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Sustainable development in natural resources industry: is geopolitical risk a catalyst for corporate excess cash holdings?

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ABSTRACT

With the outbreak of the Russia-Ukraine conflict, combined with the COVID-19 epidemic and the Federal Reserve's interest rate hike, geopolitical risks have increased sharply, which has brought great pressure on the sustainable development of natural resources industry. This study aims to discuss the impact of geopolitical risk (GPR) on corporate excess cash holdings in China's natural resources industry. The findings suggest that GRP can encourage enterprises in the natural resources industry to hold more excess cash. The findings still hold with a suite of robustness tests. The study also evidences that the above effect is more significant for state-owned enterprises, enterprises in the mining industry, and large-scale enterprises. Finally, further results show that with the increase of GPR, enterprises with strong risk-taking capacity tend to hold more excess cash, while enterprises registered in higher market-oriented regions are inclined to retain less excess cash. These findings can conduce to a deep understanding of the influence of GPR on corporate excess cash holdings and serve as a reference for policy-makers to adjust policies.

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1. Introduction

Global events such as the Russia-Ukraine war, global terrorism, COVID-19, and the Federal Reserve's interest rate hike have sharply increased geopolitical risks as the world changes unprecedented in a century accelerate. As the index of global geopolitical risk (GPR) is shown in Figure 1, since 2001 some global events have led to a dramatic increase in the GPR index, especially during the 9.11 Terrorist Attacks, the Iraq War, and the Russia-Ukraine War. The uncertainty caused by GPR will change the cognition and economic behaviors of actors, and then affect the real economy, financial market, and geo-economic pattern, and increase the uncertainty of economic policies (Wang et al., 2022). More importantly, the global geopolitical game has caused a

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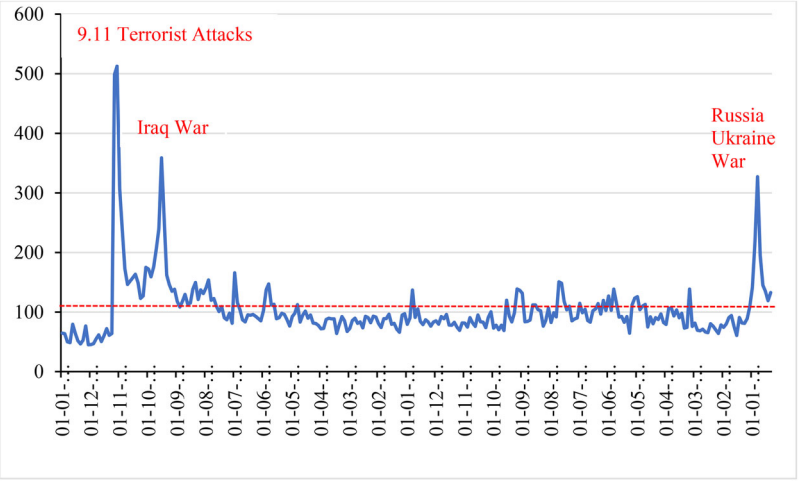

Figure 1. The index of global GPR (2000–2022).
Data source: Caldara and Iacoviello (2022).

sharp impact on the global energy market, which is a crucial factor affecting the price fluctuation of oil, natural gas, coal, and other energy sources. Correspondingly, there is no doubt that GPR has a direct impact on corporate sustainable development in the natural resources industry. Therefore, there has been an interesting and paramount significance problem to explore whether and how GPR affects corporate excess cash holdings in the natural resources industry.

Corporate cash flow is directly related to the survival and development of enterprises, and plays a very vital role in the long-term sustainable development of enterprises. Corporate cash holdings, as a highly liquid asset, are an important part of corporate decision-making behaviors and also play a crucial role in corporate sustainable development. Setting the cash holdings at a reasonable level can help enterprises avoid liquidity risks and improve business performance (Opler et al., 1999). In recent years, there has been growing interest in the topics of GPR. Scholars and practitioners have discussed its economic consequences from different perspectives, such as macroeconomy (Barros et al., 2022; Dima et al., 2016; Gu et al., 2021; Khan et al., 2022; Nguyen et al., 2022; Triki & Maatoug, 2021; Sweidan & Elbargathi, 2022), finance markets (Baur and Smales, 2020; Dogan et al., 2021; Qian et al., 2022; Qin et al., 2021; Stjepanovic et al., 2022; Su et al., 2020; Su et al., 2019), oil and gold markets (Khan et al., 2021; Su et al., 2021; Su et al., 2023). For instance, Nguyen et al. (2022) explored the influence of GPR on TFP and the inflows of FDI for emerging economies. They found that GPR negatively impacts TFP and FDI. Su et al. (2020) explored the mutual impacts between GPR and Bitcoin prices and indicated that GPR can positively affect Bitcoin prices. Sohag et al. (2022) examined the response of green investments to GPR and found that GPR can transmit positive shocks to green investments. Furthermore, some literature has documented the impact of GPR on the enterprise behaviors, such as corporate performance (Tiwari et al., 2019; Yun et al., 2021), capital structure (Khoo & Cheung, 2021), mergers and acquisitions (Shen et al., 2021), and corporate investment (Le & Tran, 2021; Su et al., 2022a). However,

there is very limited literature paid to the subject of GPR and corporate cash holdings. For example, Lee and Wang (2021) investigated whether GPR influences Chinese enterprises' cash holdings from the perspective of financial constraints. They demonstrated that enterprises with high financially constrained squint towards keeping more excess cash as a buffer against GPR. Wang et al. (2021a) focused on oil enterprises to discuss the link between GPR and corporate cash holdings. They proved that oil exploration and exploitation industries squint towards reserving more cash to confront high GPR. Demir et al. (2019) examined the link between GPR and corporate cash holdings in the shipping and hospitality industries, and they all found that enterprises in both shipping and hospitality industries reserve more cash with the increase of GPR. More importantly, little literature has discussed the influence of GPR on corporate excess cash holdings in the natural resources industry.

We intend to explore the influence of GPR on corporate excess cash holdings in the natural resources industry. There are some main reasons for discussing this topic: (1) As the largest developing country in the world, China has realized the transition from a planned economy to a market economy. In particular, China has integrated into the world economic development after joining WTO in 2001, and accordingly global GPR will inevitably affect China's economic development and corporate behaviors. (2) As the largest energy consumer and producer in the world, China's resources industry acts a pivotal part in its economic development (Shen et al., 2021). The increase of GPR will cause the fluctuation of the exchange rate and the price of crude oil and other commodities, which will inevitably affect the supply and demand of energy in China (Wang et al., 2021a). (3) With the support of China's reform and opening-up policy and the going-global strategy, a large number of Chinese resource enterprises have invested overseas in recent years. Thus, the uncertainty caused by geopolitics has increased the risks of enterprise operations. Given the above, it is an exciting topic and is valuable to discuss the impact of GPR on corporate excess cash holdings in the natural resources industry.

Taking the Chinese-listed enterprises in the natural resources industry from 2005 to 2020 as the samples, we explore the ways in which GPR affects corporate excess cash holdings in the natural resources industry. (1) We apply the GPR index proposed by Caldara and Iacoviello (2022) to discuss the influence of GPR on corporate excess cash holdings. The findings suggest that the increase of GRP will prompt enterprises to hold more excess cash. That is, enterprises in the natural resources industry will hold more excess cash with the increase of GPR, and the natural resources industryis susceptive to global geopolitical tensions. This conclusion still holds with a variety of robustness tests such as alternative measures and instrumental variable methods. (2) We further identify the heterogeneous effect of GPR on corporate excess cash holdings from three aspects: ownership, industry, and enterprise scale. The evidence from this study proves that the influence of GPR on corporate excess cash holdings varies with enterprises' characteristics. In detail, this effect is more remarkable for state-owned enterprises (SOEs), enterprises in the mining industry, and large-scale enterprises. (3) We evaluate whether the link between GPR and corporate excess cash holdings is influenced by corporate risk-taking and marketization. The findings of investigations indicate that corporate risk-taking positively moderates

the effect of GPR on corporate excess cash holdings in the natural resources industry, while marketization negatively moderates the above effect.

We make some contributions to the current literature. (1) We enrich the literature on GPR and corporate excess cash holdings. Some literature has examined the impact of GPR on corporate cash holdings in different industries, such as manufacturing (Lee & Wang, 2021), oil industry (Wang et al., 2021a), shipping industry (Kotcharin & Maneenop, 2020), and hospitality industry (Demir et al., 2019). But, up to now, there has been no reliable evidence in the natural resources industry. Therefore, this study may be the first to explore the influence of GPR on corporate cash holdings in the natural resources industry. (2) We have provided additional evidence regarding excess cash holdings relative to the industry average. The existing literature mainly focused on corporate cash holdings (e.g., Lee & Wang, 2021; Wang et al., 2021a), while our work supplements the existing literature by investigating the influence of GPR on corporate excess cash holdings in the natural resources industry. (3) We provide a deeper insight into the influence mechanism from the heterogeneity analysis, the moderating of corporate risk-taking and marketization. To date, previous literature has failed to demonstrate whether the impact of GPR varies with the different characteristics, and how risk-taking and marketization affect the relation between GPR and corporate excess cash holdings of the natural resources industry. Hence, we extend the understanding of this effect from heterogeneity and the moderating of corporate risk-taking and marketization.

The rest of this study is designed as follows: In section 2, we give a brief of theoretical analysis and hypothesis development. In section 3, we present the research design. In section 4, we discuss the key findings. In section 5, we propose a further analysis, and the final section summarizes our conclusions and policy implications.

2. Theoretical analysis and hypothesis development

2.1. GPR and corporate cash holdings

Academia has not formed a unified understanding and definition of GPR. The International Monetary Fund first highlighted the threat of GPR in its 'World Economic Outlook (2014)' and 'Global Financial Stability Report (2014)'. In 'Global Risks Report (2015)', the World Economic Forum in Davos defined GPR as a global risk that is systemic, cross-geographic, and cross-industry. It covers violent conflicts between states, civil strife in important states, large-scale terrorist attacks, the proliferation of weapons of mass destruction, and the failure of global governance. Since then, some scholars have also defined GPR, among which the most influential one is the definition proposed by Caldara & Iacoviello,(2022). They defined it as the threat, realization, and upgrade risk arising from disadvantages related to war, terrorism, and inter-state tensions affecting the peace process of international relations. They also calculated the monthly frequency of words related to geopolitical events and related threats by searching news articles published in major international English-language newspapers and then standardized them to obtain the monthly GPR index.

GPR may cause some uncertainties and have a clear impact on the financial markets, the real economy, and the geo-economic landscape. On the one hand,

geopolitical events have heightened regional tensions and have exerted a noteworthy impact on resource markets (Wang et al., 2021a; Su et al., 2022b). Especially when geopolitical events occur in major resource countries, they may lead to drastic variations in global resource prices and further affect the business activities of China's resource enterprises (Su et al., 2019). On the other hand, in the context of the 'going-out' strategy, most of China's resource enterprises have invested overseas, and geopolitical events will bring investment risks for them.

According to the real options theory, resource enterprises can make better decisions between waiting and investing immediately in the case of increased geopolitical risk (Balliauw, 2020). Based on the precautionary motive theory, as GPR intensifies the volatility of the resource market, enterprises in the natural resources industry may increase precautionary cash holdings to improve their ability to cope with uncertain risks. This may ensure plenty capital turnover in the face of future crises and challenges. In addition, most resource enterprises have a large number of fixed assets and a high fixed cost of operations (Fu & Shen, 2020). This signifies that these enterprises are inclined to hold more cash to prevent the threat of GPR to their survival (Wang et al., 2021a). Further, enterprises in the natural resources industry, especially in the oil and gas industries, are more affected by global GPR, because these risks will cause severe fluctuations in global energy supply and prices.

Given that, we propose the following hypothesis:

H1: Enterprises in the natural resources industry are inclined to hold more excess cash with the increase of GPR.

2.2. Heterogeneity analysis of GPR on corporate cash holdings

In this section, we mainly discuss the heterogeneity analysis of GPR on corporate cash holdings of resource enterprises from three aspects.

First, the natural political connection of SOEs is one of the core causes influencing enterprise decision-making in China (Khaw et al., 2016). Given the government's intervention, SOEs distort their business objectives and lack effective measures to motivate and constrain managers (Francis et al., 2009). Thus, SOEs adopt more temperate strategies in their business activities to cope with the uncertainty caused by increased geopolitical risk (Khaw et al., 2016). Because of the special governance mechanisms of SOEs, their decision-makers mainly focus on steady and sound development. Similarly, in the context of increasing GPR, they don't have any willingness to undertake the risks. On the one hand, SOEs are both 'public welfare' and 'profit-making'. That is, in addition to the pursuit of economic benefits, SOEs also undertake some social and public goals, such as regional economic development and employment, to support and serve major national strategies. On the other hand, due to the reward and punishment mechanism of SOEs, in the period of increasing GPR, their decision-makers are more inclined to reserve more excess cash to guard against various risks. Therefore, the influence of GPR on corporate excess cash holdings is more remarkable for SOEs.

Second, several prior studies such as Demir et al. (2019) and Wang et al.. (2021a) revealed that the link between GPR and corporate cash holdings differs by industry.

The natural resources industry contains some different industries, such as the coal mining industry, oil and gas extraction, and some resource-related manufacturing. Due to the different business operations of corresponding enterprises in these industries, they are affected by GPR differently. For example, Wang et al. (2021a) indicated that GPR could significantly influence the cash holdings of enterprises in the oil-related mining industry, while it has a negative or no influence on the oil-related production and service industry. Compared with manufacturing, the mining industry may reserve more excess cash in the face of rising GPR. The main reason is that China is the world's largest energy consumer and production state, but its external dependence is becoming increasingly high. For example, according to the report 'Global Oil and Gas Exploration and Development Situation and Oil Company Dynamics (2022)', oil and gas consumption continues to grow in China, and its dependence on foreign countries remains high, reaching 72.2% and 46% respectively in 2021. When some geopolitical events happen in some countries, international energy prices and supply and demand will change violently. In this situation, these enterprises in the mining industry will reserve more excess cash when the GPR increases.

Third, both large- and small-scale enterprises have a precautionary incentive to hold more cash when GPR rises. But compared with small-scale enterprises, large-scale ones need to hold more excess cash under the background of the increase of GPR. On the one hand, most large-scale enterprises in the natural resources industry have made overseas investments. As geopolitical relationships change, the risks become more unpredictable. On the other hand, large-scale enterprises have more assets and plentiful funds, and have stronger financing ability and more financing channels. However, small-scale enterprises face relatively high financing constraints, it is relatively more difficult to obtain more financial support through other channels. Thus, large-scale enterprises will reserve more excess cash when the GPR increases.

Given that, we propose the following hypotheses:

H2a: SOEs are inclined to hold more excess cash with the increase of GPR.

H2b: Enterprises in the mining industry are inclined to hold more excess cash with the increase of GPR.

H2c: Large-scale enterprises are inclined to hold more excess cash with the increase of GPR.

2.3. Geopolitical risk, corporate risk-taking and excess cash holdings

Corporate risk-taking refers to the decision-making attitude of enterprises under uncertain environments, which reflects the tendency of enterprises to chase high profits in the market and be willing to pay the price (Acharya et al., 2011). It extends from low-risk to high-risk levels (Zhang et al., 2021). For instance, enterprises with high risk-taking are less likely to waive high-yield opportunities. Some prior literature revealed that enterprises are more willing to engage in stronger risk-taking as economic policy uncertainty increases (Chatjuthamard et al., 2019; Zhang et al., 2021). When the uncertainty brought by geopolitical events increases, resource enterprises with high risk-taking stand a chance to seize the opportunities. Accordingly, when

these enterprises with low risk-taking capacity hesitate to get better investment opportunities, it is more conducive for enterprises with strong risk-taking capacity to increase investment. Hence, with the increase of geopolitical risks, enterprises with strong risk-taking capacity hold more excess cash and wait for better investment opportunities, to obtain more significant development or higher returns.

Given that, we propose the following hypothesis:

H3: As GPR increases, enterprises with high risk-taking capacity tend to hold more excess cash.

2.4. Geopolitical risk, marketization and corporate cash holdings

Over the past 40 years, China has successfully transformed its economy from a planned economy to a market economy. Among them, marketization is a vital index that reflects the role of the market in resource allocation (Liu et al., 2021b). Generally speaking, if the marketization degree of a region is higher, the region will have more advantages, such as well political and business relations, and a mature product and factor market. More importantly, China covers a broad land and has uneven regional development levels, and the marketization degree varies greatly depending on the regional development. In a region with a high marketization degree, the corresponding government intervenes less in the market. This provides a more convenient and relaxed environment for enterprises to obtain capital financing. This can effectively alleviate financing constraints and help enterprises to get funds flexibly. The corporate excess cash holdings in the natural resources industry are not only affected by their characteristics, but also by their environment to a large extent. Therefore, under different degrees of marketization, GPR may have different impacts on the corporate excess cash holdings in the natural resources industry.

Given that, we propose the following hypothesis:

H4: As the marketization increases, GPR will have less impact on corporate excess cash holdings in the natural resources industry.

3. Research design

3.1. Sample

We use the listed enterprises in China's natural resources industry from 2005 to 2020 to explore the influence of GPR on corporate excess cash holdings. The natural resources industry includes three categories: the mining industry, some resource-related manufacturing, and the production and supply of electricity, heat, gas and water. All enterprise-related data are collected from Wind data. The news-based index of GPR proposed by Caldara and Iacoviello (2022) are downloaded from https://www.matteoiacoviello.com/gpr.htm on October 2022. Finally, we process the data from the following criteria: (1) expelling the enterprises listed on the Chinese Sci-Tech Innovation Board and New Over-The-Counter Market; (2) expelling enterprises with too much missing data; (3) expelling the special treatment (ST) enterprises; (4) winsorizing all continuous variables at the 1st and 99th percentiles.

3.2. Variables

3.2.1. Corporate excess cash holdings

Corporate excess cash holdings are the explained variable. They are evaluated using the difference between an enterprise's actual cash holdings and the industry average level of holdings. Specifically, following Zhi and Zhou (2021), the enterprise's actual cash holdings are calculated in the following three measures: (1) The first measure is calculated by the share of monetary funds and net short-term investments in net assets, where net assets are equal to the total assets minus the difference between monetary funds and net short-term investments. The excess cash holdings calculated in this measure are recorded as *Ex_cash*1. (2) The second measure is calculated as the share of monetary funds and net short-term investments in total assets. The excess cash holdings calculated using this method are denoted as *Ex_cash*2. (3) The third measure is calculated by the share of the money funds in total assets, where money funds include cash and cash equivalents, restricted cash or special currency equivalents. The excess cash holdings calculated using this method are denoted as *Ex_cash*3. Finally, we adopt *Ex_cash*1 to conduct the baseline regression and use *Ex_cash*2 and *Ex_cash*3 to carry out the robustness tests.

3.2.2. GPR

The GPR is the explanatory variable in this study. Following Lee and Wang (2021), and Wang et al. (2021a, 2021b), we construct an annual GPR index using means of monthly China's GPR index (Caldara & Iacoviello, 2022). We apply China's GPR index to carry out the regression and use GPR threat (GPRT), another component index of GPR, to conduct the robustness test.

3.2.3. Control variables

Following Lin et al. (2019) and Tian et al. (2020), we control the following variables: enterprise scale (lnAsset) is proxied by the natural log of total assets. Enterprise age (Age) is presented by the natural log of the number of years since the enterprise was established. Leverage (Lev) is proxied by the share of total liabilities in total assets. Capital expenditure (lnCap) is proxied by the natural log of capital expenditure. ROA is proxied by the share of net profit in total assets. Executive shareholding (Ex_Shr) is proxied by the proportion of executive shareholding to the total number of shares for an enterprise. The proportion of independent directors (InDr_Rat) is presented using the share of independent directors in all directors. Executive salary (lnEx_Salary) is proxied by the natural log of executives' salary. SOE is proxied by the ownership of enterprise; if the ownership belongs to the stated ownership of enterprise, SOE equals 1, otherwise 0.

3.3. Empirical model

We construct Model (1) to explore the influence of GPR on corporate excess cash holdings in the natural resources industry, and specify it as follows:

$$Y_{it} = \alpha_0 + \beta_1 GPR_t + \sum \lambda Control_{it} + u_i + \varepsilon_{it} \quad (1)$$

where Y denotes the corporate excess cash holdings; *GPR* denotes China's geopolitical risk; *Control* denotes the control variables; i and t respectively represent enterprise and year; μ_i represents enterprise fixed effect; ε_{it} is the random disturbance term.

4. Empirical analysis and discussion

4.1. Descriptive statistics

We report the descriptive statistics of all variables in Table 1. We can find that all the mean values of three proxy variables *Ex_cash*1, *Ex_cash*2, and *Ex_cash*3 of corporate excess cash holdings are almost the same. However, the standard deviation, minimum and maximum values of *Ex_cash*1 are significantly larger than those of the other two variables. These results indicate that corporate excess cash holdings of samples are less than that of the corresponding industry, but there are big differences between them. For the geopolitical risk variables of GPR and GPRT, all the indicators are basically no significant differences. Due to all other variables being within the normal range, we do not detailly analyze them.

4.2. Baseline regression

We report the baseline results in Table 2. Among them, Columns (1) and (2) are the estimates using enterprise fixed effect, and Columns (3) and (4) are the estimates using industry and city fixed effects.

The results manifest that all the estimates of GPR are significant and positive at traditional statistics levels. This suggests that higher GRP is associated with higher excess cash holdings of enterprises in the natural resources industry. This finding confirms Hypothesis H1. Specificity, the coefficients of GPR in Columns (2) and (4) are 0.061 and 0.064, respectively ($p < 0.05$). These results demonstrate that for every 1% increase in GPR, enterprises in the resources industry will increase their excess cash holdings by roughly 6.1–6.4%. These conclusions are in accordance with Kotcharin and Maneenop

Table 1. Descriptive statistics results.

Variables	Obs	Mean	Std. Dev.	Median	Min	Max
Ex_cash1	3729	−0.02	0.20	−0.06	−0.39	1.02
Ex_cash2	3729	−0.01	0.10	−0.03	−0.19	0.39
Ex_cash3	3729	−0.01	0.10	−0.03	−0.19	0.38
GPR	3729	4.55	0.12	4.59	4.40	4.86
GPRT	3729	4.55	0.16	4.51	4.31	4.81
R_taking1	3729	0.04	0.04	0.02	0.00	0.25
R_taking2	3729	0.07	0.08	0.04	0.00	0.47
Market	3729	7.05	2.01	6.93	−1.42	11.71
lnAsset	3729	22.63	1.61	22.58	18.96	26.75
lnAge	3729	1.00	0.15	1.02	0.58	1.25
Lev	3729	0.53	0.21	0.54	0.06	1.22
ROA	3729	0.02	0.07	0.03	−0.38	0.22
lnCapexp	3714	19.41	2.21	19.55	11.9	24.17
Ex_Shr	3728	1.55	6.78	0.00	0.00	57.72
lnDr_Rat	3728	37.27	8.35	36.36	0.00	75.00
lnEx_Salary	3716	14.94	0.84	14.99	12.62	16.80
SOE	3699	0.68	0.47	1.00	0.00	1.00

Source: Author estimation.

Table 2. Baseline results.

	*Ex_cash*1			
Explained variables	(1)	(2)	(3)	(4)
GPR	0.093***	0.061**	0.092***	0.064**
	(3.83)	(2.44)	(3.17)	(2.22)
lnAsset		0.015**		−0.009*
		(2.03)		(−1.88)
lnAge		−0.174***		−0.086**
		(−2.90)		(−2.06)
Lev		−0.258***		−0.264***
		(−8.84)		(−11.29)
SOA		0.093		0.145**
		(1.52)		(2.35)
lnCapexp		−0.017***		−0.008***
		(−4.86)		(−2.59)
Ex_Shr		0.012*		0.013**
		(1.71)		(2.51)
lnEx_Rat		0.006***		0.003***
		(5.10)		(3.73)
lnD_Salary		0.000		0.001*
		(0.22)		(1.93)
SOE		0.004		−0.014
		(0.17)		(−1.44)
Enterprise fixed effect	Yes	Yes	No	No
Industry fixed effect	No	No	Yes	Yes
City fixed effect	No	No	Yes	Yes
Observations	3,724	3,672	3,729	3,677
Adjusted R2	0.328	0.392	0.016	0.158

***$p \leq 0.01$,
**$p \leq 0.05$, and
*$p \leq 0.10$. *t*-statistics are in parentheses.
Source: Author estimation.

(2020), Wang et al. (2021a), and Lee and Wang (2021). The main reason is that with the further acceleration of China's opening to the outside world, the international complex situation and GPR have a stronger impact on enterprises' behaviors (Lee & Wang, 2021). For resource enterprises, on the one hand, the uncertainty caused by GPR will make these enterprises delay their investment decisions and reduce any economic decisions with high sunk costs or uncertain returns. On the other hand, GPR may cause global economic growth to slow or even recession, and the prices of crude oil and other commodities to swing sharply. Therefore, these enterprises in the natural resources industry are apt to reserve more cash to alleviate the shocks from geopolitical events such as Russia-Ukraine war, global terrorism, COVID-19 and the Federal Reserve's interest rate hike. For the control variables, most of the coefficients are consistent with the theoretical expectations. Due to the potential endogeneity of control variables and the complexity of influencing corporate excess cash holdings, we pay less attention to the coefficients of control variables.

4.3. Heterogeneity analysis

The baseline regression indicates that enterprises in the natural resources industry are apt to hold more excess cash with the increase of GPR. Nonetheless, is there heterogeneity in the influence of GPR on excess cash holdings of enterprises with different characteristics? To answer this question, we further explore the heterogeneous impact

Table 3. Heterogeneity analysis results.

	Explained variables: *Ex_cash*1						
	SOE (1)	Non-SOE (2)	Industry1 (3)	Industry2 (4)	Industry3 (5)	Large (6)	Small (7)
GPR	0.105***	−0.050	0.177***	0.008	0.061	0.068*	0.056**
	(4.22)	(−0.95)	(3.41)	(0.19)	(1.64)	(1.82)	(1.99)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Enterprises fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,483	1,174	961	1,441	1,263	501	3,154
Adjusted R2	0.403	0.426	0.466	0.361	0.408	0.403	0.400
Chow test *p*-value	0.000***		0.000*** [a]			0.000***	

***$p \leq 0.01$,
**$p \leq 0.05$, and
*$p \leq 0.10$; *t*-statistics are in parentheses.
Note a: All *p*-values of Chow tests are significant at the 1% level for *Industry1* versus *Industry2*, and *Industry1* versus *Industry3*.
Source: Author estimation.

of GPR on resource enterprises with different characteristics (such as ownership, industry, and scale).

4.3.1. Ownership heterogeneity

Ownership is the main factor affecting the link between GPR and corporate excess cash holdings. According to the enterprise's ownership, we divide all samples into SOEs and non-SOEs to discuss the above issues. The estimates of ownership heterogeneity are given in Columns (1) and (2) of Table 3.

The results suggest that the estimate of GPR for SOEs is positive at the 1% level (its coefficient is 0.105, p-value$<$ 0.01). While the estimate of GPR for non-SOEs is negative but not significant at the traditional levels (its coefficient is −0.050, p-value $>$ 0.10). Further, we apply the Chow test to compare the group differences of coefficients, and the result evidences that there is a significant structural change between SOEs and non-SOEs (p-value $<$ 0.01). These findings prove that there is a remarkable difference in the impact of GPR on excess cash holdings of SOEs and non-SOEs, thus supporting Hypothesis H2a. Namely, compared with non-SOEs, SOEs in the natural resources industry are inclined to reserve more excess cash holdings when GPR increases.

The main reason for these findings is that SOEs have special internal governance and reward and punishment mechanisms (Zhang et al., 2021). When the GPR rises, SOEs are more reluctant to take risks and pay more attention to corporate stability and social responsibility. Furthermore, the political view of SOEs holds that SOEs have natural political connections and are constrained by political and social objectives. Therefore, compared with non-SOEs, SOEs may increase their cash holdings to protect against geopolitical uncertainties and other risks.

4.3.2. Industry heterogeneity

The influence of GPR on corporate excess cash holdings in the natural resources industry may vary with the industries. As the samples are shown in Section 3.1, this study separates the samples into three industries, including the mining industry (*Industry*1), manufacturing (*Industry*2), and production and supply of electricity,

heat, gas and water (*Industry*3) to discuss the heterogeneity effect between GPR and excess cash holdings in the natural resources industry. We present the estimates in Columns (3)—(5) of Table 3.

We can find that only the estimate of GPR for the mining industry (*Industry*1) is significantly positive at the 1% level (its coefficient is 0.177, p-value < 0.01). Whereas, the coefficients of GPR for manufacturing (*Industry*2) and production and supply of electricity, heat, gas and water (*Industry*3) are positive but not significant at the traditional statistics levels (their coefficients are 0.008 and 0.061, p-values >0.10). Similarly, we apply the Chow test to examine the group differences of coefficients between *Industry*1 and the other two industries (*Industry*2 *and Industry*3), and the results suggest that there is a significant structural change among them (p-value <0.01). The above results evidence that GPR will exert a more significant influence on corporate excess cash holdings of the mining industry, while they have no significant impact on the other two industries. These results confirm Hypothesis H2b.

One explanation for these differences is that China is the world's largest energy consumer and is increasingly dependent on other countries for energy consumption. While GPR will cause the volatility of energy prices and affect the operation behavior of Chinese energy enterprises (Wang et al., 2021a). Furthermore, the mining industry mainly includes coal mining and oil extraction enterprises. Under the 'going global' strategy, these enterprises have entered the global energy market and expanded their overseas business scale (Wang et al., 2021a). Thus, compared with other industries, enterprises in the mining industry will store more excess cash holdings to cope with the rising of GPR.

4.3.3. Scale heterogeneity

Enterprise size may directly affect the motivation and ability of excess cash holding of resource enterprises. We discuss the influence of GPR on corporate excess cash holdings in the natural resources industry from the perspective of enterprise scale. We divide the samples into large-scale and small-scale enterprises according to their main business income and report the estimates of scale heterogeneity in Table 3.

The estimates in Columns (6) and (7) indicate that all coefficients of GPR are positive and significant at the traditional levels (their values are 0.068 and 0.056, and p-values < 0.10). Further, we also apply the Chow test to test the differences between large-scale and small-scale enterprises, and the results suggest that there is a significant structural change among them (p-value <0.01). The above results prove that with the increase of GPR, both large-scale and small-scale enterprises will increase their excess cash holdings, but large-scale enterprises will increase more excess cash holdings. Thus, these results confirm Hypothesis H2a. The main reason for these findings is that, although large-scale enterprises have more obvious advantages such as social capital and financial capital support to bear high risks, both large-scale and small-scale enterprises will increase their excess cash holdings to prevent various uncertainties with the increase of GPR. In particular, facing the increase of GPR, large-scale enterprises need to keep more cash in reserve to guard against uncertainty than small ones.

4.4. Robustness tests

4.4.1. Alternative measures for corporate excess cash holdings

The above findings confirm that high GPR will promote resource enterprises to increase their excess cash holdings. To affirm the robustness of the above conclusions, we adopt *Ex_cash*2 and *Ex_cash*3 (the definitions are given in Section 3.2.1.) as the alternative measures of corporate excess cash holdings to perform the robustness tests. We give the specific estimates in Table 4. As shown in Columns (1) and (2), after controlling for enterprise fixed effect, the estimates of GPR are still positive at the 1% level (they all have a value of 0.025, and p-values < 0.01). Although the coefficients are different from the baseline regression results, they still indicate that the increase of GPR can significantly promote corporate excess cash holdings in the natural resources industry. These results agree with the baseline results, which further indicates that the above conclusions of this study are robust.

4.4.2. Alternative measures of GPR

This section substitutes the measures of GPR to examine the robustness of the above conclusions. We adopt the GPR threat (GPRT) to perform our robustness test and present the estimate in Column (3) of Table 4. We can find that the estimate of GPRT is significant and positive at the 1% level (the coefficient is 0.096, and p-value <0.01). This finding further substantiates that GPR has a significant impact on corporate excess cash holdings in the natural resources industry, which aligns with the above conclusions.

4.4.3. Instrumental variable (IV) method

Although we control many related variables that might affect corporate excess cash holdings in the above analysis, it is impossible to fully exclude endogeneity. In detail, the endogenous problem caused by inverse causality is not serious because the corporate excess cash holdings do not directly affect GPR at the national level. We still apply the instrumental variable methods including two-stage least square (2SLS) and generalized method of moments (GMM) to conduct the endogeneity tests. Referring to Wang et al. (2021a) and Zhang et al. (2021), we apply two instrumental variables, namely the GPR of the United States and a political risk measure from the ICRG database as the instrumental variables of GPR.

Table 4. Robustness test: alternative measures.

	Alternative measures of corporate excess cash holdings		Alternative measures of GPR
Variables	Ex_cash2 (1)	Ex_cash3 (2)	GPRT (3)
GPR	0.037***	0.039***	
	(2.85)	(3.03)	
GPRT			0.096***
			(4.05)
Controls	Yes	Yes	Yes
Enterprise fixed effect	Yes	Yes	Yes
Observations	3,665	3,665	3,665
Adjusted R2	0.392	0.392	0.319

***$p \leq 0.01$; t-statistics are in parentheses.
Source: Author estimation.

Table 5. IV results.

Variables	2SLS (1)	GMM (2)
GPR_IV	0.096***	0.089***
	(3.03)	(2.86)
Controls	Yes	Yes
Enterprise fixed effect	Yes	Yes
Observations	3,665	3,665
R2	0.046	0.046
Kleibergen-Paap Wald rk LM statistic	1052.22	1052.22
Cragg-Donald Wald F statistic	14909.00	14909.00
Kleibergen-Paap Wald rk F statistic	23957.99	23957.99
Hansen J statistic	1.351	1.351
	[0.2451]	[0.2451]

***$p \leq 0.01$; *t*-statistics are in parentheses, and *p*-values are in square brackets. This table only reports the second-stage regression results.
Source: Author estimation.

We present the estimates of the IV method in Table 5. The suitability statistics of IV such as the LM statistic and F statistic indicate that these two variables are suitable instrumental variables for GPR. The results in Columns (1) and (2) indicate that, after applying the GPR measure from the ICRG database and the GPR of the United States as the instrumental variables, all the estimates of GPR are still positive at the 1% level (the coefficients are 0.096 and 0.089, and *p*-values <0.01). These findings further prove that the previous conclusions are credible.

5. Further analysis

5.1. The role of corporate risk-taking

The uncertainty caused by GPR will affect the risk perception and behavior of enterprises and then affect the corporate excess cash holdings. We further explore whether corporate risk-taking is a crucial path for GPR to affect corporate excess cash holdings in the natural resources industry. Following Khaw et al. (2016), we adopt the standard deviation of overlapping three-year ROA to measure corporate risk-taking (*Risk*). Given the above, the model is constructed as follows:

$$Y_{it} = \alpha_0 + \beta_1 GPR_t + \beta_2 Risk_{it} + \beta_3 GPR_t \times Risk_{it} + \sum \lambda Control_{it} + u_i + \varepsilon_{it} \quad (2)$$

where *Risk* denotes corporate risk-taking; *GPR*×*Risk* is the interaction term, and its corresponding coefficient β_3 is the main interest of this study; the other variables are the same as the model (1).

We report the estimated results of the role of corporate risk-taking in Columns (1) of Table 6. The regressions contain the control variables and use the enterprise fixed effect. We can find that the estimate of GPR × Risk on corporate cash holdings is positive at the 1% level (its coefficient is 1.942, and *p*-value <0.01). This suggests that corporate risk-taking positively moderates the influence of GPR on excess cash holdings of natural resource enterprises. Namely, the more risk-taking enterprises are, the more excess cash they will hold as the GPR increases. One explanation for this finding is that the increased GPR will be a great opportunity for enterprises with a strong risk-taking capacity to seize the opportunity. The increase in GPR is more contributes to these enterprises amplifying

Table 6. The results of risk-taking and marketization.

Variables	Risk-taking (1)	Marketization (2)
GPR	0.012	0.363**
	(0.32)	(2.43)
Risk	−9.265***	
	(−2.69)	
GPR × Risk	1.942***	
	(2.61)	
Market		0.168*
		(1.84)
GPR × Market		−0.036*
		(−1.77)
Controls	Yes	Yes
Enterprise fixed effect	Yes	Yes
Observations	3,665	3,381
Adjusted R2	0.322	0.321

***$p \leq 0.01$,
**$p \leq 0.05$, and
*$p \leq 0.10$; *t*-statistics are in parentheses.
Source: Author estimation.

their investment, to obtain more significant development or higher returns (Zhang et al., 2021). Thus, these resource enterprises will hold more excess cash to look for opportunities to invest. On the contrary, enterprises with low risk-taking capacity will take precautions to avoid losses brought by the increase of GPR. Therefore, compared with enterprises with low risk-taking capacity, enterprises with high risk-taking capacity tend to hold more excess cash in the natural resources industry.

5.2. The role of marketization

The corporate excess cash holdings in the natural resources industry are not only affected by their characteristics, but also by the environment to a large extent. China is a vast country with an unbalanced regional development, and thus marketization degree also has great differences among the different regions (Liu et al., 2021a; Zhang et al., 2022). Under different marketization levels of regions, GPR may have different impacts on corporate excess cash holdings in the natural resources industry. Therefore, we further explore whether the link between GPR and corporate excess cash holdings is influenced by the marketization degree. The model is constructed as follows:

$$Y_{it} = \alpha_0 + \beta_1 GPR_t + \beta_2 Market_{it} + \beta_3 GPR_t \times Market_{it} + \sum \lambda Control_{it} + u_i + \varepsilon_{it} \quad (3)$$

where *Market* denotes the marketization degree, which is expressed by extrapolated Fan Gang marketization index from 1997 to 2020[1]; *GPR*×*Market* is the interaction term, and its corresponding coefficient β_3 is our main interest; the other variables are the same as the model (1).

We present the estimates of the role of marketization in Column (2) of Table 6. As shown, the estimate of GPR × Market is negative at the 10% level (its coefficient is −0.036, and *p*-value <0.10). This indicates that marketization can significant negative moderate the link between GPR and corporate excess cash holdings in the natural resources industry. In other words, in regions with a higher degree of marketization,

enterprises are apt to retain less excess cash holdings with the increase of GPR. A possible explanation for this is that the higher the marketization degree of regions, means these regions have more advantages in many aspects, such as good government-business relations, mature product markets, active product and factor markets, and perfect intermediary organizations. These advantages provide a more convenient and relaxed environment for enterprises to obtain fund financing and alleviate the financing constraints faced by resource enterprises in urgent need of cash. On the contrary, when the marketization degree is low in the regions where enterprises are located, it means that these regions have deficiencies in the business environment and other aspects. These deficiencies increase the financing constraints of enterprises and make it difficult to obtain external funds.

6. Conclusion and implications

This study set out to explore whether and how GPR influences corporate excess cash holdings in the natural resources industry by applying Chinese-listed enterprises from 2005 to 2020. First, we adopt the GPR index as the proxy measure of GPR to investigate the influence of GPR on corporate excess cash holdings in the natural resources industry. The most obvious finding to emerge from this study is that enterprises in the natural resources industry will hold more excess cash when GPR increases, and the resource industries are sensitive to global geopolitical tensions. Second, we discuss the heterogeneous effect of GPR on corporate excess cash holdings in the natural resources industry from the aspect of ownership, industry, and scale. The most crucial finding is that the influence of GPR on corporate excess cash holdings in the natural resources industry is heterogeneous according to enterprise characteristics. More importantly, this promoting effect is more significant for SOEs, enterprises in mining industries, and large-scale enterprises. Third, we investigate whether corporate risk-taking and marketization moderate the impact of GPR on corporate excess cash holdings in the natural resources industry. The investigations have shown that corporate risk-taking positively moderates the influence of GPR on corporate excess cash holdings of the natural resources industry, while marketization negatively moderates this effect. That is, as GPR increases, enterprises with high risk-taking capacity tend to reserve more excess cash, while enterprises located in higher market-oriented regions are inclined to retain less excess cash.

This study provides two important implications: first, this study states that GPR can exert a positive effect on corporate excess cash in the natural resources industry. Hence, when GPR increases, enterprises in the natural resources industry should not only reserve more excess cash but also pay more attention to the investment opportunities brought by GPR, especially those with strong risk-taking capacity. Second, the policymakers should pay attention to GPR and monitor its trend, and introduce relevant policies to guide resource enterprises to properly reserve cash, especially those involved in commodity trading. Third, the policymakers should give more attention to the influence of GPR on non-SOEs and small-scale enterprises, and provide responsive policies to reduce the risks brought by GPR. Finally, the policymakers should continue to deepen the reform of 'deregulation and service' and optimize the

business environment. When GPR increases, policymakers should take into account the characteristics of resource-related enterprises and introduce corresponding financial support policies to help these enterprises cope with geopolitical threats.

Finally, Finally, there are some significant limitations that need to be further considered in future research. The first one is that our study only discusses the influence of China's GPR on corporate excess cash in the natural resources industry. It is recommended that future research could explore the impact of GPR brought about by the Russia-Ukraine war, global terrorism, and COVID-19 on corporate excess cash. The other one is that our study only considered the influence mechanisms from corporate risk-taking and marketization degree. It is worthwhile to further discuss the influence mechanisms from other aspects such as the business environment and financing constraints in future research.

Note

1. Data source: https://www.wind.com.cn/

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Disclosure statement

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