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Research on the Coupling and Synergistic Development of Corporate ESG Performance and OFDI

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Abstract: The demand for corporate green governance competence has significantly increased in the international market in recent years, with the disclosure of corporate ESG information emerging as a crucial public concern. This study employs a coupling coordination degree model to investigate the mutually beneficial relationship between corporate ESG factors and OFDI in the Shanghai and Shenzhen A-share markets. The findings reveal: (1) a strong level of coupling coordination between corporate ESG performance and OFDI development, (2) a growth pattern in the interconnected coordination between corporate ESG performance and OFDI during 2010-2012, followed by a decline in 2012-2016, and subsequent recovery post-2016, and (3) a coupling coordination degree pattern of "East Central > West > Northeast”. This paper introduces three innovations: firstly, it extends beyond previous research by examining the relationship between ESG and OFDI bidirectionally; secondly, it utilizes the physical capacity coupling coordination degree model to assess the synergy level between corporate ESG performance and OFDI; and finally, it discusses the evolution mechanism and spatial distribution characteristics of the coupling coordination degree between corporate ESG performance and OFDI.

1. Introduction

Since the report of the 20th Party Congress, which emphasized the objective of achieving a modernization characterized by "harmony between human beings and nature," the concept of "dual-carbon" has emerged as a crucial component in China's efforts to implement a green development strategy and realize the goals of "harmony between human beings and nature" and "exploration of a new form of human civilization." This aligns with the ESG development concept. China's green development strategy includes the "dual-carbon" goal, which aims to achieve a harmonious coexistence between humans and nature and explore a new form of human civilization. This goal aligns with the ESG development concept, which focuses on environmental, social, and governance factors. In recent years, enterprises have also coincidentally transitioned to the ESG development mode, leading to a surge in ESG information disclosure. According to data from the China Association of Listed businesses, over 1,700 listed businesses have independently prepared and published ESG-related reports for the year 2022, representing 34 percent of the total. There has been a significant increase of around 600 ESG disclosure enterprises compared to the previous year's count of 1,112. Nevertheless, several businesses in the market continue to adhere to the notion of "profit maximization" and persist in participating in environmentally detrimental, immoral, and unregulated practices.

The European Union (EU) introduced the Non-Financial Reporting Directive (NFRD) in October 2014, marking a significant milestone in regulatory frameworks by explicitly integrating ESG aspects. This directive mandated an expansion in the scope and depth of ESG disclosures. OFDI presents both opportunities and challenges for multinational enterprises (MNEs). The new EU ESG regulation provides enhanced information for MNEs' investment decisions, prompting them to fortify their global operations and explore new avenues. Additionally, this legislation opens up possibilities for MNEs to engage in environmentally sustainable collaborations (Chen, Z., & Xiong, A., 20221). Corporate ESG advancement can bolster OFDI by improving corporate reputation and lowering financing expenses, aiding Chinese MNEs in upgrading and expanding their presence in the global market. Conversely, OFDI progress can drive ESG development by facilitating the adoption of green technology and compliance with foreign environmental standards, aligning Chinese enterprises with global norms and supporting China's high-quality economic growth. The concurrent enhancement of corporate ESG performance and OFDI not only helps Chinese MNEs enhance their global standing, boost brand reputation, and promote sustainable growth but also

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contributes to China's new development model" and fosters economic progress. Therefore, a thorough examination of the causal link between corporate ESG performance and OFDI is crucial for expanding China's MNEs' overseas investments and advancing China's ESG initiatives to achieve the "double carbon" goal.

The central focus of this paper is on ESG (Environmental, Social and Governance) and OFDI (Outward Foreign Direct Investment). ESG represents a set of criteria used to assess the environmental and social impact of an organisation. The term ESG is commonly used in the context of investment, but it can also be applied to customers, suppliers, employees and the general public. It is often used in conjunction with other related concepts such as sustainability and corporate social responsibility (CSR). In this paper, OFDI refers to the amount of non-financial direct investment that is flowed by enterprises from domestic to foreign countries.

In this paper, the coupling degree of ESG and OFDI is calculated using the amount of OFDI of A-share listed companies in one year and the ESG rating of CSI in the same year. The novelty of this paper's research is primarily demonstrated through three key characteristics in comparison to previous studies. Firstly, the study focuses on exploring the relationship between ESG and OFDI by considering multiple influencing factors rather than a singular one. Secondly, the research utilizes the Physical Capacity Coupling Co-ordination Degree model to evaluate the level of synergy development between corporate ESG performance and OFDI[2]. Lastly, the article employs the same model to assess the degree of synergy between corporate ESG performance and OFDI, examining the spatial distribution characteristics and evolution process of the coupling coordination degree between the two.

The paper is organized as follows: The second section includes the literature review and theoretical analysis. The third section describes the model setting and data. The fourth section assesses the level of coordinated development of ESG performance and OFDI coupling of enterprises, followed by a discussion of the results. Finally, the fifth section presents a summary and insights.

2. Literature review

2.1. Mechanisms of OFDI's effect on ESGs

Numerous research studies have illustrated the significant impact of ESG performance of corporations on the development of OFDI, as evidenced by Yang, Zhen et al. (2020)[3]. By employing a zero-inflated negative binomial regression model to analyze data from Chinese publicly traded manufacturing companies spanning from 2007 to 2017, the research outcomes propose that institutional pressure acts as a compelling driver for corporate OFDI towards CSR endeavors, such as corporate green innovation. Pan Zhen et al. (2020)[4] utilized identity theory to explore the relationship between internationalization and CSR from the perspective of organizers. Their findings revealed that companies involved in OFDI underwent a shift in their internationalization strategies, resulting in a modification of the social identity of corporate organizers. The transition in corporate conduct towards embracing positive ESG practices has been associated with perceived drawbacks and stereotypes linked to the stakeholders of the host country[5], as well as the relatively limited global recognition of Chinese MNEs (Wang Tao et al., 2018[6]; Liu Jianli and Liu Ruiming, 2020[7]). Moreover, the necessity for enhanced corporate ESG performance has driven organizers to partake in more CSR activities. Ahmad et al. (2019) deliberated on the Environmental Kuznets Curve (EKC) theory, proposing that as economies attain a certain developmental stage, the technological and structural impacts will surpass the scale effect, resulting in a decline in pollution levels and an escalation in green governance capacity[8]. Additionally, the expansion of corporate OFDI is viewed as advantageous for economic progress, with economic development bolstering pollution management capabilities. Research conducted by Zhang Jintao et al. (2023) on a sample of 359 Chinese firms has demonstrated a positive association between the environmental performance of multinational corporations and their OFDI choices[9]. Similarly, Bai Yu et al. (2020) have introduced a theoretical model grounded in various theories and empirical evidence from Chinese manufacturing firms, suggesting that OFDI to developed nations can facilitate reverse green technology transfer, thereby promoting environmental innovation and enhancing the ESG performance of parent companies[10].

2.2. Mechanisms of ESG on OFDI

Xie and Lv (2022)[11] utilized greenfield investment data from the Financial Times and overseas M&A data from the Thomson Reuters database to investigate the influence of ESG advantages on firms' OFDI development within an extended framework of the OLI theory. Their findings suggest that firms' ESG performance can enhance OFDI activities by reducing debt costs, easing financing constraints, and mitigating external disadvantages. In a study on 2022 listed Chinese companies from 2009 to 2022, Yang et al. (2023)[12] revealed a significant positive correlation between firms' ESG performance and their two-way foreign direct investment behavior using unbalanced panel data. LingYao and GoshuDesalegn (2023)[13] employed biblical econometrics, advanced data visualization techniques, and a comprehensive literature review to analyze 518 articles through RStudio and VOSviewer software. Their results indicate that integrating ESG goals into supply chain operations can promote sustainable development in Chinese OFDI firms and improve long-term profitability. Wang et al. (2024)[14] discovered, through a study on Chinese listed companies, that the facilitating impact of ESG performance on OFDI is influenced by financial constraints and corporate reputation. Dunning (1980)[15] proposed three primary motives for OFDI - market seeking, efficiency, and resource seeking - and suggested that ownership, location, and internalization factors determine the decision to engage in OFDI. The introduction of sustainable development requirements and enhancements in firms' ESG performance can modify firms' internal motivations, prompting them to pursue new objectives such as green resources and efficiency, thereby stimulating OFDI activities.

Previous studies predominantly focuses on the one-way impact of ESG on OFDI, with limited exploration of the interactive mechanisms between corporate ESG performance and OFDI through comprehensive theoretical and empirical analyses. This study aims to bridge this research gap by employing a coupling coordination model to delve deeper into the synergistic development mechanism between corporate ESG performance and OFDI. The primary contributions of this research are threefold: (1) enhancing the comprehension of the reciprocal relationship between corporate ESG performance and OFDI development from both theoretical and empirical standpoints, thereby enriching the literature on the mutually reinforcing dynamics of ESG and OFDI; (2) introducing an innovative methodology utilizing the coupled coordination model to evaluate the level of coordinated development between ESG and OFDI; and (3) offering a theoretical examination of the evolutionary mechanism and spatial distribution characteristics of the coupling coordination degree between firms' ESG performance and OFDI.

3. Model setup and data description

3.1. Modelling

This study utilizes the coupling coordination model to evaluate the synergistic progress between OFDI and ESG factors. The coupling degree in the model indicates the level of reciprocal impact among subsystems, encompassing both favorable and unfavorable consequences. On the other hand, the coupling coordination degree represents the degree of harmonious advancement between subsystems. Wang Heng (2023)[16] and Tian Haifeng (2023)[17] applied the coupled coordination degree model to clarify the level of coordinated advancement in digitalization and sustainability within an industry. In this study, the coupling coordination degree is used to elucidate the co-evolution between enterprise OFDI expansion and ESG performance under a specific level of coupling, focusing on the positive impact. Therefore, this research employs the coupling coordination degree to assess the interconnected synergistic development between corporate OFDI expansion and ESG performance.

In the coupling coordination model, there are n subsystems whose coupling can be depicted as:

$$C = \left[\frac{\prod_{i=1}^{n} U_i}{\left(\frac{1}{n}\sum_{i=1}^{n} U_i\right)^n}\right]^{\frac{1}{n}} \tag{1}$$

In this paper, the parameter n = 2 represents the level of coupling between ESG factors and OFDI.

$$C = 2\left[\frac{U_1 U_2}{(U_1+U_2)^2}\right]^{\frac{1}{2}} = 2\frac{\sqrt{U_1 U_2}}{U_1+U_2} \tag{2}$$

This study evaluates the level of synergistic progress between OFDI and ESG factors. In order to tackle the challenge of high interconnection but insufficient alignment between OFDI and ESG, it is crucial to calculate the degree of coupling coordination. This measure is determined by the following formula:

$$\begin{cases} D = \sqrt{C \times T} \\ T = \alpha U_1 + \beta U_2 \end{cases} \tag{3}$$

Therefore, the coupling degree between OFDI and ESG in this study is:

$$C_{it}(OE) = 2\frac{\sqrt{OFDI_{it} \times ESG_{it}}}{OFDI_{it}+ESG_{it}} \tag{4}$$

The coupling coordination degree of this paper is derived from equations (3) and (4):

$$\begin{aligned} D_{it}(OE) &= \left[C_{it}(OE) \times \frac{OFDI_{it} + ESG_{it}}{2}\right]^{\frac{1}{2}} \\ &= \left[2\frac{\sqrt{OFDI_{it} \times ESG_{it}}}{OFDI_{it} + ESG_{it}} \times \frac{OFDI_{it} + ESG_{it}}{2}\right]^{\frac{1}{2}} \\ &= \left[(OFDI_{it} \times ESG_{it})^{\frac{1}{2}}\right]^{\frac{1}{2}} \end{aligned} \tag{5}$$

Previous studies have defined the degree of coupling (C) and degree of coupling coordination (D) with values ranging from 0 to 1, while also considering the coordination index (T). The coefficients α and β, which represent the weights of the sub-systems, need to be determined such that $\alpha + \beta = 1$. Given the global importance of ESG issues and OFDI, this research assigns equal significance to both by setting α and β to 0.5 each. Previous research has classified the degree of coupling coordination into ten levels, as outlined in Table 1[18][19] .

Table 1 Types of coupling coordination degrees

Level of coordination	coordination zone	Degree of coordination
1	(0,0.1)	extreme disorder
2	(0.1,0.2)	severe disorder
3	(0.2,0.3)	moderate disorder
4	(0.3,0.4)	mild disorder
5	(0.4,0.5)	on the verge of becoming dysfunctional
6	(0.5,0.6)	sue for coordination
7	(0.6,0.7)	Primary coordination
8	(0.7,0.8)	Intermediate level coordination

9	(0.8,0.9)	good coordination
10	(0.9,1)	Quality coordination

3.2. Data description

This research focuses on A-share listed companies in China's Shanghai and Shenzhen markets as the subjects of investigation. To minimize the impact of the 2008 financial crisis and the 2020 epidemic, the study period ranges from 2009 to 2019, excluding financial and ST companies from the sample. The study incorporates CSI ESG ratings of Chinese listed companies from 2009 to 2019 and integrates OFDI data of listed companies obtained from The American Enterprise Institute and The Heritage Foundation. As the units of measurement of the indicators were not uniform, the raw data were initially processed in a dimensionless manner using the extreme variance method. Then evaluate the interconnected coordination level between ESG and OFDI. The combined dataset consists of 24,881 data points from 3,184 listed companies.

4. Measurement of the level of coordinated development of esg and ofdi coupling and analysis of results

This study utilizes the research conducted by Huang, Lingyun et al. (2018)[20] to examine the extent of synchronized advancement in firms' OFDI activities and ESG performance. The Panel Vector Autoregression (PVAR) model is employed to investigate the potential bidirectional interaction effect between ESG and OFDI. The analysis includes a smoothness assessment of ESG and OFDI panel data, impulse response function analysis, Granger causality testing, and variance decomposition for ESG and OFDI. Furthermore, the study evaluates the level of interconnected and synchronized progress between ESG and OFDI using the coupled coordination degree model and interprets the findings accordingly[21].

4.1. Tests before coupled coordinated development measurement

4.1.1. Smoothness test

This study examines the degree of synchronized advancement in firms' OFDI activities and ESG performance based on research conducted by Huang, Lingyun et al. (2018)[20]. The study employs the PVAR model to explore the potential bidirectional interaction effect between ESG and OFDI. The PVAR model is capable of accounting for individual differences and can also be employed to address endogeneity issues by incorporating variable lag terms. The analysis includes assessing the smoothness of ESG and OFDI panel data, analyzing impulse response functions, conducting Granger causality tests, and performing variance decomposition for ESG and OFDI. Additionally, the study assesses the level of interconnected and synchronized progress between ESG and OFDI using the coupled coordination degree model and interprets the findings accordingly.

Table 2 ADF test table

variant	t	P	threshold value		
			1%	5%	10%
ESG	-17.91	0.000***	-3.431	-2.862	-2.567
log(ofdi+1)	-51.685	0.000***	-3.431	-2.862	-2.567

Note: ***, **, * represent 1 per cent, 5 per cent and 10 per cent significance levels, respectively.

4.1.2. Impulse Response Function

This study utilizes Impulse Response Function (IRF) analysis to investigate the potential relationship between OFDI and ESG factors. The research adopts a multi-indicator joint confirmation methodology to determine the most appropriate lag order. According to the results outlined in Table 3, the optimal lag order determined is 6.

Table 3 Results of lag order selection

hysteresis order (math.)	logL	AIC	SC	HQ	FPE
0	-92113.465	1.729	1.729	1.729	5.633
1	-83704.08	1.053	1.055	1.054	2.867
2	-83569.323	1.043	1.046	1.044	2.838
3	-83490.265	1.037	1.042*	1.039	2.822
4	-83467.717	1.036	1.042	1.038	2.818
5	-83445.446	1.035	1.042	1.037*	2.815
6	-83437.445	1.035*	1.043	1.038	2.815*

hysteresis order (math.)	logL	AIC	SC	HQ	FPE
7	-83430.808	1.035	1.045	1.038	2.815
8	-83424.756	1.035	1.046	1.039	2.815
9	-83421.695	1.035	1.048	1.039	2.816
10	-83412.431	1.035	1.049	1.04	2.816
11	-83406.508	1.035	1.05	1.04	2.816

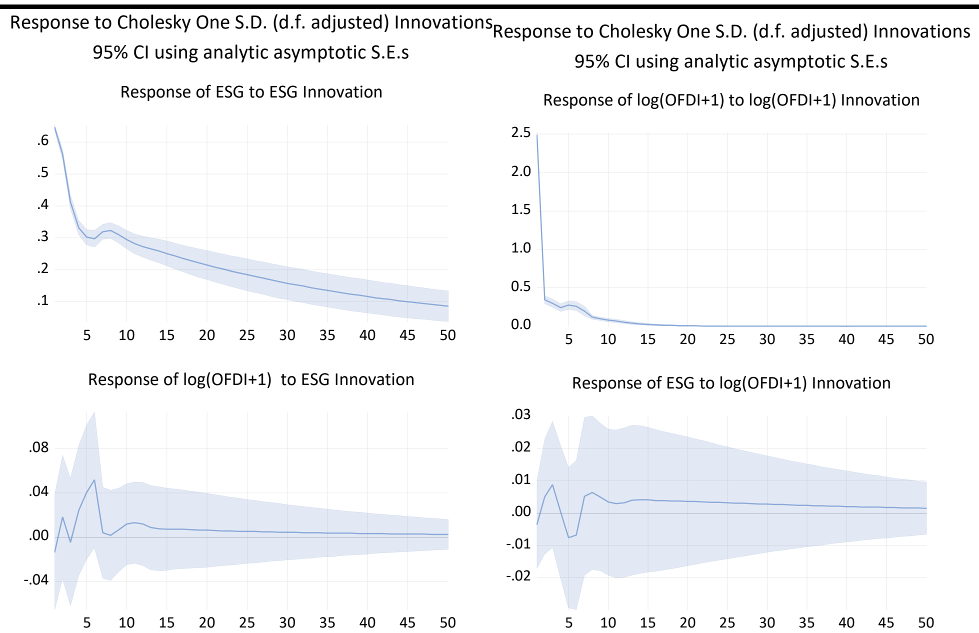


Fig. 1 Impulse response diagram

The results presented in Figure 1 show a consistent positive correlation between OFDI and ESG factors. This correlation reaches its peak in the sixth period before gradually declining towards zero. In contrast, ESG initially has a short-term positive influence on OFDI, followed by a weaker negative effect that shifts back to a positive trend from the seventh period onwards, ultimately converging. These findings suggest a significant interactive association between ESG and OFDI.

4.1.3. Granger causality test

Table 4 Results of Granger causality test

matched sample		F	P
log(ofdi+1)	ESG	2.355	0.028**
ESG	log(ofdi+1)	2.451	0.023**

Note: ***, **, * represent 1 per cent, 5 per cent and 10 per cent significance levels, respectively.

To investigate the potential association between OFDI and ESG factors, this research utilizes the Granger causality test. The statistical findings presented in Table 4 indicate that the F-value for log(ofdi+1) is 2.355, which is statistically significant at the 5% level, suggesting a Granger causality link with ESG. Similarly, the F-value for ESG is 2.451, illustrating Granger causality with log(ofdi+1) at the 5% significance threshold. These outcomes derived from the Granger causality test offer support for a substantial relationship between ESG and OFDI.

As depicted in Table 5, the analysis of ESG fluctuations indicates that the influence of OFDI on ESG is initially insignificant at 0%, gradually rising to 0.043%. This finding implies that ESG is subject to influences beyond OFDI, which have a more substantial effect. In contrast, the impact of ESG on OFDI fluctuation is minimal, starting at 0.03% and increasing to 0.031%. The limited effect of ESG on OFDI can be ascribed to the various uncertainties in both macro and microeconomic contexts that impact OFDI, with corporate ESG performance being just one of several contributing factors.

4.1.4. Variance decomposition

Table 5 Results of variance decomposition

ESG				Log(OFDI+1)			
ordinal number	standard deviation	ESG%	log(ofdi+1)%	ordinal number	standard deviation	ESG%	log(ofdi+1)%

1	0.714	100	0	1	2.358	0.03	99.97
2	0.867	99.994	0.006	2	2.388	0.03	99.97
3	0.931	99.979	0.021	3	2.407	0.029	99.971
4	0.96	99.969	0.031	4	2.408	0.03	99.97
5	0.974	99.963	0.037	5	2.409	0.031	99.969
6	0.98	99.96	0.04	6	2.409	0.031	99.969
7	0.983	99.959	0.041	7	2.409	0.031	99.969
8	0.984	99.958	0.042	8	2.409	0.031	99.969
9	0.985	99.958	0.042	9	2.409	0.031	99.969
10	0.985	99.957	0.043	10	2.409	0.031	99.969

4.2. Analysis of coupled coordination results

Following the recognition of the interactive association between firms' OFDI and ESG performance, a coupling coordination degree model was utilized to evaluate the extent of synergistic progress between OFDI and ESG. An indicator quantifying the level of coordinated development between OFDI and ESG was established through an examination of the geographical dispersion of publicly listed companies across 31 Chinese provinces, municipalities, and autonomous regions from 2009 to 2019, as outlined in Table 6.

Table 6 Coupled harmonisation of OFDI and ESG, 2009-2019

provinces	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	average value
Anhui	0.792	0.792	0.801	0.813	0.816	0.778	0.781	0.769	0.795	0.811	0.816	0.797
Beijing	0.805	0.795	0.814	0.810	0.814	0.805	0.787	0.785	0.787	0.796	0.795	0.799
Fujian	0.804	0.802	0.799	0.815	0.806	0.801	0.790	0.793	0.786	0.796	0.789	0.798
Gansu	0.766	0.753	0.765	0.782	0.798	0.784	0.773	0.772	0.727	0.758	0.709	0.762
Guangdong	0.773	0.788	0.796	0.792	0.783	0.779	0.769	0.758	0.786	0.784	0.773	0.780
Guangxi	0.790	0.769	0.780	0.798	0.768	0.798	0.749	0.748	0.740	0.753	0.717	0.765
Guizhou	0.820	0.804	0.822	0.831	0.780	0.765	0.787	0.814	0.822	0.830	0.813	0.808
Hainan	0.741	0.776	0.777	0.792	0.753	0.762	0.749	0.744	0.746	0.685	0.644	0.743
Hebei	0.784	0.766	0.788	0.787	0.812	0.784	0.776	0.760	0.777	0.800	0.787	0.784
Henan	0.781	0.785	0.798	0.803	0.816	0.814	0.790	0.767	0.775	0.799	0.795	0.793
Heilongjiang	0.766	0.751	0.777	0.775	0.756	0.757	0.758	0.730	0.747	0.771	0.774	0.760
Hubei	0.788	0.788	0.796	0.798	0.774	0.778	0.767	0.759	0.763	0.768	0.773	0.777
Hunan	0.792	0.791	0.782	0.809	0.798	0.788	0.789	0.759	0.781	0.795	0.778	0.787
Jilin	0.759	0.771	0.793	0.797	0.756	0.787	0.741	0.756	0.759	0.776	0.757	0.768
Jiangsu	0.794	0.791	0.798	0.792	0.796	0.787	0.779	0.779	0.796	0.799	0.783	0.790
Jiangxi	0.800	0.800	0.803	0.805	0.790	0.795	0.786	0.771	0.759	0.774	0.756	0.785
Liaoning	0.789	0.786	0.796	0.793	0.789	0.790	0.783	0.730	0.770	0.766	0.735	0.775
Inner Mongolia	0.779	0.790	0.787	0.786	0.808	0.797	0.761	0.765	0.759	0.738	0.744	0.774
Ningxia	0.758	0.773	0.811	0.788	0.778	0.724	0.785	0.726	0.752	0.719	0.712	0.757
Qinghai	0.754	0.612	0.744	0.788	0.783	0.753	0.764	0.791	0.764	0.788	0.786	0.757
Shandong	0.775	0.771	0.786	0.789	0.793	0.785	0.780	0.757	0.767	0.793	0.790	0.781
Shanxi	0.794	0.763	0.776	0.801	0.791	0.817	0.791	0.756	0.726	0.733	0.760	0.773
Shaanxi	0.761	0.772	0.780	0.798	0.800	0.796	0.758	0.745	0.777	0.810	0.791	0.781
Shanghai	0.776	0.779	0.788	0.787	0.778	0.777	0.778	0.750	0.769	0.781	0.786	0.777
Sichuan	0.802	0.799	0.774	0.797	0.795	0.779	0.778	0.758	0.790	0.795	0.801	0.788
Tianjin	0.789	0.780	0.800	0.777	0.783	0.805	0.767	0.744	0.777	0.801	0.803	0.784
Tibet	0.757	0.770	0.787	0.813	0.820	0.741	0.693	0.716	0.781	0.810	0.805	0.772
Xinjiang	0.789	0.801	0.778	0.775	0.771	0.777	0.778	0.770	0.760	0.753	0.763	0.774
Yunnan	0.817	0.812	0.807	0.792	0.793	0.805	0.785	0.774	0.805	0.796	0.793	0.798
Zhejiang	0.795	0.797	0.800	0.807	0.800	0.791	0.792	0.770	0.799	0.796	0.786	0.794
Chongqing	0.783	0.747	0.796	0.781	0.777	0.774	0.756	0.750	0.745	0.755	0.750	0.765

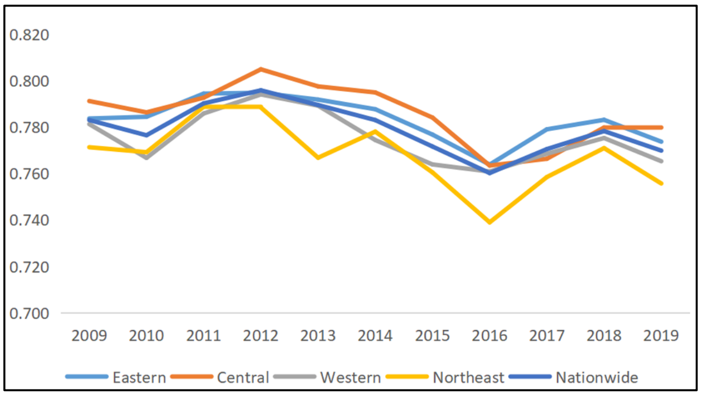


Figure 2 Trends in the level of OFDI and ESG harmonisation in the country's four regions, 2009-2019

This research investigates the relationship between ESG factors and OFDI coordination levels from 2009 to 2019 in various regions of China. The results, depicted in Figure 2, demonstrate a trend of increasing ESG and OFDI coordination between 2010 and 2012, a decrease from 2012 to 2016, and a subsequent recovery after 2016. Additionally, the analysis reveals a regional hierarchy in coordination levels, with the East Central region showing the highest coordination, followed by the West and Northeast regions. The following section will explore the underlying causes of these patterns and regional differences.

4.3. Robustness analysis

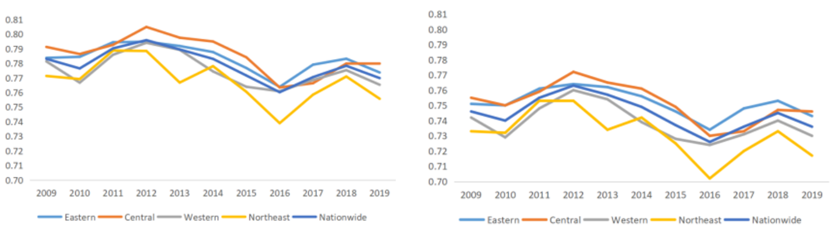
In this paper, we conduct a robust type analysis of the weights of ESG and OFDI in the coupled degree of coordination model to test the impact of different weights on the results. In this paper, the entropy weight method is first used to calculate the weights of ESG and OFDI in the model, and the results are shown in Table 7.

Table 7 Table of results of entropy weight method

entropy weighting (physics)			
Term (in a mathematical formula)	The information entropy value, e	Information utility value, d	Weighting (%)
ESG	0.994	0.006	62.202
log(ofdi+1)	0.997	0.003	37.798

The weights calculated by the entropy weight method are re-substituted into the coupling coordination degree model to calculate, and the results are shown in Figure 3. It shows that the coupling coordination degree of ESG and OFDI of Chinese companies in each region is slightly lower than the outcome of original 1:1 weight, and the range of coupling coordination degree is changed from (0.73, 0.81) to (0.7, 0.78). However, the trends are generally consistent, demonstrating the significant robustness of the results.

Figure 3 Trends in the level of OFDI and ESG harmonisation



(a) (ESG:OFDI=50:50) **(b)** (ESG:OFDI=62.202:37.798)

5. Conclusions and implications

This study investigates the correlation between OFDI by corporations and ESG performance in Chinese listed companies spanning from 2009 to 2019. The research employs the PVAR model to measure the extent of synergistic progress between corporate OFDI and ESG performance. Furthermore, the study utilizes the coupling degree of coordination model to evaluate the level of coordination between corporate OFDI and ESG performance, and conducts comparisons across regions and time periods to analyze this coordination level.

The results indicate a significant relationship between the ESG performance of enterprises and the development of OFDI. The analysis demonstrates a pattern in the coordination degree of this relationship, with a hierarchy observed as "East Central > West > Northeast". Despite this hierarchy, the overall comparison among the four main regions shows minimal variation in the coordination degree, with a consistent fluctuation pattern characterized by an increase during 2010-2012, a decline in 2012-2016, and a subsequent rise after 2016. The range of fluctuation in the coordination degree across regions varies from 0.74 to 0.82, indicating a high level of coordination between enterprise OFDI development and ESG performance.

The study suggests three primary areas of focus for the future advancement of Chinese enterprises' OFDI and ESG initiatives, based on these conclusions.

Firstly, it is suggested that the government should strengthen its oversight of corporate ESG disclosure. This involves progressively harmonizing domestic regulations with global standards to enhance green governance capabilities and incentivize businesses to shift towards sustainable development.

Secondly, at national level, promoting economic growth, the incenting businesses to participate in OFDI and highlighting the significance of economic advancement in environmental management. The study proposes that economic advancement can result in improved ESG performance, as suggested by the Environmental Kuznets curve theory. This theory posits an inverted U-shaped correlation between economic progress and pollution levels.

Thirdly, from the perspective of each region, the eastern and central regions should continue to maintain the synergistic development of ESG and OFDI, and strengthen green innovation to promote the sustainable development of enterprises. Enterprises in the western and northeastern regions should strengthen the disclosure of corporate ESG information, vigorously carry out greening and achieve international standards at an early stage to promote the further development of corporate OFDI.

The results of the analysis may be subject to bias as a consequence of the limitations imposed on data access for unlisted companies, the self-selection of the sample, and the potential for companies to engage in "greenwashing" behaviour. The CSI ESG data employed in this study reflects the actual circumstances of Chinese companies, rendering it more pertinent for research in China. Conversely, ESG ratings from other professional organizations can be utilized to assess ESG performance in other regions.

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