

# *The Impact of China's Environmental Policy Frequency on the Decoupling of Corporate ESG*

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**Abstract.** Recent years have witnessed the popularity of the global concept of sustainable development, whereas the Environmental, Social, and Governance (ESG) system has gradually become a core framework for evaluating the value creation capabilities of enterprises in the long-term. However, there exists an important limitation that most literature treats ESG as an overall concept, which ignores the possible decoupling phenomenon, indicating substantial gap between corporate commitment and real practice. This paper innovatively focuses on the environmental policy iteration density as the key institutional variable and deeply analyzes how it affects the asymmetric response behavior of enterprises in the three dimensions of ESG through differentiated incentive mechanism through the Two-way Panel Fixed Effects on low and high policy shocks, respectively. In general, the research results illustrate that the impacts of environmental and social policy frequencies on ESG decoupling obviously have some intensity thresholds, while governance policies spot marginal significance since low policy shock with comparatively lower significance. However, the mechanism of innovative competence significantly affects environmental (E) and social (S) dimensions, whereas for G, the result is partly significant, which is pertaining "Greenwashing" effect. This research not only helps to expand the application boundary of institutional theory in the ESG field, but also provides an important theoretical basis and practical guidance for policy makers to optimize the pace of environmental regulation as well as for investors to identify real ESG performance.

**Keywords:** ESG Decoupling, Policy Shock Intensity, Innovation Competence

## 1. Introduction

ESG (environmental, social, and governance) started out as a way to talk about long-term corporate value. Now, it has turned into something closer to a scoreboard. As disclosure rules tighten and ESG money keeps pouring in, a familiar problem shows up: companies often say the right things without doing much to back them up. That gap between talk and action is usually called "ESG decoupling", and in practice it often looks like "green-washing".

This issue is hard to miss in emerging markets, especially China. Since 2016, China has rolled out ESG-related policies at a fast clip, but decoupling has not gone away. That raises an awkward question: maybe the problem is not only how strong these policies are, but how often they arrive. This paper leans into that idea. Instead of treating regulation as a one-time shove ("intensity"), it

looks at the rhythm of regulation ("frequency") and uses China's wave-like policy cycle to test whether policy density changes how firms behave.

Using panel data on Chinese A-share listed firms from 2009 to 2023, the paper measures ESG decoupling by comparing what firms write in their disclosure texts with what outside ratings say about their actual performance. To do that, it applies Latent Dirichlet Allocation (LDA) to the disclosure text and then quantifies the distance between disclosure content and performance ratings.

The results are not one-size-fits-all across E, S, and G. Environmental and social policies only start to curb decoupling after they pass certain intensity thresholds, while governance policies matter even at relatively low intensity. The mechanism tests point to innovative capability as a key reason firms manage to turn E and S requirements into real actions rather than polished language. The heterogeneity tests also show that the effects depend on who owns the firm and on how developed the local factor markets are, which helps explain why the same policy push can land differently across firms and regions.

This study contributes in three ways. First, it builds a more direct measure of decoupling by using LDA to capture the "facticity" of ESG disclosure, rather than treating ESG scores as a single, clean signal. Second, it brings policy frequency into the analysis and uses it to separate the effects of regulatory quantity from regulatory strength, adding a time-pattern angle to the usual institutional-pressure story. Third, it offers a practical takeaway: regulators may need different pacing across E, S, and G to dwindle compliance fatigue, and investors can use the logic here to better spot firms whose ESG performance is more than good writing.

The rest of the paper is organized as follows. Section 2 develops the hypotheses. Section 3 describes the research design. Sections 4 and 5 present the main results, mechanism tests, and heterogeneity analyses. Section 6 concludes.

## **2. Theoretical analysis and research hypotheses**

### **2.1. Policy frequency and ESG decoupling: theoretical origins**

As ESG notions become public consensus, corporations face increasing policy pressures day by day. However, some companies may overstate their ESG disclosures to seem trustworthy and eco-friendly, without making substantial investments in actual ESG practices, which is called ESG greenwashing [1,2]. Others, by contrast, downplay their real ESG engagements as it is called ESG brownwashing because they fear adverse responses from stakeholders [3]. That is a phenomenon defined by the academic community as ESG Decoupling [4]. As a core strategy of organizations to cope with policy pressures, the decoupling behaviour allows corporations to maintain external legitimacy without substantial revolutions at high prices [5].

Current research mostly views ESG as an overall construct, which neglects the internal differences of the observability, assessment criteria, and resource requirements of environmental(E), social(S) and governance(G) aspects. As one of the most critical institutional forces, the policy environment's changing characteristics, especially the frequency of policy iteration, may differently affect enterprises' decoupling decisions in various dimensions through different incentive and constraint paths. As a result, this paper started from the dynamic independent variable, policy frequency, aims to explore the mechanism of corporate ESG responsiveness and its impact on the decoupling degree of E, S, and G dimensions, respectively.

## 2.2. Mechanisms of policy frequency impacting ESG decoupling

### 2.2.1. Innovative competence as a moderator

As a key buffer of dealing with institutional pressures, innovative competence is likely to be an efficient mechanism. Enterprises with strong innovation ability have stronger knowledge absorption, transformation and creation ability [6], which can view policy pressures as new chances. Through substantive innovations such as the development of green technologies and optimization of social processes, they are then able to meet or even exceed policy requirements, thereby reducing the decoupling in both E and S dimensions [7]. This transformation function of innovative ability enables corporations to turn from passive compliance to active value creation. However, the improvement of governance dimensions relies more on policy design and power balance, instead of the innovation of technology or procedure. Therefore, innovation ability may not play a significant moderating role in the relationship between policy frequency and G dimension.

## 2.3. Research hypotheses

Based on the theoretical framework, the following hypotheses are proposed as below:

Hypothesis 1: Stricter environmental and social regulations will noticeably reduce ESG decoupling, while governance policies—though still having some effect—will show weaker overall impact regardless of policy strength.

Hypothesis 2: A company's ability to innovate strengthens how often environmental and social policies curb ESG decoupling. But for governance policies? Not so much—innovation doesn't seem to change the relationship there.

## 3. Research design

### 3.1. Variable definitions

This study uses the ESG gap as the dependent variable to capture corporate ESG decoupling, meaning the mismatch between what firms claim (symbolic commitments) and what they actually do (substantive actions) [8,9]. The ESG gap is measured as the regression residual from standardized HuaZheng ESG ratings (treated as an external, symbolic evaluation) on the firm's symbolic commitments. Symbolic commitments is derived from corporate annual reports using a Latent Dirichlet Allocation (LDA) text model, which extracts the share of text devoted to substantive ESG topics. A large positive ESG gap suggests the firm looks good on paper but is not backing it up in operations, which is consistent with "green-washing" [10,11].

The main independent variable is policy frequency. It is split into environmental (E), social (S), and governance (G) categories based on public policy announcements. Rather than using raw yearly counts, policy frequency in each dimension is converted into two intensity-based indicators: low-frequency policy shocks (suffix "\_shock") and high-frequency policy shocks (suffix "\_high").

Control variables include environmental enforcement intensity, measured as the number of penalties multiplied by the natural log of the penalty amount. The model also includes standard firm characteristics from the CSMAR database, such as firm size, return on assets (ROA), and leverage (LEV).

## 3.2. Data source and data processing

The sample includes Chinese A-share listed firms from 2009 to 2023. ESG ratings come from HuaZheng. Annual reports, policy documents, and environmental penalty records are collected manually and then merged. Financial controls and innovation-related variables used in later mechanism tests (for example, R&D spending, the share of technical staff, and patent counts) are taken from CSMAR. For data cleaning, missing values in relevant numeric variables are set to zero. Skewed variables, including firm size and penalty amounts, are log-transformed. So as to be consistent with standard empirical practices, all continuous variables are winsorized to mitigate the statistical interference of extreme outliers.

## 3.3. Model setting

### 3.3.1. Benchmark regression model

In order to explore the impact of ESG performance on firm performance, the following benchmark regression model is constructed:

$$ESGgap_{i,t} = \alpha + \beta ind\_Policy\_X\_shock_{k,t} + \gamma_1 ln\_assets_{i,t} + \gamma_2 roa_{i,t} + \gamma_3 lev_{i,t} + \gamma_4 ln\_punish_{i,t} + \mu_i + \lambda_i + \varepsilon_i \quad (1)$$

$$ESGgap_{i,t} = \alpha + \beta ind\_Policy\_X\_high_{k,t} + \gamma_1 ln\_assets_{i,t} + \gamma_2 roa_{i,t} + \gamma_3 lev_{i,t} + \gamma_4 ln\_punish_{i,t} + \mu_i + \lambda_i + \varepsilon_i \quad (2)$$

Where  $ESGgap_{it}$  denotes the calculated ESG decoupling degree of firm  $i$  in year  $t$ .  $ind\_Policy\_X\_shock_{k,t}$  is the core explanatory variable, including the three type (E.S.G) of policy shock of  $k$  industry in year  $t$ .  $ln\_assets_{i,t}$ ,  $ln\_punish_{i,t}$ ,  $roa_{i,t}$  and  $lev_{i,t}$  are a set of control variables, including environmental punishment and business information sourced from the CSMAR database.  $\mu_i$  captures firm-fixed effects,  $\lambda_i$  captures year-fixed effects and  $\varepsilon_i$  represents residuals. Robust standard errors clustered at the firm level are used to address heteroscedasticity and serial correlation.

### 3.3.2. Mechanism tests

To uncover the underlying mechanisms, this research also follows the two-step mediating effect approach to conduct mechanism tests, focusing on the channel of innovation competitiveness.

$$Mechanism_{it} = \beta_0 + \beta_1 PolicyFreq_{it} + \beta_c X_{it} + \theta_i + \lambda_t + \varepsilon_{it} \quad (3)$$

$$ESGgap_{it} = \gamma_0 + \gamma_1 PolicyFreq_{it} + \gamma_3 Mechanism_{it} + \gamma_c X_{it} + \theta_i + \lambda_t + \varepsilon_{it} \quad (4)$$

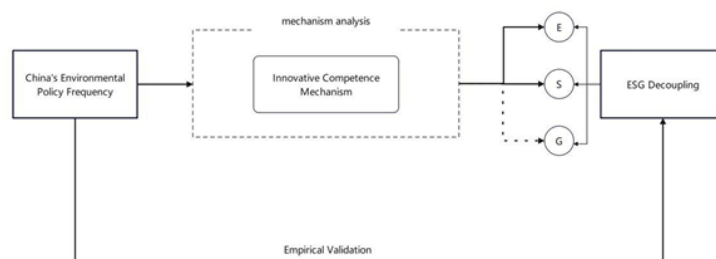


Figure 1. Mechanistic analysis

In order to verify the significant of how competitive corporations are in innovation field on the probable terminal effect for the policy frequency to ESG decoupling,  $\ln\_SpendSum$  is tested as mechanism. This corresponds with hypothesis 2.

## 4. Empirical analysis

### 4.1. Benchmark regression results

Table 1 shows the descriptive statistics for the main variables. The sample has 44,483 firm-year observations. The mean value of ESG gap (ESGgap) is about -0.0016 and its standard deviation is 0.963. So the distribution is balanced between positive and negative decoupling. For policy intensity, the mean frequency for environmental policies ( $ind\_Policy\_E$ ) is 2.29. This number is higher than the mean for social policies (0.98) and for governance policies (1.06). This means that the government focuses more on environmental rules. The shock dummy variables show that about 67.1% of observations had a shock from environmental policies. For social policies, this number is 57.3%, while for governance policies, it is 35.6%. The control variables include firm size ( $\ln\_assets$ ), leverage ( $lev$ ), and return on assets ( $roa$ ). These variables vary a lot across the sample. So we can trust the later analysis in its robustness.

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. dev.	Min	Max
ESGgap	44,483	-0.0016	0.9628	-5.6778	2.6961
$ind\_Policy\_E$	44,483	2.2900	2.3719	- .00	8.0000
$ind\_Policy\_S$	44,483	0.9842	0.9713	- .00	4.0000
$ind\_Policy\_G$	44,483	1.0557	1.8325	- .00	7.0000
$ind\_Policy\_E\_shock$	44,483	0.6718	0.4696	- .00	1.0000
$ind\_Policy\_S\_shock$	44,483	0.5729	0.4947	- .00	1.0000
$ind\_Policy\_G\_shock$	44,483	0.3559	0.4788	- .00	1.0000
$ind\_Policy\_E\_high$	44,483	0.2895	0.4535	- .00	1.0000
$ind\_Policy\_S\_high$	44,483	0.3594	0.4798	- .00	1.0000

Table 1. (continued)

ind_Policy_G_high	44,483	0.3559	0.4788	- .00	1.0000
ln_assets	44,477	22.2759	1.5074	14.9416	31.4309
lev	44,483	0.4254	0.2191	- .00	2.3900
roa	44,483	0.0337	0.0863	-2.9000	4.8400
ln_punish	44,483	0.3384	1.0217	- .00	9.7500

Table 2 reports the benchmark regression results. It looks at how different ESG policy shocks affect corporate ESG decoupling (ESGgap). For environmental policies, low-intensity shocks have no big effect. They do not push firms to make real ESG improvements. But high-intensity environmental shocks make ESG decoupling worse. Therefore, strict rules may push firms to fake compliance instead of making real green changes. Firms face more pressure, so they take this easy way out. The control variables also show clear patterns. Firm size and financial leverage have negative effects. This means that public and creditor scrutiny stops decoupling. But return on assets has a positive effect. Thus, although highly profitable firms have more resources, they are more likely to use fake disclosures.

Table 2. Baseline regression

Variable	(1) Low impact of environmental policies	(2) High impact on environmental policies	(3) Low impact on social responsibility policies	(4) High impact on social responsibility policies	(5) Low impact on corporate governance policies	(6) High impact on corporate governance policies
ind_Policy_E_shock	-0.019 (0.023)	-	-	-	-	-
ind_Policy_E_high	-	0.311*** (0.057)	-	-	-	-
ind_Policy_S_shock	-	-	-0.019 (0.023)	-	-	-
ind_Policy_S_high	-	-	-	0.064*** (0.018)	-	-
ind_Policy_G_shock	-	-	-	-	-0.062* (0.024)	-
ind_Policy_G_high	-	-	-	-	-	-0.062* (0.024)
ln_assets	-0.082*** (0.013)	-0.082*** (0.013)	-0.082*** (0.013)	-0.082*** (0.013)	-0.083*** (0.013)	-0.083*** (0.013)
roa	0.406*** (0.033)	0.406*** (0.033)	0.406*** (0.033)	0.404*** (0.033)	0.408*** (0.033)	0.408*** (0.033)

Table 2. (continued)

lev	-0.208***	-0.208***	-0.208***	-0.209***	-0.207***	-0.207***
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
Company FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	44477	44477	44477	44477	44477	44477

Note: Standard errors in parentheses Standard errors are clustered into the company; Controlling company FE+ year FE; \*\*\*p<0.01, \*\*p<0.05, \*p<0.1 \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001

## 4.2. Placebo test

To rule out unobservable random factors and model specification bias, a placebo test was conducted by randomizing the policy shock status of the core explanatory variables (ind\_Policy\_E\_high, ind\_Policy\_S\_high, and ind\_Policy\_G\_high) 500 times.

Figures 2–4 show the results. The pseudo-estimated coefficients are all near zero and they follow a normal distribution. But the true baseline estimates are 0.311, 0.064, and -0.062. These numbers are clear outliers at the tails of the distributions (p < 0.01). So the findings are very robust. As a result, high-intensity environmental and social policies worsen ESG decoupling, while high-intensity governance policies reduce it.

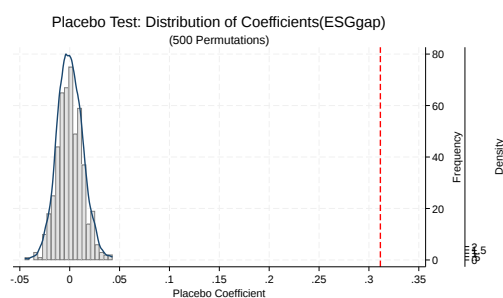


Figure 2. Placebo test for high frequency of environmental policy as explanatory variable

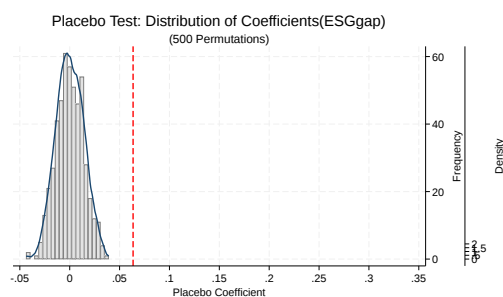


Figure 3. Placebo test for high frequency of social policy as explanatory variable

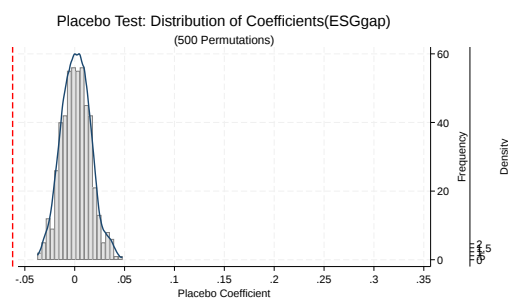


Figure 4. Placebo test for high frequency of governance policy as explanatory variable

## 5. Further research---mechanism test

The benchmark results show that high-frequency ESG policy shocks affect corporate ESG decoupling and these effects differ across dimensions. In order to know how policy shocks push firms from fake disclosure to real action, the mechanism on innovation investment is tested. This helps to see the logic behind moving from form to substance.

### 5.1. Mechanism test-R&D investment-empowering substantive ESG practices under policy pressure

This section empirically tests the mediating role of corporate R&D investment ( $\ln\_spendsum$ ) in the nexus between ESG policy shocks and ESG decoupling. Table 3 shows the results. Environmental, social, and governance policy shocks all raise R&D investment and their coefficients are positive: 0.325, 0.325, and 0.501, so strict pressure pushes firms to stop fake green claims. Additionally, table 4 also shows that R&D investment reduces ESG decoupling. For the governance dimension, high R&D investment has a negative coefficient (-0.0572,  $p < 0.05$ ). So more R&D spending closes the gap between promises and real actions. It directly improves actual ESG performance. Thus the mechanism works. ESG policy shocks force firms to invest in R&D. That R&D then reduces ESG decoupling.

Table 3. Impact of ESG policy shocks on corporate R&D investment

Variable	(1)	(2)	(3)	(4)	(5)	(6)
ind_Policy_E_shock	0.325** (0.139)					
ind_Policy_E_high		-0.439 (0.475)				
ind_Policy_S_shock			0.325** (0.139)			
ind_Policy_S_high				0.087 (0.126)		
ind_Policy_G_shock					0.501*** (0.141)	
ind_Policy_G_high						0.501*** (0.141)
$\ln\_assets$	0.947*** (0.104)	0.944*** (0.104)	0.947*** (0.104)	0.945*** (0.104)	0.948*** (0.104)	0.948*** (0.104)

Table 3. (continued)

roa	0.079 (0.320)	0.087 (0.320)	0.079 (0.320)	0.084 (0.320)	0.073 (0.321)	0.073 (0.321)
lev	-2.405*** (0.368)	-2.402*** (0.368)	-2.405*** (0.368)	-2.402*** (0.368)	-2.408*** (0.368)	-2.408*** (0.368)
Company FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	44466	44466	44466	44466	44466	44466

Notes: Standard errors are reported in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 4. Impact of R&D investment on ESG decoupling

Variable	(1)	(2)	(3)	(4)	(5)	(6)
ind_Policy_E_shock	-0.013 (0.023)					
ind_Policy_E_high		0.323*** (0.057)				
ind_Policy_S_shock			-0.013 (0.023)			
ind_Policy_S_high				0.069*** (0.019)		
ind_Policy_G_shock					-0.057** (0.025)	
ind_Policy_G_high						-0.057** (0.025)
ln_assets	-0.050* (0.029)	-0.050* (0.029)	-0.050* (0.029)	-0.050* (0.029)	-0.051* (0.029)	-0.051* (0.029)
roa	0.378*** (0.042)	0.377*** (0.042)	0.378*** (0.042)	0.375*** (0.042)	0.379*** (0.042)	0.379*** (0.042)
lev	-0.248*** (0.048)	-0.248*** (0.048)	-0.248*** (0.048)	-0.248*** (0.048)	-0.247*** (0.048)	-0.247*** (0.048)
personratio	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Company FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	44466	44466	44466	44466	44466	44466

Notes: Standard errors are reported in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

## 5.2. Heterogeneity analysis: the moderating role of firm ownership and regional factor market development

The baseline results show that high-frequency policy shocks affect ESG decoupling, but these average effects may hide important differences. These differences come from firm traits and regional environments. As claimed by institutional contingency theory, a firm's response to outside pressure depends on its own resources and outside context. So, we test if the link between policy frequency and ESG decoupling changes with firm ownership and regional factor market development. Firm ownership shows internal governance and regional factor market development shows outside resource access.

### 5.2.1. Grouping strategy and model specification

The full sample is split using two criteria. First, with CSMAR data, a firm is state-owned (SOE = 1) if the government or a state firm is the ultimate owner. Otherwise, it is non-state-owned (SOE = 0). Second, regional factor market development is measured with a sub-index from the marketization index. Then, create a dummy variable called HighFactor. It equals 1 for firms in provinces with a score above the national median for that year. This grouping shows relative positions and removes overall time trends. After that, re-estimate the baseline two-way fixed-effects model for each subgroup, using seemingly unrelated estimation (Suest) to test if the coefficients are equal across groups.

### 5.2.2. Results based on firm ownership

The Suest test results reveal highly significant coefficient differences between state-owned and non-state-owned firms across all four policy variables. Specifically, the group differences are significant for environmental policy high shocks ( $p < 0.01$ ), social policy high shocks ( $p = 0.047$ ), and both governance policy variables ( $p < 0.01$ ). These results indicate that the impact of policy frequency on ESG decoupling varies systematically with ownership type. A plausible explanation is that state-owned enterprises, which often bear policy-mandated social responsibilities while facing softer budget constraints and weaker market discipline, may be more prone to symbolic compliance or "greenwashing" under intensive policy shocks. Conversely, non-state-owned firms, driven by profit motives and market competition, are more likely to translate policy pressures into substantive actions.

Table 5. Heterogeneity analysis by firm ownership (SOE vs. Non-SOE)

Policy Variable	Chi <sup>2</sup> (1)	Prob > Chi <sup>2</sup>	Significance
ind_Policy_E_high	33.890	0.000	***
ind_Policy_S_high	3.940	0.047	**
ind_Policy_G_high	10.870	0.001	***
ind_Policy_G_shock	10.870	0.001	***

Note: \*\* $p < 0.01$ , \*\*\* $p < 0.05$ , \* $p < 0.1$ . The results indicate that the impact of high-frequency policy shocks on ESG decoupling differs significantly between state-owned and non-state-owned firms across all three policy dimensions.

### 5.2.3. Results based on regional factor market development

Turning to the external institutional environment, the analysis demonstrates that the effects of policy shocks are significantly moderated by the developmental degree of regional capital, labor, and technology markets. The coefficient differences between high- and low-development regions are significant for environmental ( $p=0.041$ ) and social ( $p=0.022$ ) policy high shocks. The difference is only marginally significant for governance high shocks ( $p=0.094$ ) and insignificant for low-intensity governance shocks, suggesting governance policies have a more homogeneous effect across regions as they rely more on internal adjustments. Ultimately, a well-developed factor market amplifies the impact of environmental and social policy shocks; firms with easier access to external financing and technological resources are better equipped to respond substantively, whereas firms in underdeveloped markets lack these resources and are forced to resort to symbolic disclosures.

Table 6. Heterogeneity analysis by regional factor market development

Policy Variable	Chi <sup>2</sup> (1)	Prob > Chi <sup>2</sup>	Significance
ind_Policy_E_high	4.160	0.041	**
ind_Policy_S_high	5.280	0.022	**
ind_Policy_G_high	2.810	0.094	*
ind_Policy_G_shock	2.810	0.094	*

Note: \*\* $p<0.01$ , \* $p<0.05$ ,  $p<0.1$ . The results show that the effects of environmental and social policy high shocks are significantly moderated by regional factor market development, while the moderating effect on governance policies is marginally significant.

## 6. Research finding and policy implications

This study uses Latent Dirichlet Allocation (LDA) and a two-way fixed-effects model on Chinese A-share firms from 2009 to 2023 to examine how policy frequency shapes ESG decoupling, defined as the gap between disclosure and substantive performance. The results reveal a clear intensity threshold effect: high-frequency environmental (E) and social (S) policies tend to worsen decoupling by inducing symbolic compliance and compliance fatigue, whereas governance (G) policies consistently reduce decoupling even at relatively low intensities.

The analysis also identifies a "towards-reality" mechanism through which firms are pushed to increase green R&D and sustainable investment, gradually moving beyond "paper compliance." Heterogeneity results further show that these effects depend on firm and regional characteristics: state-owned enterprises exhibit distinct patterns because of softer budget constraints, while regions with more developed markets are better able to convert policy pressure into substantive ESG improvement.

As a result, China's ESG governance needs a different approach for each dimension. The government should keep stable governance (G) policies, and it should also slow down environmental (E) and social (S) policies. This would help firms avoid the incentive to fake green behavior. Besides, regulators should punish firms that exaggerate their reports and they should also give more rewards for ESG-related innovation. ESG rating systems should focus less on how much firms disclose and more on measurable results, like green patents and real cuts in emissions.

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