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Environment, Social and Governance (ESG) Performance of listed companies in the Guangdong-Hong Kong-Macao Greater Bay Area: Towards the Development of an Enterprise Value Enhancement Program

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Abstract: With the increasing global attention on environmental protection, social responsibility and corporate governance (ESG), it is particularly important to study the ESG performance of listed companies. Through the data analysis from 2018 to 2023, there was a significant positive correlation between the three dimensions of ESG performance and enterprise value, among which the improvement of environment performance, social performance and governance performance can significantly promote the growth of enterprise value. However, when enterprises are grouped according to the level of pollution, ESG performance and social performance of enterprises in polluting industries are not significantly correlated with enterprise value, while environment performance is negatively correlated with enterprise value, and governance performance is significantly positively correlated. Enterprises in non-polluting industries show a significant positive correlation between the overall and various dimensions of ESG performance and enterprise value. Based on this, this research study proposed an enterprise value enhancement program for listed companies in the Greater Bay Area, aiming to comprehensively improve ESG performance and enhance enterprise competitiveness and market value through multi-dimensional measures.

Keywords: ESG Performance; Enterprise Value; Polluting Industries; Enhancement Program.

1. Introduction

With the increasingly prominent global environmental and social issues, corporate social responsibility and sustainable development are gradually taking center stage. As a vital component of the market economy, the production and operational activities of listed firms will exert a significant impact on the global ecological landscape, potentially reshaping both the environment and economic dynamics worldwide. Consequently, the ESG performance (ESGP) emerges not only as a crucial supplement for evaluating the high-quality development of these companies but also as a pivotal consideration for investors in their risk assessment and investment endeavours. In this context, the Guangdong-Hong Kong-Macao Greater Bay Area (GBA), serving as China's vanguard in realising "dual carbon" goals and advancing green development, bears the responsibility of spearheading China's sustainable development era. It is actively facilitating regional low-carbon transformation and upgrading. Consequently, the pursuit of enhancing enterprise value (EV) through improved ESGP of listed companies has become an urgent area of concern.

As a comprehensive index for measuring the enterprises' non-financial performance, ESGP measures an organization's development quality, business risk, and capacity for sustainable growth in three areas: corporate governance, social responsibility, and the environment. Lin Lin et al. (2023) noted that ESG considers environmental factors and the social impact of firms in a holistic way, which differs from the prior concentration primarily on the financial success of enterprises. Evaluating enterprise behaviour, it conveys value pursuits that financial performance alone could not capture in the past, emerging as a vital indicator of enterprise development. Several studies have demonstrated that improving a company's credibility and reputation, all of which increase a company's market value. Moreover, for listed companies requiring substantial financing, robust ESG performance can also bolster investor confidence and alleviate financing constraints, thus enabling them to secure more financial support.

Whether listed companies' ESGP has a significant impact on increasing EV has been the focus of a great deal of research, according to a sizable body of literature. According to Dalal et al. (2019), strong ESGP enhances financial success. Broadstock et al. (2020) uncovered that ESG practices can invigorate enterprise innovation, leading to improved business performance, thereby manifesting an indirect value effect of ESG. Gao et al. (2022), utilizing nonlinear regression and OLS regression, scrutinized whether enterprises could elevate corporate value through social responsibility initiatives, concluding a significant positive correlation. Additionally, Wong et al. (2021) argue that ESG certification significantly improves Tobin's Q while reducing enterprises' capital expenditures.

In the Greater Bay Area, listed companies wield influence in propelling China's regional economic and social advancement. As the nation increasingly prioritizes sustainable development and green finance, listed companies within the Greater Bay Area have also begun actively considering ESG factors on enterprise progression. As stated in the "2023 Greater Bay Area Listed Companies ESG Information Disclosure and Rating Performance Analysis Report" issued by the China Southern Finance and Economics International Forum, as of June 30, 2023, among the 1,269

listed companies in the GBA (including A-shares and Chinese-funded HK stocks), 679 had issued ESG, social responsibility, or sustainable development reports. This represents a disclosure rate of 53.51%, surpassing the national average disclosure ratio of listed companies, which stands at 40.43%.

Currently, there is also a dearth of research that integrates companies in the Greater Bay Area. Therefore, this study examined the correlation between EV and ESGP, focusing specifically on how governance, social, and environmental performance affected its value. Furthermore, it examined how ESG performance differentially affected enterprise value at different levels of environmental pollution. The study aimed to narrow the research gap in this field using Chinese data and provide valuable insights for advancing regional sustainable development.

2. Review of Related Literature

2.1. ESG Performance and Enterprise Value

2.1.1. Positive Relationship between ESG performance and Enterprise Value

Velte (2017) found that ESG performance positively impacts ROA but has no effect on Tobin's Q. Among the three ESG components, governance performance has the most significant influence on financial performance (FINP) compared to environmental and social performance. According to Dalal et al.'s (2019) regression analysis, superior ESG performance may greatly enhance financial success as measured by market and accounting metrics. ESG risks' moderating effect on the link between investment choices and EV was examined by Stiadi Doni (2023). The findings demonstrated that reducing ESG risks may improve how investment choices affect company value and support future expansion.

Chen Weili (2024) claims that ESG performance raises the E, and the EV is positively moderated by R&D investment. Likewise, Zhang Chen et al. (2024) discovered that successfully completing ESG obligations raises EV, underscoring the importance of active engagement in ESG practices, which embody the sustainability and responsibility of enterprises. Liu Zhuocong et al. (2023) observed that ESG ratings positively impact enterprise value, with adjustments made based on industry, region, and company attributes. Duan Fuzhen (2024) focuses on the ESG performance of businesses as the primary explanatory variable. ESG information and enterprise value were shown to be highly positively correlated, with debt and equity financing acting as intermediate factors that had a major impact on enterprise value. The data was gathered from A-share listed firms between 2013 and 2020.

Xue Tianhang et al. (2022) discovered that enhancing ESG performance can lead to reductions in financing costs, increased innovation input, improved profitability, and greater willingness among market entities, such as institutional investors, to invest in enterprises, thereby positively influencing enterprise value. Additionally, Wang Bo and Yang Maojia's (2022) research suggests that ESG performance significantly enhances both book value and market value of enterprises. They attribute this improvement to reduced financing costs and financial burdens, promoting the enhancement of book value, and to increased market attention and positive signals generated by fulfilling ESG responsibilities, thereby improving market value.

Based on a sample research of 4887 businesses worldwide, businesses with high ESG activity levels bring value to the market, particularly those that do well in the E, S, and G dimensions, according to Bhaskaran et al. (2020). Using data from 1,038 publicly traded firms across 22 European nations. De Lucia et al. (2020) discovered that FP (ROA and ROE) and ESG investment have a significant positive correlation. emphasizing the importance of ESG investment decisions for corporate long-term returns. Research by Chairani and Siregar (2021) shows that enterprise risk management (ERM) in the ASEAN region has a noteworthy favorable effect on FP and EV, and ESGP has a major moderating influence. especially in sensitive industries, this moderating effect is more obvious.

Based on a survey of over 4,000 businesses across 58 countries, Aouadi and Marsat (2018) discovered that while EV is connected to ESG concerns, their impact depends on the interaction of corporate social performance (CSP) scores, with high CSP scores only affecting high Significant effects are shown in attention companies, which are mainly related to the company's reputation in social and visibility.Overall, significant differences exist in the impact across various regions, industries, and ESG dimensions, revealing that companies need to develop ESG strategies based on local conditions to achieve maximum value addition.

2.1.2. Negative Relationship between ESG Performance and Enterprise Value

Fatemi et al. (2018) discovered that ESG characteristics contribute to enterprise, while ESG concerns reduce it. Additionally, for firms with ESG strengths, disclosure negatively correlates with enterprise. Landi and Sciarelli (2019) observed that in Italy, socially responsible investments (SRI) have no statistically significant impact on market premiums. Duque-Grisales and Aguilera-Caracuel (2021) demonstrated a significant negative correlation between ESG scores and financial performance (FP), with environmental, social, and governance dimensions individually showing negative correlations with FP in Latin American countries. Garcia and Orsato (2020), analyzing data from 2,165 companies in developed and emerging markets, concluded that institutional weaknesses in emerging markets result in a negative relationship between ESG scores and financial performance.

2.1.3. Mixed Relationship between ESG Performance and Enterprise Value

Han et al. (2016) observed that environmental performance scores of Korean firms exhibit a negative or U-shaped relationship with financial performance (FP), while governance performance scores show a positive or inverted U-shaped relationship. No significant link was found between social performance scores and FP. Regression study by Atan et al. (2018) indicates that individual or aggregate ESG components do not significantly correlate with FP (ROE) or EV (Tobin's Q). Saygili et al. (2022) argue that financial performance (FP) is negatively impacted by environmental disclosure. whereas stakeholder engagement improves operational efficiency in the social dimension. Giannopoulos et al. (2022) discovered that ESG initiatives had a conflicting effect on ROA, with a negative influence on ROA. However, Tobin's Q increased as ESG scores increased. The impact of ESG on EV is not bidirectional, as Behl et al. (2022) determined that there is a latency effect. The first two delays exhibit negative correlations, while the final lag exhibits a positive correlation. Lopez-de-Silanes et al. (2020)

emphasized a strong link between ESG disclosure and information quality, which linked ESG to risk reduction. However, they observed that risk-adjusted FP was minimal or nonexistent.

2.2. Environment, Social and Governance (ESG) Performance and Enterprise Value

Broadstock et al. (2021) found that high ESG portfolios generally outperform low ESG portfolios. Aydoğmuş et al. (2022) reported a significant positive correlation between overall ESG scores and firm value, with social and governance scores showing significant positive effects, while environmental scores showed no significant impact. Christian et al. (2023) revealed that overall ESG scores positively correlate with firm value, with environmental and social performance having significant positive impacts, but governance scores showing no significant effect.

Li Ying et al. (2024) observed that participation in carbon emissions trading significantly improves firms' environmental (E) and social (S) performance but has no significant impact on governance (G). Lin Lin et al. (2023) concluded that ESG performance enhances financial and market performance, with governance (G) playing a key role in both. Zhang Xiaoyan et al. (2023) demonstrated that private firms' ESG performance effectively boosts firm value, with environmental (E) and social (S) responsibilities showing more pronounced effects, primarily through improved investment efficiency and innovation quality.

2.3. ESG Performance, Enterprise Value and Level of Enterprise's Pollution

Chen Hong & Zhang Lingxiao (2023) found that firms in heavily polluting industries face greater financing constraints than those in non-polluting industries, with ESG performance having a more significant impact on enhancing firm value. Liu Zhuocong et al. (2023) highlighted that heavily polluting industries face higher environmental and energy-saving pressures, and their ESG performance attracts greater attention from governments, media, and the public, resulting in a stronger effect on firm value. Wang Bo & Yang Maojia (2022) argued that polluting firms are more likely to convey positive signals of green development through industrial transformation or technological innovation, triggering strong market responses. Zhou Shenbei et al. (2024) observed that the positive impact of ESG performance surpluses and the negative impact of performance gaps are more pronounced in heavily polluting firms, while non-polluting firms gain no economic benefits from merely fulfilling environmental responsibilities. Wang Yiqiu & Xie Meng (2022) noted that ESG disclosure has a greater effect on financing costs in heavily polluting industries, with investors paying closer attention and the capital market being more sensitive to their ESG ratings.

In contrast, Zhang Lin & Zhao Haitao (2019) suggested that in markets with high information transparency and sensitivity, polluting firms responding to public pressure through transformation or innovation can leverage "high attention" to convey positive signals and enhance firm value. For non-polluting firms, ESG performance has a more pronounced impact on value. Chen Xiaozhen & Chen Lilin(2023) found that ESG performance in non-polluting firms has a stronger effect on value enhancement. Polluting firms face stricter regulations and have inherent environmental responsibilities, leading to lower market sensitivity to their ESG disclosures. Conversely, ESG performance in non-polluting firms is more effective in driving value growth.

2.4. Hypotheses

$H_0$1: Enterprise value is not impacted by ESG performance in terms of the following:

1. Environment performance;
2. Social performance;and
3. Governance performance.

$H_0$2: There is no significant relationship between ESG performance and enterprise value when they are grouped according to polluting and non-polluting industries.

Hypotheses $H_0$1 is further divided into three hypotheses, $H_0$1a, $H_0$1b, and $H_0$1c, because ESG performance has three deminiton: Environment performance, Social performance and Governance performance.

3. Data and Methodology

3.1. Sample data

Taking into account the availability cycle of ESG data of listed companies in China and the 2018 revision of the Code of Governance for Listed Companies, which specifies the ESG management framework of listed companies, this paper selects listed companies in the Guangdong-Hong Kong-Macao Greater Bay Area as the initial research sample from 2018 to 2023. The ESG performance data for this article comes from the WIND database and the rest data from the CSMAR database.

Based on 2018-2023 A-share listed companies in Guangdong-Hong Kong-Macao Greater Bay Area as the initial research sample, the following selection is made: First, financial listed companies are excluded, because these companies have industry particularities; Then, ST and *ST listed companies are excluded, because the authenticity and accuracy of the financial data of these companies are doubtful; Finally, we eliminate listed companies with missing financial data.

As for the classification of polluting industries and non-polluting industries, this paper finally selects 16 industries as polluting industries according to the heavy polluting industries defined in the Guidelines for Environmental Information Disclosure of Listed Companies in China (Trial), and the other industries are non-polluting industries. Table 1 provides a summary of the data.

Table 1. Sample Data

Companies with an ESG score in Wind							
Sample Period	2018	2019	2020	2021	2022	2023	Total
Total Obs	468	480	520	650	680	729	3527
Number of Observations by Industry							
Polluting industries	60	63	69	84	86	94	456
Non-Polluting industries	408	417	451	566	594	635	3071

3.1.1. Dependent Variables

Many researchers prefer Tobin's Q to measure Enterprise Value.Tobin's Q is defined as the ratio of an asset's market value to its replacement value. It can also be used to measure

whether the market value of an asset is overvalued or undervalued. It is an important indicator to reflect the market value of the enterprise based on the stock price, and is formed by the comprehensive estimation and judgment of investors on the future development prospects of the enterprise. It can effectively reflect the psychological expectations of investors and the future expectations of the market for the enterprise, and more truly reflect the future value of the enterprise, reflecting the relationship between the intrinsic value of the company and the market value.

3.1.2. Independent Variables

This paper uses four independent variables namely ESG performance(ESG), Environment performance (ENV), Social performance (SOC), and Governance performance (GOV). As a quantitative tool, ESG score can intuitively reflect the performance of enterprises in these aspects. The higher the ESG score, the better the ESG performance. ESG performance can be measured by ESG combined score, Environment performance can be measured by Environment score, Social performance can be measured by Social score, Governance performance can be measured by Governance score. All ESG scores are from Wind database.

3.1.3. Moderating Variable

Considering the heterogeneity of industries, divide the sample enterprises into enterprises in polluting industries and enterprises in non-polluting industries, and conducted sub-sample regression. Polluting enterprises are 1, Non-polluting enterprises are 0.

3.1.4. Control Variables

We select Company Size(Size), Asset-liability ratio (Lev), Company Listage(Listage), Total Assets Turnover (ATO) as control variables. Table 2 provides a summary of all variables.

Table 2. Summary of variables.

Variable	Variable	Description/Formula
Dependent Variable	TobinQ	enterprise market value/enterprise replacement cost
Independent Variables	ESG	Wind ESG Combined Score
	ENV	Wind Environment Score
	SOC	Wind Social Score
	GOV	Wind Governance Score
Moderating Variable	Pollut	Polluting enterprises are 1, Non-polluting enterprises are 0
Control Variables	Size	Logarithm of Total Assets
	Lev	Total Debt/Total Assets
	Listage	logarithm of (current year-List year+1)
	ATO	Operating income/ Total Assets

3.2. Descriptive Statistics

The sample data of the Greater Bay Area for five consecutive years from 2018 to 2023 collected through secondary data are used for descriptive statistical analysis.

Table 3. Descriptive statistics of Polluting Industries

Variable	Obs	Mean	Std. Dev.	Min	Max
TobinQ	456	1.987	1.676	0.809	25.506
ESG	456	6.254	0.921	3.67	9.05
ENV	456	2.3	2.144	0	8.51
SOC	456	4.829	1.796	0.21	10
GOV	456	6.437	1.135	0.63	9.5
Size	456	8.639	1.347	6.285	13.821
Lev	456	0.405	0.164	0.069	0.884
Listage	456	2.05	0.923	0	3.466
ATO	456	0.589	0.334	0.063	2.774

Table 4. Descriptive statistics of Non-polluting Industries

Variable	Obs	Mean	Std. Dev.	Min	Max
TobinQ	3071	2.005	1.504	0.634	28.641
ESG	3071	6.005	0.867	3.14	9.61
ENV	3071	1.688	2.286	0	10
SOC	3071	3.927	1.803	0	10
GOV	3071	6.349	1.048	0.63	9.7
Size	3071	8.507	1.566	4.139	16.265
Lev	3071	0.436	0.211	0.019	0.998
Listage	3071	1.982	0.883	0	3.497
ATO	3071	0.604	0.472	-0.004	7.389

From Tables 3 and 4, we can see that , there were total 3,471 observed samples in this study, among which 456 were enterprises in polluting industries, accounting for 12.93% of the total sample, and 3,071 were enterprises in non-polluting industries, accounting for 87.07% of the total sample.The average values of EVN, SOC, and GOV, which represent ESG performance, are higher for polluting industry companies than for non-polluting industry companies. However, the average value of enterprise value (Tobin's Q) of polluting industry companies is lower than that of non-polluting industries.

Even though enterprises in polluting sectors perform better on average across EVN, SOC, and GOV dimensions than enterprises in non-polluting industries, their average enterprise value (Tobin's Q) is lower than that of non-polluting enterprises. This is because environmental risks, policy risks, and market risks faced by polluting industries lead to low expectations of investors on their future profitability. The market has more positive comments on the market prospects of non-polluting industry companies, and the development of enterprises is more in line with the trend of sustainable development. Therefore, non-polluting industry companies can obtain higher market expectations and valuations. As sustainable development and socially responsible investment gain traction, investors are progressively drawn to companies exhibiting strong social, governance, and environmental performance, particularly within non-polluting industries, which typically excel in ESG metrics and align more closely with policy directives and market trends. At the same time, investors prefer to invest in enterprises in non-polluting industries with lower risks and higher growth potential.

3.3. Methodology

This paper sets up a panel data regression with enterprise

value TobinQ (Tobin's Q) as the dependent variable and ESG, EVN, SOC, GOV as the independent variable , use Size, Leverage, Listage and Asset turn over as control variables. And constructs four models to investigate research objectives of the study.

Considering that there are a large number of individuals in the sample of this article, using individual fixed effects in the model will lose more degrees of freedom, which may lead to biased regression results. Therefore, this paper refers to the research basis of Chen Hong & Zhang Lingxiao. (2023) in the model. Add industry fixed effects and year fixed effects, and the specific model settings are:

$$TobinQ_{i,t}=\alpha_0+\alpha_1 ESG_{i,t}+cX_{i,t}+\sum Ind+\sum YEAR+\varepsilon \quad \text{(Model No.1)}$$

$$TobinQ_{i,t}=\beta_0+\beta_1 ENV_{i,t}+cX_{i,t}+\sum Ind+\sum YEAR+\varepsilon \quad \text{(Model No.2)}$$

$$TobinQ_{i,t}=\gamma_0+\gamma_1 SOC_{i,t}+cX_{i,t}+\sum Ind+\sum YEAR+\varepsilon \quad \text{(Model No.3)}$$

$$TobinQ_{i,t}=\delta_0+\delta_1 GOV_{i,t}+cX_{i,t}+\sum Ind+\sum YEAR+\varepsilon \quad \text{(Model No.4)}$$

Where $TobinQ_{i,t}$ is dependent variable, $ESG_{i,t}$, $ENV_{i,t}$, $SOC_{i,t}$, $GOV_{i,t}$ are independent variables, X is a vector of control variables, including Company Size(Size), Asset-liability ratio (Lev), Company Listage(Listage), Total Assets Turnover (ATO) as control variables. Ind is an industry dummy variable, Year is an annual dummy variable, and ε is a random disturbance term.

4. Results

4.1. Test Results

In order to verify whether the model is valid, this paper firstly conducts a variance inflation factor (VIF) test on the basic regression of the model. The results show that the VIF values of the variables in this paper are all less than 10, indicating that there is no serious multicollinearity in the variables in this paper, and the regression model is valid.

Before running the panel data regression, we first need to determine which panel data model is most suitable. There are three types of static linear panel data models: Mixed cross-sectional models, random effects models, and fixed effects models. We determine the most suitable model for our analysis by applying relevant tests. First, we compare the mixed cross-sectional model and the fixed effects model, using the F test to test individual effects. Second, we compare the fixed effects model and the random effects model, using the Hausman test. We use the F test to test the individual effects and find that the fixed effect model is more suitable than the mixed model. The Hausman test is used and the fixed effect model is more suitable than the random effect model.

After the above steps, we finally run the fixed effect model. Each company in our data has its own industry characteristics, which change over time. The fixed effects model controls for all time-varying and industry-varying firm-specific observable or unobservable characteristics, thereby mitigating omitted variable bias.

4.2. Regression results

In order to verify hypothesis H_01, H_01a, H_01b and H_01c, Table 5 conducts regression analysis to explore the relationship between ESG, ENV, SOC, GOV and enterprise value (TobinQ).

From the regression results in Table 5, there is a significant positive correlation between ESG, ENV, SOC, GOV, and enterprise value (TobinQ). It can be seen that when comparing the impact of the three dimensions of ENV, SOC, and GOV on enterprise value (TobinQ), they are sorted according to their respective coefficient sizes. The highest coefficient of GOV is 0.048, and GOV has the most significant effect on improving enterprise value, followed by SOC, with a coefficient of 0.04, indicating that the improvement of SOC is also an important factor in improving enterprise value. The last one is ENV, with a coefficient of 0.034. Although it is also significant, its direct impact on enterprise value is is slightly smaller than the other two. Therefore, the ranking is: GOV > SOC > ENV. However, taking into account the overall ESG's notable positive influence on enterprise value (coefficient of 0.127), companies should comprehensively consider and balance the performance of these three dimensions in practice to maximize enterprise value.

Table 5. Regression Results for EGS Performance

	(1)	(2)	(3)	(4)
	TobinQ	TobinQ	TobinQ	TobinQ
ESG	0.127***			
	(3.77)			
ENV		0.034**		
		(2.38)		
SOC			0.040**	
			(2.44)	
GOV				0.048*
				(1.84)
Size	-0.351***	-0.344***	-0.332***	-0.328***
	(-6.84)	(-6.18)	(-6.54)	(-6.87)
Lev	-0.046	-0.085	-0.099	-0.097
	(-0.20)	(-0.37)	(-0.43)	(-0.43)
Listage	0.281***	0.273***	0.281***	0.270***
	(6.59)	(6.38)	(6.60)	(6.36)
ATO	0.105*	0.104	0.106*	0.096
	(1.65)	(1.63)	(1.65)	(1.51)
_cons	6.679***	7.328***	7.084***	6.965***
	(4.02)	(4.43)	(4.28)	(4.19)
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	3527	3527	3527	3527
r2	0.164	0.162	0.162	0.161
F	37.038	37.255	37.548	37.549

t statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

These results suggest that companies should focus on overall ESG performance, especially GOV and SOC, when making strategy and management decisions, because they have a more significant role in enhancing corporate value. However, environmental performance cannot be ignored, as it plays a significant role in business sustainability as well. By comprehensively improving all dimensions of ESG, companies can not only enhance their competitiveness but also better respond to future market changes and regulatory requirements, thus achieving sustainable development throughout the long run.

4.3. Heterogeneity Results

In order to verify hypothesis Ho2, two regression was conducted. The results are shown in Table 6 and Table 7. This heterogeneity analysis examines whether there is a significant relationship between environment performance and enterprise value when they are grouped according to polluting and non-polluting industries. Referring to the previous article, industry fixed effects and year fixed effects are added to the model.

Table 6. Heterogeneity Results for EGS Performance of Polluting Industries

	(1)	(2)	(3)	(4)
	TobinQ	TobinQ	TobinQ	TobinQ
ESG	0.011			
	(0.18)			
ENV		-0.044*		
		(-1.82)		
SOC			-0.039	
			(-1.17)	
GOV				0.112**
				(2.15)
Size	-0.355***	-0.316***	-0.334***	-0.384***
	(-3.43)	(-2.97)	(-3.36)	(-3.70)
Lev	0.452	0.527	0.535	0.439
	(0.88)	(1.04)	(0.99)	(0.87)
Listage	0.126	0.116	0.105	0.143
	(1.15)	(1.05)	(0.98)	(1.32)
ATO	-0.253*	-0.254*	-0.258*	-0.263*
	(-1.78)	(-1.76)	(-1.80)	(-1.89)
_cons	10.046***	9.845***	10.108***	9.712***
	(3.68)	(3.71)	(3.77)	(3.62)
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	456	456	456	456
r2	0.343	0.345	0.344	0.347
F	9.145	9.170	8.904	9.456

t statistics in parentheses,* p < 0.1, ** p < 0.05, *** p < 0.01

Table 7. Regression Results for EGS Performance of Non-polluting Industries

	(1)	(2)	(3)	(4)
	TobinQ	TobinQ	TobinQ	TobinQ
ESG	0.140***			
	(3.68)			
ENV		0.041***		
		(2.58)		
SOC			0.054***	
			(2.97)	
GOV				0.033
				(1.11)
Size	-0.351***	-0.347***	-0.334***	-0.322***
	(-6.16)	(-5.59)	(-5.89)	(-6.07)
Lev	-0.023	-0.066	-0.081	-0.093
	(-0.09)	(-0.25)	(-0.32)	(-0.37)
Listage	0.296***	0.289***	0.300***	0.285***
	(6.32)	(6.16)	(6.38)	(6.06)
ATO	0.157**	0.159**	0.163**	0.150**
	(2.24)	(2.25)	(2.29)	(2.14)
_cons	3.266***	4.026***	3.680***	3.647***
	(8.28)	(10.36)	(10.35)	(8.51)
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	3071	3071	3071	3071
r2	0.159	0.157	0.158	0.155
F	34.098	34.752	34.977	34.827

t statistics in parentheses,* p < 0.1, ** p < 0.05, *** p < 0.01

When the total sample is divided into polluting industries and non-polluting industries according to the degree of pollution, in the regression analysis of samples of companies in polluting industries, there is no significant relationship between ESG, SOC and enterprise value (TobinQ) related relationships. Specifically, the coefficient of ESG is 0.011, and this coefficient is not statistically significant (t=0.18, p>0.05). The SOC coefficient is -0.039 and is not statistically significant (t=-1.17, p>0.05). The regression result between ENV score and enterprise value (TobinQ), the coefficient is -0.044, and it is statistically significant (p<0.05) and the direction of significance is opposite to expected. There is a significant positive correlation between GOV and enterprise value, with a coefficient of 0.112 and significant at the 5% significance level (t=2.15, p<0.05).

Regression of ESG samples of companies in non-polluting industries. ESG, ENV and SOC all have a significant positive correlation with enterprise value (TobinQ). Specifically, the coefficient of ESG is 0.140 and is highly statistically significant (t=3.68, p<0.01). The ENV coefficient is 0.041 and is highly statistically significant (t=2.58, p<0.01). The SOC coefficient is 0.054, which is highly statistically significant (t=2.97, p<0.01). However, the relationship between GOV and enterprise value is positively related, with a coefficient of 0.033, but it is not significant (t=1.11, p>0.1).

By comparing the differences among companies in non-polluting and polluting industries in the GBA, we can find that the ESG in non-polluting has a more significant effect on EV. Due to the particularity of polluting companies, they often need to invest more in ESG costs to respond to market and public concerns due to their industry attributes and strict regulatory environment. In contrast, non-polluting companies are more likely to be recognized and rewarded by the market for their ESG performance. These companies can enhance their brand image, attract investors and consumers, and further enhance their market value and competitiveness by improving ESG performance.

5. Discussions

5.1. Conclusion

1. Through the research, we know that companies in polluting industries only account for 12.93% of the total sample, which was far lower than the 87.07% of non-polluting industry companies. This data distribution showed that the number of non-polluting industry companies far exceeds that of polluting industry companies, reflecting the trend of the region's industrial structure developing in a more environmentally friendly and sustainable direction. In terms of ENV, SOC, and GOV, the average values of polluting industry companies are higher than those of non-polluting industry companies. However, the average value of the enterprise value (Tobin's Q) of polluting industry companies is lower than that of non-polluting industry companies. This showed that the high scores of polluting industry companies in ESG performance may reflect their efforts and investment in the environment, society, and governance, but due to the influence of various factors such as industry characteristics, market preferences, and policy pressure, investors prefer non-polluting industries with stable ESG performance and less impact, which makes polluting industry companies subject to certain suppression in capital market valuation.

2. The three dimensions of ENV, SOC, and GOV all had a significant positive impact on EV. Enterprises should focus on the comprehensive development of ESG, continuously improve ESG performance levels by formulating and implementing relevant strategies and measures, and maximize corporate value. Among the three core dimensions of ESG, GOV plays the most significant role in promoting corporate value growth. In contrast, although SOC and ENV

also had a positive impact on EV, their effects were considered to be relatively limited. This difference may be rooted in the general cognitive differences in the value of various dimensions of ESG: the positive effects of governance are generally recognized, while the direct relationship between ENV and SOC and EV is more controversial. Compared with environmental and social factors, governance factors have lower uncertainty and are factors that are basically controllable by enterprises and closely related to their profits and development. Therefore, enterprises will still invest more of their limited resources in improving governance practices.

3. Among companies in polluting industries, there is no significant correlation between ESG and EV, while there is a significant negative correlation between ENV and EV, which is contrary to expectations. At the same time, although SOC and GOV have a certain correlation with EV, the significance of SOC is not strong. This shows that in polluting industries, companies may face more stringent environmental supervision and higher environmental costs. As a result, improvements in environmental performance may not bring about an increase in enterprise value but may instead reduce enterprise value due to an increase in environmental costs. However, good GOV can still significantly enhance EV. They have a significant positive correlation with EV, while GOV has no significant effect on improving EV. Among companies in non-polluting industries, ESG, ENV, and SOC all have a significant positive correlation with EV, while GOV has no significant effect on improving EV. This shows that in non-polluting industries, companies focusing on ESG and other aspects of performance can significantly increase enterprise value, while corporate governance structure has a relatively small impact on enterprise value. In terms of differences in industry characteristics, the performance of polluting companies has attracted more attention from the market and the public, and they often face stricter supervision than before. Based on the principle of legality, companies will increase their investment in ESG to cope with strict supervision in order to obtain the qualifications to continue to exist in the market. This indicated that polluting companies need to invest more costs in ESG than other companies; it will occupy the company's operating funds and can cause financial pressure.

4. By implementing this comprehensive plan to enhance enterprise value, companies seize opportunities and lead the trend of sustainable development in the industry. Through key measures such as strengthening ESG management, improving environmental performance, enhancing social responsibility, and improving governance structure, the plan enhances the market competitiveness and brand value of enterprises. implementing this comprehensive plan for enhancing enterprise value, seize opportunities and lead the trend of sustainable development in the industry. Through key measures such as strengthening ESG management, improving environmental performance, enhancing social responsibility, and improving governance structure, the plan will enhance the market competitiveness and brand value of enterprises.

5.2. Recommendations

1.For polluting industry companies, although they have high scores in ESG performance, showing their efforts in environment, society, and governance, they still face challenges in capital market valuation. Such companies need to further strengthen their ESG strategies to meet regulatory requirements, although they dominate in number and perform better in the capital market than polluting industry companies; this does not mean that ESG improvement can be ignored. For non-polluting industry companies, although they dominate in number and perform better in the capital market than polluting industry companies, this does not mean that ESG improvement can be ignored. Such companies should make full use of their advantages in ESG performance, continuously optimize environmental and social responsibility practices, and set industry benchmarks. By fulfilling social responsibilities, strengthening environmental management, and participating in community construction, non-polluting industry companies can enhance their brand image and attract more investors who pay attention to sustainable development, thereby further enhancing corporate value.

2. There is a significant positive correlation between ESG and EV. Companies can improve their ESG performance by strengthening environmental protection measures, improving social responsibility and optimizing corporate governance structures, thereby potentially increasing EV. At the same time, companies should recognize the key role of GOV in the growth of their EV and continue to strengthen work in this area, including but not limited to establishing a sound internal management system, improving transparency, ensuring fairness and efficiency in the decision-making process, and strengthening communication with shareholders and other stakeholders.

3. For companies in polluting industries, these companies should focus on improving corporate governance, for example, by increasing board independence, improving transparency, and strengthening internal controls. For companies in non-polluting industries, there is a significant positive correlation between various aspects of ESG and enterprise value. These companies should continue to increase their investment in ESG. For example, companies can improve environmental performance by adopting clean energy, reducing waste emissions, and improving resource efficiency. In terms of social performance, companies can enhance their contribution to society by providing high-quality employment opportunities, participating in community building, and supporting educational projects.

4. By implementing the comprehensive plan for enterprise value enhancement, the government should further strengthen policy guidance on ESG practices of enterprises and formulate more targeted incentives, such as tax exemptions and green credit support, to encourage enterprises to increase their investment. An ESG performance evaluation system and reward mechanism should be established to commend and reward outstanding enterprises and form a demonstration effect. Enterprises, governments, non-governmental organizations, and academia are encouraged to strengthen cross-border cooperation and jointly study hot issues and innovative solutions in the ESG field. An information-sharing platform should be established to promote the interconnection and interoperability of ESG data and provide strong support for enterprises to formulate and implement ESG strategies. Through cooperation and exchanges, the overall level and influence of the entire region in the ESG field should be improved.

5.3. Implications for Value Enhancement Program

After summarizing the above research, we found that ESG has a significant impact on the improvement of EV of listed

companies in the GBA. In particular, improvements in ENV, SOC, and overall ESG of companies in non-polluting industries can significantly promote the growth of EV. This finding has important implications for value enhancement plans: First, companies should increase investment in the ESG field, especially in environmental and social responsibility, to enhance corporate image and market competitiveness; secondly, for companies in polluting industries, although ESG , the direct relationship between overall ESG, SOC, and EV is not significant, but the significant positive contribution of GOV shows that improving corporate governance structure is an effective way to enhance the value of such companies; finally, policymakers and regulators institutions should encourage and guide companies to strengthen ESG practices and promote the entire Greater Bay Area to move towards greener and more sustainable development by formulating relevant policies and providing incentives.

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