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Influence of ESG Performance on Stock Repurchase Decision of the Pharmaceutical and Biological Industry

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Abstract

The practice of ESG in the pharmaceutical and biological industry is directly related to public health and social trust. The correlation mechanism between ESG performance and capital operation behavior has a stronger research necessity and practical significance than other industries. This paper takes China's A-share listed companies in the pharmaceutical and biological industry from 2015 to 2024 as the research object to explore the impact of ESG on stock repurchases. The study found that the better the ESG comprehensive performance of Listed Companies in the pharmaceutical and biological industry, the more obvious their stock repurchase tendency, and the results were still robust after passing the endogenous test. The mechanism test found that the consumer confidence index was the intermediary variable, and ESG could promote stock repurchase by improving consumer confidence. Further heterogeneity analysis shows that ESG has a significant positive impact on stock repurchase in non-state-owned enterprises, while the impact is not obvious in state-owned enterprises.

Keywords

ESG performance, stock repurchase, consumer confidence index

1. Introduction

Driven by the tide of global sustainable development, ESG is a framework to measure the non-financial performance of enterprises. At the same time, with the rapid development of the capital market, stock repurchase, as a global payment policy, is widely used in the daily business activities of enterprises. As the cornerstone industry of public health, the pharmaceutical industry's R&D and production, the quality of drugs produced, the authenticity of R&D data, and the rationality of drug pricing are highly related to the three dimensions of ESG. The traditional repo decision research focuses on financial factors, but ignores the important role of ESG. Therefore, this paper focuses on the pharmaceutical industry and reveals the impact of ESG on stock repurchase decisions.

As one of the carriers of enterprise non-financial information, the existing research mainly focuses on the impact of ESG on enterprise financial performance and financing cost. Many scholars agree that there is a positive correlation between ESG performance and financial performance. The path for enterprises to promote their financial performance by improving their ESG performance is to improve the information transparency of enterprises and reduce the information asymmetry of enterprises [1]. The existing research on the impact of

ESG performance on the debt financing cost of enterprises can be mainly summarized into two kinds of Views: one is that there is a negative correlation between ESG performance and the debt financing cost of enterprises, and the other is that there is no significant correlation between the two.

Stock repurchase is the behavior of listed companies using their own funds or external financing to buy back the company's outstanding shares from the market. The existing research mainly focuses on the following factors: first, managers believe that the company's stock price is undervalued, to send a positive signal to the market, and then implement stock repurchase; Second, the repurchase of shares due to the failure of the company's equity incentive [2]. The study of stock repurchase has important practical significance for planning financial strategy, improving corporate governance, optimizing capital structure, improving corporate performance, defending against hostile takeovers, implementing employee incentive plans, and actively guiding stock prices[3]. The application of ESG in the biomedicine industry has been systematically discussed in the literature. The environmental concerns of the public can produce supervision and pressure, and urge pharmaceutical enterprises to improve their ESG performance.[4]. The research has been gradually extended in recent years. The research found that it has promoted the effective allocation of capital, and also encouraged pharmaceutical manufacturing enterprises to actively optimize the operation efficiency, which is very helpful to the financial performance of enterprises and can achieve sustainable development and long-term value growth [5].

However, there are still gaps in the pharmaceutical industry: 1. The pharmaceutical industry is market dependent, and investor sentiment will affect the repurchase effect, which has not been included in the regulatory framework in the existing studies. 2. There is a two-way causal endogeneity between ESG and repurchase. The existing research has a single treatment method, and the reliability of the conclusion needs to be strengthened. At present, there are few relevant studies on the direct relationship between ESG and stock repurchase. The research results of Majinfang (2025) show that there is an obvious positive correlation between the performance of enterprise ESG and stock repurchase behavior, which means that enterprises may be driven by ESG considerations when making stock repurchase decisions [6].

Combined with previous empirical studies, investor beliefs refer to investors' subjective views, perceptions, assumptions, and expectations of financial markets, assets, future economic conditions and their own investment ability [7]. Academia often uses the consumer confidence index as a proxy indicator of investor sentiment. The consumer confidence index can better reflect the sentiment of investors in the stock market [8]. At the same time, referring to the index selection part of gaozhenbin and liangxingbi [9], the consumer confidence index is used as an intermediary variable to put forward the hypothesis H1: the better the ESG comprehensive performance of Listed Companies in the pharmaceutical and biological industry, it may improve consumer confidence. Enterprises tend to send positive signals through stock repurchases, and the more obvious their stock repurchase tendency.

2. Research Design

2.1 Sample Selection and Data Sources

After 2015, A-share listed companies began to improve the relevant system of stock repurchase. This paper selected listed companies in China's A-share pharmaceutical and biological industry from 2015 to 2024, and selected listed companies in sub industries such as chemical pharmaceutical, traditional Chinese medicine, biological products, and medical devices as sample companies. On this basis, the data were processed: ① Eliminate the companies that are subject to st or *st and enter delisting procedures; ② Eliminate enterprises with missing data; ③ Eliminate the newly listed companies after 2015; ④ For continuous variables, 1% quantile tailing was performed.

2.2 Model Design and Variable Definition

Based on the research of Jin Ge [10], LEV, FCF, size, etc., are selected as control variables, and the research of Ma JinFang [6], the following model is constructed:

1. benchmark regression model:

$$\text{Logit}(\text{Repurchase\_D}_{it}) = \alpha_0 + \alpha_1 ESG\_\text{Score}_{it} + \sum_{k=2}^{n} \alpha_k \text{Control}_{kit} + \text{Firm}_i + \text{Year}_t + \varepsilon_{it} \quad (1)$$

Where I is the company, and t is the year. Repurchase_uis the D_{it}explained variable, which indicates the repurchase tendency of company I in year t. ESG_Score_{it} The explanatory variable, indicating the comprehensive performance of ESG. $Control_{kit}$For the control variable, the value of K is from 2 to n to avoid the ESG_Score_{it}deviation of the estimation result of the explanatory variable. $Firm_i$It is the fixed effect of enterprises and is used to control the individual differences of enterprises that do not change with time. ε_{it}Is a random error term.

2. intermediary variable regression model:

$$\ln CCI_{it} = \beta_0 + \beta_1 \times ESG\_Score_{it} + \sum \beta_i \times Control_{it} + Firm_i + Year_t + \varepsilon_{it} \quad (2)$$

3. total effect regression model:

$$\text{Logit}(\text{Repurchase\_D}_{it}) = \gamma_0 + \gamma_1 \times \text{ESG\_Score}_{it} + \gamma_2 \times \ln \text{CCI}_{it} + \sum \gamma_i \times \text{Control}_{it} + \text{Firm}_i + \text{Year}_t + \varepsilon_{it} \quad (3)$$

Table 1: definition of main variables

Variable type	Variable name	Variable definition
Explained variable	Repurchase_ D_{it}	Decision variables of whether listed companies implement stock repurchase in the current year
Explanatory variable	ESG_Score_{it}	Reflect the overall responsibility performance level of enterprises in the dimensions of environment, society and Governance
	E_Score	Score of environmental dimension in ESG rating
	S_Score	Score of social dimension in ESG rating
	G_Score	Score of governance dimension in ESG rating
Mediating variable	CCI_{it}	Consumer confidence index
Control Variable	Lev	Asset liability ratio, reflecting the level of financial leverage and debt paying pressure of enterprises
	FCF	Free cash flow, reflecting the cash resources at the disposal of the enterprise
	ROE	Return on net assets, reflecting the profit efficiency of enterprises' use of capital
	Growth	Reflect the future development level of the enterprise and affect the resource allocation of the enterprise
	Assets	total assets
	Dual	Two positions in one, the same person is 1, otherwise it is 0
	Growth_Rate	Growth rate of operating revenue
	Analyst_Following	Analysts track the number of people and control the impact of external supervision on repo
	TobinQ	Tobin Q value, control the impact of investment opportunities on repurchase
	Top10	Equity concentration reflects the degree of control of the largest shareholder over the enterprise
Firm individual fixed effect variable	$Firm_i$	Control the characteristics of enterprises that do not change with time
Time fixed effect variable	$Year_t$	Control the fixed impact that exists every year
Grouping variables	SOE	Reflect the ownership background of the enterprise

3. Descriptive Analysis

3.1 Descriptive Statistics

As shown in Table 2, all variables are 3053, indicating that the sample is balanced panel data without missing values. The mean value of the explained variable y (stock repurchase) is 0.200, indicating that about 20% of the observations in the sample have stock repurchase behavior, which conforms to the characteristics of binary variables. Observing the ESG_Score_{it} sample of core explanatory variables, there are great differences in ESG performance of enterprises. The average value of the dimensions of environment, society and governance was 1.330, 2.249 and 3.383, respectively, with the highest score of governance dimension and the lowest score of environment dimension, indicating that the sample enterprises were relatively good in governance structure and weak in environmental responsibility.

Table 2: Descriptive statistical results

variable	N	mean	sd	min	max
y	three thousand and fifty-three	zero point two zero zero	zero point four zero zero	zero	one
ESG_Score_{it}	three thousand and fifty-three	three point three zero six	three point one four four	zero	nine point six two zero
E_Score	three thousand and fifty-three	one point three three zero	two point zero five eight	zero	ten
S_Score	three thousand and fifty-three	two point two four nine	two point four eight two	zero	nine point eight three zero
G_Score	three thousand and fifty-three	three point three eight three	three point two six eight	zero	nine point nine two zero
lnAssets	three thousand and fifty-three	twenty point four three	five point zero three one	zero	twenty-six point one two
Analyst_Following	three thousand and fifty-three	five point six two seven	eight point three one four	zero	fifty-four
lnFCF	three thousand and fifty-three	ten point zero four	nine point four six two	zero	twenty-three point six seven
Lev	three thousand and fifty-three	thirty-one point six zero	twenty-seven point two six	zero	one thousand and twenty-eight
ROE	three thousand and fifty-three	fourteen point three seven	forty-five	zero	two thousand six hundred and eighty-five
lnGrowth_Rate	three thousand and fifty-three	one point nine six two	one point six seven six	zero	eleven point four six
TobinQ	three thousand and fifty-three	two point two zero three	two point nine six three	zero	seventy-six point zero nine
Top10	three thousand and fifty-three	twenty-eight point five eight	eighteen point seven zero	zero	one hundred
Dual	three thousand and fifty-three	zero point three six two	zero point four eight zero	zero	one

3.2 Correlation Analysis

As shown in Table 3, the correlation analysis table shows the Pearson correlation coefficient and its significance among variables. The correlation coefficient between windesg comprehensive score and stock repurchase (y) is 0.363, which is significantly positive at the 1% level, preliminarily supporting the hypothesis that ESG performance has a positive impact on stock repurchase. The correlation coefficient between some variables is high (for example, the correlation coefficient between the total assets of LN and the number of analysts tracking is 0.374), but it does not exceed 0.8, so it is preliminarily judged that there is no serious multicollinearity. Correlation analysis provides preliminary support for subsequent regression. The positive correlation between ESG and stock repurchase is significant, and the relationship between ESG and control variables basically meets the theoretical expectation.

Table 3: Correlation analysis results

	y	x	lnAssets	Analyst_Following	lnFCF	Lev	ROE
y	one						
x	0.363***	one					
lnAssets	0.195***	0.363***	one				
Analyst_Following	0.159***	0.0286*	0.374***	one			
lnFCF	0.108***	0.184***	0.298***	0.109***	one		
Lev	zero point zero zero nine five zero	zero point zero one two eight	0.276***	-0.0411**	0.0319**	one	
ROE	-0.0314**	-0.0281*	0.0598***	0.0383**	0.0373**	0.0538***	one
lnGrowth_Rate	-0.0416***	-0.0565***	0.251***	0.243***	0.0917***	0.0672***	0.108***
TobinQ	0.0384***	0.174***	0.0748***	0.265***	zero point zero zero eight three	-0.146***	zero point zero one nine three
Top10	0.0437***	0.130***	0.274***	-0.0251	0.136***	-0.004	zero point zero zero one five
Dual	0.0270*	0.0238*	0.118***	-0.0033	zero point zero zero three	-0.0396**	zero point zero one two four
continued							

4. Diagnostic Analysis

4.1 Benchmark Regression

As shown in Table 4, the benchmark regression table shows the four-column regression results of gradually adding control variables and fixed effects. Column (1): only addESG_Score_{it}, and do not use year fixed effect and individual fixed effect. The coefficient is 0.0462, which is significant at the 1% level, indicating that ESG performance has a positive impact on stock repurchase. Column (2): the year and individual fixed effect were added, and the coefficient decreased to 0.0309, which was still significantly positive. Column (3): add all control variables, and do not use year fixed effect and individual fixed effect. The coefficient is 0.0282, which is still significant. Further controlling the interaction between enterprise size and other variables, the coefficient is 0.0286, which is still significant. The benchmark regression results support the research hypothesis that the better the ESG performance of enterprises, the more likely they are to repurchase shares.

Table 4: benchmark regression results

	(1)	(2)	(3)	(4)
	Repurchase_D_{it}	Repurchase_D_{it}	Repurchase_D_{it}	Repurchase_D_{it}
ESG_Score_{it}	0.0462***	0.0309***	0.0282***	0.0286***
	(0.0023)	(0.0028)	(0.0032)	(0.0058)
control	control	control	control	control
$Year_t$	Uncontrolled	control	Uncontrolled	control
$Firm_i$	Uncontrolled	control	Uncontrolled	control
_cons	0.0471***	0.0478***	-0.7693**	-4.2286***
	(0.0062)	(0.0106)	(0.3123)	(0.7410)
N	three thousand and fifty-three	three thousand and fifty-three	three thousand and fifty-three	three thousand and fifty-three
adj.R2	zero point one three one nine	zero point one five nine zero	zero point zero nine five eight	zero point one four two zero

4.2 Endogenous Test

As shown in Table 5, the instrumental variable method and propensity score matching method are used in the endogenous test to alleviate possible endogenous problems. This paper selects the mean annual ESG of enterprises in the same industry as the tool variable. Before and after the control variables, the windesg score coefficients were 0.0443 and 0.0309, which were significantly positive, consistent with the benchmark regression results, indicating that the conclusion is still valid after considering endogeneity.

Table 5: instrumental variable method

	(1)	(2)
	Instrumental variable method	Instrumental variable method
ESG_Score_{it}	0.0443***	0.0309***
	(0.0028)	(0.0041)
control variable	Uncontrolled	control
$Year_t$	control	control
$Firm_i$	control	control
_cons	0.0535***	-0.7551**
	(0.0094)	(0.3122)
N	three thousand and fifty-three	three thousand and fifty-three
adj.R2	zero point one three one seven	zero point zero nine five five

As shown in Table 6, the PSM score tendency group is divided into high and low score groups according to the median of the ESG comprehensive score. The high score group is regarded as the processing group, and the treatment value is 1; The lower group is taken as the control group, and the treatment value is 0. The regression results after using the PSM score tendency are shown in the table below. The \u treated coefficient after matching is 0.1835, which is significantly positive, indicating that in the matched sample, ESG performance still has a significant positive impact on stock repurchase.

Table 6: PSM score tendency matching

	PSM scoring tendency
ESG_Score_{it}	
_treated	0.1835***
	(0.0174)
control variable	control
$Year_t$	control
$Firm_i$	control
_cons	0.1596***
	(0.0145)
N	three thousand and fifty-three
adj.R2	zero point zero three four eight

4.3 Mechanism Inspection and Analysis

As shown in Table 7, the mechanism test explores the path of ESG affecting stock repurchase by introducing the mechanism variable “LN consumer confidence index”. Column (1): ESG has a significant positive impact on the consumer confidence index (coefficient 0.0025). Column (2): adding ESG and consumer confidence index at the same time, the ESG coefficient is still significant, and the consumer confidence index is also significantly positive (0.3213), indicating that consumer confidence partially mediates the impact of ESG on stock repurchase. Column (3) (4): In a more complete control variable model, the conclusion is still robust, and the mediating effect of consumer confidence is significant. Verifying consumer confidence is one

of the important transmission mechanisms of ESG affecting stock repurchase, which supports the path hypothesis of "ESG market confidence repurchase decision".

Table 7: mechanism test analysis

	(1)	(2)	(3)	(4)
	$\ln CCI_{it}$	Repurchase_ D_{it}	$\ln CCI_{it}$	Repurchase_ D_{it}
ESG_Score_{it}	0.0025***	0.0274***	0.0122***	0.0186***
	(0.0009)	(0.0032)	(0.0011)	(0.0035)
control	control	control	control	control
$\ln CCI_{it}$		0.3213***		0.2874***
		(0.0727)		(0.0790)
_cons	-4.7076***	zero point seven four three four	-7.3777***	-2.1447**
	(0.0627)	(0.4641)	(0.2512)	(0.8492)
N	three thousand and fifty-three	three thousand and fifty-three	three thousand and fifty-three	three thousand and fifty-three
adj.R2	zero point zero seven seven nine	zero point one zero four zero	zero point two two six eight	zero point one one seven seven

4.4 Heterogeneity Analysis

As shown in Table 8, the regression is grouped according to the nature of enterprise ownership. The value of the state-owned enterprise group $ESG_Score_{it}$was 0.0279, which failed the test, indicating that ESG had little impact on the share repurchase of state-owned enterprises. For the non-state-owned enterprises group, the coefficient is 0.0278. The test at the 1% level shows that ESG has a significant positive impact on the stock repurchase of non-state-owned enterprises. This shows that state-owned enterprises are more subject to policy and administrative intervention, and their stock repurchase decisions are likely not to take into account the information from the market or the performance of ESG; While private enterprises attach great importance to their market image and investor relations, and their repurchase decisions pay more attention to the apparent state of ESG. In other words, the impact of ESG on stock repurchase is greater in non-state-owned enterprises, and the nature of enterprises is an important regulatory variable that can not be ignored.

Table 8: heterogeneity analysis

	(1)	(2)
	state-owned enterprises	Non state owned enterprises
ESG_Score_{it}	zero point zero two seven nine	0.0278***
	(0.0269)	(0.0060)
control	control	control
$Year_t$	control	control
$Firm_i$	control	control
_cons	-4.7896**	-3.8102***
	(2.1774)	(0.7860)
N	six hundred and twenty	two thousand four hundred and thirty-three
adj.R2	zero point zero nine one eight	zero point one five six six

5. Conclusion

Based on the sample of A-share listed companies in the pharmaceutical and biological industry from 2015 to 2024, this paper systematically explores the impact of ESG performance on corporate stock repurchase decisions, and uses the consumer confidence index as an intermediary variable, combining with a variety of methods to solve the endogenous problem. The core conclusions are as follows: the comprehensive performance of ESG has a significant positive impact on the stock repurchase tendency of pharmaceutical enterprises. The highest score of governance dimension and the lowest score of environmental dimension indicate that the sample enterprises are relatively good in governance structure and weak in environmental

responsibility. Enterprises with good ESG performance may enhance consumer confidence, thereby enhancing market reputation and stock price stability. Enterprises are more inclined to send positive signals through stock repurchase. It is concluded that consumer confidence is one of the important transmission mechanisms of ESG affecting stock repurchase, and the above conclusion is still reliable after robustness test and endogenous treatment.

From a small entry point into the pharmaceutical industry, the consumer confidence index was introduced to fill the middle link of ESG affecting the operation of enterprises, and the research path was further clarified. The endogenous problems caused by missing variables or reverse causal drive were solved by combining instrumental variables, PSM and other methods.

To sum up, this paper refines the industry to the pharmaceutical industry level from a theoretical perspective, breaking through the research on ESG and financial decision-making. For pharmaceutical enterprises, the relevant theoretical views are put forward, that is, we should pay attention to ESG construction and incorporate the governance dimension into the internal control system of stock repurchase, so as to continuously optimize the corporate governance structure; And we should pay attention to the problem of environmental dimension, increase capital investment and develop green technology; For investors, they can determine whether they are willing to repurchase shares according to the ESG performance of enterprises, and flexibly adjust their investment strategies according to the changes of market conditions at that time.

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Conflicts of Interest

The authors declare no conflict of interest.

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