An Examination of the Effects of Corporate Social Responsibility on Corporate Financial Performance

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Abstract: This study aims to examine the influence of CSR on the financial performance of firms. The analysis utilizes pertinent data from Chinese A-share manufacturing firms listed on the Shanghai and Shenzhen stock exchanges, covering the period from 2012 to 2022. The text analysis method of machine learning is used to construct CSR indicators. The empirical analysis results show that CSR has a significant positive impact on corporate financial performance, and the results remain consistent after endogeneity treatment. Based on this, insights are presented in terms of both CSR measurement and endogeneity treatment.

Keywords: CSR; CFP; Textual Analysis Method; System of Linked Equations Estimation

1. Introduction
Since the reform and opening up, China's corporate social responsibility has been explored around the transition to a great economic system, and has gone through four stages: the period of absence and misplacement, the period of differentiation and exploration, the period of rapid growth, and the period of innovation and standardization[1]. In the past, incidents such as "Tukeng Pickles" damaged the interests of all parties to varying degrees, which was an individual manifestation of the failure of enterprises to fulfill their social responsibility. In 2006, the Shenzhen Stock Exchange issued the Guidelines on Social Responsibility of Listed Companies, which marked a new stage in the development of social responsibility of listed companies in China. Since then, more and more enterprises in China have actively fulfilled their social responsibility, published their CSR reports and actively invested resources to strengthen the construction of CSR, which has been a pivotal factor in illustrating the fulfilment of social obligations by other enterprises in China. At present, the overall level of CSR in China is not high, still in the initial stage, and there are many challenges in the fulfillment of CSR[2]. As the micro subject of the reform of the market economy system, enterprises can only be based on the long term, focus on the future, and balance the economic interests and social responsibility, so as not to be eliminated in the market economy.

2. Review of Literature
The idea of CSR was originally proposed by Bowen in 1953, arguing that companies should base their policies and actions on the overall goals and values of society[3]. Currently, CSR focuses on enhancing the welfare of stakeholders by responding to their demands[4]. Measurement of CSR usually uses third institutional rating data[5], but in recent years, scholars have also conducted research by analyzing the readability and intonation of CSR reports[6], whereas textual analysis methods using word frequency statistics are still relatively rare.

Firm performance is an indicator of the slow organization's ability to achieve its goals and perform effective management[7]. It is primarily assessed using financial metrics, including return on equity and return on assets, while market indicators such as Tobin's Q and stock returns have limited application due to the weak effectiveness of the Chinese market[8]. The theory of maximizing shareholder value emphasizes "shareholders first", while stakeholder theory emphasizes the importance of all stakeholders, which provides a theoretical basis for CSR research[9]. Information transfer theory addresses the issue of information asymmetry within the market, highlighting the beneficial effects of timely disclosure of corporate CSR information on

both branding and financial performance.[10].
Research on the impact of CSR on corporate financial performance produces differences in results due to varying measures, different variable selection and industry aggregation[11]. Most of the studies show a positive impact relationship between CSR and firm performance; some of the studies found that CSR has been demonstrated to exert a detrimental influence on the performance of firms[12] and other studies have shown that there is a nonlinear relationship between the optimal level of responsibility for CSR itself[13], which is mainly affected by the degree of marketization and the nature of corporate property rights[14]. Studies have shown that marketing ability, corporate social capital, and technological innovation play a mechanism role between the two[15]. Other scholars analyze the relationship from the perspectives of financing constraints[16], the intensity of market competition and media attention[17].

Currently, there is no uniform standard for the measurement of CSR, but more scholars use data from third institutional rating agencies for research and analysis, and fewer use text analysis to measure CSR. The marginal contribution of this paper is mainly reflected in the following two aspects: on the one hand, the use of text analysis method in machine learning to convert unstructured data into structured data to measure CSR, expanding the measurement method of CSR. On the other hand, the great likelihood function estimation of the joint equation model to alleviate endogeneity and the robustness test based on the endogeneity-treated results are innovative in the empirical research method.

3. Research Design

3.1 Data Sources
This study object focuses on manufacturing companies listed on the A-share markets of Shanghai and Shenzhen in China, covering the period from 2012 to 2022.The CSR reports of listed companies referenced in this study were obtained from the Juchao Information Website.(The vast majority of companies publish CSR reports annually, and in recent years companies have been publishing more ESG reports and sustainability reports in place of CSR reports, so this paper first collects

CSR reports, and then collects ESG and sustainability reports in place of CSR reports for the missing years); The basic information and financial data of enterprises are from the database of Wind and CSMAR. To minimise the impact of outliers on the findings and to guarantee the dependability of the data analysis results, this paper has conducted the following processing on the samples: (1) excluding samples from non-manufacturing firms; (2) eliminating samples with a higher number of missing data points. Ultimately, this results in 5,220 annual sample observations.

3.2 Model Setting
The benchmark regression model in this paper is shown in equation (1):
$$Hroa_{i,t} = \beta_0 + \beta_1 Lcsr_{i,t} + \sum Controls_{i,t} + \varepsilon_{i,t}$$
(1)where the explanatory variable is $Hroa_{i,t}$ for firm i's firm performance in t year, the core explanatory variable $Lcsr_{i,t}$ for firm i's social responsibility in t year, $Controls1_{i,t}$ for a set of control variables, and $\varepsilon_{i,t}$ for a randomized disturbance term. Year (Year) and industry (Ind) fixed effects are controlled for. For the above model, robust standard errors based on clustering at the individual firm level are used.

3.3 Definition of Variables
The Explained variable in this paper is firm financial performance (Hroa). (The explanatory variables were multiplied by 100 because the results are in the last few decimal places). The profitability of total assets (ROA), measured using total profit/total assets, and the net profit margin on sales (NPM), as a proxy for firm performance, measured using net profit/sales revenue, were selected for robustness tests.

The explanatory variable of this paper is corporate social responsibility (Lcsr). The construction steps are as follows: (1) Select seed words (Seed Words). As evidenced in reports such as the Blue Book of Corporate Social Responsibility, China Corporate Social Responsibility Research Report (2023) prepared by Li Yang et al, the seed words are manually screened. (2) Utilize Word2vec technology to train the words in the CSR and other reports as precursors, and screen the words with higher correlation with the meaning of the seed words. (3) Eliminate the repetitive words, irrelevant words and low-frequency words to get the CSR thesaurus.

(4) Add the thesaurus into the "jieba" lexical module, use Python open source "jieba" Chinese lexical module to lexicalize the text of the CSR report of listed companies, and count the number of CSR words in the report. A value of 1 should be added to take the natural logarithm (Lcsr) as a proxy indicator for corporate social responsibility (CSR). The control variable indicators are shown in Table 1.

Table 1. Definition of Main Variables

Variable type	Variable name	Variable symbol
Explained variables	Total Asset Profit Margin	Hroa
	Operating Profit Margin	NPM
Explanatory variable	Corporate Social Responsibility	Lcsr
	S Score	S
Control variable (Ctrl)	Corporate Age	Age
	Corporate Age Squared	Age2
	Two Positions in One Board of Directors	Dual
	Board Size	Board
	Administrative Expense Ratio	Mfee
	Asset-Liability Ratio	Lev
	Current Ratio	Liquid
	Current Asset Ratio	Cr
	Cash Flow	Cflow
	Corporate Ownership	Own
	Type of Size	Size
	Whether Heavy Pollution Industry	Pol
	Whether High-Tech Industry	HT
	Corporate Audit	Big4
	City of Corporate Location	City
	Region of Corporate Location	DQ

3.4 Endogenous Discussions

Corporate financial performance may be affected by external factors such as the economic environment, policies and regulations, and public opinion, as well as by internal factors such as corporate culture, management quality, and employee quality. Without controlling for these factors, the results can generate endogeneity problems by omitting variables. Consequently, this paper develops the CSR equation based on the benchmark regression model for corporate financial performance, and employs the joint equation model for full information great likelihood estimation to alleviate the possible endogeneity problem. Referring to Chen[18], this paper assumes that ε and μ obey a two-dimensional normal distribution with a mean vector of u and a variance matrix of Σ, that is $\binom{\varepsilon}{\mu} \sim N_2(u, \Sigma)$, among others:

$$u = \binom{0}{0}, \Sigma = \begin{bmatrix} \sigma_1^2 & \rho\sigma_1\sigma_2 \\ \rho\sigma_1\sigma_2 & \sigma_2^2 \end{bmatrix} (2)$$

In this context, $N_2(\cdot)$ represents the joint distribution function associated with a binary normal distribution. $N_2(\cdot)$ is the joint distribution function of the binary normal distribution, σ_1 and σ_2 are the standard deviation of ε and μ, ρ is the correlation coefficient, the log-likelihood function lnL_i for firm i is shown in equation (3):

$$ln L_i = -\frac{M}{2} ln 2\pi - \frac{1}{2} ln |\Sigma| - \frac{1}{2}\gamma_i' \Sigma^{-1} \gamma_i$$

(3)The likelihood function equation (3) is estimated with full information great likelihood to obtain the coefficient estimate of CSR β_1, and the estimation equation is shown in equation (4):

$$\begin{cases} Hroa_{i,t} = \beta_0 + \beta_1 Lcsr_{i,t} + \gamma \sum Controls_{i,t} + \varepsilon_{i,t} \\ Lcsr_{i,t} = \alpha_0 + \alpha_1 Lmx_{i,t} + \gamma' \sum Control_{i,t}' + \mu_{i,t} \end{cases}$$

(4)where $Lmx_{i,t}$ in the CSR equation is the firm's industry average CSR for the current year.

4. Empirical Analysis

4.1 Descriptive Statistical Analysis

Table 2 shows the descriptive statistics of the main variables. The mean value of Hroa, an indicator that measures corporate performance, is 5.282 and the standard deviation is 7.114, indicating that the performance of the sample companies fluctuates widely. The mean value of Lcsr, an indicator measuring corporate social responsibility, is 3.589 and the standard deviation is 0.801, indicating that the social responsibility of the sample enterprises is more variable. The remainder of the statistics pertain to the principal control variables and demonstrate significant divergence from the norm.

Table 2. Summary Statistics of Key Variables

Var	Obs	Mean	SD	Med	Min	Max
Hroa	5220	5.282	7.114	4.432	-61.274	96.864
Lcsr	5220	3.589	0.801	3.555	0.000	6.356
Age	5220	20.348	5.804	20.000	4.000	64.000
Age2	5220	4.477	2.699	4.000	0.160	40.960
Dual	5220	0.239	0.427	0.000	0.000	1.000
Board	5220	2.160	0.192	2.197	1.386	2.890
Mfee	5220	0.069	0.046	0.059	0.002	0.487
Lev	5220	0.444	0.187	0.453	0.008	1.345
Liquid	5220	2.239	3.064	1.540	0.106	104.667
Cr	5220	0.562	0.167	0.570	0.068	0.974
Cflow	5220	0.063	0.069	0.057	-0.450	0.726

4.2 Benchmark Regression Analysis

Table 3 presents the benchmark regression outcomes for the causal relationship between CSR and firm performance. Column (1) displays the results of the regression, which includes the main control variables, while controlling for the year and industry regressions, and the regression results demonstrate a statistically significant positive relationship between corporate social responsibility (CSR) and corporate performance at the 1% level of significance, with an impact coefficient of 0.508. Columns (2)-(6) illustrate the incremental incorporation of additional control variables, and the regression outcomes demonstrate that the impact coefficients of CSR on corporate performance are all markedly positive at the 1% level of significance. As the number of control variables increases, the impact coefficient declines. These findings collectively substantiate the assertion that CSR exerts a significant and positive causal influence on corporate performance.

Table 3. The Findings from the Benchmark Regression are Outlined Below

	(1)	(2)	(3)	(4)	(5)	(6)
	Hroa	Hroa	Hroa	Hroa	Hroa	Hroa
Lcsr	0.508***	0.507***	0.485***	0.484***	0.439***	0.424***
	(5.17)	(5.16)	(4.95)	(4.94)	(4.44)	(4.26)
Con	7.126***	5.216***	5.833***	5.048***	5.108***	5.359***
	(5.25)	(3.74)	(4.19)	(3.33)	(3.37)	(3.52)
Ctrl	Yes	Yes	Yes	Yes	Yes	Yes
Own	No	Yes	Yes	Yes	Yes	Yes
Size	No	No	Yes	Yes	Yes	Yes
Pol	No	No	No	Yes	Yes	Yes
HT	No	No	No	Yes	Yes	Yes
Big4	No	No	No	No	Yes	Yes
City	No	No	No	No	No	Yes
DQ	No	No	No	No	No	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes	Yes	Yes
N	5220	5220	5220	5220	5220	5220
R^2	0.477	0.480	0.484	0.484	0.485	0.486

Note: ***, **, and * denote significance at the 1%, 5%, and 10% respective levels; t-values calculated with standard error adjustment for clustering to the firm level are in parentheses.

4.3 Endogenous Treatment

Since the results of the benchmark regressions described above may suffer from endogeneity problems, this section of the paper deals with the endogeneity problem. The exogeneity requirement for instrumental variables is more absolute, while the joint equations are estimated using full information great likelihood estimation, which mitigates the endogeneity problem using only limited information. Table 4 illustrates the results of

the endogeneity treatment for the full information great likelihood estimation of the joint equations model. It can be observed that the correlation coefficient of the residuals of the two equations pertaining to corporate performance and CSR is -0.379, and it is significant at 1% level of significance, which proves that the estimation bias due to the existence of a negative correlation between the residuals of the two equations. At this juncture, the coefficient reflecting the effect of CSR on CFP is 3.270, which is markedly higher than the 0.424 benchmark regression coefficient presented in the preceding section. This suggests that the benchmark regression results may underestimate the impact of CSR on corporate performance due to the issue of omitted variables. Based on this, the subsequent robustness test is analyzed on the basis of the endogeneity processed

Table 4. The Results of the Endogeneity Treatment and Robustness Tests are Presented Herewith

Variant	(1)	(2)	(3)
Equation 1	Hroa	Hnpm	Hroa
Lcsr	3.270***	4.360***	
	(5.73)	(3.35)	
S			0.760***
			(5.38)
Con	-3.595	7.838	-48.734***
	(-1.52)	(1.38)	(-4.72)
Ctrl	Yes	Yes	Yes
Year	Yes	Yes	Yes
Ind	Yes	Yes	Yes
Equation 1	Lcsr	Lscr	S Score
Lmx	0.685***	0.755***	0.791
	(8.87)	(9.98)	(1.39)
Con	-0.882**	-0.900**	57.303***
	(-2.18)	(-2.17)	(15.33)
Ctrl	Yes	Yes	Yes
Year	Yes	Yes	Yes
Ind	Yes	Yes	Yes
Corr (ε_1, μ_1)	-0.379***		
	(-5.93)		
Corr (ε_2, μ_2)		-0.176***	
		(-2.65)	
Corr (ε_3, μ_3)			-0.737***
			(-10.96)
N	5220	5220	5220
LL	-21420.685	-26473.785	-33960.539

4.4 Robustness Tests

In the robustness test, the explanatory variable firm performance is firstly replaced as net sales margin (Hnpm). Net sales margin, as one of the important indicators of corporate profitability, is an important component of corporate financial performance. The net sales interest rate and CSR are estimated by the linkage system, and the results are shown in column (2) of Table 4, which indicates that the results are positive at the 1% significant level, with an estimated coefficient of 4.360, which indicates that the results are relatively robust, and that CSR significantly improves the corporate performance, which is consistent with the results of the baseline regression and the endogeneity treatment.

The S-score in CSI ESG mainly assesses employee management and welfare, diversity and inclusion, human rights, community relations, and consumer rights, which are similar to the stakeholders in CSR, and it also has an impact on corporate performance. Therefore it is reasonable to use the explanatory variable S score as a proxy variable for CSR. The explanatory variable corporate performance (Hroa) and S-score are estimated by the linkage system, and the results are presented in column (3) of Table 4,

indicating a significant positive relationship at the 1% significance level, with an estimated coefficient of 0.760, which means that the results are also relatively robust, indicating that CSR significantly improves corporate performance, which is consistent with the results of the baseline regression and the endogeneity treatment.

5. Conclusions and Implications of the Study

This paper first constructs CSR indicators by using textual analysis method, and captures the rich information contained behind the social responsibility reports issued by enterprises through in-depth excavation, avoiding the limitation of relying solely on third institutional data, making it more comprehensive and representative, and laying a solid foundation for the subsequent empirical analysis. In the empirical analysis, this paper initially verifies the impact of CSR on CFP. The results demonstrate that the impact coefficient of CSR on CFP is 0.424; after dealing with the endogeneity issue, the impact coefficient of the impact of CSR on financial performance is 3.270, so ignoring the endogeneity treatment may lead to underestimation of the real contribution of CSR to financial performance. Robustness tests further validate the above findings. This study has important implications: first, when measuring the level of CSR, we should not only rely on third institutional data, but also make full use of the textual information in the CSR report to reflect the CSR performance more comprehensively. Second, for the endogeneity problem, this paper proposes an effective treatment method, which provides a reference for subsequent research. In particular, in the case of instrumental variables that are difficult to satisfy the condition of absolute exogeneity, this method can effectively alleviate this difficulty, so as to carry out a more rigorous empirical analysis based on the results of the endogeneity treatment.

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