



# "Green into Gold": The Sustainable Development of Commercial Banks from the Perspective of the Equator Principles

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**Abstract:** The Equator Principle is the goal of promoting the harmonious development of my country's economy and society. It promotes the green transformation and upgrading of the industrial structure by strictly controlling the flow of commercial bank funds, so as to achieve the goal of environmental protection and the coordinated development of the national economy. This paper uses factor analysis to reduce the dimensions of 10 financial indicators and non-financial indicators that measure the operating performance and development potential of joint-stock commercial banks, and then compares the comprehensive operating performance, liquidity, and safety of Industrial Bank and comparable banks. And the level of profitability, analyze the difference in comprehensive operating performance of joint-stock commercial banks joining the Equator Principles compared with commercial banks that have not joined the Equator Principles. The results of the study found that joining the Equator Principles of joint-stock commercial banks can improve comprehensive operating performance in the short term. In the long run, the development trend of Industrial Bank will be similar to that of comparable banks in the same category. Joining the Equator Principles of Industrial Bank can improve its liquidity and profitability, but it will not in the long run. Conducive to the improvement of the asset quality of joint-stock commercial banks. In this regard, the government, enterprises and financial institutions should work together to help commercial banks achieve an effective balance between operating performance and social responsibility, so as to achieve the goals of "carbon peak" and "carbon neutral".

**Keywords:** Carbon Neutral, Equator Principle, Industrial Bank, "Three Principles", Factor Analysis

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## 1. Introduction

In recent years, the contradiction between economic growth and environmental protection and sustainable social development has become increasingly prominent. This has brought huge challenges to achieving carbon peaks by 2030 and achieving carbon neutrality by 2060. The "Equator Principles" are in progress. International financial industry standards for judging, reviewing, and evaluating the environmental and social risks that they may encounter in project financing activities. Advocate that financial institutions perform green and sustainable prudential verification in project financing activities of more than US\$10 million, so as to promote the sustainable development of environmental protection, ecology and society.

According to the official website of the Equator Principles,

as of December 2020, 105 financial institutions from 38 countries have adopted the Equator Principles, but as of February 2021, there are only Industrial Bank, Bank of Jiangsu, Bank of Huzhou, and Chongqing Agricultural Bank of China. Commercial Bank, Mianyang City Commercial Bank, Guiyang Bank and Chongqing Bank are seven commercial banks that have joined the Equator Principles. Among them, the Industrial Bank joined the Equator Principles in 2008. As the first bank in my country to join the Equator Principles, the Industrial Bank is also known as the "Equator Bank" and has created many "China's No. 1 Banks" in the construction of sustainable development banks. "For example, the first bank to issue mortgage loans for pollution rights, the first bank to launch energy efficiency financing

products, the first bank to design and develop green credit project loans, and the first green financial management department to become a domestic bank, one of the banks that launched the first ESG wealth management product. In addition, it has won several awards for social responsibility and green financial institutions [1].

From the beginning of its establishment, Industrial Bank borrowed foreign advanced management experience and combined its own actual conditions. After more than ten years of practical experience, it gradually explored a complete operating mechanism and risk management system, which became a domestic fulfillment of social responsibility and construction of a sustainable green ecology. A model commercial bank for banks. Based on the outstanding achievements of Industrial Bank in the field of green finance in China and the typicality of cases, this article uses Industrial Bank as an example to design relevant financial performance and non-financial performance indicators to explore the joint-stock commercial banks joining the Equator Principles versus the joint-stock commercial banks that did not join the Equator Principles. For banks, the difference in comprehensive operating performance is expected to provide experience and reference for commercial banks that have joined the Equator Principles and are still waiting and see, and help Chinese commercial banks to effectively balance economic and social benefits, so as to achieve the goal of building a beautiful China.

## 2. Literature Review

Driven by the concept of sustainable development, the International Finance Corporation, ABN AMRO Bank, Barclays Bank, etc. held an international conference on environmental protection and sustainable development in London in 2002. After the conference, the participating banks discussed the environmental issues raised by the conference. A series of unified implementation guidelines were formulated, and then the internationally accepted Equator Principles were formed. After decades of continuous exploration and practice, the Equator Principles have gradually become the golden criteria in the evaluation of green financing projects [2]. Since the first revision of the Equator Principles in 2003, the Equator Principles have been continuously improved in line with the needs of international environmental changes. With global climate change, global human rights and social issues have become increasingly prominent, as of the end of 2019, the Equator Principles have been updated to Fourth edition [3]. The Equator Principle is different from green credit. The former is an industry self-discipline and a soft constraint of moral responsibility, while green credit is a legal guideline and is legally binding [4]. Since the Equator Principles have the attribute of social welfare, it is necessary to continuously evaluate the influence of the Equator Principles on financial institutions, in order to examine the applicability of the Equator Principles' soft moral constraints. After decades of practice and research, the Equator Principles have

continuously improved the business performance evaluation methods of commercial banks. The design of indicators has expanded from a single dimension to multiple dimensions. The impact of the adoption of the Equator Principles on its business performance may appear in the short and long term. Both positive and negative effects.

At present, scholars have explored the impact of adopting the Equator Principles on the comprehensive operating performance of commercial banks from a qualitative and quantitative perspective. Some scholars have analyzed the impact of Industrial Bank's accession to the Equator Principles on financial performance indicators from a qualitative perspective. Xie Weijie analyzed The financial performance indicators of Industrial Bank's total assets, non-performing loan rate, net profit and other financial performance indicators can get the performance brought by Industrial Bank's carbon finance business [1]. Chen Qi analyzed the financial performance indicators of Industrial Bank and comparable commercial banks such as net profit, net profit growth rate, non-performing loan rate and other financial performance indicators. The ranking situation was analyzed by descriptive statistics [5]. Du Chaoyun used the event research method to measure the market response to the Equator Principle, and measured the industry average by the cumulative average excess return (CAAR) of the four banks of China Merchants Bank, China Minsheng Bank, Huaxia Bank, and Shanghai Pudong Development Bank. Market reaction, studies the market effect of a series of events of the Equator Principle on the subject of the event and other banks of the same kind [6]. More scholars have established indicator systems and mathematical models to conduct empirical analysis from a quantitative perspective. The most beginners use single financial performance indicators such as ROA and ROE for measurement. Xu Feng uses synthetic control methods to study the effect of the Equator Principle on the performance of commercial banks. The impact characteristics of the level, analyze the ROA change path of the synthetic Industrial Bank and the real Industrial Bank, and use the double difference model to test the empirical results [7]. As the business philosophy of commercial banks continues to improve, and performance indicators are expanded to non-financial performance indicators such as management level, Hua Wencang and others adopted a camel evaluation indicator system to select capital adequacy, asset quality, management level, profitability and assets. It uses principal component analysis to analyze the financial performance of Industrial Bank after joining the Equator Principles, and compares and analyzes with comparable commercial banks of the same kind [8].

Regarding the negative effect of the Equator Principles on the operating performance of commercial banks, there is a cost. He Dan has found through research that commercial banks that adopt the Equator Principles in practice have due to the pre-project evaluation and supervision process in the process of project evaluation. It is more complicated, which virtually

increases the credit cost of commercial banks [3]. In addition, financial institutions generally have "greening" behaviors, and they have not achieved green benefits in the actual sense. They only use the Equator Principles as a tool to enhance their reputation. Some scholars also use empirical models to prove that the Equator Principles have a certain negative impact on commercial banks. Xu Feng found that the Equator Principles can improve the operating performance of commercial banks in the short term, while the long-term cost effect is greater than the benefits and will reduce operating performance [7]. Ning Wei and She Jinhua argued that the implementation of the Equator Principles by Chinese commercial banks has not only failed to promote the growth of the national economy, but has hindered my country's macroeconomic growth to a certain extent [9].

Studies have also shown that the Equator Principles have a positive effect on the environment, society and the operating performance of commercial banks. Chen Qi analyzed the financial performance of Industrial Bank and found that joining the Equator Principles by commercial banks is beneficial to both social and economic benefits [5]. First of all, the projects that meet the green credit are reviewed and supervised by the evaluation standards, which are undoubtedly beneficial to environmental protection and sustainable development, and have positive social benefits. Secondly, Du Chaoyun believes that the implementation of the Equator Principles can bring good reputation and social market value to commercial banks, and that commercial banks' participation in the Equator Principles to fulfill their social responsibilities will bring reputation spillover effects to enterprises and promote the improvement of their operating performance and the market. The increase in value improves the market competitiveness of financial institutions to a certain extent [6]. In addition, the Equator Principles can also improve the financial performance of commercial banks. Xie Weijie analyzes the financial report of Industrial Bank and believes that commercial banks' joining the Equator Principles can expand the scale of assets, reduce the rate of non-performing loans, improve asset quality, and ultimately improve long-term operating performance and its economic benefits [10]. As for the impact on the liquidity of commercial banks, Some authors believes that financial institutions that adopt the Equator Principles need more liquidity buffers to deal with uncertainty risks due to the impact of relevant policies and regulations. Many studies at this stage believe that this positive effect of green credit on commercial banks will take a long time to be reflected. Hua Wencang selects indicators based on the "camel rating" system and uses factor analysis to analyze the joining of commercial banks, the influence of the Equator Principles on its operating performance. The results of the study found that Industrial Bank's joining of the Equator Principles has an adverse effect on its financial status in the short term. However, in the long run, the Financial Performance of Industrial Bank is better than comparable commercial banks in the same category [8].

Through literature analysis, it is found that the research on the Equator Principles of commercial banks abroad is

relatively complete. The number of commercial banks that have joined the Equator Principles in my country is small, short, and inexperienced. At present, most of the domestic literature explores the effect of commercial banks' green credit business on operating performance. As a result, by establishing an empirical model to quantitatively compare and analyze the differences in the comprehensive operating performance of commercial banks that have joined the Equator Principles compared to commercial banks that have not joined the Equator Principles, there is less literature, which leaves room for in-depth research in this article. In this regard, this article uses the 2007-2019 data of Industrial Bank and comparable banks to establish an indicator system reflecting the comprehensive operating performance of commercial banks based on the "three characteristics" principle, and uses factor analysis to quantitatively analyze the adoption of the Equator Principle by commercial banks and comparable banks of the same kind. In contrast, its dynamic effects in the long-term and short-term comprehensive operating performance are expected to be the continuous improvement of the implementation of the Equator Principles in my country, and to provide experience and reference for commercial banks that are still waiting to join the Equator Principles.

### 3. Theories and Research Hypotheses

#### 3.1. Profitability of Commercial Banks

The core essence of green finance is to transfer resources from the high-pollution, high-energy consumption, and low-efficiency "two highs and one low" industries to environment-friendly, resource-saving enterprises. In our country, this core principle also strengthens the construction of ecological civilization, promotes the construction of a beautiful China, and contributes to the socialist cause of our country. As a public product with positive social externalities, green credit has cost effects, crowding-out effects, and encroachment effects with the bank's operating performance. At the same time, there are potential social benefits brought by reputation effects. In general, the adoption of the Equator Principles by commercial banks has positive and negative effects on their operating performance [13].

On the one hand, the main measures for commercial banks to implement green credit business are to give preferential interest rate policies to such enterprises and issue low-interest loans to environmentally friendly and resource-saving enterprises, thereby lowering the financing threshold. However, such companies usually have a long construction period, high risks, and low returns, which reduce the net interest income of commercial banks; and banks need to conduct environmental ratings on corporate projects. In the entire green finance business process, the Industrial Bank strictly reviews the pre-marketing, risk level, and loan review of each loan in strict accordance with the approval standards, so the entire process of project development requires additional evaluation costs and supervision costs, as well as Opportunity costs of investing limited resources in other

high-return industries. It is more expensive for commercial banks to adopt the Equator Principles, so commercial banks often fail to make ends meet when issuing green credits, leading to an increase in the cost-to-income ratio.

On the other hand, the management level of commercial banks that adopt the Equator Principles is better than that of ordinary commercial banks, and loan projects have higher CSR ratings. The adoption of the Equator Principles has improved their business image to a certain extent, thereby attracting depositors. In addition, the amount of non-credit financing generated by the Industrial Bank's joining the Equator Principles has become a new profit growth point for green finance projects, and the corresponding profitability is higher, which brings higher net interest income. Furthermore, with the country's encouragement and support for the construction of ecological civilization, companies engaged in corporate social responsibility also have a higher social reputation. The employees of the company are willing to accept lower wages, and consumers are more supportive or trusting in green and low-carbon. To pay higher prices for products produced by companies with corporate social responsibility and increase the earnings per share of commercial banks, so that banks can increase their return on equity.

H<sub>1</sub>: The impact of adopting the Equator Principle on the profitability of commercial banks depends on its cost and benefit effects;

### 3.2. *Safety of Commercial Banks*

The security of commercial banks mainly includes indicators such as asset quality, capital adequacy and provision coverage, reflecting the ability of commercial banks to deal with uncertain risks. Commercial banks must control the proportion of risky assets, reduce the rate of non-performing loans, hold a certain proportion of assets with higher safety performance, ensure capital adequacy, maintain loan loss reserve ratio, improve risk management and control capabilities, and ensure the steady operation of commercial banks. So as to promote the development of national green ecology to a certain extent and build a beautiful China [14].

The implementation process of green credit is through differential pricing between environmentally friendly enterprises and "two highs and one low" enterprises, so that resources flow from enterprises with high pollution and high energy consumption to enterprises with low pollution and low energy consumption, but the characteristics of environmentally friendly enterprises That is, the construction period is long, the income is low, and the liquidity is weak. It even requires government policy subsidies and bank preferential credit policy support. During the long period of project operation, stable cash flow cannot be formed, which affects the recovery of green credit assets. As my country's Equator Principles are still in the early stages of implementation, the project's evaluation and supervision mechanism is not perfect. In order to obtain financing preferential policies, some companies generally have "greening" and "fake green" behaviors of projects, and the

direction of project operation may be violated. The requirements of the Equator Principles have brought environmental risks to the project, leading to forced termination of project operations and even corporate bankruptcy, resulting in an increase in the rate of non-performing loans of commercial banks, which ultimately manifests in the deterioration of the quality of bank's green credit assets, which in turn adds to the construction of Beautiful China. "Big burden", "pull the hind legs".

H<sub>2</sub>: The Equator Principles have a negative impact on the asset quality of commercial banks;

### 3.3. *Liquidity of Commercial Banks*

Liquidity is very important to commercial banks, because having sufficient liquidity levels can enable commercial banks to withstand future risks, thereby helping to ensure the steady operation of commercial banks. Although the level of liquidity is very important to commercial banks, the liquidity risk of banks needs to be paid more attention to at each stage of commercial bank operations. In order to ensure that commercial banks always maintain the ability to withstand risks, it is necessary for us to study the current assets and loan-to-deposit ratios of commercial banks.

According to the relevant provisions of the Equator Principles, commercial banks that have joined the Equator Principles will supervise and manage the social and environmental liability risks associated with project financing. Therefore, commercial banks that have joined the Equator Principles should bear public or civil liabilities. The increase in liability risks forces commercial banks that adopt the Equator Principles to have more liquidity to pay for any expenses related to liability. Since commercial banks adopting the Equator Principles will face more supervision costs and certain risks related to social responsibility, commercial banks should increase liquidity as a buffer to deal with the higher costs and environmental risks arising from adopting the Equator Principles, and maintain their own To a certain extent, the steady operation of the company maintains its profitability and continues to inject vitality into the construction of ecological civilization. By vigorously promoting green financial services, Industrial Bank has continuously obtained stable cash flow income and achieved a green brand effect. Therefore, it can be assumed that the adoption of the Equator Principles forces commercial banks to increase the liquidity ratio; therefore, it can be assumed that there is a positive correlation between the adoption of the Equator Principles and bank liquidity.

H<sub>3</sub>: The adoption of the Equator Principle by commercial banks is conducive to improving liquidity.

## 4. Model and Index Selection

### 4.1. *Model Introduction*

Factor analysis is a statistical method that examines the interrelationships between variables, grouping a large number of overlapping information variables according to the size of

the correlation, and reducing the dimensionality to fewer and uncorrelated feature factors. Apply factor analysis to a group of indicators to be tested to determine whether different factors can be unified into a common factor. It tries to find a simple structure of the data, combining highly correlated variables into relatively uncorrelated common factors. When performing factor analysis, it is necessary to determine the type of rotation used (orthogonal or oblique), the number of factors to be extracted, and the criteria for considering whether the factor load is meaningful, and finally a common factor that integrates all properties is obtained.

Factor analysis decomposes the input data into linear combinations of common factors and specific factors in the lower dimensional space. The common factor is essentially an unobserved potential abstract variable, and the specific factor is the error measurement item corresponding to the common factor. As a feature extraction method, it finds factor scores of input data in a lower-dimensional space through linear transformation. These factor scores can be regarded as the algebraic representation of the original data from which the feature values are extracted in another low-dimensional space. In this study, we use factor scores instead of raw data to predict the comprehensive operating performance of commercial banks. The factor analysis can be simply described as follows:

$X_k^*$  Normalize the original variables with zero mean and unit standard deviation, ( $k=1, 2, \dots, m$ ). The purpose of factor analysis is to find coefficients,  $a_{kj}$  ( $j=1, 2, \dots, p$ )  $p < m$  satisfies the decomposition:

$$X_k^* = \sum_{j=1}^p a_{kj} f_j + g_k$$

Among them,  $f_1 \dots f_p$  and  $g_1 \dots g_p$  are common factors and special factors, respectively. Common factors and special factors are independent. In addition, common factors are not related to each other. Assuming that each variable has  $n$  observations, the matrix form of the equation is  $X = af + g$ , where the input data  $X$  is an  $m * n$  matrix, and the factor loading matrix  $a$  is  $m * p$ , and the common factor  $f$  is a  $p * n$  matrix [15].

Perform eigenvalue decomposition on the correlation matrix of input data  $X$ , and use least square estimation to obtain factor scores. Let  $R$  be the correlation coefficient matrix, which means  $R = AA'$ . We perform eigenvalue decomposition on the positive definite matrix  $R$ , that is  $R = P \Lambda P' = (P \Lambda^{1/2})(P \Lambda^{1/2})' = AA'$ , where  $P$  is the eigenvector matrix of  $R$ , and  $\Lambda$  is the diagonal matrix composed of the eigenvalues  $f_j = A' R^{-1} x_j, j = 1, 2, \dots, P$  of  $R$ . In addition, the factor score can be obtained by the weighted least square method. Through several abstract main factor variables to cover a large number of specific sub-factors, so as

to achieve the purpose of dimensionality reduction, this article uses STATA software for factor analysis.

#### 4.2. Data Selection and Index Design

This article takes Industrial Bank and four comparable listed joint-stock commercial banks with the same statistical caliber as the research object, including Industrial Bank, China Merchants Bank, China CITIC Bank, Hua Xia Bank, and Ping An Bank. The data comes from the annual reports and social responsibility reports of 5 listed commercial banks. According to the disclosure of commercial bank data, the data used in this article is the unbalanced panel data from 2007 to 2019. The years of establishment and the statistical caliber of financial reports have certain similarities. Try to ensure that the characteristics of the reference group and the control group are as consistent as possible, so as to eliminate the interference effect of other factors other than the equator principle on the comprehensive operating performance of commercial banks, and make the research. The results are comparable.

In order to comprehensively reflect the operating performance of commercial banks, this article combines the indicator system set by the Ministry of Finance, the three principles of commercial banks and the CAMEL evaluation principle, and the principles of scientific, relevance, comparability, innovation, and independence selected by indicators. Selected 10 indicators representing the consistency of the statistical caliber of the sample bank's comprehensive operating performance: net asset return  $X_1$  (roe), earnings per share  $X_2$  (eps), net interest income  $X_3$  (iin), capital adequacy ratio  $X_4$  (car), cost-to-income ratio  $X_5$  (cir), non-performing loan ratio  $X_6$  (npl), provision coverage ratio  $X_7$  (pcr), liquidity ratio  $X_8$  (lr), loan-to-deposit ratio  $X_9$  (ldr), loans The ratio  $X_{10}$  (10lr), as shown in Table 1. In the analysis method, the factor analysis method is used to reduce the dimensions of 10 indicators to obtain a comprehensive common factor that more comprehensively reflects the bank's performance.

Taking into account the dimensional difference of the original data, the data processing in this paper adopts the Z-score standard deviation standardization method to standardize and normalize the original data. The  $j$  index of the  $i$ -th bank is represented by  $a_{ij}$ ,  $X_j$  represents the mean value of the  $j$  index,  $\sigma_j$  represents the variance of the  $j$  index, and  $X_{ij}$  represents the standardized value. The negative index indicates that the larger the index value, the lower the operating performance. In the process of data processing, the non-performing loan ratio, cost-to-income ratio, deposit-loan ratio, and the loan ratio of the top ten customers are positively processed.

$$\text{Positive index} = (a_{ij} - X_j) / \sigma_j$$

$$\text{Negative index} = (X_j - a_{ij}) / \sigma_j$$

*Table 1. Variables and their descriptions.*

| variable name | Variable symbol        | Variable description                                                                                                                                                     |
|---------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Profitability | X <sub>1</sub> (roe)   | Return on Equity=net profit / shareholder rights                                                                                                                         |
|               | X <sub>2</sub> (eps)   | Earnings per share                                                                                                                                                       |
|               | X <sub>3</sub> (iin)   | Net interest income                                                                                                                                                      |
|               | X <sub>4</sub> (cir)   | Cost-to-income ratio=business and management fees / (operating income-other business costs)                                                                              |
| Safety        | X <sub>5</sub> (pcr)   | Provision coverage ratio=Provision coverage ratio=(general provision + special provision + special provision) / (substandard loans + doubtful loans + loss loans) × 100% |
|               | X <sub>6</sub> (npl)   | Non-performing loan ratio=ratio of substandard, doubtful and loss loans to total loans                                                                                   |
|               | X <sub>7</sub> (car)   | Capital adequacy ratio=total capital / risk-weighted asset ratio                                                                                                         |
| Fluidity      | X <sub>8</sub> (lr)    | Liquidity ratio=liquid assets / liquid liabilities                                                                                                                       |
|               | X <sub>9</sub> (ldr)   | Loan-to-deposit ratio=loan/deposit                                                                                                                                       |
|               | X <sub>10</sub> (10lr) | Loan ratio of the top ten customers                                                                                                                                      |

## 5. Empirical Analysis

This part studies the profitability, safety, liquidity, and comprehensive operating performance of joint-stock commercial banks. First, the factor analysis method is used to calculate the main factors, covering a large amount of information on the original indicators, and the comprehensive performance of the commercial bank is obtained through algebraic calculations. The comprehensive performance of Industrial Bank and comparable joint-stock commercial banks are compared, and the influence of joining the Equator Principles on joint-stock commercial banks is analyzed.

### 5.1. Sample Inspection

Before performing factor analysis, first perform KMO and SMC tests on the data. KMO test is an index of correlation

coefficient between analysis factors, and its value range is between 0-1. The stronger the correlation between the factors, the larger the corresponding KMO value, indicating that the sample data indicators are suitable for factor analysis. Generally, KMO values greater than 0.5 are suitable for factor analysis. The SMC test value is the square of the multiple correlation coefficient between one factor and the other factors, which is also called the coefficient of determination referred to in the multiple regression equation. The higher the SMC test value, the stronger the linear correlation between the factors and the more suitable Do factor analysis.

The test results are shown in Table 2. The closer the value of KMO is to 1, the more sufficient the test result of the selected index is. The test result of KMO is 0.615>0.5. Combined with the test result of SMC, it shows that the data is suitable for factor analysis.

*Table 2. KMO and SMC inspection results.*

| Variable               | KMO   | SMC   |
|------------------------|-------|-------|
| X <sub>1</sub> (roe)   | 0.638 | 0.696 |
| X <sub>2</sub> (eps)   | 0.512 | 0.262 |
| X <sub>3</sub> (iin)   | 0.649 | 0.498 |
| X <sub>4</sub> (cir)   | 0.756 | 0.437 |
| X <sub>5</sub> (pcr)   | 0.471 | 0.711 |
| X <sub>6</sub> (npl)   | 0.461 | 0.573 |
| X <sub>7</sub> (car)   | 0.765 | 0.347 |
| X <sub>8</sub> (lr)    | 0.637 | 0.426 |
| X <sub>9</sub> (ldr)   | 0.590 | 0.500 |
| X <sub>10</sub> (10lr) | 0.713 | 0.605 |
| Total                  | 0.615 |       |

### 5.2. Calculate the Cumulative Variance Contribution Rate

This paper extracts common factors from five selected joint-stock commercial banks, and uses common factors calculated by STATA analysis software to explain the original overall variance of the 10 variables. Among them, the contribution rate corresponding to the variance of the common factor represents the amount of information of the selected common factor to explain the original 10 variable data. The higher the contribution rate of the cumulative variance of the extracted common factor, the more sufficient the original information is included. The variance contribution rate is greater than 60%, which means that the selected common

factor has explained most of the information of the original data variables. This paper extracts three common factors whose eigenvalues are greater than 1. Among them, the common factor 1 explains 23.6% of the information, the common factor 2 explains 23.3% of the information, and the common factor 3 explains 17.9% of the information. The cumulative variance contribution rate reaches 64.8%, covering most of the original variable information. And through orthogonal rotation to get a more adequate explanation of the variance matrix, the cumulative variance contribution rate remains unchanged, use these 3 common factors to represent the selected 10 variables, as shown in Table 3:

Table 3. Total variance explained.

| Factor               | Initial eigenvalue |            | Extract the sum of squares and load |            | Rotate the sum of squares loading |            |
|----------------------|--------------------|------------|-------------------------------------|------------|-----------------------------------|------------|
|                      | Eigenvalue         | Cumulative | Eigenvalue                          | Cumulative | Eigenvalue                        | Cumulative |
| Factor <sub>1</sub>  | 3.593              | 0.359      | 3.593                               | 0.359      | 2.364                             | 0.236      |
| Factor <sub>2</sub>  | 1.751              | 0.534      | 1.751                               | 0.534      | 2.328                             | 0.469      |
| Factor <sub>3</sub>  | 1.136              | 0.648      | 1.136                               | 0.648      | 1.788                             | 0.648      |
| Factor <sub>4</sub>  | 0.898              | 0.738      |                                     |            |                                   |            |
| Factor <sub>5</sub>  | 0.776              | 0.815      |                                     |            |                                   |            |
| Factor <sub>6</sub>  | 0.596              | 0.875      |                                     |            |                                   |            |
| Factor <sub>7</sub>  | 0.496              | 0.924      |                                     |            |                                   |            |
| Factor <sub>8</sub>  | 0.379              | 0.962      |                                     |            |                                   |            |
| Factor <sub>9</sub>  | 0.240              | 0.987      |                                     |            |                                   |            |
| Factor <sub>10</sub> | 0.135              | 1.000      |                                     |            |                                   |            |

### 5.3. Rotated Factor Loading Matrix

Rotating the original component matrix by orthogonal rotation to obtain the rotated component matrix makes the empirical results more scientific. The 10 variables are classified according to the load values of the 3 types of principal component factors, and then the meaning of the principal component factors is named according to the variables contained in each principal component factor. The factor loads after rotation is shown in Table 4:

Table 4. Rotation factor loading matrix.

| Variable               | F <sub>1</sub> | F <sub>2</sub> | F <sub>3</sub> | Uniqueness |
|------------------------|----------------|----------------|----------------|------------|
| X <sub>1</sub> (roe)   | -0.337         | 0.694          | -0.369         | 0.268      |
| X <sub>2</sub> (eps)   | 0.082          | 0.211          | 0.671          | 0.498      |
| X <sub>3</sub> (iin)   | 0.481          | -0.067         | 0.585          | 0.422      |
| X <sub>4</sub> (cir)   | 0.731          | -0.332         | -0.019         | 0.355      |
| X <sub>5</sub> (pcr)   | -0.204         | 0.860          | 0.228          | 0.168      |
| X <sub>6</sub> (npl)   | 0.026          | 0.780          | -0.170         | 0.363      |
| X <sub>7</sub> (car)   | 0.544          | 0.102          | 0.469          | 0.474      |
| X <sub>8</sub> (lr)    | 0.692          | -0.273         | -0.136         | 0.429      |
| X <sub>9</sub> (ldr)   | -0.029         | 0.502          | -0.661         | 0.310      |
| X <sub>10</sub> (10lr) | 0.813          | -0.059         | 0.321          | 0.233      |

Factor analysis not only needs to find the common factors, but more importantly, it is necessary to name the common factors according to the meaning of the included factors. The four indicators with relatively large variance contribution rates of the principal component factors in the rotating component matrix are selected for combination and the principal component factors are named, and the resulting principal component factors are composed as follows: The factors with the largest F<sub>1</sub> load value are: X<sub>4</sub> (cir), X<sub>8</sub> (lr) and X<sub>10</sub> (10lr) respectively represent the cost-to-income ratio, liquidity ratio, and loan ratio of the top ten customers. F<sub>1</sub> is named the liquidity factor to measure the liquidity of commercial banks' funds. The factors with the largest F<sub>2</sub> load value are: X<sub>5</sub> (pcr) and X<sub>6</sub> (npl), which represent provision coverage ratio and non-performing loan ratio, respectively. F<sub>2</sub> is named the safety

factor, which comprehensively reflects the quality of assets. The factors with the largest load value of F<sub>3</sub> are: X<sub>2</sub> (eps), X<sub>3</sub> (iin) and X<sub>9</sub> (ldr), which respectively represent earnings per share, net interest income, and loan-to-deposit ratio, reflecting the long-term profitability of commercial banks.

Table 5. Nomenclature of principal component factors.

| Main factor    | Sub-factor                                                 | Main factor nomenclature |
|----------------|------------------------------------------------------------|--------------------------|
| F <sub>1</sub> | X <sub>4</sub> (cir) Cost-to-Income Ratio                  | Liquidity factor         |
|                | X <sub>8</sub> (lr) Liquidity Ratio                        |                          |
|                | X <sub>10</sub> (10lr) Loan Ratio of the Top Ten Customers |                          |
| F <sub>2</sub> | X <sub>5</sub> (pcr) Provision Coverage Ratio              | Safety factor            |
|                | X <sub>6</sub> (npl) Non-performing loan rate              |                          |
| F <sub>3</sub> | X <sub>2</sub> (eps) Earnings per share                    | Profitability factor     |
|                | X <sub>3</sub> (iin) Net interest income                   |                          |
|                | X <sub>9</sub> (ldr) Loan-to-deposit ratio                 |                          |

### 5.4. Factor Score Calculation

According to the score coefficient situation matrix of each factor in Table 6 below, the expression relationship between 3 principal component factors and 10 sub-factors can be obtained, and 10 variables are expressed as 3 principal component factors through algebraic operation through the score coefficient:

Table 6. Component score coefficient matrix.

| Variable               | F <sub>1</sub> | F <sub>2</sub> | F <sub>3</sub> |
|------------------------|----------------|----------------|----------------|
| X <sub>1</sub> (roe)   | 0.013          | 0.279          | -0.158         |
| X <sub>2</sub> (eps)   | -0.073         | 0.129          | 0.435          |
| X <sub>3</sub> (iin)   | 0.125          | 0.059          | 0.280          |
| X <sub>4</sub> (cir)   | 0.361          | -0.040         | -0.188         |
| X <sub>5</sub> (pcr)   | -0.022         | 0.393          | 0.215          |
| X <sub>6</sub> (npl)   | 0.186          | 0.386          | -0.107         |
| X <sub>7</sub> (car)   | 0.216          | 0.151          | 0.191          |
| X <sub>8</sub> (lr)    | 0.376          | -0.019         | -0.256         |
| X <sub>9</sub> (ldr)   | 0.222          | 0.232          | -0.428         |
| X <sub>10</sub> (10lr) | 0.375          | 0.114          | 0.026          |

$$F_1 = 0.013X_1 - 0.073X_2 + 0.125X_3 + 0.361X_4 - 0.022X_5 + 0.186X_6 + 0.216X_7 + 0.376X_8 + 0.222X_9 + 0.375X_{10}$$

$$F_2 = 0.279X_1 + 0.129X_2 + 0.059X_3 - 0.04X_4 + 0.393X_5 + 0.386X_6 + 0.151X_7 - 0.019X_8 + 0.232X_9 + 0.114X_{10}$$

$$F_3 = -0.158X_1 + 0.435X_2 + 0.28X_3 - 0.188X_4 + 0.215X_5 - 0.107X_6 + 0.191X_7 - 0.256X_8 - 0.428X_9 + 0.026X_{10}$$

$W_1$ ,  $W_2$ , and  $W_3$  respectively represent the weight of the comprehensive performance factor occupied by the principal component factor. After calculating the scores of the three principal component factors, the score  $F$  of the comprehensive performance factor is finally calculated according to the weight of each principal component factor.

$$W_1=0.236/0.648=0.364$$

$$W_2=0.233/0.648=0.359$$

$$W_3=0.179/0.648=0.276$$

$$F=0.364 F_1+0.359 F_2+0.276 F_3$$

Table 7 shows the average total scores of the principal component factors and comprehensive performance factors of the liquidity, safety, and profitability of the five joint-stock commercial banks from 2007 to 2019. Judging from the average performance of the study year, China Merchants Bank has a higher market share, the best comprehensive operating performance, relatively low level of asset liquidity, but the highest profitability, indicating that China Merchants Bank's asset utilization rate is high, and The management level of asset quality is good, and the non-performing loan rate is low; Industrial Bank's comprehensive operating performance ranks second, liquidity and safety are higher than comparable commercial banks of the same kind, and the corresponding profitability is relatively poor, Which shows that the Equator Principles have a certain impact on the liquidity and safety of commercial banks. During the study period, commercial banks' green credit business has promoted the improvement of Industrial Bank's asset liquidity and asset quality, but it is not conducive to the financial performance of commercial banks. Performance improvement; CITIC Bank has the highest liquidity and low profitability, indicating that the asset utilization rate of CITIC Bank is not high, and the comprehensive operating performance of Ping An Bank and Hua Xia Bank is relatively poor.

**Table 7.** Average scores and rankings of principal component factors of 5 joint-stock commercial banks from 2007 to 2019.

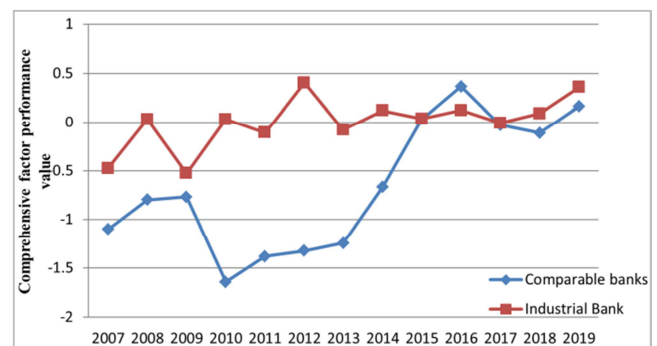
| Bank Ranking         | $F_1$ | $F_2$ | $F_3$ | $F$     | $F$ |
|----------------------|-------|-------|-------|---------|-----|
| China Merchants Bank | 3     | 1     | 1     | 0.0386  | 1   |
| Industrial Bank      | 2     | 2     | 3     | -3E-16  | 2   |
| CITIC Bank           | 1     | 5     | 4     | -0.1506 | 3   |
| Ping An Bank         | 4     | 4     | 5     | -0.2907 | 4   |
| HSBC Bank            | 5     | 3     | 2     | -0.3111 | 5   |

### 5.5. Analysis of Empirical Results

The annual average operating performance of China Merchants Bank, China CITIC Bank, Ping An Bank and Hua Xia Bank is regarded as comparable banks in the same category and compared with the development trend of Industrial Bank from 2007 to 2019. As shown in Figure 1, after the Industrial Bank joined the Equator Principles, in the short term, its comprehensive operating performance was higher than the average of comparable banks of the same kind,

and the development trend was slowly rising amidst volatility. After 2015, the development trend of the two was basically the same. It shows that joining the Equator Principles of joint-stock commercial banks will significantly improve the comprehensive operating conditions of commercial banks in the short term. Under the circumstance that the comprehensive operating performance of comparable joint-stock commercial banks of the same category has declined, the comprehensive operating performance of Industrial Bank has always remained stable. To a certain extent, the Equator Principles can help joint-stock commercial banks to develop in a sustainable and stable manner.

In the long-term development, the effectiveness of Industrial Bank's implementation of the Equator Principles has not changed much. With the gradual introduction of green finance into the bank's business development philosophy, other joint-stock commercial banks have gradually expanded the scale of green credit. Although they did not voluntarily join the Equator Principles, There are legal constraints on green credit. In fact, with the increase in the demand for green financing in society, the scale of green credit of joint-stock commercial banks has grown steadily. The effect of implementing green financial services of other joint-stock commercial banks is similar to that of commercial banks that have adopted the Equator Plain. The performance of joint-stock commercial banks is gradually converging with the development trend of the operating performance of Industrial Bank that has joined the Equator Principles.



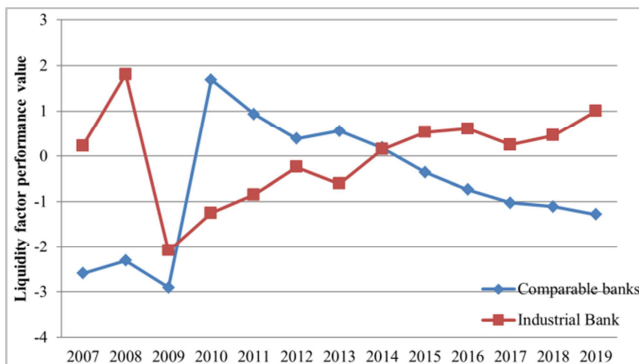
**Figure 1.** Line chart of comprehensive operating performance of Industrial Bank and comparable banks.

As shown in Figure 2, the liquidity factor of Industrial Bank first declined during the study period and then increased. The liquidity factor of comparable banks first increased and then decreased during the study period. During the period, the liquidity level of comparable banks of the same kind was higher than that of Industrial Bank. From 2007 to 2009, the liquidity level of Industrial Bank was higher than that of comparable banks in a short period of time, and the liquidity level of Industrial Bank in the short term gradually dropped below the liquidity level of comparable banks of the same kind, and the liquidity level of Industrial Bank was lower than that of comparable commercial banks of the same kind. With the reduction in operating performance, the liquidity level of Industrial



Bank has steadily increased. The Equator Principles require commercial banks to have a higher level of liquidity to deal with the risks of green credit. After 2009, the liquidity level of Industrial Bank has risen, and in 2014 Years later, it is higher than comparable banks of its kind.

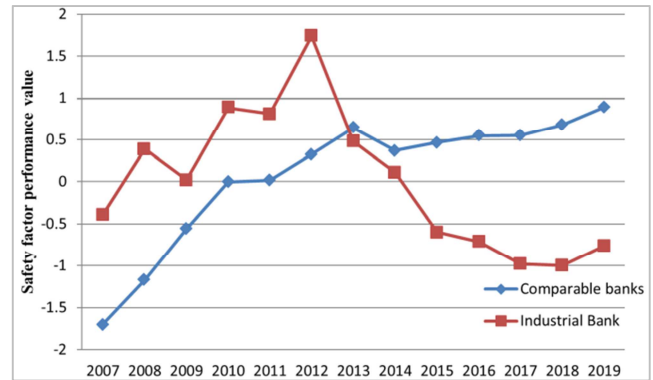
When Industrial Bank joined the Equator Principles in 2008, due to the long cycle of green credit projects and weak liquidity of funds, it was unable to generate stable and visible cash flow in the short term. Joint-stock commercial banks invested limited resources in green projects, encroaching on the maximum benefits that could be used the loan funds for other projects of Industrial Bank have led to a decline in the liquidity level of Industrial Bank. In the long run, as the construction of green projects is completed, commercial banks need a higher level of liquidity to deal with uncertain environmental liability risks. In the absence of environmental risks, this will generate predictable and stable cash flow and promote the improvement of Industrial Bank's liquidity level.



**Figure 2.** Line chart of the liquidity factor performance of Industrial Bank and comparable banks.

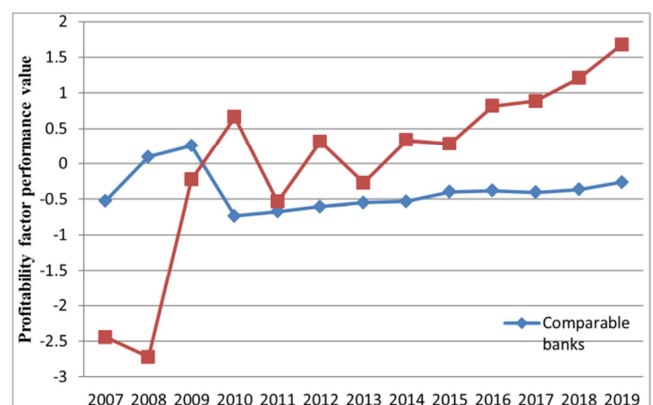
It can be seen from Figure 3 that the safety level of comparable banks of the same kind has gradually increased. The safety factor of Industrial Bank has been higher than that of comparable banks in the early stage of joining the Equator Principles. When the operating performance of comparable commercial banks of the same kind is still on the rise, Industrial Bank The asset quality gradually declined after reaching the highest point in 2012, and was lower than comparable banks in 2013, indicating that the long-term commercial banks' joining the Equator Principles has a certain negative impact on the asset quality of joint-stock commercial banks. The characteristics of green credit are long cycle, low cost recovery rate, mismatch of loan funds maturity, and uncontrollable development direction in the later stage of green project operation. Commercial banks generally have certain credit risks, which affect the assets of commercial banks. Quality, the Equator Principles have been operating in my country for a short time, the scale of projects with green loans is small, the green credit operating mechanism is imperfect, and the ability to control risks is weak. Compared with comparable commercial banks in the same category, the Equator Principles are adopted in the project operation The

later period is not conducive to the improvement of its asset quality.



**Figure 3.** Line chart of safety factor performance of Industrial Bank and comparable banks.

It can be seen from Figure 4 that the profitability gap between Industrial Bank and comparable commercial banks has gradually widened. The profitability of comparable joint-stock commercial banks in the research period has developed relatively stable. Since Industrial Bank joined the Equator Principles in 2008, its profitability has fluctuated. The increase was higher than that of comparable joint-stock commercial banks in the same category after 2009, indicating that after the Industrial Bank joined the Equator Principles in 2008, its profitability has risen sharply, effectively avoiding the risk of commercial bank credit violations, and presenting a trend of rising volatility in the short term. Through the establishment of a good corporate image within a longer operating period, a bank can form a green brand effect, increase financing channels for green projects, acquire more green resources, and form economies of scale, which can significantly improve its financial status and increase net value. The level of interest income and earnings per share.



**Figure 4.** Line chart of profitability factor performance of Industrial Bank and comparable banks.

## 6. Conclusions and Recommendations

This paper uses factor analysis to measure the 10 financial and non-financial performance indicators of Industrial Bank

and 4 comparable banks to reduce dimensionality, and obtain three principal component factors representing the liquidity, safety and profitability of commercial banks. Analysis and comparison between Industrial Bank and comparable banks. The results found that the comprehensive operating performance of Industrial Bank ranks second among comparable banks of its kind, second only to China Merchants Bank. Industrial Bank's joining the Equator Principles has helped improving its operating conditions, promote local ecological construction, and promote the construction of a beautiful China. The Industrial Bank's joining the Equator Principles can significantly improve its comprehensive operating performance in the short-term. In the long-term development trend, it is basically the same as comparable banks of the same kind. At the same time, it can improve its asset liquidity and financial performance and profitability. However, in the long-term, joining the Equator Principles is relatively comparable to similar banks. Commercial banks are not conducive to the improvement of asset quality to a certain extent, and the following suggestions are made in this regard.

### ***6.1. Strengthen the Supervision of Green Projects***

The empirical results show that, compared with comparable commercial banks of the same kind, joining the Equator Principles has certain adverse effects on asset quality. In this regard, commercial banks joining the Equator Principles pay attention to improving their asset quality and reducing the rate of non-performing loans while carrying out green projects.. Based on the establishment of a sound green credit policy and management system, the Industrial Bank evaluates projects in strict accordance with the international standards of the Equator Principles in the entire process of credit granting, appropriation and supervision, and implements single-list project management for each project., To ensure the environmental protection of the project. Commercial banks should also prudently review corporate loan projects to ensure that projects meet green credit standards and eliminate "greenish" companies; increase the safety and compliance of financing projects, strengthen risk assessment work, and accurately assess the company's subsequent debt repayment Capability: Strengthen the supervision of the Equator Principles through financial technology and other means, reduce the environmental risks of project operation, improve the green credit system of commercial banks, unify the standards for the definition of Equator Principles projects, and reduce the cost of identifying projects by financial institutions.

### ***6.2. Establish an Effective Incentive Mechanism***

Green finance is a public enterprise with positive social externalities. From the perspective of green finance, commercial banks have both profitability and social responsibility, but green projects have the characteristics of low returns and long cycles. In this regard, the government must carry out macro-intervention, and it should also learn from the perfect foreign green financial policy system. Under a sound policy management system, my country's commercial

banks can avoid detours in terms of sustainable development and are also affected by peer pressure. Institutions are more willing to adopt the Equator Principles under conditions of peer participation [12]. From the empirical results of this article, joining the Equator Principles has a positive effect on the operating performance of commercial banks in the long run. For commercial banks that have not joined the Equator Principles, the government should provide policy and financial support for commercial banks to implement green financial services to compensate. The opportunity cost brought by commercial banks to develop green credit provides endogenous motivation for commercial banks to join the Equator Principles, allowing commercial banks to make more contributions to the construction of a beautiful China.

### ***6.3. Build an Information Sharing Platform for the Equator Principles***

At present, there is a widespread problem of an imbalance between supply and demand in green project financing. Commercial banks cannot find good loan projects due to asymmetric information, so they should provide external environmental protection for the smooth implementation of the Equator Principles. The Industrial Bank established the Sustainable Finance Department, built a government-enterprise information sharing platform for green project financing, created a variety of financing models, and solved the problem of green technology and green projects and capital docking; established an environmental information disclosure mechanism during the entire project operation process. Green credit system, through the platform to track the pollutant discharge of investigation projects in a timely manner, record information on environmental violations that violate the Equator Principles, improve the transparency and credibility of Equator Principles financing projects, reduce compliance risks caused by information asymmetry, and solve business problems The worries about banks joining the Equator Principles.

### ***6.4. Establish a Long-Term Green Finance Development Plan***

The empirical results show that the Equator Principle improves the comprehensive operating performance of commercial banks in the short term, and the long-term development trend converges with comparable banks of the same kind. In this regard, commercial banks that join the Equator Principles should establish a long-term innovative green finance development concept. For Industrial Bank, green finance is not only a business category, but also a corporate culture of the bank, which has penetrated the Industrial Bank. In the daily business activities. Since joining the Equator Principles, Industrial Bank has developed innovative green financial products such as carbon mortgages, low-carbon credit cards, and "Wanlibao". At the same time, it has created a variety of financing models, strengthened international cooperation and exchanges, and integrated itself on the basis of absorbing advanced foreign experience.

According to our country's environmental risk prevention and control mechanism, we will formulate uniform standards that conform to the international Equator Principles, improve the practicability and innovation of the Equator Principles in my country's commercial banks, and attract commercial banks that are still on the sidelines to actively adopt the Equator Principles. Work together to build a harmonious economic, social and ecological environment.

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