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Research article

The impact of climate policy uncertainty on green mergers and acquisitions

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ABSTRACT

Green mergers and acquisitions (GM&A) represent a critical strategy for firms to align with environmental constraints objectives of sustainable development. This paper leverages data from A- -share listed companies spanning 2007 to 2021 to examine the impact of climate policy uncertainty (CPU) on green mergers and acquisitions activities and their underlying mechanisms. This paper reveals that climate policy uncertainty catalyzes green mergers and acquisitions, with a pronounced effect observed among non-state-owned enterprises, firms within the non-energy sector and high-tech sector. Climate policy uncertainty primarily applies pressure on companies through increased external regulatory constraints and internal operational challenges, thereby compelling firms to engage in green mergers and acquisitions. Further analysis dispels the notion that green mergers and acquisitions driven by climate policy uncertainty is merely a "greenwashing" tool; instead, climate policy uncertainty effectively promotes substantive green transformation. This paper enriches the literature on the driving factors of green mergers and acquisitions in the lens of climate policy uncertainty and provides strategic insights for government bodies aiming to encourage firms toward sustainable development.

1. Introduction

Since the mid-20th century, the global surface temperature has increased by 1.2 °C, and extreme natural events have more than doubled, highlighting the urgent need to address climate change. Melting Antarctic ice sheets, droughts in tropical rainforests, and rising sea levels are just a few consequences. These climate extremes not only harm the economy directly but also disrupt the global trading system, constraining economic growth (Tol, 2024).In response, countries have taken proactive measures to strengthen government and business resilience to extreme weather. These initiatives aim to balance economic growth with efforts to mitigate climate change impacts (Hogue and Batabyal, 2022; Ren et al., 2023). The 2015 Paris Agreement set a target to limit the global temperature rise to below 2 °C, with an effort to reach 1.5 °C. To achieve this, many countries have introduced climate policies like carbon peaking and carbon neutrality to reduce emissions (Su et al., 2022; Irfan et al., 2022).

CPU has become an increasingly important topic of study, particularly as the global push for climate action intensifies. In September 2020, China set ambitious targets to peak carbon emissions by 2030 and achieve carbon neutrality by 2060, making climate action a central element of its national strategy. As key players in this transformation, enterprises are critical to achieving these goals. However, the uncertainty surrounding the implementation, timing, and intensity of climate policies presents significant challenges for businesses. The inconsistency in policy direction makes it difficult for companies to plan and invest in green technologies, which are essential for meeting carbon reduction targets. As a result, firms face the dual pressure of managing operational costs while undergoing a green transformation (Stroebel and Wurgler, 2021; Ilhan et al., 2021).

The uncertainty surrounding climate policies directly influences corporate behavior. One promising solution for firms navigating this uncertainty is through GM&A (Zhou et al., 2020; Fu et al., 2021). GM&A offers a strategic way for businesses to integrate green technologies, reduce carbon emissions, and demonstrate commitment to sustainability. By pursuing GM&A, companies not only address environmental concerns but also aim for long-term economic and ecological benefits, considering both the financial health of target firms and their

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environmental practices.

Focusing on China, the impact of CPU on GM&A is particularly significant. The frequent updates to climate policies have raised environmental awareness among regional authorities and the public, increasing the pressure on businesses to adopt green strategies. This pressure makes GM&A an appealing option for companies striving to align with national environmental goals (Ren et al., 2022a). Furthermore, the uncertainty caused by fluctuating climate policies also influences firms' external environments (Sun et al., 2020; Hunjra, 2025; Ren et al., 2022b). With consumers increasingly favoring products from environmentally responsible companies and investors more willing to support businesses undergoing green transformation, market pressure grows. This, in turn, challenges traditional business models, leading to declining performance in firms that fail to adapt. Ultimately, such pressures further drive companies to pursue GM&A, even in the face of financial constraints, as a strategy for achieving green transformation.

As highlighted in previous research, the focus has largely been on understanding how climate policies influence business behavior, particularly in areas such as emissions reductions and green investments. While some studies have explored the impact of CPU on green transformation efforts, such as through GM&A, a key gap remains in understanding how frequent policy fluctuations and heightened uncertainty shape corporate strategies in this domain. While GM&A has been recognized as a vital strategy for companies pursuing sustainable development and eco-efficiency (Zhou et al., 2020; Fu et al., 2021), the relationship between CPU and GM&A remains underexplored.

This study addresses this gap by investigating the effects of CPU on corporate GM&A activities and the mechanisms driving these effects, using data from Chinese listed companies between 2007 and 2021. The contributions of this research are threefold: First, it offers a systematic examination of the mechanisms through which CPU influences corporate GM&A activities, thus enriching the theoretical framework that links climate policies with microeconomic firm behavior. This adds a layer of understanding that previous studies, such as those by Ren et al. (2022a) and Bai et al. (2023), have not fully addressed, particularly in terms of the interrelationship between policy uncertainty and firm-level decisions. Second, by utilizing panel data from publicly listed Chinese companies, this study empirically explores the direct impact of CPU on GM&A activities, providing new insights into how policy uncertainty affects corporate decision-making. Third, this paper critically analyzes whether GM&A activities driven by CPU represent genuine green transformation efforts or are merely "greenwashing" strategies. This distinction is crucial, as it helps to assess whether GM&A truly contributes to sustainable environmental goals or if it serves primarily as a reputational tool without meaningful impact on carbon emissions.

These contributions not only enhance our understanding of the drivers behind GM&A but also provide actionable insights for policymakers. As highlighted by Su et al. (2022) and Irfan et al. (2022), climate policies must be crafted to address the uncertainty that businesses face, ensuring that they lead to substantive green development rather than superficial actions. This study advances this conversation, providing concrete evidence on how policy uncertainty impacts corporate strategies and offering implications for future climate governance policies.

2. Literature review

2.1. Economic impacts of CPU

CPU has predominantly been explored within macroeconomic contexts (Akpa et al., 2023; Adediran et al., 2023; Li, 2022), where it is noted for its impact on energy prices (Zhou et al., 2023), market demand for various energy sources, and the broader ecological environment. For instance, Shang et al. (2022) found that CPU could positively influence the ecological environment by reducing reliance on non-renewable energy and fostering demand for renewable energy sources. However, existing literature primarily addresses these macroeconomic effects, with limited attention given to firm-level behavior, particularly in the context of GM&A. This gap is especially pronounced in transitional economies like China, where firms are key drivers of climate policy implementation. While macro-level studies provide valuable insights, they do not adequately examine the direct consequences of CPU on specific corporate strategies like GM&A, which are critical for achieving green transformation.

At the microeconomic level, research has highlighted CPU's impact on various aspects of firm behavior, including productivity (Zhang et al., 2018), revenues (Pankratz et al., 2023), and costs (He et al., 2023; Zhang et al., 2018). Some studies suggest that CPU could encourage firms to invest in green projects and clean energy technologies (Gavriilidis, 2021), while others emphasize the negative side, indicating that CPU may restrict financing opportunities (Wu and Liu, 2023), reduce firms' risk tolerance (Bag et al., 2023; Liu et al., 2023a), and stifle green innovation (Niu et al., 2023; Sun et al., 2024; Zhao et al., 2024). However, much of the existing literature is focused on broader financial constraints and general innovation dynamics (Stroebel and Wurgler, 2021; Huang, 2023; Bai et al., 2023; Zhao et al., 2025), without delving deeply into how CPU specifically drives GM&A behavior. GM&A, a strategic tool for firms pursuing green transformation, remains underexplored in the context of CPU's impact.

This gap in research underscores the need for a more targeted investigation of how CPU influences GM&A decisions. Given the central role that firms play in the green transition, understanding the link between CPU and GM&A is crucial for understanding whether these acquisitions serve as genuine actions toward green transformation or as superficial efforts that only serve to improve corporate reputation. The failure to address this gap limits our understanding of the mechanisms by which climate policy uncertainty shapes corporate sustainability strategies, especially in emerging economies like China, where the urgency of meeting climate goals is increasingly critical.

2.2. Factors influencing GM&A

Current research on GM&As primarily focuses on two key aspects: the motivations behind GM&As and the factors influencing their occurrence (Lu, 2021; Zhang et al., 2022). On one hand, motivations for GM&As are often categorized into two distinct types: "substantive green" behavior and "greenwashing" (Li et al., 2020; Yang et al., 2023). Studies such as those by Liang et al. (2022) and Xu et al. (2024) argue that firms engage in GM&As as a genuine strategy to achieve green transformation, reduce environmental capital expenditures (Sun and Liu, 2022), and enhance overall environmental performance (Yang and Chi, 2023). These actions align with broader strategic goals aimed at improving sustainability and cultivating a green corporate image (Hu et al., 2023). However, other studies suggest that GM&As can also be driven by opportunistic motives (Han et al., 2022), where firms seek to enhance their environmental reputation for investor appeal, particularly when M&A premiums are high (Liu et al., 2023b).

While these studies provide valuable insights into the motivations for GM&As, they overlook the role of external factors—especially CPU—in influencing these decisions. Existing research has primarily focused on how firms' internal strategies and market conditions drive GM&A activity, yet the impact of CPU on these decisions remains largely unexplored. Notably, the relationship between CPU and corporate green strategies, particularly through GM&As, has not been sufficiently addressed, especially in transitional economies like China. In such economies, both policy uncertainty and industrial transitions are pronounced and may significantly influence firm-level decision-making.

Furthermore, much of the existing literature on GM&As is focused on single-country studies, primarily in developed economies, with limited cross-country or cross-industry analyses. As a result, the unique challenges posed by CPU in large emerging economies, such as China, remain underexplored. China, with its rapidly evolving climate policies

and urgent need for industrial green transformation, presents a distinct case that warrants focused attention. The failure to address these gaps limits our understanding of how CPU influences corporate behavior in the context of GM&As, especially in large, emerging economies where policy uncertainty plays a critical role in shaping business strategies.

2.3. Review of research

An extensive review of the literature reveals two primary areas of focus relevant to this study. The first examines the impact of CPU on both macroeconomic and microeconomic factors. The second area of research investigates the motivations behind corporate GM&A activities.

There are several critical gaps in the existing literature. First, much of the research has focused on single-country studies, often from developed economies, neglecting the role of emerging economies such as China—a major global carbon emitter—in addressing climate change. Second, while some studies explore the relationship between CPU and corporate behavior, there is limited systematic examination of how CPU specifically influences corporate green transformation through GM&A, especially in the context of China, a transitional economy. As climate policies continue to evolve, understanding how CPU impacts GM&A behavior is crucial, making this area of research both timely and essential.

This study fills the aforementioned gaps by specifically focusing on the effects of CPU on GM&As among Chinese industrial enterprises. By analyzing data from China's A-share listed industrial companies between 2007 and 2021, we explore how CPU influences GM&A decisions and investigate the underlying mechanisms. Our findings indicate that CPU plays a significant role in driving GM&As, a conclusion that remains robust across various tests.

We contribute to the existing literature by providing empirical evidence on how CPU induces GM&As as a mechanism for green transformation. This study's theoretical contribution lies in its exploration of the dual influence of external environmental regulations and internal operational pressures in driving GM&As under CPU. Moreover, our research highlights the heterogeneity of CPU's impact across different firm types, showing that non-state-owned enterprises, companies with weaker cash flows, and firms in the energy sector are particularly influenced by CPU to pursue GM&As. We extend this analysis by demonstrating that these GM&A activities are not just superficial efforts but represent "substantive green" actions, contributing to the genuine green transformation of firms and reducing their carbon emissions.

3. Mechanism analysis and research hypotheses

3.1. The overall impact of CPU on corporate GM&As

To better explain the motivations behind GM&A and the influence of external pressures, the Institutional Theory provides a solid theoretical framework. Institutional theory emphasizes how organizations are influenced by external forces, including regulations, societal expectations, and policy frameworks, which shape their behavior and strategies.

M&As offer firms an alternative to internal development, reducing investment uncertainty and allowing for the acquisition of essential assets that provide a competitive edge (Zhu et al., 2024). For companies committed to green development, GM&A accelerates their transition to more sustainable practices (Zhang et al., 2024). While internal corporate strategies play a role in these decisions, it is primarily external pressures—such as environmental regulations and CPU—that drive firms towards GM&A as a response to these external demands.

As China enforces stricter environmental regulations to reduce carbon emissions, firms with high emission intensity face increasing pressure to comply(Shi and Huang, 2024). This external pressure prompts them to pursue GM&A as a strategy for meeting regulatory requirements (Pan et al., 2024). Additionally, rising public awareness of environmental issues forces companies to adopt more sustainable practices. GM&A thus becomes a strategic response to align with both regulatory expectations and internal sustainability goals. Over time, engaging in green initiatives through GM&A helps firms meet their environmental responsibilities, reduce their carbon footprints, and enhance their corporate reputation.

Increasing CPU signals rising expectations from both governments and the public for firms to adopt green practices, further incentivizing GM&A as a way to meet these demands. As consumer preferences shift toward greener products, adopting green development through GM&A becomes crucial for a firm's long-term sustainability. Thus, we propose hypothesis H1.

H1. CPU promotes corporate GM&As.

3.2. Mechanisms by which CPU affects firms' GM&A

(1) CPU affects corporate GM&A through the channel of environmental regulations

Controlling carbon intensity to mitigate global warming is a global priority, and China has committed to peak carbon emissions by 2030. In light of CPU, the government is increasingly focused on meeting its ambitious climate goals. This concern has led to stronger formal environmental regulations (FER), which impose strict deadlines for emission reductions, penalties, and compliance requirements on enterprises (Chen et al., 2024).

At the same time, informal environmental regulations (IER), though less rigid, also exert significant pressure on firms. These informal regulations, driven by social and public scrutiny, encourage businesses to adopt greener practices, even in the absence of legal mandates (Kou et al., 2024). While FER enforce legal compliance, IER are more fluid, reflecting the growing public demand for sustainable practices. Thus, IER play an essential role in shaping corporate behavior, particularly when combined with more formal regulatory pressures.

Given the tightening of both FER and IER due to CPU, companies are increasingly turning to GM&A as a strategic response. By engaging in GM&A, companies can quickly acquire energy-efficient technologies, reduce emissions, and ensure compliance with evolving regulatory pressures (Hunjra et al., 2024; Sun et al., 2024). This makes GM&A a powerful tool for companies to adapt to both formal and informal regulations. As the intensity of FER driven by CPU increases, so too does the likelihood of companies engaging in GM&A to mitigate the risks associated with non-compliance.

In addition to formal regulations, the rising public environmental awareness driven by CPU has led to growing public concern over corporate greenhouse gas emissions. This public scrutiny, amplified by media coverage of environmental incidents, has further strengthened the role of IER. Unlike FER, which are government-mandated, IER are driven by societal expectations and social pressure.

IER influence corporate decision-making through several mechanisms: direct negotiations with high-emission firms, influencing policymakers to impose stricter regulations, and public actions such as boycotts or legal challenges (Kathuria, 2007; Langpap and Shimshack, 2010). These mechanisms pressure firms to adopt energy-saving and emission-reducing strategies. As a result, GM&A has become a key strategy for companies not only to comply with regulations but also to enhance their environmental reputation in the eyes of both the public and investors. Therefore, this paper proposes hypothesis H2.

H2. CPU can promote corporate GM&As by enhancing the level of environmental regulations.

(2) CPU affects corporate GM&A through the channel of business pressure.

GM&As are influenced not only by external pressures, such as stricter environmental regulations, but also by internal motivations for

transformation and development. Drawing on Institutional Theory, which emphasizes how organizations respond to external pressures such as regulatory frameworks and societal expectations, we understand that businesses, particularly in transitional economies like China, are significantly influenced by CPU. In China, economic development is heavily dependent on policy implementation, and CPU forces firms to continuously adapt to fluctuating policies (Liu et al., 2021). Such adaptations often lead to increased operational and management costs (Ren et al., 2023) and can worsen financial conditions, reducing cash flow and limiting the firm's ability to engage in GM&As.

However, according to Institutional Theory, while external pressures can constrain organizational behavior, they also create the opportunity for firms to align with emerging institutional norms. The pressure generated by CPU highlights the need for companies to transition to green practices (Stroebel and Wurgler, 2021). Firms that fail to adapt to green development risk falling behind, losing out on advantages such as government subsidies, financing support, and competitive market positioning (Huang, 2023; Bai et al., 2023). Moreover, in today's market, consumers may perceive a company's failure to embrace sustainability as a neglect of social responsibility, which could damage its market reputation and erode consumer trust.

To comply with both institutional pressures and the demand for sustainable business practices, companies must realign their business models to foster green, high-quality development. This shift not only aligns with their strategic growth objectives but also responds to the broader societal and economic trends favoring sustainability. Consequently, in line with Institutional Theory, CPU serves as a key motivator for firms to pursue GM&As as a strategic means to ensure long-term competitiveness and green transformation. The external and internal pressures generated by CPU may significantly enhance the willingness of firms to engage in GM&As as a response to both regulatory expectations and market demands. Based on these insights, we propose hypothesis H3. The research approach of this article is shown in Fig. 1.

H3. CPU promotes corporate GM&As by enhancing business pressure.

4. Models, variables, and data

4.1. Model setting

To examine the impact of CPU on corporate GM&As, this study adopts a fixed effects regression model. The choice of this model is based on its ability to control for unobserved heterogeneity across firms, which could otherwise bias the results. Specifically, we use a panel data approach to exploit both cross-sectional and time-series variations in the data, allowing us to account for the dynamic nature of GM&A decisions and the evolving influence of CPU over time. Drawing on the causal inference approach of (Ongsakul et al., 2023), we construct the following regression model (1):

$$Greenma_{i,t} = \alpha_0 + \alpha_1 CPU_t + \alpha_2 X_{i,t} + \delta_i + \varepsilon_{i,t} \quad (1)$$

In this model, i denotes individual firms and t represents years. The dependent variable, $Greenma_{i,t}$, indicates the GM&A behavior of enterprises. The core explanatory variable, CPU_{it}, is the CPU index. $X_{i,t}$ includes control variables such as firm size (Size), sales growth rate (Salesgroth), leverage ratio (Lev), firm age (Age) and its square term, firm nature (SOE), firm value (TobinQ), and productivity (TFP). The model also incorporates firm-level fixed effects (δ_i) and a random error term ($\varepsilon_{i,t}$). The core explanatory variable, CPU, is a macro time-series variable that reflects changes in macro policy uncertainty over time. Since CPU is a time-varying variable, including time fixed effects in the model would lead to multicollinearity, as the time dummy variable would be highly correlated with CPU. This would destabilize the model estimates and affect the significance of the coefficients. To avoid this issue, we chose not to include time fixed effects. Despite this, time heterogeneity is effectively addressed. CPU itself captures the time-varying policy environment, serving as a substitute for time fixed effects. Additionally, control variables account for time-dependent changes in firm characteristics. The coefficient of CPU reflects its marginal effect on GM&As, with the hypothesis predicting a significantly positive relationship.

4.2. Variable descriptions

4.2.1. Explained variable: corporate GM&A

Following the methodology outlined by Lu (2021), this paper defines GM&As as acquisitions that integrate green concepts into the corporate decision-making process, with the primary aim of achieving sustainable development. Green development principles are embedded at every stage of the M&A process, from selecting acquisition targets to structuring the transaction and conducting post-merger integration. These principles guide the integration of environmentally sustainable practices into the acquiring firm's operations, aligning with both corporate growth and broader environmental objectives.

To identify GM&As, this study manually collects and reviews acquisition announcements from publicly listed companies in heavily polluted industries. A comprehensive text analysis is employed to assess key factors such as the target company's business scope, the strategic motivations behind the acquisition, and the anticipated long-term impacts on the acquiring company's operations. These factors help in determining whether an acquisition is genuinely focused on green

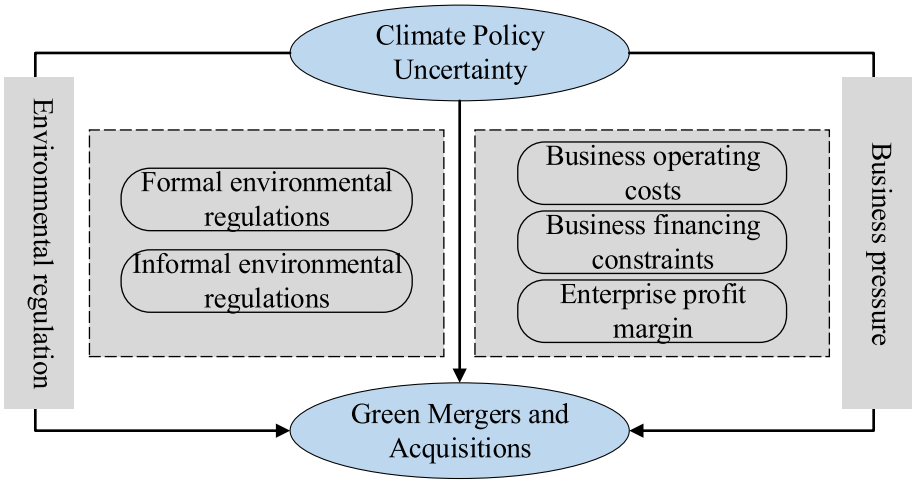

Fig. 1. Influence mechanism graph.

development.

Given that the effects of green acquisitions on a company's future growth may be realized over an extended period, this paper employs the cumulative number of green acquisitions to construct a green acquisition index for each firm. This index serves as a proxy for a company's overall commitment to green transformation through GM&As. Additionally, to ensure robustness, a binary dummy variable is used to assess whether a company has engaged in any form of green acquisition. This serves as an alternative measure and a robustness check for the primary green acquisition index.

By using these two complementary measures, this study provides a comprehensive approach to evaluating corporate engagement in GM&As, ensuring that the impact on long-term sustainable development is accurately captured.

4.2.2. Core explanatory variable: CPU

Since the introduction of the macroeconomic policy uncertainty index by Baker et al. (2016), research on uncertainty, especially economic policy uncertainty, has garnered increasing attention. With the intensification of global climate change, the impact of climate policy uncertainty (CPU) on businesses has become more significant. Following the methodologies of Ma et al. (2023), this paper uses manual auditing and deep learning algorithm MacBERT model, based on six mainstream newspapers including People's Daily, Guangming Daily, and Economic Daily, calculate the uncertainty index of China's climate policy.

4.2.3. Control variables

In addition to core explanatory variables, several firm-level characteristics influence GM&A behavior (Yang et al., 2023; Han et al., 2022). These include firm size (measured by the log of total assets), as larger firms typically have more financial resources to support GM&As. Sales growth rate reflects the firm's annual revenue growth, indicating its willingness to engage in GM&As based on its current business performance. The leverage ratio (total liabilities divided by total assets) shows the firm's reliance on debt, which can impact its propensity for GM&As. Firm age (number of years in operation) indicates stability and experience, influencing GM&A decisions, with a squared term included to capture non-linear effects. Firm nature (SOE) is a binary variable indicating whether the firm is state-owned, as SOEs often have stronger financial resources and a leadership role in green development. Firm value (TobinQ) represents the firm's market-to-replacement value ratio, reflecting its operational status and capacity for GM&As. Finally, firm productivity (TFP), measured using the LP method, represents competitiveness and affects the firm's drive for green transformation via GM&As. The definitions and specific measurement methods for all variables are detailed in Table 1.

Table 1
Variables definition.

Variables	Definition	Measurement
Greenma	GM&A	Measured using a firm's cumulative number of green acquisitions.
CPU	Climate Policy uncertainty:	Construction of a climate policy uncertainty index measure.
Size	Firm size	Measured using total enterprise assets.
Salesgroth	Revenue growth rate	Measured using a firm's revenue growth rate for the current period relative to the previous period.
Lev	Leverage ratio	Measured using total firm liabilities divided by total assets.
Capex	Capital expenditure ratio	Measured by the ratio of cash paid for the purchase and construction of fixed assets, intangible assets, and other long-term assets to total assets.
Top10	Shareholding ratio of the top ten shareholders	Measurement of the proportion of shares held by the top ten shareholders to the total share capital.

4.3. Data sources

Since 2007, China has introduced a series of important policies on green transformation, which provides sufficient data support for this study. Moreover, 2007 is the beginning of China's 11th Five-Year Plan, a period in which China's policies on green development have been strengthened, so 2007 is taken as the starting point of the time window. At the same time, 2021 is an important year for China's "carbon neutral" goal, so we take 2021 as the end of the time window. Given that China's green transformation primarily involves industrial enterprises and considering the data availability for variable construction, this paper uses a sample of listed industrial enterprises from the Shanghai and Shenzhen A-shares from 2007 to 2021. In line with Gavriilidis (2021), text analysis is utilized to construct the CPU index. The data required for other firm-level variables is sourced from the CSMAR database. To mitigate the influence of extreme values on the empirical tests, a double-sided 1 % trimming is applied to continuous variables. Table 2 provides the descriptive statistics for the dependent variable, core explanatory variable, and control variables.

5. Results and discussions

5.1. Baseline regression results and discussions

The results of the empirical test of the impact of CPU on corporate GM&A are shown in Table 3, where it can be found that CPU still significantly and positively affects corporate GM&A after adding control variables and replacing the measure of explanatory variables. Among them, the odd columns report only the results of core explanatory variables, and the even columns add all the control variables estimation results. Meanwhile, the explanatory variable empirically tested in the first two columns is the cumulative number of firms' GM&As (Greenma), and the explanatory variable empirically tested in the last two columns is a binary dummy variable for firms' GM&As (Greenmady). Each column in Table 3 controls for firm fixed effects, and given that firms within each industry have different characteristics, we use industry-level clustering standard errors in order to obtain more plausible conclusions. From the regression results, it can be seen that CPU is a positive influence on enterprises' GM&A, i.e., CPU is conducive to promoting enterprises' GM&A behavior; therefore, Hypothesis 1 CPU promotes enterprises' GM&A behavior is verified.

As CPU levels rise, both government and societal focus on sustainable development intensifies. With increasing CPUs, companies face greater policy pressures and compliance needs for environmental protection, leading to stricter regulations and emission reduction requirements (Fan et al., 2019). GM&A offers a quick means for companies to integrate green technologies and resources, enhancing production efficiency, reducing costs, and promoting green products. Additionally, rising CPUs

Table 2
Descriptive statistics.

Variables	Obs	Mean	Std. dev.	P25	Median	P75
Greenma	26,200	0.763	1.014	0	0	1.099
CPU	26,200	0.884	0.194	0.815	0.895	1.045
Size	26,200	21.98	1.249	21.08	21.80	22.68
Salesgroth	26,200	0.177	0.393	−0.0142	0.118	0.280
Lev	26,200	0.413	0.208	0.247	0.403	0.563
Capex	25,200	0.0564	0.0473	0.0212	0.0431	0.0777
Top10	26,200	0.588	0.155	0.479	0.598	0.709

Note: The Obs (Observations) refers to the number of data points for each variable. The Mean (Average) is the sum of values divided by the number of observations, indicating the central tendency. The Std. dev. (Standard Deviation) measures the spread of the data, showing how much values deviate from the mean. The Min (Minimum) represents the smallest value in the dataset, while the Max (Maximum) indicates the largest value. These statistics provide a snapshot of the distribution and variability of the data.

Table 3
Baseline regression results.

Variables	(1)	(2)	(3)	(4)
	Greenma	Greenma	Greenmady	Greenmady
CPU	1.4425***	0.7010***	0.6997***	0.3407***
	(0.0322)	(0.0335)	(0.0193)	(0.0203)
Size		0.3220***		0.1516***
		(0.0142)		(0.0082)
Salesgroth		−0.0661***		−0.0174***
		(0.0092)		(0.0055)
Lev		0.1575***		0.0810**
		(0.0589)		(0.0352)
Capex		−0.7330***		−0.3106***
		(0.1191)		(0.0753)
Top10		−0.9588***		−0.5270***
		(0.0843)		(0.0460)
Firm FE	YES	YES	YES	YES
Observations	25,833	24,813	25,833	24,813
Adj. R^2	0.7826	0.8207	0.6354	0.6752

Note: The dependent variables are Greenma and Greenmady. The independent variable is CPU. The empirical results are estimated based on model (1). The control variables include Size, Salesgroth, Lev, Capex, and Top10. We also control for firm individual fixed effects. Columns (1) and (3) present the estimation results without the control variables. Columns (2) and (4) are the estimation results with control variables added. Here ***, **, and * represent the significance at the 1 %, 5 %, and 10 % levels, respectively. Industry-level clustering robust standard errors in parentheses. Adjusted R2 represent the Goodness-of-fit of the model. Ibid.

signal that green development will be crucial for business competition, prompting companies to accelerate their green transformation through GM&A to avoid losing market opportunities and competitive advantages (Knoppen and Knight, 2022). This transformation helps businesses diversify and stabilize, better withstanding external risks. Moreover, as societal focus on green development grows, stakeholders expect higher corporate environmental performance (Indriastuti and Chariri, 2021). GM&A allows companies to showcase their commitment to sustainability, improving their social reputation and attracting consumers and investors.

5.2. Endogenous tests results and discussions

As indicated by the baseline regression results, CPU significantly encourages GM&As among enterprises. However, challenges remain in ensuring the credibility of this relationship. To prevent endogeneity issues in the baseline regression model from biasing the results, this paper addresses two main aspects: Firstly, there could be an inverse causal relationship between CPU and corporate GM&As, where GM&A activities might lead to policy adjustments, and vice versa. Secondly, the focus on listed industrial firms in China, which are generally larger than non-listed firms, could introduce selection bias by excluding non-listed industrial firms from the sample. Additionally, the influence of CPU on corporate GM&As might be affected by other omitted variables. Therefore, we try to utilize a variety of methods to solve the above problems in order to minimize the impact on the empirical results due to the endogeneity problem and to enhance the scientific validity of the conclusions we obtain.

5.2.1. Instrumental variables approach

In order to mitigate the regression bias introduced by reverse causality in the empirical test, we refer to Ren et al. (2022b) to mitigate the possible endogeneity problem by using Global Mean Surface Temperature (GMST) as an instrumental variable and re-estimating it using the instrumental variable method. The reasons for choosing GMST as the CPU instrumental variable are: first, China is one of the major contributors to global carbon emissions. In recent years, China has taken a wide range of policy measures to reduce carbon emissions. Policy uncertainty can lead to fluctuations in the level of carbon emissions. These fluctuations affect global temperature changes, which in turn have a close relationship with GMST. Therefore, there is a strong correlation between GMST and China's CPU, which satisfies the correlation requirement for instrumental variables. In addition, changes in GMST do not directly affect the GM&A behavior of Chinese firms. Therefore, GMST can fulfill the exogenous requirement of instrumental variables. Meanwhile, as a macro climate variable, GMST does not have a direct interfering effect with firms' behavior, avoiding the problem of multicollinearity introduced by other potential variables. Finally, GMST avoids disturbances that may be brought about by factors specific to the Chinese domestic context. Therefore, GMST serves as an appropriate instrument. Columns (1)–(2) of Table 4 show the estimation results of the two-stage least squares method of GMST as the instrumental variable of this paper. The empirical test in the first stage shows that the regression coefficients of the GMST on the CPU are positive, indicating that the global mean surface temperature has a strong correlation with China's climate policy, indicating a strong correlation between GMST and China's climate policy. Additionally, the F-statistic in the first column significantly exceeds the empirical threshold of 10, suggesting no weak instrument issue. The second-stage regression results in the second column reveal that, even when accounting for the instrumental variable, the core explanatory variable maintains a significant positive impact on GM&As. The absolute value of this effect is slightly higher than that observed in the baseline regression, which may be due to measurement errors or omitted variables that potentially underestimate CPU's promoting effect on GM&As in the baseline analysis.

5.2.2. Heckman two-step method

Considering that the listed industrial enterprises analyzed in this paper are relatively large and do not include smaller industrial enterprises, there may be a sample selection bias. To address this issue, we use the Heckman two-step method for re-estimation (Heckman, 1979). In the first stage of this method, we test the impact of covariates on whether an enterprise has engaged in a GM&A and calculate the inverse Mills ratio (IMR). Further, as can be seen from the second-stage regression results in column (3) of Table 4, the impact of CPU on firms' GM&A remains consistent with the baseline findings, which suggests that the conclusions obtained in this paper still hold when the sample selection bias problem is excluded.

5.2.3. Generalized method of Moments (GMM)

The GMM accommodates heteroscedasticity and serial correlation in the random error terms and offers a more robust treatment of reverse causality endogeneity compared to 2SLS. Consequently, this paper utilizes the GMM estimation method to examine the effect of CPU on

Table 4
Endogenous tests results.

Variables	(1)	(2)	(3)	(4)
	CPU	Greenma	Greenma	Greenma
CPU		5.8466***	1.2554***	5.6283***
		(0.4019)	(0.1075)	(0.3642)
GMST	0.7058***			
	(0.0462)			
IMR			1.0840	
			(0.1986)	
Control variables	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
LM Test	165.685			
F Test	233.598			
Observations	24,813	24,813	24,813	25,200

Note: The instrumental variable is GMST. IMR is the inverse Mills ratio. Columns (1) and (2) are the estimation results of the instrumental variable method, and the method used is the two-stage least squares method. Column (3) is the second-stage estimation result of Heckman's two-step method. Column (4) is the estimation results using GMM, where firm fixed effects are handled by the cross-sectional approach.

corporate GM&As. However, due to the large number of enterprise samples being examined, it is not possible to directly control for firm fixed effects when using the GMM estimation method for testing. To achieve the purpose of controlling for firm fixed effects, this paper performs a cross-sectional treatment on the data of the variables used, which involves subtracting the average value of the variable for all years of the firm from the value of the variable for the current year. The results of the test in column (4) of Table 4 find that the impact coefficients of the core explanatory variables remain significantly positive, indicating that the baseline findings are scientific.

5.2.4. Bias from omitted variables

To further identify whether other omitted variables would have a decisive impact on the baseline regression results, we adopt the sensitivity analysis method proposed by Cinelli et al. (2020). Specifically, we standardize all variables used in the baseline regression to have a mean of 0 and a variance of 1, and then perform regressions on these standardized variables. The variable with the largest impact on GM&As is found to be the squared term of the firm age, which is then used as a contrast variable for sensitivity testing. The results are shown in Fig. 2, indicating that the regression results are located to the left of the red line, which suggests that even if a 2-times stronger omitted variable is added, it would not significantly change the estimated coefficients of the baseline regression results, indicating that other omitted variables are unlikely to overturn the conclusions of this paper.

5.3. Robustness tests results and discussions

The baseline regression results suggest that CPU significantly encourages corporate GM&As. To further validate the credibility of these findings, we conduct robustness analyses from several perspectives, including modifying the core variables and adjusting the scope of the sample data.

5.3.1. Substitution of core variables

On one hand, this paper replaces the core explanatory variable. Considering that the impact of CPU on corporate GM&As may have a lag, where the uncertainty in climate policy faced by a firm in the current period requires a series of discussions within the firm to determine whether to proceed with a GM&A, how to proceed with a GM&A, and when to proceed with a GM&A, which could lead to the behavior of GM&As initiated by CPU not actually occurring until one or even two years later. Therefore, we have re-inserted the lagged first period and lagged second period of the CPU index into the baseline model for testing, and the specific empirical results are shown in Table 5, columns (1) and (2).

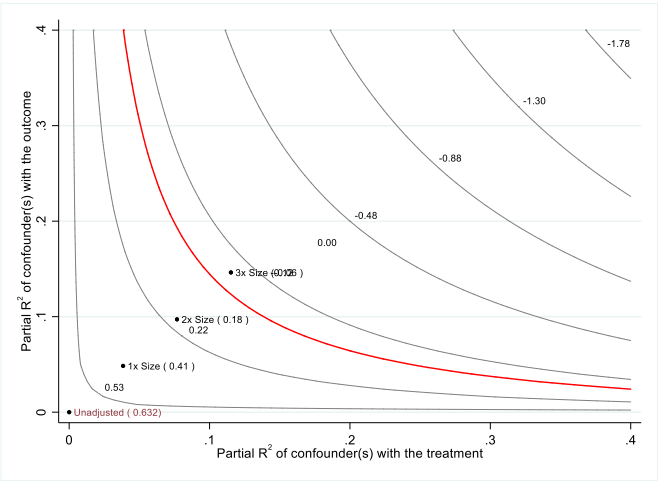

Fig. 2. Sensitivity analysis of omitted variables.

On the other hand, this paper also replaces the dependent variable with a flow measure of corporate GM&As. One approach is to take the logarithm of the number of GM&A transactions plus one, and another approach is to use a binary dummy variable to indicate whether the firm has engaged in a GM&A in the current period. The specific empirical results are shown in columns (3) and (4) of Table 5. From the empirical results, it can be seen that whether the core explanatory variable or the dependent variable is replaced, the estimated coefficients of CPU on corporate GM&As are significantly positive, thus providing further validation of the baseline conclusion of this paper.

5.3.2. Adjusting the sample range

To address the potential interference of enterprises that have not engaged in GM&As on the direct effect of CPU on GM&As through industry competition, we conduct robustness tests using the following methods: First, we exclude enterprises that have not participated in GM&As and re-test the baseline regression results. Second, we further refine the sample by excluding data from periods before the GM&A behavior began for these enterprises, then re-test the baseline regression results. The regression outcomes after these two rounds of data processing are presented in Table 5, columns (5) and (6). The findings stay consistent with the baseline regression findings.

5.3.3. Excluding other event interferences

External shocks, For example, major events such as the financial crisis and the new coronavirus outbreak may affect business behavior to a large extent, may impact the baseline conclusions. To ensure the reliability of our research findings, we further conduct robustness tests by excluding these external events. Firstly, the profound impact of the 2008 financial crisis has lasted until 2010, not only causing negative shocks to the economies of various cities, but also bringing severe tests to the sources of funds and financing costs of enterprises. The occurrence of the financial crisis will reduce the financial strength of enterprises, thereby affecting their GM&A behavior. Therefore, we deleted the sample data from 2010 and before. Secondly, the COVID-19 pandemic broke out in late 2019 and early 2020, severely affecting the normal business activities of enterprises, and also restricting the GM&A behavior of enterprises. To further validate our findings, we excluded the sample data from 2020 onward and re-tested the baseline regression results. These results, presented in Table 5, column (7), indicate that whether you consider the events of the financial crisis or the new coronavirus epidemic, the impact of CPU on GM&As remains significant and positive. This strengthens the credibility of our research conclusions.

5.4. Mechanism tests results and discussion

5.4.1. The role of environmental regulation

To address potential endogeneity bias, this study uses the instrumental variables method and conducts two-stage least squares regression. All weak instrument variable tests are passed, and results are not presented separately.

Theoretical analysis suggests that CPU influences GM&As through both FER and IER. We construct FER and IER variables to test this relationship. FER is measured by the frequency of 15 environmental keywords in annual government work reports, reflecting government focus on environmental issues (Liu et al., 2023c; Chen et al., 2024). IER is represented by the Baidu haze search index, an indicator of public concern about climate change (Zhou and Ding, 2023).

Empirical results, shown in Table 6 columns 1 and 2, indicate that CPU significantly increases both FER and IER, supporting Hypothesis 2. This suggests that CPU heightens external regulatory pressures, encouraging companies to engage in GM&A activities as part of their green development strategy.

To further confirm the impact of external regulatory pressure, we

Table 5
Robustness tests results.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Changing the explanatory variables		Changing the explained variables		Reducing the sample		Excluding other events
CPU			0.0576***	0.0728***	0.9307***	0.8377***	1.6883***
			(0.0199)	(0.0177)	(0.0405)	(0.0469)	(0.0643)
L1. CPU	0.7000***						
	(0.0339)						
L2.CPU		0.8551***					
		(0.0353)					
Control variables	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES
Observations	21,904	19,384	24,813	24,813	17,552	11,867	15,039
Adj. R2	0.8526	0.8801	0.4221	0.3368	0.8072	0.8391	0.8929

Note: The empirical results are estimated based on model (1). In columns (1)–(2), the independent variables are replaced with one-period lagged and two-period lagged CPUs, denoted by L1.CPU and L2.CPU, respectively. In columns (3)–(4), the dependent variable is changed to GM&A flows, which are replaced by the logarithmic value of the number of GM&A transactions plus one and a binary dummy variable, respectively. In columns (5)–(6), the sample of firms not involved in GM&A and the sample before firms started GM&A are excluded, respectively. Column (7) is the estimation result excluding the interference of two events, the 2008 financial crisis and COVID-19.

Table 6
Mechanism tests results.

Variables	Environmental regulation			Operational pressure		
	(1)	(2)	(3)	(4)	(5)	(6)
	FER	IER	Egp	*Cost*	KZ index	Poc
CPU	0.5938***	1.9805***	6.3745***	0.6783***	8.0105***	−0.1168***
	(0.1245)	(0.1475)	(0.7689)	(0.0955)	(0.9559)	(0.0268)
Control variables	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
Observations	3323	2480	22,187	24,810	22,262	24,812

Note: The dependent variable is the mechanism variable. Among them, the mechanism variables of environmental regulation are Formal Environmental Regulation (FER), Informal Environmental Regulation (IER), and Executive Green Perception (Egp). The mechanism variables of operational pressure are operating cost ratio index (Cost), financing constraint index (KZ) and profitability index (Poc). The dependent variable is CPU. To reduce endogeneity, the instrumental variable method was used and two-stage least squares method was conducted to estimate the results. Columns (1)–(3) present the estimation results of the mechanism variables of environmental regulation. Columns (4)–(6) are the estimation results of the operational pressure mechanism variables.

assess the green perceptions of corporate executives (Egp) by analyzing keywords related to green development in their annual reports. The results in Table 6 column 3 show a significant and positive effect of CPU on executives' green cognition, reinforcing the conclusion that CPU enhances awareness of green development, thereby promoting GM&A activities.

5.4.2. *The role of operational pressure*

To test whether CPU increases business pressure, we construct indices for business costs, financing constraints, and profit margins. The business cost index (Cost) measures the ratio of operating costs to income, the financing constraint index (KZ) is represented by the KZ index, and the profit margin index (Poc) measures net profit relative to total assets. The results in columns (4) to (6) of Table 6 show that CPU significantly increases business costs (column 4), heightens financing constraints (column 5), and reduces profit margins (column 6).

These findings demonstrate that CPU elevates business pressure, which, in turn, drives firms to pursue GM&As as a strategic response. Therefore, Hypothesis 3, which posits that CPU promotes GM&As by increasing business pressure, is supported.

5.5. *Heterogeneity tests results and discussions*

The previous section examined the effect of CPU on GM&As and the underlying mechanisms. However, the influence of CPU on GM&As may differ significantly based on the specific characteristics of the enterprises or the industries in which they operate. Therefore, we conducted heterogeneity tests from two dimensions: enterprises and industries.

5.5.1. *Heterogeneity in ownership structure*

State-owned enterprises (SOEs), as key players in the national economy, have stronger financial resources and receive more policy support (Yang et al., 2025), enabling them to invest in green technologies and clean production. This helps mitigate the pressure from CPU, reducing their need for GM&As in the short term. In contrast, private enterprises, with fewer resources, are more vulnerable to CPU and are more likely to pursue GM&As to meet green transformation goals.

To test this, we create an interaction term between CPU and enterprise ownership (CPU × SOE), where SOEs are coded as 1 and private enterprises as 0. The results in column (1) of Table 7 show a significantly negative coefficient for the interaction term, confirming that CPU has a stronger impact on GM&As in private enterprises, as they face greater pressure to transform.

5.5.2. *Heterogeneity in cash flow sufficiency*

Adequate cash flow is essential for companies to engage in GM&A activities. Firms with sufficient cash flow are better equipped to meet new environmental standards through GM&As. However, operational pressure is a key driver for CPU to promote GM&As, and firms with limited cash flow often face greater operational challenges, making them have sufficient motivation pursue GM&As under CPU. Therefore, in the context of CPU, firms with sufficient cash flow may not necessarily engage in more green mergers and acquisitions.

To test this, we created an interaction term between CPU and cash flow (CPU × Cash), measured by the ratio of cash to total liabilities. The results in column (2) of Table 7 show that The impact of CPU × Cash on GM&As is not significant, indicating that compared to firms with lower cash flow abundance, CPU cannot promote green mergers and

Table 7
Heterogeneity tests.

Variables	(1)	(2)	(3)	(4)
	Greenma	Greenma	Greenma	Greenma
CPU	7.8271***	5.5158***	5.9617***	5.4121***
	(0.6462)	(0.3586)	(0.4224)	(0.3784)
CPU × SOE	−3.4983***			
	(0.4261)			
CPU × Cash		0.4547		
		(0.3670)		
CPU × EgInd			−0.9053**	
			(0.3669)	
CPU × Ht				1.1787***
				(0.2803)
Control variables	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Observations	24,813	22,625	24,813	24,813

Note: The interaction terms are CPU × SOE, CPU × Cash, CPU × EgInd, and CPU × Ht. To reduce endogeneity, the instrumental variable method was used and two-stage least squares method was conducted to estimate the results. Column (1) presents the heterogeneity estimation results of the ownership structure. Column (2) is the heterogeneity estimation result of cash flow adequacy. Column (3) presents the heterogeneity estimation results for the energy sector. Column (4) is the heterogeneity estimation results for the high-tech industry.

acquisitions in firm with higher cash flow abundance. This supports the idea that firms with limited cash flow also have the motivation to pursue GM&As to achieve green transformation and gain competitive advantages. In the context of CPU, the willingness to engage in GM&As is not weaker than that of firms with sufficient cash flow.

5.5.3. Heterogeneity in the energy sector

Generally speaking, firms in the energy sector have core operations closely tied to high carbon emissions, requiring substantial technological upgrades and long-term capital investment for green transition. CPU may lead energy firms to favor maintaining their current business models rather than pursuing risky green acquisitions. In contrast, non-energy sector firms typically exhibit lower carbon intensity, and their shift toward sustainability involves relatively smaller marginal costs. When faced with policy ambiguity, these firms are more likely to adopt GM&As as a strategic response to align with potential regulatory demands or market shifts. Consequently, we anticipate that CPU will have a more pronounced positive effect on green GM&As activity among non-energy industry firms.

To test this, we created an interaction term between CPU and energy industry status (CPU × EgInd), with companies in the energy sector coded as 1. The results in column (3) of Table 7 show a significantly negative coefficient for CPU × EgInd, confirming that CPU has a stronger influence on GM&As in the non-energy sector. In the context of CPU, this supports the hypothesis that non-energy firms with lower costs of green transformation are more willing to acquire the necessary clean production technologies through GM&As to complete carbon reduction tasks.

5.5.4. Heterogeneity in the high-tech sector

Compared to firms in non high-tech sector, high-tech firms have high added value and a higher degree of green development, as well as a more sensitive market perception ability. In order to establish a competitive advantage in green transformation and development, high-tech firms will actively engage in GM&As to further improve their own green development level. Based on this, we expect that the promoting effect of CPU on corporate GM&As will be more pronounced in the sample of high-tech sector firms.

To test this, we created an interaction term between CPU and high-tech industry status (CPU × Ht), with high-tech firms coded as 1. The results in column (4) of Table 7 show that the interaction term is significantly positive, indicating that the promoting effect of CPU on GM&As is more pronounced in high-tech sector. This suggests that, high-tech firms, facing frequent changes in climate policies, rely on their keen market perception to quickly promote GM&As, to achieve green transformation and upgrading, and thereby enhance their market competitiveness.

6. Extend analysis results and discussions

Firms engage in GM&As with two motivations: “substantive green” and “greenwashing” (Liang et al., 2022; Liu et al., 2023b). Some firms acknowledge the risks climate change poses to their growth and may opt to acquire green technology via GM&As. This approach allows them to enhance their green products and services and to formulate long-term green development plans. However, other firms may prioritize short-term gains, viewing GM&As as a public relations strategy. Even if they engage in GM&As, they may not make substantive changes to their business models or reduce environmental impacts. Instead, some firms might use the green label merely to enhance their brand image and attract consumers and investors. When considering the impact of CPU, it becomes crucial to discern whether firms are genuinely striving for green transformation or if they are using GM&As as a form of greenwashing. If GM&As are genuinely aimed at green transformation, they can help China pursue a sustainable development path and transition its economy from a resource-intensive model to an environmentally friendly one. Conversely, if the goal is greenwashing, it would not significantly contribute to the green transformation and upgrading of China’s economy and could misallocate resources, undermining the long-term competitiveness of firms. Therefore, it is essential to scrutinize the true intent behind GM&A activities prompted by CPU. This paper will conduct such an examination.

To test the motivation behind the GM&A behavior induced by CPU, this paper mainly identifies the following two aspects: First, we directly empirically test whether CPU indeed promotes enterprise green transformation. If this conjecture is confirmed, it suggests that the GM&As prompted by CPU indeed contribute to green transformation and upgrading. To construct the green transformation index, we referred to documents such as the “13th Five-Year Plan for National Environmental Protection Standards”, the “Environmental Protection Law of the People’s Republic of China”, and the “Green Manufacturing Standardization White Paper”, along with relevant research. We identified 113 keywords related to green transformation; we measured the green transformation situation by word frequency.

Table 8 analyzes the effects of CPU on corporate green transformation. It can be observed that regardless of whether control variables are included, the regression coefficients are significantly positive. This suggests that, corporate GM&As in the context of CPU represent substantive green efforts, not greenwashing, and support the green transformation and upgrading of China’s economic development. This is also consistent with China’s economic development situation, as China has proposed a scientific development concept of coexistence with ecology, and has frequently issued various policies to advocate for the reduction of energy intensity per unit of value-added output. After 2012, China even shut down several enterprises that did not meet the carbon emission requirements, which had a warning effect and at the same time urged and promoted the green development of enterprises as a whole.

Table 8
Extend analysis results.

Variables	(1)	(2)
	Gt	Gt
CPU	6.2960***	10.8180***
	(0.0628)	(0.4961)
Control variables	No	YES
Firm FE	YES	YES
Observations	23,586	22,626

7. Conclusion and policy implications

This study finds that CPU positively influences corporate GM&As. Specifically, CPU drives GM&As by tightening both FER and IER and by increasing internal operational pressures. The impact of CPU is more pronounced in non-state-owned firms, firms in the non-energy sector and high-tech sector. Additionally, GM&As triggered by CPU represent genuine green actions, contributing to the green transformation of businesses.

The policy recommendations of this study are primarily concerned with the impact of CPU on corporate GM&As in China. (i)The government should enhance the transparency of climate policies, regularly release updates, and provide clear, forward-looking guidance. Financial incentives, such as green tax breaks, preferential green credit rates, and green development funds, should be tailored to encourage GM&A activities, especially for non-state-owned firms, firms in the non-energy sector, and those in the high-tech sector. (ii)The government should strengthen environmental regulations, such as the Environmental Protection Law and Energy Law, and raise pollution control standards. By enforcing stricter rules and creating market pressure, the government can encourage firms to accelerate their green transformation through GM&As. (iii)GM&A plays a critical role in the green transformation process. The government should refine the policy framework to promote GM&As, provide clear guidelines, and ensure policy stability. Furthermore, it should encourage firms to enhance their green innovation capabilities through technological M&As and promote the development of green technologies. The government should also establish transparent information disclosure mechanisms for GM&A, ensuring market trust and boosting green capital flows.

Compared with existing research, this study finds similarities with the research of Wang et al. (2025) and Sun et al. (2024), concluding that climate policy uncertainty promotes corporate green M&A and drives this process through mechanisms such as external environmental regulation and internal corporate pressure. On the one hand, through external environmental regulation, government climate policies increase external regulatory pressure, encouraging companies to incorporate M&A activities into their green development strategies. On the other hand, through internal business pressure, CPU significantly increases business costs, exacerbates financing constraints, and reduces profit margins. This pressure further prompts firms to adopt M&A as a strategic response measure. However, Bag et al. (2023) and Zhou et al. (2024) and found that environmental policy uncertainty has a significant negative impact on Chinese firms' green innovation and total factor productivity, potentially leading to a green upgrading dilemma. Environmental policy uncertainty suppresses corporate green transformation by crowding out research and experimental development investments and exacerbating corporate financialization. Additionally, stronger external market competition, capital market attention, and environmental information transparency can mitigate the negative impact of environmental policy uncertainty on corporate green transformation to some extent.

This study is based on a sample of listed firms in China, limiting the generalizability of the findings. Future research should consider expanding the sample to include small and medium-sized enterprises and firms from other regions. Additionally, the study's time frame may not fully capture the latest climate policy developments, suggesting that extending the study period could offer more insights. Finally, while this paper focuses on external and internal pressures, future research should explore the role of other policy factors, such as industrial and fiscal policies, in shaping GM&A decisions. Further robustness tests and sensitivity analyses are also needed to validate the findings across different model specifications.

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CRediT authorship contribution statement

Ping Yang: Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. **Ahmed Imran Hunjra:** Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. **David Roubaud:** Writing – original draft, Supervision, Methodology. **Xiaodong Yang:** Writing – original draft, Methodology, Investigation, Conceptualization.

Declaration of competing interest

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

Data availability

Data will be made available on request.

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