



## ESG and resource acquisition in Chinese startups: The role of financing strategies and resource constraints

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### ABSTRACT

In the face of rising sustainability expectations and limited resources, startups must balance financial objectives with ESG (environmental, social, and governance) goals under uncertainty. This study examines how ESG behavior influences external resource acquisition, financing choices, and strategic outcomes in early-stage enterprises. Drawing on the entrepreneurial learning perspective, we argue that startups refine ESG strategies through experimentation, feedback, and contextual reflection, making ESG engagement an evolving process rather than a one-off decision. Using a panel dataset of 1431 startups listed on China's A-share market from 2018 to 2023, we construct a composite ESG behavior index (ESGB) and employ logit and panel OLS models with lagged variables and cluster-robust standard errors. Results indicate ESG engagement increases the likelihood of securing venture capital (VC) and shapes financing strategies (FS), favoring external equity financing. ESG behavior does not significantly affect government subsidies (GOVS), suggesting policy allocation depends on broader institutional factors. Under resource constraints (RC), ESG engagement enhances growth capacity (GC), while effects on diversification (DIV) and stability (STA) are context-dependent. Theoretically, the study advances a dynamic, capability-based view of ESG by integrating resource-based and signaling perspectives. Practically, it provides insights for entrepreneurs, investors, and policymakers for sustainable development in startup ecosystems.

### 1. Introduction

In the continuously evolving global economic landscape and rapidly changing market demands, startups face unprecedented development challenges (Wei et al., 2025). On the one hand, due to the lack of financial history (Chmelíková and Somerlíková, 2018), startups need to quickly achieve profitability to reach their financial goals under the conditions of limited resources such as startup capital, technological capabilities (Anatan, 2024), and human resources (Priyanka et al., 2023), ensure that the company will survive and grow gradually in the fierce market competition. On the other hand, as society's focus on sustainability rises, a company's ESG performance is increasingly becoming a key indicator of its overall value (Hakovirta et al., 2023). Startups not only need to avoid negative impacts on the environment in

the course of their operations but also need to actively focus on employee rights and interests, community development, and the standardization of corporate governance to fulfill their due social responsibilities. Under such dual pressures, how to accurately balance financial and ESG goals with limited resources has become an urgent challenge for early-stage entrepreneurs to overcome. This challenge involves not only strategic considerations but also an experiential process. It typically requires entrepreneurs to undergo gradual adjustment and continuous learning as they respond to sustainability expectations under conditions of limited resources. Entrepreneurial learning is defined as the process of developing and acquiring the experience, knowledge, and capabilities necessary to start or engage in a new venture (Lin, 2023). Existing research suggests that under conditions of uncertainty, entrepreneurial learning often takes shape through

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experimentation, feedback, and adaptation to context, enabling startups to continuously refine their strategic choices and business models (Jones and Giordano, 2020). This perspective suggests that ESG engagement is an adaptive and evolving practice embedded in the entrepreneurial journey (Son and Suh, 2024).

The resource-based view (RBV) provides a foundational lens for understanding how resources contribute to competitive advantage (Barney, 1991). Building upon this, the dynamic capability perspective explains how firms develop, renew, and reconfigure these resources in changing environments (Teece et al., 1997). They posit that a firm's competitive advantage stems from its valuable and difficult-to-imitate resources and capabilities. For resource-constrained startups, the capacity to develop, deploy, and refine ESG-oriented practices represents precisely such a critical intangible capability. This capability is not static, it is honed through entrepreneurial learning and adaptation under uncertainty, allowing firms to convert limited means into strategic legitimacy.

This view aligns with the reality that startups must often act with limited means and under high uncertainty. The process of building ESG capability is inherently iterative: startups start with their available resources, take affordable steps toward sustainability, and adapt their ESG focus based on feedback from stakeholders and the market. Thus, observed ESG behavior is the outward manifestation and result of this evolving strategic capability, which enables startups to navigate constraints and build differentiation. The value of this capability is realized largely through its signaling function to external resource providers (Kohler, 2016). In contexts of information asymmetry concrete ESG practices serve as credible signals of a firm's underlying quality, governance standards, and alignment with prevailing institutional norms and societal expectations. However, different resource providers prioritize different aspects of these signals.

While prior studies establish a baseline positive association between ESG and external support, they largely treat ESG as a uniform signal and pay limited attention to the boundary conditions under which this signal is most effective. Crucially, the contingent roles of a startup's internal learning ability and its external resource constraints in shaping the outcomes of ESG engagement remain underexplored. Building on the integrated theoretical framework above, our study addresses this gap by posing the following twofold research question: How do a startup's internal learning ability and its external resource constraints, as distinct moderating factors, shape the effectiveness of ESG behavior in influencing critical outcomes.

By integrating the lens of dynamic capabilities with signaling theory under institutional constraints, our research develops a coherent framework for understanding ESG as a strategic tool. It specifically explores how startups leverage and signal their ESG capability to secure resources and achieve growth in contexts of scarcity and uncertainty.

This study focuses on startups listed on China's A-share market between 2018 and 2023. After excluding ST firms and observations with missing key variables, the final sample consists of 1431 firms and 6283 firm-year observations. The empirical analysis applies Logit and PanelOLS regression models, using lagged independent variables and two-way clustered robust standard errors to address potential endogeneity and enhance the robustness of the results.

This work offers several theoretical and practical contributions. From a theoretical perspective, it enriches the ESG literature by shifting from a static, goal-setting view to a more dynamic and context-sensitive understanding of ESG as a capability. By integrating insights from the resource-based view (RBV), effectuation theory, and social identity theory, the study constructs a multi-level framework that explains how ESG-oriented behavior enables startups to access external resources, make financing choices, and pursue strategic outcomes under uncertainty. It highlights that the effects of ESG practices are not uniform but vary with firms' internal constraints, underscoring the importance of aligning ESG priorities with organizational capacity. From a practical perspective, the findings help entrepreneurs balance financial and

sustainability goals under resource constraints, offer investors a non-financial lens to assess startup potential, and provide evidence for policymakers to design more adaptive ESG support mechanisms. This integrated perspective enhances our understanding of ESG as a strategic tool in early-stage enterprise development.

## 2. Literature review and hypotheses development

### 2.1. ESG and external resources

In the early stages of a firm's growth, securing external resources is critical to its survival and development, particularly for young start-ups with limited resources (Marcon and Ribeiro, 2021). Start-ups drive innovation and economic vitality and create new jobs (Men, 2021), yet they face severe information asymmetry (Hottenrott and Richstein, 2020), lack historical financial data and verifiable operating records (Lange et al., 2023), and must cope with macro-environmental uncertainty (Battisti et al., 2022; Cecchele Lago et al., 2023). These factors lower investors' risk tolerance and make evaluations more cautious (Dahooie et al., 2025), while government agencies also face greater uncertainty in allocating resources without solid quantitative benchmarks (Taweasangrunroj et al., 2022). Under resource scarcity, a startup's ability to obtain external support directly affects its market entry, survival, and subsequent growth potential.

This study defines external resources as key economic resources that a firm can secure from policies or markets beyond its own capabilities and that directly support its operations and growth (Bragge et al., 2019; Tanskanen et al., 2017). We focus on two forms: GOVS and VC. The former represents institutional policy support and is a major tool the Chinese government uses to guide industrial restructuring and encourage innovation (Li et al., 2021a; Wang et al., 2016). The latter reflects market-based capital recognition and is a primary source of financing and expansion for entrepreneurial firms (Zhang et al., 2019). Venture capitalists now weigh environmental sustainability alongside technological potential and commercial prospects, urging firms to integrate ESG values into innovation (Wang et al., 2025). As institutional and market-oriented supports, GOVS and VC serve as core proxies for startups' resource-acquisition capability. Exploring whether ESG practices improve access to these two resources, therefore has both theoretical and practical value.

With society placing greater emphasis on sustainable development, ESG practices have become an effective non-financial tool that helps start-ups signal credibility and secure external support (Zhang et al., 2025a). ESG demonstrates a firm's commitment to environmental protection, employee rights, and corporate governance, and it underscores a strategic orientation toward social responsibility and sustainability (Darsono et al., 2024; Wang et al., 2024a; Zhang et al., 2024). Chen et al. (2023) and Efthymiou et al. (2023) show that sound ESG practices build trust and external acceptance, a signaling effect that is especially valuable for start-ups lacking mature financial statements and performance records.

Zhang and Phua (2024) show that firms with strong ESG performance tend to be more competitive in securing investment and forming partnerships, while also benefiting from lower capital costs. Drawing on social identity theory (Faraz et al., 2024), firms operate within a broader social context where their decisions and behaviors are shaped by prevailing norms, expectations, and values. For startups, actively engaging in ESG practices not only aligns with these external expectations but also serves as a strategic approach to building identity and reputation. By taking concrete action on environmental and social issues, they can enhance their brand image and public recognition, creating a more favorable environment for resource acquisition.

Empirical studies further support the role of ESG as an effective signal that helps reduce adverse selection and build confidence among external stakeholders (Wu et al., 2024; Zhang and Lucey, 2022). As Heinkel et al. (2001) suggest, in situations of incomplete information,

investors often rely on non-financial indicators to assess risk (Di Chiacchio et al., 2024). High-quality ESG performance helps reduce information asymmetry and increases firms' ability to attract financing (Battisti et al., 2024). Firms frequently turn to non-financial disclosure to respond to public expectations, strengthen stakeholder trust, and, under external pressure, demonstrate increased awareness and responsiveness to ESG issues, thereby improving reputational capital and perceived legitimacy (Iazzi et al., 2025). In particular, VC investors are increasingly incorporating ESG criteria into their decision-making (Drobetz et al., 2024). When assessing early-stage firms that lack historical performance and reliable financial data, ESG performance becomes a useful indicator of governance quality and long-term potential (Lange and Banadaki, 2024). According to Nielsen and Noergaard (2011), firms with strong ESG performance are more likely to attract long-term-oriented investors and secure higher valuations. As a result, ESG practices have shifted from ethical commitments to becoming strategic tools that improve startups' ability to access external resources such as venture capital.

Similarly, in the domain of public resource allocation, ESG engagement can signal alignment with policy priorities. Wang et al. (2022) find that strong ESG performance significantly improves investment efficiency and strengthens trust from both governments and financial institutions, increasing the likelihood of accessing critical resources (Zhang et al., 2023). In China's government-led resource allocation system, subsidies and incentive programs tend to favor large state-owned enterprises (Zhao, 2019), firms with green priorities (Yi et al., 2023a), and those with clearly defined development goals (Li et al., 2023). For startups, ESG engagement signals alignment with national strategies and strengthens their position in competing for policy-based support. Building on the above, this study proposes that ESG practices can enhance startups' ability to acquire external resources. In particular, strong ESG performance is expected to increase the likelihood of obtaining both VC and GOVS. Accordingly, the following hypotheses are proposed:

**H1.** ESG practices are positively associated with the likelihood of obtaining VC among startups.

**H2.** ESG practices are positively associated with the level of GOVS received among startups.

## 2.2. ESG and financing strategy

A firm's financing strategy is shaped not only by its financial condition and capital structure preferences (Benlemlih and Cai, 2020), but also by factors such as governance capabilities (Boukattaya, 2025), strategic positioning (Hussain et al., 2025), and the level of external trust (Maung, 2024). Traditional financing theory suggests that debt financing is more suitable for firms with strong creditworthiness and lower business risk (Xiang et al., 2022). As ESG principles continue to gain traction, non-financial performance, particularly ESG practices, has become an increasingly relevant factor in financing decisions. This is especially true for startups, where RC and underdeveloped institutions may complicate the financing process.

There is still no clear consensus on how ESG practices influence firms' financing preferences. Some studies argue that good ESG performance can enhance corporate credibility, reduce default risk (Maaloul et al., 2023; Shi et al., 2024), and increase the trust of creditors or policy-based funding providers, thereby facilitating access to debt financing. Others suggest that strong ESG performance can make firms more attractive to socially responsible investors, leading them to favor equity financing instead (Lemma et al., 2022; Wu et al., 2024). This divergence is particularly evident among startups. Because they lack credit records, collateral (Chang and Kock, 2021), and stable cash flows (Bauer et al., 2024), startups tend to rely more heavily on equity financing. However, strong ESG engagement can help build external trust and reduce information asymmetry, which may improve their ability to secure debt

financing. Some studies have found that firms with strong ESG performance are more likely to obtain equity capital (Zahid et al., 2024), while others report that ESG-oriented startups often receive higher market valuations (Mansouri and Momtaz, 2022), which can help them expand financing options and increase the proportion of debt in their capital structure. The extent to which ESG practices support a shift from equity to debt financing among startups remains to be further examined, especially in the context of China, where institutional factors and green finance initiatives are rapidly evolving. Based on this discussion, the following hypothesis is proposed:

**H3.** Among startups, stronger ESG practices are associated with a higher likelihood of choosing debt financing.

## 2.3. The moderating role of resource constraints

In recent years, ESG has gradually evolved from a framework for voluntary disclosure and ethical signaling to one that is more deeply embedded in corporate strategy (Krasodomaska and Eisenschmidt, 2025; Thun et al., 2024). Its role in resource allocation and organizational development has attracted increasing attention (Bhattacharya and Bhattacharya, 2023; Burcă et al., 2024). However, for growing startups that face significant RC, whether they possess the capability and motivation to sustain ESG initiatives remains a subject of debate. According to resource-based theory, firms operating under tight resource conditions must optimize resource allocation more carefully to achieve superior performance (Cooper et al., 2023). This challenge is particularly acute in early-stage ventures, which must often strike a delicate balance between short-term performance and long-term strategic goals while navigating resource scarcity and external uncertainty (Santoso, 2024).

Effectuation theory (Sarasvathy, 2001) suggests that RC firms tend to favor strategies with controllable costs and risks, even if future returns remain uncertain. These firms focus on creating possibilities under limited conditions, rather than pursuing fixed long-term goals through linear planning. In this context, ESG practices are increasingly viewed not as external compliance burdens but as tools for enhancing organizational adaptability and strategic flexibility (Ma et al., 2024; Wu, 2025). Specifically, ESG can add strategic value by expanding relationship networks (Ho et al., 2024), attracting external resources (Srivastava et al., 2022), and improving internal governance structures (Yan et al., 2024). Under uncertain environments, such capabilities help firms improve their resilience and collaborative capacity. Based on this, we argue that under RC, firms are more likely to pursue performance pathways that enable them to leverage ESG to attract external support or optimize internal structures. In particular, ESG may influence firm performance through three main mechanisms. First, they help build external relationships and reduce institutional barriers (Bebic et al., 2025; Iurkov et al., 2024), which can support DIV strategies. Second, they signal responsibility and governance quality (Lee et al., 2025; Yu et al., 2025), which may boost growth potential. Third, they enhance transparency and internal discipline (Yin et al., 2025; Nguyen et al., 2025), which may strengthen operational stability. These mechanisms represent the key pathways through which ESG affects performance under RC.

### 2.3.1. ESG and diversification

DIV strategies typically involve greater managerial complexity and increased information processing demands, which may intensify organizational inertia in resource reallocation (Lindlbauer et al., 2025). Under such conditions, firms need sufficient resource slack and risk tolerance to support the effective operation and flexible adjustment of diversified activities. While maximizing financial performance is a common goal for diversified firms (Cao et al., 2021), RC enterprises often rely more on external cooperation, relationship networks, and institutional trust mechanisms to support DIV (Ye et al., 2025). ESG practices can release non-financial signals that improve a firm's ability to

collaborate with governments, suppliers, and financial institutions (Wu and Chen, 2024; Ziolo et al., 2023), enabling them to explore new business areas and extend organizational boundaries at lower marginal costs. Based on this, we propose hypothesis 4:

**H4.** RC positively moderates the relationship between ESG and DIV. Specifically, ESG practices are more likely to promote DIV under higher levels of RC.

### 2.3.2. ESG and growth capacity

Firms seeking growth often face obstacles such as financial constraints (Zhou et al., 2025), market uncertainty (Lin and Li, 2024), and policy barriers (Zhuang and Han, 2024). These challenges become particularly restrictive under resource limitations, especially for startups. ESG engagement can serve as an external signal of a firm's governance capacity, social responsibility, and long-term strategic vision (Müller et al., 2025; Zakriya and Chams, 2025). This signaling effect enhances the firm's credibility in capital markets and policy environments. Strong ESG performance not only demonstrates compliance and operational soundness but also shows a firm's willingness to take on environmental and social responsibilities. These qualities build trust with governments, investors, and the public, thereby improving the firm's access to resources and alleviating information asymmetry. In addition, ESG practices may generate performance benefits when aligned with external policy initiatives, such as environmental regulation (Song et al., 2025) or digital city policies (Zhao et al., 2024), further supporting enterprise growth. Therefore, the more constrained a firm is, the more likely it is to view ESG as a tool to overcome resource bottlenecks and unlock growth opportunities. Based on this, we propose hypothesis 5:

**H5.** RC positively moderates the relationship between ESG and GC. Specifically, ESG practices are more likely to promote GC under higher levels of RC.

### 2.3.3. ESG and stability

Resource scarcity weakens a firm's ability to handle external shocks (Lefebvre, 2025), making it more vulnerable to environmental changes and increasing the likelihood of financial volatility and managerial disruption. Under these conditions, governance STA (Reyad et al., 2024) and information transparency (Wang et al., 2024b) are essential for maintaining operational continuity. ESG practices typically involve environmental management, social responsibility, and governance enhancement. These include disclosure systems, compliance procedures, and internal control mechanisms that help regulate corporate operations (He et al., 2025; Zhang et al., 2025b), improve policy enforcement, and reduce risks associated with poor management or control failures.

For firms with limited resources, ESG can help compensate for weak capacity for risk management. For example, robust ESG disclosures reduce stakeholder uncertainty and increase trust (Chen et al., 2023), which can lead to more stable financing and partnership opportunities (Kang and Hong, 2025). Transparent governance and sound risk control mechanisms make firms less vulnerable to persistent disruptions in the face of external shocks. In this context, the governance advantages of ESG practices become more pronounced and can enhance a firm's operational resilience and STA. Based on this, we propose Hypothesis 6:

**H6.** RC positively moderates the relationship between ESG and STA. Specifically, ESG practices are more likely to promote STA under higher levels of RC.

## 2.4. The moderating role of learning ability

In addition to tangible resources, the knowledge competencies of startups possess external value and are sought after by resource providers (Kohler, 2016). In this study, we focus on a firm's innovative output as a core manifestation of its learning ability, represented by the

number of invention patents it holds. Patent count reflects a company's ability to absorb knowledge, conduct R&D, and generate novel, codifiable innovations (Teruel and Segarra-Blasco, 2022; Lin et al., 2012). This form of demonstrable innovative capacity is particularly valuable for startups, as it can help legitimize their claims and future potential (Richter and Zacharias, 2025). We posit that such concrete innovative output can significantly improve the signal value of ESG practices.

The credibility of ESG signals depends on external stakeholders' belief that the company possesses the underlying capability to fulfill its commitments (Chan, 2025; Katisart et al., 2025). A credible patent record provides tangible, verifiable evidence of a startup's technical competence, R&D discipline, and ability to translate inputs into valuable outputs. For resource providers, this evidence mitigates concerns about potentially less credible commitments from startups and reveals deeper organizational capabilities for implementing complex strategies. Venture capitalists highly value a startup's innovation potential and execution ability (Yu et al., 2024). A strong patent portfolio coupled with substantive ESG practices sends a powerful composite signal, indicating not only a commitment to sustainable and responsible operations but also the technical prowess and innovative discipline required to achieve long-term, scalable impact. Empirical research shows that venture capital involvement can significantly promote a firm's open innovation (Yi et al., 2023b). For VCs, this combination reduces technological and execution-related uncertainties, making the startup a more attractive investment. Therefore, we expect the positive effect of ESG on venture capital funding to be stronger for startups with a higher patent count.

Government agencies, particularly those promoting technological innovation and green development, prioritize funding projects that align with policy goals and demonstrate technical feasibility (Wu et al., 2022). For startups, patent output can be regarded as a concrete manifestation and observable outcome of their absorptive capacity, specifically their realized absorptive capacity to transform and apply external knowledge to the market (Pereira and Farias, 2023). When combined with strong ESG practices, which signal alignment with public policy objectives such as environmental protection, a substantial patent record assures policymakers that the company possesses the innovative infrastructure necessary to successfully implement subsidized projects, thereby enhancing the expected return on public funds. Thus, for startups with greater innovative output, we posit that ESG will have a stronger positive effect on securing government subsidies. Based on the above, we propose the following hypotheses (Fig. 1):

**H7.** LA positively moderates the relationship between ESG practices and the likelihood of obtaining VC.

**H8.** LA positively moderates the relationship between ESG practices and the level of GOVS.

## 3. Methodology

### 3.1. Data sample

This study focuses on A-share listed companies in China, using data from the period 2018 to 2023. Following standard practices in empirical corporate finance research, we excluded ST firms and observations with missing key variables. After initial screening, the sample includes 1431 firms and 6283 observations. Missing values were imputed using multiple interpolation (Baraldi and Enders, 2010; Schafer and Graham, 2002). All data were obtained from the CSMAR database.

In order to control the potential distortion of extreme values on parameter estimation, this study conducted tail reduction processing on the main continuous variables at the 1% level to effectively alleviate the influence of abnormal values while retaining the sample information. Similarly, in the research on cryptocurrency data with more significant extreme values, Mohamed et al. (2025) also confirmed that tailing processing can effectively improve the efficiency of the model in identifying data structure changes and outliers. Since the dataset is panel-

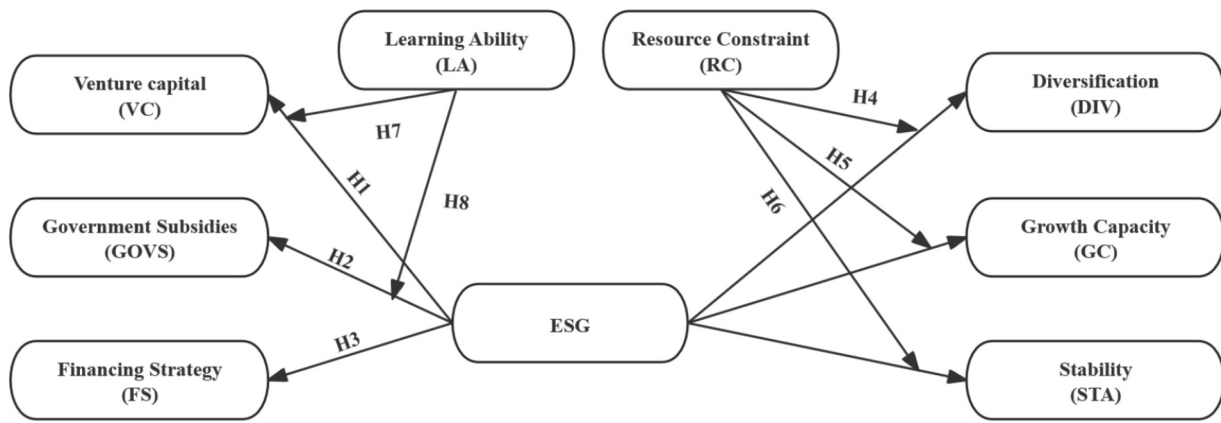


Fig. 1. Conceptual framework.

structured, we employed different estimation strategies based on the nature of the dependent variables. Logit models were used for binary outcomes (VC and FS), while PanelOLS was applied to continuous dependent variables. To address potential endogeneity, we implemented a lagged-variable approach, which reduced the number of observations to 4363. Following Cameron et al. (2011), we employed two-way cluster-robust standard errors to account for potential correlations between firms over time and across the same year.

In China, although there is no universally accepted definition of startups, we adopt a comprehensive approach to identify them. We combine multiple criteria that reflect both firm-level characteristics and institutional context. First, following Fu and Zhang (2019), who report that only 12.28% of Chinese firms survive beyond seven years, we treat firms established within the past seven years as being in the early stage of their life cycle. Second, we take into account the structure of China's capital market, which includes several specialized boards designed to support startup and growth-oriented enterprises. Accordingly, we consider firms listed on the ChiNext board (Growth Enterprise Market), the STAR Market (Science and Technology Innovation Board), or the NEEQ (National Equities Exchange and Quotations) as representative of startups. These boards are specifically tailored to firms with innovative business models, limited profitability, or incomplete financial histories, which are common features of early-stage ventures (Li et al., 2021b; Bi et al., 2024; Huang et al., 2020). This dual identification strategy enhances both theoretical relevance and empirical feasibility.

### 3.2. Variables selection

The independent variable is ESGB, constructed to reflect whether a firm is genuinely engaging in ESG-related actions. To develop this score, we selected indicators with clear institutional, governance, operational, and practice-based characteristics, including: environmental philosophy, environmental objectives, environmental management systems, environmental education and training, special environmental initiatives, emergency response mechanisms for environmental incidents, environmental awards or recognitions, the implementation of the Three Simultaneities policy (simultaneous design, construction, and operation of environmental protection facilities alongside production facilities), ISO 14001 certification, environmental petition cases, environmental violations, major environmental accidents and non-compliance in pollutant discharge.

Since all selected indicators are binary variables, in order to avoid the deviation caused by subjective weighting, this study adopts equal weight treatment for each indicator. Specifically, in the total 13 indicators, enterprises will get 1 point for each positive indicator (plus item) they meet, and 1 point will be deducted for each negative record (minus item). Finally, the ESGB score of each enterprise is the sum of its positive score and negative deduction, the ESG indicators obtained are

mainly dominated by the environmental dimension as shown in Table 1. The weighted summation method not only ensures the comprehensiveness of the information but also improves the transparency and repeatability of the score. As for the robustness test, based on the annual data frequency used in this study, we used a period lag. On the premise of effectively stripping the synchronous feedback effect, it can also avoid the problem that the model may lose the latest dynamic information or aggravate the loss of samples due to excessive lag.

The dependent variables are as follows: 1) The dependent variables are as follows: VC is a binary variable that equals 1 if the firm receives external equity investment from a registered or publicly identified venture capital institution in year *t*, and 0 otherwise; 2) GOVS is measured as the total amount of government subsidies received by the firm in a given year, with the natural logarithm applied to mitigate skewness in the distribution; 3) FS, also coded as a binary variable (1 is equity financing, 0 is debt financing), where observations involving both financing types or none were excluded to ensure classification clarity; (4) DIV, measured using the revenue entropy index to capture business heterogeneity; (5) GC, proxied by the annual revenue growth rate; and (6) STA, measured by profit volatility. For the moderating variables, resource constraint is measured by the firm's debt-to-asset ratio, while learning ability is proxied by the number of invention patents held by

Table 1  
Variable description.

Independent Variable	ESGB	comprehensive weighted evaluation of 13 indices
Dependent Variable	VC	binary variable (1 is accessed VC resources, and 0 is no)
	GOVS	the monetary amount received
	FS	binary variable (1 is equity financing, 0 is debt financing)
	DIV	the revenue entropy index
	GC	proxied by the annual revenue growth rate
	STA	measured by profit volatility
Moderating Variable	RC	proxied by the firm's debt-to-asset ratio.
	LA	represented by the number of company patents
	FA	the number of years since the firm's establishment
	OP	the natural logarithm of operating profit
	DUAL	a binary variable indicating whether the chairman also serves as general manager (1 is yes, 0 is no)
	RDI	R&D expenditure ratio
Control Variable	IDR	the proportion of independent directors relative to total board members
	BS	the number of directors on the board
	OWN	coded as 1 if the firm is state-owned and 0 otherwise
	ROA	net income divided by total assets
	GPM	gross profit over total revenue
	KPM	a dummy variable equal to 1 if the firm is listed as a key pollution monitoring enterprise, and 0 otherwise
	ER	ranging from 1 (excellent) to 4 (non-compliant)

the company.

To control for firm-level heterogeneity and isolate the effect of ESG behavior on financial outcomes, we include the following control variables: (1) firm age (FA), the number of years since the firm's establishment; (2) operating profit (OP), the natural logarithm of operating profit; (3) board duality (DUAL), a binary variable indicating whether the chairman also serves as general manager (1 is yes, 0 is no); (4) R&D intensity (RDI), R&D expenditure ratio; (5) Independent directors ratio (IDR), defined as the proportion of independent directors relative to total board members; (6) board size (BS), the number of directors on the board; (7) ownership type (OWN), coded as 1 if the firm is state-owned and 0 otherwise; (8) return on assets (ROA), net income divided by total assets; (9) gross profit margin (GPM), gross profit over total revenue; (10) key pollutant monitoring status (KPM), a dummy variable equal to 1 if the firm is listed as a key pollution monitoring enterprise, and 0 otherwise; and (11) evaluation result (ER), a categorical variable ranging from 1 (excellent) to 4 (non-compliant), reflecting the firm's information disclosure evaluation outcome.

### 3.3. Multicollinearity test

Before conducting the regression analysis, we performed a multicollinearity test to ensure the independence of explanatory variables. Table 2 reports the variance inflation factor (VIF) values for all variables included in the models. As shown, all VIF values are below the commonly accepted threshold of 10, suggesting the absence of serious multicollinearity concerns. The highest VIF observed is 1.720 less than 2, these results indicate that multicollinearity is unlikely to distort the estimation results in the subsequent regression models.

### 3.4. Model construction

To test the proposed hypotheses, we construct six empirical models based on the type of dependent variables. Models 1 and 3 are estimated to use Logit regression, as their dependent variables are binary. Models 2, 4, 5, and 6 are estimated to use PanelOLS. All models include the key independent variable ESGB and a set of control variables (CV). In Models 4 to 6, the moderator variable RC and its interaction term with ESGB are introduced to capture potential moderating effects. Finally, we tested the moderating effect of learning ability in Models 7 and 8.

	Model
$Pr(VC_{it} = 1) = \text{Logit}^{-1}(\beta_1 \text{ESGB}_{it} + \gamma \text{CV}_{it} + \epsilon_{it})$	(1)
$GOVG_{it} = \beta_1 \text{ESGB}_{it} + \gamma \text{CV}_{it} + \alpha_i + \lambda_t + \epsilon_{it}$	(2)
$Pr(FS_{it} = 1) = \text{Logit}^{-1}(\beta_1 \text{ESGB}_{it} + \gamma \text{CV}_{it} + \epsilon_{it})$	(3)
$DIV_{it} = \beta_1 \text{ESGB}_{it} + \beta_2 \text{RC}_{it} + \beta_3 (\text{ESGB}_{it} \times \text{RC}_{it}) + \gamma \text{CV}_{it} + \alpha_i + \lambda_t + \epsilon_{it}$	(4)
$GC_{it} = \beta_1 \text{ESGB}_{it} + \beta_2 \text{RC}_{it} + \beta_3 (\text{ESGB}_{it} \times \text{RC}_{it}) + \gamma \text{CV}_{it} + \alpha_i + \lambda_t + \epsilon_{it}$	(5)
$STA_{it} = \beta_1 \text{ESGB}_{it} + \beta_2 \text{RC}_{it} + \beta_3 (\text{ESGB}_{it} \times \text{RC}_{it}) + \gamma \text{CV}_{it} + \alpha_i + \lambda_t + \epsilon_{it}$	(6)
$Pr(VC_{it} = 1) = \text{Logit}^{-1}(\beta_1 \text{ESGB}_{it} + \beta_2 \text{LA}_{it} + \beta_3 (\text{ESGB}_{it} \times \text{LA}_{it}) + \gamma \text{CV}_{it} + \epsilon_{it})$	(7)
$GOVG_{it} = \beta_1 \text{ESGB}_{it} + \beta_2 \text{LA}_{it} + \beta_3 (\text{ESGB}_{it} \times \text{LA}_{it}) + \gamma \text{CV}_{it} + \alpha_i + \lambda_t + \epsilon_{it}$	(8)

$i$  denotes the firm identity and  $t$  represents the year.  $\alpha_i$  represents firm fixed effect,  $\lambda_t$  represents year fixed effects,  $\epsilon_{it}$  denotes the error term.

**Table 2**  
Multicollinearity test.

Variable	VIF	Variable	VIF
ESGB	1.536	GPM	1.133
FA	1.327	KPM	1.308
OP	1.517	VC	1.084
DUAL	1.094	GOVS	1.007
RDI	1.105	FS	1.167
IDR	1.592	DIV	1.011
BS	1.720	GC	1.021
ROA	1.512	STA	1.060
OWN	1.205		

## 4. Results

### 4.1. Regression results

The empirical results (Tables 3 and 4) provide strong support for the proposed hypotheses and highlight the strategic role of ESG engagement in shaping the financing and development outcomes of startups in China. As relatively young and often RC entities, startups play a crucial role in driving innovation and economic vitality (Men, 2021). In this context, ESG practices serve not only as signaling tools but also as a form of institutional capital. The Logit results in Model 1 confirm that ESG engagement significantly increases the likelihood of obtaining VC ( $p < 0.01$ ). For every additional unit of ESG practice, the logarithmic probability of obtaining VC increases by 0.140. By calculating the ratio, we can conclude that for every additional unit of ESG practice, the probability of startups obtaining VC increases by approximately 15%. This is particularly important for startups, as venture capitalists typically face high levels of uncertainty and information asymmetry when evaluating early-stage firms (Lange and Banadaki, 2024; Wu et al., 2024). By actively participating in ESG initiatives, such as setting formal environmental goals, adopting certification standards, and establishing governance structures, startups can enhance their credibility and attract socially conscious investors seeking responsible and transparent investment opportunities. Regarding H2, the empirical analysis reveals a positive yet statistically non-significant relationship between ESG engagement and GOVS. It suggests that the signaling logic for securing public funding may operate differently from that for attracting private venture capital. Unlike investors who evaluate firm-specific potential and commitments, government subsidy allocation is often structured by broader administrative and political-economic priorities. These include regional development goals, sector-specific industrial policies, and other macro-level criteria that may overshadow firm-level voluntary ESG initiatives (Li et al., 2023; Zhao, 2019). Thus, the non-significant result likely reflects the institutional reality that ESG, as a market-oriented signal, carries limited weight within a predominantly policy-driven allocation framework. Nonetheless, the positive coefficient direction implies that ESG may still function as a soft, complementary signal of organizational legitimacy, potentially contributing to a firm's overall profile in contexts where non-financial alignment is valued. Model 3 showing that stronger ESG performance is significantly associated with a lower likelihood of choosing equity financing instead of debt ( $p < 0.01$ ). Specifically, one unit increase in the ESGB reduces the log-odds of selecting equity financing by approximately 0.164. With other unchanged conditions, the probability of selecting debt financing will decrease by about 15.6% every time the ESG practice intensity of startups increases by one unit. For startups, higher ESG scores may be associated with more structured internal governance, clearer strategic

**Table 3**  
Logit model regression.

	Model 1		Model 3	
	$\beta$	p (z)	$\beta$	p (z)
ESGB	0.140	0.000*** (4.717)	-0.170	0.000*** (-7.032)
FA	-0.880	0.013** (-2.480)	0.590	0.000*** (19.122)
OP	-0.113	0.041** (-2.040)	0.199	0.000*** (4.467)
DUAL	0.576	0.000*** (6.750)	0.048	0.000*** (0.698)
RDI	5.379	0.000*** (5.871)	-0.783	0.000*** (-2.401)
IDR	-4.666	0.000*** (-4.019)	0.955	0.000*** (0.974)
BS	0.147	0.000*** (3.858)	0.008	0.000*** (0.241)
OWN	-0.950	0.000*** (-6.900)	-0.195	0.000*** (-1.518)
ROA	-2.232	0.036** (-2.101)	-6.290	0.000*** (-7.188)
GPM	-0.759	0.011*** (-2.548)	0.507	0.000*** (2.273)
KPM	-0.168	0.157 (-1.417)	-0.136	0.000*** (-1.372)
ER	0.249	0.191 (1.308)	0.011	0.000*** (0.069)
INTERCEPT	3.633	0.003*** (2.936)	-5.856	0.000*** (-5.767)

Statistical significance at the 1%, 5% and 10% levels is indicated by \*\*\*, \*\* and \*, respectively.

**Table 4**  
PanelOLS model regression.

	Model 2		Model 4		Model 5		Model 6	
	$\beta$	p	$\beta$	p	$\beta$	p	$\beta$	p
ESGB	-0.013	0.109	0.002	0.183	-0.304	0.000***	0.137	0.000***
FA	0.005	0.590	0.001	0.493	0.050	0.346	0.302	0.000***
OP	0.049	0.000***	0.077	0.000***	-0.393	0.000***	-0.019	0.383
DUAL	-0.021	0.366	0.015	0.000***	0.111	0.371	-0.029	0.568
RDI	-0.266	0.011	-0.100	0.000***	0.338	0.561	0.131	0.582
IDR	0.311	0.281	0.894	0.000***	11.343	0.000***	1.090	0.093
BS	0.030	0.001**	0.026	0.000***	0.249	0.000***	0.050	0.016
OWN	-0.047	0.259	-0.023	0.000***	0.580	0.010**	-0.133	0.151
ROA	-0.144	0.596	-0.556	0.000***	-1.131	0.467	-1.279	0.045
GPM	-0.040	0.586	0.010	0.289	2.074	0.000***	0.301	0.081
KPM	0.028	0.389	-0.016	0.000***	-0.210	0.232	-0.330	0.000***
ER	0.050	0.277	0.124	0.000***	0.360	0.156	-0.139	0.183
RC			-0.037	0.006***	1.035	0.087*	0.997	0.000***
INTERACTION			-0.021	0.000***	1.270	0.000***	-0.292	0.001***

Statistical significance at the 1%, 5% and 10% levels is indicated by \*\*\*, \*\* and \*, respectively.

direction, and stricter operational controls. These features improve their ability to access debt markets, which typically demand stronger disclosure and compliance mechanisms. As a result, startups with strong ESG performance may rely less on equity because they already meet the transparency and accountability standards required for debt issuance. Moreover, equity financing often leads to substantial ownership dilution for startups, especially during the growth stage. Founders who seek to retain control may prefer debt financing, as strong ESG credentials can enhance creditworthiness and reduce perceived risk for lenders. In this sense, ESG engagement influences not only market perception but also aligns with managerial preferences in capital structure decisions.

However, the effectiveness of ESG under RC appears to be mixed. Model 4 shows that the interaction term between ESG and RC is negative and significant ( $\beta = -0.021$ ,  $p < 0.001$ ), contrary to H4. This indicates that the positive relationship between ESG and diversification strategy is not strengthened but rather weakened under higher resource constraints. In other words, as resource pressure increases, startups with ESG goals may find it even more challenging to allocate resources toward diversifying into new business areas, possibly prioritizing the sustenance of their core operations. Model 5 presents a different trend. While ESG has a negative effect on GC, this relationship weakens and even reverses as RC intensifies. This suggests that ESG practices may be more effective under constrained conditions, helping firms gain access to external partnerships, funding, or policy support, which in turn creates new growth opportunities. Model 6 indicates that ESG practices generally contribute positively to firm STA. However, this positive effect diminishes as resource pressure increases. One possible explanation is that RC hinders the effective implementation of ESG mechanisms, potentially leading to weaker internal controls or poor execution. Severe RC may impede the proper implementation and maintenance of robust ESG-related governance and operational controls, thereby diluting their stabilizing benefits.

These findings highlight the context-dependent nature of ESG effectiveness in startups. On the one hand, ESG engagement can improve credibility in external financial markets and enhance a firm's growth prospects. On the other hand, when resources are highly limited, ESG may become an additional management burden, narrow strategic flexibility and create new operational constraints. This implies that firms pursuing ESG strategies should carefully evaluate their resource base and governance capacity to ensure feasibility and sustainability. The results also offer implications for policymakers. When designing ESG related regulations and incentives, it is important to account for firms' heterogeneity in resource endowments and development stages, improving the relevance and effectiveness of ESG policy tools.

This implies that startups must strategically calibrate their ESG initiatives relative to their available resource base and specific strategic priorities. For policymakers and investors, these results highlight the

importance of providing targeted, resource-sensitive support (e.g., grants, technical assistance) to help resource-constrained startups realize the full strategic potential of their ESG commitments, particularly in areas like governance that may otherwise be compromised.

#### 4.2. Endogeneity test

To further test the robustness of our findings and alleviate concerns about endogeneity, especially the potential reverse causality between ESG practices and firm outcomes, we re-estimated models 1 to 6 by replacing the contemporaneous ESG score with its one-period lagged value (ESGB\_LAG), resulting in Table 5.

The results support our main conclusions. In Model 1, the coefficient of ESGB\_LAG is significantly positive ( $\beta = 0.160$ ,  $p < 0.01$ ), confirming that previous ESG engagement increases the likelihood of receiving VC. This finding supports H1. Likewise, Model 3 shows a significant negative association between ESGB\_LAG and the likelihood of relying on equity financing, providing evidence for H3. Startups with better ESG performance are more likely to choose debt over equity. This may be because strong ESG practices help reduce perceived default risk or align more closely with the preferences of equity investors who value long-term sustainability rather than short-term liquidity.

In Model 2, which examines the relationship between ESG practices and GOVS, the coefficient of ESGB\_LAG remains statistically insignificant ( $p = 0.130$ ). This result is consistent with the main regression where ESG was also not significant. The consistent insignificance suggests that neither current nor past ESG performance leads directly to an advantage in obtaining government funding. This may reflect how subsidies are actually allocated in practice. For startups, public support tends to be determined more by macro-level policy goals, industry-specific plans or regional strategies, rather than firm-level ESG indicators. Even with sound ESG performance, startups may lack the financial track record or external recognition needed to qualify for such support. These results suggest that ESG performance has not yet become a formal criterion for allocating public resources. Thus, ESG does not appear to significantly influence access to government funding, highlighting a gap between sustainability goals and actual public resource allocation.

In Model 4, the interaction between ESGB\_LAG and RC is significantly negative ( $\beta = -0.021$ ), indicating that the marginal effect of ESG on business DIV becomes weaker as resource pressure increases. This result does not support H4. It suggests that under financial stress, startups may find it difficult to convert ESG engagement into DIV efforts. Since ESG activities often require organizational and financial input, firms under high leverage may prefer to concentrate resources on maintaining core operations rather than entering new areas. The interaction term in Model 5 is significantly positive ( $p < 0.01$ ,  $\beta = 1.270$ ), indicating that ESG engagement has a stronger positive effect on growth

**Table 5**  
Lagged variable.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	p ( $\beta$ )	p ( $\beta$ )	p ( $\beta$ )	p ( $\beta$ )	p ( $\beta$ )	p ( $\beta$ )
ESGB_LAG	0.000*** (0.160)	0.130 (-0.014)	0.000*** (-0.156)	0.279 (0.002)	0.000*** (-0.304)	0.000*** (0.130)
FA	0.044** (-0.083)	0.804 (0.003)	0.000*** (0.572)	0.789 (-0.000)	0.348 (0.050)	0.000*** (0.284)
OP	0.053* (-0.123)	0.000*** (0.047)	0.003*** (0.176)	0.000*** (0.077)	0.000*** (-0.393)	0.512 (-0.017)
DUAL	0.000*** (0.576)	0.312 (-0.026)	0.783 (-0.025)	0.000*** (0.017)	0.353 (0.111)	0.467 (-0.043)
RDI	0.000*** (5.902)	0.021** (-0.278)	0.222 (-0.524)	0.000*** (-0.090)	0.256 (0.338)	0.788 (0.074)
IDR	0.000*** (-5.215)	0.309 (0.337)	0.338 (1.257)	0.000*** (0.893)	0.000*** (11.343)	0.143 (1.092)
BS	0.003*** (0.133)	0.002*** (0.033)	0.592 (0.022)	0.000*** (0.027)	0.000*** (0.249)	0.026** (0.054)
OWN	0.000*** (-0.974)	0.352 (-0.044)	0.496 (-0.114)	0.000*** (-0.021)	0.027** (0.580)	0.161 (-0.148)
ROA	0.089* (-2.081)	0.674 (-0.132)	0.000*** (-5.656)	0.000*** (-0.524)	0.268 (-1.131)	0.063* (-1.367)
GPM	0.017** (-0.825)	0.736 (-0.029)	0.433 (0.231)	0.822 (0.002)	0.000*** (2.074)	0.083* (0.346)
KPM	0.127 (-0.209)	0.405 (0.031)	0.133 (-0.196)	0.000*** (-0.017)	0.207 (-0.210)	0.000*** (-0.317)
ER	0.173 (0.297)	0.328 (0.052)	0.576 (0.111)	0.000*** (0.125)	0.044** (0.360)	0.267 (-0.133)
RC				0.031** (-0.033)	0.028** (1.035)	0.001*** (0.927)
INTERACTION				0.000*** (-0.021)	0.000*** (1.270)	0.003*** (-0.282)
INTERCEPT	0.005*** (4.000)		0.000*** (-5.702)			

Note: Entries show  $p$ -values and test statistics in parentheses. Models 1 and 3 are Logit regressions; others are PanelOLS. Statistical significance at the 1%, 5% and 10% levels is indicated by \*\*\*, \*\* and \*, respectively.

when resources are limited. This outcome supports H5. Under financial pressure, the signals of responsibility and transparency associated with ESG can help build external trust and unlock new opportunities, making ESG a strategic tool for overcoming growth barriers.

In Model 6, we examine the relationship between ESG practices and firm STA. Without including interaction terms, ESGB\_LAG is positively and significantly associated with financial stability, suggesting that ESG practices can directly enhance firm robustness. When RC is considered, the interaction term becomes negative and significant at the 99% confidence level ( $p = 0.003$ ). This indicates that the effect of ESG on reducing earnings volatility is more pronounced in highly leveraged firms. The result supports H6 and suggests that ESG engagement can act as a buffer under financial stress, helping startups manage risk and enhance stability in resource-constrained environments.

Overall, using a lagged ESG measure reinforces our earlier findings while reducing reverse causality concerns, confirming the context-dependent role of ESG in startup strategy and performance.

#### 4.3. Two-way clustering standard errors

Our analyses may contain two types of dependencies: first, within-firm serial correlation because a company's strategic decisions are likely to be persistent over time; and second, across-firm contemporaneous correlation due to common macroeconomic or policy shocks affecting all sample firms in a given year. Ignoring such dependencies could lead to underestimated standard errors and overstate statistical significance. Therefore, to further assess the robustness of our baseline results, we follow the approach proposed by Cameron et al. (2011) and re-estimate models 1 to 6 using PanelOLS with standard errors clustered at both the firm and year levels. Given that the dependent variables in Model 1 (VC) and Model 3 (FS) are binary, we employed logit regressions. For consistency across models and to ensure the validity of clustered inference under a unified framework, we re-estimate these two models using PanelOLS. Table 6 presents the results based on the ESGB and reports the estimates using ESGB\_LAG under the same clustering strategy.

As shown in Tables 6, the results under the stricter framework of two-way clustering standard errors largely confirm our baseline findings. In Model 2 remain statistically insignificant across both columns. This suggests that GOVS may not be strongly influenced by ESG signals, particularly in the context of startups, where subsidy allocation is often driven by broader policy priorities or regional development goals rather than firm-level ESG efforts.

The result of model 4 remained robust, the main effect of ESG on div was significantly positive, but its interaction with RC was still

significantly negative. This finding further supports the substantial regulatory role of resource constraints. When a start-up enterprise is faced with serious resource constraints, its decision will turn to the resource conservation mode. The management tends to focus limited funds and attention on maintaining core business and ensuring short-term survival, rather than supporting new business exploration with uncertainty. At this time, ESG activities aimed at promoting long-term value and diversified development may in reality be regarded as a cost item that needs to consume scarce resources, forming internal resource competition with the diversification strategy, thus weakening the synergy between the two. Therefore, hypothesis H4 is not supported.

In Model 5, the main effects of ESG and ESGB\_LAG on firm GC are negative and significant, indicating that under relaxed resource conditions, ESG may impose cost burdens or distract firms from growth-oriented activities. However, the interaction terms are consistently positive and marginally significant ( $p = 0.016$  and  $p = 0.013$ ). This suggests that as RC intensifies, the negative impact of ESG on GC is mitigated and may even turn positive. In other words, under financial pressure conditions, ESG may serve as a strategic tool for enhancing credibility and governance, helping firms adapt to external changes and supporting growth. These results support H5.

Model 6 exhibit context-dependent patterns. Under two-way clustered standard errors, the interaction terms between ESG and RC fail to reach significance, suggesting limited evidence of a moderating effect when accounting for firm- and year-level clustering. However, robustness checks using robust standard errors yield statistically significant results for both models STA:  $p = 0.010$  and  $0.036$ , indicating that ESG's effects under resource constraints may still be present but are sensitive to error structure assumptions.

Notably, Model 6 shows a positive main effect and a negative interaction term, implying that while ESG enhances stability in general, its marginal benefit diminishes under financial stress. The discrepancy in findings may reflect how the impact of ESG on firm STA varies depending on the structural context. Under stricter error adjustment, the effect may be obscured by greater estimation uncertainty, while under robust errors it becomes more apparent. This indicates that the stabilizing role of ESG mechanisms may be highly context-dependent. ESG engagement may indirectly buffer financial risks under RC by improving organizational transparency, strengthening disclosure practices, and enhancing internal control systems. For startups, such governance advantages are unlikely to produce immediate financial STA but may yield long-term benefits under sustained external pressure.

**Table 6**  
Two-way clustering.

	Model 2		Lagged		Model 4		Lagged		Model 5		Lagged		Model 6		Lagged		
	p (β)		p (β)		p (β)		p (β)		p (β)		p (β)		p (β)		p (β)		
ESGB	0.177 (-0.013)	0.139 (-0.014)	0.415 (0.002)	0.494 (0.002)	0.008*** (-0.304)	0.015** (-0.334)	0.000*** (0.137)	0.015** (-0.334)	0.008*** (-0.304)	0.000*** (0.137)	0.000*** (0.130)	0.015** (-0.334)	0.000*** (0.137)	0.000*** (0.130)	0.000*** (0.130)	0.015** (-0.334)	0.000*** (0.130)
FA	0.736 (0.005)	0.860 (0.003)	0.804 (0.001)	0.921 (-0.000)	0.717 (0.050)	0.968 (0.889)	0.000*** (0.077)	0.921 (-0.000)	0.008*** (-0.393)	0.000*** (0.302)	0.000*** (0.284)	0.968 (0.889)	0.000*** (0.302)	0.000*** (0.284)	0.968 (0.889)	0.000*** (0.284)	
OP	0.000*** (0.049)	0.000*** (0.047)	0.000*** (0.077)	0.000*** (0.077)	0.008*** (-0.089)	0.000*** (0.077)	0.000*** (0.077)	0.000*** (0.077)	0.008*** (-0.393)	0.000*** (0.077)	0.742 (-0.017)	0.000*** (0.077)	0.691 (-0.019)	0.742 (-0.017)	0.000*** (0.077)	0.691 (-0.019)	
DUAL	0.760 (-0.021)	0.715 (-0.026)	0.000*** (0.015)	0.000*** (0.015)	0.726 (0.111)	0.000*** (0.015)	0.000*** (0.015)	0.000*** (0.015)	0.855 (-0.029)	0.000*** (0.015)	0.820 (-0.043)	0.000*** (0.015)	0.855 (-0.029)	0.820 (-0.043)	0.000*** (0.015)	0.855 (-0.029)	
RDI	0.018** (-0.266)	0.012** (-0.278)	0.000*** (-0.100)	0.000*** (-0.100)	0.550 (0.338)	0.000*** (-0.100)	0.000*** (-0.089)	0.000*** (-0.089)	0.500 (0.433)	0.000*** (-0.089)	0.841 (0.074)	0.000*** (-0.089)	0.500 (0.433)	0.841 (0.074)	0.000*** (-0.089)	0.500 (0.433)	
IDR	0.332 (0.311)	0.307 (0.337)	0.000*** (0.893)	0.000*** (0.893)	0.016** (1.343)	0.000*** (0.893)	0.000*** (0.892)	0.018** (1.4074)	0.018** (1.4074)	0.018** (1.4074)	0.289 (1.092)	0.018** (1.4074)	0.018** (1.4074)	0.289 (1.092)	0.018** (1.4074)	0.018** (1.4074)	
BS	0.051* (0.030)	0.039** (0.033)	0.000*** (0.026)	0.000*** (0.026)	0.001*** (0.249)	0.000*** (0.026)	0.000*** (0.027)	0.001*** (0.249)	0.000*** (0.295)	0.000*** (0.027)	0.112 (0.054)	0.000*** (0.027)	0.000*** (0.295)	0.112 (0.054)	0.000*** (0.027)	0.112 (0.054)	
OWN	0.083* (-0.047)	0.165 (-0.044)	0.018** (-0.023)	0.018** (-0.023)	0.514 (0.580)	0.018** (-0.023)	0.019** (-0.021)	0.514 (0.580)	0.513 (0.647)	0.019** (-0.021)	0.598 (-0.148)	0.019** (-0.021)	0.513 (0.647)	0.598 (-0.148)	0.019** (-0.021)	0.513 (0.647)	
ROA	0.766 (-0.144)	0.797 (-0.132)	0.000*** (-0.556)	0.000*** (-0.556)	0.569 (-1.131)	0.000*** (-0.556)	0.000*** (-0.524)	0.569 (-1.131)	0.833 (-0.454)	0.000*** (-0.524)	0.362 (-1.367)	0.000*** (-0.524)	0.833 (-0.454)	0.362 (-1.367)	0.000*** (-0.524)	0.362 (-1.367)	
GPM	0.507 (-0.040)	0.679 (-0.029)	0.179 (0.010)	0.739 (0.002)	0.000*** (2.074)	0.179 (0.010)	0.739 (0.002)	0.000*** (2.074)	0.000*** (1.975)	0.000*** (2.074)	0.343 (0.346)	0.000*** (2.074)	0.000*** (1.975)	0.343 (0.346)	0.000*** (2.074)	0.343 (0.346)	
KPM	0.648 (0.028)	0.619 (0.031)	0.033** (-0.016)	0.024** (-0.017)	0.535 (-0.210)	0.033** (-0.016)	0.024** (-0.017)	0.535 (-0.210)	0.674 (-0.206)	0.024** (-0.017)	0.201 (-0.317)	0.024** (-0.017)	0.674 (-0.206)	0.201 (-0.317)	0.024** (-0.017)	0.201 (-0.317)	
ER	0.586 (0.050)	0.586 (0.052)	0.000*** (0.124)	0.000*** (0.124)	0.399 (0.360)	0.000*** (0.124)	0.000*** (0.125)	0.399 (0.360)	0.352 (0.406)	0.000*** (0.125)	0.538 (-0.133)	0.000*** (0.125)	0.352 (0.406)	0.538 (-0.133)	0.000*** (0.125)	0.352 (0.406)	
RC			0.272 (-0.037)	0.353 (-0.033)	0.019** (1.035)	0.272 (-0.037)	0.353 (-0.033)	0.019** (1.035)	0.053* (0.889)	0.019** (1.035)	0.175 (0.927)	0.053* (0.889)	0.019** (1.035)	0.175 (0.927)	0.053* (0.889)	0.019** (1.035)	
INTERACTION			0.007*** (-0.021)	0.011*** (-0.021)	0.016** (1.270)	0.007*** (-0.021)	0.011*** (-0.021)	0.016** (1.270)	0.013** (1.546)	0.013** (1.546)	0.257 (-0.282)	0.013** (1.546)	0.013** (1.546)	0.257 (-0.282)	0.013** (1.546)	0.257 (-0.282)	

Statistical significance at the 1%, 5% and 10% levels is indicated by \*\*\*, \*\* and \*, respectively. Lagged represents lagged variable.

#### 4.4. Result of learning ability

According to Table 7, in the moderating effect of learning capacity on the relationship between ESG and VC acquisition, the interaction term in Model 1 shows high statistical significance ( $p = 0.000$ ) with a positive coefficient ( $\beta = 0.051$ ). Similarly, in the lagged model, it remains significantly positive ( $\beta = 0.052$ ). This result supports H7, indicating that a firm's learning capacity can significantly enhance the positive impact of ESG practices on the likelihood of obtaining VC. This suggests that for startups with stronger learning capacity, their ESG practices are more effective in conveying credible and execution-capable signals to venture investors.

On the other hand, in the moderating effect of learning capacity on the relationship between ESG and the level of GOVS, the interaction term in Model 2 is not significant ( $p = 0.897$ ), with a coefficient close to zero, and the result in the lagged model is similarly insignificant. Therefore, H8 is not supported. This indicates that although government agencies emphasize technological innovation and policy alignment, ESG practices and learning capacity do not generate significant synergistic enhancement effect in securing government subsidies. The evaluation mechanism for government subsidies may focus more directly on policy compliance or social benefits and is less sensitive to the signal amplification effect arising from the interaction of the two factors.

Furthermore, regarding the main effects, in both Model 1 and Model 2, the individual effects of ESGB and LA do not show statistical significance, suggesting that without considering the moderating effect, ESG practices or learning capacity alone have limited explanatory power for resource acquisition.

#### 5. Discussion

This study investigates how ESG practices affect external resource acquisition, FS choices, and strategic performance under RC among startups in China. Drawing on the RBV, social identity theory, and effectuation theory, our findings yield several important insights. Firstly, we find that stronger ESG performance is significantly associated with a higher likelihood of receiving VC. This aligns with existing literature (Lange and Banadaki, 2024; Wu et al., 2024), suggesting that proactive ESG engagement helps reduce information asymmetry and enhances investor recognition of a firm's long-term value. Importantly, H7 is strongly supported: a startup's learning ability positively moderates this relationship. As venture capitalists increasingly prioritize ESG criteria (Drobetz et al., 2024), ESG becomes an important signaling mechanism that strengthens a startup's position in capital markets.

Secondly, although we hypothesized a positive relationship between ESG and GOVS, our results do not support this assumption. This may be because government funding decisions are more influenced by macro policy priorities and industrial development plans than by firm-level ESG performance (Li et al., 2023; Zhao, 2019). Consistent with this institutional logic, H8 is not supported which proposes a positive moderating role of learning ability. Two possible explanations emerge: first, ESG practices among startups have not yet been systematically incorporated into government evaluation frameworks; second, due to the generally low survival rate of startups, even those with solid ESG practices may not be perceived as sufficiently sustainable in the long run. Compared to market-driven VC, government resource allocation may respond to ESG signals with more delay or indirectly. Under the current institutional environment, ESG engagement is not yet a major criterion in determining access to GOVS. While ESG carries signaling value, its role in public resource allocation remains limited and highlights the need for continued policy and institutional development.

Thirdly, the results strongly support H3, firms with better ESG performance are more likely to access debt financing. This is likely because ESG performance is closely associated with corporate transparency, governance quality, and regulatory compliance, these factors that are highly valued in debt markets (Maaloul et al., 2023; Shi et al., 2024).

**Table 7**  
Learning ability.

	Model 1	Lagged	Model 2	Lagged
	p ( $\beta$ )	p ( $\beta$ )	p ( $\beta$ )	p ( $\beta$ )
ESGB	0.760 (−0.004)	0.877 (−0.003)	0.142 (−0.013)	0.142 (−0.013)
LA	0.112 (−0.022)	0.127 (−0.025)	0.760 (−0.006)	0.760 (−0.005)
INTERACTION	0.000*** (0.051)	0.000*** (0.052)	0.897 (−0.000)	0.897 (−0.000)

Statistical significance at the 1%, 5% and 10% levels is indicated by \*\*\*, \*\* and \*, respectively. Lagged represents lagged variable.

Moreover, compared to equity financing, debt avoids ownership dilution, which makes it a more attractive option for startup founders and reinforces ESG's role in financing decisions.

Regarding the moderating effect of RC, we find clear context-dependent patterns. H4 is not supported. On the contrary, we observe that resource scarcity amplifies the negative relationship between ESG and DIV. This may be due to the financial and managerial resources required for ESG implementation. Under RC, firms are more likely to focus on core operations and less able to support DIV strategies (Lindlbauer et al., 2025). In contrast, H5 receives strong empirical support. The positive effect of ESG on firm growth becomes more pronounced as RC increase. This finding aligns with the predictions of effectuation theory, ESG practices may serve as a strategic tool to help firms overcome resource bottlenecks and gain access to external collaboration and policy recognition under constrained conditions (Müller et al., 2025; Zakriya and Chams, 2025).

Finally, the results are more complex for H6. Across multiple analyses, including main regressions, endogeneity checks, and robustness tests, ESG engagement may buffer financial volatility and enhance STA under RC (Chen et al., 2023; Kang and Hong, 2025). However, this effect is not statistically confirmed under the more conservative two-way clustering standard errors, suggesting that the stabilizing role of ESG is highly context-sensitive. For startups, which are inherently exposed to high uncertainty, this effect may depend on specific resource conditions and internal governance capacity.

In summary, this study highlights the dual role of ESG practices in RC startups. On one hand, ESG serves as a strategic mechanism to signal credibility and attract external support. On the other hand, in high pressure contexts, ESG may increase the firm's operational and managerial burden. Therefore, firms should assess their internal capabilities and resource conditions carefully when implementing ESG strategies, ensuring that such practices are both feasible and sustainable.

## 6. Conclusions

This study investigates the impact of ESG practices on external resource acquisition, financing choices, and strategic performance under RC among Chinese startups. The main findings are as follows: (1) ESG engagement significantly increases the likelihood of obtaining VC, enhancing the attractiveness of startups in capital markets; (2) there is no significant association between ESG practices and GOVS, suggesting that government funding decisions may be more influenced by broader policy agendas than by firm-level ESG performance; (3) firms with stronger ESG performance are more inclined to adopt debt financing, highlighting the role of ESG in improving transparency and governance; (4) under RC conditions, ESG practices weaken corporate DIV, whereas they positively influence firm GC, underscoring the differentiated effects of ESG strategies under varying resource conditions; (5) the effects of ESG on STA under financial pressure are context-dependent. While ESG may impose additional burdens that hinder diversification efforts, it may simultaneously serve as a stabilizing mechanism that buffers firms from financial volatility when implemented under relatively slack resource conditions; (6) with the moderating effect of internal learning ability, stronger learning capacity enables firms engaged in ESG practices to be more likely to obtain external investment; (7) even with certain learning

capabilities, startups that participate in ESG practices remain unlikely to secure government subsidies.

### 6.1. Theoretical contribution

This study extends and deepens the ESG literature on several theoretical fronts. First, it refines signaling theory by delineating how ESG signals are interpreted through different institutional logics. We demonstrate that for market-oriented actors like venture capitalists, the ESG signal's credibility is contingent and amplified by a startup's demonstrable learning ability. Conversely, for policy-oriented actors like government agencies, the same signal is evaluated against a distinct legitimacy calculus dominated by political and administrative priorities, where technical learning capacity shows no moderating effect. This theorizing clarifies that signal strength is not intrinsic but is co-determined by the provider's logic and the firm's complementary capabilities.

In addition, this study draws theoretical insight from the perspective of entrepreneurial learning. Entrepreneurial learning theory suggests that startups facing resource constraints often rely on a process of learning-by-doing, gradually shaping effective strategies through iterative experimentation and reflection. Under this view, ESG engagement is not only a managerial task but also a learning platform, through which firms balance constraints with evolving goals, internalize stakeholder expectations, and refine strategic routines over time.

Moreover, it integrates entrepreneurial learning theory, by viewing ESG as a platform for stakeholder engagement and strategic refinement, we provide a theoretical lens to explain how startups with limited means can evolve their sustainability practices from symbolic gestures to core, value-creating competencies over time.

### 6.2. Practical contribution

Our research shows that ESG practices play a complex role in startups, which means firms need to make targeted strategic choices in practice. For entrepreneurs and managers, our findings underscore that ESG engagement should be strategically sequenced rather than pursued uniformly. Firms should prioritize ESG actions that align with their immediate resource acquisition goals, initially focusing on low-cost, high-signal governance (G) and social (S) practices to build credibility, while phasing in more resource-intensive environmental (E) investments in line with business development stages. Crucially, managers should view ESG not as a static checklist but as a dynamic learning process, leveraging it as a platform to engage stakeholders and iteratively refine their strategic routines.

From the investor perspective, ESG can serve as an important reference for assessing governance quality and long-term value potential, especially when startups lack financial histories and standard credit evaluations. Non-financial characteristics such as governance structure, information disclosure and social responsibility commitments often better reflect growth potential and risk-management ability. For policymakers, existing GOVS and industrial support do not sufficiently recognize or encourage ESG efforts by startups. To better align public resources with sustainable development goals, policymakers could design startup-specific ESG evaluation frameworks that reward

measurable progress and link such assessments to targeted incentives. For example, establishing ESG evaluation standards suited to early-stage firms and linking them to fiscal incentives and green guidance funds could improve coordination and precision between policy and sustainable corporate development. Overall, this study not only deepens the understanding of ESG strategy mechanisms but also provides theoretical and practical references for more adaptive and effective ESG policy-making and corporate practice in the future.

### 6.3. Limitations and future lines of research

This study measures ESG engagement based on existing indicators and secondary data scoring rules. Future research could incorporate textual analysis, introduce additional ESG-related indicators or alternative methods to deepen the understanding of ESG authenticity and greenwashing risks. Secondly, although this study focuses on A-share listed startups in China, the generalizability of the findings may be limited by China's unique institutional, regulatory, and cultural context. Future empirical research in other emerging markets could investigate how ESG practices adapt and perform under varying institutional conditions, thereby expanding the contextual applicability of the findings. Lastly, while this study integrates perspectives from RBV and signaling theory, future research may also draw on stakeholder or institutional theories to better understand the dynamics factors behind ESG decision-making in startup ecosystems. By addressing these limitations, future studies may further uncover the complex interactions between ESG behavior, resource environments, and entrepreneurial development.

### CRedit authorship contribution statement

**Shaocong Bo:** Writing – original draft, Visualization, Validation, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization, Writing – review & editing. **Michael Christofi:** Visualization, Validation, Resources, Methodology, Investigation, Formal analysis, Conceptualization. **Enrico Battisti:** Writing – original draft, Visualization, Validation, Supervision, Resources, Methodology, Investigation, Formal analysis, Conceptualization, Writing – review & editing. **Armando Papa:** Visualization, Validation, Supervision, Methodology, Investigation, Formal analysis, Conceptualization.

### Declaration of competing interest

On behalf of all authors, the corresponding author states that there is no conflict of interest. The contribution of Armando Papa to this article is based on the study program of the HSE University.

### Data availability

Data will be made available on request.

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