

THE MEDIATING EFFECTS OF CORPORATE SOCIAL RESPONSIBILITY ON THE RELATIONSHIP BETWEEN ENVIRONMENTAL REGULATION INTENSITY AND GREEN ECONOMIC EFFICIENCY OF MANUFACTURING COMPANIES IN GUANGDONG

TSZYU, LAU

PhD Student, Innovation Management College, Suan Sunandha Rajabhat University, Bangkok, Thailand.

Dr. TANAPOL KORTANA

Assistant Professor, Innovation Management College, Suan Sunandha Rajabhat University, Bangkok, Thailand.

SHAOZI, CHEN

Foreign Language Department of Hanshan Normal University, China.

HONGCHUN, ZHENG

School of Economics and Management of Jiamusi University, China.

Abstract

This study investigates the manufacturing companies in Guangdong Province on the mediating role of Corporate Social Responsibility in the relationship between Environmental Regulation Intensity and Green Economic Efficiency. A quantitative approach was employed and 395 samples were collected by questionnaire. The result was analyzed by PLS-SEM. The findings support three key hypotheses which are: Environmental Regulation Intensity positively influence Green Economic Efficiency, Corporate Social Responsibility positively impacts Green Economic Efficiency, and Corporate Social Responsibility plays as a mediating role between Environmental Regulation Intensity and Green Economic Efficiency. The findings offer valuable insights for policymakers in designing effective environmental regulations, and help business develop sustainable strategies in an increasingly eco-conscious market.

Keywords: Environmental Regulation Intensity; Corporate Social Responsibility; Green Economic Efficiency; Manufacturing Companies.

1. INTRODUCTION

Recent years have seen a greater emphasis placed on corporate social responsibility and environmental regulations. These are proved to be the effective way to improve the efficiency of green manufacturing. Guangdong Province is the fastest-growing region in China in economic growth. It leads in the implementation of environmental regulations and corporate social responsibility in manufacturing industry. However, their mechanisms and effects are still unclear. This study aims to fill this gap by examining whether the intensity of environmental regulation affects the green economic efficiency of manufacturing companies and investigating the potential mediating role of corporate social responsibility.

1.1 Research Background

Numerous scholars have conducted research on the impact of environmental regulation on corporate related activities, based on different research perspectives and objects, mainly including corporate environmental investment, environmental technology development, foreign investment structure, the governance effect of environmental courts, and the efficiency of green credit execution. Strong environmental supervision can enhance the performance evaluation of corporate environmental protection strategies, as well as the positive image and word-of-mouth effects it brings, thereby making companies willing to be pioneers in environmental protection and enhancing their initiative and enthusiasm to undertake environmental responsibilities (Levy, 2024).

Furthermore, with strong environmental regulation, public awareness of environmental protection continues to increase, and stakeholders also pay attention to the governance of environmental pollution by enterprises, which puts greater environmental pressure on them and strengthens their sense of identification with green development. Enterprises will make green innovation behaviors in response to green development (Yi & Pan, 2021; Xin et al., 2024), and use the power of environmental regulation to better promote public opinion pressure and green innovation in enterprises (Gao, 2023).

Government environmental regulation has significant environmental governance effectiveness, which can increase foreign direct investment and achieve the effect of reducing total pollution emissions. It can also promote foreign-funded enterprises to actively adopt optimization and upgrading strategies and adopt more advanced environmental protection technologies, and drive the structural transformation and technological progress of Chinese enterprises through industrial linkage and technological exchange (Xu, 2024).

1.2 Statement Problem

Corporate social responsibility often encourage businesses to exceed regulatory compliance by adopting proactive measures that benefit society and the environment (Colaste, 2020). The complexity of these interrelationships necessitates a comprehensive analysis to understand how environmental regulation influences green economic efficiency through the mediating effects of corporate social responsibility. By addressing this gap, this research aims to provide deeper insights into the intricate dynamics at play in Guangdong's manufacturing sector, ultimately contributing to academic literature and offering practical recommendations for enhancing sustainable practices and economic performance (Tran, 2020).

1.3 Research Question

How is the level of Environmental Regulation Intensity influence the Green Economic Efficiency among manufacturing companies in Guangdong?

What is the mediating role of Corporate Social Responsibility in the relationship between Environmental Regulation Intensity and Green Economic Efficiency?

1.4 Research Objective

To assess the influence of Environmental Regulation Intensity on the Green Economic Efficiency among manufacturing companies in Guangdong, China.

To explain the mediating role of Corporate Social Responsibility in the relationship between Environmental Regulation Intensity and Green Economic Efficiency.

2. LITERATURE REVIEW

2.1 Underpinning Theories

1) Sustainable development theory

The concept of sustainable development has dynamic characteristics and involves various fields such as economy, society, and ecology. The World Outline for Conservation of Natural Resources first mentions this concept, stating that “it is necessary to consider both the actual needs of modern people and the possible needs of future generations for resources, and make reasonable planning for the development of resources based on comprehensive consideration”.

2) Government regulation theory

Government regulation theory, also known as government regulation or regulatory theory, is the supervision and regulation carried out by the government under market economy conditions to achieve specific public policy goals of microeconomic entities. The subject of supervision is all state institutions, including legislative, administrative, and judicial institutions. Government management is a management activity that utilizes state power to manage social activities. It can refer to the management of all commercial institutions...

3) Environmental regulation theory

Environmental regulation is a series of measures that affect a country's protection of the environment and economic behavior. It is a "win-win" environmental protection mechanism that regulates the behavior of economic entities, formulates environmental policies and measures (such as environmental policies and legal systems), and carries out management activities that prohibit and restrict environmental pollution behavior. Environmental regulations belong to the field of social regulation, mainly attributed to the externalities of pollution. The government is introducing policy measures that directly or indirectly regulate the economic activities of production enterprises to achieve the goals of environmental protection and economic development.

2.2 Environmental Regulation Intensity

Environmental regulation in China has long been of interest, with several studies exploring its effect on various aspects of economy and environment (Guo et al., 2013). Environmental regulations, government R&D funding, and green technology innovation were studied in China. Researcher Zhang et al. (2018) discovered evidence that environmental regulations can stimulate innovation within green technology fields (Zhao et al., 2018). Yang et al., (2018) carried out an empirical study to evaluate the impact of environmental policy on China's total

element productivity, particularly carbon extensive industries. Their empirical data confirmed this searching for with substantial ecological guideline effects seen on overall factor efficiency (Yang et al., 2018).

Conducting an exhaustive academic and empirical investigation on how environmental policy could assist damage China's source curse. Their job found that ecological guidelines play an essential role in mitigating adverse results triggered by wealth. They suggested that government should encourage enterprises to introduce and boost production variable allotment performance for environmental management and long-lasting business viability. Based on firm-level information from the Chinese Industrial Enterprises Database, they obtained overall aspect efficiency estimates and their components. They discovered that ecological guidelines have an effect on commercial capacity application.

Yang et al. (2020) discovered the nonlinear relationship between environmental laws and carbon strength in China with a unique focus on eco-friendly technology's mediating impacts. Ge et al. (2020) checked out the impact of ecological law performance loss on inclusive growth in China, while Zhong et al. (2020) examined its heterogeneous effects on employment levels across Chinese provinces.

They discovered that environmental regulation's benefits vary across groups. Li et al., (2021) assessed the effect of environmental regulations and co-governance measures on pollution transfer; Zhou et al. (2021) examined whether China's 10-Point Water Plan can decrease industrial water pollution intensity, providing quasi-experimental evidence on its effectiveness as a policy measure.

2.3 Corporate social responsibility

Corporate Social Responsibility has long been an area of research in business and society fields. Cochran et al. (1984) performed study reexamining its correlation to economic efficiency by utilizing industry-specific control groups, while McGuire et al. (1990) performed similar work utilizing industry certain control teams as control systems (McGuire et al., 2009).

Wartick et al. (1988) performed research study that investigated the connection in between perceptions of companies' Corporate Social Responsibility and economic performance and threat measures related to social duty. Their results recommended that measures connected with danger were strongly connected with perceptions of social obligation within companies (Wartick et al., 1985).

They traced the growth of the business social performance version, noting its difficulties such as financial obligation, public duty and social responsiveness. Their verdict: the version provided an important way of studying service and culture interaction as well as offering a design template for this field of study.

Frederick (1994) examined the shift from philosophical-ethical principle of Corporate Social Responsibility to action-oriented managerial concept of company social responsiveness, stressing dynamic theories of values and social modification as vital. Customer habits associated with Corporate Social Responsibility has also been studied extensively.

Mohr et al. (2001) performed in-depth meetings to get an understanding of customers' sights on company social duty, producing a typology of purchasing habits and exploring its results on customer reactions. Cooper et al. (2003) suggested a three-domain approach to conceiving Corporate Social Responsibility, covering financial, legal and moral obligations.

Smith et al. (2007) examined sporting activity as an avenue for Corporate Social Responsibility release; worrying its influence over social patterns alongside company influence on sporting activity itself. Generally, Corporate Social Responsibility literary works addresses numerous subjects varying from its relationship to monetary efficiency to customer practices and sporting activity's role in promoting Corporate Social Responsibility campaigns. Furthermore, there are research study instructions in the field (Wang et al., 2016).

2.4 Green Economic Efficiency

The study of the green economy in China includes a variety of aspects including the impact of manufacturing agglomeration and regulatory regulations on the environment, inclusion of financial institutions technological innovation, digital economy, technological imports, regional characteristics and the independent development. Tao et al. (2016) used a non-separable output-input SBM method to examine the green economic efficiency of the provinces of China. Yuan et al. (2020) focussed on the impact of manufacturing agglomeration on eco-friendly economic efficiency.

Shuai (2020) utilized a super efficiency model called DEA-Tobit to analyze the impact of environmental regulations on the efficiency of regional green economies. Wang (2020) studied the impact regulation of the environment on effectiveness of China's green economy regionally employing an GMM model. Wang et. (2021) examined the connection with financial inclusion, green economy efficiency and the environment in China and Li et al. (2021) investigated the impact from the internet economy as well as technological innovations to improve green economy efficiency across 277 cities across China.

Zhang et. al. (2021) suggested a fuzzy-set qualitative comparative analysis technique to develop regions that enhance the green economy efficiency. Naseer et al. (2021) examined the green economy efficiency in China employing Naseer et. al. (2021) assessed green economic efficiency in China using Analytical Hierarchical Process (AHP) method.

2.5 Conceptual Framework

The previous researches supply a strong theoretical foundation for understanding the affiliations between environmental regulation intensity, corporate social responsibility, and green economic efficiency amongst producers. Nevertheless, there is a need for even more empirical research study that especially examines these variables in Guangdong, China, which is the emphasis of the current study.

This research means to use a quantitative method, to explore exactly how ecological law strength and corporate social responsibility impact green economic efficiency, meanwhile corporate social responsibility as the moderating role among suppliers in Guangdong Province. The connection between constructs and the proposed hypothesis is represented in Figure 1.

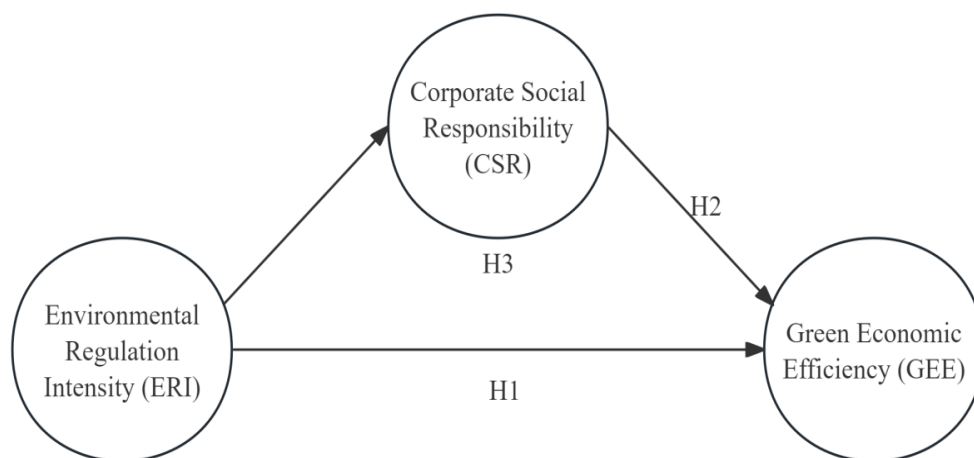


Figure 1: Conceptual Framework

2.6 Hypothesis

- H1: Environmental Regulation Intensity positively influences Green Economic Efficiency among manufacturing companies in Guangdong, China.
- H2: Corporate Social Responsibility positively influences Green Economic Efficiency among manufacturing companies in Guangdong, China.
- H3: Corporate Social Responsibility plays a mediating between Environmental Regulation Intensity and Green Economic Efficiency among manufacturing companies in Guangdong, China.

3. METHODOLOGY

The methodology of this study is presented in this section, which includes the research instruments and data, and the how the measures developed in this study.

3.1. Research Instrument and Data

This study utilized the Wenjuanxing platform’s questionnaire study method to collect information from manufacturing firms which runs in Guangdong Province. There are entirely 395 valid questionnaires in this study. The set of questions sought to measure variables pertaining to Environmental Regulation Intensity, Corporate Social Responsibility and Green Economic Efficiency.

To assess this information making use of software SMARTPLS4.0 for PLS-SEM, this approach enabled examination of complex partnerships among variables while providing insight into business social obligation's mediating function in enhancing eco-friendly financial effectiveness.

3.2. Measures

Scales used in this research to measure various constructs were selected from well-established sources to ensure reliability and credibility. The measurement items for Environmental Regulation Intensity were adjusted from previous studies on regulatory conformity and ecological enforcement devices (Leventon et al., 2019; de Bikuña et al., 2020). These items examines exactly how manufacturing business view regulative stress, conformity expenses, and financial rewards connected to environmental policies. The items for Green Economic Efficiency were adapted from previous literary works that integrates ecological performance with financial end results (Stanitsas et al., 2021).

This scale records the capability of firms to enhance environmental efficiency, such as pollution reduction and resource performance, while keeping or improving economic returns. The items measuring Corporate Social Responsibility are based upon well-known scales in the literary works (Song & Yu, 2018; Bausch & Koziol, 2020). These items catch the extent to which companies take part in Corporate Social Responsibility tasks, consisting of environmental protection policies, public welfare involvement, sustainability coverage, and supply chain partnership.

Employing established and verified scales, this study looked for to make sure precise and trustworthy dimensions, yielding insights right into relationships among Environmental Regulation Intensity, corporate social responsibility and green economic effectiveness among green manufacturing firms in Guangdong, China.

4. DATA ANALYSIS AND RESULT

Data analysis and results of this research are presented in this part. It consists of demographic information, evaluation of measurement model and assessment of reliability and validity of the data. Finally, the proposed hypotheses and tested and the Model fit are presented.

4.1 Demographic Information

Table 4.1 provides the demographic distribution of survey samples. The demographic characteristics of the 395 respondents. In terms of position distribution, Heads of Technology Innovation Departments account for the largest proportion (34.9%), followed by Production Department Managers (24.3%) and Heads of Environmental Management/CSR Departments (20.8%). This suggests that respondents predominantly come from departments closely related to environmental management and innovation.

The industry types are primarily represented by Electronic Information and Communication Equipment (23.5%), with other high-tech industries also well-represented. Regarding company size, medium-sized enterprises (300-1000 employees) constitute the largest group (48.1%), followed by small enterprises (below 300 employees) at 32.9%. And 59.5% of the companies have obtained ISO certification, indicating a significant commitment to standardized management practices.

The geographical distribution of the sample is relatively balanced across five major cities in Guangdong, with each city contributing approximately 20% of the responses. This even distribution enhances the representativeness of the sample across the region.

Table 4.1: Distribution of the Survey Samples

Type	Demographic	Frequency	Percent%
Position	Senior management	28	7.1
	Head of Environmental Management/CSR Department	82	20.8
	Head of Technology Innovation Department	138	34.9
	Head of Finance/Human Resources Department	51	12.9
	Production Department Manager	96	24.3
	Total	395	100.0
Business Type	Electronic Information and Communication Equipment	93	23.5
	Advanced Equipment Manufacturing	66	16.7
	New Materials	52	13.2
	Automobiles and Parts	53	13.4
	Biomedicine and Medical Devices	65	16.5
	Energy Conservation and Environmental Protection Industry	58	14.7
	Others	8	2.0
	Total	395	100.0
Business Size	Small (below 300 people)	130	32.9
	Medium (300-1000 people)	190	48.1
	Large (over 1000 people)	75	19.0
	Total	395	100.0
ISO Certification	Yes	235	59.5
	No	55	13.9
	Not sure	105	26.6
	Total	395	100.0
City	Guangzhou	78	19.7
	Shenzhen	79	20.0
	Dongguan	78	19.7
	Foshan	80	20.3
	Huizhou	80	20.3
	Total	395	100.0

4.2 Assessment of the Measurement Model

Table 4.2 displays factor loadings associated with variables Environmental Regulation Intensity, Corporate Social Responsibility and Green Economic Efficiency. According to Hair et al. (2010), adequate factor loadings must exceed 0.70. All items in this study exceeded this threshold with loadings ranging from 0.785 to 0.826, showing strong correlations with their respective latent constructs and providing evidence of validity and reliability of measurement items that represented them.

Such solid measurement foundation is necessary for subsequent analyses employing PLS-SEM that allow accurate assessments of relationships among environmental regulation intensity, corporate social responsibility and green economic efficiency

Table 4.2 also provides evidence that all variables studied demonstrate high reliability and convergent validity, according to Hair et al. (2010) who state that an internal consistency indicated by an alpha value greater than or equal 0.7 is indicative of good internal consistency in any study.

Cronbach's alpha values exceed 0.91 here, suggesting excellent internal consistency, while Composite Reliability values, which must exceed 0.7 for adequate reliability (Fornell & Larcker, 1981) all exceed 0.9 to confirm high reliability. For convergent validity, AVE values of greater than 0.5 are necessary in order to demonstrate effective explanation of variance among constructs (Bagozzi & Yi, 1988). This study's constructs meet this criterion with values between 0.651 to 0.656 meeting this criterion; thus indicating both reliability and validity in our measurement model.

Table 4.2: Reliability and Convergent Validity

Variables	Items	Loadings	Cronbach's alpha	CR (rho_a)	AVE
Environmental Regulation Intensity (ERI)	ERI1	0.814	0.911	0.911	0.651
	ERI2	0.803			
	ERI3	0.797			
	ERI4	0.822			
	ERI5	0.804			
	ERI6	0.813			
	ERI7	0.793			
Green Economic Efficiency (GEE)	GEE1	0.799	0.913	0.913	0.656
	GEE2	0.799			
	GEE3	0.825			
	GEE4	0.815			
	GEE5	0.822			
	GEE6	0.800			
	GEE7	0.810			
Corporate Social Responsibility (CSR)	CSR1	0.826	0.924	0.926	0.653
	CSR2	0.785			
	CSR3	0.836			
	CSR4	0.808			
	CSR5	0.785			
	CSR6	0.812			
	CSR7	0.795			

According to Fornell-Larcker Criterion (1981), discriminant validity was assessed using Table 4.3 as evidence for this assessment. According to this criterion, discriminant validity can be established if each square root AVE value for each construct exceeds any off-diagonal correlations (0.397-0.408) among them; such square roots show good discriminant validity confirming strong discriminant validity among them all.

As shown here in Table 4.3, the square roots of the AVE values are 0.808 for corporate social responsibility, 0.807 for environmental regulation intensity, and 0.81 for green economic efficiency, thus demonstrating strong discriminant validity among them all and supporting good discriminant validity all around.

Table 4.3: Discriminant Validity - Fornell-Larcker Criterion

	Corporate Social Responsibility	Environmental Regulation Intensity	Green Economic Efficiency
Corporate Social Responsibility	0.808		
Environmental Regulation Intensity	0.408	0.807	
Green Economic Efficiency	0.436	0.397	0.81

Table 4.4 displays the results for testing discriminant validity using Heterotrait-Monotrait ratio. Henseler et al. (2015) propose that for conceptually distinct constructs, values below 0.90 should indicate good discriminant validity according to this criterion; Table 4.4 has three pairs where such comparisons took place: Environmental Regulation Intensity with Corporate Social Responsibility was found at 0.442 while Green Economic Efficiency and Corporate Social Responsibility achieved 0.473 while 0.434 between Green Economic Efficiency and Environmental Regulation Intensity, indicating good discriminant validity according to this measure criterion indicating good discriminant validity.

Table 4.4: Discriminant Validity - HTMT Result

	Corporate Social Responsibility	Environmental Regulation Intensity
Environmental Regulation Intensity	0.442	
Green Economic Efficiency	0.473	0.434

4.2. Assessment of Structural Model

Based on the information in Table 4.5, multicollinearity within each construct was measured with VIF. According to Hair et al. (2011), any value below 5 indicates no critical multicollinearity issues; all items belonging to Environmental Regulation Intensity, Corporate Social Responsibility, and Green Economic Efficiency constructs have VIF values between 2.061-2.559 which falls well under Hair's threshold value of 5, implying no excess correlation among their items for further analyses and should therefore not pose as significant multicollinearity issues within these constructs.

Hair et al. (2011) suggests evaluating construct-level VIF values to detect multicollinearity issues between constructs; VIF values were set below 5 per their guidelines to avoid multicollinearity issues and those in Table 4.6 clearly fall below this critical value of 5. For Corporate Social Responsibility affecting Green Economic Efficiency (1.199), Environmental Regulation Intensity affecting Corporate Social Responsibility (1.000), and Environmental Regulation Intensity affecting Green Economic Efficiency (1.199).

These numbers clearly fall beneath this critical value and indicate there are no multicollinearity issues at construct level, thus disproving any multicollinearity issues between constructs as multicollinearity bias exists between relationships among them.

Table 4.5: Multicollinearity - VIF Result

Constructs	Items	Item VIF
Environmental Regulation Intensity (ERI)	ERI1	2.184
	ERI2	2.112
	ERI3	2.061
	ERI4	2.330
	ERI5	2.141
	ERI6	2.197
	ERI7	2.071
Green Economic Efficiency (GEE)	GEE1	2.101
	GEE2	2.114
	GEE3	2.314
	GEE4	2.263
	GEE5	2.262
	GEE6	2.118
	GEE7	2.175
Corporate Social Responsibility (CSR)	CSR1	2.525
	CSR2	2.118
	CSR3	2.559
	CSR4	2.243
	CSR5	2.076
	CSR6	2.344
	CSR7	2.174
	CSR8	2.384

Table 4.6: Multicollinearity - Construct VIF Result

Construct	VIF
Corporate Social Responsibility -> Green Economic Efficiency	1.199
Environmental Regulation Intensity -> Corporate Social Responsibility	1.000
Environmental Regulation Intensity -> Green Economic Efficiency	1.199

Table 4.7 provides data used for testing hypotheses using path coefficients, t-statistics and p-values to test direct effects. According to Hair et al. (2017), path coefficients considered significant are those where their respective t values exceed 1.96 at 5% significance level (p 0.05). H1 can be supported because its path coefficient from Environmental Regulation Intensity to Green Economic Efficiency stands at 0.263 (t = 5.521 and p = 0.000), signifying a substantial positive effect. Accordingly, its hypothesis can be accepted. At H2, the path coefficient from Corporate Social Responsibility to Green Economic Efficiency at 0.329 (t= 6.957, p = 0.000) which indicates a significant positive effect. Furthermore, Environmental Regulation Intensity to Corporate Social Responsibility shows a similarly significant positive effect with an impressive path coefficient value of 0.408 (t=9.574, p = 0.000) supporting H3’s mediation pathway.

Table 4.8 displays mediating effects testing H3. Environmental Regulation Intensity have an indirect influence on Green Economic Efficiency through Corporate Social Responsibility with an indirect path coefficient of 0.263 (t = 5.521 and p=0.000). According to Preacher & Hayes (2008), mediation effects are considered significant if their indirect effect is significant while

its confidence interval does not include zero; with significant t-value and p-value values indicative that Hypotheses 3 has been supported through mediation pathways that positively influenced both Corporate Social Responsibility which in turn positively affected Green Economic Efficiency among manufacturing companies in Guangdong Province in China.

Table 4.7: Hypothesis Test - Direct Effects

Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics ((O/STDEV))	P values
Environmental Regulation Intensity -> Green Economic Efficiency	0.263	0.263	0.048	5.521	0.000
Corporate Social Responsibility -> Green Economic Efficiency	0.329	0.329	0.047	6.957	0.000
Environmental Regulation Intensity -> Corporate Social Responsibility	0.408	0.410	0.043	9.574	0.000

Table 4.8: Hypothesis Test - Mediating Effects

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics ((O/STDEV))	P Values
Environmental Regulation Intensity -> Corporate Social Responsibility -> Green Economic Efficiency	0.134	0.135	0.024	5.583	0.000

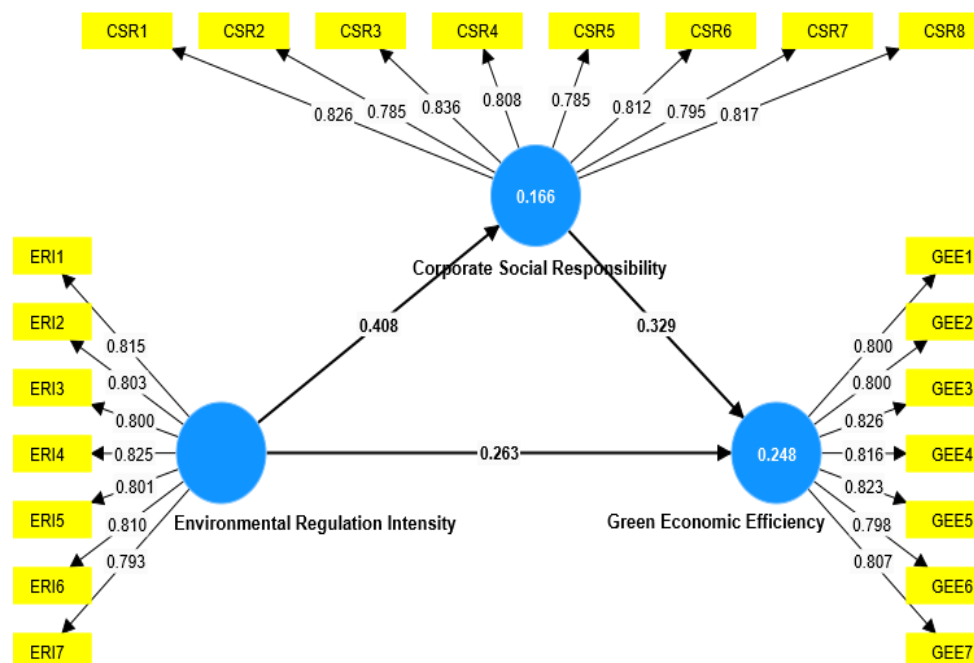


Figure 2: Hypothesis Testing

According to Table 4.9, R^2 values indicate the proportion of variance explained by independent variables for dependent variables. According to Cohen (2013), an R^2 value between 0.13 and 0.26 can be considered medium effect size in social sciences. Corporate Social Responsibility's R^2 value stands at 0.166 and its adjusted R^2 is 0.164; these results indicate that approximately 16.4% of variance is explained by this model. Green Economic Efficiency has an R^2 value of 0.248 with an adjusted R^2 of 0.244; this indicates that approximately 24.4% of its variance was explained by this model; these findings suggest it moderately explained variance within its dependent variables - making this acceptable for behavioral research studies.

Table 4.9: Regression - R^2

	R-square	R-square adjusted
Corporate Social Responsibility	0.166	0.164
Green Economic Efficiency	0.248	0.244

Based on Table 4.10, Q^2 values were assessed using blindfolding procedure to assess their predictive relevance of endogenous latent variables. According to Hair et al (2017), any Q^2 value greater than 0 indicates predictive relevance for an endogenous construct; for Corporate Social Responsibility this value stands at 0.107, while Green Economic Efficiency' Q^2 stands at 0.159; both positive Q^2 values suggest predictive relevance from models for respective constructs with green economic efficiency showing slightly more predictive relevance - suggesting it can predict latent variables to some degree thus supporting its validity within their context.

Table 4.10: Q^2 Value of Each Endogenous Latent Variable

Variable	$Q^2 (=1-SSE/SSO)$
Corporate Social Responsibility	0.107
Green Economic Efficiency	0.159

5. DISCUSSION AND CONCLUSION

5.1 Discussion of Main Findings

The study's main findings provide evidence supporting all three hypotheses, offering valuable insights into Environmental Regulation Intensity, Corporate Social Responsibility, and Green Economic Efficiency among manufacturing companies in Guangdong, China. H1, positing a positive influence of ERI on GEE, is strongly supported ($\beta = 0.263$, $t = 5.521$, $p < 0.001$). This suggests that stringent environmental regulations drive companies towards more efficient and environmentally friendly practices.

Similarly, H2, proposing a positive effect of CSR on GEE, is substantiated ($\beta = 0.329$, $t = 6.957$, $p < 0.001$), indicating that companies embracing CSR tend to achieve higher levels of green economic efficiency. The study confirms the mediating role of CSR in the relationship between ERI and GEE (H3). The significant indirect effect ($\beta = 0.134$, $t = 5.583$, $p < 0.001$) in the confidence interval underscore CSR's crucial intermediary function.

5.2 Theoretical and Practical Implications

The findings of this study offer significant theoretical and practical implications for understanding the relationships between Environmental Regulation Intensity, Corporate Social Responsibility, and Green Economic Efficiency in the manufacturing sector. From a theoretical perspective, this research contributes to the existing literature by empirically validating the positive impact of environmental regulations on green economic performance. It also extends our understanding of CSR's role as a mediator, bridging the gap between regulatory pressures and sustainable economic outcomes. Practically, policymakers can leverage these insights to design more effective environmental regulations that not only directly improve green economic efficiency but also encourage CSR practices. For business leaders, the results underscore the importance of proactively embracing CSR initiatives as a strategic approach to enhancing green economic performance, rather than viewing environmental regulations solely as compliance requirements. Moreover, the study provides a roadmap for manufacturing companies in Guangdong to optimize their environmental strategies, potentially leading to improved competitiveness and sustainability in an increasingly eco-conscious market.

5.3 Limitations and Future Research

Despite its contributions, this study has several limitations that pave the way for future research. The focus on Guangdong Province limits the generalizability of findings. Future studies could extend to other regions in China or conduct cross-country comparisons. The current study provides a snapshot view. Longitudinal research could offer insights into how relationships between ERI, CSR, and GEE evolve over time. While focusing on manufacturing provides depth, it limits breadth. Future research could explore these relationships across different sectors. Reliance on questionnaires may introduce bias. Incorporating objective measures of environmental performance and economic efficiency could enhance validity. While CSR was examined as a mediator, other potential mediators or moderators (e.g., technological innovation, organizational culture) could be explored. Future research addressing these limitations would further enrich our understanding of the complex interplay between environmental regulations, corporate responsibility, and sustainable economic performance.

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