Proactive Risk Management of Climate Change Youth Forum Research Result 4

Analysis of Stress Testing Methods for Climate Transition Risks

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How to effectively control climate risks is a major challenge commercial banks will face in their future operation, as environment and climate risks draw high attention since 2020 when Chinese President Xi Jinping put forth the goal to peak emissions before 2030 and achieve carbon neutrality by 2060 ("dual carbon goal"). As a forward-looking risk management tool, stress testing provides a powerful approach for regulators and financial institutions in different countries to assess climate risks. By conducting climate risk stressing tests, banks could assess the risk profiles of carbon-intensive enterprises, better support the development of green finance, and promote the realization of the dual carbon goal with financial strength.

Climate risks can be divided into two categories: transition risks and physical risks. Transition risks mainly result from human factors such as policies and technologies, whereas physical risks mainly refer to natural disasters and events. In practice, major regulators and financial institutions currently focus on testing transition risks. In recent years, CCB has provocatively carried out climate risk stress tests. Relying on a group of backbone professionals, it used a set of self-developed methodologies to conduct quantitative calculations on carbon-intensive industries such as thermal power, iron and steel, cement, and aviation. In this paper, we will introduce the transition risk stress test methodologies used by CCB and put forward some policy recommendations to further improve the stress testing system.

I. Environmental and climate risk stress tests carried out by CCB

As per the *Guidelines on Stress Testing of Commercial Banks,* stress testing is a type of banking risk management and supervisory analysis tool. It is used to analyze the impact of an assumed, extreme but possible adverse scenario on a bank's overall or asset portfolio, and therefore assess its negative impact on the bank's asset quality, profitability, capital level, liquidity, etc. From academic and industry practices, climate risks, as a new risk type, can be quantitatively assessed through stress testing methods so that banks are able to analyze the risks to which they may be exposed in the future.

CCB is one of the first commercial banks to conduct environmental and climate risk stress tests. From the perspective of air pollution, it in 2019 carried out the environmental risk stress test for the chemical industry to analyze the impact of the raised environmental standards on enterprises. In 2020, based on carbon emissions trading, it conducted climate risk stress tests on the thermal power industry to examine the risk exposure facing thermal power enterprises in the scenarios of different carbon prices (CO2 emission allowance prices). In 2021, the Bank further expanded the scope of testing by including the iron and steel, cement, and aviation industries.

II. Carbon trading-based climate risk stress tests

The European Union (EU) is one of the world's first economies that started carbon trading. It controls CO2 emissions in the region by means of aggregate management. In the early stage of carbon trading, carbon allowances were issued by the government for free. If the actual emissions exceeded its allowances, an enterprise was required to purchase additional allowances in the carbon trading market. The resulting financial pressure would push companies through the low-carbon transition. As technology develops and the market matures, the number of free carbon allowances gradually decreases. Ultimately, it will be replaced by an auction system where all carbon allowances are purchased and paid by enterprises on their own.

i. Basic ideas

At present, CCB's climate risk stress tests are mostly carried out under the carbon trading mode through a bottom-up approach. Specifically, by calculating the carbon emissions of enterprises, the Bank can set the carbon prices and the proportions of free allowances, and measure the costs enterprises have to pay for purchasing additional allowances. The cost increase will lead to changes in relevant financial indicators, such as the elevated probability of default and growing expected losses. On this basis, the Bank could finally calculate the non-performing loan ratio and capital adequacy ratio.

ii. Scenario design

Reasonable scenario assumptions are the key to stress testing, because they can directly affect the measurement results. For the climate risk stress tests based on carbon trading, scenario elements mainly include carbon price and proportion of free allowances, etc. Scenario design can adopt the historic simulation approach/expert judgment approach or a combination of both. For example, when deciding carbon prices, we may refer to the

carbon prices in the Chinese region where carbon trading has been introduced on a pilot basis, the historical carbon prices in the EU, or the future carbon prices of China predicted by external agencies. The proportion of free allowances can be determined by referring to the allowance allocation scheme prevailing in the regions that have engaged in carbon trading on a pilot basis.

iii. Carbon emissions of enterprises

Comprehensive and accurate carbon emission data of enterprises is the foundation of climate risk stress tests. At present, listed companies make relatively comprehensive information disclosure, so that carbon emission data can be gathered from their annual reports or corporate social responsibility (CSR) reports. In comparison, non-listed companies disclose less carbon emission data. They generally measure emissions in accordance with the *Greenhouse Gas Emissions Accounting Methodology and Reporting Guidelines*. The measurement process involves a large amount of non-financial data and professional technical parameters, which need to be screened and collected by account managers on a case-by-case basis.

iv. Risk transmission path

At the core of climate risk stress testing is a realistic risk transmission path, through which the probability of default on the corporate front as well as the non-performing loan rate and capital adequacy ratio on the bank side will be obtained. In the scenario of carbon trading, specific pressure elements such as carbon price and proportion of free allowances are transmitted to the financial indicators of an enterprise through the risk transmission path, so that a bank can obtain the balance sheet and income statement of the enterprise under the pressure through relevant rules and models, and then assess the probability of default of the enterprise under the pressure using its internal model. In this process, the formulation of rules for changes in financial indicators of enterprises is particularly critical, which requires comprehensively considering various factors such as accounting standards, production and operation modes of enterprises, and internal models of banks as well as pooling together the wisdom of experts in various fields of risk measurement, credit management, credit approval, corporate banking, etc.

III. Work recommendations for the next step

i. Establish an environmental and climate risk management system at an accelerated pace. Environmental and climate risk management is a branch of science

involving many disciplines such as environment and meteorology, chemistry, physics, economics, and finance. So it is very challenging to conduct stress tests on environmental and climate risks. To effectively control such risks, commercial banks urgently need to bolster up their shortcomings in environmental and climate areas. At present, major commercial banks generally rely on external expertise and advanced technologies/methods to improve their stress testing capabilities and build their own environmental and climate risk management systems. It is recommended that, in addition to holistic arrangements, CCB should also introduce external resources given its business reality to make up for its shortcomings in the relevant fields at a faster pace, build its environmental and climate risk management system, and ensure its risk management capability can keep leading the industry, thus laying a solid foundation for preventing and resolving material risks.

ii. Move faster to lay a solid data foundation for environmental and climate-related risk management. In addition to financial data, climate risk stress tests also require using a large amount of non-financial data, such as carbon emissions and product output of enterprises. At this stage where the national carbon trading market has just started to operate in China, except for a small number of pilot enterprises and listed companies, most enterprises have neither carried out carbon accounting nor disclosed carbon-related data. Furthermore, many of their production data and technical parameters are not open to the public. This situation makes it difficult for banks to assess environmental and climate risks, when carrying out green finance business. It is hence recommended that CCB should actively cooperate with government departments and external agencies, improve the data collection system, and introduce data of enterprises such as carbon emissions and product output into its internal system. All of these steps will lay a solid data foundation for the environmental and climate risk management across the Bank.

iii. Expedite the training of environmental and climate risk control professionals. The State Council recently issued the *Action Plan for Carbon Dioxide Peaking before 2030*, which proposed cementing international cooperation in green finance and actively participating in the international efforts to establish carbon pricing mechanisms and green finance standards. As an emerging field, environmental and climate risk management is so specialized that CCB urgently needs to raise the awareness of environmental and climate risks among all employees and to train a professional workforce in the field of risk identification, measurement, and monitoring. The Bank is

also advised to strengthen general training for all employees and enhance the awareness of environmental and climate risks at all levels of the organizational structure. For specific personnel such as those engaged in risk measurement, it is recommended that special training be conducted jointly with universities to enhance the level of professional competence.