Income-based carbon emissions of Chinese listed banks

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Financial institutions not only contribute to carbon emissions through their own business activities but, more importantly, play a crucial role in the transition to a green economy by directing capital flows through their investment and financing activities. Accurately measuring the financed carbon emissions of financial institutions helps assess their impact on climate change and provides valuable insights to guide them toward green investment and sustainable finance.
In the field of carbon emission accounting, there are three parallel principles for allocating carbon responsibility: production-based carbon emissions, consumption-based carbon emissions, and income-based carbon emissions. Among these: production-based carbon emissions of financial institutions are minimal since financial activities do not involve on-site fossil fuel combustion. Consumption-based carbon emissions focus on final products and consumer-side mitigation strategies, such as green consumption, which have limited relevance to financial institutions. Income-based carbon emissions focus on the enabled downstream carbon emissions of financial institutions, considering them as providers of primary inputs to economic activities. From the above description, income-based carbon emissions are the most relevant for financial institutions because financial institutions indirectly shape the carbon footprint of the industries and projects they fund, making income-based carbon accounting the most appropriate approach to capture their true impact on emissions.
The income-based carbon emissions of financial institutions have attracted widespread attention. Many organizations currently provide methodological guidance for financial institutions to account for carbon emissions. For example, the Partnership for Carbon Accounting Financials (PCAF) has set up separate calculation methods for carbon emissions associated with six different asset classes in 2022. In 2023, the European Central Bank (ECB) released Towards Climate-Related Statistical Indicators, which primarily measures financial institutions' carbon emissions by combining portfolio holdings with corporate emissions or assessing portfolio transition risk. Although current carbon emission measurement methodologies for financial institutions incorporate a life-cycle perspective by attributing the emissions of financed entities to the institutions themselves, they typically stop at primary financing targets, failing to capture these cross-value chain emission transmission effects. Take oilfield exploration financing as an example: while the direct carbon intensity of the exploration phase is relatively low, successful exploration triggers emissions across the entire oil extraction-refining-consumption industrial chain.
While the Leontief inverse, as a demand-driven model, is widely used to analyze complete consumption-based carbon emissions, the Ghosh inverse, as a supply-driven model, is ideally suited for analyzing complete income-based carbon emissions. In the literature, some scholars have already defined and analyzed income-based carbon emissions at the national level using the Ghosh model (Lenzen & Murray, 2010; Marques et al., 2012). In this study, we propose a Ghosh model-based input-output framework to analyze the income-based carbon emissions of financial institutions, filling the gap in existing research and providing a whole perspective on the role of finance in climate change.
As the worldâ€™s largest carbon dioxide emitter, China pledged in 2020 to peak its carbon emissions before 2030 and achieve carbon neutrality before 2060. Given the central role of banks in financial intermediation and capital allocation, this study measures the income-based carbon emissions of 42 A-share listed banks in China from 2010 to 2022. The Ghosh model and Hypothetical Extraction Method (HEM) are applied, and the data are from annual report of banks, the CSMAR and EXIOBASE databases. Additionally, we conduct structural path analysis to reveal the key financed carbon emission paths of each bank. The main findings are as follows. First, from

2010 to 2022, income-based carbon emissions from Chinese listed banks, including those embedded in their loan portfolios, have shown an overall upward trend. Large state-owned banks account for more than 60% of these emissions, highlighting their continued capital allocation to high-carbon industries. Second, while the carbon emission intensity of bank loans has generally declined, large state-owned banks exhibit significantly higher emission intensity than other types of banks, with the slowest rate of decline. Third, the study reveals that carbon emissions from further-tier financingâ€”previously overlooked in past researchâ€”are 2 to 10 times larger than those from tier 1 financing, which has been the primary focus of previous studies or accounting standards. This finding underscores the critical importance of tracing the complete financial chains of financi