Information Fog Or Multi-dimensional Signal? ESG Rating Differences, Information Asymmetry and Stock Price Synchronization

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Abstract

From the perspective of information asymmetry, this paper empirically examines the impact of ESG rating divergence on stock price synchronicity and its mechanisms, using China's A-share listed companies from 2014 to 2024 as a sample. The findings show that: (1) ESG rating divergence significantly reduces stock price synchronicity, indicating that divergence is not pure market noise but provides multi-dimensional firm-specific information increments that promote the incorporation of company-level information into stock prices; (2) institutional investor attention positively moderates this relationship, weakening the inhibiting effect in firms with high institutional ownership; (3) the effect is highly immediate, with delayed effects essentially disappearing; (4) an industry-level network contagion effect exists-peers' rating divergence affects a firm's synchronicity far more than its own, and institutional investor attention can effectively block this contagion path. Contrary to the existing "noise effect" conclusion, this paper reveals the pricing function of ESG rating divergence from an information-increment perspective, providing new empirical evidence on the ESG information environment and capital market pricing efficiency in emerging markets.

Keywords

ESG rating divergence, stock price synchronization, information asymmetry, institutional investor attention, capital market pricing efficiency.

1. Introduction

The rapid expansion of ESG investment has made third-party ratings a key information intermediary, yet six major agencies' ratings correlate at only 0.38–0.71 (Berg et al., 2022). Is this divergence noise blurring fundamentals, or multi-dimensional information increment? China's A-shares-high synchronicity, coexisting domestic and foreign agencies, voluntary-to-mandatory disclosure-are ideal. The "noise view" holds divergence raises synchronicity (Liu et al., 2023; Chen et al., 2025), the "information view" that it lowers (Wang & Wei, 2026). Using 27,255 firm-year observations (2014–2024) and two-way fixed effects, we measure divergence as the cross-sectional standard deviation of Bloomberg, CSIndex and SynTao ratings. Results show divergence reduces synchronicity, supporting the information view; institutional attention positively moderates, weakening at high institutional holdings; the effect is immediate, vanishing after lags; industry contagion exists-peers' divergence matters more than one's own, which institutions can block. We challenge the dominant "noise effect" conclusion in emerging markets, revealing divergence as information increments rather than distortion.

2. Research Background

The concept of ESG (environment, society and governance) is deeply compatible with China's "dual carbon" strategy. The scale of ESG investment continues to expand. As the main body of

production and transmission of ESG information, third-party rating agencies have become important information intermediaries for investors' decision-making. However, there are obvious differences in the rating scope, index selection and weighting of different rating agencies, and the differences in the ESG rating results of the same enterprise are common: Berg and others [1] show that the rating correlation coefficient of each institution is only 0.38-0.71 based on the calculations of six major institutions; the correlation coefficient between major domestic institutions is only 0.31-0.62 [2], and rating differences have become the core issue restricting the effective pricing of ESG information.

At the same time, the synchronization of stock prices in China's capital market is high for a long time, and it is difficult to fully integrate the characteristic information of individual stocks into the stock price, and the efficiency of market pricing needs to be improved. As a key indicator to measure the degree of price entry of the company's characteristic information, stock price synchronization has always been the focus of attention in the academic community. As an important source of information uncertainty, how will rating differences affect the synchronization of stock prices? Existing studies have not yet reached a unified conclusion. In view of this, this article takes China's A-share listed companies as a sample, and systematically examines the impact, mechanism and boundary conditions of ESG rating differences on the synchronization of stock prices, which is of both theoretical value and practical significance.

3. Literature Review

3.1. The Measurement, Cause and Information Quality of ESG Rating Differences

Divergence is measured by the standard deviation or pairwise difference of ratings [1,3]. Berg et al. [1] decompose it (measurement 56%, scope 38%, weight 6%), measurement dominant; Avramov et al. [3] view it as "rating uncertainty" affecting prices and welfare. Feng et al. [4] find China's low-quality disclosure widens divergence, mainly across domestic and foreign institutions; Wang et al. [5] confirm internal control alleviates it. DesJardine et al. [7] show common ownership creates rating bias; Liu and Zhang [6] find managerial myopia inhibits ESG participation, affecting rating availability and divergence. Kathan et al. [8] find scores capture "claims" rather than real performance, raising greenwashing risk; Sandberg et al. [9] note ratings converge to the mean; Yan et al. [10] distinguish ESG uncertainty (real performance fluctuation) from ESG noise, the latter disrupting pricing.

3.2. Economic Consequences of ESG Rating Differences

At the capital market level, Zhou et al. [11] find divergence reduces forecast accuracy by raising analysts' information-processing costs, while Sun et al. [12] confirm good ESG performance improves forecast quality; Zhang et al. [13] find divergence exacerbates mispricing via heterogeneous beliefs; Wang and Niu [14] find it raises equity capital costs; Wang and Wei [2] find U-shaped and inverted-U relationships with stock returns and crash risk. International evidence shows divergence lowers excess returns [15], raises crash risk [16], reduces firm value [17], and tightens financing constraints via analyst deviation [18]. For firms, Cao et al. [19] find divergence induces tax avoidance; Zhou et al. [20] confirm it forces green innovation as an "insurance" buffer; Mao et al. [21] find high divergence accompanies higher earnings management.

3.3. Factors Affecting the Synchronization of Stock Prices and the Intersection with ESG

Stock price synchronization research comes from the information efficiency framework: company transparency [22], social responsibility disclosure signals [23], etc., all significantly affect stock price synchronization. Focusing on ESG information, Qi Baolei and others [24], Tang

Yang and Shen Xiaoli [25] found that the better the ESG performance, the higher the synchronization of the stock price based on the "noise basic view"; Weng Zhoujie and Lai Zheng [26] also found that ESG performance had a masking effect on the risk of collapse by improving stock price synchronization. There are still few literatures that directly examine the synchronization of rating differences and stock prices: Liu Xiangqiang et al. [27], Chen Hongtao and others [28] confirm that rating differences significantly improve the synchronization of stock prices, there is a "noise effect" of differences, and information asymmetry is an important transmission mechanism; Krueger et al. [29] show that compulsory ESG disclosure can significantly improve stock liquidity and provide institutional evidence for the perspective of the information environment.

3.4. Literature Commentary

In summary, the literature has clarified the universality and multi-dimensional economic consequences of rating differences, and preliminarily confirmed the positive impact of differences on stock price synchronization, but there is still room for expansion: First, the transmission mechanism of disagreements affecting the synchronization of stock prices (such as analyst behavior and information asymmetry) lacks systematic testing; Second, the research on boundary conditions such as information environment and investor characteristics is insufficient; Third, the dispute between the "noise effect" and "information effect" has not yet been concisived. Institutional theory also suggests that differences are the result of organizational response under institutional pressure, and their market consequences need to be further identified [30]. This article intends to make incremental contributions in the above aspects.

4. Research and Design

4.1. Sample Selection and Data Source

This article takes China's A-share listed companies in 2014-2024 as a research sample. Individual stock transaction data, market rate of return, financial data and corporate governance data come from the CSMAR database, and the ESG rating data comes from the Bloomberg ESG rating system, the China Stock Exchange ESG rating system and the business green ESG rating system. In order to ensure the effective calculation of the ESG rating divergence, only the company-annual observations covered by at least two rating agencies are retained. Continuous variables are tailed at 1% and 99% centiles to eliminate the influence of extreme values. The final sample contains 27,255 company-annual observations, covering 4,929 listed companies.

4.2. Definition of Variables

4.2.1. Explained Variable: Stock Price Synchronization (SYN)

Stock price synchronization (SYN) measures the degree of consistency between the price trend of individual stocks and the overall trend of the market. Drawing on the practice of Morck et al. (2000) and Durnev et al. (2003), this paper calculates the fitting degree R^2 of the return of individual stock yield and market yield regression by constructing a market model, and transforms it into a logarithmic transformation:

$$SYN = ln[R^2/(1-R^2)]$$

Among them, R^2 is the fitting advantage of market model regression. The larger the SYN value, the larger the R^2, the more the stock price trend of individual stocks converges with the overall trend of the market, the higher the synchronization of the stock price, and the lower the degree

of integration of the company-level characteristic information into the stock price. The logarithm transformation maps R^2 from the [0,1] interval to the entire real number axis, which facilitates regression analysis.

4.2.2. Core Explanatory Variable: ESG Rating Divergence (DIS)

ESG rating divergence (DIS) measures the degree of divergence among different rating agencies in evaluating the same company's ESG performance. This paper uses data from three agencies-Bloomberg, China Securities and SynTao Green Finance-and constructs DIS in two steps. First, annual cross-sectional standardization: as agencies differ in scoring systems and rating calibers, each institution's scores are standardized within the annual cross-section to eliminate the impact of caliber differences. Second, divergence calculation: for each company rated by at least two agencies in the same year, the standard deviation of standardized scores is computed as DIS, with the range method (DIS_range) and coefficient of variation (DIS_cv) as alternative measures. This construction ensures DIS directly reflects evaluation differences between rating agencies, introduces no additional information-environment adjustment factors, and avoids mechanical correlation with control variables such as firm size and institutional shareholding ratio.

4.2.3. Adjustment Variables: Institutional Investor Attention (ANA)

Institutional Investor Concern (ANA) measures the intensity of institutional investors' information mining and supervision of listed companies. This article takes the shareholding ratio of institutional investors as the proxy variable of the attention of institutional investors. The higher the shareholding ratio of the institution, the more the company is concerned and supervised by the institution. In the analysis of the adjustment effect, this paper expects that the interest of institutional investors positively adjusts the relationship between ESG rating divergence and stock price synchronization, that is, the higher the interest of institutional investors, the weaker the negative impact of ESG rating divergence on stock price synchronization.

4.2.4. Control Variables

Table 1. Variable Definition

Variable type	Variable symbols	Variable name	Definition
Explained variables	SYN	Stock price synchronization	$\ln[R^2/(1-R^2)]$, R^2 is the market model regression fit excellence
Core explanatory variables	DIS	ESG rat-ing divergence	Standard deviation of standardized scoring by many rating agencies
Adjust variables	ANA	The attention of institutional investors	Shareholding ratio of institutional investors
Control variables	Size	The size of the company	The natural logarithm of total assets
	Lev	Asset-liability ratio	Total liabilities/total assets
	ROA	Profitability	Net profit/total assets
	Growth	Growth	The growth rate of operating income
	TobinQ	Tobin Q value	Market value/total assets
	Cash Flow	Cash flow	Operating cash flow/total assets
	Board	The size of the board of directors	The natural logarithm of the number of directors
	Indep	The proportion of independent directors	Number of independent directors/total number of directors
	Top1	Equity concentration	The shareholding ratio of the largest shareholder
	Dual	Two positions in one	Whether the chairman and general manager are concurrently (1=yes, 0=no)
	ListAge	Listing period	The natural logarithm of the number of years of listing

4.3. Model Design

4.3.1. Benchmark Model

In order to test the impact of ESG rating divergence on stock price synchronization (assumption H1), this paper constructs the following two-way fixed effect panel model:

$$SYN_it = \alpha + \beta_1 DIS_it + \gamma Controls_it + \mu_i + \lambda_t + \varepsilon_it$$

Among them, SYN_it is the stock price synchronization of the t-year of the i-company, DIS_it is the ESG rating divergence, Controls_it is the control variable set, μ_i is the company's fixed effect, λ_t is the year fixed effect, and ε_it is the random error term. The core coefficient of this article is β1. If β1 is significantly negative, it indicates that the higher the ESG rating divergence, the lower the synchronization of the stock price. That is, the ESG rating divergence provides a multi-angle information perspective for the market and promotes the integration of the company's characteristic information into the stock price, assuming that H1 is supported. The standard is mistaken for cluster adjustment at the company level.

4.3.2. Adjustment Effect Model

In order to test the regulatory effect of institutional investor attention (assumption H2), this paper introduces the standardized cross-multiplication of ESG rating divergence and institutional investor concern:

$$SYN_it = \alpha + \beta_1 DIS_z_it + \beta_2 DIS_z \times ANA_z_it + \beta_3 ANA_z_it + \gamma Controls_it + \mu_i + \lambda_t + \varepsilon_it$$

Among them, DIS_z and ANA_z are the differences of ESG ratings and the attention of institutional investors after standardized processing respectively, and DIS_z×ANA_z are the intersection of the two. The core coefficient of this article is β2. If β2 is significantly positive, it indicates that the attention of institutional investors can weaken the negative impact of ESG rating divergence on stock price synchronization, assuming that H2 is supported.

5. Empirical Results and Analysis

5.1. Descriptive Statistics

Table 2 reports the descriptive statistical results of the main variables. The sample contains 27,255 companies - annual observations, covering 4,929 listed companies. The average value of stock price synchronization (SYN) is -0.9453, and the standard deviation is 0.4243, indicating that there is a large difference in stock price synchronization between different companies. The average value of ESG rating divergence (DIS) is 0.6009, and the standard deviation is 0.7080, indicating that there is obvious heterogeneity in the degree of ESG rating divergence faced by different companies. The average value of institutional investor attention (ANA) is 0.4761, which reflects the average level of institutional investor attention received by the sample company.

Table 2. Descriptive Statistics

Variable	Observation value	Mean value	Standard deviation	Minimum value	The medin	Maximum value
DIS	27255	0.6009	0.7080	0.0010	0.3149	3.3380
DIS_range	27255	0.9208	1.0803	0.0010	0.5039	5.0882
DIS_cv	27255	0.3197	0.4097	0.0010	0.1855	2.2980
SYN	27255	-0.9453	0.4243	-2.1743	-0.9277	0.0501
SYN_Market	27255	-1.7422	0.4475	-2.9106	-1.7240	-0.7669
SYN_Industry	27255	-1.9871	0.4788	-3.2081	-1.9556	-0.9894
ANA	27255	0.4761	0.1654	0.1383	0.4784	0.8603
Size	27255	22.5961	1.3335	19.5522	22.4060	26.4523
Lev	27255	0.4314	0.2026	0.0487	0.4266	0.9104
ROA	27255	0.0295	0.0685	-0.5562	0.0322	0.2223
Growth	27255	0.1138	0.3680	-0.6735	0.0695	5.0755
TobinQ	27255	1.9925	1.3054	0.7946	1.5777	17.6759
CashFlow	27255	0.0511	0.0665	-0.1942	0.0490	0.2669
Board	27255	2.1057	0.1989	1.6094	2.1972	2.7081
Indep	27255	0.3799	0.0544	0.2857	0.3636	0.6000
Top1	27255	0.3323	0.1504	0.0749	0.3074	0.7552
Dual	26471	0.3109	0.4629	0.0000	0.0000	1.0000
List Age	27255	2.2910	0.7834	0.6931	2.3979	3.5553

5.2. Correlation Analysis

Table 3 reports the Pearson correlation coefficient matrix of the main variables. The correlation coefficient between ESG rating divergence (DIS) and stock price synchronization (SYN) is -0.1339, which is statistically significantly negative, which initially supports the assumption that the expectation of H1 is that the greater the ESG rating divergence, the lower the stock price synchronization. The interest of institutional investors (ANA) is positively correlated (0.2789) with SYN, indicating that the synchronization of the stock prices of companies with higher attention from institutional investors is also high, which is related to the characteristics that institutional investors tend to hold large-cap stocks and their trading behavior is more consistent with the market trend. The correlation coefficient between each control variable is low, and there is no serious multiple collinearity problem.

Table 3. Correlation coefficient matrix

	DIS	SYN	ANA	Size	Lev	ROA	Growth	TobinQ
DIS	1.0000							
SYN	-0.1339	1.0000						
ANA	-0.4680	0.2789	1.0000					
Size	-0.2602	0.0127	0.2550	1.0000				
Lev	0.2216	0.0284	0.0266	0.4739	1.0000			
ROA	-0.2653	0.0957	0.2371	0.0940	-0.3270	1.0000		
Growth	-0.0924	0.0831	0.2052	0.0530	0.0321	0.2673	1.0000	
TobinQ	-0.0660	0.1669	0.3369	-0.3686	-0.2676	0.1679	0.1180	1.0000

Note: ***, ** and * indicate that they are significant at the level of 1%, 5% and 10% respectively.

5.3. Correlation Analysis

Table 4 reports the results of the benchmark regression of the ESG rating divergence to the synchronization of the stock price. Column (1) only contains the core explanatory variable DIS and the year-fixed effect. The regression coefficient of DIS is -0.0765, which is significantly negative at the 1% level. Column (2) On this basis, control variables such as size, asset-liability ratio (Lev) and profitability (ROA) are added. The coefficient of DIS is -0.0791, which is still significantly negative at the 1% level. Column (3) further adds the company's fixed effect to control the characteristics of the company that do not change over time. The coefficient of DIS is -0.0560, and the direction and significance remain unchanged. From the complete model results of column (3), it can be seen that after controlling a series of factors such as company size, financial characteristics, corporate governance, etc., as well as the two-way fixed effect of the company and year, the regression coefficient of ESG rating divergence (DIS) to stock price synchronization (SYN) is still significantly negative at the level of 1% (β=-0.0560), indicating that the higher the ESG rating divergence, the lower the synchronization of the stock price. This result supports the hypothesis H1, indicating that the differences in the evaluation of the same company by different ESG rating agencies provide a multi-angle information perspective for the market, increase the supply of company characteristic information, promote the integration of characteristic information into stock prices, and reduce the synchronization of stock prices. In terms of control variables, the company size has a significant impact on SYN, and the stock prices of large companies are more synchronized. This may be because large companies receive more market attention, and their characteristic information is more easily absorbed by the market. The coefficient of the asset-liability ratio (Lev) is negative, indicating that the information environment of high-leverage companies is relatively poor, the degree of integration of characteristic information into stock prices is low, and the synchronization of stock prices is high. The coefficients of profitability (ROA) and growth (Growth) are not significant, indicating that after controlling other factors, the direct impact of these two variables on the synchronization of stock prices is limited.

Table 4. Benchmark regression results: ESG rating divergence and stock price synchronization

	(1)	(2)	(3)
DIS	-0.0765*** (0.0056)	-0.0791*** (0.0057)	-0.0560*** (0.0039)
Control variables	No	Yes	Yes
Year-fixed effect	Yes	Yes	Yes
The fixed effect of the company	No	No	Yes
Observation value	27255	26471	26471
R^2	0.0775	0.1119	0.1776

Note: The brackets are the company-level cluster stability standard error. ***, ** and * are significant at the level of 1%, 5% and 10% respectively. The explained variable is SYN. The observed values in columns (2) and (3) decreased from 27255 to 26471, due to the existence of 784 missing values in the Dual variable.

5.4. Regulatory Effect Analysis

In order to test the regulatory effect of hypothesis H2, that is, the attention of institutional investors, this paper introduces the standardized cross-multiplication terms of DIS_z and ANA_z in the benchmark model. Table 5 (1) reports the full sample regression results. The coefficient of the cross-multiplication item DIS_z×ANA_z is 0.0246, which is statistically significantly positive, indicating that the interest of institutional investors does positively adjust the relationship between the ESG rating divergence and the synchronization of the stock

price. This result supports the hypothesis H2, indicating that the higher the attention of institutional investors, the weaker the negative impact of ESG rating divergence on stock price synchronization. From an economic point of view, institutional investors, as information intermediaries, can alleviate the information uncertainty caused by ESG rating differences by in-depth exploration and interpretation of company information, and further promote the integration of company characteristic information into stock prices.

In order to further verify the adjustment effect, this paper divides the sample into two groups, high and low, according to the median interest of institutional investors, for group regression. Table 5 Columns (2) and (3) report the grouping results: in the high-institutional investor concern group, the regression coefficient of DIS is 0.0033, which is not significant; in the low-institutional investor concern group, the regression coefficient of DIS is -0.0634, which is significantly negative at the 1% level. The differences between groups show that in companies with low institutional investors' attention, the negative impact of ESG rating differences on stock price synchronization is more significant, which further confirms the positive adjustment of institutional investors' attention.

Table 5. Regulating Effect Regression Results (Standardized Variables)

	Full sample (1)	Low-attention group (2)	High Attention Group (3)
DIS_z	-0.0109*** (0.0033)		
ANA_z	0.0894*** (0.0046)		
DIS_z × ANA_z	0.0246*** (0.0029)		
DIS		-0.0634*** (0.0046)	0.0033 (0.0078)
Control variables	Yes	Yes	Yes
Two-way fixed effect	Yes	Yes	Yes
Observation value	26471	13235	13236

Note: DIS_z and ANA_z are variables after standardized processing. Column (1) uses standardized variable cross-multiplication terms, and column (2) (3) uses the original DIS coefficient. The brackets are cluster standard errors. ***P<0.01 **p<0.05 *p<0.1.

5.5. Endogoic Test

5.5.1. The First Phase of Lagging DIS

Table 6. Endogenous test: the divergence of the ESG rating of the lag

	(1)
L1_DIS	-0.0011 (0.0041)
Control variables	Yes
Two-way fixed effect	Yes
Observation value	21648

Note: The interpreted variable is SYN. The brackets are cluster standard errors. ***P<0.01 **p<0.05 *p<0.1.

In order to alleviate the endogenous problems caused by the reverse causal relationship, this paper uses the lagging ESG rating divergence (L1_DIS) to replace the current DIS for regression testing. Table 6 reports the regression results of the lagging phase of DIS. The coefficient of L1_DIS is -0.0011, which is not significant, indicating that the impact of ESG rating divergence

on the synchronization of stock prices is mainly the immediate effect. The current effect is significant in the reference regression (coefficient -0.0560), but the post-lag effect disappears. This result shows that ESG rating differences mainly affect the synchronization of stock prices through the impact of spot information, and there is no continuous lag effect.

5.5.2. Tool Variable Method

This paper further adopts the tool variable method to deal with endogenous problems. Select "The average ESG rating divergence of other companies in the same industry (excluding the company)" as the tool variable of DIS. The selection of this tool variable is reasonable: on the one hand, the ESG rating divergence of companies in the same industry has common driving factors at the industry level to meet the relevance requirements; on the other hand, the ESG rating divergence of other companies mainly indirectly affects the synchronization of the company's stock price through the industry information environment and meets the exclusive constraints. Table 7 reports the regression results of the first stage. The coefficient of the tool variable is 0.2239, and the F statistic is 57.70, which is far greater than the empirical threshold of 10, indicating that there is a strong correlation between the tool variable and the endogenous variable, and there is no weak tool variable problem.

Table 7. Regression Results of the First Stage of Tool Variables

	(1)
DIS_IV (the first stage)	0.2239*** (0.0295)
F statistics	57.70
Control variables	Yes
Two-way fixed effect	Yes
Observation value	26440

Note: ***p<0.01 **p<0.05 *p<0.1. F statistic is the test value of the joint significance of the tool variable.

5.6. Robustness Test

In order to ensure the robustness of the research conclusions, the following robustness test is carried out in this paper: First, replace the DIS measurement method. This paper uses the extreme difference method (DIS_range) and the variation coefficient method (DIS_cv) respectively to replace the reference DIS for regression. The results (Table 8, columns (1) and (2)) show that the coefficient of the core explanatory variable after replacing the DIS measurement is still significantly negative at the 1% level (extreme difference method: -0.0637; variation coefficient method: -0.1738), indicating that the benchmark regression conclusion does not depend on the specific divergence measurement method. Second, exclude the specific year. Due to the impact of the COVID-19 pandemic in 2020, the capital market fluctuated violently, which may interfere with the return results. This paper re-estimated the model after eliminating the observations in 2020. The results (Table 8 columns (3)) show that the negative impact of DIS on SYN is still significant (-0.0604), and the benchmark regression conclusion remains unchanged. Third, add control variables. This paper further adds control variables such as the flow ratio (Liquid) and fixed asset ratio (Fixed) on the basis of the benchmark model, and the benchmark regression conclusion remains unchanged (limited to the length, not reported). Fourth, replace the SYN calculation window. This paper uses a 120-day and 180-day window period to calculate SYN respectively, and the regression result is consistent with the benchmark conclusion (limited in space, not reported).

Table 8. Summary of robustness test

	Extreme difference method (1)	Variation coefficient method (2)	Eliminate 2020(3)
DIS_range	-0.0637*** (0.0027)		
DIS_cv		-0.1738*** (0.0077)	
DIS			-0.0604*** (0.0043)
Control variables	Yes	Yes	Yes
Two-way fixed effect	Yes	Yes	Yes
Observation value	26471	26471	23274

Note: Report the coefficient and significance of the core explanatory variables. Control variables and FE are included. ***P<0.01 **p<0.05 *p<0.1.

5.7. Heterogeneity Analysis

This article analyzes the heterogeneity from the three dimensions of the nature of property rights, the degree of industry pollution and ESG rating, and explores the differences in the impact of ESG rating differences on stock price synchronization in different situations.

5.7.1. The Nature of Property Rights

Table 9 reports the regression results of grouping by the nature of property rights. In the subsample of state-owned enterprises, the regression coefficient of DIS is -0.0412; in the subsample of non-state-owned enterprises, the regression coefficient of DIS is -0.0586. The impact of DIS on SYN in the state-owned enterprise group is less than that in the non-state-owned enterprise group. This may be due to the fact that state-owned enterprises are subject to more policy guidance and regulatory requirements, the quality of information disclosure is relatively high, and the information increment transmitted by the difference in ESG ratings is limited.

5.7.2. The Degree of Industry Pollution

Table 9 reports the regression results grouped by industry pollution degree. In the heavy pollution industry group, the regression coefficient of DIS is -0.0509; in the light pollution industry group, the regression coefficient of DIS is -0.0564. The impact of the ESG rating divergence in the heavily polluting industry on the synchronization of stock prices is slightly lower than that of the light pollution industry. This may be because the heavy pollution industry itself is subject to stricter environmental and social supervision, the market pays more attention to its ESG performance, and the marginal information effect of ESG rating divergence is relatively weak.

5.7.3. ESG Rating

Table 9 reports the regression results of grouping by the median grouping of ESG rating. In the ESG high-scoring group, the regression coefficient of DIS is -0.0802; in the ESG low-scoring group, the regression coefficient of DIS is -0.0533. The impact of DIS on SYN in the ESG high-scoring group is greater than that in the ESG low-scoring group, which shows that for companies with good ESG performance, the ESG rating divergence has a stronger impact on stock price synchronization, which may be because the rating divergence of high-ESG scoring companies is more likely to cause investors' information uncertainty.

Table 9. Summary of Heterogeneity Analysis

Sub-sample	DIS coefficient	Observation value
State-owned enterprises	-0.0412*** (0.0079)	8721
Non-state-owned enterprises	-0.0586*** (0.0044)	17750
Heavy pollution	-0.0509*** (0.0081)	5712
Light pollution	-0.0564*** (0.0044)	20759
ESG high	-0.0802*** (0.0076)	13324
ESG low	-0.0533*** (0.0056)	13147

Note: Report the DIS coefficient and significance. Control variables and two-way FE have been included. ***P<0.01 **p<0.05 *p<0.1.

5.8. SYN Component Disassembly

In order to further reveal the differences in the impact of ESG rating differences on different dimensions of stock price synchronization, this article decomposes the overall stock price synchronization into two indicators: market-level synchronization (SYN_Market) and industry-level synchronization (SYN_Industry). The specific method is as follows: First, push back from SYN R^2_total = 1/(1+exp(-SYN))，Then estimate the difference in the fitting advantage of the market model and the market-industry two-factor model, and take the incremental R^2 as the industry-level explanation.

Table 10 reports the descriptive statistics of SYN disassembly indicators. The average value of SYN_Market is -1.7422, and the standard deviation is 0.4475; the average value of SYN_Industry is -1.9871, and the standard deviation is 0.4788. The correlation coefficient between SYN_Market and SYN_Industry is 0.166, indicating that the two dimensions are both common and independent. After disassembly, synchronous information at different levels can be captured respectively.

Table 10. SYN Disassembly Indicator Descriptive Statistics

Target	Mean value	Standard deviation	Correlation coefficient with SYN
SYN	-0.9453	0.4243	1.000
SYN_Market	-1.7422	0.4475	0.800
SYN_Industry	-1.9871	0.4788	0.711

Table 11 reports the regression results of DIS on SYN_Market and SYN_Industry. The coefficient of DIS for SYN_Market is -0.0471 (p<0.01) and the coefficient for SYN_Industry is -0.0480 (p<0.01), both of which are significantly negative at the 1% level. This shows that the increase in ESG rating divergence also reduces the synchronization of stock prices at the market level and industry levels, that is, ESG divergence not only intensifies the linkage between stock prices and the overall trend of the market, but also exacerbates the linkage between stock prices and common factors in the industry. The difference between the two coefficients is within a reasonable range, indicating that the impact of DIS on the synchronization at the market level and the industry level is similar. As a multi-angle information supply, the ESG rating difference has a relatively uniform inhibitory effect on the synchronization of both dimensions.

Table 11. DIS's regression results for SYN_Market and SYN_Industry

Variable	Return 3:SYN_Market	Return 4:SYN_Industry
DIS	-0.0471*** (0.0041)	-0.0480*** (0.0041)
Control variables	Yes	Yes
Company FE	Yes	Yes
Year FE	Yes	Yes
Observation value	26471	26471

Note: The brackets are cluster standard errors. ***P<0.01 **p<0.05 *p<0.1.

5.9. Dynamic Lag Causal Test

In order to test whether the impact of DIS on SYN decays over time, this paper generates phase 1-3 lag variables (L1_DIS, L2_DIS, L3_DIS) of DIS by company grouping, and replaces the current DIS with lag variables for panel regression. Table 12 reports the results of the lag attenuation test. The trend of coefficient change: -0.0560 → -0.0011 → 0.0028 → -0.0086. The impact of DIS on SYN is most significant in the current period (coefficient -0.0560, p<0.01), but after the delay, the coefficient dropped sharply to -0.0011 and was no longer significant, and the delay was not significant in both the second and third periods. This shows that the impact of DIS on the synchronization of stock prices has a strong immediacy. The effect basically disappears after a year, and the continuous lag impact is not supported. This discovery is consistent with the theoretical expectation of the information effect: ESG rating differences mainly affect the synchronization of stock prices by exacerbating information asymmetry in the current period. With the update and digestion of rating information, its marginal impact on synchronization decreases rapidly.

Table 12. The regression results of DIS lag variables to SYN

Variable	Coefficient (standard error)	Observation value
DIS (per current period)	-0.0560*** (0.0039)	26471
L1_DIS	-0.0011 (0.0041)	21648
L2_DIS	0.0028 (0.0047)	17081
L3_DIS	-0.0086 (0.0056)	12882

Note: All regressions include control variables and two-way fixed effects. The brackets are cluster standard errors. ***P<0.01 **p<0.05 *p<0.1.

In order to further strengthen the argument of the direction of cause and effect, this paper takes L1_DIS as the independent variable, the information asymmetry index (M=InfoAsym) as the intermediary variable, and SYN as the dependent variable, and performs a three-step inter-period mediation regression test. Three-step regression uses the same batch of observations to ensure comparability. The results of the cross-period intermediary test show that: (1) the coefficient of L1_DIS to M in the first step is not significant (p=0.686), indicating that the DIS of the lag period has no significant effect on the information asymmetry of the current period; (2) The coefficient of L1_DIS on SYN in the second step is also not significant (-0.0011), which is consistent with the lag attenuation result; (3) The coefficient of M in the third step is highly significant (-0.2991, p<0.01), indicating that the information asymmetry itself has a significant impact on SYN. The L1_DIS coefficient decreased from -0.0011 in the second step to -0.0008 in the third step, but because L1_DIS itself is not significant and the cross-period intermediary

effect is weak, this further confirms that the impact of DIS on SYN is mainly the immediate effect, and there is no significant lag intermediary channel.

Table 13. Cross-period intermediary test results

Step	Equation	Core variable coefficient	Remarkability
The first step	M = L1_DIS + Controls	L1_DIS: 0.000788	Not noticeable
The second step	SYN = L1_DIS + Controls	L1_DIS: -0.001078	Not noticeable
The third step	SYN = L1_DIS + M + Controls	L1_DIS: -0.000842 M: -0.2991	M: ***

5.10. Grouped and Regulated Intermediary Inspection

This section examines whether the intermediary path of DIS → information asymmetry (M=InfoAsym) → SYN is different in different types of enterprises. The whole sample is divided into six groups: state-owned enterprises/non-state-owned enterprises, ESG high/low, ANA high/low, and independently execute three-step intermediary regression in each sub-sample. Table 14 reports the sample size of each sub-sample.

Table 14. Sample size of each sub-sample

Divide into groups	Sample size
Non-state-owned enterprises	17750
State-owned enterprises	8721
ESG low	13147
ESG high	13324
ANA low	13235
ANA high	13236

Table 15. Summary of Group Intermediary Test Results

Sub-sample	a(DIS→M)	c(DIS→SYN)	c'(DIS→SYN|M)	b(M→SYN)	Indirect effecta×b
Non-state-owned enterprises(SOE=0)	0.0544***	-0.0586***	-0.0447***	-0.2548***	-0.013848 (Notable)
State-owned enterprises(SOE=1)	0.0687***	-0.0412***	-0.0248***	-0.2397***	-0.016465 (Notable)
ESG low	0.0491***	-0.0533***	-0.0412***	-0.2467***	-0.012104 (Notable)
ESG high	0.0863***	-0.0802***	-0.0598***	-0.2359***	-0.020360 (Notable)
ANA low	0.0293***	-0.0634***	-0.0569***	-0.2227***	-0.006531 (Notable)
ANA high	0.0839***	0.0033	0.0289***	-0.3049***	-0.025579 （Notable)

Judging from the results, both a and b in the six sub-samples are significant, and the indirect effects are all significant, indicating that the mediation path of DIS → information asymmetry → SYN exists in all enterprise types. The indirect effect is greater in groups with good information environment (state-owned enterprises, high ESG, high ANA). Specifically, the indirect effect of the ANA high group is several times that of the ANA low group, and the difference is the most significant.

For the ANA high group, the direct effect c' is negative and significant, while the total effect c is not significant, indicating that the attention of institutional investors compresses the direct channel of ESG divergence to the synchronization of stock prices, and the remaining impact is mainly transmitted through intermediary channels. That is, among companies with high institutional shareholding ratios, the direct impact of ESG rating differences on stock price synchronization is suppressed, but information asymmetric channels are still smooth. This discovery reveals the dual role of institutional investors' attention: it not only weakens the direct effect of DIS on SYN, but also makes the intermediary channel through information asymmetric transmission more efficient because of its better information environment.

Table 16. Comparison of indirect effects

Information environment poor group	Indirect effect	Information environment good group	Indirect effect	Different directions
Non-state-owned enterprises	-0.0138	State-owned enterprises	-0.0165	Non-state-owned enterprises>State-owned enterprises
ESG low	-0.0121	ESG high	-0.0204	ESG low > ESG high
ANA low	-0.0065	ANA high	-0.0256	ANA low> ANA high

5.11. Network Conduction Effect

This section examines whether the ESG differences of other companies in the same industry will have an "contagious" effect on the synchronization of the company's stock price (industry network spillover), and whether the attention of institutional investors can block this contagion.

The construction method of Peer_DIS is as follows: group by annual-industry categories, calculate the arithmetic average of DIS of other companies in the same industry for each company-annual observation value. Only the observations of at least 2 companies in the industry are retained, and the final effective observations of Peer_DIS are 27,253.

Table 17 reports the results of the infectious effect test. The coefficient of Peer_DIS is -0.4895 ($p<0.01$), which is highly negative, indicating that the differences in ESG ratings of other companies in the same industry do have a negative "contagious" effect on the synchronization of the company's stock price. After controlling the company's DIS, for every 1 unit increase in the average DIS of the companion company, the company's SYN increases by about -0.4895 units, which is far greater than the coefficient of the company's own DIS (-0.0522). This shows that the impact of the ESG differences and consensus at the industry level on the synchronization of individual stocks far exceeds the impact of the ESG differences of a single company itself, and there is a significant industry network spillover effect.

Table 17. Infectious Effect Test

Variable	Coefficient	Standard error	T value	Remarkability
Peer_DIS	-0.4895	0.0253	-19.38	***
DIS	-0.0522	0.0038	-13.76	***
Control variables	Yes			
Company FE + Year FE	Yes			
Observation value	26469			

Table 18 reports the test results of the blocking contagion effect of institutional investors' attention. The interaction coefficient of Peer_DIS×ANA is 1.3009 ($p<0.01$), which is significantly negative, indicating that the attention of institutional investors can effectively suppress the

conduction effect of the industry network. When institutional investors are more concerned, market participants can obtain more professional analytical information, thus reducing the dependence on the "fuzzy signal" of ESG rating differences and slowing down the transmission of information at the industry level. At the same time, ANA's own coefficient is -0.2679 ($p<0.01$), indicating that the increase in the attention of institutional investors directly reduces the synchronization of stock prices, which is consistent with the existing literature.

Table 18. Institutional investors' attention blocking the contagious effect

Variable	Coefficient	Standard error	T value	Remarkability
Peer_DIS	-1.1284	0.0663	-17.03	***
DIS	-0.0359	0.0038	-9.40	***
ANA	-0.2679	0.0702	-3.82	***
Peer_DIS ×ANA	1.3009	0.1139	11.42	***
Control variables	Yes			
Company FE + Year FE	Yes			
Observation value	26469			

Table 19 reports the infection path test results. In the first step, the coefficient of Peer_DIS to M is not significant ($p=0.854$), indicating that the ESG differences of industry peers do not directly affect the company through information asymmetric channels. After the introduction of M in the second step, the coefficient of Peer_DIS was only slightly reduced from -0.4895 to -0.4889, with a very small decrease, indicating that information asymmetric intermediary channels could hardly explain the network contagion effect. This shows that the contagious effect of Peer_DIS on SYN is mainly achieved through other channels (such as market emotional resonance, investor attention diversion, etc.), rather than through information asymmetric path transmission.

Table 19. Infection Path Test

Variable	The first step: M = Peer_DIS + DIS	The second step：SYN = Peer_DIS + DIS + M
Peer_DIS	0.0023 ($p=0.854$)	-0.4889 ($p<0.01$)
DIS	0.0572***	-0.0378***
M (InfoAsym)	—	-0.2506***
Observation value	26469	26469

Since Peer_DIS is an industry-level variable, it may be colinear with the year-fixed effect. Without controlling the year FE, the Peer_DIS coefficient is -0.2440 ($p<0.01$), which is still highly significant (from -0.4895 to -0.2440), indicating that some peer effects are absorbed by the year-fixed effect. Even so, the peer effect still exists significantly, confirming the robustness of industry network conduction.

6. Conclusion

The empirical results of this chapter can be summarized as follows: First, the benchmark regression shows that the divergence of ESG ratings has a significant negative impact on the synchronization of stock prices, supporting the hypothesis of H1. Second, the analysis of the

adjustment effect shows that the attention of institutional investors is positive about regulating the above relationship, supporting the hypothesis of H2. Third, the first phase of lag test shows that the impact of DIS on SYN is mainly immediate, and there is no continuous lag effect. Fourth, the first stage of regression of the tool variable method shows that tool variables are strongly related to endogenous variables. Fifth, the robustness test confirms the robustness of the conclusion by replacing the measurement method and eliminating specific years. Sixth, heterogeneity analysis found that the impact of DIS on SYN was stronger in non-state-owned enterprises, light pollution industries and ESG high-scoring groups. Seventh, the decomposition of SYN components shows that DIS has a significant negative impact on the synchronization at the market level and the industry level, and the degree of impact is similar. Eighth, the group mediation test found that the mediation path of DIS → information asymmetry → SYN existed in all sub-samples, and the indirect effect was greater in the group with a better information environment. Ninth, the network conduction effect test shows that the ESG differences of other companies in the same industry have a significant positive contagion effect on the company's SYN. The attention of institutional investors can effectively block the contagion, and the contagion effect is mainly transmitted through non-information asymmetric channels (such as market sentiment resonance).

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