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Dividend payouts and biodiversity risk — Chinese evidence

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ABSTRACT

Across 25979 firm years, from 2007 to 2022, we investigate how Chinese firms exposed to biodiversity risk adjust corporate dividend payouts. The results show that biodiversity risk exposure significantly lowers the level of corporate dividend payouts, mainly through two channels — aggravating financing difficulties and promoting resource reallocation. Further, the negative impact of biodiversity risk on corporate dividend payouts is more prominent in firms with weaker political connections, stronger external supervision, and poorer internal governance. Our findings are consistent across several robustness checks. Overall, our work sheds light on the influence of the emerging challenge of biodiversity risk on corporate dividend payouts.

1. Introduction

Biodiversity loss, defined as the variety of genes, species, and ecosystems, has emerged as an urgent challenge for societies worldwide. While the public and authorities are increasingly concerned about the influence of climate change on the health of our planet, biodiversity loss extends beyond climate change. The Earth has witnessed an average decline of 73% in wildlife populations since 1970, posing multifaceted threats to humanity and even evolving into a broader nature crisis.[1] Correspondingly, the ability of ecosystems to sustain human survival and well-being has been undermined, affecting essential aspects such as climate resilience, food security, cultural identity, and health care. Notably, economic stability is seriously impacted. The World Bank claims that under the present path some countries could experience an annual loss of 10% in real GDP, while the global loss could reach 2.3% by 2030 (Johnson et al., 2021).

Given the severe consequences caused by biodiversity collapse, firms have recognised the gravity of biodiversity risk exposure. An important reason is that firms rely heavily on natural capital, which is underpinned by the provision of essential ecosystem services (Giglio et al., 2023). In particular, ecosystem services are crucial and distinct factors of production that complement labour, capital, and other factors (Daily, 1997). In other words, the reduction in ecosystem services would significantly affect output, and the loss is hard to offset by merely increasing other factors (Chichilnisky and Heal, 1998; Ekins et al., 2003). This actual loss of

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[1] See more details in https://www.worldwildlife.org/publications/2024-living-planet-report.

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biodiversity is regarded as a physical risk. In addition, firms also encounter political, reputational, legal, and market-sentiment risks arising from investors and regulators concerning the protection of biodiversity, which are transition risks (Giglio et al., 2023). Hence, the degradation of biodiversity is a major risk facing firms. Facing this, some investors have begun to require a risk premium in response to uncertainties around potential regulatory changes and legal actions aimed at preserving biodiversity (Garel et al., 2024). Thus we can say that firms' exposure to biodiversity risks could dramatically affect their financial behaviours, performance, and value, which in turn prompts them to adjust their decision-making. For instance, firms may alter their financial and investment policies as a result of depressed capital expenditure for investment (Trinh, 2023), increased precautionary demand for cash holdings (Ahmad and Karpuz, 2024), and additional capital for borrowing in the corporate bond market (Soylemezgil and Uzmanoglu, 2024). Biodiversity concerns therefore span across the whole corporate finance function.

In the case of payouts, both empirical and theoretical research has explored differences in dividend payout levels across firms, emphasising that dividend policy is driven not only by internal firm characteristics but also by external business conditions (Black and Scholes, 1974; Fama and French, 2001; Brav et al., 2005; Chay and Suh, 2009). On the one hand, a strand of studies suggests that the likelihood of paying dividends and the level of payouts are shaped by factors such as corporate governance (Farinha, 2003), ownership structure (Cao et al., 2017; Jiang et al., 2017; Balachandran et al., 2019), executive incentives (Brown et al., 2007; De Cesari and Ozkan, 2015), and board gender composition (Chen et al., 2017; Saeed and Sameer, 2017; Ye et al., 2019). On the other hand, works investigate the influence of external factors like religion (Ben-Nasr and Ghouma, 2022), national culture (Shao et al., 2010; Bae et al., 2012), political crises (Huang et al., 2015), and financing shocks (Bliss et al., 2015). These factors will influence the stability of future earnings, a primary determinant of corporate dividend policies (Chay and Suh, 2009). Consequently, given that biodiversity risks can be viewed as an essential business condition, it is important to consider firms' exposure to these risks and their impact on dividend payouts.

Due to the insufficient data, there is limited research on biodiversity risk exposure at the firm level, which provides a more granular and precise understanding of firm-specific dynamics. Existing studies primarily focus on aspects such as board gender diversity (Haque and Jones, 2020), board characteristics (Toukabri and Alwadai, 2024), capital expenditure (Trinh, 2023), cash holdings (Ahmad and Karpuz, 2024), borrowing costs in the corporate bond market (Soylemezgil and Uzmanoglu, 2024), and sustainability strategies (Tian and Chen, 2025). While these studies provide valuable insights into corporate responses to biodiversity risk, they largely overlook its direct impact on corporate payout policy, a crucial financial decision that affects not only shareholders and managers but also other market participants and the firm itself.

China, one of the world's most biodiverse countries, has actively supported global efforts on biodiversity conservation by enhancing its legal framework, governance capacity, and supervisory mechanisms. Specifically, China aimed to basically control biodiversity decline and loss by 2020 and effectively protect biodiversity by 2030. With these government-led initiatives, the majority of Chinese corporates are aware of biodiversity issues (He et al., 2024a). Meanwhile, China is the largest emerging economy worldwide, showcasing a tremendous increase in its global economic influence. Therefore, it is crucial to examine whether and how Chinese firms adjust their dividend payouts in response to biodiversity risks.

In this context, we utilise a large sample of Chinese listed firms from the years 2007 to 2022, revealing a significant negative relationship between biodiversity risk exposure and the level of dividend payouts. Our heterogeneity analysis suggests that the effect of biodiversity risk on dividend payouts is more evident in firms with weaker political connections, stronger external supervision, and poorer internal governance. Further, we find that aggravating financing difficulties and promoting resource reallocation are the two underlying channels through which the biodiversity risk affects dividend payouts. Finally, we employ plenty of additional tests to verify the robustness of our research, such as propensity score matching, entropy balancing, difference-in-difference analysis, etc. Unlike prior studies that focus on governance characteristics or short-term financial indicators, our study is the first to comprehensively investigate the impact of biodiversity risk exposure on corporate dividend payouts, addressing this gap by providing empirical evidence from China. By examining the underlying mechanisms and heterogeneity across firms, we contribute to the growing literature on biodiversity risk and corporate financial decision-making. Furthermore, our findings have broader implications that can be generalised to other emerging and developed economies, where biodiversity concerns and financial decision-making are becoming increasingly interconnected.

Specifically, our work contributes to the extant literature in several ways. First, we complement the limited but growing body of literature by examining the relationship between Earth's health and corporate decision-making, with a particular focus on biodiversity risk, an emerging factor distinct from climate change. By doing so, we demonstrate that Chinese firms respond to biodiversity risk in ways that go beyond adjusting cash holdings (Ahmad and Karpuz, 2024) and also opt to reduce dividend payouts. Second, we enrich the studies regarding the determinants of dividend payouts, proving novel evidence of the economic impact of firm-level biodiversity risk. Amid China's ongoing efforts on biodiversity conservation, we underscore the importance of accounting for biodiversity risk in comprehending corporate financial behaviour. Third, we innovatively propose effective mechanisms for the effects of biodiversity risk on corporate dividend payouts, including aggravating financing difficulties and promoting resource reallocation. Meanwhile, we uncover the heterogeneity of the adverse effects of biodiversity risk on corporate dividend payouts under varying levels of political connections, external supervision, and internal governance, providing valuable insights for policymakers in designing and implementing appropriate strategies, as well as for corporate managers seeking to mitigate biodiversity risk.

The remainder of this paper is organised as follows. Section 2 presents the related literature and develops testable hypothesis. Section 3 describes the data and the empirical methodology. Section 4 reports the empirical results. Section 5 discusses the robustness tests. Section 6 concludes the paper.

2. Literature review and hypothesis development

2.1. Corporate biodiversity risk exposure

It has long been acknowledged that the natural environment plays a crucial role in impacting worldwide economic performance (Costantini and Monni, 2008). In October 2021, the Kunming Declaration (2021) was adopted by over 100 countries at the 15th Conference of the Parties (COP15) to the United Nations Convention on Biological Diversity (CBD), marking a significant headway in global biodiversity protection. Despite the growing awareness of biodiversity issues, academic research has focused primarily on climate risk (Balachandran and Nguyen, 2018; Huang et al., 2018; Ginglinger and Moreau, 2023; Chang et al., 2024; Zhu and Hou, 2022; Boubaker et al., 2024; Ayed et al., 2024; He et al., 2024b; Benkraiem et al., 2025; He et al., 2025b), leaving biodiversity risk largely underexplored.

However, while interconnected, biodiversity risk is conceptually distinct from climate risk, with each referring to different aspects of the environment. The former is related to threats to the variety of living lives on our planet, and the latter emphasises the negative consequences of climate change (Giglio et al., 2023). Although extensive studies have examined the financial implications of climate risk, research on the financial impact of biodiversity risk remains in its infancy. This gap is particularly concerning, given that approximately half of the global GDP is generated by industries that rely substantially on natural resources and related services (Karolyi and Tobin-de la Puente, 2023; Giglio et al., 2024).

For firms, biodiversity risk refers to the potential impacts stemming from changes in the natural environment that affect corporate production, operation, and other business activities (Garel et al., 2024). Governments have set ambitious targets for protecting biodiversity and have implemented a series of increasingly severe actions and policies. Concurrently, investors have recognised biodiversity risk and incorporated it into asset prices in financial markets. Giglio et al. (2023), Garel et al. (2024), and Huang et al. (2024) point out that biodiversity risk has begun to be factored into equity pricing, especially after COP15. Moreover, Soylemezgil and Uzmanoglu (2024) show that higher biodiversity risk exposure is tied to higher yield spreads among long-term bonds, indicating biodiversity as a long-run risk. Correspondingly, it is exceptionally costly for firms to cope with physical risks, such as disruptions in supply chains and resource availability, as well as transition risks, such as rising costs for regulatory compliance and changing consumer sentiment toward biodiversity-unfriendly firms (Chang et al., 2024).

Recent studies further highlight the financial consequences of biodiversity risk. Trinh (2023) demonstrates that biodiversity-induced uncertainty can depress capital expenditure because of investment irreversibility. Ahmad and Karpuz (2024) find that firms exposed to biodiversity risks tend to increase precautionary demand for cash holdings. These findings suggest that biodiversity risk exposure pronouncedly enhances the corporate financial risks, e.g., unstable profitability and cash shortfalls. However, there is limited research on the direct impact of biodiversity risks on corporate dividend payouts. We aim to fill this gap to contribute to the emerging literature on biodiversity finance and corporate decision-making.

2.2. Hypothesis development

There are numerous existing studies on corporate dividend policy, especially after introducing the dividend irrelevance hypothesis that the firm value is detached from its dividend policy in perfect capital markets (Miller and Modigliani, 1961). However, capital markets are inherently imperfect because of the existence of asymmetric information, transaction costs, agency costs, irrational market behaviours, and other issues (Baker, 2009; Al-Malkawi et al., 2010). In particular, biodiversity risk is intertwined with these issues and can, therefore, be seen as a factor exacerbating market imperfections. Hence, firms might adjust their dividend policies to mitigate opposite forces on nature and to align with global biodiversity conservation goals.

Biodiversity risk is typically regarded as a source of uncertainty. In the organisational context, the term ‘uncertainty’ refers to the unpredictable environment that influences corporate performance (Miller, 1992). In this regard, uncertainty related to biodiversity stems from future changes in political, economic, legal, and regulatory conditions, which could result in detrimental influences on business activities. Since firms have limited prior knowledge of biodiversity loss and its consequences, they encounter challenges in assessing its impacts (Weinhofer and Busch, 2013). In line with the risk premium theory, when firms are exposed to higher biodiversity risks, investors demand higher returns to compensate for the potential uncertainties. As a result, firms may face additional financial risks, such as increased difficulties in securing financing and a reduced capacity for debt repayment, which can impair a firm’s liquidity and profitability. As noted by Grullon and Michaely (2002), Hoberg and Prabhala (2008), and Michaely and Moin (2022), firms tend to adopt conservative dividend policies in times of uncertainty. Dividend payouts can serve as a risk management tool, while maintaining a lower payout level enhances a firm’s financial flexibility (Chang et al., 2024). Hence, firms suffering from biodiversity risk are inclined to pay lower dividends to preserve capital and protect against future uncertainties.

The uncertainty-based statement presented above is different from the view that firms reduce dividends primarily due to the direct impact of environmental disasters on earnings and cash flow. Our argument is grounded in the uncertainty surrounding future biodiversity risks, and we expect that firms adjust their decision-making to manage potential long-term risks. According to agency theory, agency conflicts arise from the divergence of corporate ownership and control (Jensen and Meckling, 1979). Dividends play a crucial governance role in the presence of conflicts of interest between agents (managers) and principals (shareholders). Firms with higher biodiversity risk tend to experience greater information asymmetry, resulting in inefficient resource allocation, undervalued equity pricing, and misaligned incentives between managers and shareholders (Baker and Wurgler, 2007). For instance, managers might reduce dividend payouts and build financial slack to fund innovation investment and other strategic initiatives, which could improve their social reputation (Deshmukh et al., 2013; Caliskan and Doukas, 2015; Ahmad and Karpuz, 2024). However, these

Table 1
Variable definitions.

Variable type	Variable abbreviation	Variable name	Definition
Dependent variable	*DivPayout*	Dividend payouts	Cash dividend per share/earnings per share.
Independent variable	*BiodiversityRisk*	Biodiversity risk exposure	Equal to 1 if biodiversity terms appear more than twice in the annual report, and 0 otherwise.
Control variables	*Size*	Firm size	Natural logarithm of total assets.
	Cashflow	Operating net cash flow	Net cash flow from operating activities/total assets.
	Leverage	Capital structure	Total liabilities/total assets.
	Growth	Growth rate of operating revenue	Annual change in operating income.
	Age	Firm age	Natural logarithm of the number of years since a firm was listed.
	ROE	Return on equity	Net income/book value of equity.
	ConRatio	Shareholding ratio of controlling shareholders	Percentage of shares held by controlling shareholders.
	Centrality	Independent director network centrality	Influence of a firm in independent director network.
	Top1	Ownership concentration	Percentage of shares held by the largest shareholder.

actions may not align with the financial interests of shareholders who prioritise returns (Jiraporn et al., 2011; Luo and Tang, 2021). Consequently, agency conflicts could become more pronounced in firms exposed to biodiversity risk. This suggests a negative relationship between biodiversity risk exposure and dividend payouts.

Inspired by the above theoretical inference, we propose that firms facing biodiversity risks have more difficulties in operational and financial activities, which in turn negatively affect corporate value and, thus, dividend payouts. In response to higher investment demand and increased external financing costs, firms exposed to potential biodiversity risk pay lower dividends to investors to achieve long-term orientation and uncertainty avoidance. Specifically, we propose our main hypothesis as follows:

H1: The biodiversity risk exposure of a firm is negatively associated with its dividend payout level.

3. Data and empirical design

3.1. Variables and baseline model

Currently, studies on biodiversity and corporate decision-making are limited, primarily due to the lack of effective measures for accessing biodiversity risk exposure at the firm level. Some researchers have introduced firm-level measures for U.S. companies (e.g., Giglio et al., 2023). Inspired by their work, He et al. (2024a) first proposed the Chinese corporate biodiversity exposure indices, using the annual reports of over 4000 firms for 15 years. By conducting the textual analysis, He et al. (2024a) accurately capture the corporate strategic characteristics and development objectives.

Hence, we adopt the *Biodiversity Risk Index* (*BiodiversityRisk*) of He et al. (2024a) as the biodiversity risk exposure for Chinese companies. Besides, referring to Benartzi et al. (1997), Adjaoud and Ben-Amar (2010), and Balachandran and Nguyen (2018), we use dividend payout ratio (*DivPayout*), which is equal to cash dividend per share divided by earnings per share, to quantify the corporate dividend payouts.

Then, we evaluate the effect of biodiversity risk on dividend payouts via the following baseline regression:

$$DivPayout_{i,t} = \beta_0 + \beta_1 BiodiversityRisk_{i,t} + \sum\nolimits_i \beta_i Controls_{i,t} + f_i + d_t + \varepsilon_{i,t}, \tag{1}$$

where $BiodiversityRisk_{i,t}$ and $DivPayout_{i,t}$ are the independent variable and dependent variable for firm *i* in year *t*. $Controls_{i,t}$ denotes a set of control variables, consisting of firm-level characteristics that are known to potentially explain dividend payouts (Firth et al., 2016; Jiang et al., 2017; Ye et al., 2019). Specifically, it includes: (i) firm operating characteristics, i.e., firm size (*Size*), operating net cash flow (*Cashflow*), capital structure (*Leverage*), growth rate of operating revenue (*Growth*), firm age (*Age*), and return on equity (*ROE*); (ii) firm governance characteristics, i.e., shareholding ratio of controlling shareholders (*ConRatio*), independent director network centrality (*Centrality*), and ownership concentration (*Top*1). We provide a detailed definition of these variables in Table 1.

In addition, the firm-fixed effect f_i and year-fixed effect d_t are considered to account for unobservable firm-level differences and time-varying macroeconomic factors. $\varepsilon_{i,t}$ indicates that the heteroscedasticity-robust standard errors are clustered at the firm level.

3.2. Sample selection

Our research sample includes A-share firms listed in China, covering the periods from 2007 to 2022. We pre-process the sample by eliminating financial sector companies, ST and *ST companies, and samples with missing records. By doing so, we gain a total of 25 979 firm–year observations. In addition to the *BiodiversityRisk* data from He et al. (2024a), we primarily collect other data from the China Stock Market Accounting Research (CSMAR) database and the Chinese Research Data Services (CNRDS) database. Moreover, all continuous variables are winsorised at the 1% level to mitigate the impact of outliers.

Table 2
Descriptive statistics.

Variables	Obs	Mean	SD	Min	Max
DivPayout	25 979	0.374	0.320	0.048	2.177
BiodiversityRisk	25 979	0.433	0.495	0.000	1.000
Size	25 979	22.256	1.323	20.047	26.382
Cashflow	25 979	0.057	0.068	−0.138	0.250
Leverage	25 979	0.396	0.192	0.050	0.826
Growth	25 979	0.335	0.834	−0.556	5.733
Age	25 979	1.930	0.944	0.000	3.332
ROE	25 979	0.097	0.062	0.006	0.323
ConRatio	25 979	38.497	14.937	9.330	76.050
Centrality	25 979	0.401	0.350	0.000	1.500
Top1	25 979	36.519	14.893	9.978	75.734

Notes: All continuous variables are winsorised at the 1st and 99th percentiles. A total of 25 979 firm–year observations are obtained. Obs, Mean, SD, Min, and Max refer to the number of observations, mean value, standard deviation, minimum value, and maximum value, respectively.

Table 3
Effect of biodiversity risk exposure on dividend payouts.

	(1) *DivPayout*	(2) *DivPayout*	(3) *DivPayout*	(4) *DivPayout*
BiodiversityRisk	−0.025***	−0.018***	−0.031***	−0.022***
	(−4.307)	(−3.256)	(−5.673)	(−4.008)
Size		−0.032***		−0.007*
		(−3.833)		(−1.876)
Cashflow		0.228***		0.599***
		(5.955)		(15.398)
Leverage		−0.091***		−0.156***
		(−3.003)		(−7.243)
Growth		−0.004		−0.013***
		(−1.300)		(−4.079)
Age		0.009		0.008**
		(1.381)		(2.119)
ROE		−1.824***		−1.353***
		(−28.150)		(−22.953)
ConRatio		0.001*		0.001***
		(1.661)		(3.133)
Centrality		0.002		0.014*
		(0.186)		(1.682)
Top1		0.000		0.001**
		(0.510)		(2.110)
_cons	0.384***	1.203***	0.387***	0.588***
	(151.244)	(6.478)	(89.099)	(8.628)
Year FE	Yes	Yes	No	No
Firm FE	Yes	Yes	No	No
Obs	25 979	25 979	25 979	25 979
Adj. R^2	0.273	0.346	0.002	0.084

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4. Empirical results

4.1. Descriptive statistics

We report the descriptive statistics of our main variables in Table 2. The mean value of *DivPayout* is 0.374, indicating that our sample firms typically pay out 30% of net earnings as dividends. However, the standard deviation of *DivPayout* is 0.320, and its minimum and maximum values are 0.048 and 2.177, respectively, suggesting varying dividend payouts across companies. Furthermore, we also find apparent differences in firm governance characteristics. The average *BiodiversityRisk* is 0.433, and its standard deviation is 0.495, which denotes that nearly 43.4% of our sample firms are exposed to biodiversity risk. This finding is consistent with He et al. (2024a), who state that Chinese companies experience greater biodiversity risk than U.S. companies.

4.2. Baseline regression

We display the average effect of biodiversity risk exposure on corporate dividend payouts in Table 3. Columns (1) and (2) present the results with firm- and year-fixed effects, where the coefficients of *BiodiversityRisk* are negative (−0.025 and −0.018) and are significant at the 1% level. Specifically, when considering the control variables, each unit increase in biodiversity risk exposure

Table 4
Heterogeneity analysis: political connections.

	Non-state-owned firms (1) *DivPayout*	State-owned firms (2) *DivPayout*
BiodiversityRisk	−0.019**	−0.012
	(−2.452)	(−1.477)
Size	−0.066***	0.003
	(−5.576)	(0.269)
Cashflow	0.283***	0.139***
	(5.325)	(2.747)
Leverage	−0.064	−0.127***
	(−1.543)	(−2.835)
Growth	−0.007	−0.001
	(−1.320)	(−0.376)
Age	0.000	0.003
	(0.008)	(0.248)
ROE	−1.948***	−1.645***
	(−22.421)	(−16.668)
ConRatio	0.002*	−0.000
	(1.881)	(−0.067)
Centrality	−0.006	0.012
	(−0.527)	(1.015)
Top1	0.001	0.001
	(0.739)	(0.413)
_cons	1.952***	0.451*
	(7.369)	(1.734)
Year FE	Yes	Yes
Firm FE	Yes	Yes
Obs	16 233	9689
Adj. R^2	0.357	0.326

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

leads to a 1.8% decrease in the dividend payout ratio. Our findings also hold when firm- and year-fixed effects are excluded, with significant negative coefficients of −0.031 and −0.022 in Columns (3) and (4). The above results illustrate that firms with greater biodiversity risk exposure are inclined to pay less dividends, thus supporting the main hypothesis proposed in this study.

4.3. Heterogeneity analysis

In response to biodiversity risk, different companies might react differently according to their internal characteristics and external conditions. Hence, these factors should be thoroughly considered when investigating the effect of biodiversity risk on corporate decisions. In this subsection, we conduct three heterogeneity tests in terms of political connections, external supervision, and internal governance.

4.3.1. Political connections

The economic system of China is unique in the world, mainly due to the institutional division of state-owned and non-state-owned firms. Since the Chinese authorities serve as the ultimate controller of state-owned firms, these firms bear greater social responsibilities and typically enjoy stronger social reputations (Fan et al., 2011; He et al., 2024c). This is highly related to the cost of debt financing and equity capital (Boubakri et al., 2012). Thereby, the speciality of state-owned firms gives them the advantages of diverse financing channels and stable resource allocations, and thus, they possess a strong ability to cope with biodiversity risk. In contrast, with relatively weaker government backing, non-state-owned firms tend to alter their internal resource allocations and make decision adjustments, e.g., enlarge investment in biodiversity conservation, to boost their reputation (Zhu and Yang, 2016).

We divide our sample into two subsamples, i.e., state-owned and non-state-owned firms, according to their equity ownership. Table 4 reveals the difference in the effects of biodiversity risk exposure between these two subsamples. In Column (1), the coefficient of *BiodiversityRisk* is significant and negative (−0.019) at the 5% level for non-state-owned firms, while in Column (2), the coefficient is still negative (−0.012) but insignificant for state-owned firms.

Compared to state-owned firms, non-state-owned firms face greater difficulties in securing external financial support, leading to more severe financial constraints (Allen et al., 2005; Ding et al., 2013). As a result, they rely more heavily on cash, whereas state-owned firms benefit from political connections that help mitigate agency conflicts and provide financial stability. Without government backing, non-state-owned firms are more vulnerable to economic risks, including those arising from biodiversity risks. This makes them more susceptible to external financial pressures and constraints, further limiting their ability to respond effectively to biodiversity-related challenges. All in all, the negative impact of biodiversity risk exposure on corporate dividend payouts is more pronounced in firms with weaker political connections.

Table 5
Heterogeneity analysis: external supervision.

	Low proportion of shareholding by institutional investors (1) *DivPayout*	High proportion of shareholding by institutional investors (2) *DivPayout*
BiodiversityRisk	−0.010	−0.020***
	(−1.145)	(−2.713)
Size	−0.045***	−0.019*
	(−3.808)	(−1.786)
Cashflow	0.223***	0.235***
	(3.972)	(4.412)
Leverage	−0.047	−0.133***
	(−1.049)	(−3.191)
Growth	−0.002	−0.010**
	(−0.544)	(−2.267)
Age	0.029***	−0.006
	(2.789)	(−0.658)
ROE	−2.011***	−1.670***
	(−20.870)	(−18.832)
ConRatio	0.000	0.002
	(0.142)	(1.507)
Centrality	0.005	0.005
	(0.389)	(0.468)
Top1	0.003*	−0.001
	(1.812)	(−0.537)
_cons	1.393***	0.976***
	(5.432)	(4.228)
Year FE	Yes	Yes
Firm FE	Yes	Yes
Obs	12 424	13 073
Adj. R^2	0.359	0.365

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.3.2. External supervision

External supervision is essential for alleviating agency conflicts, helping to reduce information asymmetry and guaranteeing the benefits of stakeholders (La Porta et al., 2000; Grinstein and Michaely, 2005). In particular, institutional investors can be regarded as essential components of external supervision, as they are paying increasing attention to corporate environmental performance in addition to financial performance (Riedl and Smeets, 2017; Dyck et al., 2019). Consequently, as long-term investors, institutional investors focus on the sustained growth of corporate value and investment returns and, hence, are likely to actively supervise and participate in corporate biodiversity conservation. For instance, they might require information disclosure regarding corporate biodiversity risk management, which could prompt companies to adopt defensive financial strategies.

To investigate the effect of external supervision, we separate the samples into two subgroups, i.e., low and high proportion of shareholding by institutional investors, based on the median value. As seen in Table 5, Columns (1) and (2) show negative coefficients of −0.01 and −0.02, respectively. Nonetheless, the coefficient is significant for firms with a high proportion of shareholding by institutional investors at the 1% level, but insignificant for those with a low proportion.

The stakeholder theory suggests that firms are tasked with balancing and addressing the diverse needs and concerns of multiple stakeholders, including shareholders, customers, employees, and the broader society (Gul and Leung, 2004). As key stakeholders, institutional investors serve as external supervisors, demanding transparent and high-quality biodiversity risk disclosures. From this standpoint, firms may prioritise biodiversity risk management not only to fulfil their social responsibilities but also to maintain legitimacy in the eyes of these external supervisors. In response to heightened external oversight, firms with stronger external supervision may adopt more conservative financial policies, including reducing dividend payouts, to enhance their resilience against potential biodiversity risks. In short, firms with stronger external supervision are more inclined to reduce dividend payouts.

4.3.3. Internal governance

Corporate internal governance is crucial for long-term development and risk management, especially in the context of global efforts on biodiversity conservation (Luo and Tang, 2021; Ludwig and Sassen, 2022). In particular, the biodiversity risk amplifies the exposure of firms with poorer internal governance. While facing multiple innovative challenges, these firms always possess greater operating and management uncertainties, leading to additional litigation, financial, and reputational risks (Damert and Baumgartner, 2018). Hence, we posit that, compared to firms with improved internal governance, firms with defective governance structures are less likely to cope effectively with biodiversity risks. In other words, they face more obstruction in financing and greater demand for capital redistribution.

Following He et al. (2024c), we utilise the administrative expensive ratio, i.e., the administrative expenses divided by total sales revenue, to reflect the corporate internal governance. In China's relationship-based society, an elevated administrative expensive

Table 6
Heterogeneity analysis: internal governance.

	Low administrative expensive ratio (1) *DivPayout*	High administrative expensive ratio (2) *DivPayout*
BiodiversityRisk	−0.006	−0.035***
	(−0.620)	(−3.237)
Size	−0.048***	−0.020
	(−3.102)	(−1.386)
Cashflow	0.181**	0.232***
	(2.553)	(2.654)
Leverage	−0.097*	−0.067
	(−1.729)	(−1.059)
Growth	−0.012**	−0.002
	(−1.966)	(−0.244)
Age	0.008	−0.013
	(0.514)	(−0.929)
ROE	−1.954***	−1.913***
	(−15.488)	(−13.698)
ConRatio	0.002*	−0.001
	(1.720)	(−0.557)
Centrality	−0.006	−0.008
	(−0.358)	(−0.468)
Top1	−0.002	0.002
	(−1.002)	(1.150)
_cons	1.582***	1.019***
	(4.732)	(3.174)
Year FE	Yes	Yes
Firm FE	Yes	Yes
Obs	7156	7217
Adj. R^2	0.361	0.345

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

ratio could denote illegitimate corporate behaviours beyond day-to-day operating costs, such as anti-competition, bribery, and rent-seeking (Hu et al., 2020). Therefore, we divided our samples according to the median administrative expensive ratio. A higher administrative expensive ratio indicates a weaker internal governance. As shown in Table 6, the coefficient of *BiodiversityRisk* is negative (−0.035) and significant for firms with a high administrative expensive ratio (Column (2)) at the 1% level, while it is negative (−0.006) but insignificant for firms with low administrative expensive ratio (Column (1)).

Effective corporate governance not only helps to mitigate agency conflicts, but also ensures the appropriate organisation and utilisation of corporate resources (He et al., 2025a). By improving decision-making processes and aligning the interests of managers and shareholders, strong governance enables firms to effectively tackle both financial and biodiversity-related challenges. This, in turn, helps safeguard shareholder value while fulfilling broader social and environmental responsibilities. In this context, firms with weaker internal governance are less equipped to manage the risks associated with biodiversity, which can lead to more significant financial constraints and reduced ability to pay dividends. Therefore, the negative effect of biodiversity risk exposure on corporate dividend payouts is more evident in firms with weaker internal governance.

4.4. Channel analysis

In this subsection, we examine the channels that transfer the effect of biodiversity risk exposure to corporate dividend payouts. Specifically, we verify two possible channels, i.e., aggravating financing difficulties and promoting resource allocation.

4.4.1. Aggravating financing difficulties

Financing is a crucial source of corporate financial support, promoting daily operations, enhancing competitiveness, and dealing with market challenges (Chang et al., 2024). As we discussed above, biodiversity risk exposure affects corporate dividend payouts by generating additional financial uncertainties and lowering financial flexibility. Hence, firms exposed to biodiversity risk might reduce their dividend payouts because of aggravating financing difficulties. Specifically, the biodiversity risk exposure will (i) reduce the accessibility of financing channels and (ii) increase the costs to secure funds, thus forcing firms to pay lower dividends to cope with potential future uncertainties.

Therefore, we employ the *KZ index* (Kaplan and Zingales, 1997) and the *WW index* (Whited and Wu, 2006) to proxy for the accessibility of financing. The greater *KZ/WW* values denote the more severe financing constraints and, thus, the lower financing accessibility. Moreover, following Easton (2004), we apply the well-known PEG model to quantify the costs of financing, which is calculated as:

$$COC = \frac{\sqrt{EPS_{t+2} - EPS_{t+1}}}{P_t}, \tag{2}$$

Table 7
Channel analysis: aggravating financing difficulties.

	Financing accessibility		Financing costs
	(1)	(2)	(3)
	KZ	*WW*	*COC*
BiodiversityRisk	0.036**	0.002*	0.002*
	(1.963)	(1.871)	(1.950)
Size	−0.353***	−0.043***	0.009***
	(−11.836)	(−30.940)	(8.037)
Cashflow	−1.843***	−0.087***	−0.027***
	(−13.756)	(−9.300)	(−4.340)
Leverage	4.657***	0.017***	0.010**
	(44.514)	(3.097)	(2.423)
Growth	−0.139***	−0.037***	−0.001
	(−7.805)	(−29.558)	(−1.461)
Age	0.647***	0.005***	0.001
	(16.817)	(3.667)	(0.938)
ROE	−6.035***	0.033***	0.080***
	(−28.102)	(2.952)	(11.047)
ConRatio	−0.005	−0.000	0.000
	(−1.365)	(−1.130)	(0.457)
Centrality	−0.008	−0.001	0.001
	(−0.307)	(−0.472)	(0.724)
Top1	−0.003	0.000	−0.000
	(−0.789)	(0.961)	(−0.394)
_cons	5.538***	−0.063**	−0.107***
	(8.409)	(−2.148)	(−4.553)
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Obs	23 999	25 971	24 146
Adj. R^2	0.695	0.511	0.235

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

where EPS_{t+2} and EPS_{t+1} are the average earnings per share forecasted by analysts at periods t+2 and t+1, respectively. *COC* denotes the costs of equity capital and P_t is the stock end-price at period t. To examine whether financing difficulties act as a channel, we estimate the direct impact of biodiversity risk on financing difficulties:

$$Difficulties_{i,t} = \beta_0 + \beta_1 BiodiversityRisk_{i,t} + \sum_i \beta_i Controls_{i,t} + f_i + d_t + \varepsilon_{i,t}. \tag{3}$$

As reported in Table 7, the biodiversity risk is positively and significantly associated with financing difficulties. In detail, the coefficients of *BiodiversityRisk* on two financing accessibility measures (Columns (1) and (2)) are 0.036 and 0.002, which are significant at the 5% and the 10% levels, respectively. Besides, the coefficient of *BiodiversityRisk* on financing costs (Column (3)) is 0.002 and is significant at the 10% level. These findings confirm that biodiversity risk exposure heightens financial difficulties by reducing financing accessibility and increasing financing costs, thereby leading to reduced dividend payout levels.

4.4.2. Promoting resource reallocation

From the perspective of long-run sustainability, enterprises should focus on both financial performance and environmental performance. The improvement of the latter is always accompanied by long-term innovation investments, thus requiring substantial resources across various domains, e.g., financial, human, and technological resources (Chen, 2008). Hence, by conducting biodiversity risk management, firms might reallocate resources to enhance long-term competitiveness by shifting capital from short-term liquidity to long-term biodiversity-related innovation investments. These will result in (i) less cash holdings and (ii) more biodiversity-related innovations such as green innovations. Consequently, the level of dividend payouts will sharply decrease.

Referring to Subramaniam et al. (2011), we calculate cash holdings (*CashHoldings*) as the ratio of cash capital to total assets. Since there is no specific data for firm-level biodiversity-related innovations, we employ the natural logarithm of the number of green patent applications (*GPatents*) as a proxy, which encompasses a broad range of environmental innovations. Then, to investigate whether resource reallocation serves as a channel, we examine the direct impact of biodiversity risk on *CashHoldings* and *GPatents* as follows:

$$CashHoldings_{i,t} = \beta_0 + \beta_1 BiodiversityRisk_{i,t} + \sum_i \beta_i Controls_{i,t} + f_i + d_t + \varepsilon_{i,t}, \tag{4}$$

$$GPatents_{i,t} = \beta_0 + \beta_1 BiodiversityRisk_{i,t} + \sum_i \beta_i Controls_{i,t} + f_i + d_t + \varepsilon_{i,t}. \tag{5}$$

As displayed in Table 8, the coefficient of *BiodiversityRisk* is negative (−0.003) on *CashHoldings* (Column (1)) and is significant at the 10% level. Besides, the coefficient of *BiodiversityRisk* is positive (0.047) on *GPatents* (Column (2)) and is significant at the 1% level. These results prove that biodiversity risk exposure prompts firms to reallocate resources by reducing cash holdings and increasing innovation investments. Hence, under pressure from biodiversity conservation, firms might prioritise long-term innovation and sustainability, which weakens the ability of firms to pay dividends in the short run.

Table 8
Channel analysis: promoting resource reallocation.

	(1) *CashHoldings*	(2) *GPatents*
BiodiversityRisk	−0.003*	0.047***
	(−1.661)	(3.124)
Size	0.005	0.340***
	(1.631)	(12.253)
Cashflow	0.214***	0.019
	(17.881)	(0.224)
Leverage	−0.205***	0.020
	(−18.632)	(0.231)
Growth	−0.000	0.002
	(−0.074)	(0.223)
Age	−0.077***	−0.080***
	(−17.032)	(−3.856)
ROE	0.068***	−0.137
	(6.245)	(−1.002)
ConRatio	−0.000	−0.001
	(−0.686)	(−0.374)
Centrality	−0.001	−0.001
	(−0.325)	(−0.042)
Top1	0.000***	0.000
	(3.429)	(0.001)
_cons	0.309***	−6.621***
	(4.929)	(−10.788)
Year FE	Yes	Yes
Firm FE	Yes	Yes
Obs	23 527	25 979
Adj. R^2	0.618	0.686

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

5. Robustness checks

5.1. Endogeneity

5.1.1. Propensity score matching

To avoid the sample selection bias, we apply the propensity score matching (PSM) approach (Caliendo and Kopeinig, 2008). Specifically, we define the firms exposed to biodiversity risk as the treatment group, and others as the control group. Then, according to the firm operating and governance characteristics, we choose the matched samples using two strategies, i.e. (i) one-to-four nearest neighbour matching using a calliper width of 0.01, and (ii) calliper matching with 0.01.

Table 9 reports the PSM balancing test statistics, from which we observe that the treatment and control firms after PSM balancing do not show statistically significant differences in characteristics. This suggests that our PSM procedure is convincing. We re-estimate our baseline regression with PSM samples and display the results in Table 10. The coefficients of *BiodiversityRisk* are negative for both nearest neighbour matching (Columns (1) and (2)) and calliper matching (Columns (3) and (4)) and are significant at the 1% level, demonstrating that selection bias is not the cause of the inverse relationship between a firm's dividend payouts and its exposure to biodiversity risk. Thereby, our baseline findings are further supported.

5.1.2. Entropy balancing

Since PSM works with the reduced sample, we further employ the entropy balancing that retains the whole sample (Hainmueller, 2012). We also define the treatment and control groups based on the exposure to corporate biodiversity risk. This strategy helps to gain covariates balance between the treatment and control groups by taking into account the mean, variance, and skewness of firm-level characteristics.

As seen in Table 11, the covariates balancing test statistics reveal that the variation of covariates can be ignored. In other words, the treatment and control groups are matched appropriately. By re-estimating the baseline regression with post-entropy-balancing samples, we report the results in Table 12. The coefficients of *BiodiversityRisk* are negative for both including (Columns (1) and (2)) and excluding (Columns (3) and (4)) fixed effects and are significant at the 1% level, further confirming our main baseline findings that firms exposed to biodiversity risk pay lower dividends.

5.1.3. Difference-in-difference analysis

In 2011, the State Council of China approved the establishment of the China National Committee for Biodiversity Conservation and issued *China's Strategy and Action Plan for Biodiversity Conservation (2011–2030)*, which clarified the guiding ideology, basic principles and medium- and long-term goals for biodiversity conservation in the next two decades. In this document, 35 priority areas for biodiversity conservation, covering 27 provinces or cities, are designated when considering the representativeness of ecosystem

Table 9
PSM balancing test statistics.

Variables	Treatment	Control	Difference	P value
Panel A: Pre-matching balancing test				
Size	22.688	21.926	0.762	0.000
Cashflow	0.059	0.056	0.003	0.000
Leverage	0.420	0.377	0.043	0.000
Growth	0.359	0.317	0.041	0.000
Age	2.111	1.791	0.320	0.000
ROE	0.097	0.096	0.001	0.135
ConRatio	38.135	38.774	−0.639	0.001
Centrality	0.432	0.377	0.056	0.000
Top1	36.587	36.468	0.119	0.525
Panel B: Post-matching balancing test				
Size	22.685	22.686	−0.001	0.955
Cashflow	0.059	0.060	−0.001	0.473
Leverage	0.420	0.424	−0.004	0.164
Growth	0.359	0.374	−0.015	0.219
Age	2.111	2.114	−0.003	0.774
ROE	0.098	0.097	0.001	0.469
ConRatio	38.135	38.202	−0.067	0.744
Centrality	0.432	0.436	−0.004	0.425
Top1	36.585	36.688	−0.103	0.612

Note: Treatment (Control) represents the group of firms for which the firm-level indicator variable *BiodiviersityRisk* equals 1 (0).

Table 10
Effect of biodiversity risk exposure on dividend payouts for the PSM sample.

	Nearest neighbour matching		Calliper matching	
	(1) *DivPayout*	(2) *DivPayout*	(3) *DivPayout*	(4) *DivPayout*
BiodiversityRisk	−0.023***	−0.016***	−0.025***	−0.018***
	(−3.711)	(−2.695)	(−4.315)	(−3.261)
Size		−0.031***		−0.032***
		(−3.416)		(−3.827)
Cashflow		0.223***		0.228***
		(5.489)		(5.960)
Leverage		−0.099***		−0.091***
		(−3.074)		(−2.999)
Growth		−0.004		−0.004
		(−1.132)		(−1.294)
Age		0.017**		0.009
		(2.192)		(1.387)
ROE		−1.814***		−1.824***
		(−26.667)		(−28.152)
ConRatio		0.001		0.001*
		(0.989)		(1.661)
Centrality		0.001		0.001
		(0.158)		(0.182)
Top1		0.001		0.000
		(1.376)		(0.496)
_cons	0.382***	1.153***	0.384***	1.203***
	(136.878)	(5.781)	(151.236)	(6.473)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Obs	22789	22789	25973	25973
Adj. R^2	0.278	0.349	0.273	0.346

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

types, the degree of specificity, the special ecological function, the richness of species, etc. Therefore, the firms in these priority areas might face higher expectations of social responsibility, as well as more regulations and compliance requirements, which gives rise to additional costs and less surplus available for distribution to shareholders, thus affecting dividend payments.

To estimate the impact of the biodiversity priority conservation policy on corporate dividend payouts, we employ the designation of priority areas for biodiversity conservation as a quasi-natural experiment. More specifically, we take the year 2011 as the policy

Table 11
Covariates balancing test statistics.

	Treatment			Control		
	Mean	Variance	Skewness	Mean	Variance	Skewness
Panel A: Pre-entropy-balancing						
Size	22.670	1.926	0.605	21.920	1.361	0.895
Cashflow	0.059	0.004	0.076	0.056	0.005	0.006
Leverage	0.419	0.035	0.138	0.376	0.038	0.256
Growth	0.358	0.702	3.962	0.317	0.691	4.330
Age	2.088	0.832	−0.673	1.776	0.943	−0.386
ROE	0.097	0.004	1.186	0.096	0.004	1.160
ConRatio	38.170	228.200	0.310	38.800	219.200	0.331
Centrality	0.433	0.119	0.527	0.377	0.124	0.706
Top1	36.580	230.900	0.420	36.470	214.900	0.450
Panel B: Post-entropy-balancing						
Size	22.670	1.926	0.605	22.670	2.132	0.638
Cashflow	0.059	0.004	0.076	0.059	0.005	0.022
Leverage	0.419	0.035	0.138	0.419	0.041	0.085
Growth	0.358	0.702	3.962	0.358	0.894	3.988
Age	2.088	0.832	−0.673	2.088	0.811	−0.797
ROE	0.097	0.004	1.186	0.097	0.004	1.106
ConRatio	38.170	228.200	0.310	38.170	237.900	0.371
Centrality	0.433	0.119	0.527	0.433	0.140	0.598
Top1	36.580	230.900	0.420	36.580	234.200	0.473

Note: Treatment (Control) represents the group of firms for which the firm-level indicator variable *BiodiviersityRisk* equals 1 (0).

Table 12
Effect of biodiversity risk exposure on dividend payouts after entropy balancing.

	(1) *DivPayout*	(2) *DivPayout*	(3) *DivPayout*	(4) *DivPayout*
BiodiversityRisk	−0.022***	−0.016***	−0.020***	−0.020***
	(−3.719)	(−2.871)	(−3.347)	(−3.494)
Size		−0.027***		−0.010**
		(−3.226)		(−2.461)
Cashflow		0.197***		0.575***
		(4.871)		(12.309)
Leverage		−0.101***		−0.148***
		(−3.243)		(−6.393)
Growth		−0.002		−0.011***
		(−0.509)		(−3.453)
Age		0.007		0.010**
		(0.929)		(2.220)
ROE		−1.768***		−1.274***
		(−25.605)		(−18.377)
ConRatio		0.001		0.001***
		(1.006)		(2.950)
Centrality		0.000		0.019**
		(0.044)		(2.086)
Top1		0.001		0.001**
		(0.772)		(2.078)
_cons	0.377***	1.116***	0.376***	0.640***
	(126.784)	(5.986)	(74.633)	(8.349)
Year FE	Yes	Yes	No	No
Firm FE	Yes	Yes	No	No
Obs	25 979	25 979	25 979	25 979
Adj. R^2	0.289	0.357	0.001	0.081

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

implementation year, defining firms in priority provinces or cities as the treatment group and others as the control group. By doing so, we construct the difference-in-differences model as follows:

$$DivPayout_{i,t} = \beta_0 + \beta_1 Time_t \times Priority_i + \sum_i \beta_i Controls_{i,t} + f_i + d_t + \gamma_p + \tau_j + \varepsilon_{i,t}, \tag{6}$$

where $Time_t$ is a dummy variable that equals 1 if an observation is from the period after the designation of priority areas for biodiversity conservation and 0 otherwise. $Priority_i$ is a dummy variable that equals 1 if firms are located in priority provinces or cities and 0 otherwise. Besides, province and industry fixed effects are also considered to control for any time-invariant provincial and industrial characteristics.

Table 13
Effect of biodiversity priority conservation policy on dividend payouts.

	(1) *DivPayout*	(2) *DivPayout*
Time × *Priority*	−0.023*	−0.026*
	(−1.699)	(−1.756)
Time	−0.004	
	(−0.365)	
Priority	0.022*	
	(1.720)	
Size	−0.008**	−0.031***
	(−2.333)	(−4.033)
Cashflow	0.602***	0.239***
	(15.456)	(6.299)
Leverage	−0.159***	−0.085***
	(−7.354)	(−2.828)
Growth	−0.013***	−0.004
	(−4.102)	(−1.281)
Age	0.009**	0.009
	(2.226)	(1.307)
ROE	−1.366***	−1.826***
	(−22.842)	(−28.206)
ConRatio	0.001***	0.002*
	(3.284)	(1.914)
Centrality	0.016*	0.003
	(1.921)	(0.390)
Top1	0.001*	0.000
	(1.947)	(0.252)
_cons	0.612***	1.178***
	(9.156)	(7.045)
Year FE	No	Yes
Firm FE	No	Yes
Province FE	No	Yes
Industry FE	No	Yes
Obs	25 978	25 978
Adj. R^2	0.084	0.349

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

As shown in Table 13, Column (1) lists the results that do not include fixed effects, while Column (2) denotes the regression without *Time* and *Priority*, whose explanatory powers are absorbed by the fixed effects (Nguyen and Phan, 2020). The coefficients of the interaction term in Columns (1) and (2) are negative and significant at the 10% level, indicating that the biodiversity priority conservation policy lowers corporate dividend payout levels to a certain degree.

5.1.4. Instrument variable

Following Safiullah et al. (2021), we use the geographic location as an instrument variable (IV) to address endogeneity issues associated with reverse causality. In detail, we calculate the average score of biodiversity risk exposure for firms surrounding the same three-digit zip codes in China. This indicator can be regarded as an ideal selection because zip codes in China are determined by geographical postal delivery instead of corporate financial performance. According to Jiraporn et al. (2014), the biodiversity risk of a specific company tends to be affected by other companies that are geographically proximate.

The results of the two-stage least squares are shown in Table 14. Column (1) illustrates that IV (*Zip*) is positively related to biodiversity risk, significant at the 1% level. Besides, the fitted value of *BiodiversityRisk* is negatively correlated with dividend payout levels, which is significant at the 5% level. Therefore, our main hypothesis about the negative relationship between biodiversity risk and corporate dividend payouts is further supported.

5.1.5. Lagged variables

Further, we alleviate the endogeneity concerns about reverse causality by using lagged values of the independent and control variables. As seen in Table 15, the *BiodiversityRisk* is significantly negatively correlated with the dividend payouts while considering lagged variables, which aligns with our main baseline findings.

5.2. Alternative measures of dependent and independent variables

In the prior studies, there are different measurements for corporate dividend payouts. According to Chang et al. (2024), we take *DivToAssets*, *DivToRevenue*, and *DivPerShare* as alternative proxies of the dependent variable, which are measured by cash dividends/total assets, cash dividends/operating revenue, and cash dividends/number of shares, respectively. Moreover, we also employ *BiodiversityConcern* (He et al., 2024a) as an alternative measure of the independent variable.

Table 14
Effect of biodiversity risk exposure on dividend payouts when considering instrument variable.

	(1) First stage	(2) Second stage
Zip	0.859***	
	(51.346)	
BiodiversityRisk		−0.052**
		(−3.092)
Size	0.078***	−0.029***
	(8.031)	(−3.445)
Cashflow	−0.033	0.227***
	(−0.738)	(5.937)
Leverage	−0.049	−0.094**
	(−1.326)	(−3.074)
Growth	0.003	−0.004
	(0.781)	(−1.264)
Age	0.017	0.010
	(1.848)	(1.455)
ROE	0.057	−1.821***
	(0.938)	(−28.118)
ConRatio	0.001	0.001
	(0.917)	(1.689)
Centrality	−0.005	0.001
	(−0.485)	(0.175)
Top1	0.001	0.001
	(0.635)	(0.558)
Year FE	Yes	Yes
Firm FE	Yes	Yes
Obs	25 979	25 979
Adj. R^2	–	0.098

Notes: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The command *ivreghdfe*in Stata is employed, and thus, the constant in two stages and the R^2 in the first stage are not reported.

Table 15
Effect of biodiversity risk exposure on dividend payouts when considering lagged variables.

	(1) *DivPayout*	(2) *DivPayout*
BiodiversityRisk	−0.011*	−0.010*
	(−1.748)	(−1.648)
Size		0.011
		(1.350)
Cashflow		−0.022
		(−0.548)
Leverage		−0.266***
		(−8.224)
Growth		−0.008***
		(−3.091)
Age		0.036***
		(4.769)
ROE		−0.641***
		(−12.134)
ConRatio		0.001
		(1.491)
Centrality		0.003
		(0.338)
Top1		0.001
		(1.111)
_cons	0.386***	0.145
	(144.990)	(0.790)
Year FE	Yes	Yes
Firm FE	Yes	Yes
Obs	25 111	25 111
Adj. R^2	0.280	0.295

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

The results for alternative measures of dependent and independent variables are displayed in Table 16. The coefficient of *BiodiversityConcern* on *DivPayout* is negative and significant at the 10% level, and the coefficients of *BiodiversityRisk* on *DivToAssets*, *DivToRevenue*, and *DivPerShare* are negative and significant at the 5% levels. In summary, our main results are consistent and robust.

Table 16
Effect of biodiversity risk exposure on dividend payouts when considering alternative measures.

	(1) *DivPayout*	(2) *DivToAssets*	(3) *DivToRevenue*	(4) *DivPerShare*
BiodiversityConern	−0.000*			
	(−1.893)			
BiodiversityRisk		−0.001**	−0.002**	−0.043**
		(−2.494)	(−2.486)	(−2.251)
Size	−0.033***	−0.001	0.004***	0.224***
	(−3.936)	(−1.190)	(3.375)	(8.064)
Cashflow	0.231***	0.026***	0.009	0.709***
	(6.052)	(11.235)	(1.334)	(8.829)
Leverage	−0.090***	−0.038***	−0.105***	−0.471***
	(−2.961)	(−19.016)	(−13.387)	(−6.396)
Growth	−0.004	−0.001***	−0.002*	0.002
	(−1.351)	(−3.657)	(−1.937)	(0.383)
Age	0.009	−0.003***	−0.010***	−0.792***
	(1.307)	(−5.683)	(−7.330)	(−24.207)
ROE	−1.838***	0.125***	0.158***	2.365***
	(−28.239)	(26.683)	(13.227)	(17.185)
ConRatio	0.001*	0.000	0.000	−0.003*
	(1.668)	(0.609)	(0.411)	(−1.861)
Centrality	0.001	−0.000	0.002	−0.012
	(0.171)	(−0.393)	(0.972)	(−0.755)
Top1	0.000	0.000	0.000	0.003
	(0.482)	(0.955)	(1.118)	(1.559)
_cons	1.220***	0.036***	−0.019	−3.097***
	(6.572)	(3.449)	(−0.643)	(−5.474)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Obs	25 979	25 979	25 979	25 979
Adj. R^2	0.347	0.635	0.556	0.562

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

5.3. Controlling for climate risk

Several works point out that biodiversity risk is related to but conceptually different from climate risk (Giglio et al., 2023). To distinguish climate risk from biodiversity risk and concentrate exclusively on how biodiversity risk exposure influences dividend payouts, we employ *China's provincial Climate Policy Uncertainty (CPU) index* and *China's city level Climate Policy Uncertainty (CPU) index* to account for climate risk (Ma et al., 2023). We add these two CPU indices as control variables and report the results in Table 17. Apparently, the coefficients of two *ClimateRisk* are insignificant, while the coefficient of *BiodiversityRisk* remains negative and significant at the 1% level, indicating that biodiversity risk shows a distinct influence on corporate dividend payouts, which does not stem from climate risk.

5.4. Controlling for financial crisis and COVID-19 periods

In periods of crisis, firms are more likely to implement a conservative dividend policy. Hence, to isolate the influence of the 2008 financial crisis and the 2020 COVID-19 period, we exclude the corresponding years and re-estimate our baseline regression. The results are displayed in Table 18, suggesting that the negative impact of biodiversity risk on corporate dividend payouts is still significant at the 1% level even after excluding the periods of crises.

5.5. Changing fixed effects

In the above, we consistently control for firm- and year-fixed effects. To consider the potential impact of other unobservable characteristics at the provincial and industrial levels, we include province- and industry-fixed effects in our baseline model. Table 19 reports the results, indicating that our main findings remain consistent when changing fixed effects.

6. Conclusion

Considering the profound impact of the awareness of biodiversity on corporate performance, we investigate the relationship between biodiversity risk exposure and corporate dividend payouts by employing a rich sample of Chinese-listed firms from 2007 to 2022. The empirical results uncover that firms exposed to biodiversity risk significantly reduce their dividend payouts, primarily through two channels. In detail, biodiversity risk exposure negatively impacts dividend payouts by aggravating financing difficulties, i.e., reducing financing accessibility and increasing financing costs, and by promoting resource reallocation while shifting capital from short-term cash holdings to long-term biodiversity-related innovation investments.

Table 17
Effect of biodiversity risk exposure on dividend payouts when controlling for climate risk.

	(1) *DivPayout*	(2) *DivPayout*
BiodiversityRisk	−0.018***	−0.018***
	(−3.082)	(−3.266)
ClimateRisk (City level)	−0.004	
	(−0.652)	
ClimateRisk (Province level)		0.004
		(0.639)
Size	−0.034***	−0.032***
	(−3.738)	(−3.845)
Cashflow	0.217***	0.228***
	(5.430)	(5.952)
Leverage	−0.092***	−0.091***
	(−2.855)	(−2.995)
Growth	−0.004	−0.004
	(−1.188)	(−1.299)
Age	0.007	0.009
	(1.006)	(1.368)
ROE	−1.820***	−1.824***
	(−26.557)	(−28.163)
ConRatio	0.001	0.001*
	(1.562)	(1.659)
Centrality	0.003	0.002
	(0.413)	(0.184)
Top1	0.000	0.000
	(0.312)	(0.509)
_cons	1.255***	1.197***
	(6.258)	(6.419)
Year FE	Yes	Yes
Firm FE	Yes	Yes
Obs	23 393	25 979
Adj. R^2	0.352	0.345

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 18
Effect of biodiversity risk exposure on dividend payouts when excluding financial crisis and COVID-19 periods.

	(1) *DivPayout*	(2) *DivPayout*
BiodiversityRisk	−0.027***	−0.018***
	(−4.326)	(−3.056)
Size		−0.036***
		(−4.322)
Cashflow		0.214***
		(5.243)
Leverage		−0.092***
		(−2.962)
Growth		−0.002
		(−0.601)
Age		0.011
		(1.588)
ROE		−1.792***
		(−26.321)
ConRatio		0.001
		(1.471)
Centrality		−0.000
		(−0.059)
Top1		0.001
		(0.656)
_cons	0.383***	1.289***
	(148.832)	(6.914)
Year FE	Yes	Yes
Firm FE	Yes	Yes
Obs	22 950	22 950
Adj. R^2	0.274	0.345

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 19
Effect of biodiversity risk exposure on dividend payouts when adding province and industry fixed effects.

	(1) *DivPayout*	(2) *DivPayout*
BiodiversityRisk	−0.035***	−0.022***
	(−5.697)	(−3.770)
Size		0.000
		(0.110)
Cashflow		0.567***
		(14.243)
Leverage		−0.182***
		(−7.917)
Growth		−0.007**
		(−2.212)
Age		0.004
		(1.083)
ROE		−1.424***
		(−24.122)
ConRatio		0.001***
		(3.075)
Centrality		0.014*
		(1.739)
Top1		0.001**
		(2.015)
_cons	0.389***	0.461***
	(88.240)	(6.209)
Year FE	Yes	Yes
Firm FE	No	No
Province FE	Yes	Yes
Industry FE	Yes	Yes
Obs	25 978	25 978
Adj. R^2	0.032	0.109

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Furthermore, our heterogeneity analysis reveals that (i) firms with weaker political connections are more susceptible to external financial pressures and constraints; (ii) firms with stronger external supervision are more prudent in maintaining legitimacy; and (iii) firms with poorer internal governance face greater operating and management uncertainties. Hence, the adverse effect of biodiversity risk exposure on corporate dividend payouts is more pronounced in these firms. Additionally, to ensure the robustness of our findings, we conduct plenty of endogeneity analyses, such as propensity score matching, entropy balancing, and the use of instrument and lagged variables. We also implement a difference-in-difference analysis, finding that biodiversity priority conservation policy significantly lowers corporate dividend payouts. Besides, we re-estimate our results by using alternative measures of dependent and independent variables, controlling for climate risk, controlling for financial crisis and COVID-19 periods, and changing fixed effects, all of which confirm the consistency of our findings.

While our study focuses on China, its implications extend beyond national borders, offering valuable insights into other emerging and developed economies. First, many emerging markets face similar challenges in balancing rapid industrialisation and economic growth with environmental sustainability, often relying heavily on ecosystem resources. As global biodiversity risks intensify, firms in these economies are likely to encounter heightened financial constraints, mirroring the challenges observed in China. Second, with increasing global attention on biodiversity, international investors and regulators may impose stricter biodiversity conservation requirements and demand more transparent risk disclosures. However, due to data limitations, research on biodiversity risk and corporate financial policies remains scarce in many other economies. In this context, China's experience can serve as a valuable reference for policymakers, regulators, and businesses in other emerging and developed markets, particularly in areas such as financing strategies, resource allocation, and corporate decision-making in response to biodiversity risks.

The challenges and opportunities generated by biodiversity risk should be aware. On the one hand, corporate managers must recognise the potential uncertainties and, therefore, need to effectively manage biodiversity risk to balance the short-term benefits with the long-term sustainable development goals. For example, they should proactively assess and manage biodiversity risks by integrating biodiversity conservation into core business strategies, including adopting green technologies, implementing biodiversity-friendly investment, and enhancing supply chain transparency, thus strengthening competitiveness by improving environmental performance. Moreover, managers should develop comprehensive biodiversity risk management frameworks to mitigate the financial impact of biodiversity-related uncertainties and ensure long-term resilience.

On the other hand, policymakers can help to shape an enabling environment for effective biodiversity risk management. For instance, they could strengthen regulatory frameworks by enhancing disclosure requirements and introducing tax incentives for biodiversity-friendly investments to encourage biodiversity conservation and innovation. Additionally, they could establish financial support mechanisms to help businesses, particularly small and medium-sized firms, alleviate financial constraints associated with biodiversity-related challenges. By fostering cross-sector collaboration between regulators, investors, and corporations, policymakers can drive a more sustainable and resilient corporate ecosystem.

CRediT authorship contribution statement

Yang Zhou: Writing – original draft, Formal analysis, Methodology, Conceptualization. **Brian M. Lucey:** Writing – review & editing, Supervision, Conceptualization. **Feng He:** Software, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data is available upon request.

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