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A Study of the Effect of Patient Capital on Climate Transition Risk Disclosure by Energy Companies

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Abstract: This paper examines the impact of patient capital on the climate transition risk disclosure of energy companies and its mechanism of action, using Chinese A-share listed energy companies from 2015 to 2023. It is found that patient capital can significantly improve the level of climate transition risk disclosure of energy companies, and the conclusion still holds after a series of robustness tests. Further mechanism analysis shows that patient capital plays a positive role through two pathways: optimizing internal governance and strengthening external monitoring.

1. Introduction

Driven by the deepening global consensus on carbon neutrality and low-carbon energy transition, The Climate Change Financial Disclosure Framework (TCFD) is reshaping the corporate risk management paradigm. Disclosure of climate transition risks is a key part of addressing the global climate change challenge and an important reflection of corporate sustainability [1]. With increasing global attention on climate change issues, there is a growing demand from regulators, investors and other stakeholders for companies to disclose their climate transition risks [2]. However, companies face many challenges in disclosing climate transition risk information, such as high disclosure costs, information complexity, and short-term reactions from stakeholders [3]. And energy companies, as the main body of carbon emissions, have a complex and uncertain transition process. Therefore, exploring how to improve the level of climate transition risk disclosure of energy companies to enhance market transparency and corporate sustainability has become an important issue in current academic and practical circles.

In recent years, with the rise of the concept of long-term investment, patient capital has been gradually emphasized as an important source of financing. The Chinese government has also actively promoted this long-term investment model, encouraging capital to flow into areas with long-term development potential to promote sustainable economic development. The long-term capital injection brought by patient capital can effectively alleviate the short-term financial pressure of enterprises, help enterprise management break through the limitations of strategic decision-making, and reduce the constraints of stakeholders [4]. Unlike capital that seeks short-term profits, the stability and long-

term nature of patient capital enables enterprises to get rid of excessive attention to short-term financial indicators and instead focus on long-term strategic planning and sustainable development [5]. This long-term perspective not only encourages management to take a more active stance on climate change risk disclosure, thereby breaking the "disclosure inertia" dilemma, but also provides companies with a sustained motivation to address the challenges of climate change and pushes them to make substantial progress in environmental sustainability.

In view of this, this paper selects Chinese A-share listed energy companies from 2015-2023 as the research object, and empirically analyzes the relationship between patient capital and climate transition risk disclosure. The results show that patient capital can significantly improve the climate transition risk disclosure of energy companies, and the conclusion still holds after a series of robustness tests. The influence path test found that patient capital can exert governance effect and monitoring effect, i.e., optimize internal governance and strengthen external monitoring role, so as to improve their climate transition risk disclosure.

The possible marginal contributions of this paper are (1) Reveals the significant positive impact of patient capital on corporate climate transition risk disclosure through empirical analysis, providing a new perspective for understanding the multiple drivers of corporate non-financial information disclosure and enriching research on the influencing factors of climate transition risk disclosure; (2) enriches the research on the corporate governance of patient capital from the perspective of climate transition risk disclosure by examining the impact of patient capital based on non-financial information holdings on corporate climate transition risk disclosure, further expanding the boundaries of the theoretical application of patient capital in corporate governance and providing new empirical evidence for the corporate governance effect of patient capital; (3) clarifies the path of the role of patient capital and verifies its positive impact on corporate climate transition risk disclosure.

2. Theoretical analysis and hypothesis formulation

Climate transition risk disclosure is an important part of a company's non-financial information and is of great importance for the sustainable development of companies. With the growing global concern about climate change, there is an increasing demand from regulators, investors and other stakeholders for companies to disclose their climate transition risks. However, companies face a number of challenges in disclosing climate transition risk information. In the short term, disclosure of such information may lead stakeholders to take actions that are detrimental to the company, such as adjusting investment strategies or triggering stock price volatility [6]. However, the long-term value creation effect is significant, as disclosure builds reputational capital and enhances stakeholder trust by communicating the firm's commitment to climate responsibility; at the same time, transparent data provides investors with a basis for decision-making, optimizes the efficiency of resource allocation, and thus increases the level of corporate climate governance and sustainable competitiveness [7].

The main constraints on the level of corporate climate transition risk disclosure are the strategic determination of management and the effectiveness of stakeholder constraints [8]. In this context, the intervention of patient capital provides important support to enterprises, and the long-term financial support of patient capital can alleviate the short-term financial pressure of enterprises, which helps to break through these constraints and improve the quality of climate transition risk disclosure [9]. Compared with short-term profit-seeking capital, patient capital's long-term nature and high risk tolerance can make enterprises stop focusing on short-term financial indicators and expand their horizons to long-term strategic planning and sustainable development. This long-term perspective not only helps management make more positive decisions in disclosing climate transition risks, but also effectively breaks the "disclosure inertia" of companies.

Disclosure ability and willingness are key factors influencing the disclosure of climate transition risk of energy enterprises. While optimizing internal governance and enhancing external supervision can improve energy enterprises' ability and willingness to disclose, which is an effective way to promote energy enterprises' climate transition risk disclosure. Therefore, this paper explores the effect of patient capital on energy enterprises' climate transition risk disclosure from the perspective of internal governance mechanism and external supervision mechanism.

From the perspective of governance effect, patient capital can actively participate in corporate governance [10] by improving the quality of internal governance of enterprises, and then promote the disclosure of climate transition risk information. The introduction of patient capital brings long-term stable financial support to enterprises, which not only alleviates the financial pressure of enterprises, but also provides resources for enterprises to optimize internal governance [11]. On the one hand, the introduction of patient capital brings long-term stable financial support to enterprises, which not only alleviates the financial pressure of enterprises, but also provides resources for enterprises to optimize internal governance. In addition, patient capital is usually accompanied by a more perfect governance mechanism and supervision system, which helps enterprises to establish a more scientific and reasonable decision-making process and internal control mechanism. This optimized governance structure enables enterprises to respond and adapt more actively to the challenges posed by environmental changes in the face of external supervision and market pressure [5]. On the other hand, optimizing internal governance can significantly improve the quality and transparency of energy companies' climate change risk disclosure. Good internal governance can ensure that companies fully consider climate transition risks in their decision-making process, and integrate climate transition risks into their strategic planning and daily operations by establishing effective risk assessment and management mechanisms [12]. Improving internal governance can enhance energy companies' awareness and ability to disclose information, leading companies to more actively disclose climate transition risk information and meet stakeholders' environmental information needs [13].

From the perspective of monitoring effect, patient capital can strengthen external monitoring and promote disclosure of climate transition risks by attracting media attention. Due to its own characteristics, the investment strategy of patient capital will attract the attention of external monitoring forces such as the media, regulators, and non-governmental organizations (NGOs), thus creating public opinion monitoring pressure and regulatory scrutiny, and thus promoting the disclosure of information on climate transition risks. On the one hand, the investment behavior of patient capital usually attracts high market attention, and its investment decisions are often regarded as key signals for the long-term development of companies. The media's tracking of this investment behavior not only increases the transparency of corporate behavior, but also potentially triggers public concern and discussion about corporate climate action. This public scrutiny pressure prompts companies to pay more attention to their reputation and image, and thus to be more proactive in disclosing climate transition risks [14]. On the other hand, as global attention to climate change issues increases, investors are becoming more aware of the impact of climate transition risks on the long-term value of companies [3]. Media reports not only increase market sensitivity to corporate climate transition risks, but also prompt investors to pay more attention to corporate climate transition risk disclosure. When evaluating the investment value of companies, investors will pay more attention to companies' disclosure of climate transition risks and their ability to manage them. In order to attract and retain investors, companies will pay more attention to the quality of climate transition risk disclosure to enhance investor confidence and increase their market value [2]. This increased market sensitivity not only encourages companies to disclose climate transition risk information in a more transparent way, but also makes the disclosure process more efficient.

In summary, this paper proposes the following hypotheses:

Hypothesis 1. Patient capital can promote climate change risk disclosure by energy companies.

3. Research design

3.1. Sample Selection and data source

The research sample of this paper is the data of Chinese A-share listed companies in the energy industry from 2015 to 2023. According to the study of Guo Daoyan et al. (2024)[16], the selected subsectors of the energy industry include coal mining and washing, oil and gas extraction, petroleum processing, coking and nuclear fuel processing, electricity and heat production and supply, and gas production and supply. Because the measurement of patient capital needs to use the "national team" shareholding data, and the "national team" began to enter the market on a large scale in 2015, the relevant data from the beginning of the year is more complete and representative, so 2015 as the starting point of the study. The sample is processed as follows: (1) companies with abnormal status such as ST, PT, etc. are excluded; (2) observations with missing data are excluded; (3) all continuous variables are deflated by 1% up and down. The financial data are obtained from CSMAR, CNRDS and WIND databases, and the relevant annual report data of the companies are obtained from Juchao Information Network.

3.2. Empirical model

In order to explore the effect of patient capital on energy companies' climate transition risk disclosure, this paper constructs the following regression model to test it:

$$RISK_{i,t}=\lambda_0+\lambda_1 PC_{i,t}+\lambda_2 \Sigma CONTROLS_{i,t}+ \Sigma IND+ \Sigma YEAR+\varepsilon_{i,t} \quad (1)$$

In Eq. (1), i,t represents the company and the year, respectively; $RISK_{i,t}$ denotes the level of climate transition risk disclosure of energy companies; $PC_{i,t}$ denotes the shareholding ratio of patient capital; $CONTROLS_{i,t}$ is the control variable, including the company's employee size, debt level, profitability, and other factors that may affect climate transition risk disclosure; IND and YEAR denote the industry fixed effect and the year fixed effect; and $\varepsilon i,t$ is the error term.

3.3. Variable measurement

3.3.1. Climate Transition Risk Information Disclosure (RISK)

Based on the research of Du Jian et al. (2023) [2], this paper uses the Win Go financial text analysis platform and machine learning technology to construct a climate transition risk disclosure indicator by analyzing the annual reports of energy companies from 2015 to 2023, counting the word frequency of transition risk terms in the annual reports, and taking the logarithm of the number of times added to 1 to construct the climate transition risk disclosure indicator.

3.3.2. Patience Capital

According to the “Several Policies and Measures to Promote High-Quality Development of Venture Capital” issued by the Chinese government, it is clearly proposed to accelerate the cultivation of high-quality venture capital, which emphasizes that state-owned capital and government investment funds should be cultivated as patient capital to play a leading role in the demonstration [15]. In this context, it is theoretically reasonable and practically feasible for this paper to take the shareholding ratio of the “national team” as a proxy variable for patient capital.

4. Empirical result

4.1. Baseline regressions

Table 1 presents the baseline regression results. Column (1) controls only for industry and time fixed effects, and the coefficient of patient capital is significantly positive; column (2) adds control variables, and the coefficient of patient capital is still significantly positive, indicating that an increase in the shareholding ratio of patient capital can lead firms to be more proactive in disclosing climate risk information, thus enhancing the quality of firms' disclosure of climate risk information. Therefore, hypothesis Hypothesis 1 of this paper is verified.

Table 1: Baseline regressions.

	RISK	
	(1)	(2)
PC	0.031***	0.028***
	(6.734)	(6.046)
CONSTANT		
CONTROLS	NO	YES
Observations	1,082	1,082
IND & YEAR	YES	YES
Adj-R^2	0.235	0.318

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.2. Robustness tests

4.2.1. Consider delayed effects

In order to accurately capture the long-term effect of patient capital, this paper conducts regression analysis with explanatory variables lagged by one and two periods, respectively, to avoid the influence of short-term fluctuations on the results. The regression results are shown in columns (1)(2) of Table 2, and the regression coefficients of patient capital on energy companies' climate transition risk disclosure are significantly positive at one and two periods lagged, indicating that its facilitating effect is still stable and significant after considering the time lag effect.

4.2.2. Replacement of explanatory variables

Based on the research method of Du Jian et al. (2023) [2], climate transition risk disclosure is remeasured by the ratio of the frequency of words related to transition risk disclosure in annual reports to the total vocabulary of annual reports. The regression results are shown in column (3) of Table 2, and the regression coefficient of patient capital is positive, indicating that its facilitating effect on energy companies' climate transition risk disclosure remains stable under different measurement methods.

4.2.3. Propensity Score Matching

In order to avoid bias due to sample selection, this paper uses PSM for testing, based on the study of Wen Lei and Li Sifei (2024) [17], grouping based on the median patient capital and performing 1:1 nearest neighbor matching to balance the distribution of characteristics of the treatment and control groups. After matching and regression, the results are shown in column (4) of Table 2, the

regression coefficient of patient capital on climate transition risk disclosure of energy companies is still significantly positive, indicating that the main hypothesis still holds after controlling for sample selection bias.

Table 2: Robustness tests

	RISK			
	(1)	(2)	(3)	(4)
PC	0.027***	0.028***	0.036***	0.028***
	(5.138)	(5.516)	(4.604)	(5.85)
CONSTANT	0.929***	0.900***	1.225***	0.939***
	(5.772)	(5.132)	(7.113)	(5.91)
CONTROL	YES	YES	YES	YES
IND & YEAR	YES	YES	YES	YES
Observations	846	655	1082	1028
Adj-R^2	0.309	0.342	0.258	0.333

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.3. Mechanism analysis

As mentioned in the previous theoretical analysis, patient capital can promote the disclosure of climate transition risk information of energy enterprises through the following ways: First, patient capital can play the governance effect, improve the internal control governance of enterprises, and then promote the disclosure of their climate transition risk information. Second, patient capital can play the monitoring effect to attract media attention, which in turn promotes the disclosure of climate transition risk information. Therefore, this paper designs the mediation effect model to further clarify the influence path of *Hypothesis 1*.

Referring to Di Giuli and Laux (2022) [18] and Ma Hui and Chen Shenglan (2022) [19] for the mediation variable test, the basic idea is: the first stage first estimates the effect of patient capital on the mechanism variable (M); and the second stage adopts the predictive mechanism variable (M_pre) estimated by the model in the first stage to test the disclosure of climate transition risk information. The two-stage test can be realized by the following system of equations:

$$M_{i,t}=\alpha_0+\alpha_1 PC_{i,t}+\alpha_2 \Sigma CONTROLS_{i,t}+ \Sigma IND+ \Sigma YEAR+\varepsilon_{i,t} \quad (2)$$

$$RISK_{i,t}=\beta_0+\beta_1 M\_pre+\beta_2 \Sigma CONTROLS_{i,t}+ \Sigma IND+ \Sigma YEAR+\varepsilon_{i,t} \quad (3)$$

4.3.1. Internal Governance Optimization

Following Liang Shangkun et al. (2022) [20], the Dibble internal control index is used as a proxy for internal governance optimization (IC), which measures the effectiveness of a firm's internal control and reflects the overall level of its design and operation. For ease of presentation, it is scaled down by a factor of 100 in this paper, and the larger the IC, the stronger the company's internal governance optimization.

Columns (1) and (2) of Table 3 show the test results of the internal governance optimization mechanism. The results show that the regression coefficient of IC in column (1) in the first stage is significantly positive, indicating that patient capital can improve the internal governance level of enterprises; the regression coefficient of IC_pre in column (2) in the second stage is significantly

positive, indicating that patient capital can play the role of internal governance optimization as a means of improving the disclosure of climate change risk information of energy enterprises.

4.3.2. Enhanced External Oversight

Following Wang Fusheng et al. (2022) [21], media attention (MA) is measured by the number of media reports of each firm for the whole year, which effectively reflects the external attention received by the firm. Firms are monitored by media coverage for reputational reasons. In this paper, the number of media reports throughout the year is processed by adding 1 to take the logarithm to obtain the media attention indicator, and the larger the MA, the more the firm is subject to external monitoring.

Columns (3) and (4) of Table 3 show the results of the tests of the external monitoring reinforcement mechanism. The results show that the regression coefficient of MA in column (3) in the first stage is significantly positive, indicating that the injection of patient capital can be noticed by external media; the regression coefficient of MA_pre in column (2) in the second stage is also significantly positive, indicating that patient capital can play the role of external supervision and enhance the disclosure of climate change risks of energy enterprises.

Table 3. Mechanism analysis

	(1)	(2)	(3)	(4)
	IC	RISK	MA	RISK
PC	0.068***		0.038***	
	(3.876)		(4.004)	
IC_pre		0.415***		
		(6.046)		
MA_pre				0.735***
				(6.046)
CONSTANT	4.782***	-0.984***	3.270***	-1.404***
	(8.462)	(-3.059)	(9.945)	(-3.633)
CONTROL	YES	YES	YES	YES
IND & YEAR	YES	YES	YES	YES
Observations	1082	1082	1082	1082
Adj-R^2	0.191	0.318	0.653	0.318

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5. Conclusions

Taking Chinese A-share listed energy companies from 2015-2023 as the research object, this paper thoroughly explores the impact of patient capital on the climate transition risk disclosure of energy companies and its mechanism of action. It is found that patient capital can significantly improve the level of climate transition risk disclosure of energy companies, and this conclusion still holds after a series of robustness tests. This finding still holds after a series of robustness tests. The mechanism of its effect is mainly reflected in two aspects: first, by optimizing internal governance, improving the quality of internal control, and prompting companies to integrate climate transition risks into their strategic planning and daily operations, thereby improving the quality and transparency of information disclosure; and second, by strengthening external supervision, attracting more media attention, and creating public opinion pressure and regulatory scrutiny, which prompts companies to disclose climate transition risk information in a more proactive manner. The second is to attract more

media attention to create public opinion monitoring pressure and regulatory scrutiny, which prompts enterprises to disclose information on climate transition risks in a more proactive manner.

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