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Lu Zheng*

Southeast University

No.2，Southeast University Road, Jiangning District

Nanjing, Jiangsu, China, 200093

Email: zhenglu106@163.com

Telephone：(+86) 17765190502

Zhibin Chen

Southeast University

No.2，Southeast University Road, Jiangning District

Nanjing, Jiangsu, China, 200093

Email: seuczb@126.com

*Corresponding author, Lu Zheng. I appreciate workshop participants at Southeast University. All remaining errors are the responsibility of the author.

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Abstract: Using the sample of Chinese A-share listed firms from 2020 to 2021, this study investigates the impact of EPU on corporate ESG performance. We find that EPU improves corporate ESG performance, and the results largely hold after a series of robustness tests. Furthermore, EPU has a significantly positive effect on each dimension of corporate ESG performance (environment, society and governance). In addition, we document that the positive effect of EPU on corporate ESG performance is more pronounced for state-owned firms, and firms with better internal governance, better external governance, and firms that are more financially-constrained. This study provides large-sample empirical evidence for the effect of EPU on corporate ESG performance, which provides implications for management to make use of corporate ESG performance in the face with uncertain economic policy environment.

Keywords：Economic policy uncertainty; ESG; Corporate sustainability

1. Introduction

Since the United Nations World Commission on Environment and Development (WCED) lighted the importance of sustainable development in 1978, many companies have incorporated sustainability considerations into their operations (Logan and Joeal,2022). Nowadays, in face with the ongoing outbreak of global crises such as environmental pollution, climate change, local wars and COVID-19 epidemic, EPU substantially increases and put the development of enterprises sustainable under great threat (Garel and Petit-Romec, 2021). Thus, the pure pursuit of profit maximization goal for enterprises is more inconsistent with the management objectives. Enterprises which seek sound future development need to continuously improve profitability but also need to specifically coordinate the interests of government regulation and other stakeholders (Li and Zheng, 2022). Therefore, the concept of ESG, which meets the needs of current economic and social development, is increasingly concerned by the academic and practical circles. Driven by government regulation and social appeals, and for the sake of sustainable development for themselves, enterprises gradually pay more attention to bearing social responsibilities, including environmental, social responsibility, corporate governance and related information disclosure.

ESG was first proposed by the Global Compact of the United Nations Environment Program in 2004. It is a concept and practical way to measure the sustainable development ability and long-term value of enterprises from multiple dimensions and provides conceptual support for the implementation of the sustainable development of enterprises. In 2005, the United Nations Responsible Investment Agency and UNEP jointly issued the Principles of Responsible Investment, which sought to integrate the three ESG factors with capital markets. Since then, the scale of ESG investment worldwide has increased rapidly. According to United Nations Organization for the Principles of Responsible Investment, by the end of 2021, it had signed up 3,826 institutions from different countries with a total asset of $121.3 trillion under management. Intermediary services such as the Big Four accounting firms are also coming on board, making ESG the focus of audit and consulting business development. Thus, the concept of ESG began to prevail and attracted increasing attention from capital market investors

A large body of studies focus on the consequences of corporate ESG performance from various perspectives, such as debt financing (Ge et al., 2022; Li, Zhou and Xiong, 2020), investment activities (Wang, Yu & Li, 2022), non-financial performance (Bruna et al., 2022; Azmi et al., 2021; Baran et al., 2022); stock

market value（Giese et al., 2019; Miralles-Quiros and Redondo, 2019). risk management (Li et al., 2020; Broadstock et al., 2021; He et al., 2022; Yoon et al., 2021), information asymmetry (Kim & Park,2022) and economic growth (Diaye et al., 2022). Relatively few studies shed light on the determinants of corporate ESG performance. From the perspective of internal factors, Jia et al. (2022) find that firms with more institutional ownership have better ESG performance because institutional investors pay more attention to corporate ESG performance. Zheng et al. (2022) shows that firm's green innovation could significantly improve corporate ESG performance of Global Entrepreneurship Monitor firms. In terms of external factors, industry characteristics have been confirmed as a significant determinant. Garcia et al. (2017) find that companies in sensitive industries (those subject to moral debates, political pressures and social taboos, or more likely to cause environmental damage) present superior environmental responsibility performance of ESG. Through the above review of the extant literature, we find that the correlation between EPU and corporate ESG is a significant literature gap in this research field. However, it is important for government and managers to understand whether and how EPU will affect corporate ESG performance, in order to better conduct ESG practice and promote the construction of ESG practice. In this paper, we fill this void by linking EPU with corporate ESG performance, and further reveal how the relationship is affected by different moderating variables.

Using a sample of non-financial Chinese-listed firms from 2010-2021, we begin by examining how EPU affect corporate ESG performance. Results show that EPU have a positive effect on corporate ESG performance in China. We provide further evidence that the effects on corporate ESG performance are significantly positive in the environment, society and governance dimension of corporate ESG performance. Finally, we introduce moderating variables: property right, internal governance level, external governance level and financial constraints to examine whether there are any heterogeneous effects in the relationship between EPU and corporate ESG performance. In particular, the effect is more significant in state-owned firms, and firms with better internal and external governance level, or with more serious financial constraints.

The main contributions of this paper are as follows. (1) Present literature investigates the determinants of corporate ESG performance from the perspectives of firm-level and industry-level factors. This paper enriches the existing research from the perspective of macro-economic factor (EPU) which is supposed to affect corporate ESG performance. This study has confirmed the promoting effect of EPU on overall corporate ESG performance and the each of its dimensions. Besides, we also confirmed the heterogeneous effect of firms' property right, internal governance, external governance and financial constraint in the relationship. (2) Present literature has confirmed the financial consequence of economic policy uncertainty (Qi et al., 2022). Few studies have looked into the non-financial consequence of EPU. Our study contributes to the present studies by filling the void that EPU may cause non-financial consequence of corporate ESG performance. (3) Moreover, this study reveals the positive consequence of EPU, that is corporate managers will pay more attention to bearing environmental, social and governance responsibility as a tool to cope with risks raised by EPU and so as to correspondingly improve their ESG performance.

The reminder of this paper is organized as follows. Section 2 introduce literature review and hypothesis development; Section 3 describes research design; Section 4 puts forward empirical results and results discussion; Section 5 is the conclusion and the possible limitations for future research.

2. Literature review and hypothesis development

2.1 Economic Literature Consequence on EPU

EPU mainly refers to the possibility that future policies will differ from current policies, and how these changes would affect economic activities (Baker et al., 2016). Prior studies mainly investigate the

consequences of EPU from the perspectives of firm and industry-level factors (Zheng et al., 2012; Zheng and Zhang, 2022). For example, during the period of high EPU, it is difficult for firms to raise external capital. As a result, these firms tend to increase cash holdings for precautionary motivation. (Legesse, 2022;Duong et al.,2020; Li, 2019). From the perspective of corporate investment, a growing number of studies document a reduction in corporate investment when EPU level raises. This is because EPU aggravates information asymmetry. Managers have less information to make rational investment decisions. Consequently, they are inclined to delay capital investment until the environment becomes more stable (Kong et al., 2022; Vo et al., 2021; Liu, 2020). In terms of financial performance, studies document that EPU will generally exert a negative influence on firm's financial performance, the impact is more profound in new firms, non-state-owned firms and firms in less developed regions (Yu and Jin, 2022). Alternatively, EPU may exert a positive influence on corporate real activities. William and Wang (2022) and Guan et al. (2021) document that EPU enhances long-term investment such as corporate innovation as for these activities can reduce agency cost and alleviate financing constrain. This positive effect is more significant in state-owned enterprises, high technology industries and firms with higher level of innovation R&D adjustment cost. Hao (2020) contend that EPU raises the overall level of Firms' social responsibility. This relationship is more significant in firms with less effective internal control and more volatile earnings. Nagar et al. (2019) contend that although EPU would increase the information asymmetry of corporate, it would also promote the company's management to proactively disclose information to reduce the negative effect of information asymmetry.

2.2 Literature on corporate ESG performance

Paucity of literature investigates the determinants of corporate ESG performance from the perspectives of CEO and firm-level characteristics, industry heterogeneity and macro-environmental factors. Among them, CEO and firm-level characteristics are salient determinants (Qi et al., 2022). For instance, Romano et al. (2020) contend that the ratio of women on Board of Directors has a positive impact on ESG scores. Dyck et al. (2019) and Jia et al. (2022)find that institutional ownership ration is significantly and positively to corporate ESG performance because institutional investors usually push for stronger firm-level ESG performance. Zheng, Khurram and Chen (2022) show that green innovation significantly improves the corporate ESG performance of GEM listed companies for the reason that green innovation positively affects the environmental dimension of ESG indicator and meanwhile promote the firms' sustainability. Garcia et al. (2017) find that companies belonging to sensitive industries which are seen as having stronger socio-environmental impacts achieve better corporate ESG performance than companies not belonging to these industries. In terms of macroeconomics factors, Mooneeapen et al, (2022) reveal that corporate ESG performance is associate with country governance environment. Corporate ESG performance is higher in countries with better regulatory quality or a lower level of democracy and political stability. Similarly, Qi et al. (2022)find that government-led construction of a national civilized city encourages enterprises to assume more ESG investments. Deng et al. (2022) suggest that the capital market opening has a promoting effect on corporate ESG performance. What's more, internal governance and external governance play an intermediary role between capital market opening and corporate ESG performance.

Through the above review of the previous studies about EPU and corporate ESG performance, we conclude that the effect of EPU on firms' financial activities have been widely investigated, but non-financial activities remain an under-explored field. While several studies focus on the impact on enterprises social responsibility performance, very few researches have associate EPU and corporate ESG performance. However, ESG has become a more comprehensive index to measure enterprises fulfillment of their environmental, social and governance responsibilities, the government and stakeholders are concerned of whether the EPU would impact corporate ESG practice. On the other hand, there still remains a limited understanding of the relationship between macroeconomic factors and ESG permanence heterogeneity. To fill in this gap, in this study, we examined the impact of EPU on corporate ESG performance to complement

relevant theory and provide valuable policy references for China and other countries' governments to achieve sustainable economic development goals.

2.3 Hypothesis development

According to risk management theory, enterprises will plan, organize, lead, and control the activities of organization to minimize the impact of risks on the assets and income (COSO,2017). ESG activities can be viewed as a measure to control risks (Wang and Hao, 2022), Thus firms have a stronger motivation to enhance corporate ESG performance in face with EPU. When the economic policies uncertainty rises, the external risks of firms will increase (Pástor, 2012). Enterprises may take ESG practices as an anti-risk measure to hedge external risks and avoid possible adverse effects. Karwowski, M. and Raulinajtys-Grzybek, M (2021);Wang and Hao (2022) proposed that good performance of ESG practices will form capital for enterprises, which can mitigate the impact of systemic risks and reduce the negative effect of risk events on the survival of enterprises. Di T.C. and Thornton J. (2020) find that high ESG scores are associated with a modest reduction in risk-taking for banks that are high or low risk-takers. Cuadrado-Ballesteros, Garcia-Sanchez & Ferrero (2016) find that to actively implement ESG responsibilities can help establish good close relationship with stakeholders, alleviate the negative emotions of stakeholders in a high policy uncertain period. So, when encounter the increase EPU, enterprises may pay more attention to their ESG practices and improve corporate ESG performance significantly.

Furthermore, following the signaling theory, better corporate ESG performance signals a firm's sustainable development ability to various stakeholders. Constructed from the perspective of asymmetric information, signaling theory demonstrates that a firm's financial decisions function as a signal gave by its management toward stakeholders, and this mechanism can counter information asymmetries (Vural-Yava, I., 2021; Connelly et al., 2011). An enterprise's active performance of ESG can convey the signal of "rationality of existence" and "sustainability of development" to stakeholders, enabling stakeholders to give more tolerance to enterprises' mistakes, and reduce the negative evaluation of stakeholders of negative events, allowing enterprises obtain more opportunities for sustainable development (Raimo, N. et al., 2021;Wang and Hao, 2022).Therefore an enterprise's active performance of ESG is regarded as a commitment to long-term sustainable development enabling stakeholders to maintain confidence in the development prospects of the enterprise.

However, EPU may also negatively affect corporate ESG performance. First, Present studies address that firms' investment decisions would be affected by EPU (Bonaime et al., 2018; Nguyen et al., 2018; Phan et al., 2019). Firms will consider ESG investment only when their core investment needs are satisfied (Waddock et al., 1997). In an environment of EPU, firms' financial constraints will increase because banks are less willing to lend to firms (Gu ,2018). The core business investment demands may lack enough funds, let alone the ESG performance. In this case, it is more difficult for firms to fulfill their ESG performance. In other words, High EPU leads to the lack of funds for ESG investment and impair corporate ESG performance (Chang et al.2016). Second, firms tend to postpone their business plans in order to avoid loss from inaccurate information and wait for EPU to resolve, including long-term decisions about corporate ESG performance (Bloom, Bond, and Van, 2007).

Based on theoretical analysis above, how EPU affects corporate ESG responsibility has both positive and negative possibilities. So, we propose the following competitive hypotheses:

Hypothesis 1a: The EPU will positively influence corporate ESG performance.
Hypothesis 1b: The EPU will negatively influence corporate ESG performance.

3. Sample and research design

3.1 Sample and data

This study uses the data of China's listed companies in A-share market from the year of 2010 to 2021. By the time this study is conducted, the financial data and ESG rating data in Bloomberg database has not been completely released, so we did not include the data in the year of 2022. The financial data on firms and industries are mainly extract from the China Stock Market and Accounting Research database (CSMAR). We delete firms in financial industry because of their distinct accounting rules, ST, *ST or PT firms due to their abnormal financial status, and firms with important missing data. All continuous variables are winterized at 1% and 99% levels to eliminate outlier effects. After these exclusions, we are left with a sample of 1130 listed firms and 10022 observations.

We use the EPU index developed by Baker et al. (2016) as the proxy for EPU. Stanford university and University of Chicago jointly launched the index in their website www.policyuncertainty.com and the index can be tracked back to 1995. EPU index mainly adopts text analysis measure to construct the index by calculating article numbers in local large newspapers. As for Chinese EPU index, it takes South China Morning Post (SCMP), the largest newspaper in Hongkong, as the text analysis objective. First, they identified articles regarding policy economic uncertainty of China, then divides the number of articles identified by total article number in SCMP in that month, the results are the monthly Chinese EPU index.

We use Bloomberg ESG ratings via Bloomberg ESG rating database as the proxy for corporate ESG performance. Bloomberg ESG ratings are based on actual information revealed. It captures how firms report corporate ESG performance with 21 indicators and 122 sub-indicators across three dimensions.

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3.2 Variables

3.2.1 Economic Policy Uncertainty（EPU）

EPU index is widely used as the proxy for the EPU in a country in previous research (Li, 2019; Zhao, Xiao and Zhang, 2020; Wang, Zhang and Dai, 2023). likely, in this study, we adopt the Chinese EPU index as the proxy of EPU in China. We collect the monthly data from EPU Index website and apply the arithmetic mean of EUP index of 12 months in a year to proxy yearly EPU level.

3.2.1 Corporate ESG Performance

ESG score developed and disseminated by Bloomberg can incident the fulfillment of corporate ESG performance and has been widely used as a proxy of corporate ESG performance in empirical studies (Romano et al, 2020; Wang, Yu and Li, 2022). So, we adopt Bloomberg ESG total and dimension score to measure the fulfillment of corporate ESG performance and environmental, social, governance performance. Because there is distinction between different ESG rating systems provided by different rating agencies, to verify the robustness of the analysis, we adopt China Security ESG ratings developed by the Securities Investment Fund Association of China (SIFMA) as a robustness test.

3.2.3 Control Variables

Following prior literature (Baraibar-Diez and Odriozola, 2019;Madison & Schiehll, 2021 ; DasGupta, 2022; Jang et al., 2022), the control variables include board size ($Board_{i,t}$), board independence ($Indep_{i,t}$), CEO duality ($Duality_{i,t}$), the indicator of state-owned enterprises ($Soe_{i,t}$), firm size ($lnAssets_{i,t}$), firm age ($Age_{i,t}$), financial leverage ($Leverage_{i,t}$), net profit return on total assets ($Roa_{i,t}$),Shareholding ratio of the largest shareholder($Top1_{i,t)}$,The sum of the squares of a company's largest shareholder ($HH1_{i,t}$).Since EPU has significant time , industry and regional heterogeneity (Xu and Yano, 2017), year, industry and province dummies are also controlled. Detailed definitions of all the variables used in regression analysis are shown in Appendix A.

3.3 Research design

To explore the association between EPU and corporate ESG performance, we adopt the following model:

$$ESG_{i,t} = \beta_0 + \beta_1 EPU_{i,t} + \beta_2 Controls_{i,t} + YearFE + IndustryFE + ProvinceFE + \varepsilon_{i,t}$$

Where i and t denote firm i and year t, respectively. The dependent variable used in the regression is the EPU Index, which is the EPU index published by Scott Baker et al. from January 1995 to the present. $ß_1$ reflects the correlation between the EPU and corporate ESG performance, in this study, it is expected to be significantly correlated with ESG positively or negatively. Since EPU has significant time, industry and regional heterogeneity, Year FE, industry FE and Province FE separately refer to year, industry and regional effects here.

4. Empirical results

4.1. Descriptive statistics

The descriptive statistics regarding main variables in the baseline model are summarized in Table 1. As we can see, the mean of the dependent variable (EPU) is 375.522, and the media is 236.434, respectively. These values are approximately the same as the existing studies (Lu, Bai and Ye, 2021). The independent variable corporate ESG performance has a mean of 20.639 and a median of 19.835, which are also roughly consistent with the extent research (Yang et al., 2021). Besides, the main control variables, BoardS, BoardIn, ROA, TOP1, HH1, Duality, Age, Lev, SOE, IND, also have summary statistics in line with the existing studies (Rezende et al., 2019; Cai et al., 2020; Li, 2023).

Table 1
Descriptive Statistics.

Variable	*Obs.*	*Mean*	*S.D.*	*p25*	*Median*	*p75*
EPU	10022	375.522	236.434	170.636	363.874	460.470
ESG	10022	20.639	6.786	16.529	19.835	23.140
BoardS	10022	23.083	1.298	22.137	22.981	23.887
BoardIN	10022	0.376	0.056	0.333	0.364	0.429
ROA	10022	0.046	0.063	0.016	0.039	0.075
Top1	10022	36.997	16.060	24.170	35.647	48.966
HH1	10022	0.163	0.131	0.058	0.127	0.240
Duality	10022	0.200	0.400	0.000	0.000	0.000
Age	10022	2.494	0.643	2.197	2.708	2.996
Lev	10022	0.476	0.202	0.320	0.487	0.631
SOE	10022	0.515	0.500	0.000	1.000	1.000

4.2. Basic results

Table 2 reports the results of the baseline hypothesis results. In column (1), we do not incorporate the control variables in regression analysis. Then we consider the impact of control variables, the results are shown in column (2). For both regressions, the coefficients of *EPU* are significantly positive at the 1% level, suggesting that the levels of countries' EPU are statistically positive with corporate ESG performance, similar to the findings of previous research (Hao, 2020; Nagar et al., 2019), This result supports hypothesis 1a in the above that EPU will lead to better corporate ESG performance. The possible explanation for this result is that corporate ESG performance plays the role as an anti-risk measure of firms to hedge external risks and avoid possible loss on firms (Wang and Hao, 2022); Meanwhile, Firm's improvement in corporate ESG performance is a positive signal to outside stakeholders, enabling them to maintain confidence in the development prospects of the firm.

Table 2

Main results for the baseline hypothesis.

Variable	***ESG***	***ESG***
EPU	**0.011*** **	**0.012*** **
	(24.40)	**(13.32)**
SIZE		1.450***
		(6.86)
ROA		-0.230
		(-0.20)
SOE		2.093***
		(4.64)
Top1		0.100***
		(3.13)
HH1		-9.793***
		(-2.59)
Duality		-0.229
		(-1.16)
Age		-1.385***
		(-3.21)
Leverage		-1.124
		(-1.61)
Indep		-1.959
		(-1.06)
Board		-1.508***
		(-2.74)
Constant	18.204***	-7.566
	(8.21)	(-1.43)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	10015	10015
r2_a	0.274	0.293

Note: Table 2 presents the regression results of the impact of EPU on corporate ESG performance. In column (1)， the control variables are not excluded; in column (2) they are concluded. T-values based on robust standard errors clustered by firm are reported in parentheses. *, **, and *** denote significance better than 10%,5%, and 1%, respectively.

4.3 Heterogeneous analyses

To confirm the expectation that the effect of EPU on corporate ESG performance is heterogeneous in different firms, we choose three factors which may moderate the correlation of EPU and corporate ESG performance. Firstly, because sound internal governance will bring about stronger risk-defense capability, it may reduce the motivation for managements to adopt ESG performance as an anti-risk tool in an uncertain environment (Chintrakarn et al., 2016). On the other hand, however, if a company is faced with severe threat of resource constraints, it will enhance the managers' motivation to assume ESG responsibilities to build up ability to acquire external resources. Furthermore, when external supervision intensity is more effective, the effect of corporate ESG performance of conveying positive signals and mitigating risks will be more significant, thus strengthening the motivation of managers to improve corporate ESG performance (Garcia-Sanchez et al., 2022; Liu et al., 2023) Thus, we investigate the heterogeneous effects of EPU on corporate ESG performance from the perspectives of property right, internal governance level, financing constraint degree, and external supervision intensity. We perform moderate effect tests separately; Table 3 represents the empirical results of the moderating effect test.

4.3.1. The heterogeneous effect of property right

First, we explore how the nature of property right moderates the correlation between EPU and corporate ESG performance. Previous studies (Jin, 2017; Zhang,et al,2022) show the property right may cause significant difference in firm's strategy horizon and recourse level. We raise the presumption that the relationship between EPU and corporate ESG performance are more salient in state-owned firms. In term of strategy horizon, the actual controller of state-owned enterprises is the government, who usually pays attention to the social service and social image of state-owned firms (Quan and Li,2020). Controlled by the government, the executives of state-owned companies not only need to pursue the goal of financial performance, but also need to assume social responsibilities during the period of high EPU, such as promoting employment, maintaining social stability and protecting environment, so as to satisfy performance evaluation and enhance their potential political advancement chances. From the perspective of resource level, corporate ESG performance can be regarded as a long-term investment which need funds support (Leins, 2020; Aich et al., 2021; Kong et al., 2023). State-owned companies are more sufficient in terms of internal and external resources to support the investment of corporate ESG performance during the period of EPU increase. So, they are more capable to invest in ESG practice than non-state-owned firms and so as to have higher level of corporate ESG performance.

Following previous studies (Wu, Chen and Guo,2022; Jin and Wu, 2022), we adopt dummy variable *SOE* to proxy for the nature of property rights, which equals 1 if the firm's ultimate controlling shareholder is the government, equals 0 if not, and then perform regression analysis.

The regression result is showed in Panel A of Table 3. We can observe a positive coefficient of economic policy uncertainty EPU*SOE at the significance level of 5%, which confirmed our presumption that the property right exerts a significant moderating effect on the relationship between economic policy uncertainty EPU and ESG. Specifically, State-owned firms have a higher level of corporate ESG performance than non-state-owned firms when faced with high EPU, because of possible reasons that state-owned firms assume more social responsibilities and owe higher level of resource.

4.3.2. The heterogeneous effect of internal governance

Second, we explore how internal governance moderates the correlation between EPU and corporate ESG performance. We expect that firms with effective board governance are more likely to use corporate ESG performance as the anti-risk measure because they probability have better cognition of the how corporate ESG performance could function in high EPU environment. Following previous studies (Nagar & Raithatha, 2022; Qiao,2022)., we discuss three main variables used in studies to proxy for the quality of corporate internal governance the first one is the board size. ESG practice is a long-term value behavior (Deng et al., 2022), and larger board scale means that the directors have enough expertise, experience and knowledge to recognize the value of corporate ESG performance in coping with EPU. If the board is too small, it would just lack enough

cognition resource to recognize the function of corporate ESG performance as long-term governance measure. The second is the board independence, namely the percentage of independent directors in the board. The independent directors represent minority shareholder and stakeholders. They issue independent opinions on the operation of firms, so as to form supervision from minority shareholder and stakeholders over the board and the management's behaviors, encouraging the board and the management to act in line with stakeholders, including taking the measure of improving corporate ESG performance. The third is the institutional investors' stock shares. Institutional investors can influence the boards' decision making related to corporate ESG performance through voting rights. Because institutional investors in inclined to hold shares for a longer period and expect stable and continuous returns, they have a strong incentive to encourage the board to assume more ESG responsibilities to cope with EPU and realize long-term sustainable development. According to the above analysis, we raise the assumption that the quality of internal governance plays a moderating role in the relationship between EPU and corporate ESG performance. Specifically, Firms with better internal governance quality would have higher level of corporate ESG performance when in face with EPU. We use BoardS, BoardIn and INSTOWN to proxy for the board size, the independence of the board and the stock share of institutional investors. Then return the regression results separately in Panel B, C and D.

Panel B, C and D of Table 3 reports the heterogeneous effects of board size, board independence and Institutional investor share ratio. Columns (2) shows that the coefficients on EPU*BoardS, EPU*BoardIn and EPU*INSTOWN are all statistically significant and positive at the 1% level, which indicate that companies with larger board size, more independent board or receiving higher institutional investor share ratio have better corporate ESG performance in the face with EPU. The above analyst confirms the existence of the moderating role of internal governance quality on the relationship between EPU and corporate ESG performance.

4.3.3. The heterogeneous effects of external governance

Third, we explore how external governance moderates the correlation of EPU and corporate ESG performance. We expect that firms are more inclined to adopt ESG performance as an anti-risk measure when operating in an environment with more effective external governance, because the ESG performance can be better "seen" by external stakeholders in such environment and play a better role in delivering positive signals and maintaining corporate images. From the perspective of analysts following, their reports will attract the attention of capital market investors and effect their evaluation about a firm (Yu, Dai and Song, 2020). Under this mechanism, firms with more analyst attention will consciously conduct more ESG responsibilities to deliver positive signals of sustainable development than those with fewer analyst attention to investors. Besides, auditing is another important external governance force. The larger the accounting firms' scale is, the stricter audit processes the auditors will conduct, because they pay attention to maintain brain image and face higher litigation risks (Zhu et al., 2015). In the process of auditing, social responsibility reports or ESG reports are an important material for auditors to understand the strategic objectives and sustainability of the audited entity. In this case, we expected that firms audited by larger accounting firms would consciously improve their ESG performance than those audited by smaller accounting firms.

Drawing lessons from the measurement method of (Gao et al., 2021; Yu, Dai and Song, 2020;), if the firms have more analyst teams or analyst reports coverage, the firms can be regarded as attracting greater analysts' attention. And, if the companies are audited by the "Big Four" accounting firms or international accounting firms, they can be regarded as receiving better quality of audit. So, we use the dummy variable AnalystT and AnalystR to represent if the accounting firm is from abroad, if it is true the value equals 1, otherwise the value equals 0, and then we perform regression analysis separately. Then we use the dummy variable AuditBF and AuditIn to represent if the accounting firm is from the "Big Four" accounting firms, if it is true the value equals 1, otherwise the value equals 0. Then we return the regression results separately in Panel E, F, G and D.

It can be seen from Panel E and F that the coefficients of EPU*AnlystT and EPU*AnlystR are all significantly positive at the level of 1%, showing that firms with greater analysts' attention have higher level of corporate ESG performance in face the EPU, confirming the existence of the mediating effect of analyst

attention. Besides, Panel G and H show the regression results of audit quality. From Column (2) we can see that the coefficients of EPU*AuditBF and EPU*AuditIn are also significantly positive at the level of 1%, meaning the firms receiving better quality of audit have higher level of corporate ESG performance in face the EPU, confirming the existence of mediating effect of audit quality.

4.3.4. The heterogeneous effects of financial constraints

In this part, we examine how financial constraint moderates the relationship between EPU and corporate ESG performance. Financial constraints are defined as factors preventing firms from funding their planned investments, such as credit constraints, illiquidity and inability to borrow or issue equity (Lamont et al., 2001). Previous litterateurs generally believe that financial constraints could cause firms to limit their ESG investments as ESG practice is costly in the short term and firms may only be able to reap the requisite benefits in the long run(Attig, 2023; Leong and Yang, 2021). But in this study, how does the financial constraints would be moderating the relation between EUP and ESG permanence might be different in mechanism from previous studies. When the economic policy uncertainty EPU increases, the cash inflow of enterprises becomes unstable or decreases. At this time, enterprises with more serious financing constraints have greater demands for external financing to supplement cash flow. So, they have a stronger incentive to adopt corporate ESG performance as the measure to improve corporate image and external financing ability. Through the above analysis, we raise the assumption that financial constraint is a significant moderating variable for the relationship between economic policy uncertainty EPU and corporate ESG performance, and the more serious is the financial constraint, the more positive correlation is between economic policy uncertainty EPU and corporate ESG performance. As (Wu, 2013) and (Zhang and Hu, 2020), We use the SA index and FC index from CASMAR database to measure financing constraints. The larger the absolute values of SA and FC indexes is, the more serious the financing constraint of the firms is.

It can be seen from Panel I and G that the coefficients of economic policy uncertainty EPU*SA are 0.005, significant at the level of 1%, the coefficients of economic policy uncertainty EPU*FC are 0.001, also significant at the level of 1%. The results show that financial constraint can moderate the relationship between EPU and ESG. Specifically, firms with greater financial constraint would have stronger incentive to use ESG performance as a measure to demonstrate sustainable development image and to reduce the difficulty of external financing, which consequently lead to better corporate ESG performance than firm without serious financial constraint problems. Thus, our assumption of the existence of the moderation effect of financial constraint is confirmed.

Table 3

Main results for heterogeneous effects.

Panel A: Property right	**(1)**	**(2)**
	ESG	***ESG***
EPU	0.011***	0.011***
	(19.19)	(11.10)
SOE	**-0.088**	**0.01**
	(-0.22)	**（0.25）**
EPU*SOE		**0.001***
		(1.68)
Other Variables	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	10015	10015
Adj - R^2	0.275	0.294

Panel B：Board Size	***ESG***	***ESG***
EPU	0.006*	0.006**
	(1.94)	(2.05)
Board	**-1.415****	**-2.337**
	(-2.11)	**（-3.2）**
EPU*Board		**0.002***
		(1.89)
Other Variables	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	10015	10015
Adj - R^2	0.275	0.293
Panel C：Board Independence	***ESG***	***ESG***
EPU	0.007***	0.007***
	(3.58)	(3.80)
BoardIn	**-4.462***	**-6.05****
	(-1.79)	**（-2.46）**
EPU*BoardIn		**0.011****
		(2.26)
Other Variables	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	10015	10015
Adj - R^2	0.007***	0.007***
Panel D: InsTT	***ESG***	***ESG***
EPU	0.009***	0.008***
	(11.30)	(8.30)
InsTT	**0.002*****	-0.012
	（4.76）	(-1.46)
EPU*InsTT		**0.001*****
		(6.34)
Controls	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	10015	10015
r2_a	0.298	0.302
Panel E: Analyst teams	***ESG***	***ESG***
EPU	0.008***	0.010***
	(14.04)	(7.53)
AnlystT	-0.275**	**-0.421*****
	(-2.35)	**（-3.43）**
EPU*AnlystT		**0.001*****
		(8.00)
Controls	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes

Province FE	Yes	Yes
N	10015	10015
r2_a	0.305	0.310
Panel F: Analyst reports	***ESG***	***ESG***
EPU	0.010***	0.010***
	(23.43)	(23.43)
AnalystR	0.010***	**-5.903*** **
	(23.43)	**（-5.85）**
EPU*AnlystR		**0.008*** **
		(6.10)
Controls	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	10015	10015
r2_a	0.306	0.311
Panel G: AuditBF	***ESG***	***ESG***
EPU	0.010***	0.010***
	(22.46)	(12.11)
AuditBF	-1.448*	-1.587**
	(-1.93)	(-2.14)
EPU*AuditBF		**0.006*** **
		(6.03)
Controls	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	10015	10015
r2_a	0.296	0.312
Panel H: AuditIn	***ESG***	***ESG***
EPU	0.010***	0.011***
	(23.43)	(12.69)
AuditIn	-5.719***	-5.903***
	(-5.60)	(-5.850)
EPU*AuditIn		**0.008*** **
		(6.10)
Controls	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	10015	10015
r2_a	0.306	0.311

Panel I: SA	***ESG***	***ESG***
EPU	0.031***	0.042***
	(6.82)	(8.48)
SA	-8.695***	-6.043**
	(-3.94)	(-2.68)
EPU*SA		**0.005*** **
		(4.08)
Controls	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	10015	10015
r2_a	0.299	0.307
Panel J: FC	***ESG***	***ESG***
EPU	0.005***	0.010***
	(4.59)	(10.20)
FC	-0.002***	-0.002**
	(-3.12)	(-3.04)
EPU*FC		**0.001*** **
		(3.86)
Controls	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	10015	10015
r2_a	0.276	0.290

Note: Table 3 presents the regression results for the impact of EPU on corporate ESG performance. In column (1)，the control variables are not excluded; in column (2) they are concluded. T-values based on robust standard errors clustered by firm are reported in parentheses. *, **, and *** denote significance better than 10%,5%, and 1%, respectively.

4.4 Further analyses

To provide more substantive results, in this section, we decompose corporate ESG performance into environmental, social, and governance dimension, measured using decomposing score of ESG score collected from Bloomberg Database. The environmental, social, and governance dimension scores indicate a firm's performance in assuming environmental responsibility, commitment to the community and the degree to which its functionaries act in the best interest of its shareholders (Ranjan, 2022). This study shows that EPU has a statistically significant positive effect comprehensive corporate ESG performance and each of its dimension. These results further substantiate our hypothetical viewpoint that EPU has a statistically positive effect on corporate ESG performance, including comprehensive score and each single dimension.

Table 4

Fixed effects regression results for EPU on environmental, social and governance dimension of corporate ESG performance.

	(1)	(2)	(3)
	ESG_E	***ESG_S***	***ESG_G***
EPU	**0.014*****	**0.013*****	**0.007*****
	(11.72)	(9.46)	(11.58)
BoardS	1.318***	2.502***	0.455***
	(4.86)	(8.07)	(3.31)
BoardIND	-1.322	-1.393	-2.871**
	(-0.51)	(-0.46)	(-2.16)
ROA	0.171	-1.599	-0.660
	(0.12)	(-0.87)	(-0.88)
AE	-2.778***	-2.258***	-0.598*
	(-4.82)	(-2.99)	(-1.87)
top1	0.091**	0.138**	0.087***
	(2.19)	(2.56)	(3.22)
HH1	-7.651	-15.899**	-8.757***
	(-1.61)	(-2.54)	(-2.83)
Dual	-0.191	-0.484	-0.058
	(-0.69)	(-1.60)	(-0.44)
Age	-1.451***	0.793	-3.376***
	(-2.59)	(1.13)	(-10.26)
Lev	-0.045	-2.930***	-1.298***
	(-0.05)	(-2.68)	(-2.68)
_cons	-17.858***	-31.083***	44.086***
	(-2.73)	(-3.69)	(12.19)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Province FE	Yes	Yes	Yes
N	10015	10015	10015
r2_a	0.240	0.240	0.238

Note: Table 4 presents the regression results for the impact of EPU on corporate ESG performance. In column (1)，the control variables are not excluded; in column (2) they are concluded. T-values based on robust standard errors clustered by firm are reported in parentheses. *, **, and *** denote significance better than 10%,5%, and 1%, respectively.

4.5 Robustness tests

In this section, we undertake a number of robustness tests to reinforce the results of baseline analysis. First, we address the potential problem that a poor proxy of corporate ESG performance causes the result, because there is a lack of a commonality in the definition of ESG characteristics, attributes and standards in defining E, S and G components. The heterogeneity in rating criteria can lead agencies to have opposite opinions on the same evaluated companies and that agreement across those providers is substantially (Billio, M.; 2021). To solve this problem, we replace previous ESG index with the ESG index provided by China Securities Investment Fund Management Association (SIFMA). Compared with the international ESG index, The ESG index issued by SIFMA incorporated indicators that align with the characteristics of current development stage of China, such as information disclosure quality, penalties from China Securities Regulatory Commission, and targeted poverty alleviation. So, it should be an effective proxy for corporate ESG performance from domestic perspective Panel A of Table 5 shows that the coefficient of EPU is still positive and statistically significant with corporate ESG performance, consistent with the baseline findings in

Table 2.

To address the issue of two-way causal problem, we lag the explained variable (corporate ESG performance) by one and two years to verify if the effect of EPU and corporate ESG performance persist. If it is so, the results of the baseline results can be regarded as more robust. We generate the lag variable of corporate ESG performance as L.ESG and L2. ESG, then conduct the regression analysis again. Panel B of Table 5 shows that the coefficient of EPU is still positive and statistically significant with Corporate ESG performance lag with one year and two years, confirming that the effect of EPU and corporate ESG performance persist at least three 3 years.

To solve potential concerns that the results may be confounded by other time-invariant and firm-level characteristics that influence corporate ESG performance, we re-estimate the baseline regressions using firm, year and province fixed effects. Panel C of Table 5 suggests that the estimated coefficients of the variable EPU are significantly positive at the level of 5% after adding all the control variables, indicating that the baseline result is not driven by time-invariant firm-specific characteristics.

To further check whether the baseline results are robust to an alternative sample period. We excluded the data in of the year 2020 and 2021 when the COVID-19 pandemic broke out in Wuhan Province in China. This unexpected disaster may interference the general relationship between EPU and corporate ESG performance. In order to gain more general result, we drop the data of the year when COVID-19 pandemic broke out to gain a smaller sample without the influence of unexpected events, then we use this sample to conduct the regression analysis again. Panel D of Table 5 shows that the coefficient of EPU is still positive and statistically significant with corporate ESG performance, demonstrating that the baseline results still largely hold after this robustness check.

Table 5

Main results for heterogeneous effect.

Panel A: Replacement measure of ESG	***(1)***	***(2)***
	HZ_ESG	***HZ_ESG***
EPU	**2.163*** **	**0.001*** **
	(6.06)	**(6.87)**
Controls	No	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	22730	22730
r2_a	0.0643	0.070
Panel B: Lagged effect of EPU	***L.ESG***	***L2.ESG***
EPU	**0.012*** **	**0.009*** **
	(11.85)	**(11.26)**
Controls	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	8887	7763
r2_a	0.278	0.266
Panel C: Firm fixed effect	***ESG***	***ESG***
EPU	**0.011*** **	**0.011*** **
	(24.64)	**(11.26)**
Controls	No	Yes
Year FE	Yes	Yes

Firm FE	Yes	Yes
Province FE	Yes	Yes
N	10015	10015
r2_a	0.284	0.287
Panel D: Delete Covid-19 Sample	***ESG***	***ESG***
EPU	**0.010*** **	**0.009*** **
	(24.12)	**(11.26)**
Controls	No	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	8912	7763
r2_a	0.268	0.266

Note: Table 5 presents the regression results for robustness test tests on the relationship between EPU and corporate ESG performance. In column (1)， the control variables are not excluded; in column (2) they are concluded. T-values based on robust standard errors clustered by firm are reported in parentheses. *, **, and *** denote significance better than 10%,5%, and 1%, respectively.

5. Conclusion

With the increase of EPU in China and worldwide, Scholars have paid more attention to how EPU may affect corporate business actions. corporate ESG performance maybe an effective measure to resist EPU and attracts the attention of scholars. However, there is a lack of studies quantitatively exploring the relation between EPU and corporate ESG performance. This research contributes to the existing studies on EPU and corporate ESG practice. Moreover, it provides in-depth theoretical and empirical evidence for how EPU effects each dimension of ESG comprehensive performance, and the moderating effect by property right, internal governance, external governance and financial constraints.

Specifically, employing a multiple liner research design that enables us to establish the fix-effect impact of the EPU on corporate ESG performance, we find that the increase in EPU will motivate firms to improve overall ESG performance. Accordingly, it appears that the corporate ESG performance plays a role as a positive signal to stakeholders about the firms' sustainable development prospect, enhancing firms' capability to maintain good relationship with stakeholders and gain access to key resources for development, so as to reduce the risk bought by high level of EPU. Furthermore, we find that each dimension (environment, social and governance) of corporate ESG performance is statistically positive effected by EPU, but the effect on the dimension of environment and society is more positive than the dimension of governance, probably because assuming environment and social responsibility can better release positive signals to external investors in capital market and the public than improving internal governance. At last, the heterogeneous effect analysis show that property right nature, internal governance, external governance and financial constraint play moderating roles in the relation of EPU and ESG. Specifically, in the face with EPU, State-owned firms have higher level of corporate ESG performance because their board probably have profounder cognition and more resources to support ESG practice; Firms in better internal and external governance environment would have higher level of corporate ESG performance, because in these environments, ESG performance is valued by executives and can play a better role as signal of sustainable development prospect as well; Financial constraint would also moderate the relation between EPU and corporate ESG performance: the more severe the financial constraint is, the stronger the firms motivation is, and the corporate ESG performance level is higher.

Our study helps supplement the literature investigating the determinants of corporate ESG performance. Previous literature has only provided evidence of firm-level and industry-level factors to corporate ESG performance, whereas the macro-economic factors remained unexplored. This study fills this research gap by

exploring the correlation between EPU and corporate ESG performance. Our findings suggest that increased EPU does lead to the improvement of corporate ESG performance, and the effect exists in three dimensions of corporate ESG performance. Moreover, this study the relationship is moderated by firms' internal and external characteristic: property right, internal governance, financial constraints and external governance.

First, As the study have shown that the corporate ESG performance is an effective tool for companies to cope with risks, company managements should improve their cognition of the function of corporate ESG performance and make good use of it as so to improve the ability to reduce the impact brought by EPU. Second, as the uncertainty of economic policies increases the potential risks of enterprises, governments should try the best to maintain the stability of policies so that enterprises can predict the policy trend and stably adjust ESG decision and practice to reduce the risk they may face. Meanwhile the government can actively play a guidance role in regulating firms ESG practice and relevant information disclosure. Third, for investors in capital market, when the uncertainty of economic policy rises, the fulfillment of ESG responsibility is a tool for companies to cope with risks. When EPU rises, investors should be alert to the possible false information issued by enterprises who disclose their ESG responsibilities just as a self-interested measure.

To test the overall effect of the EPU, this study focuses only on the sample in China which is an emerging market, it is worth exploring whether conclusion holds in other kinds of market such as in developed countries or underdeveloped countries. Besides, it is worth exploring whether other internal or external factors would moderate the relation between EPU and corporate ESG performance, such as firms' profitability level, characteristics of executives, government regulations etc. In addition, a broader study of other macro environment determinants related to corporate ESG performance can be carried out, such as the cultural characteristics or legal strictness of an area.

Appendix A. Variable definitions

Variable	*Definition*
ESG	ESG composite score calculated by Bloomberg Database
EPU	Simple average of China EPU for each month of the year
BoardS	The number of directors in the board
BoardIn	The percentage of independent director on the number of board members.
Duality	Dummy variable, which equals to 1 if the chairman and CEO are one person, zero the otherwise.
LnAssets	Firm's assets scale, measured by the natural logarithm of firms' total assets.
Top1	Ownership concentration, equals to the largest shareholder shareholding ratio
HH1	The Herfindahl index of shares, equals to the sum of the squares of the shareholding ratio of the largest shareholder in this case
Age	Firm age, equals to the number of years a firm has gone public
Leverage	Financial leverage, measured by total liability divided by total asset
Soe	Dummy variable, which equals to 1 if the firm is state-owed, and 0 otherwise.
AQ	Annual evaluation results of accounting information disclosure quality of listed firms by China Securities Regulatory Commission, 1= excellent; 2= good; 3= qualified; 4= rejected.
AnlystT	Analyst concern degree, which equals to the number of analyst teams which have covered the company within a year.
AnalystR	Analyst concern degree, which equals to the number of research reports which racked and analyzed the company within a year.
AuditTop10	Dummy variable, measured by if the firm's auditors are from top 10 domestic audit firms in terms of evaluation score or income, yes=1; no=0.
AduditIn4	Dummy variable, measured by if the firm's auditors are from the international big 4 audit firms, yes=1; no=0.
Instituts	The ratio of the total number of shares held by institutional investors to the total shares of the firm.
SA	An indicator that reflects the degree of corporate financing constraints; the larger the SA index is, the lower the degree of financing constraint the firm faces
FC	Another indicator that reflects the degree of corporate financing constraints; the larger the KZ index is, the higher the degree of financing constraint the firm faces

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