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Research on the Correlation Between Improved Corporate Composite Scores and Stock Prices in the Context of Carbon Neutrality

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Abstract: The stock market attracts many investors because of its high risk and high return characteristics. Therefore, it is of strong practical value to find a scientific and effective evaluation method for listed companies and explore its relationship with stock prices. This article combines the financial and non-financial data of listed companies from 2020 to 2023 to provide a composite score for companies based on the improved Wall Marking Way, and uses the Pearson correlation coefficient and regression analyses to investigate the correlation between the score on stock value. It is found that there is a significant positive correlation between comprehensive score and stock price, which proves the feasibility of the scoring method. On this basis, this article further explores the relationship further through regression analysis. The experimental results provide a scientific and reasonable index for evaluating the comprehensive ability of enterprises, and also provide an important reference basis for investors' investment decisions.

Keywords: Wall Marking Way, stock price, relevance analysis.

1. Introduction

The stock market, as an important part of the financial market, is favoured by the majority of investors because of its high liquidity, high risk and high return, and a relatively sound information disclosure mechanism. In the context of global warming and the policies of carbon neutrality and carbon peaking (dual-carbon), the green sustainability of enterprises also has an impact on their stock prices to a certain extent. Exploring how to synthesise the operating conditions and sustainable development potential of an enterprise to make a reasonable assessment of its stock price is of great significance to both the enterprise and investors.

A number of scholars have previously studied the factors associated with stock prices. A study found that there is a correlation between the overall financial indicators and the stock price, among which the earnings per share (EPS) indicator has the most significant correlation with the stock price [1]. It has also been shown that there is a significant correlation between corporate profitability indicators and investors' excess returns in the stock market [2]. As early as the beginning of the 20th century, Wall Alexander proposed a comprehensive method of evaluating the financial condition of a business, known as the Wall Marking Way [3]. This methodology provided a rational assessment of the value of a business through the consolidation of corporate financial data, but it had certain

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flaws in the selection of financial indicators and other aspects. Nonetheless, scoring listed companies by the improved Wall Marking Way still clearly revealed a significant correlation between their composite scores and stock prices moving in the same direction [4]. This proved the feasibility of Wall Marking Way scoring in stock price evaluation.

However, it has also been shown that purely financial factors cannot adequately assess their stock prices. Lian (2021) noted that the fluctuation of the stock price is related to its published financial data but the degree of fit is not high [5]. Some studies have shown that a number of non-financial factors including national policies and innovation activities would also have a great impact on the enterprise's share price [6,7]. China has responded positively to the call of the United Nations by issuing a series of national-level ‘dual-carbon’ policies to encourage enterprises to green their operations. By analysed the impact of issuing green bonds on share price through the event study method, Lei found that the issuance of green bonds has a positive impact on the stock market [8]. In another word, the market has a positive attitude towards green finance. On this basis, it has also been shown that carbon performance has a positive impetus to both corporate financial performance and stock price performance [9]. Furthermore, there was a positive correlation between carbon neutral scores and share prices, and the correlation was getting stronger year by year [10].

In summary, the stock price has obvious correlation with the financial data of enterprises, but at the same time, it is affected by other non-financial factors. This paper selects the carbon neutral scoring which is in line with the current policy direction as a non-financial factor, combines with the financial factors to provide comprehensive scoring of the enterprises and verify its correlation with stock prices.

The study is in line with the direction of world environmental protection development, and provides enterprises with self-assessment standards and guidelines for development in the context of international environmental protection. It is of great significance to the healthy development of enterprises. In addition, this article correlates that scoring criteria with stock prices to provide reference for investors to reasonably assess the value of enterprises. This facilitates investors to make more rational investment decisions in the financial market, which in turn helps the healthy development of the financial market. In addition, the score focuses on Environmental, Social and Governance (ESG) aspects at the same time, integrating carbon emissions, social responsibility and corporate financial data, which is a kind of scoring criteria in line with the ESG concept, and is conducive to promoting high-quality and sustainable development of enterprises and society.

2. Method

2.1. Data Source

All data in this article is from the Wind database. The time span is from the first quarter of 2020 to the fourth quarter of 2023. The data includes financial data of listed companies in China's A-share market, stock prices and HuaZheng Carbon Neutral Ratings.

2.2. Variable Selection

In terms of enterprise scoring, this article is based on the Wall Marking Way, combines enterprise financial indicators and non-financial indicators (carbon neutral scores) to assess the comprehensive status of enterprises. The specific scoring indicators are shown in Table 1.

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Table 1: Enterprise Scoring Indicators

Type of Indicator	Indicator Name	Formula	Logogram
Financial Indicators	Earnings per share (EPS)	$\frac{net\ profit}{total\ shares}$	X_1
	Return on net assets (ROA)	$\frac{net\ profit}{owners'\ equity} \times 100\%$	X_2
	Net profit margin	$\frac{net\ profit}{revenues} \times 100\%$	X_3
	Accounts receivable turnover ratio	$\frac{revenues}{accounts\ receivable}$	X_4
	Inventory turnover rate	$\frac{revenues}{inventory\ value}$	X_5
	Total asset turnover	$\frac{revenues}{total\ assets}$	X_6
	Current ratio	$\frac{current\ assets}{current\ liabilities}$	X_7
	Shareholder equity ratio	$\frac{owners'\ equity}{total\ assets} \times 100\%$	X_8
	Net asset value per share	$\frac{owners'\ equity}{total\ shares}$	X_9
Non-financial Indicators	Carbon neutral score	Ratings from C to AAA correspond to scores from 60 to 100	X_{10}

As shown in Table 1, nine financial indicators and one non-financial indicator were selected for the report to provide a composite score for companies. The aspect of financial indicators is mainly evaluated from four aspects, namely, profitability (X1, X2, X3), operating capacity (X4, X5, X6), solvency (X7, X8) and intrinsic value (X9) of the enterprise. The non-financial indicators are quantitatively converted based on the carbon neutral rating. It is worth clarifying that all financial data is broken down on a quarterly basis, but carbon neutrality ratings are given on an annual basis, so a company's carbon neutrality score will not change over the course of the year.

2.3. Method Introduction

2.3.1. Treatment of Scoring Indicators

Since there are many companies in different industries in the A-share market, the way of scoring based on the Wall Marking Way using industry averages as a benchmark is no longer applicable. Therefore, this article will firstly use the linear interpolation method for comprehensive scoring according to Formula (1), converting each indicator to a score from 0 to 100 respectively.

$$F_{X_i} = \frac{X_i - \min(X_i)}{\max(X_i) - \min(X_i)} \times 100 \quad (1)$$

In Equation (1), X_i represents the scoring indicator, $\min(X_i)$ and $\max(X_i)$ represent the minimum and maximum values of the indicator respectively, and F_{X_i} represents the score of the indicator after conversion. In particular, the maximum and minimum values are selected in such a way that individual very large and very small values are excluded, thus ensuring that the scores are not affected by individual extremes of data.

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2.3.2. Weighting Factor

In order to reasonably evaluate the overall situation of the enterprise, this article refers to previous studies and fine-tunes the weight coefficients of each indicator according to the importance of each indicator and its impact on investors, as shown in Table 2.

Table 2: Indicator Weights

Capacity indicators	Indicator logogram	Weights (ω_i)
Profitability	X_1	20%
	X_2	15%
	X_3	15%
Operating capacity	X_4	5%
	X_5	5%
	X_6	5%
Solvency	X_7	5%
	X_8	5%
Intrinsic value	X_9	15%
Sustainability	X_{10}	10%

As shown in Table 2, corporate profitability as the core competitiveness of listed companies is the most important indicator for investors and therefore accounts for 50%. Operating capacity is greatly influenced by the subjective factors of the enterprise management, so the coefficient of weighting is not suitable to be too high, at 15%. Solvency reflects a company's ability to withstand debt risk, but debt risk is usually low in the normal course of a listed company's production and operations, so it accounts for 10%. The intrinsic value of a company is an important basis for supporting its stock price, so it accounts for 15%. Sustainability is in line with the policy direction, however, taking into account that industries such as the chemical industry are at a significant disadvantage due to their own special characteristics, so it accounts for 10%.

2.3.3. Comprehensive Scoring Methodology

A comprehensive scoring model was constructed based on the fundamentals of the Wall Marking Way, as shown in Equation (2).

$$S = \sum_{i=1}^{10} \omega_i F_{X_i} \tag{2}$$

In Equation (2), ω_i represents the weight corresponding to each indicator and S represents the overall score of the enterprise, which takes values from 0 to 100.

2.3.4. Correlation analysis Methodology

This article will use SPSS software to analyse the correlation between the composite scores of listed companies and stock prices. In this article, Pearson correlation coefficient is chosen to test, the specific test method is shown in Formula (3).

$$\rho_{SP} = \frac{COV(S,P)}{\sqrt{D(S)}\sqrt{D(P)}} \tag{3}$$

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In Formula 3, S is the company's composite score, P represents the stock price. To further test the correlation between composite scores and stock prices, regression analyses will be performed using SPSS software.

3. Results and Discussion

3.1. Enterprise Composite Score Results

Since the selected financial indicators are not applicable to the financial sector, listed companies in the financial sector were excluded from the composite score calculation. Meanwhile, companies listed after 2020 and some companies with incomplete financial data were excluded, and finally the complete comprehensive score indicators of 3472 companies were obtained. The distribution of company scores is shown in Figure 1.

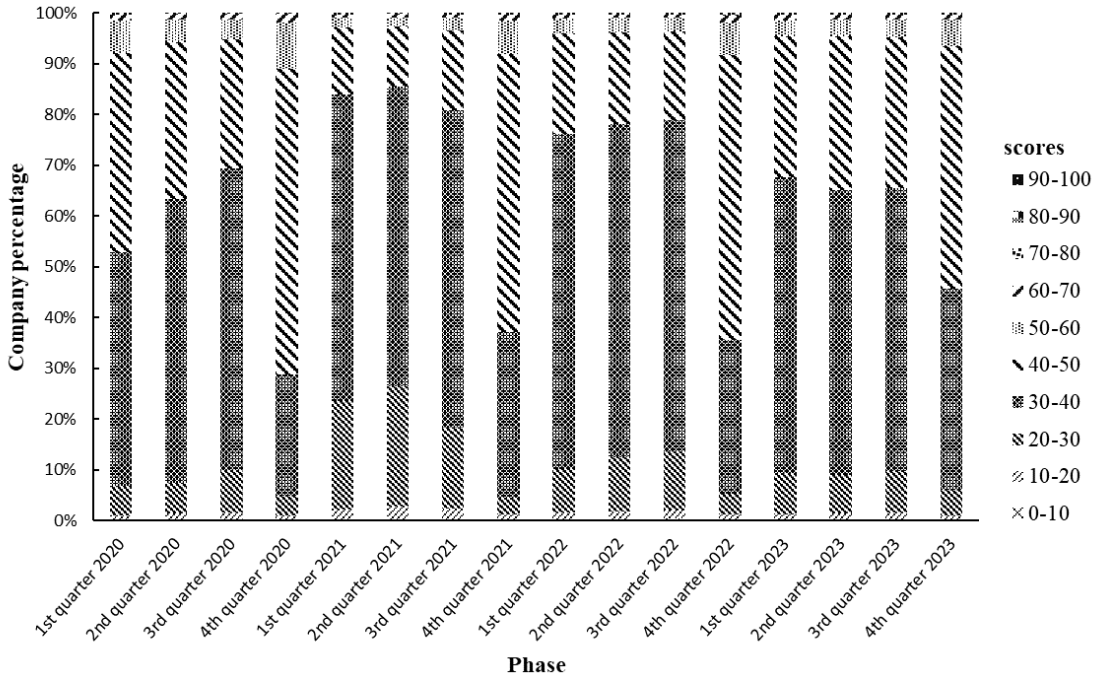

Figure 1: Company Score Distribution

As can be seen in Figure 1, the majority of companies' scores are concentrated in the range of 30 to 50, which is about 80% of the total number of listed companies, and decreases to both sides.

In the first quarter of 2020, the majority of companies with a score of over 50 were in food and new energy, with low scores for technology companies. However, in the fourth quarter of 2023, the number of companies in the technology and healthcare sectors has increased considerably among the companies with a score of over 50. This shows that China's new energy industry has strong comprehensive strength and rapid development of high-tech industry, which is in line with the development direction of China's ‘dual-carbon’ policy objectives.

3.2. Correlation Analysis Results

Correlation analyses were conducted by randomly selecting 100 companies from all 3,472 companies in the A-share market that received a composite score. These samples represent 2.88% of all scored companies, of which 61 companies are listed on the Shenzhen Stock Exchange (SZ), accounting for 3.01% of the total number of scored stocks on the SZ, and 39 companies are listed on the Shanghai

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Stock Exchange (SH), accounting for 2.70% of the total number of scored stocks on the SH. The distribution of the sample scores was approximately the same as the population. The sample selected was therefore considered representative.

Pearson's correlation coefficient was used to analyse the correlation between the scores and stock prices of the sample companies on a quarterly basis. The results of the analysis are shown in Table 3.

Table 3: Correlation Analysis Results

Year	Quarter	Correlation Coefficient	Significance
2020	1st	0.638	<0.001
	2nd	0.604	
	3rd	0.575	
	4th	0.511	
2021	1st	0.658	<0.001
	2nd	0.644	
	3rd	0.658	
	4th	0.593	
2022	1st	0.635	<0.001
	2nd	0.660	
	3rd	0.652	
	4th	0.631	
2023	1st	0.703	<0.001
	2nd	0.710	
	3rd	0.707	
	4th	0.638	

As shown in Table 3, the correlation coefficients between corporate composite scores and stock prices for the four years analysed are greater than 0.5 and the significances less than 0.001, indicating a significant positive correlation between corporate composite scores and stock prices. This suggests that the scoring methodology is generally reasonable. In addition, the correlation between corporate composite score and stock price generally shows an increasing trend from 2020 to 2023, indicating that the correlation between the two variables is increasing. This indicates that the scoring methodology is in line with current trends in business development and investor interest.

3.3. Regression Analysis

As the correlation between the composite score and share price of the above 100 sample companies for the second quarter of 2023 is the strongest, the data for this period is selected for regression analysis. Meanwhile, in order to exclude the interference of other factors on the stock price, the control variables List Age and Firm Size (natural logarithm of total assets for the year) are added to the regression analysis. The results of regression analysis are shown in Table 4-5.

Table 4: Model Summary[b]

Model	R	R-square	Adjusted R-square	Errors in standard estimates	Durbin Watson
1	0.718[a]	0.530	0.516	25.4444460	1.920

a. predictor variable: (constant), S, List Age, Firm Size
b. dependent variable: P

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As can be seen from Table 4, in the linear regression model with the company's composite score as the independent variable and stock price as the dependent variable, the adjusted R-square of the model fit index is 0.516, which is more than 0.3. This indicates that the composite score explains 51.6% of the reasons for the change in the stock price, which is a high degree of goodness-of-fit.

Table 5: Coefficient[a]

Model	Unstandardised coefficient		Standardised coefficient	t	significance
	B	Standard error	Beta		
(constant)	-47.827	43.510		-1.099	<0.001
S	3.247	0.359	0.705	9.041	<0.001
Size	-1.355	2.190	-0.049	-0.619	0.538
List Age	-9.545	4.981	-0.145	-1.916	0.058

a. dependent variable: P

From the regression results in Table 5, it can be seen that the constant of the regression coefficient is -47.827 and the significance is less than 0.001, indicating that the constant term is significant. The regression coefficient for the composite score is 3.247 and the significance is less than 0.001, indicating that the score term is significant. Meanwhile, the t-value is 9.967 which is greater than 0, indicating that S and P are significantly and positively correlated at the 0.05 level, which is statistically significant, meaning that the positive correlation between the composite score and the stock price is established.

The significance of the control variables List Age and Firm Size are greater than 0.05 indicating that there is no significant correlation between them and stock prices. In addition, it is noted that there is a more pronounced negative correlation between list age and stock price, which deviates from the general perception. It is surmised that the market may have lowered its expectations for companies with a longer list age because of saturated market demand and the fact that corporate restructuring and technological innovation tend to take a longer period of time. In contrast, newly listed companies have high development potential and investors are unfamiliar with the companies, which can lead to information asymmetry and other issues that cause the market to overestimate their stock prices. Therefore, equation (4) is the corresponding linear regression equation.

$$P = 3.247 \times S - 47.827 \tag{4}$$

The regression model was tested for significance. The F-test was passed by giving the value of F-statistic as 36.148 with significance less than 0.001. It indicates that S has a great effect on P in the regression model that is, there is a significant correlation between the company's composite score and the stock price in the model. This article next presents a diagnostic analysis of the regression model.

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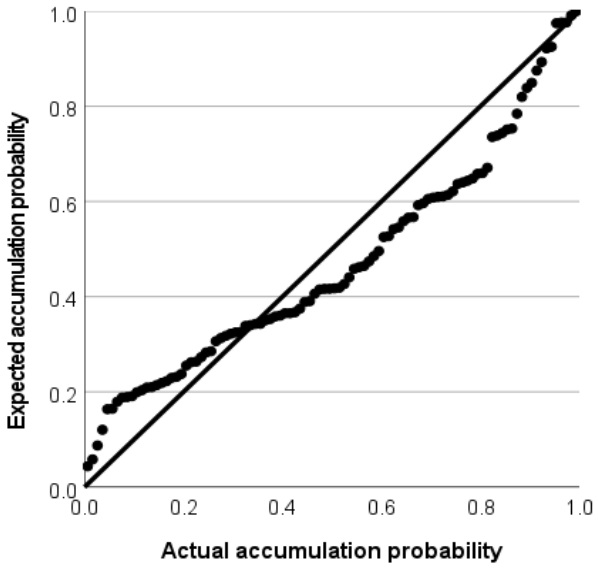

Figure 2: Normalized P-P Plots of Regression Standardized Residuals

Diagnostic analysis of the regression model, as shown in Figure 2, revealed that the normally distributed P-P plot of the standardised residuals approximated a diagonal line, but the fit was not very good. It is speculated that it is caused by the existence of individual abnormal data in the 100 samples drawn, but it does not affect the overall reasonableness of the regression model.

Overall, this article innovatively incorporates the carbon neutral score in line with the ESG concept as a non-financial factor into the comprehensive quality assessment of enterprises, which makes the scoring system more practical reference value. The increasing correlation between corporate scores and stock prices also reflects that the conclusions drawn from this method are increasingly recognised by the market, which is in line with the current direction of development. Compared with the previous scoring method that only considered financial data, this scoring method significantly improves the correlation between scores and stock prices, and improves the explanatory strength of the regression model. This proves that corporate development should not be limited to financial data, but also consider aspects such as social responsibility and environmental protection. Investors' investment decisions should also consider non-financial factors such as corporate responsibility in order to create a healthier financial market.

4. Conclusion

This article assessed the comprehensive status of enterprises by constructing a comprehensive scoring model. Combined with the stock price of A-share listed companies from 2020 to 2023, the reasonableness of the scoring model was tested by correlation analysis and regression analysis methods, and the regression equation was given.

During the analysis, this article used Pearson's correlation coefficient to analyse the correlation between composite score and stock price. It is found that there is a significant positive correlation between company score and stock price and the correlation is increasing year by year. It shows that the company scoring method is basically reasonable and in line with the direction of corporate development. By further constructing a regression model to quantitatively explore the relationship between scores and stock prices, it is found that the scores can explain nearly half of the stock price changes, which has strong practical value.

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This article still has some limitations and needs further research. There is no industry-specific discussion in the corporate scoring process, and the weights of scoring indicators in different industries should be adjusted according to the different industry focuses. However, in this article, in order to simplify the scoring method and take care of all listed companies, the weight coefficients used are all the same, which is not in line with the actual situation. In addition, the non-financial factors used in this article are time-sensitive, so the specific application process should be based on the policy and other factors to select the factors that are in line with the current direction of development to be included in the score. It is worth mentioning that the comprehensive scoring methodology of this article aims at assessing the comprehensive capability of enterprises through their fundamentals, which is mainly applicable as a reference for long-term value investment.

Finally, it is hoped that the composite scoring methodology and regression model in this article can be a major reference for stock market investors' investment decisions. It may also be helpful for enterprises to judge their own comprehensive ability and improve their core competitiveness in the financial market.

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