares the median energy intensity across different regions, which shows narrowing differences among regions. Companies in the Middle East, Africa, and South America have experienced a continuous and rapid decline in energy intensity. In contrast, companies in North America and the Asia-Pacific region experienced some fluctuations, but trends downward overall. In the post-pandemic period, intensity changes in these regions stabilized and increased slightly. European companies, on the other hand, have seen a consistent and steady decrease in energy intensity, with a more pronounced decline after 2020, likely related to the EU's accelerated efforts to promote renewable energy initiatives.



Note: The figure plots the median energy consumption of businesses by region and year; data for 2023 businesses have not been fully updated and are approximate estimates based on an incomplete sample.
Data source: Bloomberg Terminal, plotted by author's calculations

Figure 2-17 2014—2023 Corporate Energy Consumption by Region



Note: The figure plots the median energy consumption of firms per billion dollars of sales revenue by region and year; data for 2023 firms are not yet fully updated and are approximate estimates based on an incomplete sample.
Data source: Bloomberg Terminal, plotted by author's calculations.

Figure 2-18 2014—2023 Corporate Energy Consumption Intensity by Region

2.2 Rates of Change in Emissions and Energy Consumption

To gain a whole picture of corporate carbon reduction progress, we turn to the distribution of changes in carbon emissions and energy consumption. Figure 2-19 presents the cumulative probability distribution (CDF) of the change rates in carbon emissions (left) and emission intensity (right) for the sample companies.

By using two reference lines—one at a change rate of 0 on the x-axis and another at a cumulative probability of 50% on the y-axis—we can observe the changes across different years. For instance, when the CDF line for a particular year intersects at the crossing point of these two reference lines, it indicates that 50% of companies experienced a year-on-year decrease in emissions or emission intensity, while the other half saw an increase.

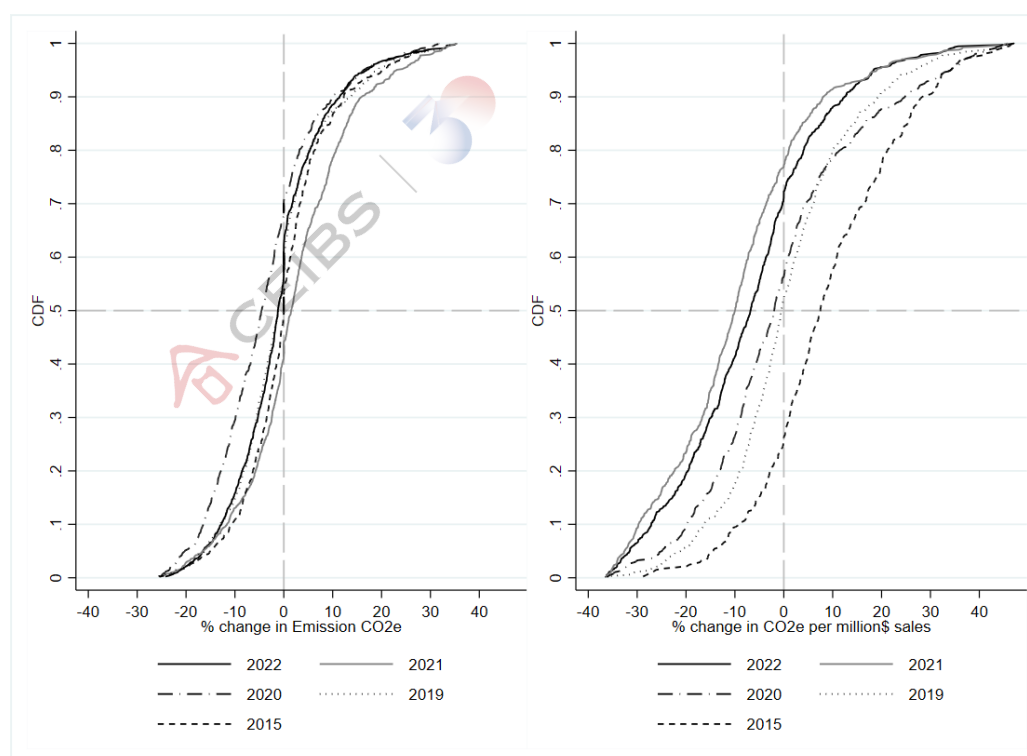
To take into account of fluctuations in recent years, due to impacts of the COVID-19 pandemic, the subsequent recovery, and the energy crisis, we perform comparisons between several recent years with 2015.

Overall, the variations in emission intensity have been more pronounced than those in total emissions. In terms of emissions (as shown in the left chart of Figure 2-19), approximately half of the companies experienced a year-on-year decrease in emissions in 2015, while the other half saw an increase. By 2019, the proportion of companies with a year-on-year reduction in carbon emissions exceeded 50%. In 2020, around 70% of companies either decreased their emissions or maintained them at the same level, with half of these companies reporting a year-on-year decline greater than 4.5% and a quarter experiencing declines of over 11.2%. Meanwhile, the leftward shift of the CDF for 2019 and 2020 compared to 2015 shows a slower growth for companies with increasing emissions in the two years.

However, with the post-pandemic recovery taking place in 2021, the trend in carbon emissions was reversed. The CDF shifted to the right compared to 2015, with only 44% of companies reporting a year-on-year decrease in carbon emissions, while a quarter of the companies increasing at a rate higher than 9%. By 2022, the trend in emissions had largely reverted to levels similar to those seen in 2019.

Regarding the changes in carbon emission intensity, the right chart of Figure 2-19 indicates that only about 27% of companies experienced a year-on-year decrease in emission intensity in 2015. But by 2019, the number is close to 50%. In 2020, the proportion remained relatively stable (approximately 56%); however, the magnitude of the decline was significantly larger, with a quarter of the companies' reduction rate exceeding 10.7%. Meanwhile, the growth rate of companies with increasing emission intensity slowed, particularly among the top 20% of emission-intensive companies.

Although the number of companies with increasing carbon emissions exceeded those with decreasing emissions in 2021, emission intensity improved significantly, with over 77% of companies showing a decline in intensity and only 13% reporting a year-on-year increase. This suggests that during this period, the growth in sales revenue for most companies outpaced the growth in emissions. In 2022, while the reduction in emission intensity slightly regressed, it was still significantly better than pre-pandemic levels, with 71% of companies experiencing a year-on-year decrease in intensity. Additionally, the growth rate of the top 10% of most carbon intensive companies narrowed.



Note: The figure shows the estimation of the cumulative distribution function of the corresponding variables, and the sample data have been 5% winsorized. It depicts the cumulative probability distribution of the rate of change in carbon emissions (left) and emissions intensity (right) of the sample firms.

Data source: Bloomberg Terminal, plotted by author's calculations.

Figure 2-19 CDF of the Rate of Change in Carbon Emissions and Emission Intensity

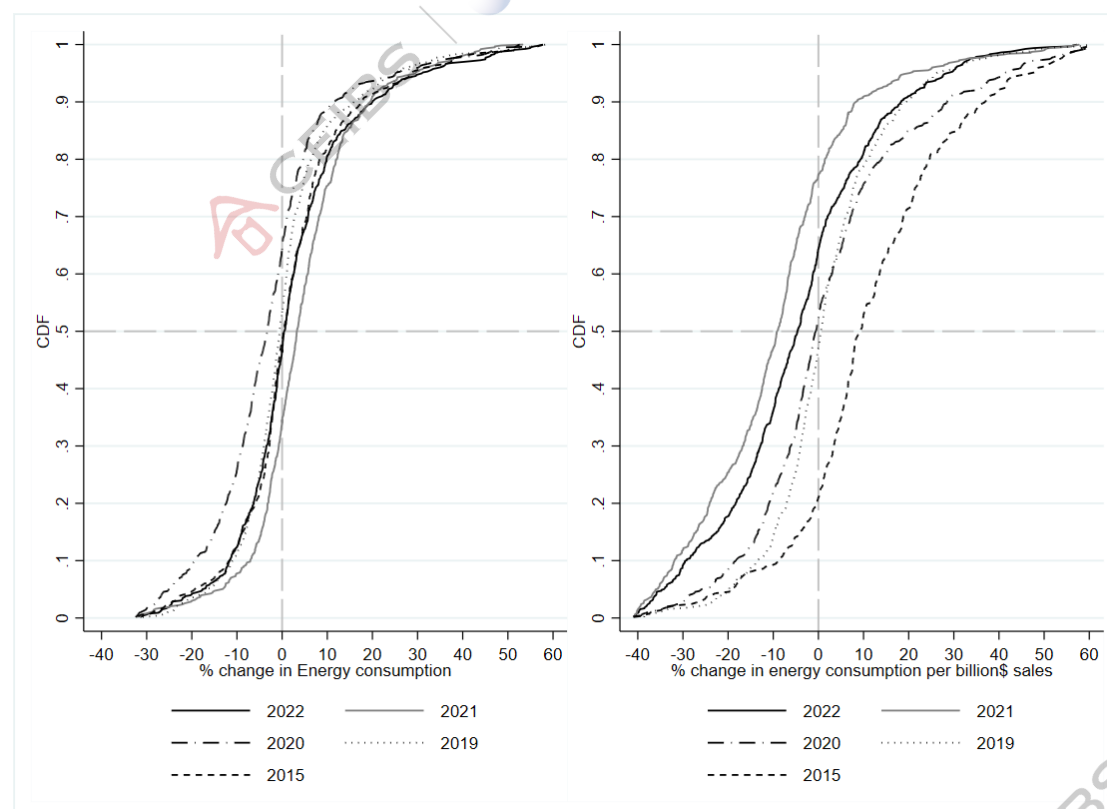
Figure 2-20 presents the cumulative probability distribution (CDF) of changes in corporate energy consumption and energy intensity. The left chart shows the distribution of year-on-year changes in energy consumption, while the right chart illustrates the distribution of changes in energy intensity.

In 2019 and 2020, increasing numbers of companies experienced a year-on-year reduction in energy consumption, moreover, the growth rate of companies with increasing energy consumption slowed. This trend was similar to the changes observed in carbon emissions. However, in 2021, the trend reversed, with approximately 65% of companies showing an increase in energy consumption, and one-quarter of them reporting growth rates exceeding 9.8%. By 2022, the trend in energy consumption had largely returned to pre-pandemic levels.

The improvement in energy intensity was significantly greater than the changes in total energy consumption. The proportion of companies with declining energy intensity expanded annually before 2021, growing from 20% in 2015 to 73% in 2021, as reflected by the leftward shift of the CDF in the chart. However, in 2022, the improvement in energy intensity slowed, with the CDF shifting to the right compared to 2021, indicating that the rate of decline in energy intensity had decelerated.

Overall, the changes in carbon emissions and energy consumption among the sample companies exhibited some volatility. Prior to the pandemic, an increasing number of companies

were reducing their emissions and energy consumption. The trend was reversed during the pandemic. However, in the post-pandemic recovery phase, these indicators rebounded to some extent.



Note: The graphs are estimates of the cumulative distribution functions of the corresponding variables, and the sample data are 5% winsorized. It depicts the cumulative probability distribution of the rate of change in energy consumption or energy consumption intensity of the sample firms.

Data source: Bloomberg Terminal, plotted by author's calculations

Figure 2-20 CDF of the Rate of Change of Energy Consumption and Energy Intensity

3. Progress of Carbon Reduction on Chinese Firms

The sample includes 114 Chinese companies, and we will focus on the emission reduction trends reflected by these companies. Due to the small number of companies in certain industries, the 114 companies have been consolidated into four industry sectors. Table 2-4 presents the median values for greenhouse gas emissions, energy consumption, and the intensity of both indicators for each sector in 2023, along with changes since 2016.¹

The table shows significant differences in carbon emissions and energy consumption across industries. The consumer goods and services sector has performed particularly well in reducing emissions, with notable declines in both the median values of emissions and emission intensity. Since 2016, total emissions in this sector have decreased by 16%, and emission

¹ It may be that due to the small number of firms disclosing relevant information, there are a large number of default values for data prior to 2016, and thus we only consider changes since 2016.

intensity has fallen by nearly one-third. On average, emissions in this sector have decreased by 2% annually, while emission intensity has declined by 5% per year.

However, the other three sectors show an upward trend in emissions. The energy and power sector saw the most significant increase, with the median emissions in 2023 rising by 45% compared to 2016. Similarly, in the metals and chemicals sector, which is also carbon-intensive, the median emissions grew by 19% over the same period. In contrast, the manufacturing and technology sector experienced a smaller increase, with emissions rising by only 3% in 2023 compared to 2016.

Despite the continuous rise in total emissions, the emission intensity in all three sectors has been declining annually, with average reductions ranging between 1% and 2% per year.

In terms of energy consumption, all three sectors, except for the metals and chemicals sector, showed varying degrees of increase in median energy consumption. The most notable rise occurred in the manufacturing and technology sector, where energy consumption increased by 41% from 2016 to 2023, with an average annual growth rate of 6%. The energy and power sector saw the most significant decline in energy intensity, with a reduction of nearly 60% compared to 2016, averaging an annual decrease of 10%.

Overall, at the current stage, carbon emissions of the corporate sector in China seem to rise annually. However, the consumer goods and services sector has taken the lead in achieving emissions reductions, with the average emission and emission intensity reduction has been remarkable. Despite year-on-year increase in emission, it should not be overlooked that both emission intensity and energy intensity have seen substantial declines.

Table 2-4 Carbon Emissions and Energy Consumption of Chinese Firms by Sector (2023)

	Carbon Emissions			Carbon Emission Intensity		
	Million tons of CO ₂ e	% change since 2016	Average annual change rate %	Tons CO ₂ e/US\$ Million	% change since 2016	Average Annual change rate %
Consumer goods & services	0.7	-16%	-2%	103.7	-29%	-5%
Energy & Power	168.6	45%	6%	402.6	-16%	-1%
Manufacturing & Technology	0.3	3%	1%	43.7	-17%	-2%
Metals & Chemicals	12.3	19%	3%	2111.8	-11%	-1%
	Energy Consumption			Energy Consumption Intensity		
	GWh	% change since 2016	Average annual change rate %	GWh/US\$ Billion	% change since 2016	Average annual change rate %
Consumer goods & Services	1265.6	3%	1%	245.2	-21%	-3%
Energy & Power	346053.0	14%	3%	795.8	-57%	-10%
Manufacturing & Technology	620.7	41%	6%	81.1	-16%	-2%
Metals & Chemicals	31924.9	-7%	-1%	5139.5	-41%	-5%

Note: The table shows the median value of the sample of Chinese firms by industry, as well as its rate of change. Consumer goods and services includes industries such as food, food and drug store, beverages, and lodging; energy and power includes industries such as power generation, crude oil production, and integrated oil companies; manufacturing and technology includes industries such as automotive OEMs, autom parts, courier services, machinery, mobile handset manufacturing, and personal computer manufacturing; and metals and chemicals includes industries such as basic and diversified chemicals, agriculture chemicals, copper, gold, and steel. compounds, aluminum, copper, gold, and steel industries. Missing values are replaced with values from the most recent year available. Data source: Bloomberg Terminal.

Chapter III

- CEIBS Alumni Insight - China's ESG Products and the Optimization of Brokerage Firms' ESG Investment Strategies¹

This article is comprised of four parts. The first three sections explore the current state of ESG development in China from three perspectives: the regulatory landscape on the supply side of ESG products, the practices of publicly listed companies, and the asset management market. The fourth section depicts the demand side of ESG products. We will begin by examining the specific ESG investment needs of institutional investors, illustrating the establishment of ESG product selection mechanisms and analyzing the effectiveness of ESG factors.

Research and participation in ESG within China's capital markets are still at an early stage. Through this study, we aim to enhance our understanding of the changes and future trends of ESG in China's investment market. We will explore the underlying causes of the effectiveness of ESG factors in the Chinese market, with the hope of providing guidance for future ESG investments.

ESG regulation in China is becoming increasingly standardized, and the disclosure of ESG information by companies is becoming more routine. Policy frameworks are gradually aligning ESG reporting requirements with annual reports, and in the future, mandatory ESG disclosure may be required for all publicly listed companies. Below, we outline the timeline of relevant policy developments from the China Securities Regulatory Commission (CSRC), the stock exchanges in China, and the State-owned Assets Supervision and Administration Commission (SASAC).

¹ This chapter was co-authored by CEIBS FMBA Class of 2022 alumni Jingchang Zou, Zhuo-jun Kong, Jin Li, Shoupeng Xu, and Jiancheng Zhang.

Section I

ESG Regulatory Trends in China

1. CSRC Policies

In 2018, CSRC issued the revised “Code of Corporate Governance for Listed Companies”, establishing the basic framework for the disclosure of Environmental, Social, and Governance (ESG) information. It stipulates that listed companies must disclose environmental information and report on their social responsibilities, such as poverty alleviation efforts, in accordance with relevant laws, regulations, and requirements from authorities.¹

In 2022, CSRC issued the “Guidelines for Investor Relations Management of Listed Companies”, which explicitly included ESG information as part of the communication content between listed companies and their investors.²

On April 12, 2024, under the guidance of CSRC, the Shanghai, Shenzhen, and Beijing stock exchanges jointly issued the “Self-Regulatory/Continuous Supervision Guidelines for Listed Companies - Sustainability Reports (Trial)” (No. 14, No. 17, and No. 11, respectively, hereinafter referred to as the “Guidelines”). The Guidelines came into effect on May 1, 2024.

According to the Guidelines, companies that were continuously included in the Shanghai Stock Exchange 180 Index, STAR Market 50 Index, Shenzhen Stock Exchange 100 Index, and ChiNext Index during the reporting period, as well as companies listed on both domestic and overseas exchanges, are required to publish their 2025 Sustainability Reports in accordance with the Guidelines by April 30, 2026. Other listed companies are encouraged to voluntarily disclose sustainability reports.³

2. Policies of Major Chinese Exchanges

2.1 Shanghai Stock Exchange

In 2008, the Shanghai Stock Exchange issued the “Notice on Strengthening the Social Responsibility of Listed Companies and Issuing the Environmental Information Disclosure Guidelines for Listed Companies”, encouraging listed companies to disclose social responsibility reports. The notice specified the environmental information that listed companies

¹ For more information:

https://www.gov.cn/xinwen/2018-10/04/content_5327899.htm?eqid=da97c81a0001c23800000004646f4de3

² For detailed information:

<http://www.csrc.gov.cn/csrc/c101954/c2334702/2334702/files/%E9%99%84%E4%BB%B61%EF%BC%9A%E4%B8%8A%E5%B8%82%E5%85%AC%E5%8F%B8%E6%8A%95%E8%B5%84%E8%80%85%E5%85%B3%E7%B3%BB%E7%AE%A1%E7%90%86%E5%B7%A5%E4%BD%9C%E6%8C%87%E5%BC%95.pdf>

³ Shenzhen Stock Exchange official website,

https://www.szse.cn/lawrules/publicadvice/t20240208_606058.html

should disclose and required the inclusion of efforts related to promoting social, environmental, and ecological sustainability in the reports.¹

In 2022, the Shanghai Stock Exchange issued the “Notice on the Disclosure of the 2021 Annual Reports of STAR Market Listed Companies”, which explicitly required the inclusion of ESG-related information in annual reports. Companies were also encouraged to prepare and disclose separate reports, such as ESG reports, social responsibility reports, sustainability reports, and environmental responsibility reports, as appropriate. The notice specifically called for companies listed in the STAR 50 Index to take a leading role by disclosing social responsibility reports. However, if a company had already disclosed an ESG report, there was no need to publish a separate social responsibility report.²

2.2 Shenzhen Stock Exchange

In 2006, the Shenzhen Stock Exchange issued the “Guidelines for Social Responsibility of Listed Companies”, which explicitly set requirements for environmental protection and sustainable development. This marked the formal disclosure of social responsibility reports by Chinese listed companies. The guidelines encouraged companies to voluntarily disclose their Social Responsibility Reports, while all companies listed in the Shenzhen 100 Index were required to disclose such reports.³

In 2020, the Shenzhen Stock Exchange revised the “Assessment Measures for Information Disclosure by Listed Companies”, introducing the concept of voluntary ESG disclosure for the first time. The revision formally included whether listed companies disclosed ESG-related information in the assessment criteria. The newly added Article 16, “Disclosure of Social Responsibility Fulfillment,” assesses the disclosure of corporate social responsibility (CSR) and considers it as a factor for awarding additional points in the evaluation.⁴

2.3 Hong Kong Stock Exchange

In 2012, the Hong Kong Stock Exchange issued the “Environmental, Social and Governance (ESG) Reporting Guide”.⁵

In 2015, the Hong Kong Stock Exchange revised the “Environmental, Social and Governance (ESG) Reporting Guide”, upgrading the compliance requirement for certain indicators to a “comply or explain” basis.⁶

In 2020, the Hong Kong Stock Exchange issued an updated version of the “Environmental,

¹ Shanghai Stock Exchange official website ,
http://www.sse.com.cn/aboutus/mediacenter/hotandd/c/c_20150912_3988192.shtml

² Shanghai Stock Exchange official website,
https://www.udfspace.com/article/5331758517950251.html?cat_id_123542797996=404763

³ Shenzhen Stock Exchange official website,
https://www.szse.cn/disclosure/notice/general/t20060925_499697.html

⁴ Shenzhen Stock Exchange official website,
<https://www.szse.cn/lawrules/rule/peal/rules/P020231230545299887508.pdf>

⁵ Hong Kong Stock Exchange official website,
https://www.hkex.com.hk/-/media/HKEX-Market/Listing/Rules-and-Guidance/Other-Resources/Letters-to-Issuers/20120831_sc.pdf

⁶ Hong Kong Stock Exchange official website,
https://cn-rules.hkex.com.hk/sites/default/files/net_file_store/HKEXCN_SC_8299_VER3461.pdf

Social and Governance (ESG) Reporting Guide”, which included the disclosure of "climate change" factors. Additionally, the disclosure requirements were revised to follow a "comply or explain" approach.¹

In 2021, the Hong Kong Stock Exchange enhanced the guidelines for the new ESG Reporting Guide by adding the topic "A4 Climate Change." It was explicitly stated that the "Climate Disclosure Guidelines" would be mandated for implementation in 2025, at which point relevant industries would be required to disclose TCFD (Task Force on Climate-related Financial Disclosures) reports.²

3. SASAC Requirements

In 2008, SASAC issued the “Guidelines on Central State-owned Enterprises' Fulfillment of Social Responsibility”, encouraging central state-owned enterprises to actively fulfill their social responsibilities and establishing a social responsibility reporting system.³

In 2016, SASAC issued the “Guidelines for State-owned Enterprises to Better Fulfill Social Responsibility”, which expanded the implementation scope to all state-owned enterprises. The guidelines further emphasized the establishment of a social responsibility reporting system for state-owned enterprises.

In 2022, the former Bureau of Technological Innovation and Social Responsibility of SASAC was restructured into two independent entities: the Bureau of Technological Innovation and the Bureau of Social Responsibility. SASAC officially released the Action Plan for “Improving the Quality of Central State-Owned Enterprises' Listed Companies”, which aims to enhance the ESG governance capabilities and risk management skills of centrally-controlled listed companies. The plan encourages more centrally-controlled listed companies to disclose specialized ESG reports, with the goal of achieving "full coverage" of such disclosures by 2023.⁴

1 Hong Kong Stock Exchange official website, https://cn-rules.hkex.com.hk/sites/default/files/net_file_store/HKEXCN_SC_8299_VER3461.pdf

2 Hong Kong Stock Exchange official website, https://cn-rules.hkex.com.hk/sites/default/files/net_file_store/HKEXCN_SC_8299_VER3461.pdf

3 SASAC official website, <http://www.sasac.gov.cn/n2588025/n2588119/c2705671/content.html>

4 SASAC official website, <http://www.sasac.gov.cn/n2588025/n2588139/c24857876/content.html>

Section II

Status of ESG Disclosure of A-share Listed Companies

1. ESG Report Release by Chinese Listed Companies

According to China Association for Public Companies(CAPCO), as of May 2, 2024, excluding companies that have delayed announcements and those that have been delisted, a total of 5,330 listed companies on the Shanghai, Shenzhen, and Beijing stock exchanges published their 2023 annual reports. Among these, 2,124 companies independently prepared and released their 2023 ESG reports, accounting for approximately 39.8% of A-share companies. Notably, among companies listed in the CSI 300 Index, the proportion that published ESG reports in 2024 reached as high as 95%.

Among these, the Shanghai Stock Exchange had the highest ESG report publication rate at 49.9%, followed by the Shenzhen Stock Exchange at 33.2%. The Beijing Stock Exchange, established in 2022, had the lowest ESG report publication rate at 2.8%. The overall low rate of ESG report disclosures can be attributed to several factors, including:

First, under the “Self-Regulatory/Continuous Supervision Guidelines for Listed Companies - Sustainability Reports (Trial)”, published by CSRC, most listed companies are encouraged to voluntarily disclose their sustainability reports, but this is not yet mandatory.

Second, there is a lack of a unified framework for ESG report disclosure, with multiple different disclosure frameworks existing in the market. This makes it difficult for companies to navigate, and as a result, discourages their reporting efforts.

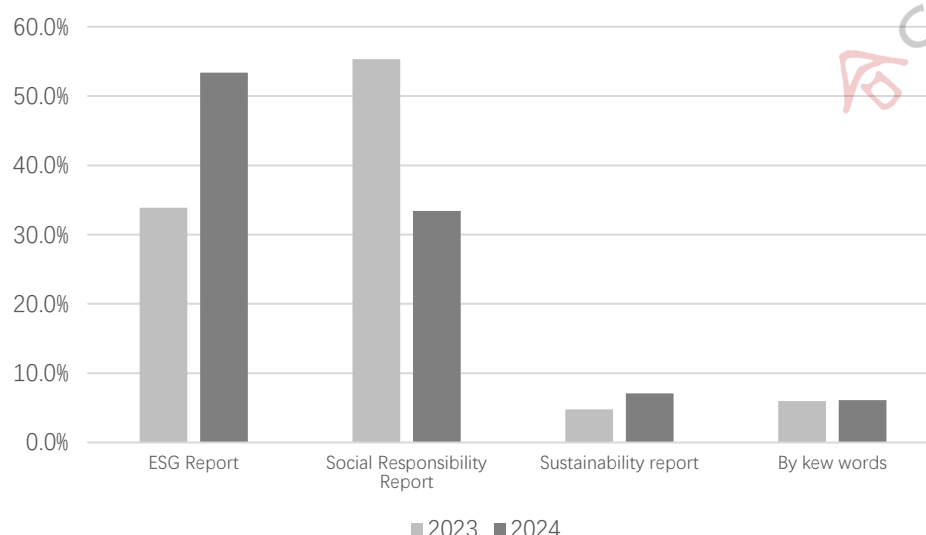
Third, there is a lack of a scientifically robust and systematic ESG rating and investment framework, making it difficult for companies to benefit from ESG disclosures, diminishing companies' motivation to proactively disclose their ESG information.



Data Source: Compiled by Shangdao Zongheng based on ESG disclosure report of A-share listed companies.

Figure 3-1 2009—2024 The number of ESG reports issued by A- share listed companies

With the simultaneous release of the “Self-Regulatory/Continuous Supervision Guidelines for Listed Companies - Sustainability Reports (Trial)” (Nos. 14, 17, and 11) ¹ on April 12, 2024, regulated by CSRC, it is expected that "Sustainability Reports" will become the mainstream label convention for ESG annual reports published by domestic listed companies in the future. The application of ESG nomenclature will primarily be seen in overseas markets, while the proportion of reports named under Corporate Social Responsibility (CSR) will continue to decline.



Data source: Shangdao Zongheng.

Figure 3-2 2023—2024 Labels of ESG-related Reports Released by A-share companies

¹ Shenzhen Stock Exchange official website,
https://www.szse.cn/lawrules/publicadvice/t20240208_606058.html

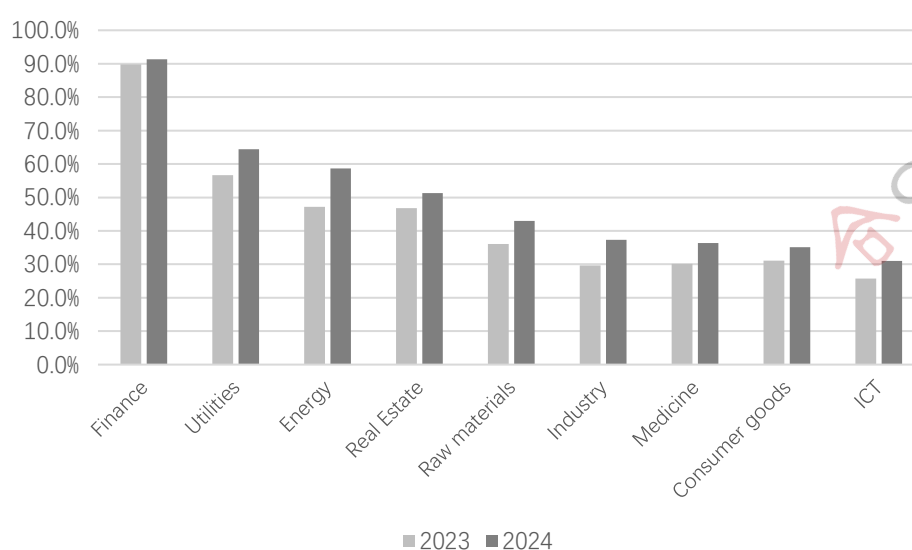
2. ESG Report Release by Sector

Overall, the publication rate of ESG reports among A-share listed companies across various industries is low, indicating that there is significant room for improvement in ESG information disclosure among these companies.

In 2024, the top three sectors for ESG report publication rates among A-share listed companies are financial services (91.3%), utilities (64.4%), and energy (58.7%). In contrast, the sectors with the lowest publication rates are Information and Communications Technology (ICT), consumer goods, pharmaceuticals, and industrial sectors, with publication rates of 31.0%, 35.1%, and 36.4%, respectively.

Compared to 2023, the ESG report publication rates across various industries in the A-share market have all increased to varying degrees. The highest publication rate among sectors has exceeded 90%, while the lowest has surpassed 30%. Notably, the energy sector saw the most significant growth in its ESG report publication rate, with an increase of 11.5%.

However, sectors such as ICT, consumer goods, pharmaceuticals, and industrial have a relatively large base of companies and require more attention and emphasis in terms of ESG management and information disclosure practices.

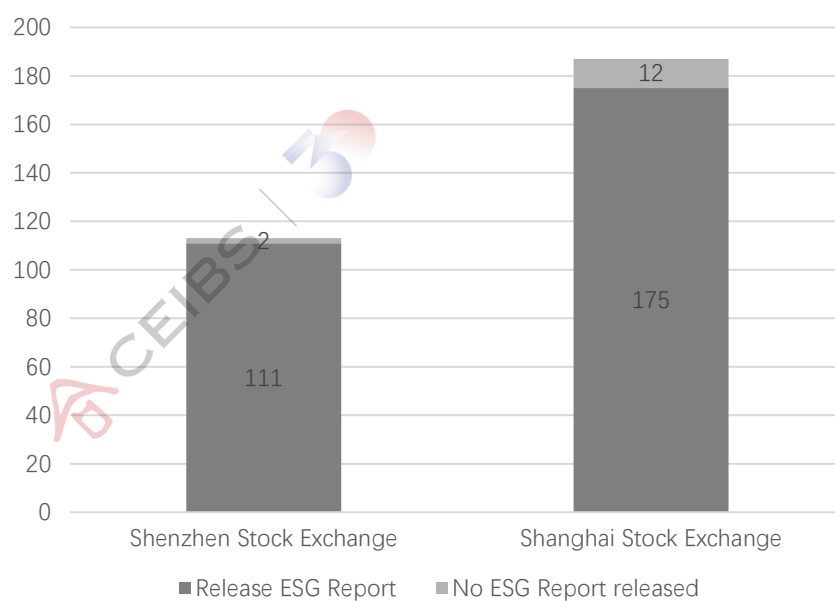


Data source: Shangdao Zongheng.

Figure 3-3 2023—2024 ESG Report Publication Rate by Industry for A-share Listed Companies

3. ESG Disclosure for CSI300 Constituent Companies

As of June 10, 2024, a total of 286 companies in the CSI 300 Index have published ESG reports, accounting for 95.3% of the index. Among these, 111 companies are listed on the Shenzhen Stock Exchange, while 175 are listed on the Shanghai Stock Exchange.



Data source: Shangdao Zongheng.

Figure 3-4 2024 Number of ESG Reports Published by CSI 300 Index Constituents

Section III

Current Status of ESG Asset Management Products in China

China has become the world's second-largest asset management market. By the end of 2022, the total size of the domestic asset management market had exceeded 136 trillion yuan(RMB), accounting for one-fifth of the global market share. The main types of products in the domestic asset management industry include bank wealth management products, public funds, and private funds (including those from brokerages and insurance companies). ESG products began to emerge in 2019, and primarily evolved from prior social responsibility initiatives.

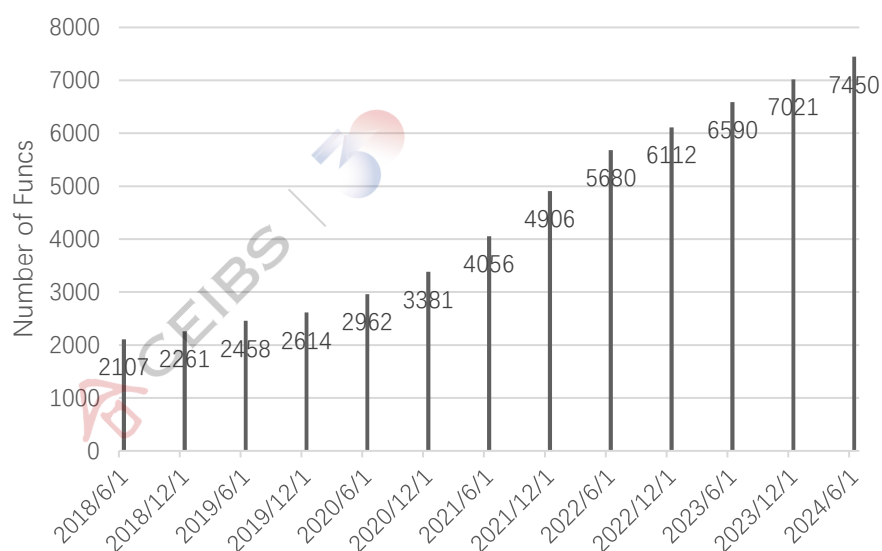
Up to mid-2024, domestic ESG-related asset management products are predominantly public funds and bank wealth management products, with only a small number of primary equity private placements using the ESG label, and hardly any involvement in ESG investments by secondary private placements. Therefore, public ESG products and bank wealth management products represent the current state of ESG asset management products in China.

To understand the current status of domestic ESG asset management products, we have compiled information on the issuance and scale of public ESG products from 2018 to June 30, 2024, as well as the issuance and scale of bank wealth management ESG products.

1. Issuance and Scale of Public ESG Products

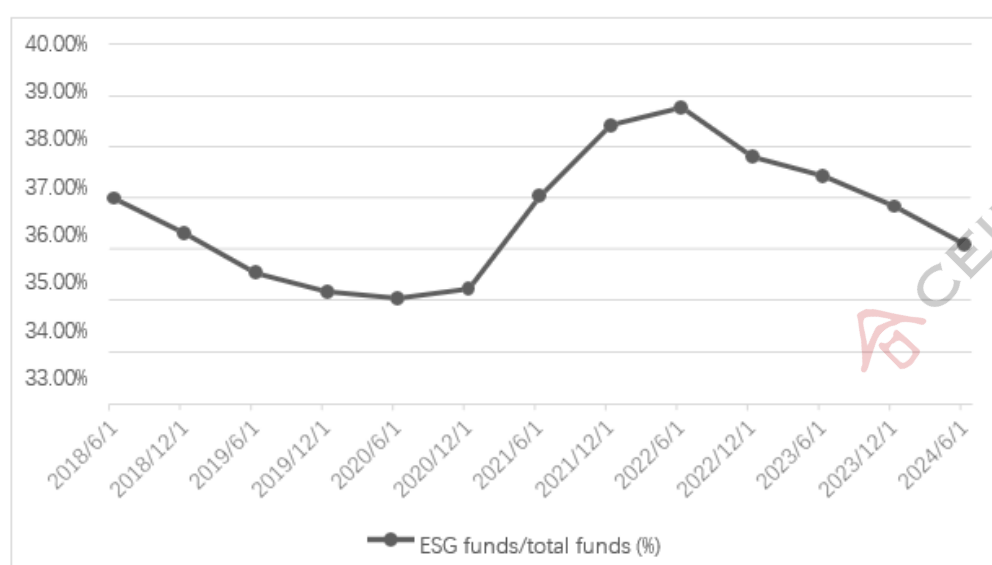
In terms of the number of products issued, both ESG and non-ESG products saw a 3.6-fold increase in the number of active products by mid-2024 compared to mid-2018. From 2018 to 2024, the proportion of ESG products consistently ranged between 35% and 40% of the total market products, peaking at 38.8% in mid-2022.

In terms of active scale, the proportion of ESG public products relative to the total public products has risen from 14% in 2018 to 27% in mid-2022, before experiencing a subsequent decline.



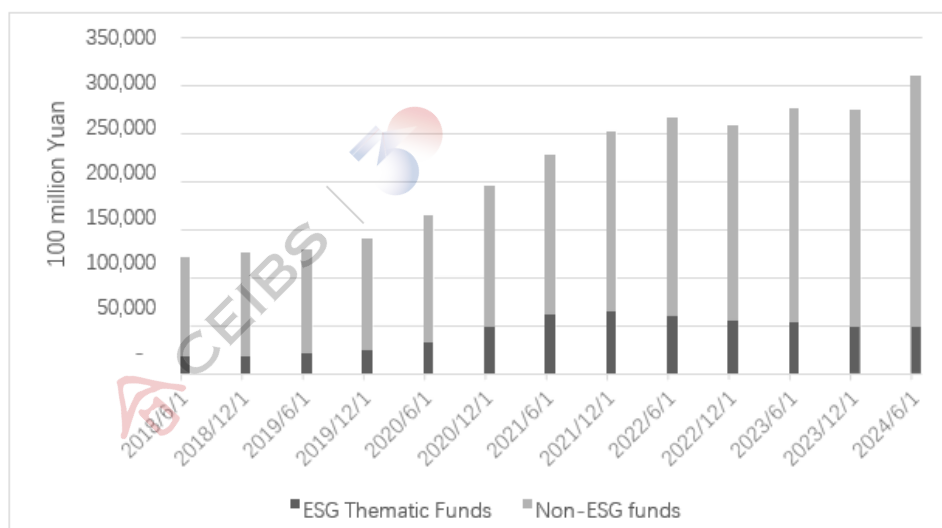
Data source: Wind.

Figure 3-5 2018—2024 H1 Number of Public ESG Funds



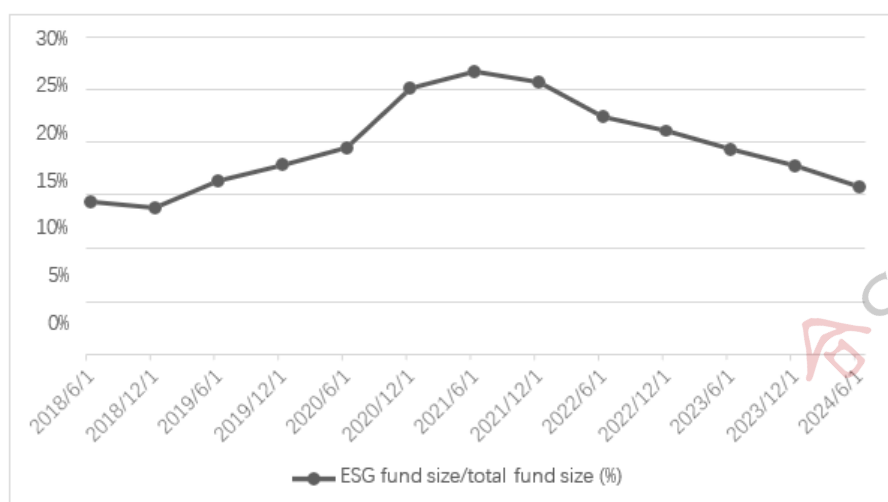
Data source: Wind.

Figure 3-6 2018—2024 H1 Percentage of Public ESG Funds in Total Public Funds



Data source: Wind.

Figure 3-7 2018—2024 H1 Active Scale of Public ESG Funds

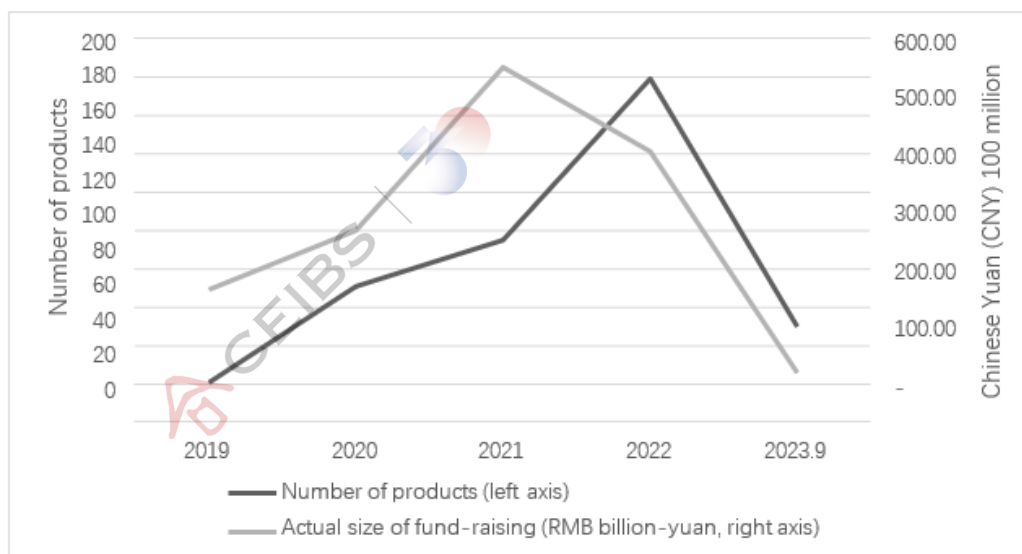


Data source: Wind.

Figure 3-8 2018—2024 H1 Percentage of Active Public ESG Funds in Total Active Public Funds

2. Issuance and Scale of Bank Asset Management ESG Products

Data from the PYStandard Database indicates that the issuance of bank wealth management ESG products has followed a similar trajectory to that of public ESG products. Between 2019 and 2021, the pace of issuance accelerated, with the number of newly launched ESG products and the actual fundraising scale reaching their peaks in 2021 and 2022, respectively, before subsequently declining.



Data source: PYSTANDARD, <https://www.pystandard.com/>

Figure 3-9 2019—2023 (first nine months) Number of Bank Wealth Management ESG Products Issued and Actual Size Raised

Section IV

Optimization of Brokerage Firms' ESG Product Screening Mechanism

We will introduce the screening mechanism for ESG products and how to analyze the effectiveness of ESG factors through a hypothetical case. It is important to note that this case primarily applies to the ESG investment needs and product screening of brokerage firms.

Consider the following scenario: An institutional client has received a task from the Board's Strategy and ESG Committee, which require the incorporation of ESG into its investment operations. The effort should ultimately be reflected in the company's annual social responsibility or ESG report. The client's investment primarily includes public funds and direct equity investments.

We will design the ESG investment strategy from two perspectives:

First, we will evaluate and screen Public Funds based on ESG dimensions. Then, we will formulate an appropriate ESG investment strategy aligned with the client's goals.

Second, we will investigate and identify effective ESG investment factors that can be utilized in the investment process.

1. Screening Public ESG Funds

Referring to Wind's classification of Fund themes, we will categorize the fund products into ESG-themed funds and non-ESG funds based on the descriptions of investment objectives, investment scope, investment strategies, decision-making basis, investment focus, investment criteria, portfolio restrictions, investment philosophy, performance benchmarks, and risk disclosures in the prospectuses.

The ESG funds scale is derived from the weighted sum of the ESG products in all portfolio stocks, disclosed in the fund's semi-annual and annual reports. Therefore, the data frequency is semi-annual.

The screening process for a basket of ESG public funds including the following steps: the identification of the ESG product optional pool, scoring and assigning performance metrics, ESG scoring, and ranking (Refer to Table 3-1 for detail).

Table 3-1 ESG Public Fund Screening Process

Screening Steps	Explanation
Optional Pool	For equity investment clients, it is recommended to select products categorized as "ESG-themed funds" and overlay the five secondary categories of equity-biased hybrid funds, flexible allocation funds, enhanced index funds, common equity funds and passive index funds as the pool of ESG public funds to choose from. Among them, note the exclusion of funds with a recently disclosed size of less than 200 million (at risk of liquidation) as well as Class C funds (to avoid duplication).
Performance Indicator Scoring + Weighting	<p>We calculate a series of fund performance metrics, and after obtaining the values of these metrics, we calculate the quartiles in the same performance interval (3 years and above/below 3 years) and the same range of benchmark values, and then expand them in the same proportion to get the metrics scoring between 0 and 10. In the case of downside capture rate, volatility control and retracement control, the original scores are subtracted from 10 to ensure that all scores are as high as possible.</p> <p>Performance metrics include: Information Ratio, Excess Return, Excess Win Rate, Upside Capture Rate, Downside Capture Rate, Annualized Volatility Control, Retracement Control, Downside Risk, Sortino Ratio, Sharpe Ratio, Jensen Ratio.</p> <p>Different weights can be assigned to different indicators, taking into account the client's investment preferences. Finally, the total score is obtained. (For example: for the characteristics of pursuing absolute return and performance stability, 15% weight can be assigned to downside capture rate score, volatility control score, retracement control score and downside risk score; 10% weight can be assigned to information ratio score, Sortino ratio score and sharpe score; and 5% weight can be assigned to excess return score, excess win rate score, upside capture rate score and Jensen score. 5% weights. The weights are totaled to 100% and the Fund's total performance score is calculated.)</p>
ESG Scoring	Refer to the ESG database for the fund's ESG score.
Assign Weights to Performance and Total ESG Scores	Adjust score assignments for ESG and total performance score based on the client's focus on ESG.
Rank by the Total Score	The final score of the fund is calculated and ranked.

As an illustration, Table 3-2 lists a basket of ESG fund recommendations screened by a customized screening mechanism over a certain period of time.

Table 3-2 Examples of ESG Fund Basket Screening

Stock Code	Investment type(secondary classification)	ESG*40%+ performance*60%	Latest ESG score	Total score
5###10.OF	Passive Index Funds	7.4	7.04	7.63
5###50.OF	Passive Index Funds	7.17	7.04	7.25
0###14.OF	Equity-biased Hybrid Funds	7.11	6.57	7.48
9###24.OF	Equity-biased Hybrid Funds	7.08	6.69	7.34
0###48.OF	General Equity Funds	6.83	7.46	6.4
0###23.OF	Equity-biased Hybrid Funds	6.77	7.33	6.4
0###52.OF	General Equity Funds	6.76	6.81	6.73
0###26.OF	Equity-biased Hybrid Funds	6.7	6.8	6.64
0###83.OF	Equity-biased Hybrid Funds	6.43	7.16	5.95
0###28.OF	Equity-biased Hybrid Funds	6.42	6.68	6.25

Data Source: Wind, calculated by authors and desensitized.

2. Finding Effective ESG Factors

We use the CSI 300 Index as a benchmark to validate the effectiveness of ESG factors. We observe that the Alpha of ESG factors is primarily presented from July 2021 to the present, with no significant Alpha observed between 2018 and July 2021. Regarding the generation of Alpha, we have the following three hypotheses:

- 1) Changes in Actual Holding Styles ;
- 2) Prominent Alpha Contributions from Specific E/S/G Dimensions;

Net Inflows of ESG-Themed Funds Driven by Policy Guidance.

Based on the above conjecture, after further validation of all three aspects it is found that policy orientation better explains the source of alpha of the ESG factor in recent years.

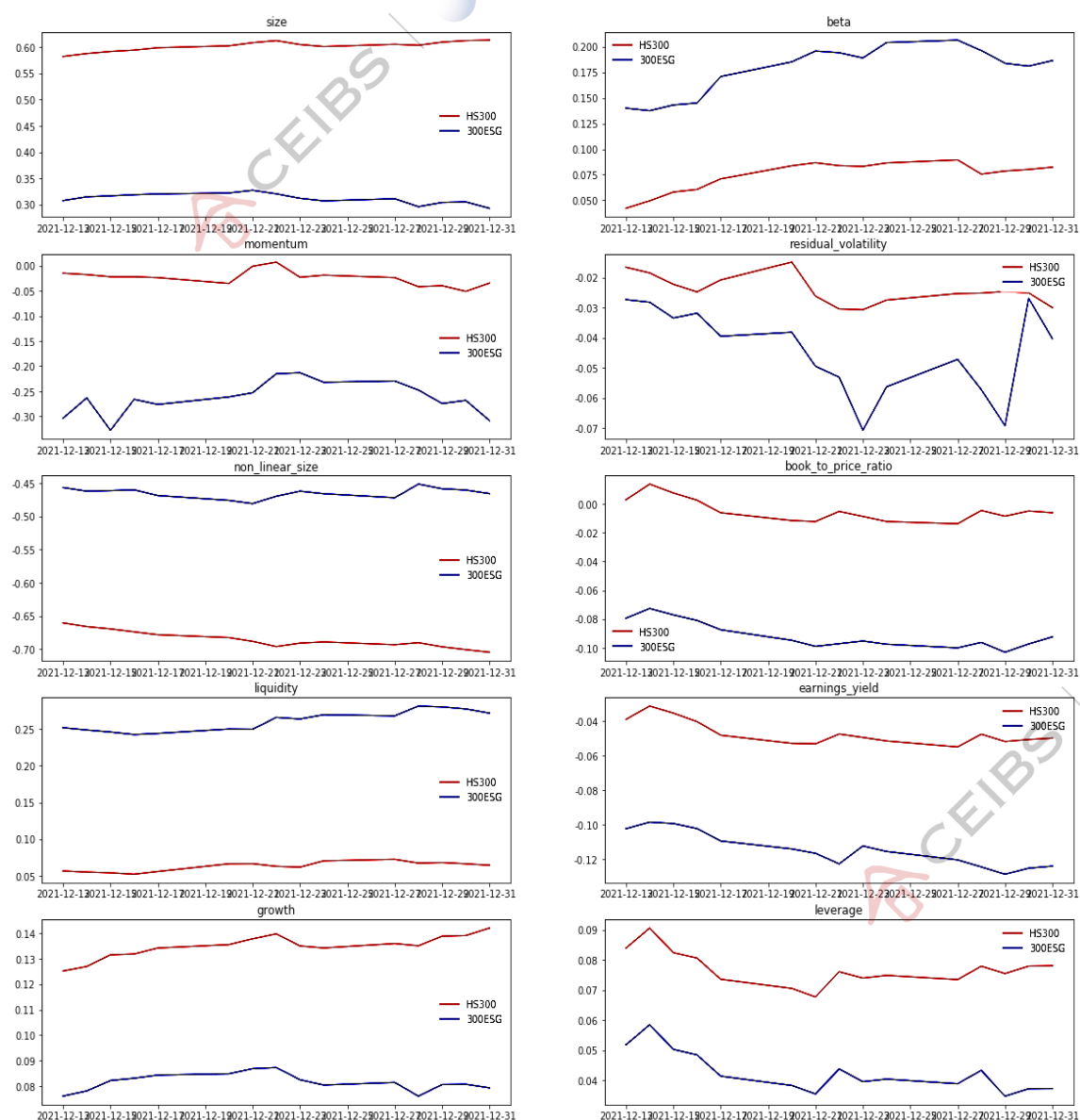
2.1 Multi-factor Analysis of Holding Styles

The backtesting results reveal that the ESG factor combination has maintained a stable Alpha since August 2021. We attempt to analyze whether the transition from ineffective to effective factors is attributable to changes in holding styles. By conducting a quantitative analysis of the holdings for each period, we examine the exposure to various risk factors, including market capitalization, momentum, nonlinear market capitalization, liquidity, growth, market risk, volatility residuals, and several fundamental indicators (a total of 10 factors), on a semi-annual basis.

Using the CSI 300 as a comparative benchmark, we find that most factor styles remain stable. Factors such as market capitalization, momentum, liquidity, and market risk demonstrate consistent stability, while a few factors exhibit cyclical variations, such as volatility residuals and earnings yield. However, these cyclical changes have a relatively minor impact on the overall performance of the portfolio.

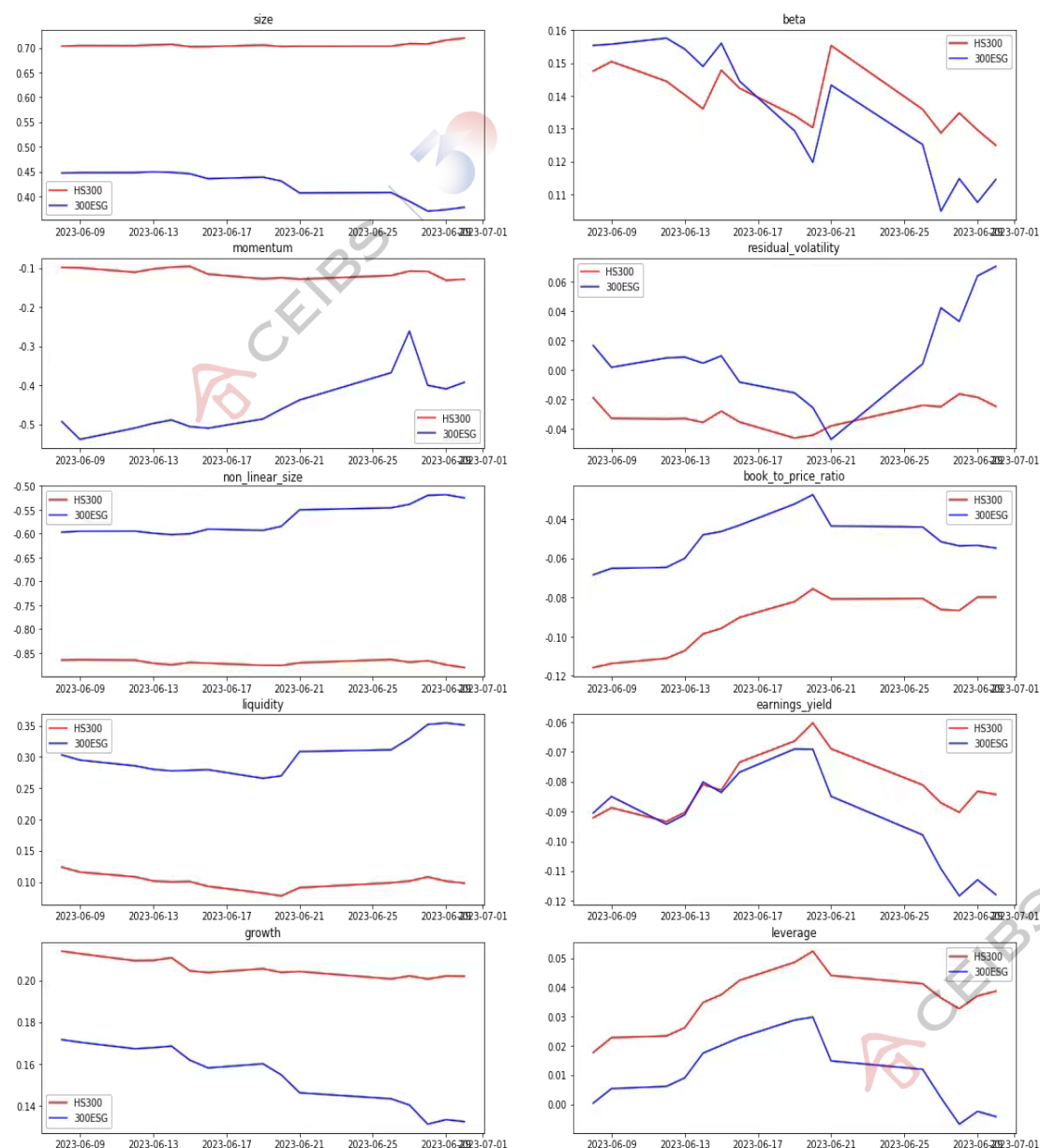
We selected factor analyses at three time points for demonstration: July 2021 (before the

Alpha transition), June 2023 (the endpoint of the strategy backtesting data), and July 2024 (recent holding signals). The conclusion drawn from this analysis is that the changes in the effectiveness of ESG factors are not attributable to variations in exposure to the primary risk factors of the holdings.



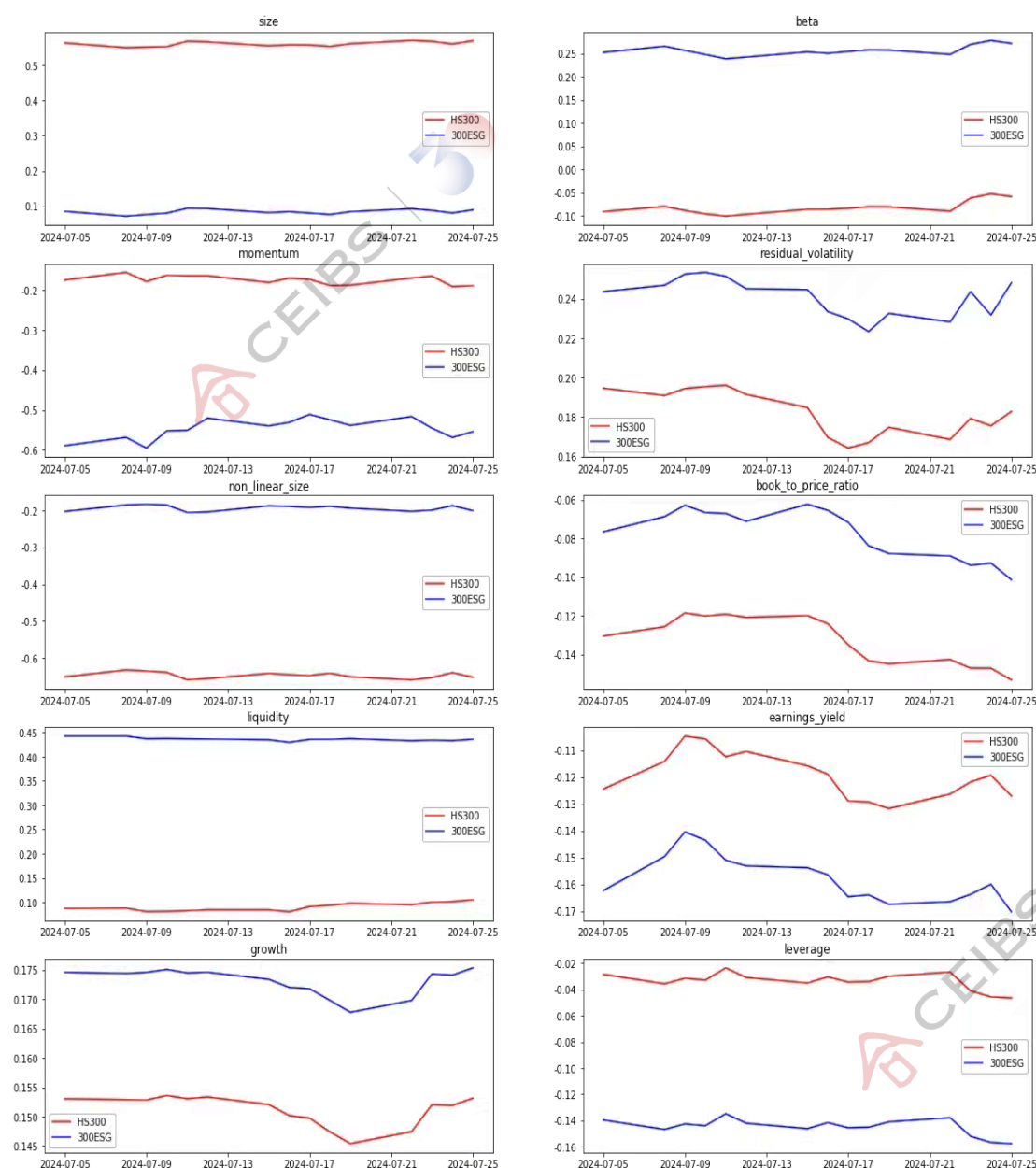
Data source: Wind, Calculated by authors.

Figure 3-10 Multi-factor analysis of holding styles, July 2021



Data source: Wind, Calculated by authors.

Figure 3-11 Multi-factor analysis of holding styles, June 2023



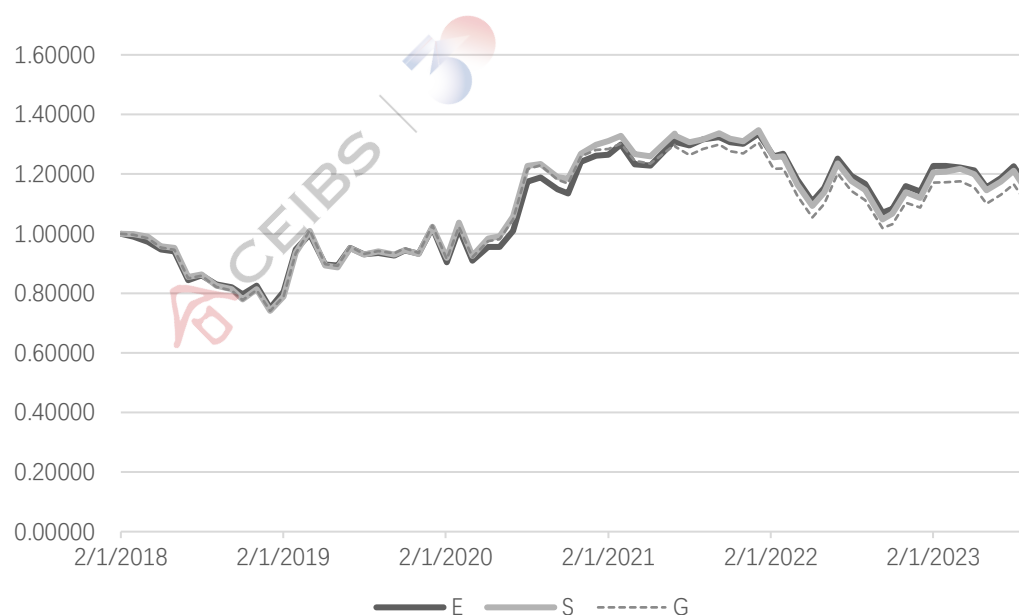
Data source: Wind, Calculated by authors.

Figure 3-12 Multi-factor analysis of holding styles, July 2024

2.2 Prominent Alpha Contribution from Specific E/S/G Dimensions

To test the Alpha contribution of each individual E/S/G dimension, we re-weighted the portfolio using the ESG sub-scores and backtested the portfolio's performance. It was observed that the performance correlations among the three sub-factors are extremely high, and their contributions to the portfolio's returns are essentially consistent. Within the range of stocks selected from the CSI 300 Index, there are no significant differences observed between the separated E/S/G dimensions and ESG as a whole. Additionally, we noted that these companies maintain a high level of consistency across the three dimensions of E/S/G, which may suggest that companies that prioritize overall ESG performance also tend to emphasize each of the three

dimensions equally.



Data source: Wind, Calculated by authors.

Figure 3-13 Portfolio Performance After Reweighting with E/S/G Scores

2.3 Net Inflows of ESG-Themed Funds Driven by Policy Guidance

During our data collection process, we identified an important rhythm in the release of ESG indices that may influence the inflow of capital into ESG-themed investments. The CSI 300 ESG Total Return Index was launched in July 2021, and after its release, several public funds introduced ETFs that were linked to this index. We analyze that the source of Alpha is likely driven by policy-induced index releases, which attract sustained and comparatively stronger capital inflows into such styles of investments compared to the broader market.