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Impact of climate policy uncertainty on the credit asset quality of commercial banks

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ABSTRACT

This study examines the effect of climate policy uncertainty on the quality of bank credit assets using data from 42 listed commercial banks in China, covering the period from 2012 to 2021. A fixed-effects model is employed to analyse this relationship, with a focus on exploring the moderating role of digital finance. The results indicate that climate policy uncertainty significantly worsens the quality of bank loan assets. Moreover, digital finance plays a notable moderating role, alleviating the negative impact of climate policy uncertainty on loan asset quality. These findings offer valuable insights for commercial banks in managing climate-related uncertainties and enhancing the credit asset quality.

KEYWORDS

Climate policy uncertainty; commercial bank credit asset quality; digital finance; moderating mechanism

JEL CLASSIFICATION

G21; Q54; Q58

1. Introduction

Climate change has emerged as a key factor influencing economic, financial, and social stability (Lin and Wu 2023). In 2019, the Network for Greening the Financial System (NGFS) issued a statement indicating that ‘climate change may lead to structural changes in the financial system.’ As countries focus on enhancing their capacity to address climate risks, particularly those most severely impacted, the banking sector faces significant challenges. Extreme weather events and environmental changes pose risks to bank stability, thereby generating systemic risks (Cai and Cui 2024).

In response to these challenges, governments worldwide have ramped up efforts to regulate the behaviour of economic entities through climate policies. However, these policies introduce uncertainty regarding their future direction and impact. Climate policy uncertainty has far-reaching consequences for economic and financial systems. It can reduce enterprise investment efficiency (Sun, Cao, and Liu 2024), trigger corporate upgrading challenges (Wang, Yu, and Lei 2024), and negatively influence stock price synchronization (Li, Han, and Li 2024). It may also hinder firms’ capacity for

green and low-carbon innovation (Wang and Hu 2024), lower the asset value of high-carbon enterprises, and increase financing difficulties – ultimately weakening firms’ repayment ability and adversely affecting the quality of bank assets. Furthermore, climate policy uncertainty can diminish overall financial market performance (Tommaso, Foglia, and Pacelli 2024). As a core component of the financial system, the stability and development of banks are crucial to the overall stability of the financial system. The quality of bank credit assets is closely linked to bank stability, making the study of climate policy uncertainty’s effects on bank credit asset quality significant.

This paper uses panel data from 42 listed commercial banks in China from 2012 to 2021, employing a fixed-effects model to investigate the impact of climate policy uncertainty on bank credit asset quality, as well as exploring the moderating effect of digital finance. The contributions of this paper are twofold. First, it provides empirical evidence on the impact of climate policy uncertainty on the credit asset quality of listed banks in China, thereby enriching the empirical literature on climate policy uncertainty

and offering a new perspective on bank credit asset quality. Second, it incorporates digital finance into the analysis, demonstrating how digital finance can mitigate the adverse effects of climate policy uncertainty on credit asset quality. This highlights the potential role of digital finance and offers a theoretical foundation for banks to strengthen their fintech infrastructure.

II. Model and data

Model specification

To examine the impact of climate policy uncertainty on bank credit asset quality, this study adopts a panel data model following Dell’ariccia, Laeven, and Suarez (2017) and Tian and Li (2020). The empirical model is specified as follows:

$$NPL_{it} = \alpha_0 + \alpha_1 CPU_t + \alpha_2 X_{it} + \alpha_3 Z_t + \mu_i + \varepsilon_{it} \quad (1)$$

where i and t denote bank and year, respectively. The dependent variable NPL represents the non-performing loan ratio of bank i in year t , and CPU captures the level of climate policy uncertainty. X and Z are sets of bank-level and macroeconomic control variables, respectively. Moreover, μ represents bank fixed effects, and ε is the error term. Standard errors are clustered at the bank level to account for potential heteroskedasticity and serial correlation.

Variables

Dependent variable (NPL)

Following Zhang et al. (2024), the dependent variable is measured by the non-performing loan (NPL) ratio, which serves as a proxy for the quality of bank credit assets.

Key explanatory variable (CPU)

Climate policy uncertainty is represented by the China Climate Policy Uncertainty Index developed by Ma et al. (2023). The index is constructed using the MAC-BERT deep learning algorithm, combined with manual auditing. The textual data are sourced from articles in six mainstream Chinese newspapers.

Control variables

In line with Dell’ariccia, Laeven, and Suarez (2017) and Zhuang and Zhang (2022), this study incorporates both micro-level and macro-level control variables. At the microeconomic level, control variables include the logarithmic value of the bank’s total assets (ASSET), Capital Adequacy Ratio (CAR), Cost-to-Income Ratio (CIR), and Gross Revenue Turnover (GRTO). At the macroeconomic level, we include the annual GDP Growth Rate (GDPGR), Custom Price Index (CPI), and the Banking Climate Index (BCI).

Data

This study uses data from 42 listed commercial banks in China over the period 2012–2021. The Climate Policy Uncertainty Index is obtained from the source: <https://doi.org/10.6084/m9.figshare.24071193.v1>. Data on NPL ratios and control variables are sourced from financial databases such as Tonghuashun, Sina Finance, and the National Bureau of Statistics.

III. Results and discussion

Baseline regression results

The baseline regression results on the impact of climate policy uncertainty on the credit asset quality of banks are presented in Table 1. As shown, climate policy uncertainty significantly increases the NPL ratio of banks. Before including control variables, the coefficient is positive and statistically significant at the 1% level. After incorporating control variables, the estimated coefficient remains significant at the 5% level, with a value of 0.3787. These findings indicate that climate policy uncertainty deteriorates the quality of bank credit assets. This effect may stem from its adverse impact on firms, such as reduced investment efficiency, impeded investment activities (Wang et al. 2024; Zhao et al. 2025), and a significant suppression of total factor productivity growth. These disruptions weaken both the willingness and ability of firms to repay loans, thereby undermining the credit asset quality of banks. Moreover, climate policy uncertainty can negatively affect high-carbon enterprises in particular, which further contributes to the deterioration of banks’ credit asset quality.

Table 1. Baseline regression results.

	(1) NPL	(2) NPL
CPU	0.2933*** (3.8050)	0.3787** (2.3869)
ASSET		−0.3307* (−1.7236)
CAR		0.0074 (0.4204)
CIR		−0.0060 (−0.7788)
GRTO		−0.0075*** (−4.1595)
GDPGR		0.0113 (0.4532)
CPI		0.1110*** (3.3772)
BCI		−0.0436*** (−9.3396)
CONSTANT	0.5659*** (2.8529)	12.3895** (2.3804)
N	420	420
R ²	0.080	0.446

*, **, and *** represent significance levels of 10%, 5%, and 1%, respectively; the numbers in parentheses are t-statistics. The same applies hereafter.

Moderating mechanism

Given the roles of digital finance in technological empowerment and financial innovation, this study investigates how digital finance moderates the impact of climate policy uncertainty on the credit asset quality of commercial banks. Specifically, digital finance is introduced as a moderating variable, and a moderation effect model is constructed as shown in Equation (2):

$$NPL_{it} = \beta_0 + \beta_1 CPU_t + \beta_2 DF_{it} + \beta_3 CPU_t * DF_{it} + \beta_4 X_{it} + \beta_5 Z_t + \mu_i \quad (2)$$

Where DF represents the level of digital finance development. Following Guo et al. (2020), this study uses the Digital Inclusive Finance Index developed by the Digital Finance Research Center at Peking University as a proxy for digital finance development. All other variables are defined consistently with those in the previous models.

Table 2 reports the regression results with digital finance as the moderating mechanism. The coefficient of the interaction term is significantly negative at the 1% level, with a value of −0.0037, indicating that digital finance helps to alleviate the adverse impact of climate policy uncertainty on bank credit asset quality. This mitigating effect may arise because digital finance, through technological spillovers and financial innovation (Fang and Wang 2025), drives commercial banks to undergo

Table 2. Results of the moderating mechanism of digital Finance.

	NPL
CPU	1.3486*** (3.7437)
DF	0.0104*** (3.8943)
CPU*DF	−0.0037*** (−3.4711)
ASSET	−0.3821* (−1.7176)
CAR	0.0148 (0.9207)
CIR	−0.0070 (−0.9537)
GRTO	−0.0071*** (−4.0554)
GDPGR	0.0544*** (3.1143)
CPI	0.0748*** (3.0038)
BCI	−0.0310*** (−4.8438)
CONSTANT	9.9337 (1.5510)
N	420
R ²	0.464

substantial transformations in their business processes, models, and service scopes. These changes significantly enhance the operational efficiency of banks, thereby strengthening the foundation for credit supply, improving banks' capabilities in managing credit risk (Du and Liu 2022), and ultimately contributing to better credit asset quality.

IV. Conclusions

This study empirically investigates the impact of climate policy uncertainty on the credit asset quality of banks, using panel data from 42 listed commercial banks in China between 2012 and 2021. It further examines the moderating role of digital finance in this relationship. The results reveal two key findings: (1) climate policy uncertainty significantly deteriorates the credit asset quality of banks; and (2) digital finance plays a mitigating role, helping to reduce the negative impact of climate policy uncertainty.

These findings offer the following policy implications: First, the government should formulate clear and coherent climate policies and promote their implementation in a stable and orderly manner. In doing so, policymakers must consider regional heterogeneity and sector-specific adaptability, with particular attention to ensuring policy consistency and continuity over time. Second, since technological progress is a key driver of digital finance, banks should accelerate their digital

transformation. By enhancing product innovation and improving data collection and processing capabilities, banks can strengthen their credit supply capacity and risk management effectiveness, ultimately improving the quality of their credit assets.

The conclusions of this paper have important practical implications for unlisted banks that are impacted by climate policy changes – particularly rural commercial banks that serve agriculture, rural communities, and farmers, as well as banks in emerging market economies. These institutions should adopt context-specific measures to effectively manage risks associated with climate policy uncertainty.

Author contributions

CRedit: **Chenggang Li**: Conceptualization, Funding acquisition, Project administration, Supervision, Validation, Writing – original draft, Writing – review & editing; **Junjie Meng**: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing; **Mu Yue**: Writing – review & editing; **Fengling Tang**: Writing – original draft; **Guanghui Zhao**: Writing – review & editing.

Disclosure statement

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