Empirical Research on the Quality of Environmental Accounting Information Disclosure based on SPSS

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Abstract. In the era of big data, data is undergoing rapid expansion, determining future corporate development. Although many enterprises may not realize the hidden dangers of the explosive data growth, people will become increasingly aware of the importance of data to enterprises. Faced with excessive data, how to disclose accounting information is an issue worth studying. Survival and development of energy industry as a key emerging industry in the country are inextricably linked with natural resources and ecological environment. Appearance of environmental accounting can greatly alleviate a series of environmental problems caused by the development of energy industry. Disclosure of environmental accounting information is a must task to prevent and manage complex environmental problems in society. However, there are still many loopholes in the development of environmental accounting information disclosure in China: the government lacks targeted standards and regulations; companies face no mandatory system requirements for environmental information disclosure, lack the initiative to disclose relevant information, and the disclosure form and content also lack standardization. With the listed energy companies in Guangdong Province as the research objects, this paper selects 19 listed companies from CNINFO that meet the conditions of listing on the Shenzhen Stock Exchange or the Shanghai Stock Exchange with A-share stocks. The four-year data of 2015-2018 is taken as a sample size to analyze the status of environmental accounting information disclosure, the content and method of disclosure, and the quality of disclosure. SPSS is taken to perform descriptive analysis, multiple linear regression analysis and other empirical analysis on the data, and the analysis results are summarized. It can be seen from empirical analysis that the four factors including the proportion of tradable shares, the proportion of independent directors, ISO environmental certification and government environmental protection subsidies, have the most significant impact on the quality of environmental accounting information disclosure of listed energy companies in Guangdong. Where, government environmental protection subsidies have the greatest impact on enterprises’ environmental accounting information disclosure. Finally, referring to the experience of environmental accounting information disclosure in other countries, this paper believes that China should improve relevant regulations and standards for environmental accounting information disclosure, while strengthening internal and external supervision of enterprises to promote the development of environmental accounting, thereby contributing to the goal of socialism with Chinese characteristics: development of circular economy, development of resource economizing type, environment-friendly low-carbon economy and society.
Keywords-listed companies; environmental accounting; information disclosure; energy industry

1. Introduction
Environmental resources on which global economic development depends have been over-exploited. If such situation is not properly controlled, the concept of sustainable development advocated by mankind will come to an end. To alleviate environmental problems, people have been trying different environmental protection approaches, but these efforts only "cure the symptoms, not the disease." The increasing number of companies in the pollution industry and the surge in social demand has made environmental issues more related to the interests of society and companies. Therefore, traditional financial accounting and environmental resources have to be combined to promote long-term corporate development. With the continuous decline in natural environment quality and the increasing awareness of environmental protection, environmental accounting came into being. The British Industrial Revolution began in 1860, through which, mankind began to lead an efficient and prosperous life. The development of modern industry has also brought to people many raw materials and products necessary for life. At the same time, with continuous technological improvement, production efficiency is continuously growing, but what follows is the serious pollution and irreparable loss to the environment owing to the excessive exploitation and utilization of natural resources. The status quo has attracted the attention of environmentalists, ecologists and economists. To improve these situations, they began to study integrated development of economy and environment in 1970. In 1999, the "Announcement on Environmental Accounting and Reporting Positions" was adopted and promulgated by the United Nations. This announcement allows the formation of a good environmental accounting and reporting guidelines worldwide, and systems suitable for different countries are also established. People then began to face up to environmental accounting. Under such global actions, we need to improve and perfect our accounting system. In the global context, ordinary accounting can no longer lack the involvement of environmental concepts. Therefore, China should also speed up environmental accounting research and establish its own complete environmental accounting system.

2. Literature Review
Han Jin et al. (2018) found through comparative research that there is negative correlation between environmental information disclosure quality and corporate asset-liability ratio [1]. Dong Xiumei et al. (2014) found through empirical research that company size and the level of corporate environmental information disclosure show changes in the same direction [2]; Burns J and Contrafatto M (2013) proposed that companies should disclose more environmental protection efforts in environmental information [3]. Pan, Hengyu et al. (2019) believed that environmental accounting information disclosure should have focus in content, such as focusing on environmental pollution, environmental-related gains and losses, and accident impacts [4]. Cui Cheng (2017) further confirmed this view by studying 50 Chinese listed companies engaged in the mining industry [5]. Qiang Qunli (2015) found through research that profitability does not significantly affect corporate environmental information disclosure [6]. Zhao Haiyan (2018) concluded from respective empirical research and analysis that the size of the board of directors, the size of the board of supervisors, the proportion of independent directors, and the ownership concentration of listed companies are all proportional to environmental accounting information disclosure index [7]. Wang Longfei (2015) found through research that companies with initiative in environmental accounting information disclosure perform better [8]. Zhang Benyue et al. (2017) found through empirical research that there is a change in the same direction between the government's environmental supervision and the level of corporate environmental accounting information disclosure [9]. Tian Yunling et al. (2010) found through empirical research according to the principles of green finance that companies with higher financing
demand perform better in corporate environmental information disclosure [10]. Xiao Hua (2016) concluded based on a comparative analysis of several companies in the chemical industry that: soundness of environmental protection system affects the disclosure of environmental accounting information [11]. Based on the similarities and differences in environmental accounting information disclosure of paper manufacturing companies between the Mainland and Taiwan, Xu Guanghua et al. (2017) concluded that environmental information disclosure is also affected by laws and regulations [12]. Zhang Zhaoxia (2018) pointed out through research that the quality of corporate environmental accounting information disclosure can be significantly improved by political connections [13].

Comparison of foreign research on environmental accounting information disclosure reveals that foreign scholars have comprehensively studied the factors influencing environmental accounting information disclosure, and the research scope has covered all the factors that may be affected, including the enterprise itself and the social environment. On the contrary, domestic scholars' research on influencing factors mainly focuses on corporate internal factors such as company size, profitability, asset-liability ratio, proportion of independent director, and research on external factors such as government environmental protection subsidies, ISO environmental certification, and investor decision-making is still in a relatively blank state. Therefore, this paper takes energy industry as an example, combines qualitative and quantitative analysis, internal and external corporate factors to conduct a small-scale special study on listed companies in Guangdong Province, which carries practical significance for improving our research on environmental accounting information disclosure, advancing the development of environmental accounting information disclosure, and establishing related legal and regulatory systems in China.

3. Methodology
When conducting environmental accounting information disclosure research on these sample companies, this paper combines frequency analysis method to analyze their 2015-2018 annual reports and some independent reports such as independent environmental reports and social responsibility reports. Study is carried out from quantity, method, content of environmental accounting information disclosure as well as release status of corporate independent reports. From the 2015-2018 annual reports of the 19 selected energy listed companies, it can be seen that all companies have disclosed environmental accounting information, but vary greatly in disclosure content and methods. This paper adopts multiple regression method in attempt to find the factors influencing quality of environmental accounting information disclosure, thereby improving information disclosure quality.

3.1 Hypothesis
According to the above principles and basic theories of environmental accounting information disclosure, there are many factors influencing environmental accounting information disclosure. This paper takes listed energy companies in Guangdong as examples to make hypotheses about factors affecting environmental accounting information disclosure based on the status quo of environmental accounting information disclosure and description of research hypotheses in related literature.

3.1.1 Hypothesis on company size
Many empirical studies can prove that certain connection exists between company size and quality of environmental accounting information disclosure. As early as the 1980s, foreign scholars found through research on influencing factors that company size and industry category have the greatest impact on environmental information disclosure. Some other scholars believe that larger company size means increased political sensitivity, social attention, and illegality costs of the company. Domestic scholars have also found through research on domestic capital market that quality of environmental accounting information disclosure will be affected by company size, and there is a proportional relationship between the two. Larger energy companies will also attract more investors, customers, partners, etc. which leads to people’s higher requirements for the degree of environmental accounting information disclosure. Only companies with full disclosure and information transparency can attract
better partners. At the same time, to maintain their position in the industry, large-scale energy companies are more willing to disclose environmental accounting information, thus establishing a good corporate image. Therefore, Hypothesis 1 is proposed.

Hypothesis 1: Company size is positively correlated with the environmental accounting information disclosure quality of listed energy companies in Guangdong.

3.1.2 Hypothesis on loan level
Energy companies with higher loan level face greater negative financial impact it brings. For investors, higher loan level of a company means its loan safety factor and debt solvency are lower. Therefore, to better judge whether the company is worthy of investment, investors will require more information disclosure by the company. To maintain investors, investment and gain investors’ trust, energy companies with heavy debt will also consciously disclose more information, including more environmental accounting information. Therefore, Hypothesis 2 is proposed.

Hypothesis 2: Company loan level is positively correlated with the environmental accounting information disclosure quality of listed energy companies in Guangdong.

3.1.3 Hypothesis on profitability
Profitability of a company reflects value of the company. Profitability of an energy company determines the company’s resource allocation and utilization efficiency. There is a positive correlation between them. The increase of these three will also lead to increased investment value of the company, so that there will be more return to shareholders. As environmental accounting information disclosure features information asymmetry, investors can only rely on their own subjective consciousness when making investment decisions. Companies with strong profitability can win the trust of stakeholders like investors, partners and gain more investment opportunities, which will thus disclose more environmental accounting information to reflect the true company value, thereby successfully gaining investment. On the other hand, energy companies with strong profitability have more funds for environmental protection-related work, and will disclose environmental accounting information more positively to display their achievements in environmental protection, thereby establishing a good corporate image and winning the favor of investors. Hence, based on the above characteristics, hypothesis 3 is proposed.

Hypothesis 3: Company profitability is positively correlated with the environmental accounting information disclosure quality of listed energy companies in Guangdong.

3.1.4 Hypothesis on proportion of tradable shares
According to the theory of information asymmetry, company management knows the interior company situation better than shareholders and other investors. In the stock information market, shareholders of tradable shares have the right to sell company stocks and refuse to purchase it as appropriate, which will invisibly put pressure on company management. To maintain investment from investors and shareholders of tradable shares, management layer of energy companies with a larger proportion of tradable shares will more actively and detailed disclose information on environmental accounting to establish a good image and gain support from more shareholders and investors. Therefore, Hypothesis 4 is proposed.

Hypothesis 4: Proportion of company's tradable shares is positively correlated with the environmental accounting information disclosure quality of listed energy companies in Guangdong.

3.1.5 Hypothesis on proportion of tradable shares
The trend of economic globalization is getting more and more obvious, and increasingly more energy companies attempt to attract foreign investment to enhance competitiveness. However, compared to some countries with earlier popularity of environmental accounting, the quality of corporate environmental accounting information disclosure in domestic energy industry is far inferior. Therefore, to attract more foreign capital, energy companies need disclose environmental accounting information
as much and comprehensively as possible in an effort to improve the information disclosure quality of the company and enhance its competitiveness against foreign-funded enterprises. Therefore, Hypothesis 5 is proposed.

Hypothesis 5: Proportion of foreign shares in the company is positively correlated with the environmental accounting information disclosure quality of listed energy companies in Guangdong.

3.1.6 Hypothesis on proportion of independent directors
Independent directors refer to directors who do not hold positions within the company, have no important internal ties, are independent of corporate management, and have independent judgment. With more independent directors in the board of directors, supervision on the company is stronger, which can better help stakeholders safeguard their interests and supervise energy companies, so that they disclose environmental accounting information. Accordingly, hypothesis 6 is proposed.

Hypothesis 6: Proportion of independent directors is positively correlated with the environmental accounting information disclosure quality of listed energy companies in Guangdong.

3.1.7 Hypothesis on government environmental protection subsidies
At this stage, with the popularization of low-carbon economy and sustainable development concepts in society, the government imposes increasingly higher requirements for environmental protection. To make energy industry, one of the most polluting industries, reduce losses, save energy and reduce emissions, the government will provide certain environmental protection subsidies to energy companies that have undertaken environmental protection work to encourage more companies. Under government and social concern, energy companies can only do a job in environmental protection to avoid the negative impact of public opinion on corporate image; only by disclosing environmental accounting information can it gain social awareness and receive government environmental protection subsidies. At the same time, companies with environmental protection subsidies will also enter a virtuous cycle of continued environmental protection and external disclosure. Accordingly, hypothesis 7 is proposed.

Hypothesis 7: Company's government environmental protection subsidies are positively correlated with environmental accounting information disclosure quality of listed energy companies in Guangdong.

3.1.8 Hypothesis on ISO environmental system certification
ISO environmental management system is an enterprise management standard proposed by international organizations to reduce environmental pollution, save natural resources, improve environmental quality, and promote green development, which aims to standardize environment-related activities of enterprises. If a company passes this certification, it means that it can guarantee good control of the various pollutants generated in the operation process, so that they meet the corresponding requirements. It also indicates that the company has reached the international level in environmental management, and can well fulfill environmental protection commitments and bear social responsibility to establish a good social image. Therefore, this paper proposes hypothesis 8.

Hypothesis 8: Acquisition of ISO environmental system certification is positively correlated with environmental accounting information disclosure quality of listed energy companies in Guangdong.

3.2 Date Collection
This paper selects all A-share listed companies belonging to energy industry from the list of companies on CNINFO. The data search shows a total of 223 companies nationwide. By screening registration places of the national energy listed companies, a total of 23 companies in Guangdong are derived. Where, two companies are listed on both A-share and B-shares, and the others are pure A-share listed companies. Finally, according to the main business of each company, more precise positioning and exclusion are carried out one by one. Accordingly, there are 19 listed energy companies in Guangdong meeting all the sample conditions required for the study, including 4 on
Shanghai Stock Exchange and 15 on Shenzhen Stock Exchange. Since the company's annual report for 2019 has not yet been published, this paper selects 2015-2018 data for relevant information disclosure analysis and information about the selected listed energy companies is shown below.

| Stock code | company abbreviation | listing exchange | Stock code | company abbreviation | listing exchange |
|------------|----------------------|------------------|------------|----------------------|------------------|
| 003816     | CGN                  | Shenzhen Stock Exchange | 000531 | Guangzhou Hengyun Enterprises Holdings Ltd | Shenzhen Stock Exchange |
| 002256     | Shenzhen Sunrise New Energy | Shenzhen Stock Exchange | 000027 | Shenzhen Energy | Shenzhen Stock Exchange |
| 000690     | Baoxin Energy        | Shenzhen Stock Exchange | 000539 | Guangdong Electric Power Development | Shenzhen Stock Exchange |
| 000040     | Tunghsu Azure        | Shenzhen Stock Exchange | 000037 | Shenzhen Nanshan Power | Shenzhen Stock Exchange |
| 002616     | Rimbunan Hijau Group | Shenzhen Stock Exchange | 000637 | Maohua Shihua | Shenzhen Stock Exchange |
| 601139     | Shenzhen Gas Corporation Ltd | Shanghai Stock Exchange | 000096 | Shenzhen Guangju Energy | Shenzhen Stock Exchange |
| 002911     | Foran Energy         | Shenzhen Stock Exchange | 002060 | Guangdong Hydropower Engineering Group | Shenzhen Stock Exchange |
| 000601     | Guangdong Shaoneng Group | Shenzhen Stock Exchange | 300335 | Devotion Corporation | Shenzhen Stock Exchange |
| 600868     | Guangdong Meiyan Jixiang Hydropower Co., Ltd | Shanghai Stock Exchange | 601330 | Dynagreen Environmental Protection Group | Shanghai Stock Exchange |
| 600098     | Guangzhou Development Group Incorporated | Shanghai Stock Exchange | | | |

3.2.1 Select dependent variables

Drawing on domestic and foreign scholars’ research methods, this paper uses environmental accounting information disclosure index to represent the quality level of environmental accounting information disclosure of listed energy companies in Guangdong. The advantage of this method is that it can transform complex texts into simple digits, which enables intuitive understanding of the related information and strengthens comparability between information. According to the relevant regulations of the Ministry of Environmental Protection on the environmental accounting information disclosure of key polluting companies and by referring to previous descriptive analysis of the current status of the research objects, direct aggregation method is usually adopted for calculation of environmental information disclosure index in the world to avoid subjective factors. Therefore, this paper also takes direct aggregation method to sum up the 13 items.

3.2.2 Filter independent variables

Based on the above research hypothesis, this paper screens 8 influencing factors as independent variables, including company size, debt capacity, profitability, proportion of tradable shares, proportion of foreign shares, proportion of independent directors, government environmental
protection subsidies or no, ISO environmental system certification or no. The specific independent variable settings are shown in Table 2 below:

| Independent variable name          | Independent variable value                                      |
|-----------------------------------|-----------------------------------------------------------------|
| company size                      | natural logarithm of ending total assets                        |
| debt capacity                     | asset-liability ratio                                           |
| profitability                     | net interest rate                                               |
| ratio of tradable shares          | tradable shares/total shares                                    |
| ratio of foreign shares           | foreign shares/total shares                                     |
| ratio of independent directors    | Number of independent directors/total number of board of directors |
| government environmental protection subsidies or no | dummy variable, yes=1, no=0                                      |
| environmental system certification or no | dummy variable, yes=1, no=0                                      |

**4. Research Model**

This paper adopts multiple linear regression analysis in attempt to construct a regression equation. According to statistical principles, when correlation coefficient between the independent variables has an absolute value greater than 0.5, the constructed regression equation may face multicollinearity problems, which will affect the regression results. Therefore, before establishing the regression model, this paper uses SPSS software to test Pearson correlation of the eight independent variables. The testing results are shown in Table 3 below:

| Company size=ln (ending total assets) | Pearson correlation | Significance (two-tailed) | Number of cases |
|--------------------------------------|---------------------|---------------------------|-----------------|
| Company size                         | 1                   | 0.593**                   | 0.692**         |
| Asset-liability ratio                | 1                   | 0.000                     | 0.000           |
| Percentage of foreign shares         | 0.593**             | 0.000                     | 0.297**         |
| Percentage of independent directors  | 0.000               | 0.009                     | 1               |
| Percentage of foreign shares         | 0.297**             | 0.009                     | 1               |

**. At level 0.01(double tails), the correlation was significant.
*. At level 0.05(double tails), the correlation was significant.

It can be seen from the table that two coefficients exceed 0.5, 0.593 and 0.692 respectively, which are respectively the correlation coefficients between asset-liability ratio, foreign investment ratio and company size. The correlation coefficients between the two are too high. At the same time, as these two factors have less impact on accounting information disclosure than company size, after comprehensive consideration, this paper decides to delete the two variables of asset-liability ratio and foreign investment ratio. The correlation coefficients of the remaining six variables are tested again, as shown in Table 4 below:

| Company size | Profitability=net interest rate | Percentage of tradable shares | Percentage of independent | ISO environmental system | government environmental protection |
|--------------|--------------------------------|------------------------------|---------------------------|--------------------------|-----------------------------------|
From the table, we can see that the maximum correlation coefficient between each variable is smaller than 0.5, and the maximum is only 0.356, indicating a certain correlation between the other six explanatory variables. To better test the correlation between the six independent variables of company size, profitability, proportion of tradable shares, proportion of independent directors, ISO environmental certification and government environmental protection subsidies, and prevent multicollinearity between independent variables from affecting the regression results, this paper tests tolerance and variance inflation factor of these six independent variables, as shown in Table 5:

| Model | Unstandardized coefficient | Annotated coefficient | Collinearity statistics |
|-------|---------------------------|----------------------|------------------------|
|       | B       | Standard error | Beta  | Tolerance | VIF  |
| (Constant) | 35.183 | 6.763     |  |  | |
|  | Company size | 0.075 | 0.562 | 0.011 | 0.878 | 1.139 |
|  | Profitability | 2.832 | 5.236 | 0.044 | 0.974 | 1.027 |
When $0 \leq VIF < 10$, there is no multicollinearity; when $10 \leq VIF < 100$, there is strong multicollinearity; when $VIF \geq 100$, there is serious multicollinearity. Tolerance = $1/VIF$. Therefore, if the tolerance is greater than 0.1, there will be no serious multicollinearity. It can be seen from the table that the variance inflation factors of all independent variables are between 1 and 2, and the tolerances are greater than 0.5 and much greater than 0.1. Combining the above correlation coefficient test results, it can be concluded that: There is no multicollinearity between all variables, and multiple linear regression models can be constructed. Therefore, let dependent variable $y = \text{environmental accounting information disclosure index}$, $X_1 = \text{company size}$, $X_2 = \text{profitability}$, $X_3 = \text{proportion of tradable shares}$, $X_4 = \text{proportion of independent directors}$, $X_5 = \text{ISO environmental certification}$, $X_6 = \text{government environmental protection subsidies}$. A multiple linear regression model is thus established: $Y = A + BX_1 + CX_2 + DX_3 + EX_4 + FX_5 + GX_6 + \varepsilon$. In this model, $A$ is a constant independent of each influencing factor; the regression coefficient is $B$-$G$, which means that each change of explanatory variables is caused by a unit; the stochastic disturbance term is $\varepsilon$.

## 5. Date Analysis

### 5.1 Multiple linear regression analysis

#### 5.1.1 The goodness of fit test on the regression equation

| Model | $R$ | $R$-square | Adjusted $R$-square | Standard estimation error |
|-------|-----|------------|---------------------|--------------------------|
| 1     | 0.743$^a$ | 0.551      | 0.512               | 6.4285                   |

$a$. Predictive variables: (constant) government environmental protection subsidies, profitability, proportion of independent directors, proportion of tradable shares, company size, ISO environmental certification.

From Table 6, we can see that $r = 0.743$, which is close to 1. It can be considered that the observed values are almost distributed near a straight line. The regression equation has high fitting degree and supports independent variable's interpretation of the dependent variable.

#### 5.1.2 Significance test of regression equation

| Model | Sum of Squares | Degree of Freedom | Mean Square | $F$ | Significance |
|-------|----------------|-------------------|-------------|-----|--------------|
| 1     | Regression     | 3505.725          | 6           | 584.288 | 14.139       | 0.000$^b$ |
|       | Residual       | 2851.472          | 69          | 41.326 |              |             |
|       | Total          | 6357.197          | 75          |       |              |             |

$a$. Dependent Variable: Environmental Accounting Information Disclosure Index

$b$. Predictive variables: (constant) government environmental protection subsidies, profitability, proportion of independent directors, proportion of tradable shares, company size, ISO environmental certification.

As shown in Table 7, $F$ value represents significance of the regression equation. With greater $F$ value, significance is more obvious. It can be seen from the above table that $F = 14.139$, 0.00 is the significance level and does not exceed 0.05. That is, it passes the test on significance level of 0.05, which fully indicates the linear relationship between the independent variable and dependent variable in the regression equation. Thus, the model can be constructed.
5.1.3 Significance test of regression coefficient

Table 8 Significance test results of the regression coefficients

| Model                              | Unstandardized coefficient | Annotated coefficient | t   | Significance |
|------------------------------------|----------------------------|-----------------------|-----|--------------|
|                                    | B     | Standard error | Beta |               |             |               |               |
| 1 (Constant)                       | 35.183 | 6.763        | 5.202 | 0             |               |               |               |
| Company size                       | 0.075   | 0.562       | 0.011 | 0.133  | 0.895         |               |               |
| Profitability                      | 2.832   | 5.236       | 0.044 | 0.541  | 0.590         |               |               |
| Proportion of tradable shares      | -7.889  | 2.899       | -0.229 | -2.722 | 0.008         |               |               |
| Proportion of independent directors| -55.858 | 15.889   | -0.305 | -3.516 | 0.001         |               |               |
| ISO environmental certification    | -4.57   | 1.901       | -0.223 | -2.404 | 0.019         |               |               |
| Government environmental protection subsidies | 14.723 | 1.878   | 0.709 | 7.839  | 0             |               |               |

a. Dependent variable: environmental accounting information disclosure index

As shown in Table 8:
- The non-standard constant is 35.183, t value is 5.202, and the probability corresponding to t value is 0.000 and smaller than 0.05. Therefore, it passes the T significance test.
- The t-values of company size and profitability are 0.133 and 0.541, respectively, and the corresponding significance is respectively 0.895 and 0.590, both of which are greater than 0.05. The significance test is not passed, indicating small influence of these two factors. This also reflects that among listed energy companies in Guangdong, both large and small, profitable and less profitable companies are not very active and proactive in environmental accounting information disclosure.
- Proportion of tradable shares has a non-standardized coefficient of -7.8889, T value of -2.722, and the probability corresponding to T value is 0.008, which is smaller than 0.05. It thus passes the T significance test, indicating a significant impact on the dependent variable. This also reflects that ordinary shareholders and investors ignore environmental accounting information disclosure and lack of environmental protection awareness.
- Proportion of independent directors has a non-standardized coefficient of -55.858, T value of -3.516, and the probability corresponding to T value is 0.001, which is smaller than 0.05. It thus passes the T significance test, indicating a significant impact on the dependent variable. This also reflects that listed energy companies in Guangdong ignore environmental accounting information disclosure and lack supervision on environmental protection work.
- ISO environmental certification has a non-standardized coefficient of -4.570, T value of -2.404, and the probability corresponding to T value is 0.019, which is smaller than 0.05. It thus passes the T significance test, indicating a significant impact on the dependent variable. It also reflects that environmental protection of listed energy companies in Guangdong is not geared to international standards.
- Government environmental protection subsidies have a non-standardized coefficient of 14.723, T value of 7.839, and the probability corresponding to T value is 0.000, which is smaller than 0.05. It thus passes the T significance test, indicating that this factor is an important factor affecting environmental accounting information disclosure quality. It also reflects that government subsidies can increase corporate environmental awareness, thereby enhancing the overall effect of environmental protection.

5.1.4 Residual analysis of the regression equation

In the regression analysis of dependent variable and independent variable, the regression model has practical significance only if the residual obeys normal distribution. To test whether the residual obeys normal distribution, this paper performs corresponding analysis and testing through regression standard histogram and regression standard P-P plot, as shown in Figures 1 and 2:
From the residual distribution histogram and residual distribution P-P plot, it can be known that the residuals almost obey normal distribution, and scattered points of the regression standardized residuals are basically distributed near the oblique line, so the regression model has practical significance. From descriptive statistical analysis of the variables and multiple regression analysis of the constructed regression equation, we can know that the regression model is established. Where, the constant, proportion of tradable shares, proportion of independent directors, ISO environmental certification and government environmental protection subsidies have all passed the significance test, and the
corresponding non-standardized coefficients are respectively 35.183, -7.8889, -55.858, -4.570, 14.723. Thus, the multiple linear regression equation is finally derived:

$$Y = 35.183 - 7.889X_2 - 55.858X_4 - 4.570X_5 + 14.723X_6$$

6. Conclusion

After empirical analysis on the factors influencing environmental accounting information disclosure of listed energy companies in Guangdong, this paper draws the following conclusions:

- The environmental accounting information disclosure quality of listed energy companies in Guangdong is not significantly related to company size and profitability. That is, Hypothesis 1 and Hypothesis 3 fail to pass the significance test. This shows that large companies and companies with strong profitability lack environmental protection awareness, and management generally ignores corporate environmental responsibilities in the effort to expand company scale and increase economic benefits. It also shows that market conditions and environmental regulations fail to motivate companies with strong profitability, leading to their low initiative and enthusiasm for environmental information disclosure. Therefore, the government needs to strengthen environmental protection publicity, enhance investors' environmental protection awareness, thus making them change investment concepts and pay more attention to corporate environmental accounting information, so that energy companies improve their environmental accounting disclosure quality.

- Environmental accounting information disclosure quality of listed energy companies in Guangdong is negatively correlated with the proportion of tradable shares. That is, under higher proportion of tradable shares, environmental accounting information disclosure quality is lower, which is contrary to the original hypothesis (hypothesis 4). The results show that ordinary investors in the Guangdong capital market are still immature, and disclosure of environmental accounting information and corporate performance information plays little reference role in investors’ decision-making. Instead, they are more concerned about speculative investment, and their recognized company value in the market does not cover the company's environmental performance. Therefore, it is necessary to strengthen risk education and concept education on stable investment among ordinary investors, while increasing the publicity of environmental protection awareness.

- The proportion of independent directors has a significant impact on environmental accounting information disclosure quality of listed energy companies in Guangdong, but the correlation between the two is negative. That is, they change in opposite directions, and the empirical results are contrary to the original hypothesis. Although the number meets the relevant requirements, independent directors of Guangdong energy companies play poor supervisory role in the environmental accounting information disclosure of energy companies. Therefore, the government and the companies must strengthen governance over company internal structure to achieve effective supervision of the management by independent directors.

- Environmental accounting information disclosure quality of listed energy companies in Guangdong has a negative correlation with the index of whether the listed company has passed ISO environmental certification. That is, companies that have passed ISO environmental certification have ever lower environmental accounting information disclosure quality, which is inconsistent with the expected hypothesis (hypothesis 8). This shows that listed energy companies in Guangdong Province lack awareness of and attention to ISO environmental management system, with a large gap with the international level, which needs to be corrected in the future.

- Environmental accounting information disclosure quality of listed energy companies in Guangdong is positively correlated with the index of government environmental protection subsidies. That is, energy companies with government environmental protection subsidies are more willing to improve environmental accounting information disclosure quality, which is in line with the expected hypothesis (Hypothesis 7). In addition, this variable is highly significant.
at the 0.05 level, indicating that government environmental protection subsidies serve as an important factor affecting environmental accounting information disclosure.

- Due to the high correlation between asset-liability ratio, foreign investment ratio and company size, they are not selected as independent variables in this paper. Also, considering their small impact on environmental accounting information disclosure of energy companies, these two variables are excluded in the empirical analysis.

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